

Contract for: **Wastewater Treatment Facility**

Between: **English River Enterprises Property
Management LP**

And: **Wright Construction Western Inc.**

Project: **7603-002-00**

Contract Date: **January 15, 2021**

Volume: **3 of 6**

APPENDIX D1

Process Flow Diagram



SHOP DRAWING REVIEW FORM

Name of Contract: English River Property Mangement

Job No.: 5401-002-00

Supplier: SUEZ

Description: Process Flow Diagrams

Tag Numbers: _____

SHOP DRAWING REVIEW

The review of this drawing does not in any way
relieve the contractor of responsibility as detailed
in the contract documents.

	Reviewed
X	Reviewed as noted
	Revise & Resubmit

Submission No. 3

Job No. 7603-002-00

Date October 14, 2020

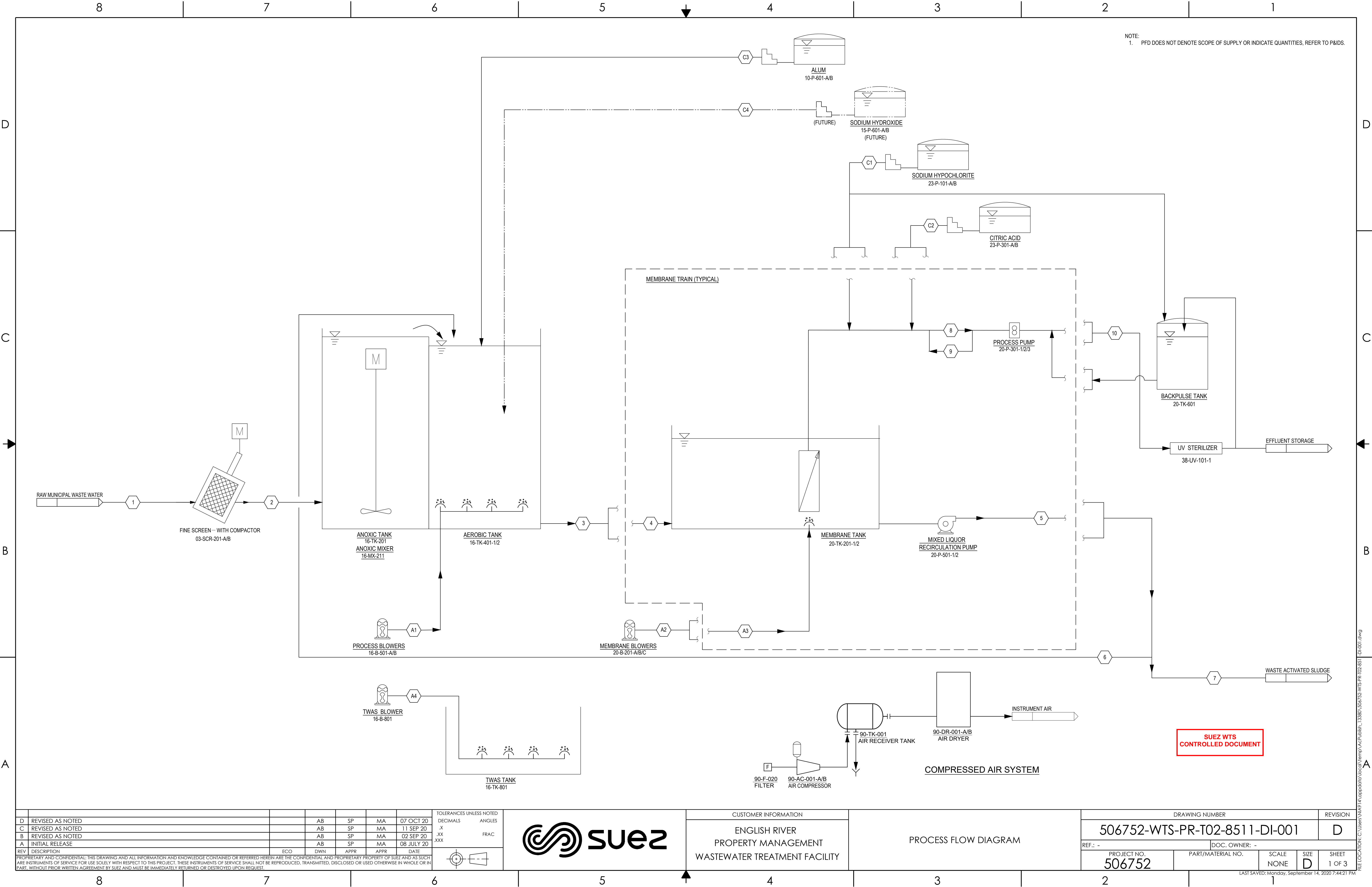
Dwg. reviewed by IK

MPE ENGINEERING LTD.

Engineer's Notes:

- Please see comments within.

Attachments: 506752-WTS-PR-T02-8511-DI-001



NOTE:
1. PFD DOES NOT DENOTE SCOPE OF SUPPLY OR INDICATE QUANTITIES, REFER TO P&IDS.

REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE
D	REVISED AS NOTED			AB	SP	MA 07 OCT 20
C	REVISED AS NOTED			AB	SP	MA 11 SEP 20
B	REVISED AS NOTED			AB	SP	MA 02 SEP 20
A	INITIAL RELEASE			AB	SP	MA 08 JULY 20

TOLERANCES UNLESS NOTED

DECIMALS ANGLES

X .XX XXX

FRAC



CUSTOMER INFORMATION

ENGLISH RIVER
PROPERTY MANAGEMENT
WASTEWATER TREATMENT FACILITY

PROCESS FLOW DIAGRAM

DRAWING NUMBER				REVISION
506752-WTS-PR-T02-8511-DI-001				D
REF.: -		DOC. OWNER: -		
PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
506752		NONE	D	1 OF 3

LAST SAVED: Monday, September 14, 2020 7:44:21 PM

FILE LOCATION: C:\Users\WMA914\AppData\Local\Temp\AcPublish\13380\506752-WTS-PR-T02-8511-DI-001.dwg

PFD Flow Data - Phase 1 ENGLISH RIVER PROPERTY
MANAGEMENT WASTEWATER TREATMENT FACILITY

Stream ID	Stream Description		Type of Flow	Units	ADF	MMF	MDF	MDF N-1	Buildout
					Average Day Flow (Phase 1)	Maximum Month Flow (Phase 1)	Maximum Day Flow (Phase 1)	Maximum Day Flow With One Train Offline (Phase 1)	All Membrane Spaces Filled
	Plant Capacity			m3/d	188	282	376	376	--
-	Number of membrane trains running		-		1	2	2	1	1 or 2
1	Plant Raw Influent Flow		Continuous	m3/d	188	282	376	376	--
2	Bioreactor Influent Flow		Continuous	m3/d	188	282	376	376	--
-	Recirculation Ratio [R]		-	-	4	4	2	Δ (2.5)	--
3	Membrane Feed Activated Sludge Flow (Total) [(R+1) × Q]		Continuous	m3/d	940	1410	1128	1316	--
4	Membrane Feed Activated Sludge Flow (Per Train) [(R+1) × Q]		Continuous	m3/d	940	705	564	1316	--
5	Membrane Recirculated Activated Sludge (RAS) Flow (Per Train) [R × Q]		Continuous	m3/d	752	564	376	940	--
	Membrane Tank Drain Flow		Intermittent	m3/d	1228				--
6	Membrane Recirculated Activated Sludge (RAS) Flow (Total) [R × Q]		Continuous	m3/d	752	1128	752	940	--
7	Waste Activated Sludge (WAS)	Volume	Daily Average	m3/d	5	5	--	--	--
8	Permeate Flow (Per Train)	Net [Q]	Net	m3/d	188 94	141	188	376	--
		Instantaneous	Instantaneous	m3/d	226 113	169	226	451	--
9	Backpulse Flow	Backpulse	Intermittent	m3/d	447				1022
		Maintenance Clean	Intermittent	m3/d	267				611
		Recovery Clean	Intermittent	m3/d	267				611
10	Permeate Flow (Total)	Net [Q]	Net	m3/d	188	282	376	376	--
		Instantaneous	Instantaneous	m3/d	226	338	451	451	--

Chemical Flows									
C1	Sodium Hypochlorite (12% w/v)	Maintenance Clean	Intermittent	m3/d	0.44				0.89
	(10.3% w/w solution)	Recovery Clean	Intermittent	m3/d	2.44				4.91
C2	Citric Acid	Maintenance Clean	Intermittent	m3/d	0.86				1.73
	(50% w/w solution)	Recovery Clean	Intermittent	m3/d	0.95				1.90
C3	Alum Dosing (48.5% w/w)		Intermittent	m3/d	0.034	0.015	--	--	--
C4		Sodium Hydroxide (50% w/w)	Intermittent	m3/d	0.00 _D	_D 0.00	--	--	--

Air Flows										
A1	Process Air to Aerobic Tanks (Total)			Continuous	scfm	140	140	110	110	--
A2	Membrane Air (Total)	Leap Low	Continuous	icfm	32	66	66	n/a	72 or 144	
		Leap High	Continuous	icfm	64	132	132	64	144 or 288	
A3	Membrane Air (Per Train)	Leap Low	Continuous	icfm	32				72	
		Leap High	Continuous	icfm	64				144	
A4	TWAS Tank Aeration			Continuous	scfm	<div><div>210</div><div>⚠</div></div>			--	
A5	Air compressor (Total)		Continuous	cfm	32					

REV

DESCRIPTION

D

REVISED AS NOTED

C

REVISED AS NOTED

B

REVISED AS NOTED

A

INITIAL RELEASE

ECO

DWN

APPR

APPR

DATE

TOLERANCES UNLESS NOTED

DECIMALS

ANGLES

FRAC

ENGLISH RIVER
PROPERTY MANAGEMENT
WASTEWATER TREATMENT FACILITY

CUSTOMER INFORMATION

PROCESS FLOW DIAGRAM

DRAWING NUMBER

506752-WTS-PR-T02-8511-DI-001

REVISION

D

REF.: -

PROJECT NO.

506752

DOC. OWNER: -

PART/MATERIAL NO.

SCALE

NONE

SIZE

D

SHEET

2 OF 3

LAST SAVED: Monday, September 14, 2020 7:44:21 PM

PFD Flow Data - PHASE 2 ENGLISH RIVER PROPERTY
MANAGEMENT WASTEWATER TREATMENT FACILITY

Stream ID	Stream Description	Type of Flow	Units	ADF	MMF	MDF	MDF N-1
				Average Day Flow (Phase 2)	Maximum Month Flow (Phase 2)	Maximum Day Flow (Phase 2)	Maximum Day Flow With One Train Offline (Phase 2)
	Plant Capacity		m3/d	288	432	576	576
-	Number of membrane trains running	-		1	2	2	1
1	Plant Raw Influent Flow	Continuous	m3/d	288	432	576	576
2	Bioreactor Influent Flow	Continuous	m3/d	288	432	576	576
-	Recirculation Ratio [R]	-	-	5	5	$\frac{3.5}{D}$	$\frac{D}{3.5}$
3	Membrane Feed Activated Sludge Flow (Total) [(R+1) × Q]	Continuous	m3/d	1728	2592	2592	2592
4	Membrane Feed Activated Sludge Flow (Per Train) [(R+1) × Q]	Continuous	m3/d	1728	1296	1296	2592
5	Membrane Recirculated Activated Sludge (RAS) Flow (Per Train) [R × Q]	Continuous	m3/d	1440	1080	1008	2016
	Membrane Tank Drain Flow	Intermittent	m3/d	1228			
6	Membrane Recirculated Activated Sludge (RAS) Flow (Total) [R × Q]	Continuous	m3/d	1440	2160	2016	2016
7	Waste Activated Sludge (WAS)	Volume	Daily Average	m3/d	7	--	--
8	Permeate Flow (Per Train)	Net [Q]	Net	m3/d	288 144	216	288
		Instantaneous	Instantaneous	m3/d	346 173	259	346
9	Backpulse Flow	Backpulse	Intermittent	m3/d	769		
		Maintenance Clean	Intermittent	m3/d	458		
		Recovery Clean	Intermittent	m3/d	458		
10	Permeate Flow (Total)	Net [Q]	Net	m3/d	288	432	576
		Instantaneous	Instantaneous	m3/d	346	518	691

Chemical Flows							
C1	Sodium Hypochlorite (12% w/v) (10.3% w/w solution)	Maintenance Clean	Intermittent	m3/d	0.76		
		Recovery Clean	Intermittent	m3/d	4.20		
C2	Citric Acid (50% w/w solution)	Maintenance Clean	Intermittent	m3/d	1.47		
		Recovery Clean	Intermittent	m3/d	1.62		
C3	Alum Dosing (48.5% w/w)	Intermittent	m3/d	0.049	0.022	--	--
C4	Sodium Hydroxide (50% w/w)	Intermittent	m3/d	0.038	0.019	--	--

Air Flows							
A1	Process Air to Aerobic Tanks (Total)	Continuous	scfm	$\frac{230}{D}$	$\frac{230}{D}$	160	160
A2	Membrane Air (Total)	Leap Low	icfm	56	112	n/a	n/a
		Leap High	icfm	112	224	224	112
A3	Membrane Air (Per Train)	Leap Low	icfm	56			
		Leap High	icfm	112			
A4	TWAS Tank Aeration	Continuous	scfm	$\frac{210}{D}$			
A5	Air compressor (Total)	Continuous	cfm	32			

APPENDIX D2

Process & Instrumentation Diagrams



SHOP DRAWING REVIEW FORM

Name of Contract: English River First Nation WWTF

Job No.: 5401-002-00

Supplier: SUEZ

Description: Process and Instrumentation Diagrams

Tag Numbers: _____

SHOP DRAWING REVIEW

The review of this drawing does not in any way relieve the contractor of responsibility as detailed in the contract documents.

	Reviewed
X	Reviewed as noted
	Revise & Resubmit

Submission No. 4

Job No. 7603-002-00

Date October 14, 2020

Dwg. reviewed by IK

MPE ENGINEERING LTD.

Engineer's Notes:

- See comments in Red within.

Attachments: 506752-WTS-PR-T02-8521-DS-000,001,101-111



Water Technologies & Solutions

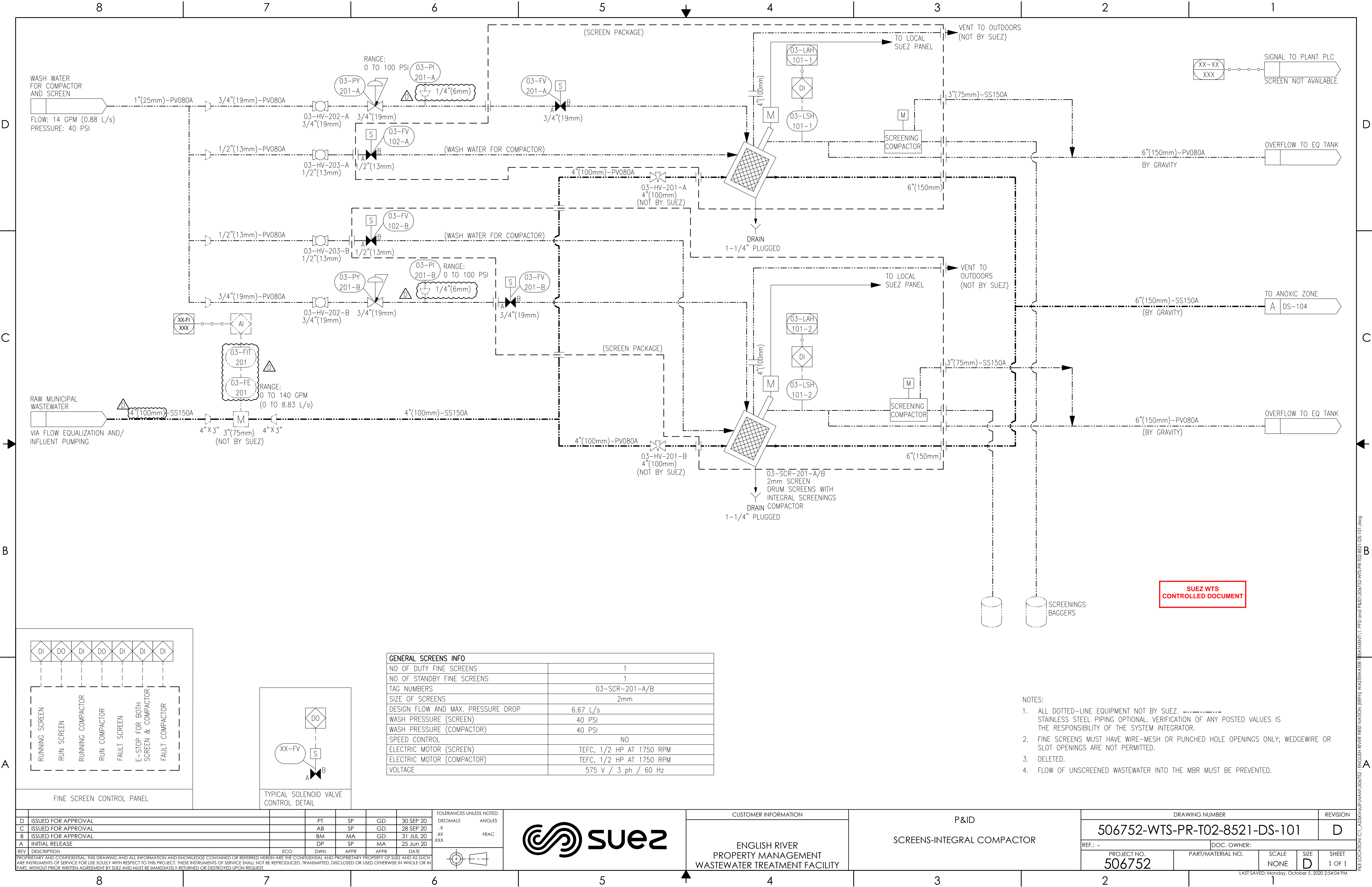
ENGLISH RIVER PROPERTY MANAGEMENT WASTEWATER TREATMENT FACILITY

PIPING AND INSTRUMENTATION DIAGRAMS

SUEZ WTS
CONTROLLED DOCUMENT


										TOLERANCES UNLESS NOTED			CUSTOMER INFORMATION	TITLE PAGE	DRAWING NUMBER				REVISION			
										DECIMALS	ANGLES				506752-WTS-PR-T02-8521-DS-000				A			
										.X	FRAC				REF.: -							
										.XX					DOC. OWNER:							
										.XXX						PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET		
																506752		NONE	D	1 OF 1		
																LAST SAVED: Tuesday, April 30, 2019 2:34:19 PM						

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CONTROL VALVE ACTUATORS		VALVE SYMBOLS		RELIEF		PUMPS, BLOWERS, & COMPRESSORS		FLOW ELEMENT		CONNECTIONS		FILTERS		VESSELS/TRIM	
ACTUATED VALVE OPERATION IS NORMALLY CLOSED UNLESS MARKED OTHERWISE		OPEN DURING NORMAL PROCESS OPERATION		CLOSED DURING NORMAL PROCESS OPERATION											
PISTON DOUBLE ACTING		GATE (OR GENERIC)		PRESSURE SAFETY		CENTRIFUGAL PUMP		PADDLE WHEEL		FLANGE		FIXED SCREEN		CONICAL BOTTOM TANK	
PISTON SPRING TO OPEN		BALL		VACUUM SAFETY		CENTRIFUGAL/REGENERATIVE BLOWER		ANNUBAR		FLANGE BLIND		TOP HAT STRAINER		PROPELLER AGITATOR	
PISTON SPRING TO CLOSE		BUTTERFLY		MULTIFUNCTION		PROPELLER PUMP		FLOW NOZZLE		MECHANICAL COUPLING OR VICTAULIC		BAR SCREEN		VORTEX BREAKER	
DIAPHRAGM DOUBLE ACTING		NEEDLE		PRESSURE RUPTURE DISK		METERING PUMP		FLUME		MECHANICAL COUPLING OR VICTAULIC PLUG		HEPA FILTER		VESSEL INSULATION	
DIAPHRAGM SPRING TO OPEN		GLOBE		AIR OPERATED DOUBLE DIAPHRAGM PUMP		ROTARY LOBE COMPRESSOR BLOWER		MAGNETIC		SANITARY		Y STRAINER		TANK (CLOSED TOP)	
DIAPHRAGM SPRING TO CLOSE		DIAPHRAGM		VERTICAL TURBINE PUMP		VACUUM PUMP (DRY)		PITOT		SANITARY PLUG		CONICAL STRAINER		TANK (OPEN TOP)	
DIAPHRAGM DOUBLE BALANCING		ANGLE		AIR COMPRESSOR PISTON		POSITIVE DISPLACEMENT PUMP		SONIC/ULTRASONIC		THREADED		FILTER		DOMED TANK	
BACK PRESSURE CONTROL (EXTERNAL REGULATING)		PLUG		CAN PUMP		VACUUM PUMP LIQUID RING		TURBINE		THREADED PLUG		PUMP SCREEN		MANHOLE	
BACK PRESSURE CONTROL (INTERNAL REGULATING)		PINCH		AIR COMPRESSOR ROTARY SCREW		WELL PUMP		VENTURI TUBE		CAMLOCK		STEAM TRAP		MANHOLE W/ DAVIT ARM	
PRESSURE REDUCING (EXTERNAL REGULATING)		V-BALL		DRUM PUMP		REFRIGERATED AIR DRYER		MASS FLOW/CORIOLIS		CAMLOCK PLUG		RESIN TRAP		WATER LEVEL	
PRESSURE REDUCING (INTERNAL REGULATING)		KNIFE GATE		SUBMERSIBLE SUMP PUMP		FAN		ROTAMETER		HOSE BARB		MEMBRANE MODULE		LADDER/PLATFORM	
ROTARY MOTOR ANALOG		UPWARD OPENING SLIDING GATE		HYDRAULIC PRESSURE BOOSTER		MOTOR		IN-LINE FLOW GLASS		WELDED PIPE CAP					
ROTARY MOTOR DIGITAL		DOWNWARD OPENING SLIDING GATE						FIXED ORIFICE		PLAIN END PIPE COUPLING					
I/P CONVERTER		MANUAL BLAST GATE						ADJUSTABLE ORIFICE		REDUCER					
POSITIONER		BACKFLOW PREVENTER						RESTRICTED ORIFICE		COMPRESSION FITTING					
TRAVEL STOP		CHECK						RESTRICTED ORIFICE ANGLE		COMPRESSION FITTING PLUG					
MANUAL GEAR WHEEL		INJECTION QUILL						ORIFICE PLATE QUICK-CHANGE		SPECTACLE BLIND OPEN					
MANUAL CHAIN WHEEL		FOOT								SPECTACLE BLIND CLOSED					
SOLENOID		FLOAT								TANK HEATER					
SOLENOID 3 WAY		MUD								HEAT EXCHANGER					
SOLENOID 4 WAY		3 WAY								IN-LINE HEATER					
		4 WAY								PLATE & FRAME HEAT EXCHANGER					
		5 WAY								END PORT HOUSING					
		6 WAY								MEMBRANE MODULE					
		2 VALVE MANIFOLD								DESUPERHEATER					
		3 VALVE MANIFOLD													
		5 VALVE MANIFOLD													
		SAMPLE													
</															



GENERAL SCREENS INFO	
NO OF DUTY FINE SCREENS	1
NO OF STANDBY FINE SCREENS	1
TAG NUMBERS	03-SCR-201-A/B
SIZE OF SCREENS	2mm
DESIGN FLOW AND MAX. PRESSURE DROP	6.67 L/s
WASH PRESSURE (SCREEN)	40 PSI
WASH PRESSURE (COMPACTOR)	40 PSI
SPEED CONTROL	NO
ELECTRIC MOTOR (SCREEN)	TEFC, 1/2 HP AT 1750 RPM
ELECTRIC MOTOR (COMPACTOR)	TEFC, 1/2 HP AT 1750 RPM
VOLTAGE	575 V / 3 ph / 60 Hz

- NOTES:
- ALL DOTTED-LINE EQUIPMENT NOT BY SUEZ.
 - STAINLESS STEEL PIPING OPTIONAL. VERIFICATION OF ANY POSTED VALUES IS THE RESPONSIBILITY OF THE SYSTEM INTEGRATOR.
 - FINE SCREENS MUST HAVE WIRE-MESH OR PUNCHED HOLE OPENINGS ONLY; WEDGEWIRE OR SLOT OPENINGS ARE NOT PERMITTED.
 - DELETED.
 - FLOW OF UNSCREENED WASTEWATER INTO THE MBR MUST BE PREVENTED.

D	ISSUED FOR APPROVAL			PT	SP	GD	30 SEP 20	TOLERANCES UNLESS NOTED DECIMALS ANGLES .x .xx FRAC .xxx
C	ISSUED FOR APPROVAL			AB	SP	GD	28 SEP 20	
B	ISSUED FOR APPROVAL			BM	MA	GD	31 JUL 20	
A	INITIAL RELEASE			DP	SP	MA	25 Jun 20	
REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE		
PROPRIETARY AND CONFIDENTIAL: THIS DRAWING AND ALL INFORMATION AND KNOWLEDGE CONTAINED OR REFERRED HEREIN ARE THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF SUEZ AND AS SUCH ARE INSTRUMENTS OF SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT. THESE INSTRUMENTS OF SERVICE SHALL NOT BE REPRODUCED, TRANSMITTED, DISCLOSED OR USED OTHERWISE IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN AGREEMENT BY SUEZ AND MUST BE IMMEDIATELY RETURNED OR DESTROYED UPON REQUEST.								



CUSTOMER INFORMATION	
ENGLISH RIVER PROPERTY MANAGEMENT WASTEWATER TREATMENT FACILITY	

P&ID	
SCREENS-INTEGRAL COMPACTOR	

DRAWING NUMBER				REVISION
506752-WTS-PR-T02-8521-DS-101				D
REF.: -		DOC. OWNER:		
PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
506752		NONE	D	1 OF 1

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D

C

B

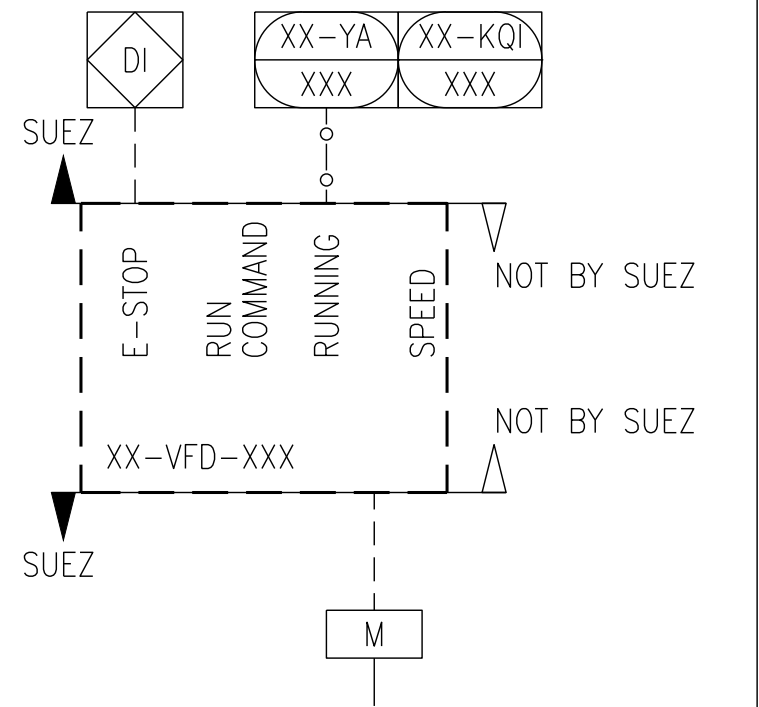
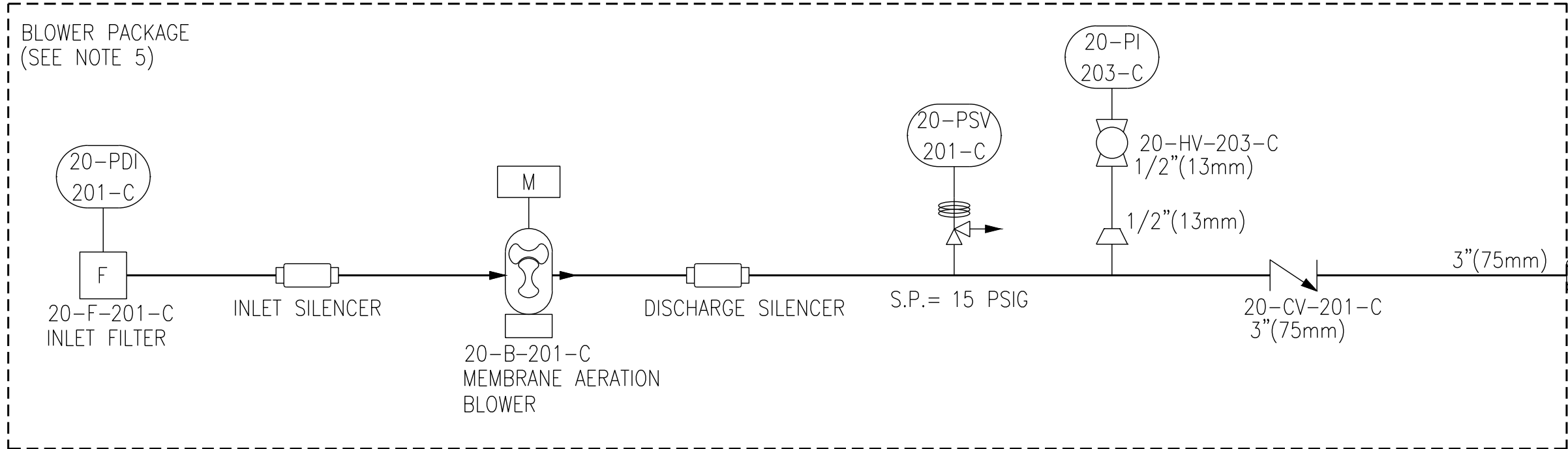
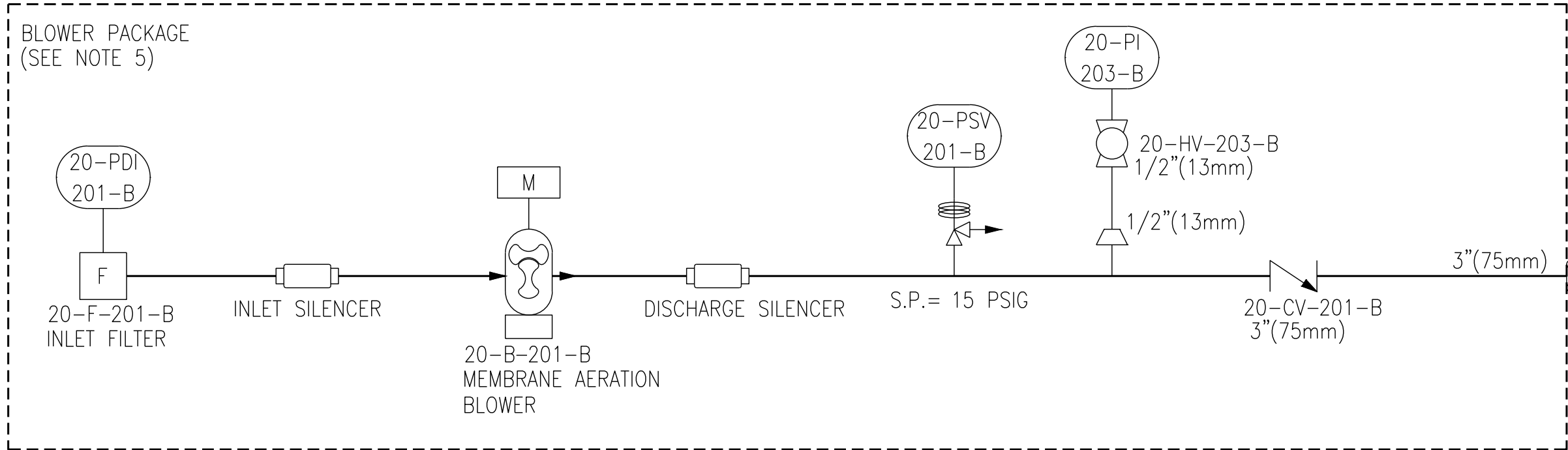
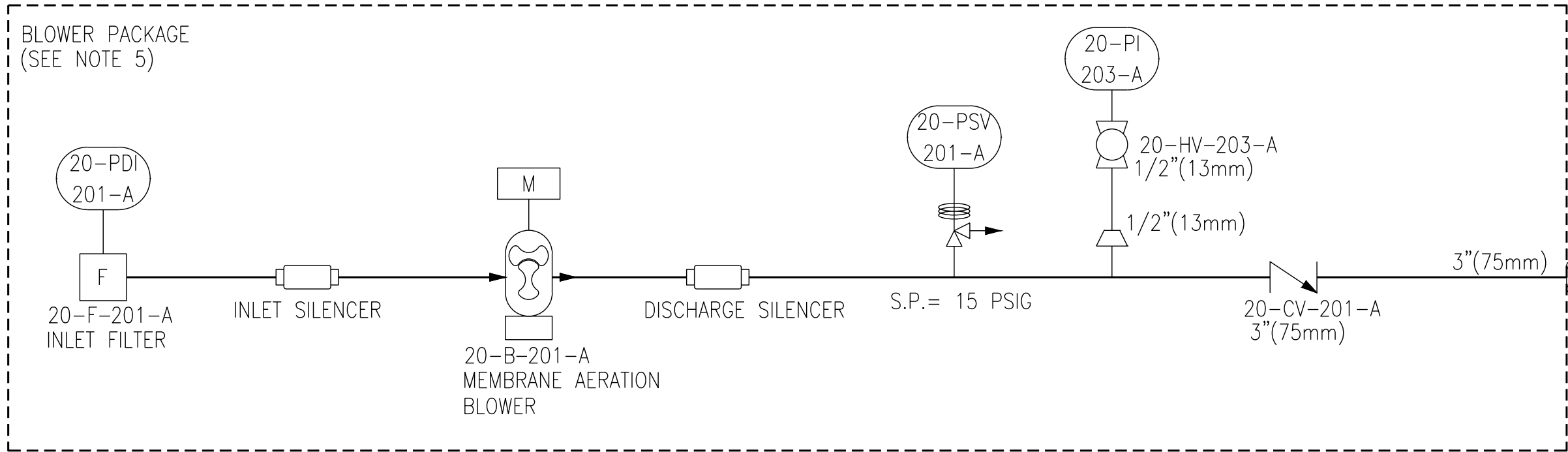
A

D

C

B

A



MEMBRANE BLOWERS INFO			
GENERAL BLOWER INFO	PHASE 1	PHASE 2	BUILDOUT
NO OF DUTY BLOWERS	2	2	2
NO OF STANDBY BLOWERS	1	1	1
TOTAL NO OF BLOWERS	3	3	3
TAG NUMBERS	20-B-201-A/B/C		
TYPE OF BLOWER	POSITIVE DISPLACEMENT		
SOUND ENCLOSURE PROVIDED	YES		
SPEED CONTROL	YES		
ELECTRIC MOTOR	TEFC, 10 HP AT 1800 RPM		
VOLTAGE	575 V / 3 ph / 60 Hz		
SHEAVED BLOWER MAX SPEED	4800 RPM		

BLOWER DESIGN CONDITIONS	PHASE 1			PHASE 2		
RATED CAPACITY (UNSHEAVED)				156 SCFM	at	6.5 PSIG
MIN CAPACITY, AS SUPPLIED	32 SCFM	at	4.2 PSIG	56 SCFM	at	4.4 PSIG
MAX CAPACITY, AS SUPPLIED	64 SCFM	at	6.5 PSIG	112 SCFM	at	6.5 PSIG
MAX DISCHARGE TEMPERATURE	98°C			98°C		
BLOWER MIN SPEED	33 SCFM at 4.4 PSIG (1703 RPM, 35% of max blower speed)					

- NOTES:
- ALL DOTTED-LINE EQUIPMENT NOT BY SUEZ.
VERIFICATION OF ANY POSTED VALUES IS THE RESPONSIBILITY OF THE SYSTEM INTEGRATOR.
 - THE ACTUAL BLOWER DISCHARGE PRESSURE IS DETERMINED BASED ON MAXIMUM POSSIBLE LIQUID LEVEL IN TANKS BEING AERATED.
 - SYSTEM INTEGRATOR IS RESPONSIBLE FOR HOT AIR PIPE THERMO-INSULATION AS APPLICABLE.
 - BLOWER DISCHARGE FLEXIBLE SLEEVE.
 - ACOUSTIC ENCLOSURES ARE INCLUDED.
 - ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
 - VFD's SUPPLY AND POWER NOT BY SUEZ BUT CONTROLLED BY SUEZ PLC.

D	ISSUED FOR APPROVAL		PT	SP	GD	30 SEP 20	TOLERANCES UNLESS NOTED
C	ISSUED FOR APPROVAL		AB	SP	GD	28 SEP 20	DECIMALS ANGLES
B	ISSUED FOR APPROVAL		BM	MA	GD	31 JUL 20	X .XX .XXX
A	INITIAL RELEASE		DP	SP	MA	25 Jun 20	FRAC
REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE	
PROPRIETARY AND CONFIDENTIAL: THIS DRAWING AND ALL INFORMATION AND KNOWLEDGE CONTAINED OR REFERRED HEREIN ARE THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF SUEZ AND AS SUCH ARE INSTRUMENTS OF SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT. THESE INSTRUMENTS OF SERVICE SHALL NOT BE REPRODUCED, TRANSMITTED, DISCLOSED OR USED OTHERWISE IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN AGREEMENT BY SUEZ AND MUST BE IMMEDIATELY RETURNED OR DESTROYED UPON REQUEST.							



CUSTOMER INFORMATION

ENGLISH RIVER
PROPERTY MANAGEMENT
WASTEWATER TREATMENT FACILITY

P&ID

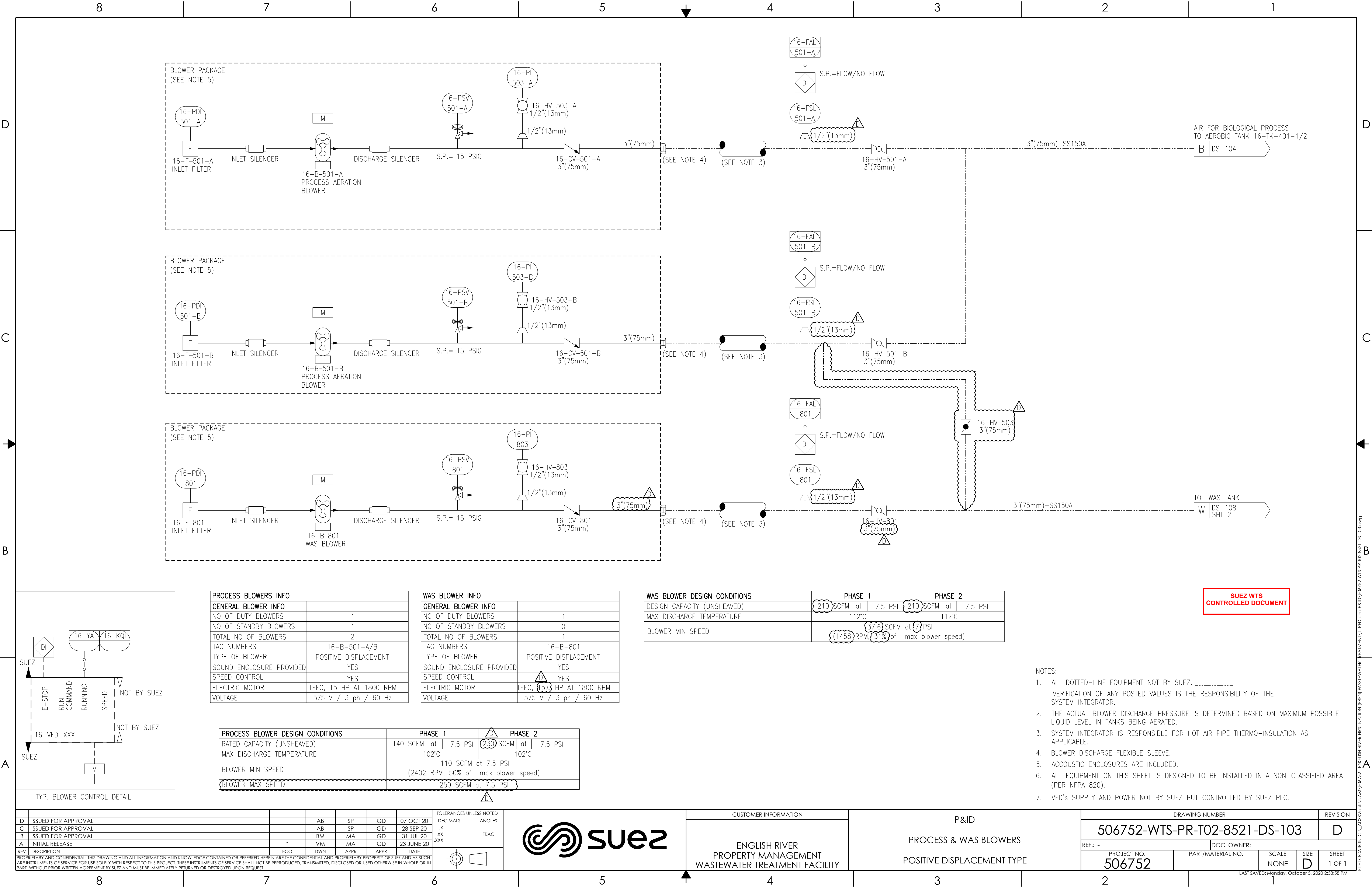
MEMBRANE BLOWERS

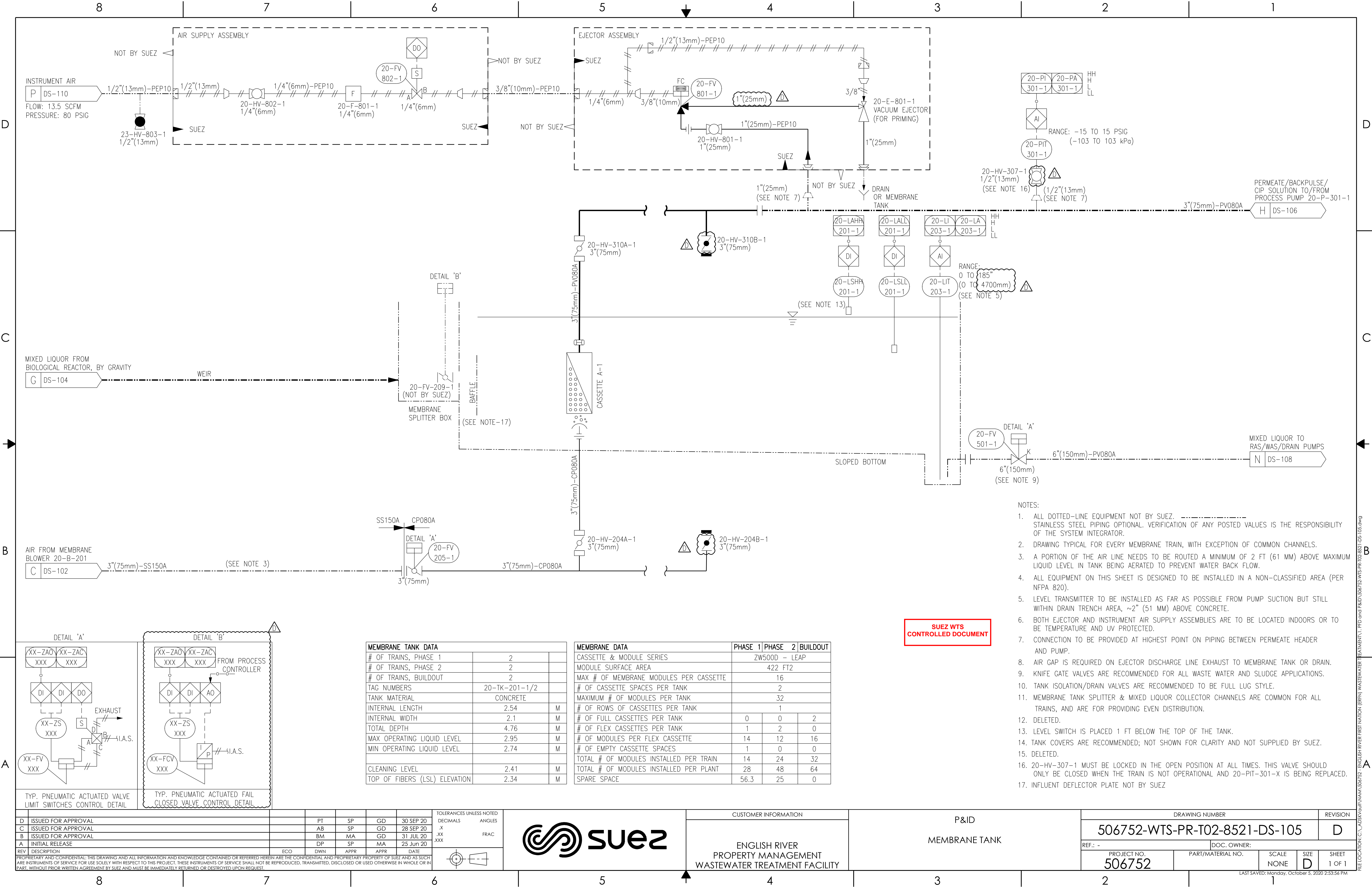
POSITIVE DISPLACEMENT TYPE

DRAWING NUMBER				REVISION
506752-WTS-PR-T02-8521-DS-102				D
REF.: -	DOC. OWNER:	SCALE	SIZE	SHEET
PROJECT NO. 506752	PART/MATERIAL NO.	NONE	D	1 OF 1

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- NOTES:
- ALL DOTTED-LINE EQUIPMENT NOT BY SUEZ. ----- STAINLESS STEEL PIPING OPTIONAL. VERIFICATION OF ANY POSTED VALUES IS THE RESPONSIBILITY OF THE SYSTEM INTEGRATOR.
 - DRAWING TYPICAL FOR EVERY MEMBRANE TRAIN, WITH EXCEPTION OF COMMON CHANNELS.
 - A PORTION OF THE AIR LINE NEEDS TO BE ROUTED A MINIMUM OF 2 FT (61 MM) ABOVE MAXIMUM LIQUID LEVEL IN TANK BEING AERATED TO PREVENT WATER BACK FLOW.
 - ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
 - LEVEL TRANSMITTER TO BE INSTALLED AS FAR AS POSSIBLE FROM PUMP SUCTION BUT STILL WITHIN DRAIN TRENCH AREA, ~2" (51 MM) ABOVE CONCRETE.
 - BOTH EJECTOR AND INSTRUMENT AIR SUPPLY ASSEMBLIES ARE TO BE LOCATED INDOORS OR TO BE TEMPERATURE AND UV PROTECTED.
 - CONNECTION TO BE PROVIDED AT HIGHEST POINT ON PIPING BETWEEN PERMEATE HEADER AND PUMP.
 - AIR GAP IS REQUIRED ON EJECTOR DISCHARGE LINE EXHAUST TO MEMBRANE TANK OR DRAIN.
 - KNIFE GATE VALVES ARE RECOMMENDED FOR ALL WASTE WATER AND SLUDGE APPLICATIONS.
 - TANK ISOLATION/DRAIN VALVES ARE RECOMMENDED TO BE FULL LUG STYLE.
 - MEMBRANE TANK SPLITTER & MIXED LIQUOR COLLECTOR CHANNELS ARE COMMON FOR ALL TRAINS, AND ARE FOR PROVIDING EVEN DISTRIBUTION.
 - DELETED.
 - LEVEL SWITCH IS PLACED 1 FT BELOW THE TOP OF THE TANK.
 - TANK COVERS ARE RECOMMENDED; NOT SHOWN FOR CLARITY AND NOT SUPPLIED BY SUEZ.
 - DELETED.
 - 20-HV-307-1 MUST BE LOCKED IN THE OPEN POSITION AT ALL TIMES. THIS VALVE SHOULD ONLY BE CLOSED WHEN THE TRAIN IS NOT OPERATIONAL AND 20-PIT-301-X IS BEING REPLACED.
 - INFLUENT DEFLECTOR PLATE NOT BY SUEZ

MEMBRANE TANK DATA			
# OF TRAINS, PHASE 1	2		
# OF TRAINS, PHASE 2	2		
# OF TRAINS, BUILDOUT	2		
TAG NUMBERS	20-TK-201-1/2		
TANK MATERIAL	CONCRETE		
INTERNAL LENGTH	2.54	M	
INTERNAL WIDTH	2.1	M	
TOTAL DEPTH	4.76	M	
MAX OPERATING LIQUID LEVEL	2.95	M	
MIN OPERATING LIQUID LEVEL	2.74	M	
CLEANING LEVEL	2.41	M	
TOP OF FIBERS (LSL) ELEVATION	2.34	M	

MEMBRANE DATA				PHASE 1	PHASE 2	BUILDOUT
CASSETTE & MODULE SERIES				ZW500D -- LEAP		
MODULE SURFACE AREA				422 FT2		
MAX # OF MEMBRANE MODULES PER CASSETTE				16		
# OF CASSETTE SPACES PER TANK				2		
MAXIMUM # OF MODULES PER TANK				32		
# OF ROWS OF CASSETTES PER TANK				1		
# OF FULL CASSETTES PER TANK				0	0	2
# OF FLEX CASSETTES PER TANK				1	2	0
# OF MODULES PER FLEX CASSETTE				14	12	16
# OF EMPTY CASSETTE SPACES				1	0	0
TOTAL # OF MODULES INSTALLED PER TRAIN				14	24	32
TOTAL # OF MODULES INSTALLED PER PLANT				28	48	64
SPARE SPACE				56.3	25	0

REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE	TOLERANCES UNLESS NOTED
D	ISSUED FOR APPROVAL		PT	SP	GD	30 SEP 20	DECIMALS ANGLES
C	ISSUED FOR APPROVAL		AB	SP	GD	28 SEP 20	X .XX .XXX
B	ISSUED FOR APPROVAL		BM	MA	GD	31 JUL 20	FRAC
A	INITIAL RELEASE		DP	SP	MA	25 Jun 20	
REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE	

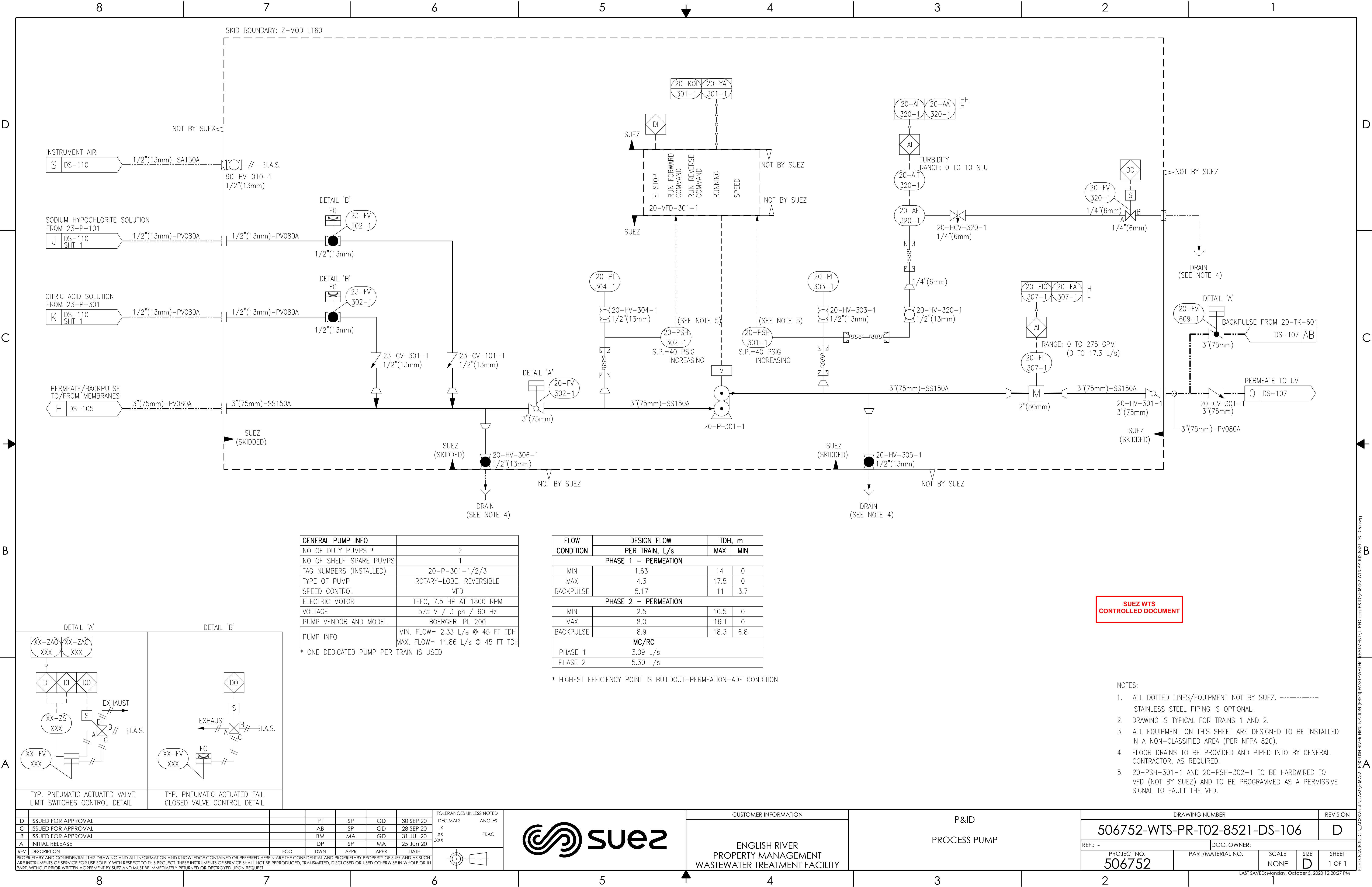
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CUSTOMER INFORMATION	
ENGLISH RIVER PROPERTY MANAGEMENT WASTEWATER TREATMENT FACILITY	

P&ID
MEMBRANE TANK

DRAWING NUMBER				REVISION
506752-WTS-PR-T02-8521-DS-105				D
REF.: -		DOC. OWNER:		
PROJECT NO. 506752	PART/MATERIAL NO.	SCALE NONE	SIZE D	SHEET 1 OF 1



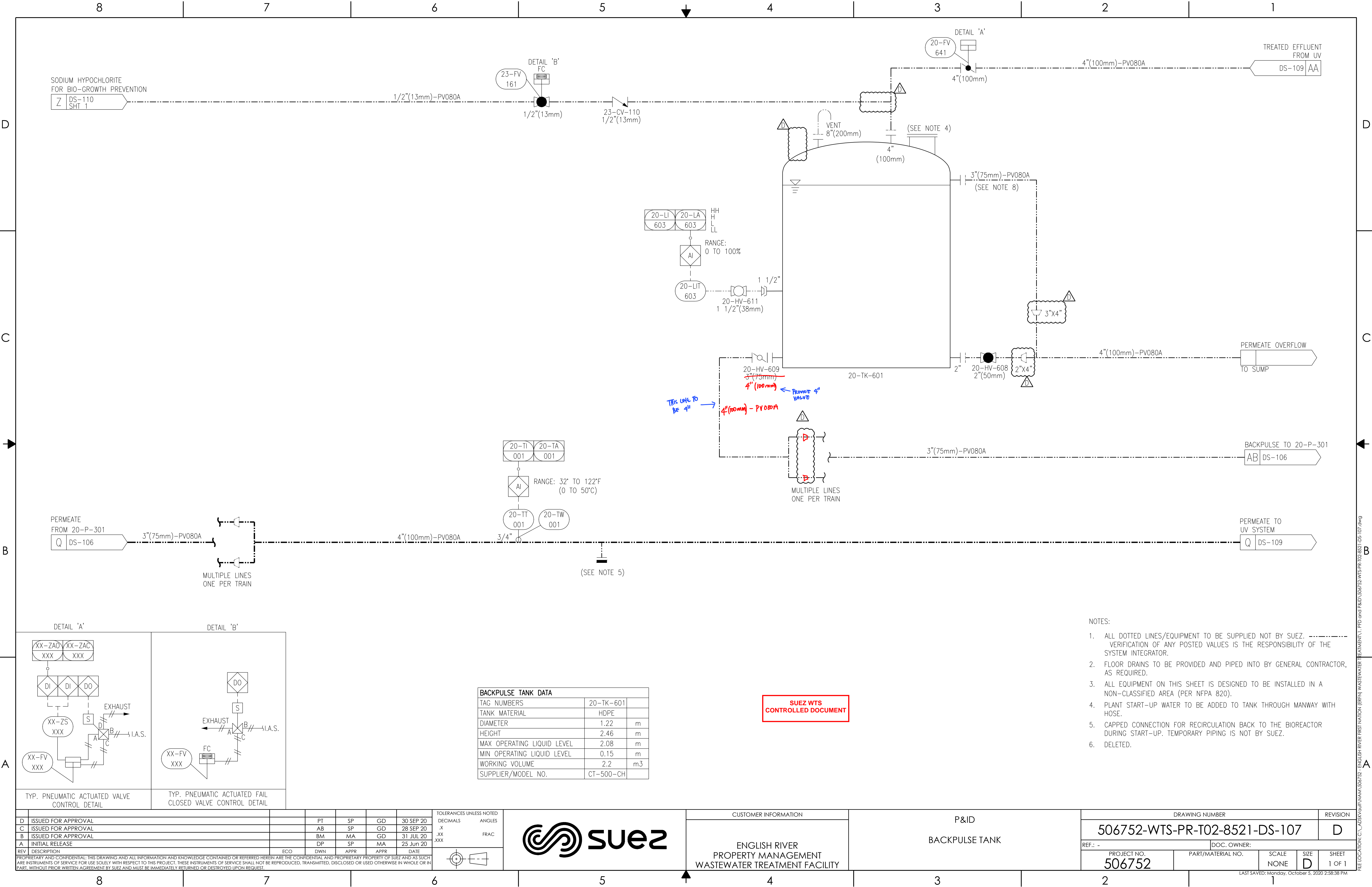
GENERAL PUMP INFO	
NO OF DUTY PUMPS *	2
NO OF SHELF-SPARE PUMPS	1
TAG NUMBERS (INSTALLED)	20-P-301-1/2/3
TYPE OF PUMP	ROTARY-LOBE, REVERSIBLE
SPEED CONTROL	VFD
ELECTRIC MOTOR	TEFC, 7.5 HP AT 1800 RPM
VOLTAGE	575 V / 3 ph / 60 Hz
PUMP VENDOR AND MODEL	BOERGER, PL 200
PUMP INFO	MIN. FLOW= 2.33 L/s @ 45 FT TDH MAX. FLOW= 11.86 L/s @ 45 FT TDH
* ONE DEDICATED PUMP PER TRAIN IS USED	

FLOW CONDITION	DESIGN FLOW	TDH, m	
	PER TRAIN, L/s	MAX	MIN
PHASE 1 - PERMEATION			
MIN	1.63	14	0
MAX	4.3	17.5	0
BACKPULSE	5.17	11	3.7
PHASE 2 - PERMEATION			
MIN	2.5	10.5	0
MAX	8.0	16.1	0
BACKPULSE	8.9	18.3	6.8
MC/RC			
PHASE 1	3.09 L/s		
PHASE 2	5.30 L/s		

* HIGHEST EFFICIENCY POINT IS BUILDOUT-PERMEATION-ADF CONDITION.

- NOTES:
- ALL DOTTED LINES/EQUIPMENT NOT BY SUEZ. ----- STAINLESS STEEL PIPING IS OPTIONAL.
 - DRAWING IS TYPICAL FOR TRAINS 1 AND 2.
 - ALL EQUIPMENT ON THIS SHEET ARE DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
 - FLOOR DRAINS TO BE PROVIDED AND PIPED INTO BY GENERAL CONTRACTOR, AS REQUIRED.
 - 20-PSH-301-1 AND 20-PSH-302-1 TO BE HARDWIRED TO VFD (NOT BY SUEZ) AND TO BE PROGRAMMED AS A PERMISSIVE SIGNAL TO FAULT THE VFD.

REV		ECO		DWN		APPR		DATE		TOLERANCES UNLESS NOTED		CUSTOMER INFORMATION		DRAWING NUMBER		REVISION	
D	ISSUED FOR APPROVAL			PT	SP	GD		30 SEP 20		DECIMALS	ANGLES	ENGLISH RIVER PROPERTY MANAGEMENT WASTEWATER TREATMENT FACILITY		506752-WTS-PR-T02-8521-DS-106		D	
C	ISSUED FOR APPROVAL			AB	SP	GD		28 SEP 20		X							
B	ISSUED FOR APPROVAL			BM	MA	GD		31 JUL 20		.XX							
A	INITIAL RELEASE			DP	SP	MA		25 Jun 20		.XXX	FRAC						
DESCRIPTION												P&ID		PROJECT NO.		DOC. OWNER:	
PROPRIETARY AND CONFIDENTIAL: THIS DRAWING AND ALL INFORMATION AND KNOWLEDGE CONTAINED OR REFERRED HEREIN ARE THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF SUEZ AND AS SUCH ARE INSTRUMENTS OF SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT. THESE INSTRUMENTS OF SERVICE SHALL NOT BE REPRODUCED, TRANSMITTED, DISCLOSED OR USED OTHERWISE IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN AGREEMENT BY SUEZ AND MUST BE IMMEDIATELY RETURNED OR DESTROYED UPON REQUEST.												PROCESS PUMP		506752		SCALE	
														PART/MATERIAL NO.		NONE	
														SIZE		D	
														SHEET		1 OF 1	



- NOTES:
- ALL DOTTED LINES/EQUIPMENT TO BE SUPPLIED NOT BY SUEZ. ----- VERIFICATION OF ANY POSTED VALUES IS THE RESPONSIBILITY OF THE SYSTEM INTEGRATOR.
 - FLOOR DRAINS TO BE PROVIDED AND PIPED INTO BY GENERAL CONTRACTOR, AS REQUIRED.
 - ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-Classified AREA (PER NFPA 820).
 - PLANT START-UP WATER TO BE ADDED TO TANK THROUGH MANWAY WITH HOSE.
 - CAPPED CONNECTION FOR RECIRCULATION BACK TO THE BIOREACTOR DURING START-UP. TEMPORARY PIPING IS NOT BY SUEZ.
 - DELETED.

BACKPULSE TANK DATA			
TAG NUMBERS	20-TK-601		
TANK MATERIAL	HDPE		
DIAMETER	1.22	m	
HEIGHT	2.46	m	
MAX OPERATING LIQUID LEVEL	2.08	m	
MIN OPERATING LIQUID LEVEL	0.15	m	
WORKING VOLUME	2.2	m ³	
SUPPLIER/MODEL NO.	CT-500-CH		

SUEZ WTS
CONTROLLED DOCUMENT

REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE
D	ISSUED FOR APPROVAL			PT	SP	GD 30 SEP 20
C	ISSUED FOR APPROVAL			AB	SP	GD 28 SEP 20
B	ISSUED FOR APPROVAL			BM	MA	GD 31 JUL 20
A	INITIAL RELEASE			DP	SP	MA 25 Jun 20

TOLERANCES UNLESS NOTED

DECIMALS ANGLES

X .XX .XXX

FRAC

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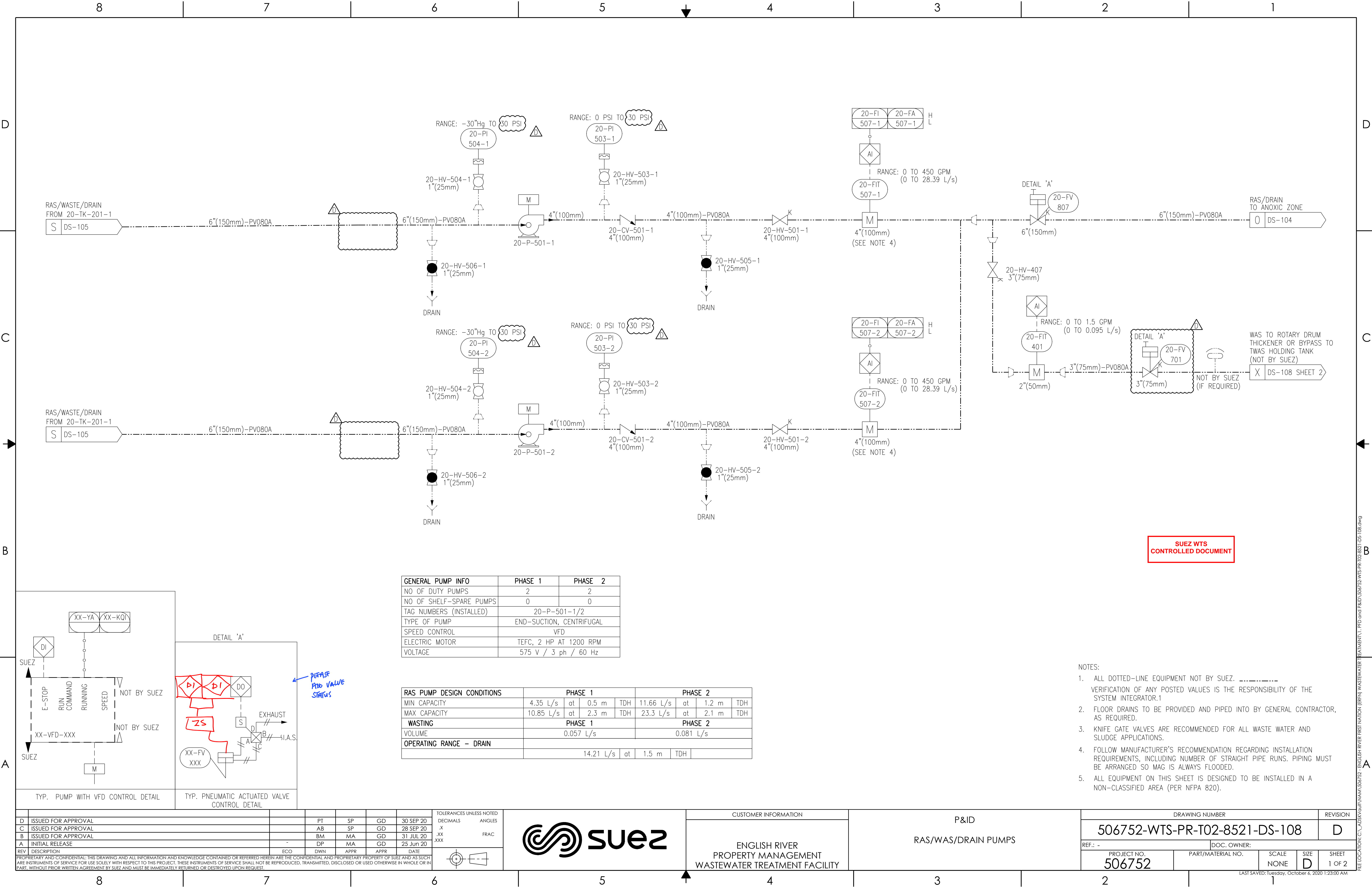
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CUSTOMER INFORMATION	
ENGLISH RIVER PROPERTY MANAGEMENT WASTEWATER TREATMENT FACILITY	

P&ID
BACKPULSE TANK

DRAWING NUMBER				REVISION
506752-WTS-PR-T02-8521-DS-107				D
REF.: -		DOC. OWNER:		
PROJECT NO. 506752	PART/MATERIAL NO.	SCALE NONE	SIZE D	SHEET 1 OF 1



GENERAL PUMP INFO	PHASE 1	PHASE 2
NO OF DUTY PUMPS	2	2
NO OF SHELF-SPARE PUMPS	0	0
TAG NUMBERS (INSTALLED)	20-P-501-1/2	
TYPE OF PUMP	END-SUCTION, CENTRIFUGAL	
SPEED CONTROL	VFD	
ELECTRIC MOTOR	TEFC, 2 HP AT 1200 RPM	
VOLTAGE	575 V / 3 ph / 60 Hz	

RAS PUMP DESIGN CONDITIONS		PHASE 1				PHASE 2			
MIN CAPACITY	4.35 L/s	at	0.5 m	TDH	11.66 L/s	at	1.2 m	TDH	
MAX CAPACITY	10.85 L/s	at	2.3 m	TDH	23.3 L/s	at	2.1 m	TDH	
WASTING		PHASE 1				PHASE 2			
VOLUME		0.057 L/s				0.081 L/s			
OPERATING RANGE – DRAIN		14.21 L/s				at	1.5 m	TDH	

- NOTES:
- ALL DOTTED-LINE EQUIPMENT NOT BY SUEZ.
VERIFICATION OF ANY POSTED VALUES IS THE RESPONSIBILITY OF THE SYSTEM INTEGRATOR.1
 - FLOOR DRAINS TO BE PROVIDED AND PIPED INTO BY GENERAL CONTRACTOR, AS REQUIRED.
 - KNIFE GATE VALVES ARE RECOMMENDED FOR ALL WASTE WATER AND SLUDGE APPLICATIONS.
 - FOLLOW MANUFACTURER'S RECOMMENDATION REGARDING INSTALLATION REQUIREMENTS, INCLUDING NUMBER OF STRAIGHT PIPE RUNS. PIPING MUST BE ARRANGED SO MAG IS ALWAYS FLOODED.
 - ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-Classified AREA (PER NFPA 820).

ISSUED FOR APPROVAL

ISSUED FOR APPROVAL

ISSUED FOR APPROVAL

INITIAL RELEASE

REV DESCRIPTION

ECO

DWN

APPR

APPR

DATE

PT

AB

BM

DP

SP

SP

MA

MA

GD

GD

GD

GD

30 SEP 20

28 SEP 20

31 JUL 20

25 Jun 20

TOLERANCES UNLESS NOTED

DECIMALS

ANGLES

FRAC

ENGLISH RIVER
PROPERTY MANAGEMENT
WASTEWATER TREATMENT FACILITY

CUSTOMER INFORMATION

P&ID

RAS/WAS/Drain PUMPS

DRAWING NUMBER

506752-WTS-PR-T02-8521-DS-108

REVISION

D

REF.: -

PROJECT NO.

506752

DOC. OWNER:

PART/MATERIAL NO.

SCALE

NONE

SIZE

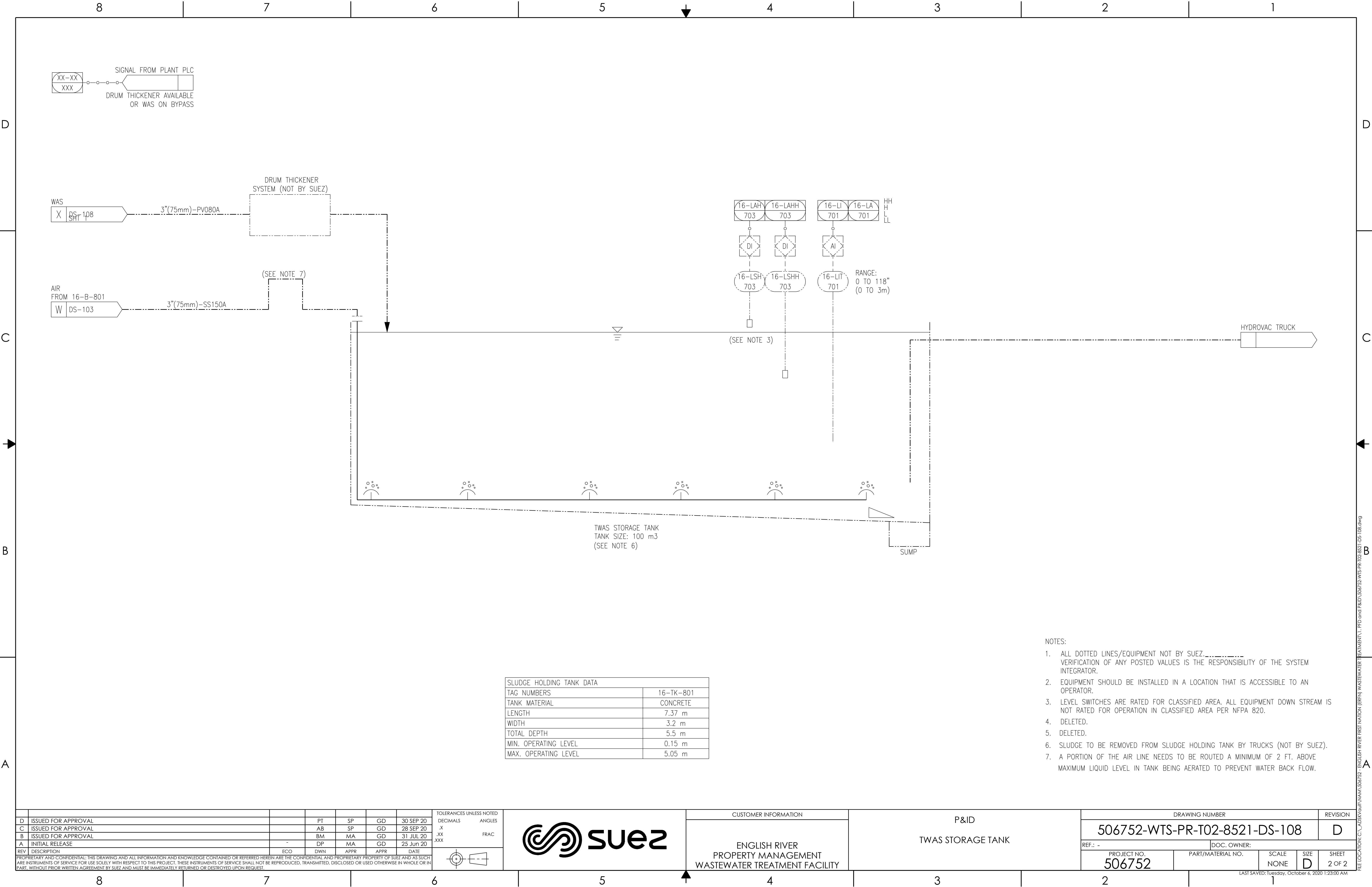
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SHEET

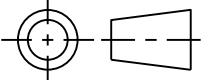
1 OF 2

LAST SAVED: Tuesday, October 6, 2020 1:23:00 AM

FILE LOCATION: C:\ASKY\win\506752 - ENGLISH RIVER FIRST NATION (ERFN) WASTEWATER TREATMENT\1 - P&ID and P&ID\506752-WTS-PR-T02-8521-DS-108.dwg



D	ISSUED FOR APPROVAL		PT	SP	GD	30 SEP 20	TOLERANCES UNLESS NOTED
C	ISSUED FOR APPROVAL		AB	SP	GD	28 SEP 20	DÉCIMALS
B	ISSUED FOR APPROVAL		BM	MA	GD	31 JUL 20	X
A	INITIAL RELEASE		DP	MA	GD	25 Jun 20	.XX
REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE	FRAC
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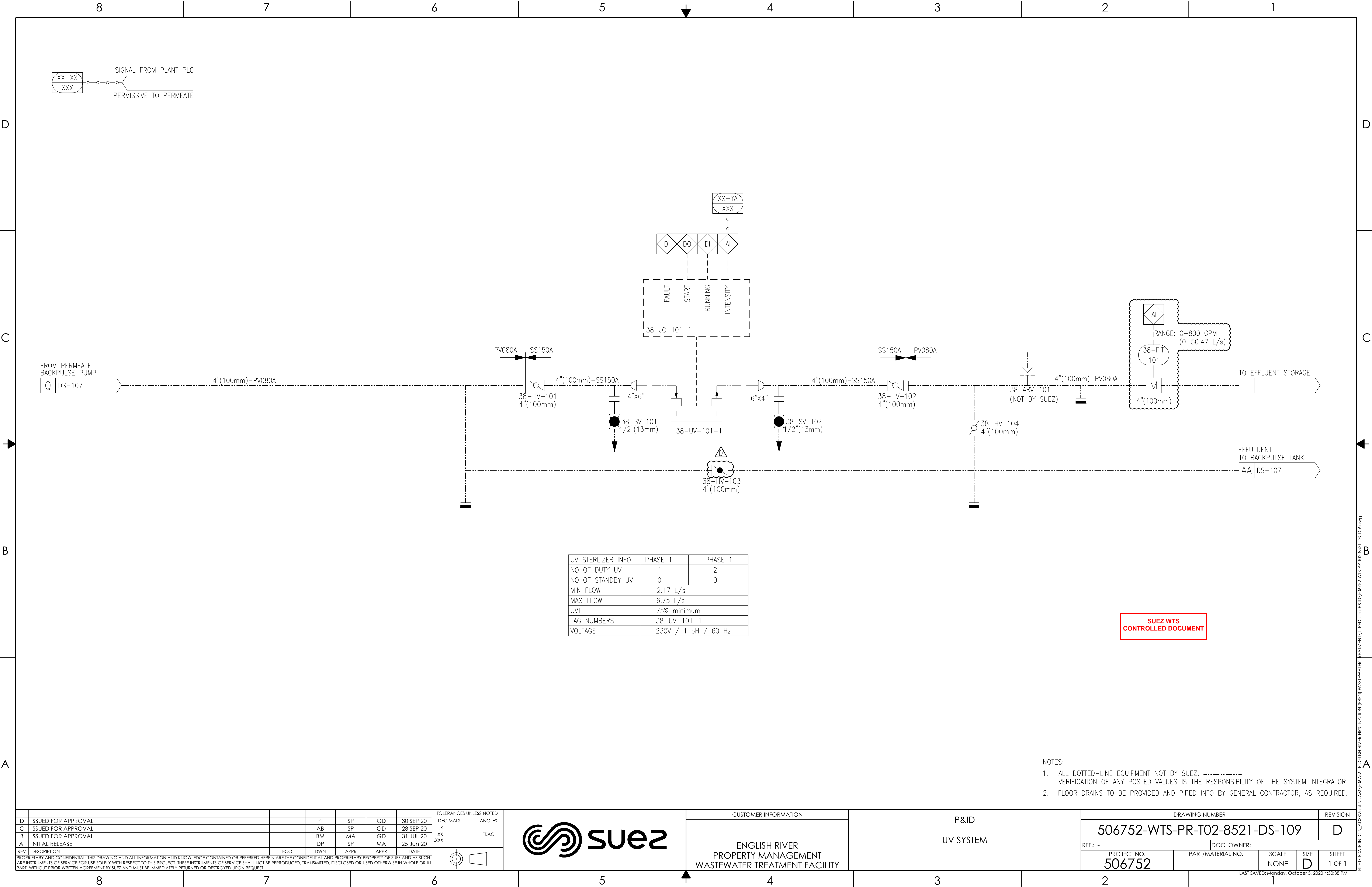


CUSTOMER INFORMATION
ENGLISH RIVER PROPERTY MANAGEMENT WASTEWATER TREATMENT FACILITY

P&ID
TWAS STORAGE TANK

DRAWING NUMBER				REVISION
506752-WTS-PR-T02-8521-DS-108				D
REF.: -	DOC. OWNER:			
PROJECT NO. 506752	PART/MATERIAL NO.	SCALE NONE	SIZE D	SHEET 2 OF 2

LAST SAVED: Tuesday, October 6, 2020 1:23:00 AM



UV STERLIZER INFO	PHASE 1	PHASE 1
NO OF DUTY UV	1	2
NO OF STANDBY UV	0	0
MIN FLOW	2.17 L/s	
MAX FLOW	6.75 L/s	
UVT	75% minimum	
TAG NUMBERS	38-UV-101-1	
VOLTAGE	230V / 1 pH / 60 Hz	

SUEZ WTS
CONTROLLED DOCUMENT

- NOTES:
- ALL DOTTED-LINE EQUIPMENT NOT BY SUEZ.
VERIFICATION OF ANY POSTED VALUES IS THE RESPONSIBILITY OF THE SYSTEM INTEGRATOR.
 - FLOOR DRAINS TO BE PROVIDED AND PIPED INTO BY GENERAL CONTRACTOR, AS REQUIRED.

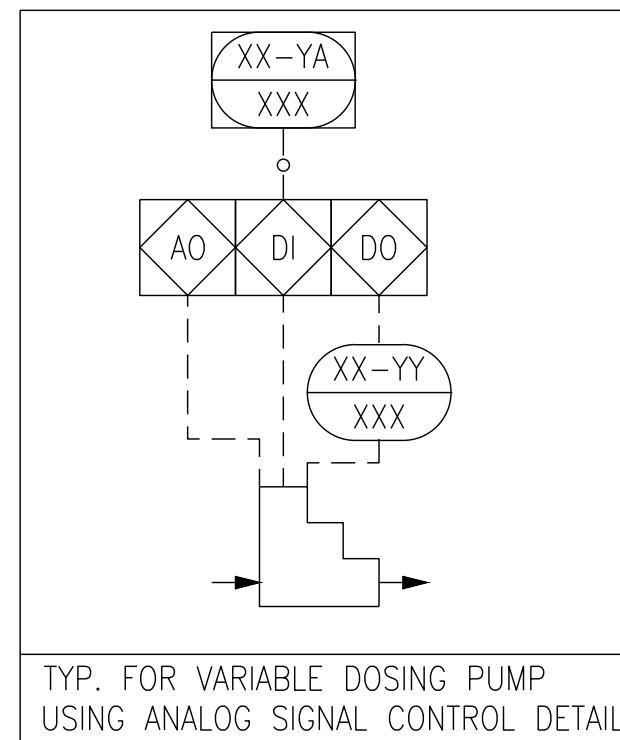
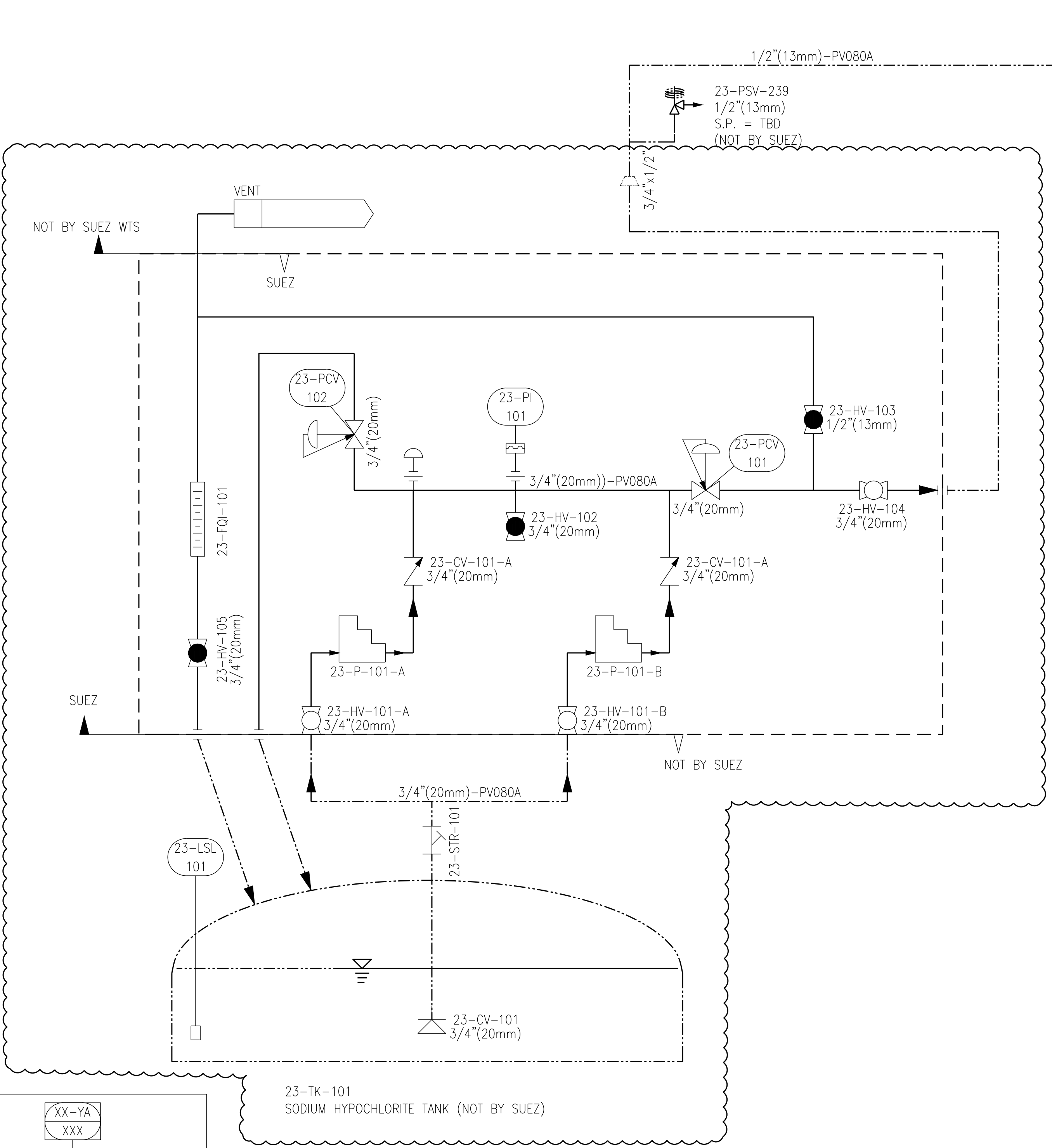
						PT			SP			GD			30 SEP 20			TOLERANCES UNLESS NOTED						CUSTOMER INFORMATION			P&ID			UV SYSTEM			DRAWING NUMBER			REVISION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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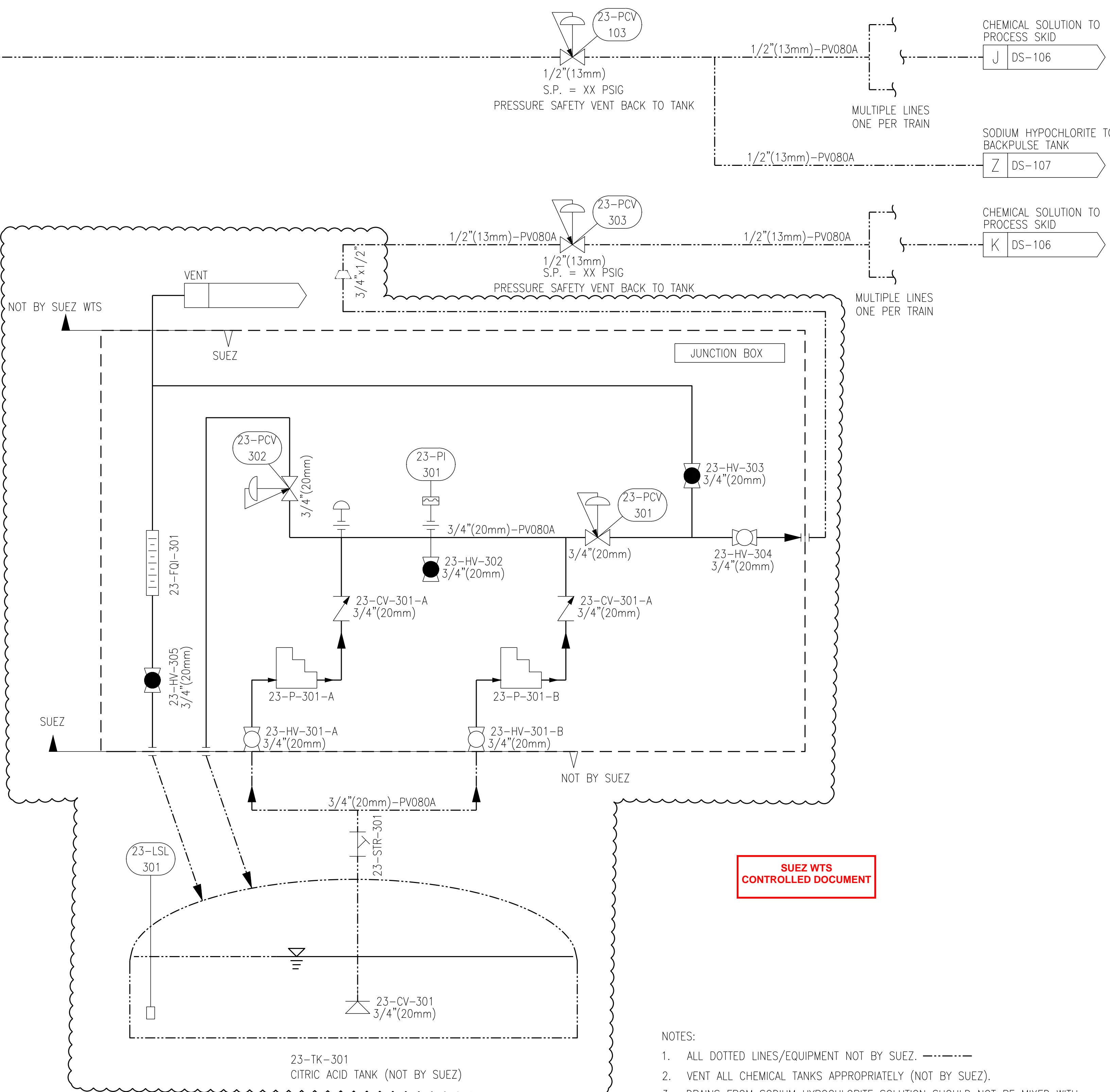
C

B

A



SODIUM HYPOCHLORITE PUMP DATA		10.3 % wt/wt
TAG NUMBERS	23-P-101-A/B	
# OF PUMPS	1 DUTY/1 STAND BY	
DESIGN FLOW	0.005-0.048 L/s	
VOLTAGE	120 V/ 1 PH/ 60 HZ	
SUPPLIER, MODEL	PROMINENT	



CITRIC ACID PUMP DATA		50% wt/wt
TAG NUMBERS	23-P-301-A/B	
# OF PUMPS	1 DUTY/1 STAND BY	
DESIGN FLOW	0.01-0.019 L/s	
VOLTAGE	120 V/ 1 PH/ 60 HZ	
SUPPLIER, MODEL	PROMINENT	

- NOTES:
- ALL DOTTED LINES/EQUIPMENT NOT BY SUEZ.
 - VENT ALL CHEMICAL TANKS APPROPRIATELY (NOT BY SUEZ).
 - DRAINS FROM SODIUM HYPOCHLORITE SOLUTION SHOULD NOT BE MIXED WITH DRAINS FROM ANY ACIDS, SINCE POISONOUS GASES MAY BE CREATED.
 - ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-Classified AREA (PER NFPA 820).
 - CHEMICAL CONTAINMENT NOT BY SUEZ.

D	ISSUED FOR APPROVAL	AB	SP	GD	07 OCT 20	TOLERANCES UNLESS NOTED
C	ISSUED FOR APPROVAL	AB	SP	GD	28 SEP 20	DECIMALS ANGLES
B	ISSUED FOR APPROVAL	BM	MA	GD	31 JUL 20	X .XX XXX
A	INITIAL RELEASE	DP	SP	MA	25 Jun 20	FRAC
REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE

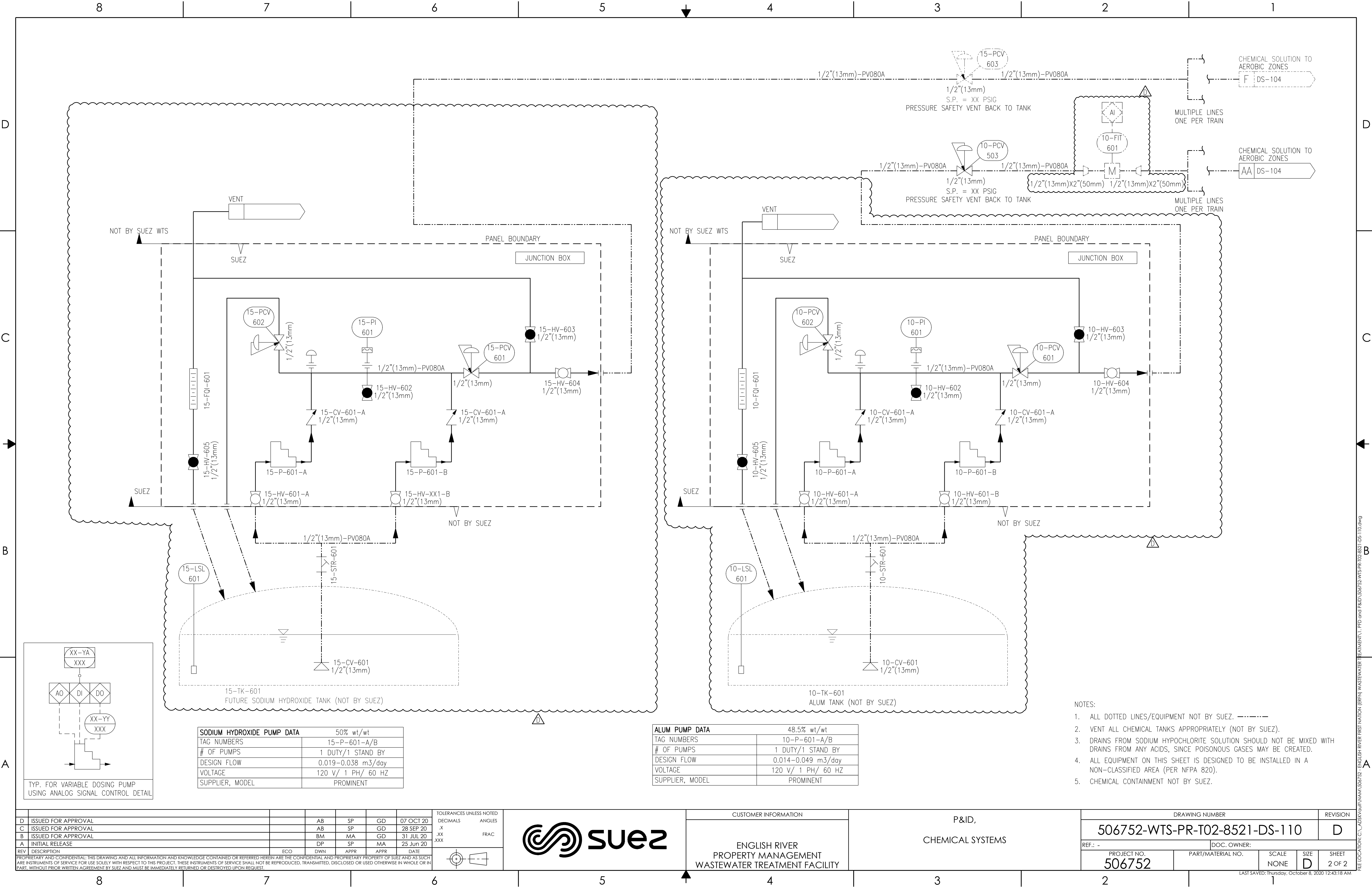


CUSTOMER INFORMATION

ENGLISH RIVER
PROPERTY MANAGEMENT
WASTEWATER TREATMENT FACILITY

P&ID,
CHEMICAL SYSTEMS

DRAWING NUMBER				REVISION
506752-WTS-PR-T02-8521-DS-110				D
REF.: -	DOC. OWNER:	SCALE	SIZE	SHEET
PROJECT NO. 506752	PART/MATERIAL NO.	NONE	D	1 OF 2



SODIUM HYDROXIDE PUMP DATA		50% wt/wt
TAG NUMBERS	15-P-601-A/B	
# OF PUMPS	1 DUTY/1 STAND BY	
DESIGN FLOW	0.019-0.038 m3/day	
VOLTAGE	120 V/ 1 PH/ 60 HZ	
SUPPLIER, MODEL	PROMINENT	

ALUM PUMP DATA		48.5% wt/wt
TAG NUMBERS	10-P-601-A/B	
# OF PUMPS	1 DUTY/1 STAND BY	
DESIGN FLOW	0.014-0.049 m3/day	
VOLTAGE	120 V/ 1 PH/ 60 HZ	
SUPPLIER, MODEL	PROMINENT	

- NOTES:
- ALL DOTTED LINES/EQUIPMENT NOT BY SUEZ. -----
 - VENT ALL CHEMICAL TANKS APPROPRIATELY (NOT BY SUEZ).
 - DRAINS FROM SODIUM HYPOCHLORITE SOLUTION SHOULD NOT BE MIXED WITH DRAINS FROM ANY ACIDS, SINCE POISONOUS GASES MAY BE CREATED.
 - ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-Classified AREA (PER NFPA 820).
 - CHEMICAL CONTAINMENT NOT BY SUEZ.

D	ISSUED FOR APPROVAL		AB	SP	GD	07 OCT 20	TOLERANCES UNLESS NOTED
C	ISSUED FOR APPROVAL		AB	SP	GD	28 SEP 20	DECIMALS
B	ISSUED FOR APPROVAL		BM	MA	GD	31 JUL 20	ANGLES
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REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE	

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CUSTOMER INFORMATION		DRAWING NUMBER		REVISION	
ENGLISH RIVER PROPERTY MANAGEMENT WASTEWATER TREATMENT FACILITY		506752-WTS-PR-T02-8521-DS-110		D	
		REF.: -	DOC. OWNER:		
		PROJECT NO. 506752	PART/MATERIAL NO.	SCALE NONE	SHEET 2 OF 2

LAST SAVED: Thursday, October 8, 2020 12:43:18 AM



**SUEZ WTS
CONTROLLED DOCUMENT**

NOTES:

1. ALL DOTTED LINES/EQUIPMENT NOT BY SUEZ.
2. MULTIPLE LINES WITH AT LEAST 1 ISOLATION VALVE PER TRAIN. (VALVES SUPPLIED BY OTHERS).
3. HANDLE FOR BYPASS VALVE TO BE REMOVED OR VALVE LOCKED IN CLOSED POSITION.
4. AUTO-DRAIN PLUGS INTO LOCAL 120VAC RECEPTACLE.
5. TIMED DRAIN VALVES TO BE LOCATED AT ANY LOW POINTS IN PIPING WHERE MOISTURE MAY ACCUMULATED, VALVES NOT BY SUEZ.
6. PRESSURE RELIEF AND PRESSURE REGULATING VALVES TO BE SET IN THE FIELD BY SUEZ FSR.
7. ONLY ONE DRYER TO OPERATE AT A TIME AND TO BE ROTATED MANUALLY ON A WEEKLY BASIS.
8. CONTRACTOR TO WIRE AIR COMPRESSOR PRESSURE SWITCH TO MCC. SUEZ FSR TO CONFIRM DURING COMMISSIONING.
9. REFER TO VENDOR ASSEMBLY DRAWING FOR MORE DETAILS.
10. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.

D	ISSUED FOR APPROVAL		PT		SP	GD	30 SEP 20
C	ISSUED FOR APPROVAL		AB		SP	GD	28 SEP 20
B	ISSUED FOR APPROVAL		BM		MA	GD	31 JUL 20
A	INITIAL RELEASE		VL		MA	GD	23 Jun 20
REV	DESCRIPTION	ECO	DWN	APPR	APFR	DATE	
<p>PROPRIETARY AND CONFIDENTIAL: THIS DRAWING AND ALL INFORMATION AND KNOWLEDGE CONTAINED OR REFERRED HEREIN ARE THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF SUEZ AND AS SUCH ARE INSTRUMENTS OF SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT. THESE INSTRUMENTS OF SERVICE SHALL NOT BE REPRODUCED, TRANSMITTED, DISCLOSED OR USED OTHERWISE IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN AGREEMENT BY SUEZ AND MUST BE IMMEDIATELY RETURNED OR DESTROYED UPON REQUEST.</p>							



P&ID

AIR COMPRESSOR

DRAWING NUMBER					REVISION	
506752-WTS-PR-T02-8521-DS-111					D	
REF.: -			DOC. OWNER:			
PROJECT NO. 506752		PART/MATERIAL NO.		SCALE NONE	SIZE D	SHEET 1 OF 1

LAST SAVED: Monday, October 5, 2020 12:19:07 PM

APPENDIX D3

Bill of Materials



SHOP DRAWING REVIEW FORM

Name of Contract: English River First Nation WWTF

Job No.: 5401-002-00

Supplier: SUEZ

Description: Bill of Materials

Tag Numbers: _____

SHOP DRAWING REVIEW

The review of this drawing does not in any way relieve the contractor of responsibility as detailed in the contract documents.

	Reviewed
X	Reviewed as noted
	Revise & Resubmit

Submission No. 3

Job No. 7603-002-00

Date October 14, 2020

Dwg. reviewed by IK

MPE ENGINEERING LTD.

Engineer's Notes:

- See comments in Red within.

Attachments: 506752-WTS-ME-T02-8510-BQ-001



**SUEZ WTS
CONTROLLED DOCUMENT**

C.	Issued for Approval	JS	CV	GD	07-10-2020
B	Issued for Approval	JS	CV	GD	28-08-2020
A.	Issued for Approval	JS	CV	GD	21-08-2020
REV	DESCRIPTION	WRITTEN BY	CHECKED BY	APPROVED BY	DATE DD-MM-YY

DOCUMENT TYPE:	SUEZ DOCUMENT NUMBER :						
BOM	CONTRACT	ISSUER	DISCIPLINE	PRODUCT	PHASE	TYPE	CHRONO
	506752	WTS	ME	T02	8510	BQ	001

ENGLISH RIVER PROPERTY MANAGEMENT WASTEWATER TREATMENT FACILITY

BOM

PROPRIETARY AND CONFIDENTIAL: THIS DOCUMENT AND ALL INFORMATION AND KNOWLEDGE CONTAINED OR REFERRED HERIN ARE THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF SUEZ AND AS SUCH ARE INSTRUMENTS OF SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT. THESE INSTRUMENTS OF SERVICE SHALL NOT BE REPRODUCED, TRANSMITTED, DISCLOSED OR USED OTHERWISE, IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN AGREEMENT BY SUEZ AND MUST BE IMMEDIATELY RETURNED OR DESTROYED UPON REQUEST.



Bill of Material
Project #: 506752
ENGLISH RIVER PROPERTY MANAGEMENT - WASTEWATER TREATMENT FACILITY
506752-WTS-ME-T02-8510-BQ-001
REV. C - CHK: PS, APV: GD

Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
1					DRUM SCREENS		DS-101		
2	2	EA	3090184	VALVE- BALL,PVC,0.75,SOC/THD,TU,GF,EPDM	VALVE, BALL, TRUE UNION, GEORGE FISCHER TYPE 546 , PT# 161546343, 0.75", PVC BODY, TEFLON SEATS, EPDM O-RINGS, SOCKET/THREADED COMBO END CONNECTIONS.	03-HV-202-A/B	DS-101	B01	C
3	2	EA	3006123	VALVE- BALL,PVC,0.50,SOC,TU,GF,EPDM,150	BALL VALVE SIZE: 0.5" MANUFACTURER: GEORGE FISCHER MODEL: 161.546.342 BODY MATERIAL: PVC SEAL MATERIAL: EPDM PRESSURE RATING: 150 PSI END CONNECTION: TRU UNION SOCKET/ THREAD NPT ACTUATOR: HANDLE	03-HV-203-A/B	DS-101	B01	C
4	2	EA	506752-MA-28	VALVE-REG,PR,PVC,0.75,TU,582,GF	PRESSURE REDUCING VALVE SIZE: 0.75 IN MANUFACTURER: GEORGE FISHER MODEL: 161582203, SERIES 582 BODY MATERIAL: PVC PRESSURE RATING: 150lb SEAL MAT: EPDM CONNECTION: UNION	03-PY-201-A/B	DS-101	B19	C
5	2	EA	3081129	GAUGE- PRESS,2.5,BTM,0.25M,100PSI,AS	PRESSURE GAUGE, ASHCROFT PT# 63-1008SL-02L 100PSI, SS CASE 63MM DIAL(2.5"), 0-100 PSI (DUAL SCALE PSI & kPa) 1/4" LOWER CONNECTION,GLYCERINE FILLED, 3-2-3% ASME GR B ACCURACY, POLYCARBONATE WINDOW.	03-PI-201-A/B	DS-101	C04	C
6	2	EA	506752-MA-01	SCREEN- DRUM,304,0.5HP,575V/3PH/60HZ, WC	TWO (2) ONLY JWCE - IPEC MODEL IFM 1836P INTERNALLY FED ROTARY SCREEN, IN ALL 304 STAINLESS STEEL CONSTRUCTION, COMPLETE WITH: 18" DIAMETER BY 36" LONG, PERFORATED SCREEN DRUM; 2MM SCREEN PERFORATIONS; HEADBOX TANK ASSEMBLY, EXTENDING 2/3 THE LENGTH OF THE DRUM, IN 11 GAUGE PLATE C/W FLANGED INLET; HOUSING IN 11 GAUGE PLATE; 4" INLET CONNECTION C/W 304 STAINLESS STEEL ANSI FLANGE; 6" OUTLET CONNECTION C/W 304 STAINLESS STEEL ANSI FLANGE; SPLASH GUARDS IN 11 GAUGE PLATE; INTEGRAL DRAINAGE PAN IN 11 GAUGE CONSTRUCTION; INTEGRATED SOLIDS DISCHARGE CHUTE IN 11 GAUGE CONSTRUCTION; SHAFT MOUNTED, 4" DIAMETER BY 1-1/2" WIDE UHMW POLYURETHANE ROLL WHEELS; EXTERNAL SPRAY BAR 3/4" SCH 40, 304 STAINLESS STEEL PIPE C/W 11 FAN JET (1 USGPM PER NOZZLE @ 40 PSI) SPRAY NOZZLES, AND SOLENOID VALVE NC CLASS 1 DIV. 1, PRV, BALL VALVE, PRESSURE GAUGE, MANIFOLD AND HINGED SPLASH COVER; #40 STAINLESS STEEL ROLLER CHAIN, STAINLESS STEEL DRIVEN SPROCKET AND DRIVE SPROCKET; RESISTANT ROLLER CHAIN, STAINLESS STEEL DRIVEN SPROCKET AND DRIVE SPROCKET; HELICAL GEAR DRIVE C/W 1/2 HP, TEFC EX CLASS 1 DIV 1 MOTOR, 575V/3PH/60HZ C/W ODOR VENT FLANGE. TWO (2) ONLY JWCE - IPEC PLB 668 SCREENINGS CONVEYOR/COMPACTOR, ALL 304 STAINLESS STEEL CONSTRUCTION, 1/2 HP, TEFC EX CLASS 1 DIV 1 MOTOR TWO (2) ONLY SMALL SCREENINGS BAGGING DEVICE TWO (2) ONLY REMOTE E-STOP – PER IFM/PLB COMBO TWO (2) ONLY ULTRASONIC OVER WASH SENSOR TWO (2) ONLY MECHANICAL WEIR OVERFLOW	03-SCR-201-A/B 03-FV-102-A/B 03-FV-201-A/B 03-LSH-101-1/2	DS-101	B38	C
7					MEMBRANE BLOWERS		DS-102		
8	3	EA	3104401	SWITCH-FLOW,BRS,24VDC,N4,KO,3.3 66'/SEC	SWITCH FLOW, KOBOLD PTH# KAL-8115-C, 3.3-66 FT/SEC VELOCITY RANGE,0.5"MNPT PROC. CONNECTION, NI-PLATED BRASS WETTED PARTS, NYLON HOUSING,8-LED FLOW TREND, 2-COLOUR LED SWITCH STATUS, NEMA 4,0.5"NPT CONDUITCONNECTION, 24V DC POWER SUPPLY, 1-SPDT SWITCH, 120 PSIG MAX. OPERATINGPRESSURE, -10 TO +250 DEGREE F. PROCESS TEMPERATURE, +/-1%REPRODUCIBILITY, UP TO 60 SEC. TIME DELAY START UP, CSA APPROVAL ISREQUIRED.	20-FSL-201-A/B/C	DS-102	C01	C
9	3	EA	3090312	VALVE-BTFLY,HV,3",LUG,SS,LEV	SET POINT = FLOW / NO FLOW VALVE, BUTTERFLY, BRAY SERIES 31-169, 3" CAST IRON LUG STYLE BODY, RATED VACUUM TO 150 PSI, SS DISC AND SHAFT, EPDM SEAT, LEVER OPERATOR; BRAY ASSEMBLY ID 9C030LF169L.	20-HV-201-A/B/C	DS-102	B03	C
10	3	EA	506752-MA-02	BLOWER- MEMBRANE,1800RPM,10HP,575V/6 OHZ,AERZEN	SCOPE OF SUPPLY MEMBRANE AIR BLOWER - TAGS : 22-B-201 - A/B/C AERZEN GENERATION 5 BLOWER PACKAGE - GM 3S DN 50 - PRESSURE - INCLUDING: AERZEN GM 3S BLOWER DRIVE MOTOR: 10HP, 1800RPM, TEFC, 575V/60HZ BASE WITH INTEGRATED REACTIVE TYPE DISCHARGE SILENCER INTAKE FILTER SILENCER HINGED MOTOR SUPPORT AS AUTOMATIC BELT TENSIONING DEVICE SET OF VIBRATION ISOLATION MOUNTS NARROW V-BELT DRIVE WITH GUARD - 1 SET SPRING LOADED RELIEF VALVE PRESET TO: 950 MBAR DISCHARGE MANIFOLD WITH EXTERNALLY ACCESSIBLE INTEGRATED CHECK VALVE CAPOT INSONORISANT - INTERIEUR/EXTERIEUR FLEXIBLE CONNECTOR WITH CLAMPS FOR SCHEDULE 40 PIPE, DISCHARGE ACOUSTIC ENCLOSURE - INDOOR/OUTDOOR INSTRUMENTS PRESSURE GAUGE C/W ISOLATION BALL VALVE (3X) DIRTY FILTER INDICATOR (3X) CONNECTION POINTS: INTAKE CONNECTION: LOCAL DISCHARGE CONNECTION: DN 80 - 3" VENDOR: AERZEN	20-F-201-A/B/C 20-PDI-201-A/B/C 20-B-201-A/B/C 20-PSV-201-A/B/C 20-HV-203-A/B/C 20-PI-203-A/B/C 20-CV-201-A/B/C	DS-102	A03	C

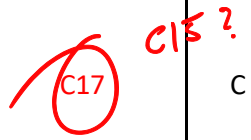
Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
11					PROCESS AND WAS BLOWERS		DS-103		
12	3	EA	3104401	SWITCH-FLOW,BRS,24VDC,N4,KO,3.366"/SEC	SWITCH FLOW, KOBOLD PT# KAL-8115-C, 3.3-66 FT/SEC VELOCITY RANGE,0.5"MNPT PROC. CONNECTION, NI-PLATED BRASS WETTED PARTS, NYLON HOUSING,8-LED FLOW TREND, 2-COLOUR LED SWITCH STATUS, NEMA 4,0.5"NPT CONDUITCONNECTION, 24V DC POWER SUPPLY, 1-SPDT SWITCH, 120 PSIG MAX. OPERATINGPRESSURE, -10 TO +250 DEGREE F. PROCESS TEMPERATURE, +/-1%REPRODUCIBILITY, UP TO 60 SEC. TIME DELAY START UP, CSA APPROVAL ISREQUIRED.	16-FSL-501-A/B 16-FSL-801	DS-103	C01	C
13	4	EA	3090312	VALVE-BTFLY,HV,3",LUG,SS,LEV	VALVE, BUTTERFLY, BRAY SERIES 31-169, 3" CAST IRON LUG STYLE BODY, RATED VACUUM TO 150 PSI, SS DISC AND SHAFT, EPDM SEAT, LEVER OPERATOR; BRAY ASSEMBLY ID 9C030LF169L.	16-HV-501-A/B 16-HV-503 16-HV-801	DS-103	B03	C
14	2	EA	506752-MA-03	BLOWER-PROCESS,1800RPM,15HP,575V/60HZ,AERZEN	SCOPE OF SUPPLY PROCESS AIR BLOWER - TAGS : 16-B-401 - A/B AERZEN GENERATION 5 BLOWER PACKAGE - GM 7L DN 80 - PRESSURE - INCLUDING: AERZEN GM 7L BLOWER DRIVE MOTOR: 15HP, 1800RPM, TEFC, 575V/60HZ BASE WITH INTEGRATED REACTIVE TYPE DISCHARGE SILENCER INTAKE FILTER SILENCER HINGED MOTOR SUPPORT AS AUTOMATIC BELT TENSIONING DEVICE SET OF VIBRATION ISOLATION MOUNTS NARROW V-BELT DRIVE WITH GUARD - 1 SET SPRING LOADED RELIEF VALVE PRESET TO: 750 MBAR DISCHARGE MANIFOLD WITH EXTERNALLY ACCESSIBLE INTEGRATED CHECK VALVE FLEXIBLE CONNECTOR WITH CLAMPS FOR SCHEDULE 40 PIPE, DISCHARGE ACOUSTIC ENCLOSURE - INDOOR/OUTDOOR INSTRUMENTS PRESSURE GAUGE C/W ISOLATION BALL VALVE (2X) DIRTY FILTER INDICATOR (2X) CONNECTION POINTS: INTAKE CONNECTION: LOCAL DISCHARGE CONNECTION: DN 80 - 3" VENDOR: AERZEN	16-F-501-A/B 16-PDI-501-A/B 16-B-501-A/B 16-PSV-501-A/B 16-HV-503-A/B 16-PI-503-A/B 16-CV-501-A/B	DS-103	A03	C
15	1	EA	506752-MA-17	BLOWER-WAS,1800RPM,15HP,575V/60HZ,AERZEN	SCOPE OF SUPPLY WAS BLOWER - TAG : 16-B-801 AERZEN GENERATION 5 BLOWER PACKAGE - GM 7L DN 80 - PRESSURE - INCLUDING: AERZEN GM 7L BLOWER DRIVE MOTOR: 15HP, 1800RPM, TEFC, 575V/60HZ BASE WITH INTEGRATED REACTIVE TYPE DISCHARGE SILENCER INTAKE FILTER SILENCER HINGED MOTOR SUPPORT AS AUTOMATIC BELT TENSIONING DEVICE SET OF VIBRATION ISOLATION MOUNTS NARROW V-BELT DRIVE WITH GUARD - 1 SET SPRING LOADED RELIEF VALVE PRESET TO: 750 MBAR DISCHARGE MANIFOLD WITH EXTERNALLY ACCESSIBLE INTEGRATED CHECK VALVE ONORISANT - INTERIEUR/EXTERIEUR FLEXIBLE CONNECTOR WITH CLAMPS FOR SCHEDULE 40 PIPE, DISCHARGE ACOUSTIC ENCLOSURE - INDOOR/OUTDOOR INSTRUMENTS PRESSURE GAUGE C/W ISOLATION BALL VALVE (1X) DIRTY FILTER INDICATOR (1X) CONNECTION POINTS: INTAKE CONNECTION: LOCAL DISCHARGE CONNECTION: DN 80 - 3" VENDOR: AERZEN	16-F-801 16-PDI-801 16-B-801 16-PSV-801 16-HV-803 16-PI-803 16-CV-801	DS-103	A03	C

Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
16					BIO REACTOR		DS-104		
17	1	EA PER TRAIN	506752-MA-22	DIFFUSER-GRID, MEM AER, FLEXAIR, EDI	FLEX AIR PANEL DIFFUSERS: 2PA BASIN. SINGLE GRID IN EACH BASIN. 13 FLEXAIR MP1 DUPLEX DIFFUSER ASSEMBLIES EACH MP1 HAS 2 PANELS MOUNTED IN A DUPLEX CONFIGURATION FEED VIA 4" DROP	NO TAG	DS-104	B27	C
18	1	EA	506752-MA-05	MIXER-SUBMERS, CI, 1.2HP, 600/60/3, XYLEM	ANOXIC MIXER 4610.410-0981 FLYGT MODEL SR-4610 SUBMERSIBLE MIXER 1.2HP/0.89KW 600VOLT 3PHASE 60HZ 4POLE STAINLESS STEEL PROPELLER CODE 042107SF 16M 4G2.5+2X1.5 316 STAINLESS STEEL BODY, VITON O-RINGS MAST INSTALLATION FLS 14-58 79 94 SS UPPER G.B. ADAPTOR 2" SYSTEM 14-58 79 95 SS UPPER G.B. HOLDER 2" SYSTEM 13-45 00 36 MAST 2" X 2" X 3/16" X 6M LG. S/S 316 14-58 70 08 LOWER GUIDE BAR ADAPTOR 2" SYSTEM 4 S/S 316 14-58 79 99 SS BEARING BLK ASSY 2" SYSTEM 84 52 84 SPRING HOOK 83 57 24 SUPPORT GRIP 13-50 05 30 SUPPORT CABLE ASS'Y 3/16" DIA. X 6.0M LGS/S 316 83 45 63 CABLE HOLDER 13-44 00 40 SHACKLE 7/16 STAINLESS STEEL 316 13-40 02 00 SOCKET II PINS BACK MOUNTED 13-40 01 87 MOUNTING BRACKET TO MOUNT MINI CAS 11 40-50 10 98 MINI CAS II 120 VAC 13-50 05 24 LIFTING CABLE ASS'Y 1/4" X 17M S/S 316 C/W S/S 316 HOOK 13-50 05 13 HOLDING CLAMP FOR LIFTING CABLE SS316 13-51 03 93 SUPPORT ARM, 20 DEG 2" MAST S/S 316 13-56 00 24A FREIGHT CHARGES TXBL VENDOR: XYLEM	16-MX-211	DS-104	B25	C
19	1	EA PER TRAIN	3087034	SWITCH-FLOAT, PP, 120/220VAC, 4" FLT	SWITCH, LEVEL, MJK PT# 202810, MODEL 7030, CABLE SUSPENDED 4" Ø FLOAT, POLYPROPYLENE HOUSING, 39 FT LONG OIL RESISTANT PVC CABLE, 120VAC OR 220VAC, 1PH/60Hz, -20oC to 60oC OPERATING TEMPERATURE.	16-LSHH-401-1/2	DS-104	C08	C
20	1	EA PER TRAIN	506752-MA-06	TRANS-LEVEL, 1.50, MNPT, 0-216", E+H	TRANSMITTER, LEVEL. FMB52-12KE0/101 FMB52-CA21JD1HGK45RGJB3A DELTAPILOT M FMB52 CA APPROVAL: CSA C/US IS CL.I,II,III DIV.1 GR.A-G, CSA C/US IS CL.I DIV.2 GR.A-D, EX IA, C: ZONE 0,1,2/US: ZONE 0,1,2,20,21,22 2 OUTPUT: 4-20MA HART 1 DISPLAY, OPERATION: LCD, PUSH BUTTON ON DISPLAY/ELECTRONICS J HOUSING: F31 ALU, GLASS WINDOW D ELECTRICAL CONNECTION: THREAD NPT1/2, IP66/68 NEMA4X/6P 1H SENSOR RANGE: 1.2BAR/120KPA/18PSI GAUGE, 12MH2O/40FTH2O/480INH2O OVERLOAD: 24BAR/2.4MPA/350PSI G REFERENCE ACCURACY: STANDARD K CALIBRATION; UNIT: CUSTOMISED LEVEL; SEE ADDITIONAL SPEC. 45 PROBE CONNECTION: 216.00 IN CABLE, FEP RGJ PROCESS CONNECTION: THREAD ANSI MNPT1-1/2, 316L B MEMBRANE MATERIAL: ALLOYC 3 FILL FLUID: SYNTHETIC OIL, FDA A SEAL: FKM VITON REQUIRED RANGE 0 TO 216"	16-LIT-403-1/2	DS-104	C09	C
21	1	EA PER TRAIN	506752-MA-23	SENSOR-DO, 316, 1.00, MNPT, 20PPM, HA	SENSOR, DISSOLVED OXYGEN, HACH, LDO, MODEL 2, 10M HACH, ITEM# 9020000, 0-50 DEG. C, 0 TO 20 PPM RANGE, WETTED MATERIALS, PROBE; FOAMED NORYL & 316 SS, SENSOR: POLYBUTYL METHACRYLATE.. 925000 POLE MOUNT KIT, PVC	16-AE-405-1/2	DS-104	C16	C
22	1	EA PER TRAIN	506752-MA-04	SENSOR-PH, 0.75, HA, PROBE	SENSOR, PH/ORP, GLI/HACH PT# DPC1R2A, CONVERTIBLE (PIPE OR IMMERSION MOUNTING), PROBE, 3/4" NPT BOTH ENDS, RYTON BODY (GLASS FILLED), FLAT ELECTRODE, PT 1000 OHM RTD, C/W DIGITAL GATEWAY - REFER TO CUTSHEET FOR SPECIFIC PART NUMBERS. C/W EXTENSION CABLE DPC1RA CONSISTS OF: 1-PC1RA PH SENSOR 1-612060 PH/ORP GATEWAY 1-5796000 CABLE 7.7M1-6122400 CABLE ASSY 1.0M PROBE IS ANALOG FOR USE WITH SC100 CONTROLLER. IMMERSION MOUNTING - EACH IMMERSION HARDWARE INCLUDES A 1/2-INCH DIAMETER X 4 FOOT LONG PIPE, 1/2 X 3/4-INCH NPT COUPLING, AND PLASTIC PIPE-MOUNT JUNCTION BOX WITH TERMINAL STRIP. MH432G CPVC PIPE	16-AE-402-1/2	DS-104	C13	C
23	1	EA PER TRAIN	3090984	CONTROLLER, DUAL 4-20mA, 100-240, SC200, HA	CONTROLLER, UNIVERSAL, HACH MODEL SC 200 PT# LXV404.99.00552, DUAL 4-20 mA OUTPUTS (OPTIONAL 4 ADDITIONAL), W/O DIGITAL OUTPUTS, NEMA 4X/IP66 ENCLOSURE, 100-240 VAC 50-60 HZ, MOUNTING HARDWARE FOR CONTROLLER INCLUDED. CAN BE USED WITH DIGITAL AND ANALOG SENSORS AND PROBES (PH, TEMP, DO, TURBIDITY).	16-AIT-405-1/2	DS-104	C17	C
24	1	EA PER TRAIN	3090312	VALVE-BTFLY, SS, 3.00, MAN, LG, 150, EPDM, BR	BUTTERFLY VALVE MANUFACTURER: BRAY SERIES: 31-375 VALVE SIZE: 3 IN. MATERIAL: BODY- DUCTION IRON DISC- 316SS STEM- 416SS SEAT- EPDM CONTROL: LEVER OPERATOR CONNECTION: LUG PRESSURE RATING: VACUUM TO 150 PSI	16-HV-505-1/2	DS-104	B03	C

Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
25					MEMBRANE TANK		DS-105		
26	1	EA PER TRAIN	1112797	VALVE-BALL,316,0.50,MAN,FPT,AP	APOLLO 76-103 MOC: SS 316 END CONN: 0.5" FNPT HAND LEVER OPERATED	23-HV-803-1/2	DS-105	B01	C
27	1	EA PER TRAIN	3178078	ASSY-EJECTOR,316,24VDC,PE TUBE	AIR SUPPLY ASSEMBLY - 1/4" BALL VALVE - FILTER - 1/4" SOLENOID VALVE EJECTOR ASSEMBLY - 1" BALL VALVE - ANGLED ACTUATED VALVE - VACUUM EJECTOR	-	DS-105	A06	C
27	-	-	-	VALVE-BALL,316,0.25,2PC THD	VALVE, BALL, PINACLE, 2-PC FULL PORT, P/N 13TBV2025, NPT,316SS BODY & TRIM, PTFE SEAT & SEAL, CV = 16, 1000# WOG,WITH LEVER.	20-HV-802-1/2	DS-105	A06	C
27	-	-	-	FLT- AIR,COMPRESSED,1/4",40MICRON	FILTER, COMPRESSED AIR, WATTS #F-602-024A, GENERAL PURPOSE, 40 MICRON ELEMENT, 1/4" NPTF CONNECTIONS, C/W SIGHT GAUGE AND TWIST DRAIN, METAL BOWL	20-F-801-1/2	DS-105	A06	C
27	-	-	-	VALVE-SOL,316,3/2- WY,0.25,24VDC,HAF,MH	VALVE, SOLENOID, HAFNER PT# MH 311 701 NPT KES,24VDC TYPE: 3-WAY/2 POS, NC, SPRING RETURN, MANUAL OVERRIDE BODY: 316L SS PILOT HEAD: POLYMER PORTS: 1/4"FNPT SEALS: PUR AIR FLOW: 1250 L/MIN OPER. PRESS: 29 TO 145 PSI VOLTAGE: 24VDC PT# 108-030-1204 cURus DIN PLUG CONN: 1/2" FNPT, PT# 612-201-0053 PROTECTION CLASS: IP65	20-FV-802-1/2	DS-105	A06	C
27	-	-	-	EDUCTOR- VAC,HDPE,1.00,FPT,GEO,ERP.6010	PUMP, VACUUM MANUFACTURER: GEO.T.WHITE PART# ERP6010HDPE.AI.NR.V BODY: HDPE CARTRIDGES: PIAB P6010 SI32-3X4,PT# P6010.AI.01.LJ.56.XX PROCESS CONN INLET/OUTLET: 1" FNPT AIR SUPPLY CONN: 1/4" MNPT X 3/8" TUBE GAUGE PORT: 1/8" FNPT (INCLUDES VACUUM GAUGE) DESIGN: EVAC. RATE: 0.8 S/FT3 TO -9" HG; MAX VAC: -21"HG; AIR CONS: 12.7 SCFM @ 72 PSI ASSEMBLED AS PER GEO.T.WHITE DRAWING # 3178013 REV A	20-E-801-1/2	DS-105	A06	C
27	-	-	-	VALVE-BALL,316,1.00,2PC THD	VALVE, BALL, PINACLE, 1", 2-PC FULL PORT, P/N 13TBV21,NPT, 316SS BODY & TRIM, PTFE SEAT & SEAL, CV = 110, 1000#WOG, WITH LEVER LOCKING HANDLE.	20-HV-801-1/2	DS-105	A06	C
27	-	-	-	VALVE- ANGLE,316L,1.00,A/S,FPT,NUM	8290-ANGLE BODY VALVE, NORMALLY CLOSED - ENTRY UNDER THE DISC MANUFACTURER: ASCO NUMATICS PART NUMBER: 8290A395 CONTROL FUNCTION SPRING TO CLOSED (NC) PORT CONNECTIONS: 1" FNPT BODY MATERIAL 316L SS (CF3M) SEAL MATERIAL PTFE AIR PORT: 1/8" NPT ACCESSORIES: INCLUDE PUSH TO CONNECT FITTING: INB103-104-020 NICKEL PLATED 3/4" TUBE X 1/8" NPT ----- OPERATING PRESSURE DIFFRENTIAL MAX: 90 PSI FLUID TEMP: 15deg F (-9deg C) TO 366 deg F (185deg C) AMBIENT TEMP: 15deg F (-9deg C) TO 140 deg F (60deg C) PILOT AIR PRESSURE: 60-150 PSI	20-FV-801-1/2	DS-105	A06	C
28	2	EA PER TRAIN	506752A	M/C- ZW500D,RX12,16/14,316L,LEAP,2X4	ZW500D CS2 CASSETTE, POPULATED WITH 14/16 ZW500D MODULES, EACH MODULE HAS 422 FT2 OF SURFACE AREA	CASSETTE A-1	DS-105	A01	C

Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
29	1	EA PER TRAIN	506752-MA-29	VALVE-BTFLY,316,3.00,A/A SV,LG,LS,24V,BR	VALVE, BUTTERFLY, BRAY SERIES 31-390, 3" DUCTILE IRON LUG STYLE BODY, RATED VACUUM TO 150 PSI, 316SS DISC, SS SHAFT, EPDM SEAT, BRAY PNEUMATIC RACK AND PINION DOUBLE ACTING ACTUATOR SERIES 92/83, C/W NAMUR DIRECT MOUNT SOLENOID 24VDC 630250-21524536, DIN PLUG, WITH SPEED CONTROLS AND MICRO SWITCH S50 PRE-WIRED	20-FV-205-1/2	DS-105	B04	C
30	4	EA PER TRAIN	3160704	VALVE-BTFLY,316,3.00,MAN,VIC,EPDM	VALVE, BUTTERFLY, VICTAULIC SERIES 700, 3.00" CAST IRON, VICTAULIC GROOVE, 316SS DISC, SS SHAFT, EPDM SEAT, LEVER OPERATOR; PN# V030700XEJ	20-HV-204A-1/2 20-HV-204B-1/2 20-HV-310A-1/2 20-HV-310B-1/2	DS-105	B03	C
31	1	EA PER TRAIN	506752-MA-21	VALVE-KNIFEGATE,316,6",LUG,BI,DA,24V,LS	22-3636R-06.0-DARDC-SOL-LS KNIFE GATE VALVE STANDARD 6" ORBINOX MODEL: BT - BIDIRECTIONAL MSS SP-81 ACTUATOR: PNEUMATIC DOBLE ACTING. BODY: CF8M GATE: AISI 316 SEAT: EPDM PACKING: ST FLANGE: ANSI 150 LIMIT SWITCHES: (2) TELEMECANIQUE LIMIT SWITCH LSTLXCKL115HC SOLENOID VALVE: ASCO NUMATICS SOLENOID, SOL082SA43CM, 24VDC, 4-WAY, NEMA-4	20-FV-501-1/2	DS-105	B18	C
32	1	EA PER TRAIN	3006123	VALVE-BALL,PVC,0.50,SOC,TU,GF,EPDM,150	BALL VALVE SIZE: 0.5" MANUFACTURER: GEORGE FISCHER MODEL: 161.546.342 BODY MATERIAL: PVC SEAL MATERIAL: EPDM PRESSURE RATING: 150 PSI END CONNECTION: TRU UNION SOCKET/ THREAD NPT ACTUATOR: HANDLE	20-HV-307-1/2	DS-105	B01	C
33	1	EA PER TRAIN	3152673	TRANS-PRESS,0.50,NPT,15PSI,E+H	TRANSMITTER, PRESSURE. CERABAR M PMCS1 PMCS1-CD21JD1MGJRLJA [CD] APPROVAL: CSA C/US GENERAL PURPOSE [2] OUTPUT: 4-20MA HART [1] DISPLAY, OPERATION: LCD, PUSH BUTTON ON DISPLAY/ELECTRONICS [J] HOUSING: F31 ALU, GLASS WINDOW [D] ELECTRICAL CONNECTION: THREAD NPT1/2, IP66/68 NEMA4X/6P [1M] SENSOR RANGE: 4BAR/400KPA/60PSI GAUGE,40MH2O/133FTH2O/1600INH2OOVERLOAD: 25BAR/2.5MPA/375PSI [G] REFERENCE ACCURACY: STANDARD [J] CALIBRATION; UNIT: CUSTOMISED PRESSURE; SEE ADDITIONAL SPEC.. [RLJ] PROCESS CONNECTION: THREAD ANSI MNPT1/2 FNPT1/4, 316L [A] SEAL: FKM VITON > RANGE 4 TO 20 MA FROM -15 TO 15 PSI	20-PIT-301-1/2	DS-105	C07	C
34	1	EA PER TRAIN	3087034	SWITCH-FLOAT,PP,120/220VAC,4"FLT	SWITCH, LEVEL, MJK PT# 202810, MODEL 7030, CABLE SUSPENDED 4" Ø FLOAT, POLYPROPYLENE HOUSING, 39 FT LONG OIL RESISTANT PVC CABLE, 120VAC OR 220VAC, 1PH/60Hz, -20oC to 60oC OPERATING TEMPERATURE	20-LSHH-201-1/2	DS-105	C08	C
35	1	EA PER TRAIN	3087034	SWITCH-FLOAT,PP,120/220VAC,4"FLT	SWITCH, LEVEL, MJK PT# 202810, MODEL 7030, CABLE SUSPENDED 4" Ø FLOAT, POLYPROPYLENE HOUSING, 39 FT LONG OIL RESISTANT PVC CABLE, 120VAC OR 220VAC, 1PH/60Hz, -20oC to 60oC OPERATING TEMPERATURE.	20-LSLL-201-1/2	DS-105	C08	C
36	1	EA PER TRAIN	506752-MA-07	TRANS-LEVEL,316,3.00,FLG,185",E+H	TRANSMITTER, LEVEL. DELTAPILOT M FMB51 FMB51-CD21JD1FGK85AGJB3U [CD] APPROVAL: CSA C/US GENERAL PURPOSE [2] OUTPUT: 4-20MA HART [1] DISPLAY, OPERATION: LCD, PUSH BUTTON ON DISPLAY/ELECTRONICS [J] HOUSING: F31 ALU, GLASS WINDOW [D] ELECTRICAL CONNECTION: THREAD NPT1/2, IP66/68 NEMA4X/6P [1F] SENSOR RANGE: 400MBAR/40KPA/6PSI GAUGE,4MH2O/13FTH2O/160INH2OOVERLOAD: 8BAR/800KPA/120PSI [G] REFERENCE ACCURACY: STANDARD [K] CALIBRATION; UNIT: CUSTOMISED LEVEL; SEE ADDITIONAL SPEC.. > ADDITIONAL TEXT: 0...185" H2O [85] PROBE CONNECTION: 185 IN ROD, 316L [AGJ] PROCESS CONNECTION: 3" 150LBS RF, 316/316LFLANGE ANSI B16.5 [B] MEMBRANE MATERIAL: ALLOY C	20-LIT-203-1/2	DS-105	C09	C

Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
37					PROCESS PUMP		DS-106		
38	1	EA PER TRAIN	3067260	VALVE-BALL,316,0.50,1PC THD	VALVE, BALL, PINACLE, 1/2", 1-PC REDUCED PORT, P/N 13TBV105, NPT, 316SS BODY & TRIM, PTFE SEAT & SEAL, CV = 5.5, 800# WOG, WITH LEVER LOCKING HAND	90-HV-010-1/2	DS-106	B01	C
39	1	EA PER TRAIN	3089341	VALVE-BALL,FV,0.5",PVC/FPM,SRFC,24V	VALVE, BALL, 0.5", TRUE UNION, PVC BODY, TEFLON SEATS, FPM O-RINGS, SOCKETWELD, GEORGE FISCHER TYPE 546, C/W PA11 SPRING RETURN FAIL CLOSE PNEUMATIC RACK AND PINION ACTUATOR PT# 199 233 073, ASSEMBLY PT# S199 233 073 C/W CSA/UL APPROVE D SOLENOID PILOT VALVE 24 V/DC TYPE PV95 PT#199190554CSA	23-FV-102-1/2	DS-106	B02	C
40	1	EA PER TRAIN	3089339	VALVE-BALL,PVC,0.50,A/S SV,SOC,EPDM,24V	VALVE, BALL, 0.5", TRUE UNION, PVC BODY, TEFLON SEATS, EPDM O-RINGS, SOCKETWELD, GEORGE FISCHER TYPE 546, C/W PA11 SPRING RETURN FAIL CLOSE PNEUMATIC RACK AND PINION ACTUATOR PT# 199 233 063, ASSEMBLY PT# S199 233 063 C/W TYPE PV95 24 VDC/8 WATTS SOLENOID VALVE PT# 199 190 554, CSA/UL APPROVED.	23-FV-302-1/2	DS-106	B02	C
41	1	EA PER TRAIN	3090239	VALVE-CHK,PVC,0.50,CONE,SOC,TU,GF,VTN	VALVE, CONE CHECK, 0.5" TRUE UNION, PVC BODY, Viton SEAL, MODEL: 161 561 112, SOCKET END CONNECTIONS CV: 13 MF:9 L/m	23-CV-101-1/2	DS-106	B10	C
42	1	EA PER TRAIN	3090233	VALVE-CHK,PVC,0.50,CONE,SOC,TU,GF,EPDM	VALVE, CONE CHECK, 0.5", Model: 161 561 102 TRUE UNION, PVC BODY, EPDM SEAL, SOCKET END CONNECTIONS. CV: 13 MF: 9 L/m	23-CV-301-1/2	DS-106	B10	C
43	2	EA PER TRAIN	3067260	VALVE-BALL,316,0.50,1PC THD	VALVE, BALL, PINACLE, 1/2", 1-PC REDUCED PORT, P/N 13TBV105, NPT, 316SS BODY & TRIM, PTFE SEAT & SEAL, CV = 5.5, 800# WOG, WITH LEVER LOCKING HANDLE	20-HV-306-1/2 20-HV-305-1/2	DS-106	B01	C
44	1	EA PER TRAIN	1268174	VALVE-BTFLY,NYL,3.00,MAN,LG,150,EPDM,BR	BUTTERFLY VALVE MANUFACTURER: BRAY SERIES: 31-390 VALVE SIZE: 3 IN. MATERIAL: BODY- DUCTILE IRON DISC- NYLON COATED DUCTILE IRON STEM- 416SS SEAT- EPDM CONTROL: MANUAL-LEVER CONNECTION: LUG PRESSURE RATING: 150 PSI	20-HV-301-1/2	DS-106	B03	C
45	1	EA PER TRAIN	3136735	TRANS-FLOW,MAG,2.00FLG,0-150GPM,E+H	"ENDRESS+HAUSER PROMAG 10W MAGMETER FLOW TRANSMITTER WITH SENSOR-COMPACT-2"" 10W50-ULOA1RA0B4BA* [U] LINER: POLYURETHANE [L] PROCESS CONNECTION: CL.150, A105, FLANGE ANSI B16.5 [O] ELECTRODES: 1.4435/316L [A] CALIBRATION: 0.5% [1] ADDITIONAL TEST: W/O [R] APPROVAL: FM NI CL. I DIV. 2 / CSA CL. I DIV. 2 [A] HOUSING: COMPACT ALU, IP67 NEMA4X [O] CABLE, REMOTE VERSION: NOT USED [B] CABLE ENTRY: THREAD NPT 1/2 [4] POWER SUPPLY; DISPLAY: 85-250VAC; 2-LINE, PUSH BUTTONS [B] ADJUSTMENT; SOFTWARE FEATURE: CUSTOMISED; BASIC VERSIONVOLUME FLOW [A] OUTPUT: 4-20MA HART + PULSE PASSIVE. LANGUAGE: ENGLISH > RANGE 4 TO 20 MA FROM 0 TO 150 USGPM" REQUIRED RANGE 0 TO 275 GPM	20-FIT-307-1/2	DS-106	C10	C
46	1	EA PER TRAIN	3109178	VALVE-BTFLY,NYL,3.00,A/A SV,LG,LS,24V,BR	VALVE, BUTTERFLY, BRAY SERIES 31-119, 3" DUCTILE IRON LUG STYLE BODY, RATED VACUUM TO 150 PSI, NYLON COATED DISC, SS SHAFT, EPDM SEAT, BRAY PNEUMATIC RACK AND PINION DOUBLE ACTING ACTUATOR SERIES 92/83, C/W NAMUR DIRECT MOUNT SOLENOID 24VDC 630250-21524536, DIN PLUG, WITH SPEED CONTROLS AND MICRO SWITCH S50 PRE-WIRED	20-FV-302-1/2	DS-106	B04	C
47	1	EA PER TRAIN	3109178	VALVE-BTFLY,NYL,3.00,A/A SV,LG,LS,24V,BR	VALVE, BUTTERFLY, BRAY SERIES 31-119, 3" CAST IRON LUG STYLE BODY, RATED VACUUM TO 150 PSI, NYLON COATED DISC, SS SHAFT, EPDM SEAT, BRAY PNEUMATIC RACK AND PINION DOUBLE ACTING ACTUATOR SERIES 92/83, C/W NAMUR DIRECT MOUNT SOLENOID 24VDC 630250-21524536, DIN PLUG, WITH SPEED CONTROLS AND MICRO SWITCH S50 PRE-WIRED	20-FV-609-1/2	DS-106	B04	C
48	1	EA PER TRAIN	3173740	VALVE-CHK,Ci,3.00,WF,BR	BRAY V0312CET ANSI 125 MODEL 210 WAFER CHECK VALVE, CAST IRON BODY, STAINLESS STEEL DISC AND TRIM. EPDM N O-RING SEAT INTEGRAL TO BODY, TEFLON SPACERS	20-CV-301-1/2	DS-106	B11	C
49	1	EA PER TRAIN	3095094	PUMP-PD,Ci,7.5HP,480/60/3,BO,ZMODL,PLZ00	MANUFACTURE: BOERGER MODEL NUMBER: PL 200 w/ Z-MOD L BASE FRAME CODE: PP2SARCAEBEDCCC16 BÖRGER ROTARY LOBE PUMP PL200 CASING: ONE-PIECE BLOCKCASING FROM GREY CAST IRON ASTM A48-40 B AXIAL CASING PROTECTION LINERS FROM HARD METAL ROTOR GEOMETRY: TRI-LOBE, ENTIRELY ELASTOMER COATED, SCREW FORM, FOR ALMOST PULSATION-FREE OPERATION ROTOR COATING: BUNA-N SOLID PASSING CAPABILITY D = 1.6" DISPLACEMENT: 47.52 GAL/100 REV SHAFT SEAL: SINGLE-ACTING MECHANICAL SEALS, TYPE LW MATERIAL CODE ACCORDING EN 12756 [DIN 24960]: Q2 Q2 P G SEAL FACES: SISIC/SISIC DYNAMIC O-RINGS: BUNA-N SEAL HOLDING BUSHES: AISI 316L STATIONARY O-RINGS: BUNA-N	20-P-301-1/2	DS-106	A04	C
50	2	EA PER TRAIN	3156360	GAUGE-PRESS,4.0,BCK,0.25,-30HG/60PSI,AS	PRESSURE GAUGE, ASHCROFT PT# 100-1008SL-02B 30HG/0/60PSI, SS CASE, 100MM DIAL (4"), 30" MERCURY to 60 PSI (DUAL SCALE IN MERCURY & PSI/kPa) 1/4" BACK CONNECTION, GLYCERINE FILLED, 3-2-3% ASME GR B ACCURACY, POLYCARBONATE WINDOW.	20-PI-303-1/2 20-PI-304-1/2	DS-106	C04	C
51	2	EA PER TRAIN	3103207	SWITCH-PRESS,BRS,N4,UE,40PSIG,J6	UNITED ELECTRIC PT #J6-152-M201, 1/4" FNPT PROCESSOR CONNECTION, BRASS BELLOWS, 0-50 PSIG, ONE SPDT RELAY (15A), 0.1 TO 0.5 PSI FIXED DEAD BAND, 75 PSI PROOF PRESSURE, 1/2" FNPT ELECTRICAL CONNECTION, NEMA4, ALUMINIUM BODY, +-1% REPEATIBILITY. SET POINT = 40 PSIG INCREASING	20-PSH-301-1/2 20-PSH-302-1/2	DS-106	C11	C
52	2	EA PER TRAIN	3067260	VALVE-BALL,316,0.50,1PC THD	VALVE, BALL, PINACLE, 1/2", 1-PC REDUCED PORT, P/N 13TBV105, NPT, 316SS BODY & TRIM, PTFE SEAT & SEAL, CV = 5.5, 800# WOG, WITH LEVER LOCKING HANDLE	20-HV-303-1/2 20-HV-304-1/2	DS-106	B01	C

Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
53	1	EA PER TRAIN	3067260	VALVE-BALL,316,0.50,1PC THD	VALVE, BALL, PINACLE, 1/2", 1-PC REDUCED PORT, P/N 13TBV105, NPT, 316SS BODY & TRIM, PTFE SEAT & SEAL, CV = 5.5, 800# WOG, WITH LEVER LOCKING HAND	20-HV-320-1/2	DS-106	B01	C
54	1	EA PER TRAIN	3159335	ANLZR-TURBID,HACH,TU5300	MANUFACTURER: HACH P/N: LXV445.99.13112 - MODEL: TU5300SC LOW RANGE LAZER TURBIDIMETER WITH SYSTEM CHECK AND RFID, EPA VERSION. COMES WITH: P/N: LZY871, WALL MOUNT BRACKET P/N: LZY963, FLOW REGULATOR MODEL: TU5300SC SPECIFICATIONS ACCURACY: ±2% OR 0.01 NTU FROM 0 - 40 NTU / ±10% NTU FROM 40 - 1000 NTU CABLE LENGTH: 1.6 m (5.25 ft) CERTIFICATIONS: CE COMPLIANT, US FDA, EPA, 1420492-000 ISO version, Australian ACMA Marking COMPLIANCE: EPA DIMENSIONS (H X W X D): 249 mm X 268 mm X 190 mm ENCLOSURE RATING: ELECTRONIC COMPARTMENT IP55; ALL OTHER FUNCTIONAL UNITS IP65 FITTING TYPE: SAMPLE QUICK CONNECTOR: ¼-IN. FOR ¼-IN. TUBING LOWER LIMIT OF DETECTION (LOD): 0.002 NTU OPERATING HUMIDITY: RELATIVE HUMIDITY: 5 - 95% AT DIFFERENT TEMPERATURES, NON-CONDENSING OPERATING TEMPERATURE RANGE: 0 - 50 °C (32 - 122 °F) RESOLUTION: 0.0001 NTU / FNU / TE/F / FTU / EBC RESPONSE TIME: T90 <45 SECONDS AT 100 ML/MIN SAMPLE FLOW RATE: 100 - 1000 ML/MIN; OPTIMAL FLOW RATE: 200 - 500 ML/MIN SAMPLE PRESSURE: 6 BAR (87 PSI) MAXIMUM SAMPLE TEMPERATURE: 2 - 60 °C (35 - 140 °F) SIGNAL AVERAGE TIME: 30 - 90 SECONDS STORAGE CONDITIONS: -40 - 60 °C (-40 - 140 °F) WEIGHT: 5.95 LBS. (2.7 KG); 11 LBS. (5.0 KG) WITH ALL ACCESSORIES	20-AE-320-1/2	DS-106	C15	C
55	1	EA PER TRAIN	3090984	CONTROLLER,DUAL 4-20mA,100-240,SC200,HA	CONTROLLER, UNIVERSAL,HACH MODEL SC 200 PT# LXV404.99.00552, DUAL 4-20 mA OUTPUTS (OPTIONAL 4 ADDITIONAL), W/O DIGITAL OUTPUTS, NEMA 4X/IP66 ENCLOSURE, 100-240 VAC 50-60 HZ, MOUNTING HARDWARE FOR CONTROLLER INCLUDED. CAN BE USED WITH DIGITAL AND ANALOG SENSORS AND PROBES (PH,TEMP,DO,TURBIDITY).	20-AIT-320-1/2	DS-106	 C17	C
56	1	EA PER TRAIN	3177994	VALVE-NEEDLE,NYL,0.25,TB,HACH,LZY963	MANUFACTURER: HACH P/N: LZY963 KIT, FLOW REGULATOR FOR TU5X00SC, INCLUDES: FLOW REGULATOR AND TUBE 1/4in. OD X 0.13m (5.11in.)	20-HCV-320-1/2	DS-106	B16	C
57	1	EA PER TRAIN	3161836	VALVE-SOL,BRS,0.25,A/S,24VDC,2-WAY	BURKERT 00304792 2/2-WAY-SOLENOID VALVE; DIRECT ACTING TYPE 256 CIRCUIT FUNCTION A 2/2-WAYS; NORMALLY CLOSED ORIFICE SIZE 4,0MM (5/32") SEAL MATERIAL FKM BODY MATERIAL BRASS PORT CONNECTION NM82 NPT 1/4 THREADED PORT VOLTAGE 24 VOLTS FREQUENCY DC POWER CONSUMPTION 12 WATT SPECIAL FEATURE AF12 SHORT BODY PU09 COIL UL RECOGNIZED CURUS PRESSURE MIN: 0 PSI PRESSURE MAX: 87 PSI CV (GPM) 0.58 QNN 628.02 T MEDIUM MIN: -10 C T MEDIUM MAX: 130 C T AMBIENT MAX: 55 C	20-FV-320-1/2	DS-106	B09	C

Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
58					BACK PULSE TANK		DS-107		
59	1	EA	3089341	VALVE- BALL,FV,0.5",PVC/FPM,SRFC,24V	VALVE, BALL, 0.5", TRUE UNION, PVC BODY, TEFLON SEATS, FPM O-RINGS, SOCKETWELD, GEORGE FISCHER TYPE 546, C/W PA11 SPRING RETURN FAIL CLOSE PNEUMATIC RACK AND PINION ACTUATOR PT# 199 233 073, ASSEMBLY PT# S199 233 073 C/W CSA/UL APPROVE D SOLENOID PILOT VALVE 24 V/DC TYPE PV95 PT#199190554CSA.	23-FV-161	DS-107	B02	C
60	1	EA	3090250	VALVE- CHK,BALL,0.5",THD,PVC/VITON	VALVE, BALL CHECK, 0.5" TRUE UNION, GEORGE FISCHER TYPE 360, PT# 161 360 592, PVC BODY, FPM SEAL, THREADED END CONNECTIONS.	23-CV-110	DS-107	B15	C
61	1	EA	3090187	VALVE- BALL,PVC,2.00,SOC/THD,TU,GF,EPDM	VALVE, BALL, TRUE UNION, GEORGE FISCHER TYPE 546, PT# 161546347, 2", PVC BODY, TEFLON SEATS, EPDM O-RINGS, SOCKET/THREADED COMBO END CONNECTIONS.	20-HV-608	DS-107	B01	C
62	1	EA	506752-MA-08	TANK- BACKPULSE,HDPE,ATM,CLS/FLAT,AC O <i>MAKE 4"</i>	BACK PULSE TANK ACO MODEL: CT-500-CH, HDPE (1.5S.G.) CLOSED TOP TANK WITH 16" MAN WAY DIMENSIONS: 48"Ø X 97" TALL CAPACITY: 500 IG / 600 USG / 2,200 L COMPLETE WITH: 1 - 1-1/2" FNPT PVC TANK ADAPTER WITH PVC FLANGE ADAPTER - LIT 1 - 8" PVC SPOOL FLANGE WITH DONKER BOLTS - VENT 1 - 4" PVC SPOOL FLANGE WITH DONKER BOLTS - FILL 1 - 3" PVC SPOOL FLANGE WITH DONKER BOLTS - OVERFLOW (COMES WITH INTERNAL ELBOW FACNIG UP) 1 - 2" PVC SPOOL FLANGE WITH DONKER BOLTS - DRAIN 2 - STEEL LIFTING LUG ASSEMBLY WITH DONKER BOLTS 4 - HDPE WELDED HOLD DOWN LUG 1 3" 4" FLANGED CONNECTION - RAS SUCTION GASKETS: EPDM INCLUDES: 1. SHOP DRAWINGS SHOWING MATERIALS AND FITTING PLACEMENT 2. HYDROSTATIC TEST REPORT 3. CERTIFICATE OF CONFORMANCE 4. STANDARD SUEZ CHECKLIST	20-TK-601	DS-107	F01	C
63	1	EA	506752-MA-30	TRANS-TEMP,316L,0.75,M,0-50°C,EH	TRANSMITTER, TEMPERATURE WITH THERMOWELL, E+H RTD-ASSEMBLY TH13, TW-TYPE U.S.STYLE TH13-8A23A1ABQ1AK TEMPERATURE MEASURING DEVICE WITH THERMOWELL. SPRING LOADED ELEMENT. PT100 SENSOR COMPLY WITH IEC60751 STANDARD, ALPHA=0.00385. ORDER CODE DESCRIPTION 8 THERMOWELL IMMERSION LENGTH U: 4.00 INCH (INCREMENT 0.5) I A2 PROCESS CONNECTION: NPT3/4 MALE THREAD, 316 3 THERMOWELL SHAPE: TAPERED A THERMOWELL LAG T: NOT SELECTED 1 EXTENSION: HEX NIPPLE 316 E=1" A SENSOR TYPE: 1 PT100 CLASS B, 3 WIRE, -50-200OC B ENCLOSURE; CABLE ENTRY: ALU, E+H BLUE; NPT1/2 Q ELECTRICAL CONNECTION: HART TMT82 1 ADDITIONAL OPTION 1: NOT SELECTED A ADDITIONAL OPTION 2: NOT SELECTED K VERSION: STANDARD A >>>MARKING: TAGGING (TAG), METAL DETAILS LOW RANGE VALUE 0.000 °C UPPER RANGE VALUE 50.000 °C DUAL-SENSOR CONFIGURATION PV = CH1; CH2 NOT METAL LABEL 71072708 71072708	20-TT-001 20-TW-001	DS-107	C03	C
64	1	EA	3147192	TRANS-LEVEL,316,1.50,FLG,0-96",E+H	VENDOR: ENDRESS+HAUSER, LEVEL TRANSMITTER, DELTAPILOT M FMB50 FMB50-CA21JD1FGKAEJB3U+Z1 [CA] Approval: CSA,C/US IS C1.I,II,III DIV. 1 GR.A-G, CSA C/US IS C1.I DIV. 2 GR.A-D, EX 1A, C:ZONE 0,1,2,20,21,22 [2] OUTPUT: 4-20MA HART [1] DISPLAY, OPERATION: LCD, PUSH BUTTON ON DISPLAY/ELECTRONICS [J] HOUSING: F31 ALU, GLASS WINDOW [D] ELECTRICAL CONNECTION: THREAD NPT1/2, IP66/68 NEMA4X/6P [1F] SENSOR RANGE: 400MBAR/40KPA/6PSI GAUGE,4MH2O/13FTH2O/160INH2OOVERLOAD: 8BAR/800KPA/120PSI [G] REFERENCE ACCURACY: STANDARD [K] CALIBRATION; UNIT: CUSTOMISED LEVEL; SEE ADDITIONAL SPEC.. > RANGE 4 TO 20 MA FROM 0 TO 96 INH2O [AEJ] PROCESS CONNECTION: NPS 1-1/2" C1.150 RF, 316/316L FLANGE ASME B16.5 [B] MEMBRANE MATERIAL: ALLOY C [3] FILL FLUID: SYNTHETIC OIL, FDA [U] SEAL: NONE, CELL WELDED	20-LIT-603	DS-107	C09	C
65	1	EA	3090186	VALVE- BALL,PVC,1.50,SOC/THD,TU,GF,EPDM	VALVE, BALL, TRUE UNION, GEORGE FISCHER TYPE 546, PT# 161546346, 1.5", PVC BODY, TEFLON SEATS, EPDM O-RINGS, SOCKET/THREADED COMBO END CONNECTIONS.	20-HV-611	DS-107	B01	C
66	2	EA	3109179	VALVE-BTFLY,NYL,4.00,A/A SV,LG,LS,24V,BR	BUTTERFLY VALVE MANUFACTURER: BRAY VALVE #: 31-390 VALVE SIZE: 4 IN. MATERIAL: BODY- DUCTILE IRON DISC- NYLON COATED DUCTILE IRON STEM- 416SS SEAT- EPDM CONNECTION: LUG STYLE ACTUATOR: DOUBLE ACTING ACTUATOR SIZE: SERIES 92/83 PRESSURE RATING: VACUUM TO 150 PSI ACCESSORIES: C/W NAMUR DIRECT MOUNT, SOLENOID 24VDC/6.9 WATTS PART # 630250-21401536, WITH SPEED CONTROLS AND MICRO SWITCH S50 PRE-WIRED	20-FV-641	DS-107	B04	C
67	1	EA	3090312	VALVE- BTFLY,NYL,3.00,LG,150,EPDM,BR	BUTTERFLY VALVE MANUFACTURER: BRAY SERIES: 31-390 VALVE SIZE: 3 IN. MATERIAL: BODY- DUCTILE IRON DISC- NYLON COATED DUCTILE IRON STEM- 416SS SEAT- EPDM CONTROL: LEVER OPERATOR CONNECTION: LUG PRESSURE RATING: 150 PSI	20-HV-609	DS-107	B03	C

Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
68					RAS/WAS/DRAIN PUMPS		DS-108, SHEET 1		
69	2	EA	506752-MA-24	VALVE- KNIFEGATE,316,4.00,MAN,LG,OX,BD	4" ORBINOX 22-3636R-04.0-HW KNIFE GATE VALVE STANDARD MODEL: BT - BIDIRECTIONAL MSS SP-81 ACTUATOR: HANDWHEEL RISING STEM BODY: CF8M GATE: AISI 316 SEAT: EPDM PACKING: ST FLANGE: ANSI 150	20-HV-501-1/2	DS-108, SHEET 1	B17	C
70	2	EA	506752-MA-09	PUMP- CENTRI,Ci,5.0HP,575/60,SULZER	RAS PUMP – SULZER SITE SUPPLY FREQUENCY: 60 HZ TYPE/SIZE: APT21-3(O) END SUCTION SINGLE STAGE CENTRIFUGAL PUMP IMPELLER- IMPELLER TYPE: OPEN IMPELLER HOLES: BALANCE HOLES MATERIALS OF CONSTRUCTION VOLUTE CASE : GREY CAST IRON (ASTM A48 CL35B) IMPELLER : DUPLEX STEEL (ASTM A890 3A) WETTED NON CASTED ALLOYS: 316 SS OR BETTER GRADE SHAFT: DUPLEX STEEL (EN1.4460 / AISI 329 / SS2324) BEARING HOUSING : GREY CAST IRON (ASTM A48 CL30B) MECHANICAL SEAL TYPE: JOHN CRANE, 5610 (FC16) BASEPLATE BASEPLATE TYPE: STANDARD BASEPLATE FOR PUMP AND MOTOR (SLP) BASEPLATE MATERIAL: CARBON STEEL BASEPLATE EQUIPMENT: FOUNDATION SCREW, WELDED BASEPLATE SURFACE TREATMENT: HOT GALVANIZING Motor detail: (SIEMENS/BALDOR/WEG/MARATHON) SEVERE DUTY 6 POLES 2HP TEFC 184T 575V FOOT MOUNTED	20-P-501-1/2	DS-108, SHEET 1	A11	C
71	2	EA	506752-MA-13	TRANS-FLOW,MAG,4.00FLG,0-450GPM,E+H	PROMAG W 400, 5W4C1H, DN100 4" (5W4C1H-C6ELHA0DUA1K0A+AADAZ1) ELECTROMAGNETIC FLOWMETER - INLINE VERSION. CORROSION-RESISTANT TRANSMITTER VERSION C6 APPROVAL: CSA C/US NI CL.I DIV.2 GR. ABCD E DESIGN: FIXED FLANGE L POWER SUPPLY: 100-240VAC/24VAC/DC H OUTPUT; INPUT: 4-20MA HART, PULSE/FREQ., SWITCH OUTPUT A HOUSING: COMPACT, ALU, COATED O CABLE, REMOTE VERSION: NOT USED D ELECTRICAL CONNECTION: THREAD NPT1/2 U LINER: POLYURETHANE A1K PROCESS CONNECTION: CL.150, CARBON STEEL, FLANGE ASME B16.5 O ELECTRODES: 1.4435/316L A CALIBRATION FLOW: 0.5% AA >OPERATION LANGUAGE DISPLAY: ENGLISH DA >>CUSTOMIZED PARAMETERIZATION: OUTPUT 1 Z1 >>MARKING: TAGGING (TAG), SEE ADDITIONAL SPEC. DETAILS CURR. OUTPUT 1 VOLUME FLOW CURRENT SPAN 4...20 MA NAMUR VALUE 0/4 MA 0.00000 USGAL/MIN VALUE 20 MA 450.00000 USGAL/MIN CH: GKV ANNEX 1 AND 2, NOT LISTED EC: REG 428/2009 ANNEX I, NOT LISTED IR: CH REG IRAN ANNEX II, NOT LISTED IR: REG (EU) NO 267/2012 ANII & 2015/1861 ANVIIB, NOT LISTED RU: REG (EU) 833/2014 ANNEX II, NOT LISTED SUBJECT TO THE US EXPORT ADMINISTRATION REGULATIONS - EAR99	20-FIT-507-1/2	DS-108, SHEET 1	C10	C
72	2	EA	3087304	RING-GROUND,4",316SS,150#	PAIR OF GROUNDING RINGS FOR 4" E&H MAGMETER WITH POLYURETHANE LINER, 316SS, 150# RATING, PART NO. 4200360	NO TAG	DS-108, SHEET 1	C10	C
73	4	EA	3090191	VALVE- BALL,PVC,1.00,SOC/THD,TU,GF,VTN	VALVE, BALL, TRUE UNION, GEORG FISCHER TYPE 546, PT# 161546354, 1", PVC BODY, TEFLON SEATS, VITON O-RINGS, SOCKET/THREADED COMBO END CONNECTIONS.	20-HV-505-1/2 20-HV-506-1/2	DS-108, SHEET 1	B01	C
74	2	EA	3173741	VALVE-CHK,Ci,4.00,WF,BR	BRAY V0412CET ANSI 125 MODEL 210 WAFER CHECK VALVE, CAST IRON BODY, STAINLESS STEEL DISC AND TRIM. EPDM N O-RING SEAT INTEGRAL TO BODY, TEFLON SPACERS	20-CV-501-1/2	DS-108, SHEET 1	B11	C
75	4	EA	3090191	VALVE- BALL,PVC,1.00,SOC/THD,TU,GF,VTN	VALVE, BALL, TRUE UNION, GEORG FISCHER TYPE 546, PT# 161546354, 1", PVC BODY, TEFLON SEATS, VITON O-RINGS, SOCKET/THREADED COMBO END CONNECTIONS.	20-HV-504-1/2 20-HV-503-1/2	DS-108, SHEET 1	B01	C
76	2	EA	506752-MA-18	GAUGE-PRESS,30"HG,30PSI,SS,GF	ASHCROFT DIAPHRAGM SEAL 1"NPT PROCESS CONNECTION, 316SS DIAPHRAGM & BOTTOM HOUSING, 1/2"NPT INSTRUMENT CONNECTION SILICONE FILL FLUID BEING ATTACHED TO ABOVE GAUGES MODEL:10-100SS-04T ASHCROFT PRESSURE GAUGE 30"HG/0/30PSI 3-1/2"DIAL (100MM DIAL), STAINLESS STEEL CASE & BOURDON TUBE 1/2"NPT LOWER CONNECTION MODEL:1008 SL-30/30	20-PI-504-1/2	DS-108, SHEET 1	C04	C
77	2	EA	506752-MA-19	GAUGE-PRESS,0-30PSI,SS,GF	ASHCROFT DIAPHRAGM SEAL 1"NPT PROCESS CONNECTION, 316SS DIAPHRAGM & BOTTOM HOUSING, 1/2"NPT INSTRUMENT CONNECTION SILICONE FILL FLUID BEING ATTACHED TO ABOVE GAUGES MODEL:10-100SS-04T ASHCROFT PRESSURE GAUGE 0/30PSI 3-1/2"DIAL (100MM DIAL), STAINLESS STEEL CASE & BOURDON TUBE 1/2"NPT LOWER CONNECTION MODEL:1008 SL-0/30	20-PI-503-1/2	DS-108, SHEET 1	C04	C

Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
78	1	EA	506752-MA-14	TRANS-FLOW,MAG,2.00FLG,0-1.5GPM,E+H	PROMAG W 400, 5W4C50, DN50 2" - (5W4C50-C6ELHA0DUA1K0A+AADAZ1) ELECTROMAGNETIC FLOWMETER INLINE VERSION. C6 APPROVAL: CSA C/US NI CL.I DIV.2 GR. ABCD E DESIGN: FIXED FLANGE L POWER SUPPLY: 100-240VAC/24VAC/DC H OUTPUT; INPUT: 4-20MA HART, PULSE/FREQ., SWITCH OUTPUT A HOUSING: COMPACT, ALU, COATED O CABLE, REMOTE VERSION: NOT USED D ELECTRICAL CONNECTION: THREAD NPT1/2 U LINER: POLYURETHANE A1K PROCESS CONNECTION: CL.150, CARBON STEEL, FLANGE ASME B16.5 O ELECTRODES: 1.4435/316L A CALIBRATION FLOW: 0.5% AA >OPERATION LANGUAGE DISPLAY: ENGLISH DA >>CUSTOMIZED PARAMETERIZATION: OUTPUT 1 Z1 >>MARKING: TAGGING (TAG), SEE ADDITIONAL SPEC. DETAILS CURR. OUTPUT 1 VOLUME FLOW CURRENT SPAN 4...20 MA NAMUR VALUE 0/4 MA 0.00000 USGAL/MIN VALUE 20 MA 1.50000 USGAL/MIN CH: GKV ANNEX 1 AND 2, NOT LISTED EC: REG 428/2009 ANNEX I, NOT LISTED IR: CH REG IRAN ANNEX II, NOT LISTED IR: REG (EU) NO 267/2012 ANII & 2015/1861 ANVIIB, NOT LISTED RU: REG (EU) 833/2014 ANNEX II, NOT LISTED SUBJECT TO THE US EXPORT ADMINISTRATION REGULATIONS - EAR99 REQUIRED RANGE: 0 TO 1.5 GPM	20-FIT-401	DS-108, SHEET 1	C10	C
79	1	EA	3087302	RING- GROUNDING,316,2.00,150#,POLY LINER	PAIR OF GROUNDING RINGS FOR 2" E&H MAGMETER WITH POLYURETHANE LINER, 316SS, 150# RATING, PART NO. 4200356	NO TAG	DS-108, SHEET 1	C10	C
80	1	EA	506752-MA-25	VALVE- KNIFEGATE,316,3.00,MAN,LG,OX,BD	3" ORBINOX 22-3636R-03.0-HW KNIFE GATE VALVE STANDARD MODEL: BT - BIDIRECTIONAL MSS SP-81 ACTUATOR: HANDWHEEL RISING STEM BODY: CF8M GATE: AISI 316 SEAT: EPDM PACKING: ST FLANGE: ANSI 150	20-HV-407	DS-108, SHEET 1	B17	C
81	1	EA	506752-MA-26	VALVE-KNIFEGATE,316,3.0,A/A SV,LG,24,BD,TS	3" ORBINOX 22-3636R-03.0-DATS-SOL KNIFE GATE VALVE STANDARD MODEL: BT - BIDIRECTIONAL MSS SP-81 ACTUATOR: PNEUMATIC DOBLE ACTING TRAVEL STOP IN THE OPEN POSITION 0-100% BODY: CF8M GATE: AISI 316 SEAT: EPDM PACKING: ST FLANGE: ANSI 150 SOLENOID VALVE: ASCO NUMATICS SOLENOID, SOL082SA43CM, 24VDC, 4-WAY, NEMA-4 LIMIT SWITCHES	20-FV-701	DS-108, SHEET 1	B18	C
82	1	EA	506752-MA-27	VALVE-KNIFEGATE,316,6.0,A/A SV,LG,24,BD, TS	6" ORBINOX 22-3636R-06.0-DATS-SOL KNIFE GATE VALVE STANDARD MODEL: BT - BIDIRECTIONAL MSS SP-81 ACTUATOR: PNEUMATIC DOBLE ACTING TRAVEL STOP IN THE OPEN POSITION 0-100% BODY: CF8M GATE: AISI 316 SEAT: EPDM PACKING: ST FLANGE: ANSI 150 SIZE (INCH): 6 : SOLENOID VALVE: ASCO NUMATICS SOLENOID, SOL082SA43CM, 24VDC, 4-WAY, NEMA-4 LIMIT SWITCHES	20-FV-807	DS-108, SHEET 1	B18	C

Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
83					TWAS STORAGE TANK		DS-108, SHEET 2		
84	1	EA	506752-MA-20	DIFFUSER-GRID,WAS AER,FLEXAIR,EDI	FLEXAIR MAGNUM MEDIUM BUBBLE DIFFUSERS, SINGLE GRID, FEED VIA 4" DROP, 9 FLEXAIR 84P DUPLEX DIFFUSER ASSEMBLIES	NO TAG	DS-108, SHEET 2	B27	C
85					UV SYSTEM		DS-109		
86	1	EA	506752-MA-15	TRANS-FLOW,MAG,4.00FLG,0-800GPM,E+H	PROMAG W 400, 5W4C1H, DN100 4" - (5W4C1H-C6ELHA0DUA1K0A+AADAZ1) ELECTROMAGNETIC FLOWMETER INLINE VERSION. C6 APPROVAL: CSA C/US NI CL.I DIV.2 GR. ABCD E DESIGN: FIXED FLANGE L POWER SUPPLY: 100-240VAC/24VAC/DC H OUTPUT; INPUT: 4-20MA HART, PULSE/FREQ., SWITCH OUTPUT A HOUSING: COMPACT, ALU, COATED O CABLE, REMOTE VERSION: NOT USED D ELECTRICAL CONNECTION: THREAD NPT1/2 U LINER: POLYURETHANE A1K PROCESS CONNECTION: CL.150, CARBON STEEL, FLANGE ASME B16.5 O ELECTRODES: 1.4435/316L A CALIBRATION FLOW: 0.5% AA >OPERATION LANGUAGE DISPLAY: ENGLISH DA >>CUSTOMIZED PARAMETERIZATION: OUTPUT 1 Z1 >>MARKING: TAGGING (TAG), SEE ADDITIONAL SPEC. DETAILS CURR. OUTPUT 1 VOLUME FLOW CURRENT SPAN 4...20 MA NAMUR VALUE 0/4 MA 0.00000 USGAL/MIN VALUE 20 MA 800.00000 USGAL/MIN CH: GKV ANNEX 1 AND 2, NOT LISTED EC: REG 428/2009 ANNEX I, NOT LISTED IR: CH REG IRAN ANNEX II, NOT LISTED IR: REG (EU) NO 267/2012 ANII & 2015/1861 ANVIIB, NOT LISTED RU: REG (EU) 833/2014 ANNEX II, NOT LISTED SUBJECT TO THE US EXPORT ADMINISTRATION REGULATIONS - EAR99 REQUIRED RANGE - 0 TO 800 GPM	38-FIT-101	DS-109	C10	C
87	1	EA	3087304	RING-GROUND,4",316SS,150#	PAIR OF GROUNDING RINGS FOR 4" E&H MAGMETER WITH POLYURETHANE LINER, 316SS, 150# RATING, PART NO. 4200360	NO TAG	DS-109	C10	C
88	4	EA	3090313	VALVE-BTFLY,HV,4",LUG,SS,LEV	VALVE, BUTTERFLY, BRAY SERIES 31-169, 4" CAST IRON LUG STYLE BODY, RATED VACUUM TO 150 PSI, SS DISC AND SHAFT, EPDM SEAT, LEVER OPERATOR; BRAY ASSEMBLY ID 9C040LF169L.	38-HV-101 38-HV-102 38-HV-103 38-HV-104	DS-109	B03	C
89	2	EA	1112797	VALVE-BALL,316,0.50,MAN,FPT,AP	APOLLO 76-103 MOC: SS 316 END CONN: 0.5" FNPT HAND LEVER OPERATED	38-SV-101 38-SV-102	DS-109	B01	C
90	1	EA	506725-MA-20	UV-STERLIZER,AQUA,107GPM	SLP200-4 LOW PRESSURE HIGH OUTPUT UV SYSTEM INCLUDING: <ul style="list-style-type: none"> EACH REACTOR RATED FOR UP TO 107 US GALLONS/MINUTE DISINFECTION AT 75% UV TRANSMISSIVITY OR BETTER 80 MJ/CM2 UV DOSAGE AT END OF LAMP LIFE 4 205W 254 NM LOW PRESSURE HIGH OUTPUT AMALGAM LAMPS PER REACTOR 316LSS UV REACTOR BODY 10 INCH (250 MM) ANSI FLANGE CONNECTIONS 6 INCH (150 MM) BODY DIAMETER ONE (1) HIGH TEMPERATURE SENSOR PER REACTOR ONE (1) UV INTENSITY MONITOR PER REACTOR ONE (1) ELECTROMECHANICAL WIPER ASSEMBLY PER REACTOR ONE (1) SLP IP54 (=NEMA 12) CONTROL PANEL PER REACTOR 220/230/240V, 1 PH, 50/60 HZ POWER CONSUMPTION = 1.4 KW PER REACTOR 	38-UV-101-1	DS-109	A13	C
91					CHEMICAL SYSTEMS		DS-110, SHEET 1		
92	1	EA	3083847	VALVE-BACK PRESS,PVC,0.50,FPT,PR	BACK PRESSURE VALVE, PROMINENT PT# 1006850, 1/2" FNPT, 0-150 PSIG SETTING, PVC, PTFE-FACED EPDM DIAPHRAGM.	23-PCV-303	DS-110, SHEET 1	B39	C
93	1	EA	506752-MA-10	VALVE-BACK PRESS,PVC,0.50,FPT,PR	BACK PRESSURE VALVE, PROMINENT 1006850 , 1/2" FNPT, 15-150 PSIG SETTING, PVC, VITON DIAPHRAGM.	23-PCV-103	DS-110, SHEET 1	B39	C
94	1	EA	3180414	SYS-CHEM,PVC,0.75,V,DUAL,MTR,WM,PR,S2C	PROMINENT CHEM FEED PANEL:SUEZ-PROSIP MW P2-0.75-PVC-V-BPY-PDY-10000, NO. OF PUMPS:2.0, MOUNTING:WALL, PROMINENT PART:1096041, REF. DWG.:1096041-200, PUMP MODEL:S2CBH07220PVT\$070UD11001EN, LIQUID END MAT'L:PVDF, SEALS/DIAPHRAGM MAT'L:PTFE, FLOW(LPH):2.64-264, PRESSURE (BAR/PSI):7.0/101.0, POWER:100-230VAC,1PH,50/60 HZ. MOTOR DRIVEN W/ PULSATION DAMPENER, CONTROL:MANUAL + EXT W/ PULSE & 4-20 MA ANALOG, PIPING/SEAL MAT'L:PVC/VITON, PANEL MAT'L:FRP PLASTIC	23-P-101-A/B 23-HV-101-A/B 23-HV-102 23-HV-103 23-HV-104 23-HV-105 23-FQI-101 23-PI-101 23-CV-101-A/B 23-STR-101 23-PD-101 23-PCV-101 23-PCV-102	DS-110, SHEET 1	A09	C
95	2	EA	3081108	SWITCH-LEVEL,PVDF,PR,2STG,15FT	LEVEL SWITCH, FLOAT, DUAL STAGE, PROMINENT PT# 7792640, PVDF BODY WITH3-POLE ROUND CONNECTOR, 60V MAXIMUM CONTACT LOAD, 15' CABLE LENGTH,C/W1.53" DIA X 1.26" CERAMIC WEIGHT #404004.	23-LSL-301 23-LSL-101	DS-110, SHEET 1	C08	C
96	1	EA	3180415	SYS-CHEM,PVC,0.75,E,DUAL,MTR,WM,PR,S2C	PROMINENT CHEM FEED PANEL:SUEZ-PROSIP MW P2-0.75-PVC-E-BPY-PDY-10000, NO. OF PUMPS:2.0, MOUNTING:WALL, PROMINENT PART:1096042, REF. DWG.:1096042-200, PUMP MODEL:S2CBH07220PVT\$070UD11001EN, LIQUID END MAT'L:PVDF, SEALS/DIAPHRAGM MAT'L:PTFE, FLOW(LPH):2.64-264, PRESSURE (BAR/PSI):7.0/101.0, POWER:100-230VAC,1PH,50/60 HZ. MOTOR DRIVEN W/ PULSATION DAMPENER, CONTROL:MANUAL + EXT W/ PULSE & 4-20 MA ANALOG, PIPING/SEAL MAT'L:PVC/EPDM, PANEL MAT'L:FRP PLASTIC	23-P-301-A/B 23-HV-301-A/B 23-HV-302 23-HV-303 23-HV-304 23-HV-305 23-FQI-301 23-PI-301 23-CV-301-A/B 23-STR-301 23-PD-301 23-PCV-301 23-PCV-302	DS-110, SHEET 1	A09	C

Line No.	Qty	Unit	SAP Part No.	Primary Description	Complete Description	Suez Equipment Tags	SUEZ Drawing No.	Cutsheet Folder	REV
97					CHEMICAL SYSTEMS		DS-110, SHEET 2		
98	1	EA	3083847	VALVE-BACK PRESS,PVC,0.50,FPT,PR	BACK PRESSURE VALVE, PROMINENT PT# 1006850, 1/2" FNPT, 0-150 PSIG SETTING, PVC, PTFE-FACED EPDM DIAPHRAGM.	10-PCV-603	DS-110, SHEET 2	B39	C
99	1	EA	3180383	SYS- CHEM,PVC,0.50,E,DUAL,SOL,WM,L,P R,GMX	PROMINENT CHEM FEED PANEL:SUEZ-PROSIP SW P2-0.5-PVC-E-BPY-PDN-100, NO. OF PUMPS:2.0, MOUNTING:WALL, PROMINENT PART:1095966, REF. DWG.:1095966-200, PUMP MODEL:GMXA1604PVT2M000UDC0300EN, LIQUID END MAT'L:PVDF, SEALS/DIAPHRAGM MAT'L:PTFE, FLOW(LPH):0.01-3.6, PRESSURE (BAR/PSI):16.0/232.0, POWER:100-230VAC,1PH,50/60 HZ. SOLENOID DRIVEN, CONTROL:MANUAL + EXT W/ PULSE & 4-20 MA ANALOG, PIPING/SEAL MAT'L:PVC/EPDM, PANEL MAT'L:FRP PLASTIC	10-P-601-A/B 10-HV-601-A/B 10-HV-602 10-HV-603 10-HV-604 10-HV-605 10-FQI-601 10-PI-601 10-CV-601-A/B 10-STR-601 10-PD-601 10-PCV-601 10-PCV-602	DS-110, SHEET 2	A09	C
100	1	EA	3081108	SWITCH-LEVEL,PVDF,PR,2STG,15FT	LEVEL SWITCH, FLOAT, DUAL STAGE, PROMINENT PT# 7792640, PVDF BODY WITH3-POLE ROUND CONNECTOR, 60V MAXIMUM CONTACT LOAD, 15' CABLE LENGTH,C/W1.53" DIA X 1.26" CERAMIC WEIGHT #404004.	10-LSL-601	DS-110, SHEET 2	C08	C
101					AIR COMPRESSORS		DS-111		
102	1	EA	506752-MA-11	ASSY-COMPRESSOR,AIR,575V,CSI	GARDNER DENVER DUPLEX COMPRESSOR SET MODEL V04PDRHS-12 WITH TWO ROTARY VANE AIR COOLED OIL LUBRICATED HYDROVANE COMPRESSOR PUMPS. CAPACITY PER PUMP IS 16CFM AT 150PSI (32CFM TOTAL) 5.0HP TEFC MOTORS (QTY TWO) 575/3/60 START STOP CONTROL VIA PRESSURE SWITCHES. INCLUDES STARTER. NOISE LEVEL 72 DBA ALL ABOVE MOUNTED ON A 120-GALLON HORIZONTAL ASME TANK COMPLETE WITH SAFETY VALVE, OUTLET VALVE, GAUGE AND AUTOMATIC TANK DRAIN 115V. FOOD GRADE OIL &VIBRATION MOUNTS INCLUDED. VENDOR: COMPRESSOR SCIENCE INC.	90-F-001-A/B 90-AC-001-A/B 90-TK-001 90-PSL-001 90-PI-001 90-PSV-001 90-HV-001 90-FV-001	DS-111	A07	C
103	2	EA	506752-MA-16	AIR DRYER,25CFM,115V,CSI	GARDNER DENVER REFRIGERATED DRYER MODEL GSRN25 CAPACITY PER UNIT 25CFM AT 100PSI VOLTAGE 115/1/60 - 1/2" NPT. UNITS WILL PROVIDE A 35-39F DEWPOINT PROVIDING INLET AIR TO DRYER IS LESS THAN 100F AND AMBIENT AIR IS LESS THAN OR EQUAL TO 100F AUTO DRAIN INCLUDED. VENDOR: COMPRESSOR SCIENCE INC.	90-DR-001-A/B	DS-111	A08	C
104	4	EA	1113073	VALVE-BALL,316,0.75,FPT,AP	APOLLO # 76-104-01 (1 PIECE)	90-HV-002-A/B 90-HV-003-A/B	DS-111	B01	C
105	1	EA	3152435	ASSY-FLT,ALUM,MAIN INST,AIR,70SCFM,PROAX	MAIN COMPRESSED AIR ASSEMBLY, PROAX TECHNOLOGIES PT# 3152435 ASSEMBLED AS PER PROAX DRAWING D1511AM23-11-A1 REV11,ASSEMBLY DESIGNED FOR 70 SCFM , MAIN COMPONENTS CONSIST OF THE FOLLOWING ITEMS: SMC SHUTOFF VALVES: PT# VHS40-N06B-Z AL BODY, CONN: 3/4" FNPT, PROOF PRESSURE: 217 PSI, CV: 5 SMC PRESSURE REGULATOR: PT# AR40K-N06E-Z-B BACKFLOW FUNCTION, AL BODY, CONN: 3/4" FNPT, SQUARE EMBEDDED PRESSURE GAUGE, PRESS RANGE: 7-123 PSI, PROOF PRESS: 217 PSI RELIEVING TYPE SMC MAIN LINE FILTER: PT# AFF11C-N06D-T AL BODY & HOUSING, CONN: 3/4" FNPT, 3 MICRON, 99% EFFICIENCY MAX OPERATING PRESURE: 145 PSI (PROOF PRESS: 217 PSI), ELEMENT SERVICE INDICATOR, AUTO-DRAIN W/10MM PUSH-TO-CONNECT GEMS PRESSURE SWITCH: PT# PS75-30-AMNZ-C-HC-FS90PSIF GENERAL PURPOSE, BRASS BODY, IP65 ELECTRICAL CONN: DIN 43650A WITH 9MM CABLE CLAMP, 5A @ 125/250VOLTS AC, 5A RESISTIVE, 3A INDUCTIVE @ 28V, SPDT, PRESSURE RANGE: 50-150 PSI, DEADBAND: 15 PSIG,cRUus APPROVED. S.P. = 90 PSIG FALLING GEMS PRESSURE SWITCH: PT# PS75-30-AMNZ-C-HC-FS70PSIF GENERAL PURPOSE, BRASS BODY, IP65 ELECTRICAL CONN: DIN 43650A WITH 9MM CABLE CLAMP, 5A @ 125/250VOLTS AC, 5A RESISTIVE, 3A INDUCTIVE @ 28V, SPDT, PRESSURE RANGE: 50-150 PSI, DEADBAND: 15 PSIG,cRUus APPROVED. S.P. = 70 PSIG FALLING	90-HV-004 90-HV-005 90-F-020 90-DPI-001 90-HV-006 90-PY-001 90-PSL-003 90-PSLL-002	DS-111	B20	C

APPENDIX D4

General Arrangement Drawings

SHOP DRAWING REVIEW FORM

Name of Contract: English River Property Management WWTF

Job No.: 5401-002-00

Supplier: SUEZ

Description: Membrane General Arrangement Drawing
Permeate Skid General Arrangement Drawing

Tag Numbers: _____

SHOP DRAWING REVIEW

The review of this drawing does not in any way relieve the contractor of responsibility as detailed in the contract documents.

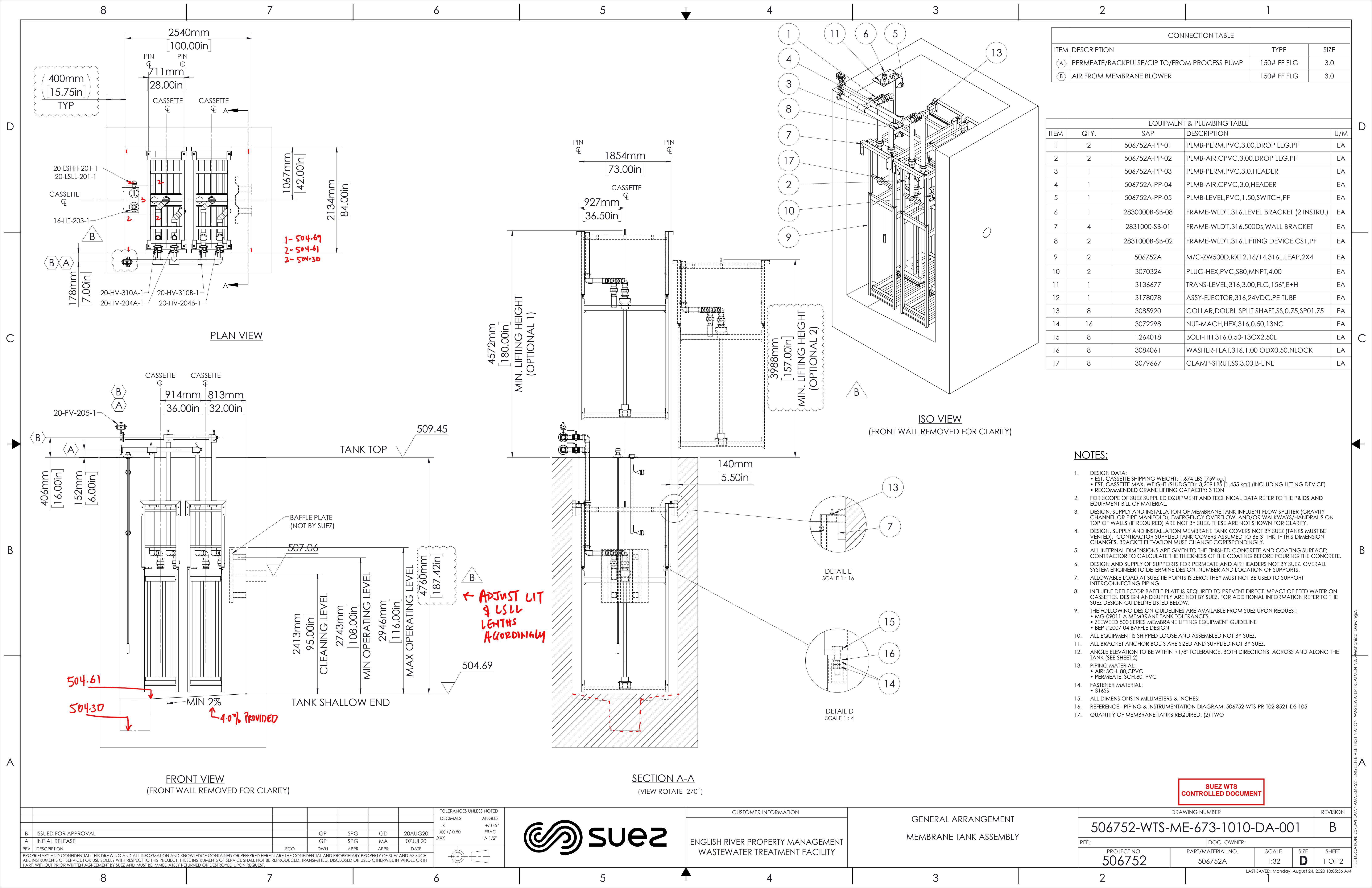
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<input checked="" type="checkbox"/>	Reviewed as noted	Job No. <u>7603-002-00</u>
<input type="checkbox"/>	Revise & Resubmit	Date <u>September 22, 2020</u>

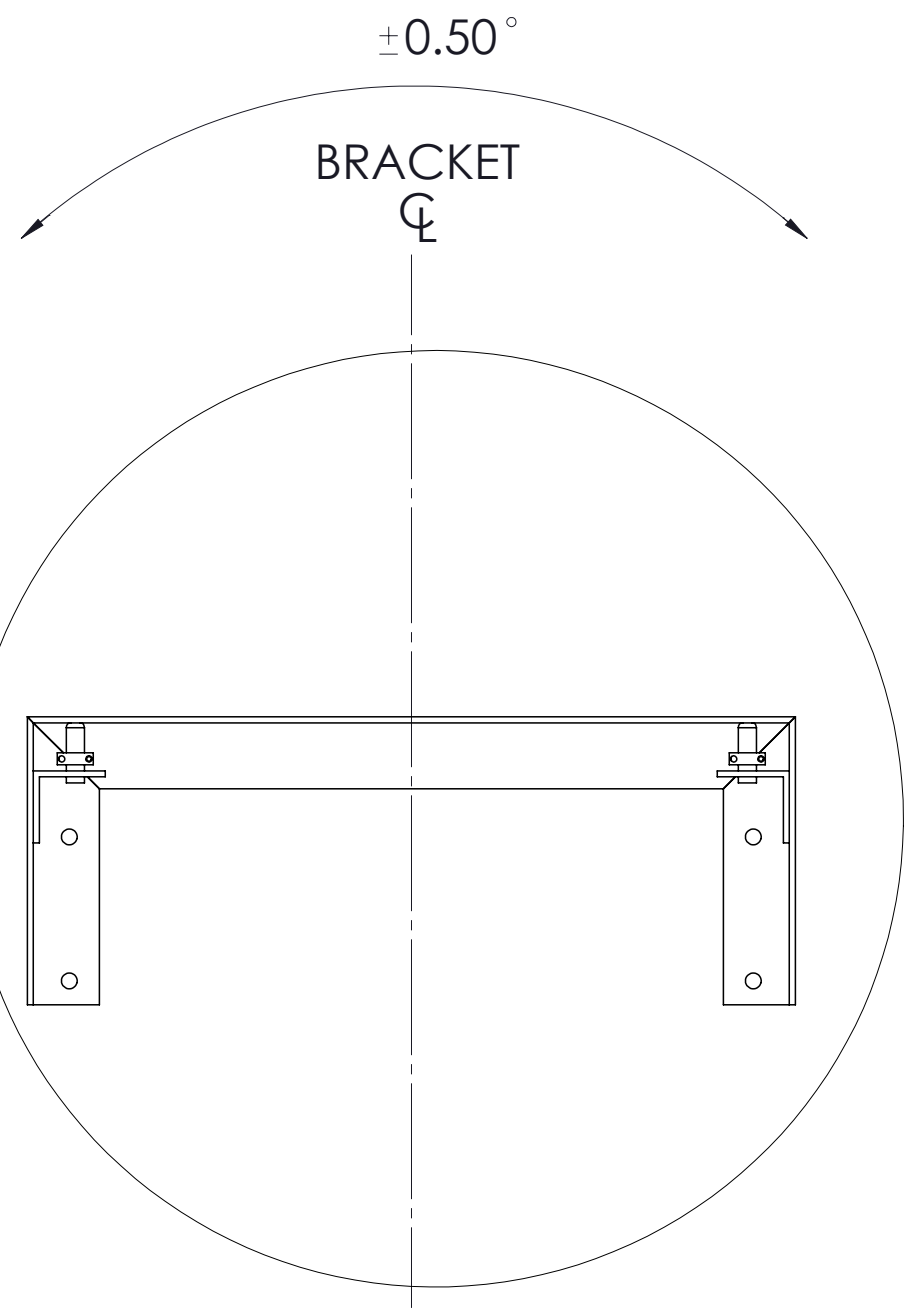
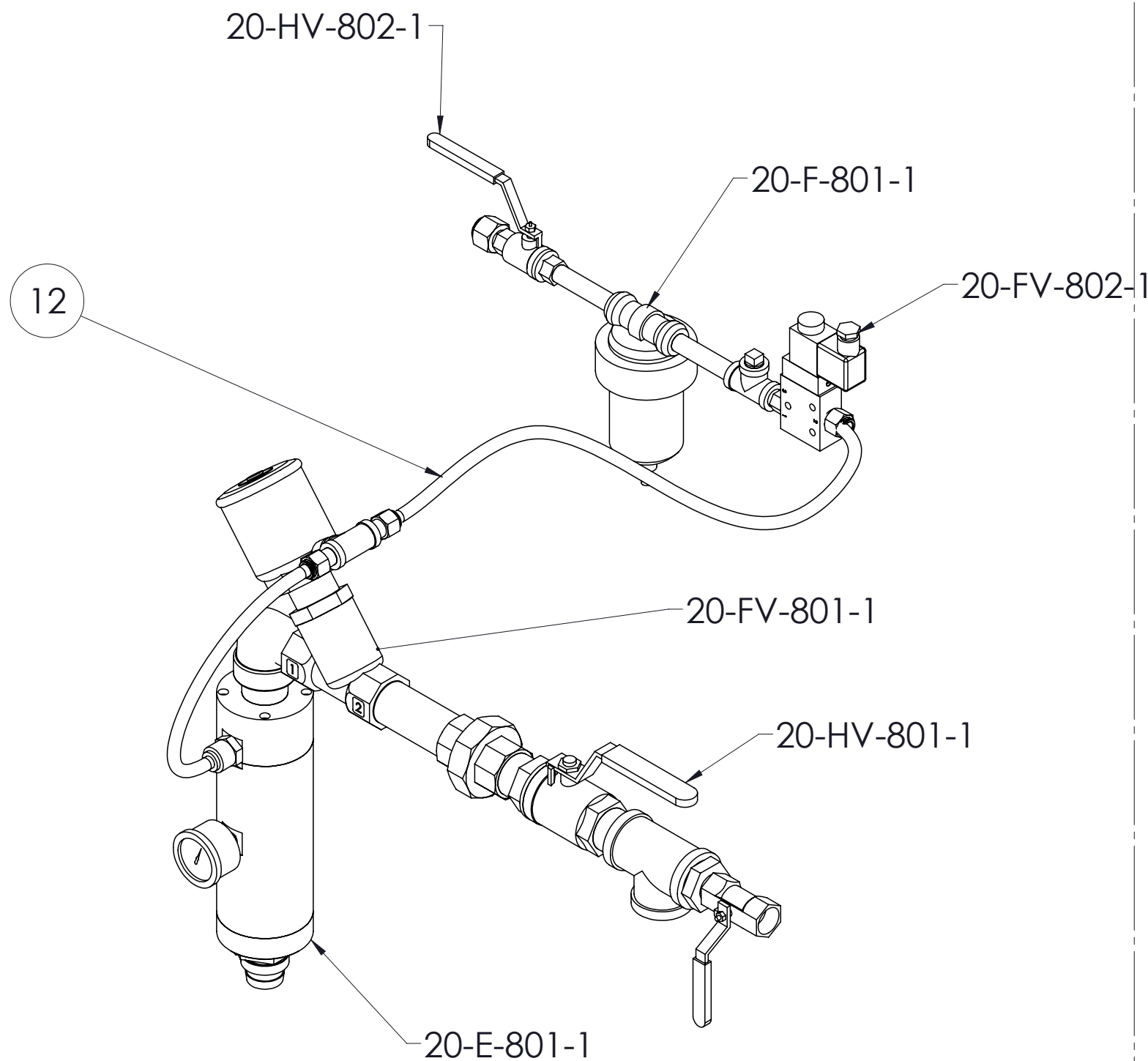
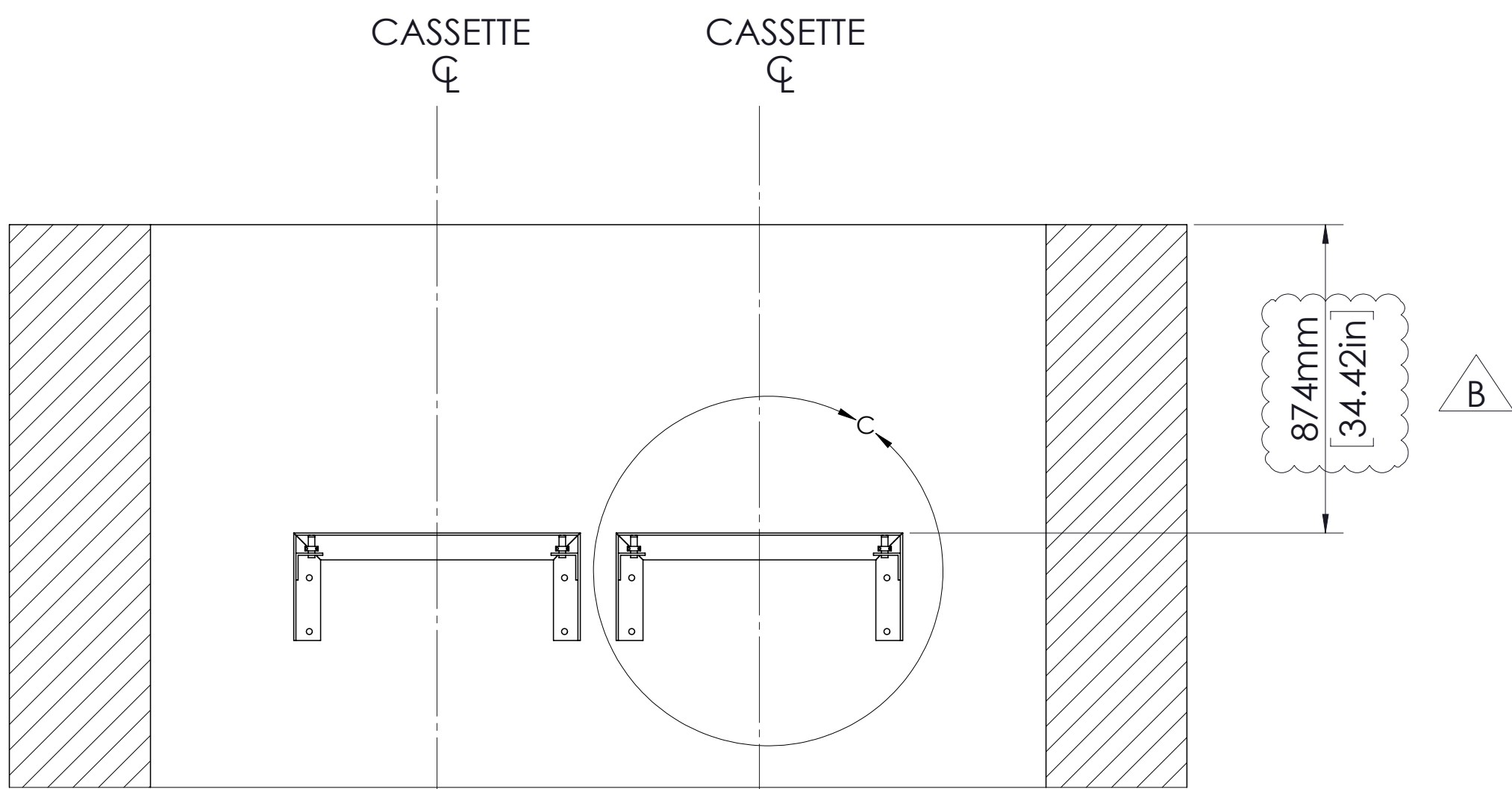
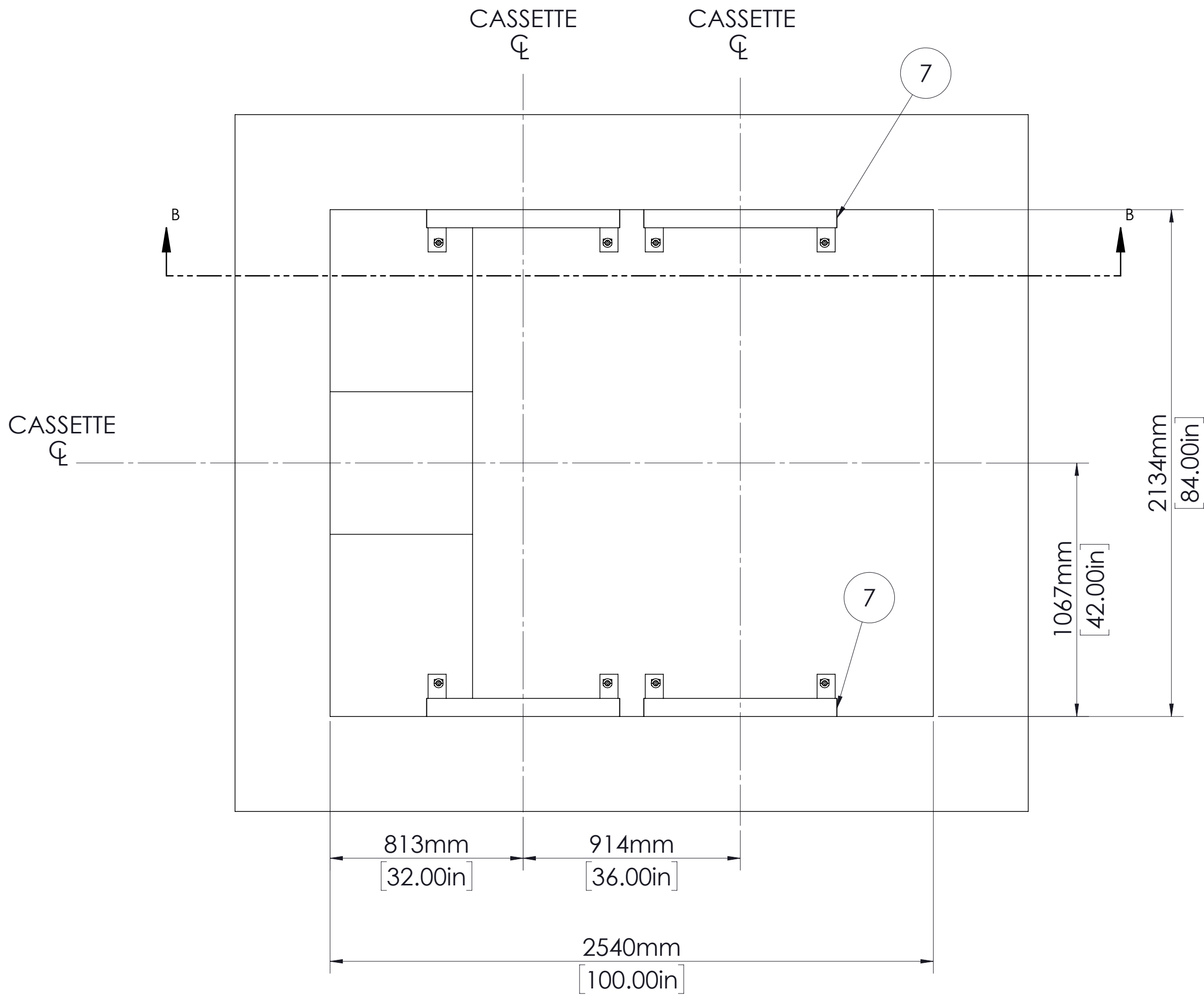
Dwg. reviewed by IK
MPE ENGINEERING LTD.

Engineer's Notes:

- Please see comments within for reference

Attachments: **506752-WTS-ME-673-1010-DA-001**
506752-WTS-ME-673-2010-DA-001





REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE
B	ISSUED FOR APPROVAL					
A	INITIAL RELEASE					

GP	SPG	GD	20AUG20
GP	SPG	MA	07JUL20

TOLERANCES UNLESS NOTED
DECIMALS
ANGLES
.X +/0.5°
.XX +/0.50
.XXX +/-.1/2"

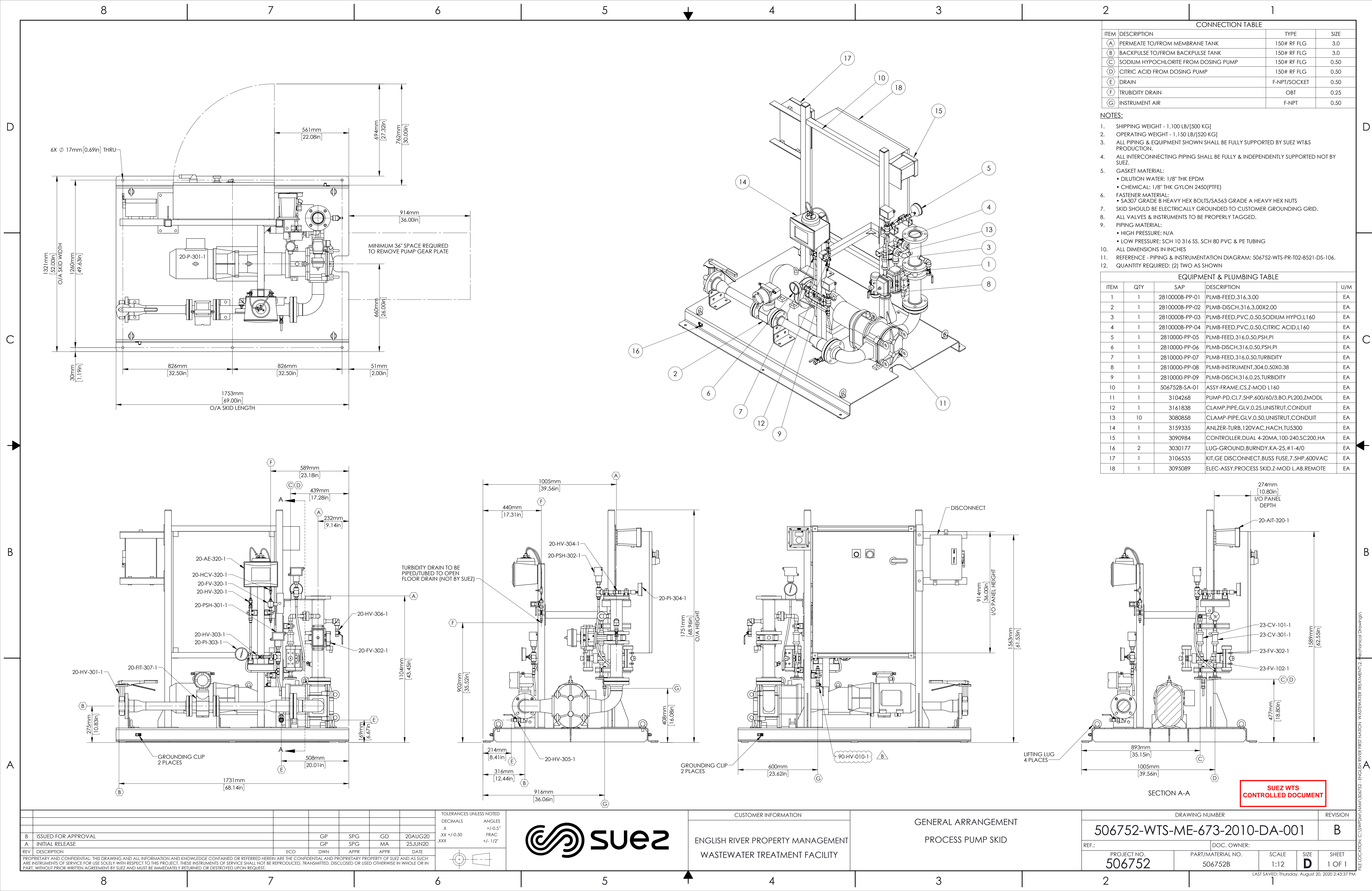


CUSTOMER INFORMATION

ENGLISH RIVER PROPERTY MANAGEMENT
WASTEWATER TREATMENT FACILITY

GENERAL ARRANGEMENT
MEMBRANE TANK ASSEMBLY BRACKETS

DRAWING NUMBER					REVISION
506752-WTS-ME-673-1010-DA-001					B
REF.:		DOC. OWNER:			
PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET	
506752	506752A	1:16	D	2 OF 2	



APPENDIX D5

Cutsheets



SHOP DRAWING REVIEW FORM

Name of Contract: English River First Nation WWTF

Job No.: 5401-002-00

Supplier: SUEZ

Description: CutSheets

Tag Numbers: _____

SHOP DRAWING REVIEW

The review of this drawing does not in any way relieve the contractor of responsibility as detailed in the contract documents.

	Reviewed
X	Reviewed as noted
	Revise & Resubmit

Submission No. 3

Job No. 7603-002-00

Date October 14, 2020

Dwg. reviewed by IK

MPE ENGINEERING LTD.

Engineer's Notes:

- See comments in Red within.

Attachments: 506752-WTS-ME-673-0100-SD-001



**SUEZ WTS
CONTROLLED DOCUMENT**

C	Issued for Approval	SP	AD	GD	07-10-2020			
B	Issued for Approval	JS	VC	GD	28-08-2020			
A	Issued for Approval	JS	VC	GD	21-08-2020			
REV	DESCRIPTION	WRITTEN BY	CHECKED BY	APPROVED BY	DATE DD-MM-YY			
DOCUMENT TYPE:		SUEZ DOCUMENT NUMBER :						
DATA SHEET		CONTRACT	ISSUER	DISCIPLINE	PRODUCT	PHASE	TYPE	CHRONO
		506752	WTS	ME	673	0100	SD	001

ENGLISH RIVER PROPERTY MANAGEMENT WASTEWATER TREATMENT FACILITY

CUT SHEET PACKAGE

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ZeeWeed* 500D cassette

Cassette Dimensions			
Product	Width (A) mm (in)	Length (B) mm (in)	Height (C) mm (in)
68M	1,745 [68.7]	2,136 [84.1]	2,561 [100.8]
64M	1,745 [68.7]	2,116 [83.3]	2,561 [100.8]
48M			
20M	738 [29.1]	1,744 [68.7]	2,512 [98.9]
16M			2,149 [84.6]
20Ms			
16Ms			
10Ms	738 [29.1]	980.2 [38.6]	2085.8 [82.1]
8Ms	738 [29.1]	980.2 [38.6]	2085.8 [82.1]

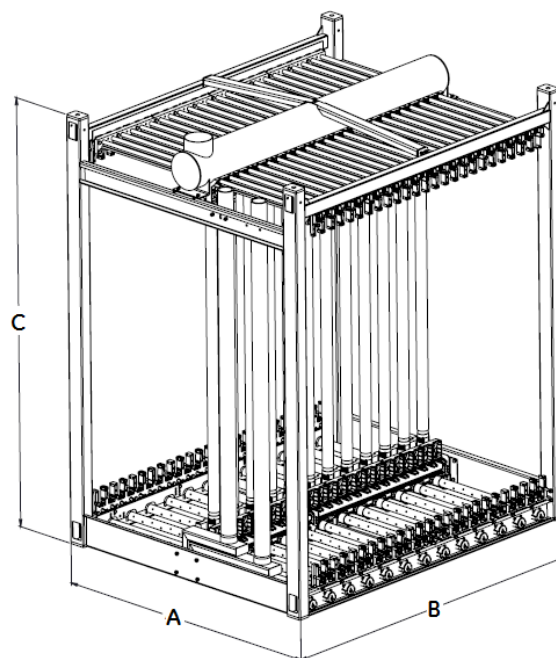


Figure 1: Drawing of 48M Cassette

Cassette Tie-Points & Weights							
Application	Product	Max. # of ZW Modules	Min. # of ZW Modules	Permeate Connection	Air Connection	Max. Shipping Weight* kg (lb)	Lifting Weight ** kg (lb)
	48M D	48	24	1 x 6" Pipe	2 x 3" pipe	1,729 (3,812)	1,959 – 4,064 (4,320 – 8,962)
	16M D	16	8	2 x 4" FNPT	1 x 3" FNPT	714 (1,574)	756 – 1,464 (1,667 – 3,228)
	16M Ds	16	8			677 (1,493)	1,366 (2,946)
	8M Ds	8	4	1 x 3" FNPT	1 x 2" FNPT	295 [651]	648 [1,430]
Non-MBR	68M D	68	34	1 x 8" horz. Pipe	2 x 3" FNPT		
	64M D	64	32		2 x 3" pipe	2,033 (4,483)	2,375 – 4,380 (5,237 – 9,659)
	20M D	20	10	2 x 4" FNPT	1 x 3" FNPT	800 (1,764)	870 – 1,553 (1,918 – 3,424)
	20M Ds	20	10			754 (1,662)	1,509 (3,327)
	10M Ds	10	5	1 x 3" FNPT	1 x 2" FNPT	295 [651]	1,170 [2,579]

* Crated with maximum number of modules

** Varies with number of modules and solids accumulation

Find a contact near you by visiting www.suezwatertechnologies.com and clicking on "Contact Us."

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POSITIVE DISPLACEMENT BLOWERS

DELTA BLOWER GENERATION 5

Volume flows from 30 m³/h to 15,000 m³/h



AERZEN

DELTA BLOWER.

A TOUGH ENDURANCE RUNNER IN
COUNTLESS COMPRESSION
PROCESSES.



Delta Blower Generation 5

Positive displacement blowers of the Delta Blower Generation 5 act as the driving force behind many processes, and are the beating heart of a strong machine combination. This generation of assemblies from AERZEN compresses more than 150 years of experience as world market leader in blower development. And it is more innovative than ever. AERZEN has introduced many innovations with this young series. They stand for Blower Pow-

er in the oil-free transport of air and neutral gases. They provide a large volume-flow range from 30 to 15,000 m³/h. With reduced life-cycle costs. For easier handling. For even quieter operation. But one thing remains the same: This blower class remains highly robust, thoroughly reliable and has an extremely long service life. No wonder then that customers choose it for continuous, long-term applications - over years and decades.



UNIVERSAL GENIUSES FOR EACH APPLICATION.

The versatile compact power packages of the Delta Blower series can be used in all climate zones of the world. Just as safe under the most difficult environmental conditions as in indoor installation. They work stand-alone or in a machine combination. In earthquake areas as reliable as with ship or other mobile installations.

Versatility in figures.

Delta Blowers are strong all-rounders: The smallest assemblies are mounted on silo trucks. The largest machines operate in lifting systems. They unload transport vessels. With an hourly performance of up to 1,000 tons.



Control range between
25 % and 100 %



Volume flows from
approx. 30 to 15,000 m³/h



Pressures up to 1,000 mbar
Negative pressures down to
-500 mbar



Nominal diameters
DN 50 to DN 400

Applications

- Water and Waste water treatment
- Aeration
- Backwash of filters
- Pneumatic conveying of bulk materials
- Gas conveying

- Degassing
- Dedusting
- Generation of negative pressure
- Biogas treatment
- Vehicle operation
- Ship unloading
- Tunnel boring
- and much more

Industries

- Wastewater treatment plants
- Chemistry and process engineering
- Power plant
- Cement and lime
- Foodstuff technology
- Paper industry
- Pharmacy and many more

Goods conveyed

- Granules
- Sugar
- Cement
- Cereals
- Carbon
- and much more



Indispensable for power plant technology



Conveying of powdery goods



Powerful for ship loading and unloading

MACHINES AND SERVICES FROM AERZEN. IN USE WORLDWIDE AND HIGHLY AVAILABLE.

The extremely high load capacity of Delta Blower packages is legendary. Just like their already proverbial reliability, their durability or their intelligent operating and maintenance concept. Why are the services of AERZEN an issue at all? Because service is a must. And because our worldwide wellpositioned service teams are an important decision criterion for plant operators: for blowers made by AERZEN.

*It's the inner values that matter:
the AERZEN blower stage*



High availability.
The best blower packages are those that you do not notice. Because they are steadfast in their work. For years and decades. The Delta Blowers from AERZEN are such assemblies. Their proven robust nature and durability have a reason.

AERZEN manufactures all core components itself. From the assembly to the control system. From the idea to engineering and configuration. And thus ensures the high productivity of its machines. Our value contribution to the quality standard made in Germany.

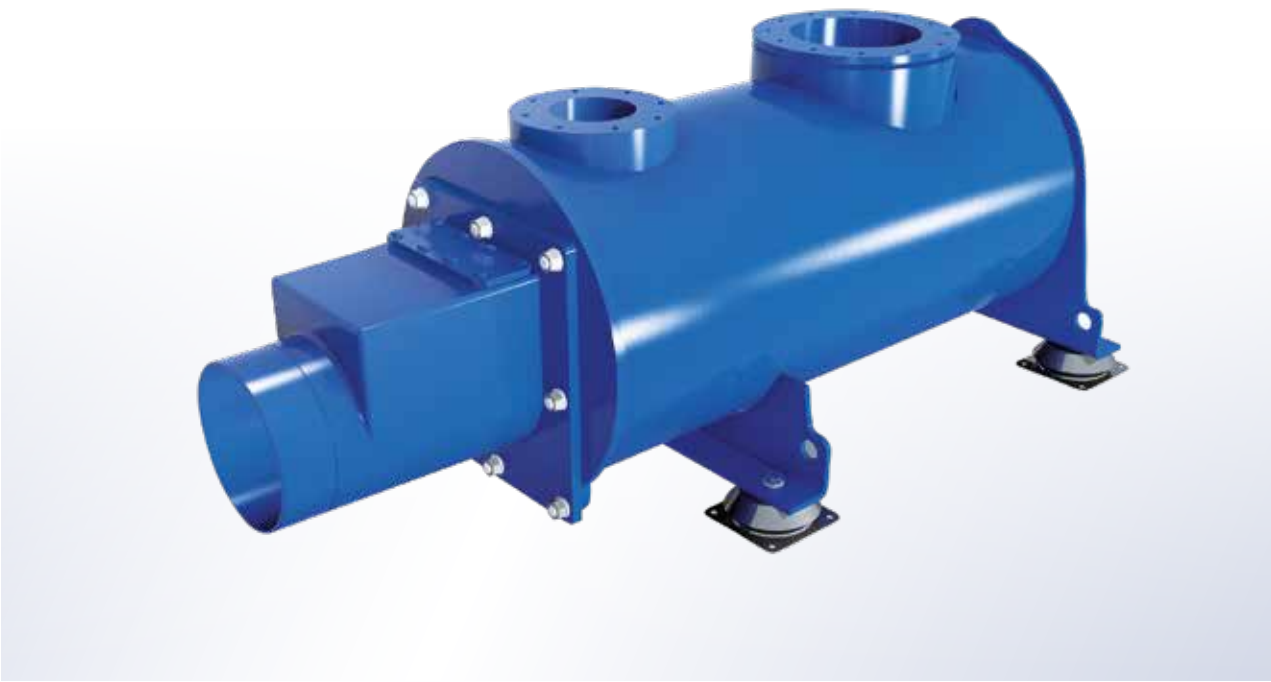
On site worldwide.
Typical for AERZEN: The reliable availability of its solutions. This refers to our machines. And to our services. The fact that our service teams look after your systems over their entire life cycle protects the value of your investment. The fact that we have a dense network of 50 subsidiaries and agencies in more than 100 countries around the globe guarantees short distances. So we are quickly there for you - in case we are needed.

- Safely AERZEN.**
- Commissioning by qualified personnel
 - Individual training of your specialist personnel
 - Customer-specific service and maintenance contracts
 - Machine revision also directly on site

Intelligently designed.
What does compact, easy handling or ease of maintenance mean? The value of these promises only becomes apparent in everyday practice. And there they cannot be weighed out with gold. Just like these tangible benefits:

- Small footprint
- Flexible machinery mountings
- Easy to transport with forklift/lift truck
- Space-saving side-by-side installation
- Plug&play installation and commissioning
- Easy access to all wearing parts
- Oil level check from the outside while the machine is running
- Maintenance work such as oil and filter change from the front
- Low sound pressure level
- Belt drive for optimum volume flow design, subsequent power adjustment is quick and easy

Intelligent silencing: the AERZEN discharge silencer without absorption material



100 % clean.
How do we offer food suitability, avoid expensive cleaning or even production restrictions? We do not use absorption material for sound absorption. "Therefore, AERZEN made the base support a discharge silencer and reduces the noise exclusively by means of air deflections.

100 % free of absorption material, because this could wear out and contaminate the downstream system. By the way, the AERZEN base support is patented and certified as spark arrester for ATEX applications.

BLOWER IS BLOWER?

THIS IS THE END OF PREJUDICES.

AERZEN belongs to the most innovative companies worldwide in the field of compressor technology. In 1868, we started manufacturing positive displacement blowers. By the way, we were the company that manufactured the first positive displacement blower in Europe. Since then, we have taken the performance features of this technology to the peak with every generation. Let yourself be surprised. Discover these special blowers: Delta Blower Generation 5.

Extremely robust blower package

- For a wide range of applications within a high control range from 25 to 100%
- Various modifications are possible

Compact design

- Space-saving side-by-side installation
- Small dimensioning of machine rooms

Easy operation and low-maintenance design

- Highly available at continuous operation even under toughest environmental conditions
- The front side is used for operation and maintenance

Plug&play Solution

- Completely configured, parameterised and ready for connection
- Integrated service kit with first oil fill

Oil-free as per class 0

- According to ISO 8573-1, certified by the TÜV (German technical inspection association)

Free from absorption material

- Suitability for use with foodstuffs in the pneumatic conveying of bulk materials (no impurities)
- Safety for energy-efficient productivity in the Water treatment (no sedimentation of absorption material in the aeration plates, no clogging of the aeration plugs, no pressure loss)

Integrated power supply panel (optional)

- Frequency converter, star-delta, direct, softstarter
- Intelligent AERZEN AERtronic control system

Smart oil system

- Oil level check while machine is running
- It can be read from the outside
- Oil instead of grease: Oil-lubricated bearings increase the service life



Advantages for the life cycle assessment

- Standard use of energy-efficient motors of class IE3
- Suction on the cold side of the assembly
- Base package to be found in a highly efficient machine combination of AERZEN rotary lobe compressors und AERZEN turbo blowers
- Belt drive for optimal volume flow design
- Subsequent power adaptations are easily and quickly possible

Belt tensioning hinged motor mounting plate

- Fully automatic and maintenance-free belt tension
- Inspection of V-belt tension no longer necessary
- Easy assembly or replacement of V-belts

Multifunctional hoist for hinged motor mounting plate

- Transport safety lock
- Easy and safe assembly of V-belts
- Mobile installation of assemblies (e.g. ship installation/earthquake design)
- Hinged motor mounting plate support for heavy motors

Low noise level

- Safe observance of the sound values, close to building areas and production areas
- Lowest sound values by optimised acoustic hood
- Integrated method for reducing pulsation (Patented AERZEN blower stage)

PED pressure-vessel guidelines approval (pressure safety valve)

- for overpressure operation

ATEX-compliant

- AERZEN base supports certified as spark suppressor for ATEX applications

TÜV-certified zone separation filter (optional)

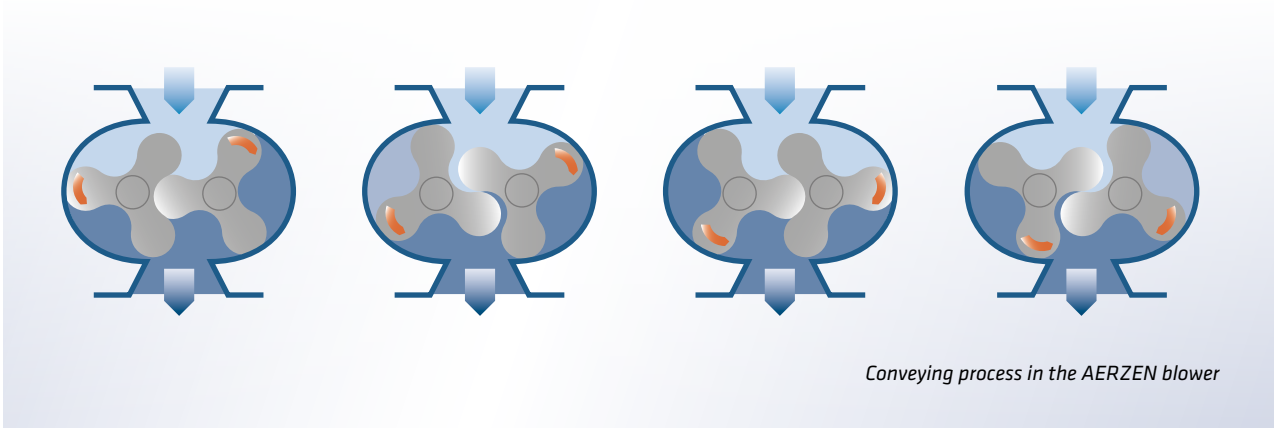
INTERESTED IN THE INNER VALUES? CONSTRUCTION AND DESIGN.

It is good to know what is in the assemblies of the Delta Blower line from AERZEN:
The wealth of experience of the world market leader. The quality standard of the traditional German family business. The innovation goal "Best solution provider for our customers".
In addition first-class material selection. And a principle that has proven itself in tens of thousands of applications: Roots.

Innovation pulsation reduction.

Especially for its Delta Blower stages AERZEN has developed a unique process and integrated it into all sizes: the pulsation reduction. The patented AERZEN process prevents pulsations and noise already at the origin within the blower stage. For this purpose the AERZEN blowers equipped with 3-lobe

pistons have two special channels cast in the cylinder. These control the backflow of the medium into the conveying chamber in such a way that the typical backstroke and squeezing pulses (typical for 2-lobe blowers) are eliminated. The end for pulsations due to patented interference method.



Intelligent technical details ensure that the Delta Blower packages retain their value. One example of many: the patented pulsation reduction, an AERZEN innovation for longer bearing life.

Blower stage

- AERZEN Blowers with 3-lobe pistons and integrated pulsation reduction
- Housing consisting of: Cylinder (with two cylinder with cast-in pre-inlet channels at discharge side to minimise the sound by pulsation reduction), wheel housing, housing cover and side plates
- Material EN-GJL-200
- Ribbed surfaces

Pistons

- Sizes GM 3 S to GM 130 L:
- Pistons and shafts in one piece
- Sizes GM 150 S to GM 240 S:
- Pistons made of nodular cast iron, shafts made of tempered steel

Drive type

- Overhung via narrow V-belt
- Direct drive

Cooling

- Convection cooling

Lubrication

- Oil splash lubrication for bearings and timing gears

Oil-free conveying

- The oil-free design according to ISO 8573-1 class 0 is guaranteed by the piston ring labyrinth seal, which has proven itself over decades, in combination with neutral chambers (open to the atmosphere)

Timing gears

- Hardened and ground, helically geared and made of case-hardened steel
- They are fitted to the shafts by taper interference fit
- maximum running smoothness and service life

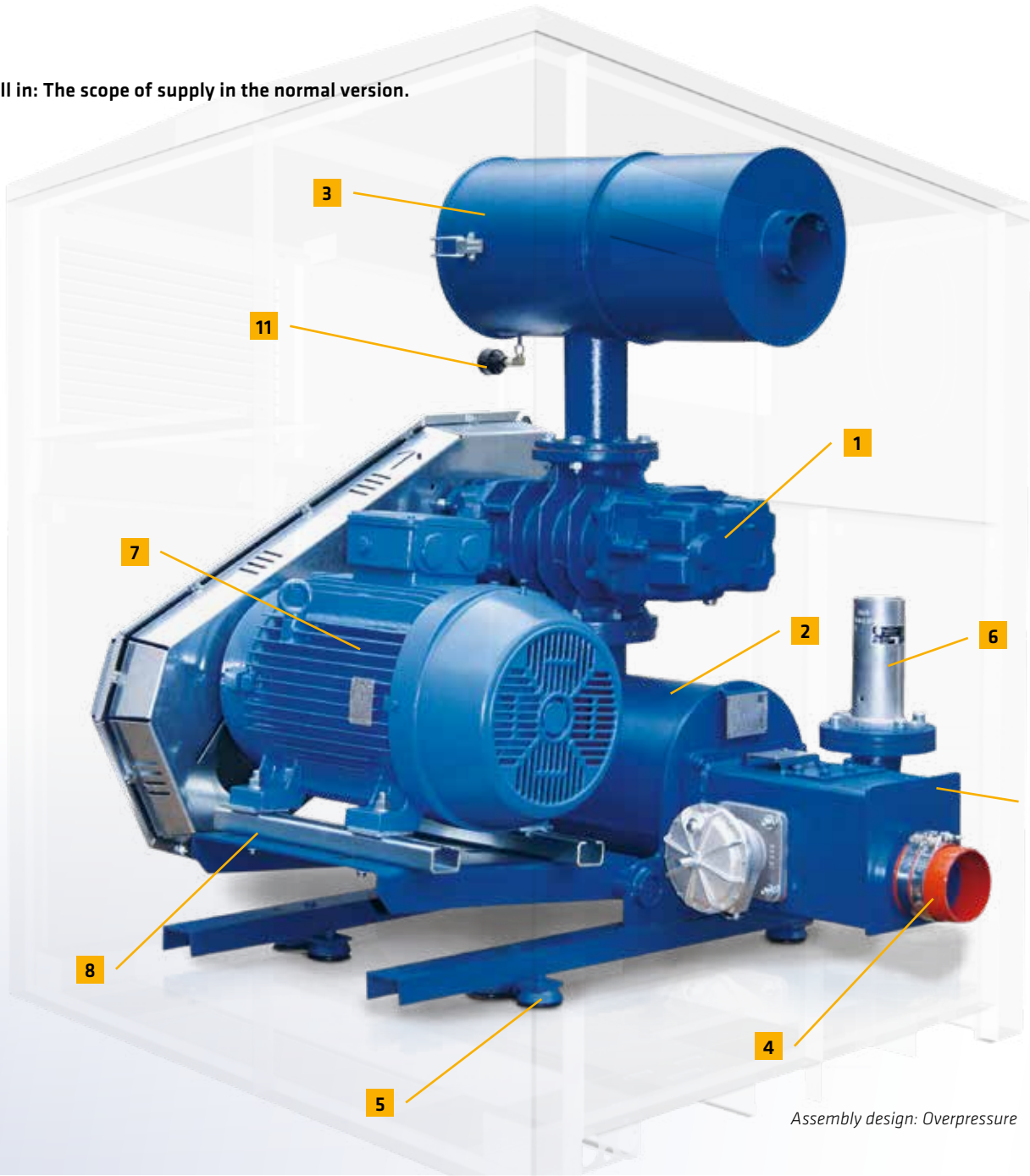


It's the inner values that matter: the AERZEN blower stage

ALREADY IN THE STANDARD VERSION EXTRAORDINARY. THE DELIVERY CONCEPT OF AERZEN.

Some call it comfortable. The others efficient. We call it all-in: the delivery concept of AERZEN. When the Delta Blower package comes to you, it is already completely configured, parameterised and mounted ready for connection at the factory. Naturally, this is tailored to your processes. Including all standardised accessory components for trouble-free operation at the touch of a button.

All in: The scope of supply in the normal version.



Assembly design: Overpressure

- 1 3-lobe blower stage**
 - With integrated pulsation reduction (see page 10/11)



- 2 Base supports with integrated discharge silencer**
 - Certified as spark arrester
 - Absorbent-free silencing through patented discharge silencer

- 3 Intake silencer with integrated air filter or strainer**
 - Standard suction from the atmosphere (overpressure)
 - Suction via piping optional (standard for negative pressure)
 - Suction via filter element for negative pressure optional



Overpressure



Negative pressure

- 4 Flexible rubber sleeve**
 - with clamps
- 5 Flexible machinery mountings**
 - For the decoupling of structure-borne noise
- 6 Pressure valve or suction valve**
 - For machine protection

- 7 Drive**
 - Via high-performance narrow V-belt drive by means of three-phase motor
 - Standard use of energy-efficient class IE3 motors (up to motor size 315)

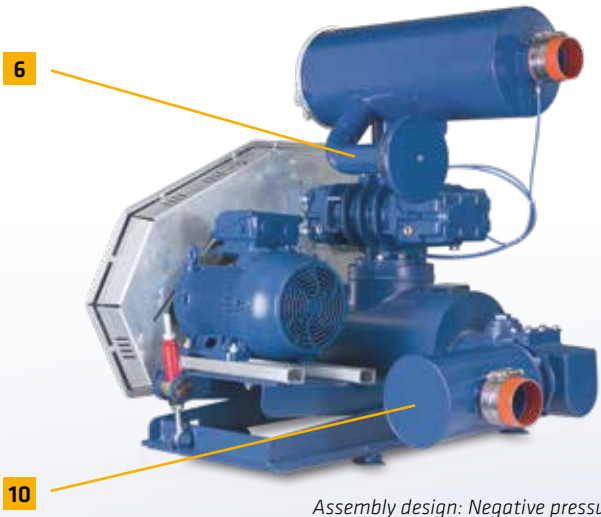
- 8 Hinged motor mounting plate**
 - Automatic tensioning device for the belt drive
 - Multifunctional hoist for hinged motor mounting plate



- 9 Connecting housing**
 - integrated check valve

- 10 Integrated blow-off silencer**
 - Horizontal version (up to DN 125)

- 11 Standard instrumentation**
 - Pressure gauge for indication of the conveying pressure (overpressure)
 - Maintenance indicator for monitoring the intake filter (overpressure)
 - Vacuum meter for indication of the conveying pressure (negative pressure)



Assembly design: Negative pressure

MODIFICATIONS AND ACCESSORIES.

THE BEST FOR EVERY APPLICATION.

Added value: The accessory components.

- Acoustic hood for indoor and outdoor installation, forced ventilation via mechanical fan
- Start unloading device, required for star-delta starting of the motor (overpressure),
- Vertical blow-off silencer with base plate (negative pressure)
- discharge side expansion joint instead of flexible rubber sleeve
- Power cabinet Star-delta, frequency converter, soft starter
- AERZEN AERtronic blower control
- AERZEN original spare parts
- Other accessories on request



AERZEN Start unloading device

Modifications.

- Special motors
- special varnish
- ATEX compliant design
- Acoustic hood for desert installation with special sand collector
- Acoustic hood for low temperatures down to minus 40°C with heating and gravity louvers
- Acoustic hood for earthquake resistance and increased wind loads
- Ship installation and vehicle deployment
- Use for special gases through the use of special materials
- Customised documentation
- Compliance with legal requirements for delivery e.g. in Eurasian customs union



Always the safe choice: ATEX compliant design from AERZEN

The new AERtronic - the way into the digital future.

The new edition of the AERtronic control system offers a user-friendly and clear possibility for the analysis and processing of relevant process parameters and thus provides more transparency, safety and efficiency. All measured values converge in the new control system and can be transferred to the production control system via common interfaces in order to always operate the plant at the optimum operating point. The AERtronic is available in three versions:

Basic: As a fully digital display instrument

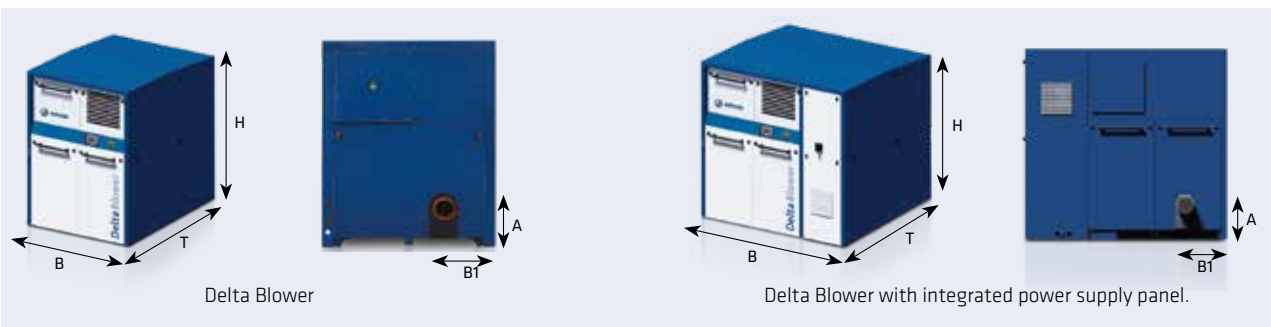
Advanced: For active process control

Premium: As an intelligent interface with cloud compatibility.



COMPACT DESIGN. CAN BE SET UP SIDE-BY-SIDE, OF COURSE.

Dimensions and weights (subject to technical changes - product is subject to technical change).



Delta Blower.

Type	B mm	T mm	H mm	A mm	B1 mm	Nominal diameter DN	Weight without acoustic hood kg	Weight with acoustic hood kg
GM 3 S	800	800	1.055	228	245	50	148	212
GM 4 S	925	1.135	1.280	258	258	80	207	299
GM 7 L	925	1.135	1.280	258	258	80	212	304
GM 10 S / DN 80	925	1.135	1.280	258	258	80	236	328
GM 10 S / DN 100	1.250	1.350	1.500	294	375	100	336	496
GM 15 L	1.250	1.350	1.500	294	375	100	351	511
GM 25 S	1.250	1.350	1.500	294	375	125	407	567
GM 30 L	1.500	1.800	1.900	356	435	150	690	1.020
GM 35 S	1.500	1.800	1.900	356	435	150	780	1.110
GM 50 L	1.700	2.055	2.111	357	525	200	905	1.475
GM 60 S	1.700	2.055	2.111	357	525	200	1.035	1.605
GM 80 L	1.900	2.200	2.308	456	600	250	1.550	2.200
GM 90 S	1.900	2.200	2.308	456	600	250	1.620	2.270
GM 100 S	1.900	2.200	2.308	456	600	250	1.820	2.470
GM 130 L	2.100	2.850	2.345	410	635	300	2.436	3.410
GM 150 S	2.100	2.850	2.345	410	635	300	2.796	3.750
GM 220 L *	2.800	4.304	3.500	410	800	400	4.981	8.240
GM 240 S *	2.800	4.304	3.500	410	800	400	5.371	8.630

* Design in Compact IV

Weights without motor and belt drive


Delta Blower with integrated power supply panel.

Type	B mm	T mm	H mm	A mm	B1 mm	Nominal diameter DN	Weight with acoustic hood kg
GM 10 S	1.850	1.350	1.500	294	375	100	619
GM 15 L	1.850	1.350	1.500	294	375	100	661
GM 25 S	1.850	1.350	1.500	294	375	125	717
GM 30 L	2.100	1.800	1.900	356	435	150	1.322
GM 35 S	2.100	1.800	1.900	356	435	150	1.412
GM 50 L	2.300	2.055	2.111	357	525	200	1.825
GM 60 S	2.300	2.055	2.111	357	525	200	1.955

Weights without motor, power electrics and belt drive

DELTA BLOWER IN FIGURES.

SIZES AND PRESSURE RANGES.



Type Positive displacement blower

Design Overpressure

Volume flow 30 bis 14.640 m³/h

Overpressure up to 1.000 mbar

Conveying medium Air, Neutral gases

Handling oil-free

Figure:
Delta Blower GM 25 S - Assembly without acoustic hood


Performance data - DELTA BLOWER - overpressure operation

Blower size	Differential pressure max. mbar	Volume flow max. m³/h *	Motor rating max. kW	Sound pressure level max. dB(A) **
GM 3 S	1000	240	11	70
GM 4 S	1000	334	15	70
GM 7 L	700	488	15	70
GM 10 S / DN 80	1000	600	30	72
GM 10 S / DN 100	1000	684	30	72
GM 15 L	700	1020	30	72
GM 25 S	1000	1446	55	73
GM 30 L	700	2058	75	75
GM 35 S	1000	2388	90	75
GM 50 L	700	3288	90	76
GM 60 S	1000	3528	132	78
GM 80 L	700	4968	160	80
GM 90 S	1000	5352	200	81
GM 100 S	1000	6288	250	82
GM 130 L	700	7920	250	84
GM 150 S	1000	9000	355	84
GM 220 L	600	12570	315	84
GM 240 S	800	14640	500	86

* Volume flow (corresponds to the delivery volume flow measured according to ISO 1217 and converted to the reference suction conditions according to the (informative) Annex F of ISO 1217 [inlet pressure = 1.0 bar / inlet temperature = 20°C, RH = 0%])

** Machine noise at a distance of 1m with acoustic hood and connected, insulated pipe, tolerance ± 2 dB(A)

Further pressure ranges can be requested for the AERZEN spectrum. Extensive performance data charts can be found in our Customer Net.



Type Positive displacement blower

Design Negative pressure

Volume flow 30 to 15,000 m3/h

Overpressure down to -500 mbar

Conveying medium Air, Neutral gases

Handling oil-free

Figure:
Delta Blower GM 15 L - Assembly without acoustic hood

Performance data - DELTA BLOWER - negative pressure operation

Blower size	Differential pressure max. mbar	Volume flow max. m³/h *	Motor rating max. kW	Sound pressure level dB(A) **
GM 3 S	-500	250	7,5	68
GM 4 S	-500	340	7,5	70
GM 7 L	-500	520	11 - 18,5	70
GM 10 S / DN 80	-500	600	15 - 37	70
GM 10 S / DN 100	-500	730	15 - 37	70
GM 15 L	-500	1080	22 - 37	73
GM 25 S	-500	1510	30 - 55	73
GM 30 L	-500	2120	45 - 90	75
GM 35 S	-500	2420	55 - 90	75
GM 50 L	-500	3450	75 - 250	78
GM 60 S	-500	3640	75 - 250	78
GM 80 L	-500	5150	110 - 250	80
GM 90 S	-500	5600	110 - 250	80
GM 100 S	-500	6600	110 - 250	80
GM 130 L	-500	8070	400	82
GM 150 S	-500	9700	400	82
GM 220 L	-500	12800	400	82
GM 240 S	-500	15000	400	80

* Volume flow (corresponds to the delivery volume flow measured according to ISO 1217 and converted to the reference suction conditions according to the (informative) Annex F of ISO 1217 [inlet pressure = 1.0 bar / inlet temperature = 20°C, RH = 0%])

** Machine noise at a distance of 1m with acoustic hood and connected, insulated pipe, tolerance ± 2 dB(A)

Further pressure ranges can be requested for the AERZEN spectrum. Extensive performance data charts can be found in our Customer Net.

MATURED TO PERFECTION IN 150 YEARS: THE SERVICE WORLD OF AERZEN.

The best kind of service is the kind you don't need. But every technology involves wear and tear. Our machines are designed to do their job for as long and efficiently as possible. If necessary, for decades. The goal of AERZEN Services is to extend service life and availability – simple added value for your investment!

Benefit from AERZEN OEM competence - at any time and anywhere



Contact worldwide

2,500 employees work for AERZEN. On every continent. With six sales offices in Germany alone, we're there for you. And with 50 subsidiaries in over 100 countries around the world. Hence we're never far away – should you ever need us. Give us a call:
+49 5154 81-0

Service-Infoline

Our German Service Centre is available for customers and operators. We are happy to help you. We look forward to your call:
+49 700 49318551

Customer Net

Where you can learn more about the company and the leading compressor technologies from Aerzen? It's simple: In our Customer Net on our website, where we have stored everything that is worth knowing for you:
www.aerzen.com

With your OEM's best recommendations.

We have been manufacturing quality products for over 150 years. At the same time, we also developed a corresponding service world. With tailor-made offers for every phase of your machine's lifespan. With OEM original parts, reliable logistics and excellent service at its core. And with decentralised service centres in your vicinity, which guarantee fast provision of spare parts and competent service - worldwide.

AERZEN on-site service.

Our service teams work where our machines are. All over the world. Onshore or offshore. Often under extreme conditions. How do we do it? With short distances. AERZEN has a dense network of service centres and decentralised parts warehouses around the globe. More than 200 excellently trained service technicians can come to your aid from there. Any time and anywhere you need us.



AERZEN. Compression - the key to success.

AERZEN was founded in 1864 as Aerzener Maschinenfabrik. In 1868 we manufactured the first positive displacement blower in Europe. In 1911, the first turbo blowers followed, in 1943 the first screw compressors and in 2010 the first rotary lobe compressor package. Innovations made by AERZEN are still driving the development of compressor technology towards new frontiers. Today, AERZEN is one of the largest and most experienced manufacturers in the world of positive displacement blowers, rotary lobe compressors, screw compressors and turbo blowers. And it is one of the undisputed leaders in many areas of application.

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AERZEN
EXPECT PERFORMANCE

OPERATING INSTRUCTIONS

POSITIVE DISPLACEMENT BLOWER

DELTA BLOWER

Read the instructions prior to performing any task!
Keep for future reference!



AERZEN



G4-006 Q

Translation of the original operating instructions
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GB



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1 General Information

1.1 Information about these instructions

These instructions allow for the safe and efficient handling of this machine. These instructions are an integral part of the machine and must be kept in the immediate vicinity of the machine so that it is accessible for personnel at all times. Keep these instructions in a safe place for future reference.

Personnel must read these instructions carefully and have understood them before beginning work. A fundamental requirement for working safely is compliance with all specified safety notes and guidelines in these instructions.

In addition, the local occupational health and general safety regulations apply to the machine's range of applications.

The diagrams in these instructions serve to provide the user with a basic understanding and may deviate somewhat from the actual design.

The following is a list of additional, supplementary documents:

Declaration of Conformity	CE MRL 1012-1 PED
Installation drawing	
Operating manual Drive motor	
Operating manual AERZEN Safety Valve	G4-002...

1.2 Explanation of symbols

Safety instructions

Safety instructions in this manual are illustrated using symbols. The safety instructions are organised into signalling words which designate the level of danger posed.



DANGER!

This combination of symbol and signalling word points to an imminently dangerous situation that could be fatal or lead to serious injury if it is not avoided.


WARNING!

This combination of symbol and signalling word points to a potentially dangerous situation that could be fatal or lead to serious injury if it is not avoided.


CAUTION!

This combination of symbol and signalling word points to a potentially dangerous situation that could lead to minor injuries if it is not avoided.


NOTICE!

This combination of symbol and signalling word points to a potentially dangerous situation that could lead to material damage if it is not avoided.


ENVIRONMENT!

This combination of symbol and signalling word points to a potential risk for the environment.

Safety instructions as part of operating guidelines

Safety instructions may relate to certain individual operating guidelines. These safety instructions are integrated into the operating guidelines themselves so as to simplify the task of reading while carrying out work. The signalling words mentioned above are used.

For example:

1. ➞ Loosen screw.

2. ➞


CAUTION!

Pinch hazard on the cover!

Close cover carefully.






3. ➞ Tighten screw.

Tips and recommendations


This symbol draws attention to useful tips and recommendations as well as information about efficient and trouble-free operation.




Special safety instructions

To draw attention to exceptional hazards, the following symbols are used as part of the safety instructions:

Warning signs	Type of danger
	Warning – automatic start-up.
	Warning – hand injuries.
	Warning – high-voltage.
	Warning – flammable substances.
	Warning – danger zone.

Additional designations

To draw attention to operating guidelines, events, listings, references and other elements in this manual, the following designations are used:

Designation	Explanation
 1., 2., 3. ...	Step-by-step operating guidelines
	References to sections of this manual and to relevant documentation
	Lists without a designated sequence
[push-button]	Control elements (e.g. push-buttons, switches), display elements (e.g. signal lamps)
„Display“	Screen elements (e.g. buttons, allocation of function keys)

1.3 Copyright protection

The contents of this manual is protected by copyright. The use of this manual is permitted within the framework of machine use. Any other use is excluded unless there is written approval by the manufacturer.

1.4 Addresses

1.4.1 Manufacturer

Tab. 1: Manufacturer

Address	Aerzener Maschinenfabrik GmbH Reherweg 28 31855 Aerzen Germany
Telephone	+49 (0) 51 54 8 10
Fax	+49 (0) 51 54 8 1 9191
E-mail	info@aerzener.de
Internet	www.aerzen.com

1.4.2 Customer service

Our customer service staff are on hand to provide you with technical information:

Tab. 2: After sales service/service contact

Address	Aerzener Maschinenfabrik GmbH Reherweg 28 31855 Aerzen Germany
Service hotline	+49 171 3 51 18 34
E-mail	info@aerzener.de
Internet	www.aerzen.com

In addition, we are always interested in receiving information and feedback pertaining to machine use that could be useful in helping us improve our products.

2 Safety

This section gives an overview of all important safety aspects relevant to the protection of persons and to safe and trouble-free operation. Further task-based safety instructions are contained in the section on the individual phases of the machine's service life.

Non-compliance with the handling and safety instructions provided in this manual can lead to serious hazards.

The following section outlines the residual risks and hazards during the service life of the product that may arise as a result of non-compliance with safety instructions or the disabling of safety devices.

In order to reduce health and safety risks and to avoid dangerous situations, observe the safety and warning notes in this manual.

2.1 Residual risks and fundamental risks

The following chapter states the general residual risks that have been established on the basis of a risk analysis.

- Compliance with these safety instructions and the safety instructions in the main chapters reduces the risk of personal injury, property damage and environmental harm and prevents dangerous situations.

2.1.1 Electrical hazards

Electric current



DANGER!

Risk of fatal injury from electric current!

Coming into contact with live parts poses an immediate and potentially fatal risk of an electric shock. Damage to insulation or individual components can prove fatal.

- Work on the electrical system should only be carried out by qualified electrical personnel.
- If the power supply's insulation is damaged, switch off the machine immediately and have the damage repaired.
- Before starting to work on active parts of the electrical systems and operating equipment, ensure that the machine is completely disconnected from any power source and remains so for the duration of the work.

When doing this observe the following 5 safety rules:

- Disconnect the machine completely.
- Secure the machine against restarting.
- Confirm that the machine is completely disconnected from any power source.
- Earth and short-circuit the device.
- Cover or shut off adjacent live parts.
- Never bypass or deactivate fuses.
- When changing fuses, comply with the correct specified amperage.
- Keep moisture away from live parts. Moisture can cause the machine to short-circuit.

Stored charges



DANGER!

There is a risk of fatal injury from stored charges!

Electrical charges can be stored in electronic components and maintained even after the deactivation and separation of the electric power supply. Coming into contact with these components can lead to fatal injuries.

- Observe all applicable safety rules.
- Before performing any work on the listed components, disconnect them completely from the power supply.
- Observe a waiting period of 15 minutes under all circumstances! This will allow the internal capacitors to discharge.
- Measure to ensure there is no live voltage!

Operating faults caused by short-circuiting



WARNING!

Risk of injury from operating faults!

If the electrical system short circuits this can render the entire system inoperable. Operating faults can lead to serious injuries.

- Connect the machine's earthing connections and acoustic hood to the local equipotential bonding rail.
- Install a fault-current circuit breaker in order to prevent sparks and contact voltage in the event of a fault.
- After all work on the machine has been carried out, ensure that the earthing connection and equipotential bonding are connected correctly.

2.1.2 Hazards associated with the acoustic hood

Inside the acoustic hood

**DANGER!****Risk of injury if the acoustic hood is open during operation!**

By opening the acoustic hood while the machine is in operation there is a risk of direct contact with hazardous zones, e.g. hot surfaces or rotating or moving components.

- Never open the acoustic hood while the machine is in operation or in stand-by mode.
- Never stand on or reach into the acoustic hood while the machine is in operation.
- Always lock the acoustic hood with the key provided and keep it locked.
- Only allow authorised personnel access to the key.

Falling parts

**CAUTION!****Risk of injury from unsecured parts of the acoustic hood!**

Unsecured parts of the acoustic hood can lead to injuries if they fall from the machine.

- Secure loose elements against falling.
- Always wear protective gear.
- Have a second person help you.

Air flow at the air outlet

**CAUTION!****Risk of injury from the strong air flow at the air outlet of the acoustic hood!**

Strong air flows at the air outlet on the acoustic hood can suck in dirt particles from the environment and disperse them.

- Avoid standing in the direct vicinity of the air flow.
- Wear safety goggles and a safety mask.

Noise



WARNING!

Risk of injury from noise!

The noise level present at the installation area can cause hearing damage. The magnitude of the noise level is dependent on operational data, among other factors.

- Never undertake measures to bypass or deactivate sound insulation.
- Wear hearing protection while working.
- Only stand in the high-noise-level area if it is absolutely necessary.

Risk of falling



CAUTION!

Risk of injury from standing on the acoustic hood!

Standing on the acoustic hood carries with it a risk of injury from the potential collapse of the roof elements. Persons could fall into the internal area of the machine.

- Never stand on the acoustic hood.
- Never exert pressure on roof elements.

Spark-generating work



WARNING!

Risk of fire and injury / damage to property from spark-generating work in the immediate vicinity of the machine!

Welding or cutting work on the machine or in the immediate vicinity of the machine can cause fire to break out. This can result in damage to property or personal injury.

Sparks and incandescent or flammable objects could be sucked in through the air openings on the acoustic hood or through the intake silencer. The ventilator can fan flames leading to the formation of smouldering objects. The insulation material may, under unfavourable conditions, begin to smoulder.

- Avoid allowing sparks to fly in the direction of the machine.
- Never carry out work that generates sparks while the machine is in operation.

Risk of fire and injury**WARNING!****Risk of fire from easily-flammable materials that are sucked into the machine!**

Easily-flammable material, fluids or gases can be sucked into the machine and cause it to catch fire. This can lead to serious or fatal injuries.

- Never allow flammable materials to be sucked into the machine.
- In case of emergencies, have extinguishing agents (fire blanket, fire extinguisher, fire-extinguishing powder for fire class A, B, C) at hand.
- Immediately report suspicious materials, liquids or gases to the responsible persons.
- In case of fire, stop your work immediately and make an emergency call.

Use of non-original belts**WARNING!****Risk of fire and injury from using non-original belts!**

If, for a number of possible reasons, the machine is running sluggishly or is blocked, the belts may slip if non-original belts are being used. This results in heat generation which may lead to a fire.

- Only use original belts from the machine manufacturer.
- Adhere strictly to the designated belt type, as only this type will have the required characteristics.
- Never select and use random belts.
- Activate motor overload protection and observe the setting values.

2.1.3 Risks of machines with belt guard

Lärm



WARNING!

Risk of injury from noise!

The noise level present at the installation area can cause severe hearing damage. The magnitude of the noise level is dependent on operational data, among other factors.

- Never undertake measures to bypass or deactivate sound insulation.
- Wear hearing protection while working.
- Only stand in the high-noise-level area if it is absolutely necessary.

Spark-generating work



WARNING!

Risk of fire and injury / damage to property from spark-generating work in the immediate vicinity of the machine!

Welding or cutting work on the machine or in the immediate vicinity of the machine can cause fire.

Sparks and incandescent or flammable objects could be sucked in through the intake silencer. The air flow can fan flames leading to the formation of smouldering objects. The insulation material may, under unfavourable conditions, begin to smoulder.

- Avoid allowing sparks to fly in the direction of the machine.
- Never carry out work that generates sparks while the machine is in operation.

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- Only use original belts from the machine manufacturer.
- Adhere strictly to the designated belt type, as only this type will have the required characteristics.
- Never select and use random belts.
- Activate motor overload protection and observe the setting values.

2.1.4 Hazards at the installation site and operating site

Securing the machine against restarting



DANGER!

An unauthorised or unregulated restart can have fatal consequences.

An unauthorised or unregulated restart of the machine can lead to serious or fatal injuries. There may be people located in the hazard zone. Activating the energy supply and starting the machine could result in those people being fatally injured.

- Prevent the machine from restarting by:
 - disconnecting the electrical power supply.
 - activating the EMERGENCY STOP function
 - operating the main circuit breaker
 - attaching a padlock to the main circuit breaker
 - checking and ensuring that the machine is completely disconnected from the power source
 - displaying a sign on the machine that prohibits a machine start
 - displaying a sign on the remote station that prohibits a machine start
- Before restarting, ensure that safety devices are installed and functioning correctly and that there are no potential hazards to the safety of any persons.

Water contact with live components



DANGER!

Risk of fatal injury from water contact with live components!

Risk of fatal injury from cleaning work with water in areas with live components. Water spray may enter electrical and electronic components.

- Do not use water.
- When performing cleaning operations, proceed with care and make sure that no water comes into contact with live components.
- Water spray must not enter electrical and electronic components.
- Under no circumstances must areas with live voltage be cleaned using a high-pressure jet.

Unexpected machine start**WARNING!****Risk of injury or personal shock if the machine starts suddenly!**

For example, a superordinate control system could send a start command to the machine so that it starts operating.

- Shut down the machine for all work and secure it against restarting.
- When operating via a control centre, also take suitable measures at that location to prevent restarting.
- You must be prepared for the machine to start at any time.

Sharp edges and corners**CAUTION!****Risk of injury from sharp edges and corners!**

Sharp edges and corners can cause excoriations and cuts on the skin.

- If working in the vicinity of sharp edges and corners, proceed with caution.
- If in doubt, wear protective gloves.

Intake components**WARNING!****Risk of injury from intake components!**

Intake-side silencers, at their inlets, suck in ambient air with great force.

- During operation, never place body parts or objects in front of the inlet of the silencer.
- Maintain a safe distance from intake components.

Sudden gas emission



CAUTION!

Risk of injury from sudden gas emission!

Components such as safety valves and start unloading devices may open suddenly during operation and emit hot compressed gas. Dust particles may be blown around.

- Never attempt to look inside the blow-off opening.
- Wear safety glasses when in the immediate vicinity of these components.
- Never close the blow-off opening.
- Always keep the blow-off opening clean.

Vibrations



WARNING!

Risk of injury from vibrations!

Vibrations may, in the long term, lead to injuries and chronic damage to personal health. The vibration source is decoupled from the surrounding environment by means of a vibration damper.

- Do not deactivate the vibration damper.
- Avoid coming into contact with vibrating areas.

Build-up of fluids



CAUTION!

Risk of injury from slipping as a result of a build-up of fluids!

Slipping on fluids that have built up on the floor area may lead to a fall. A fall may result in injury.

- Immediately remove built-up fluids with a suitable medium.
- Wear non-slip safety shoes.
- Place a warning notice and mandatory sign on or in the vicinity of any area where there could be a build-up of fluids on the floor area.

2.1.5 Mechanical hazards

Rotating components

**WARNING!****Risk of injury from rotating components!**

Rotating components may cause serious injury.

- During operation never reach into or perform work on rotating components.
- Never open covers during operation.
- Observe the lag time: before opening covers, make sure that no components are still moving.
- When in a hazard area, wear tight-fitting protective work clothing with minimal tensile strength.

Fan

**WARNING!****Risk of injury from rotating components of the ventilator!**

Rotating components of the ventilator can cause serious injuries due to their high revolution speed.

- Prior to any work, switch off the machine and secure it against restarting.
- Observe the lag time.
- Before opening covers, check that no components are still moving.
- Never open covers or maintenance covers and work on the ventilator during operation.
- The blade wheel must not be accessible during operation.

Risk of crushing and shearing injuries

**WARNING!****Risk of crushing and shearing injury from the hinged motor support!**

Risk of injury from moving or adjusting the hinged motor support!

- When transporting the machine, always have the hinged motor support fixed in place.
- Never step or reach into the swivelling range of the hinged motor support.

2.1.6 Thermal hazards

Hot surfaces



WARNING!

Risk of injury from hot surfaces!

Component surfaces may become very hot during operation. Skin contact with hot surfaces causes serious burns.

- For all work performed in the vicinity of hot surfaces, always wear protective work clothing and protective gloves.
- Before beginning any work, ensure that all surfaces have cooled down to the environment temperature.

Hot media



WARNING!

There is a risk of injury from the sudden emission of hot media from the valve, e.g. a pressure valve!

The emission of hot media may lead to scalding.

- Never stand in the immediate vicinity of the outlet vent.
- Never attempt to look inside the outlet vent.
- Never close or cover the outlet vent.

2.1.7 Risks from pressurised components

Pressurised components



WARNING!

Risk of injury from compressed conveyed materials!

When disassembling pressurised components, or in the case of a fault in a pressurised component such as pipes, containers, hoses or valves, hot conveying material can escape with a strong gas flow. This can result in serious injury.

- Before beginning work, fully relieve pressurised components of pressure.
- Check that components are not pressurised.
- Replace malfunctioning components immediately.
- Only disassemble pressurised components when they are not under pressure.

Noise during disassembly**CAUTION!****Risk of injury from noise during the disassembly of pressurised gas pipes!**

For the disassembly of pressurised components, such as pipes, containers, hoses or valves, hot conveying material is released, resulting in noise. This can cause hearing damage.

- Before beginning work, fully relieve pressurised components of pressure.
- Check that components are not pressurised.
- Only disassemble pressurised components when they are not under pressure.

2.1.8 Risks from hazardous substances**Hazardous substances****WARNING!****Risk of poisoning due to hazardous substances! Risk of skin irritation and allergic reactions!**

Substances such as lubricants and cleaning agents contain hazardous components. These can lead to serious poisoning, skin irritation or allergic reactions.

- Observe the safety data sheets.
- Avoid shaking these substances and avoid mist formation.
- If inhalation occurs, bring the affected person out into fresh air immediately. Seek medical help.
- If a substance is swallowed, seek medical help immediately. The mouth must be rinsed out thoroughly with water.
- Avoid skin and eye contact:
Before working with these substances apply suitable hand protection cream.
Wear plastic or rubber protective gloves.
- Remove any soiling from the workspace properly and in an environmentally-friendly way.
Lubricants and cleaning agents must not enter the sewerage system or run into soil.
- Do not eat, drink or smoke when working with these substances.

Hazardous dust



WARNING!

Risk of injury from rising dust!

Dust deposits may rise during machine operation.

Inhaling this dust may, in the long term, lead to lung damage or other health problems.

- Avoid the relevant hazardous area.
- For all work in the hazard zone wear light respiratory protection.

2.1.9 Risks from flammable substances

Fire hazard



WARNING!

Risk of fire from spark-generating work and ignition sources in the immediate vicinity of the machine!

Easily-flammable substances, fluids or gases may catch fire and cause serious or fatal injury.

- Take measures to protect against the build-up of steam in deep-lying or closed areas.
- Take measures to protect against electro-static pressure charging.
- Do not smoke in the hazard zone or in the direct vicinity of the machine.
Do not use naked lights, fire or ignition sources of any kind.
- Immediately report suspicious materials, liquids or gases to the responsible persons.
- Have extinguishing agents (fire-extinguishing powder) for fire class A, B, and C at hand.
- In case of fire, stop your work immediately. Leave the hazard zone until it is safe to return and notify the fire brigade.

Improper fire protection**WARNING!**

There is a risk of injury and material damage from limited or improper fire protection!

If, in the event of fire, the fire extinguisher is not operational or not suited to the specific class of fire, there is a risk of serious or fatal injury and considerable material damage.

- Ensure that only suitable fire extinguishers (fire-extinguishing powder for fire classes A, B and C) are at hand.
- Inspect fire extinguishers every 2 years to ensure they are functioning correctly.
- Refill fire extinguishers after each use.
- Only use extinguishing agents and replacement parts that correspond to the recognised model specified on the fire extinguisher.
- In case of use, observe the safety and operating instructions on the fire extinguisher.

2.1.10 Risks associated with conveyance of nitrogen**Leaking gas****DANGER!**

Risk of suffocation from build-up of leaking gases during nitrogen conveyance!

Gaseous nitrogen displaces the oxygen in the room. High concentrations can cause persons to suffocate. Symptoms here include the loss of physical mobility and loss of consciousness. An affected person will not notice that they are “suffocating”. Escaping nitrogen can accumulate for example in recesses, wells, acoustic hoods.

- Avoid the occurrence of leaks.
- Ventilate the installation site properly.
- Set the lag time for the fan of the acoustic hood and pay close attention to it.
- After a machine downtime, ventilate the machine for a period.
- Guide leaking gases directly out of the machine.
- Guide leaking gases directly into a collective line.

Leaking gases during machine downtime



DANGER!

Risk of suffocation from build-up of leaking gases during machine downtime!

Depending on the type of sealing used, gaseous nitrogen can escape into the environment during machine downtime. This can lead to a build-up of gases inside the acoustic hood or at the installation site. High concentrations can cause persons to suffocate.

- Interrupt the flow of nitrogen into the conveying system.
- Guide nitrogen away using a collective line.
- Ventilate the installation site properly.

Build-up of gas



DANGER!

Risk of suffocation from build-up of nitrogen during conveyance!

When the safety valve is opened, nitrogen is released from the system. There may be a build-up of gas with high concentrations of nitrogen.

Gaseous nitrogen displaces the oxygen in the room. High concentrations of nitrogen can cause persons to suffocate. Symptoms here include the loss of physical mobility and loss of consciousness. The persons affected do not notice that they are “suffocating”.

Escaped nitrogen can accumulate in recesses, wells, acoustic hoods etc.

- Avoid a build-up of gas
- Guide gases directly out of the machine.
- Guide gases directly into a collective line.
- Ventilate the installation site properly.

2.2 Intended use



Fig. 1: Correct use

The **positive displacement blower** machine is intended for conveying and compressing air and non-flammable gases.

The **positive displacement blower** machine is intended for operation with non-flammable gases in a non-explosive atmosphere.

The **positive displacement blower** machine has been designed and constructed solely for its “intended use” in the industrial field, as described here.

Observe and comply with the job-based operating data and operational limits!

This intended use also includes compliance with all information in this instruction manual.

Any application that deviates from the intended use, or any other type of non-standard application, is considered misuse.



Operating data that deviate from the standard must be coordinated with the manufacturer.

2.3 Foreseeable misuse

Serious injury



DANGER!

Danger in case of misuse! Dangerous situations could occur that may lead to fatal or serious injury!

- Never disregard the instructions for “intended use”.
- Never operate the machine in an operating area other than the one intended.
- Never convey or compress gases that are not listed in the order confirmation and the technical data.
- Never disregard the following information on misuse.

Serious material damage



NOTICE!

Danger in case of misuse! Dangerous situations could occur that may lead to serious machine damage!

- Never disregard the instructions for “intended use”.
- Never operate the machine in an operating area other than the one intended.
- Never convey or compress gases that are not listed in the order confirmation and the technical data.
- Never disregard the following information on misuse.

Misuse



Fig. 2: Prohibited use

The machine is not intended for:

- Conveying media in solid, liquid or powder form.
- Conveying caustic media.
- Conveying corrosive media.
- Conveying flammable or poisonous gases, vapours or mists.
- Alteration, retrofitting or modification of the overall design or of individual equipment parts, with the aim of altering the field of application or scope of use.

Further examples of misuse

The following operating modes/applications and uses are considered improper and must be avoided!

**■ Operation:**

- outside the scope of intended use.
- outside the scope of the intended operating data.
- using gases other than those originally intended.
- with the machine operating in the incorrect direction of rotation.
- in a potentially-explosive atmosphere.
- With closed flange connections
- with missing or damaged components
- without a correctly connected control system, fault transmitter, EMERGENCY STOP function.
- without any or with damaged protective equipment.
- with contaminated intake filter or starting strainer.
- without sufficient ventilation of the room.
- activation while the machine is coming to a stop or when it is rotating backwards.
- pole changing to a lower rotational speed before the drive motor has come to a standstill.
- Non-compliance with maintenance intervals.
- Exceeding the maximum oil level.

■ Operation without:

- Intake filter
- Safety valve
- Intake silencer
- oil

■ Applications:

- using the machine to “purge” blockages in the conveying pipes. exceeding the maximum permissible discharge pressure.
- using the safety valve or pressure valve to regulate the operating data.

■ Installation:

- installation on inclined, sloped or lamellar surfaces.
- installation outdoors without due consideration of particular protective measures for avoiding the effects of weather conditions.
- attachment of transportation equipment to the acoustic hood.
- open flames or spark formation in the immediate vicinity of the machine.

2.4 Responsibility of the operator

Operator

The operator is the person who either operates the machine himself, for commercial or business purposes, or who assigns the use of the machine to a third party. During operation, the operator holds legal responsibility pertaining to the product, for the protection of the user, personnel or a third party.

Operator's obligations

The machine is used for commercial purposes. The operator of the machine is thus subject to the applicable legal obligations for occupational safety.

Alongside the safety instructions in this manual, the safety, occupational and environmental regulations relevant to the field of application for the machine must also be complied with.

The operator is obligated to:

- Inform himself about the applicable occupational protection regulations. As part of a hazard assessment, the operator must also establish the hazards that could result from special working conditions at the machine location. He must implement these for the operation of the machine in the form of operating instructions. The necessary safety data sheets can be obtained from the relevant manufacturer.
- During the entire service life of the machine, check that the operating instructions created by the manufacturer correspond to the current status of the applicable regulations. If necessary, adjust the operating instructions accordingly.
- Clearly structure and specify the responsibilities for installation, operation, fault rectification, maintenance and cleaning.
- Ensure that all persons who come into contact with the machine have read and understood these instructions. In addition, the operator must regularly provide personnel training as pertains to machine use and inform personnel of the related hazards.
- Provide personnel with the necessary protective equipment and communicate to personnel that the wearing of this protective equipment is compulsory.

In addition, the operator is responsible for ensuring that the machine is in perfect technical condition.

For this reason the following applies:

- The maintenance intervals described in this instruction manual must be complied with.
- All safety devices must be regularly inspected to ensure they are in good working order.

Additional obligations of the operator

The operator must ensure that the following requirements are complied with and put into practice:

- The machine is only operated in its original delivered condition. In cases where the operator adds his own add-on parts or makes modifications, the manufacturer's declaration of conformity is rendered void.
- Any working behaviour that jeopardises the safety of the machine is prohibited.
- The machine must always be kept in a technically-perfect and operationally-safe condition. Replace damaged or non-operational components immediately. If in doubt, be sure to contact the manufacturer or the responsible contact person.
- Do not operate the machine when the protective equipment has been disassembled or disabled.

- Observe all warnings and notices displayed on the machine and make sure they are legible. You must replace any loose or illegible signs. Ask the manufacturer for replacements.
- Install the separately provided components listed in the scope of delivery on the machine and incorporate these in the safety concept.
- Do not disassemble or incorrectly fit any electrical, mechanical or hydraulic connections.
- For protection against potential damage caused by lightning, make sure a suitable earthing system is in place.
- If the conveyed medium tends to form condensate, the condensate must be bled off (e.g. using collection tanks, residual gas pipes or by briefly opening the lower condensation bores).
- Separate any accompanying dusty material before it enters the machine. Material that collects in the conveying chamber or the rotors presents a particular danger to the working safety of the machine.

Operator's obligations at the installation site

The operator must ensure that the following requirements are complied with and put into practice:

- Machine use only in a stable three-phase power supply. Voltage fluctuations / drops beyond the tolerance level may cause serious damage to the drive system.
- Activate motor overload protection.
- For system variants without a main circuit breaker featuring an EMERGENCY STOP function, the safety circuit of the machine should be incorporated into the EMERGENCY STOP concept for the overall system. Ensure the accessibility of additional EMERGENCY STOP switches in the vicinity of the machine. The machine must be equipped with one or more EMERGENCY STOP command devices for the purposes of operation. The EMERGENCY STOP function must be available and operational at all times, independent of the operating mode.
- It must not be possible for a powered-down machine to start automatically.
- For the purposes of operation, the machine must be equipped with a command device that shuts down the machine in dangerous situations. The power supply to the motor must be cut off. If this is not possible, the "standstill" operating condition must be monitored and maintained.
- Avoid electrostatic charges. Connect an equipotential bonding.
- For accidents and emergencies, incorporate emergency measures for the machine into the overall emergency measures. Make particular efforts to integrate these measures into the evacuation and rescue plan and the fire warning plan.

2.5 Replacement parts

Use of incorrect replacement parts




CAUTION!

Safety risk from using incorrect replacement parts!

Incorrect, defective or unsuitable replacement parts or copies of original components may endanger personal safety and lead to damage, faults or the total failure of the machine.

- Only use the manufacturer's original replacement parts or parts approved by the manufacturer.
- If in doubt, always contact the manufacturer.

Purchase replacement parts from an authorized dealer or from the manufacturer directly. For contact information see Customer service  on page 11.

Replacement parts

Replacement parts that have not been provided by AERZEN have not been tested or approved. They do not correspond to the original components. The use of such products can potentially have an effect on the default design characteristics of the system. The manufacturer assumes no liability for damage resulting from the use of non-original components.

2.6 Requirements for personnel

2.6.1 Qualifications

The various tasks described in this instruction manual represent a variety of requirements in terms of the qualifications of the persons responsible for carrying out these tasks.

Insufficient qualifications



WARNING!

Risk if persons are not sufficiently qualified!

Insufficiently qualified persons are unable to gauge the risks presented by the use of the machine and put themselves, and others, at risk of serious or fatal injury.

- Only allow work to be carried out by suitably qualified persons.
- Observe the information on qualifications in this manual.
- Keep insufficiently qualified persons away from the operating range of the machine.

For the purposes of all work with this machine, only allow persons who are expected to carry out their work reliably to do so. Persons whose reaction times have been impaired, e.g. through drug or alcohol consumption or medication, must not be permitted to work.

This instruction manual contains the following qualification requirements for the various tasks:

Authorised electricians

Authorised electricians, on the basis of their field-specific training, expertise, experience and knowledge of the relevant standards and requirements, are able to carry out their work on electrical systems safely while independently recognising and avoiding hazards.

Authorised electricians are specially trained for the environment in which they work and are familiar with the relevant standards and requirements.

Authorised electricians with additional qualifications

Authorised electricians have the additional qualifications needed for working in the field of frequency converters and EMC. Authorised electricians are familiar with the relevant standards and requirements.

Written documentation acts as proof of a completed safety instructional course and evidence of the necessary additional knowledge.

Due to their additional qualifications, these authorised electricians are able to carry out work on electrical systems with frequency converters and can independently recognise and avoid possible hazards. The additional skills that constitute this qualification should be taught through regular practical application.

Manufacturer's customer service division

Certain work may only be performed by the customer service division of the manufacturer. On the basis of its special, field-specific training, expertise and experience, the customer service division is up to the task of performing highly-skilled work.

The customer service division is a competent point of contact for all stages of the machine's service life. It is able to perform all work on the machine with the highest efficiency.

Service personnel

Service personnel are able to carry out their work on the basis of their field-specific training, expertise, experience and knowledge of the relevant standards and requirements. Personnel recognise hazards independently and avoid risks.

Service personnel in particular possess practical experience and extensive field-specific expertise for the variety of tasks.

- Transport
- Set-up / installation
- Commissioning
- Maintenance
- Fault rectification
- Disassembly

Depending on the designated job, the person must have additional qualifications:

- Operation and handling of compressors.
- Parameterisation of compressors.
- Optimisation work within the permissible operating data range.

Skilled staff for industrial waste

Skilled staff for industrial waste possesses comprehensive, field-specific expertise relating to the disposal and recycling of industrial waste. Skilled staff transports the industrial waste to the waste disposal company and holds responsibility for proper sorting of waste. The staff incorporates this sorting into the recycling and disposal processes.

Trained persons

A trained person has been expressly instructed and, if necessary, trained on site by the responsible management about the tasks delegated to him or her and the risks that are posed by improper behaviour. A trained person has been instructed regarding the necessary protective equipment and protective measures. He or she is in a position to work cautiously and to recognise hazards and react accordingly. The trained person may not interfere with the handling and operation of the machine.

Depending on the designated job, the person must have the following expertise:

- Transport and handling of packaged units.
- Ability to perform visual inspections of the machine.

User

The machine user is trained by the system operator in terms of operation, maintenance work and basic fault rectification. He or she is informed of possible operational hazards and improper behaviour. Tasks that go beyond those for which the machine user is trained or instructed may only be carried out if these tasks are listed in this instruction manual and the operator has expressly designated these tasks to the user.

2.6.2 Unauthorised personnel

Unauthorised personnel in the installation area

**WARNING!****Risk of fatal injury for unauthorised persons in the installation area!**

Unauthorised persons who do not fulfil the requirements described here, are not familiar with the hazards in the installation area. Therefore, unauthorised persons are at risk of serious or fatal injury.

- Keep unauthorised persons away from the installation area.
- If in doubt, instruct such persons to leave the installation area.
- Stop all work as long as unauthorised persons are in the installation area.

- Date of training
- Name of the training participant
- Content of the training
- Name of the training instructor
- Signatures of the participant and instructor

2.7 Personal protective equipment

Personal protective equipment serves to protect persons from breaches of safety and health hazards when working.

Personnel, when working near or with the machine, must wear the personal protective equipment described separately in the various sections of this instruction manual.

Description of personal protective equipment

The following is a description of the personal protective equipment:



Hearing protection

Hearing protection serves to protect against hearing damage from noise generation.



Industrial hard hat

Industrial hard hats protect the head against falling or stray objects and loads and from collisions against stationary objects.



Light respiratory protection

Light respiratory protection protects against harmful dusts.



Protective gloves

Protective gloves protect hands from friction, abrasion, puncture hazards or more serious injuries and from contact with hot surfaces.

They are oil-resistant and protect hands from coming into contact with lubricants.



Protective work clothing

Protective work clothing is tight-fitting work clothing with minimal tensile strength, tight sleeves and without protruding parts.



Safety goggles

Safety goggles serve to protect the eyes against flying particles and splashing liquids.



Safety shoes

Safety shoes protect feet from being crushed, from falling objects and from slipping on slippery surfaces.

2.8 Safety devices

Correct functioning of safety devices



WARNING!

Risk of fatal injury from non-functioning safety devices!

Non-functioning or deactivated safety devices may cause serious or fatal injury.

- Before beginning work, check that all safety devices are functioning correctly and are correctly installed.
- Never deactivate or bypass safety devices.
- Ensure that all safety devices are accessible at all times.

2.8.1 EMERGENCY STOP function



The EMERGENCY STOP function serves, in cases where there is a hazard or when one is averting a hazard, to bring the machine quickly to a safe stop (standstill).

Depending on the customer's specifications, machine variants are available with or without a power circuit breaker system.

Depending on the model, the machine:

- may not feature a control system
- may not feature an EMERGENCY STOP function

Before operating the machine:

Check whether the EMERGENCY STOP function is in place and installed.

It must function perfectly.

EMERGENCY STOP control device



Fig. 3: Example: EMERGENCY STOP control device

An EMERGENCY STOP control device includes a special command unit which is connected to the control system.

The EMERGENCY STOP function allows for the machine to be shut down safely and immediately in case of a potential or existing hazard.

The power supply to all turning components is interrupted immediately when the EMERGENCY STOP function is activated.

It is also possible to install additional EMERGENCY STOP control devices.

Without a power circuit breaker system

- For this variant, an EMERGENCY STOP control device is not installed on the machine at the factory.
- The machine is delivered without an EMERGENCY STOP apparatus.
- The operator must provide a power circuit breaker system with electrical overload protection, an On/Off command unit and an EMERGENCY STOP function.
- Activate Stop Category 0.
- Detail the performance data of the electrical installation in accordance with the operating data of the motor. Take into consideration the necessary data, for example: voltage, current, frequency.
- The connection to the power supply is made using the installed and delivered power cabinet.
- The lines running to the power supply are fed directly to the electric motor and are connected inside a terminal box.
- Feed the connection lead through the cable conduit to the terminal box.
- Protect the motor against overheating.
- A main circuit breaker must be installed.

With a power circuit breaker system

- Depending on the model, an EMERGENCY STOP control device is installed at the factory in the power circuit breaker system.
 - If the factory-installed power circuit breaker system *does not* feature an EMERGENCY STOP command device, this must be provided by the operator. Activate Stop Category 0.
 - If the factory-installed power circuit breaker system *does* feature an EMERGENCY STOP command device, Stop Category 0 is performed.
- A main circuit breaker must be installed if it is not part of the power circuit breaker system.
- The power supply is connected at the power cabinet.
- Observe the wiring diagram!



Notes on installation by the operator

The EMERGENCY STOP facility must:

- be installed and integrated into the safety line of the system controller.
- be clearly recognisable, highly visible and quickly accessible.
- shut down dangerous operation quickly without causing any additional risks.
- if necessary, trigger specific safety measures or authorise the triggering of safety measures.
- be installed in such a way that the machine user can activate it immediately in an emergency.
- be designed in such a way that, in cases where there is an interruption in the power supply or the power supply is activated after an interruption, no situations can occur in which there is a threat of personal injury or material damage.
- supplement other protective measures without acting as a substitute for them.

Requirements for installation by the operator

The EMERGENCY STOP function must be available and operational at all times, independent of the operating mode.

The EMERGENCY STOP facility must not require the entire machine to be voltage-free. In situations where a risk is detected, it must be possible for the user to stop the machine in order to protect against a hazard. For the purposes of a controlled shut-down, electrical voltage may be necessary. The electrical system is still under voltage.

If several EMERGENCY STOP devices are in place, all of these devices must be able to shut down the machine.

The EMERGENCY STOP function must, after being triggered, remain effective until authorisation is given for a restart.

It must not be possible to attempt to block the EMERGENCY STOP device without a "stop" command being issued.

Ensure that it is only be possible to release the EMERGENCY STOP device by means of authorised activation.

This authorisation must not cause the machine to start operating again automatically but rather it should make a machine restart possible.

2.8.2 Hinged support with lifting device

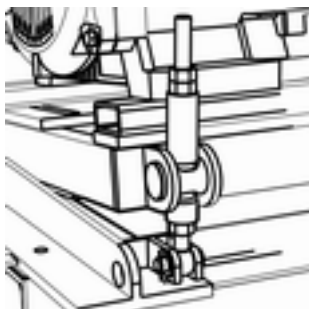


Fig. 4: Hinged support



The hinged support serves to protect against mechanical hazards.

- The hinged support holds the motor hinge in place during transport and assembly. It prevents uncontrolled movement of the motor hinge.
- When operating the machine, the hinged support must be released and positioned accordingly.

2.8.3 Motor mount without lifting device

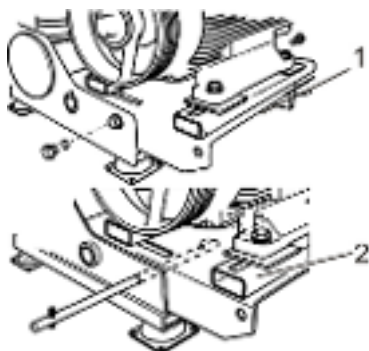


Fig. 5: Motor mount

- 1 DN50
- 2 DN80



The motor mount serves to protect against mechanical hazards.

- The hinged support holds the motor hinge in place during transport and assembly. It prevents uncontrolled movement of the motor hinge.
- When operating the machine, the motor mount must be released and positioned accordingly.

2.8.4 Acoustic hood

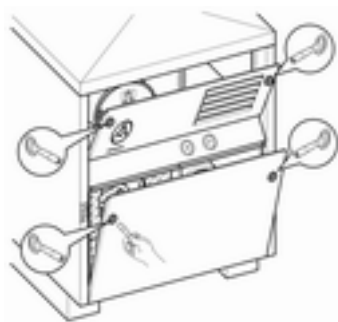


Fig. 6: Acoustic hood, front view (example)



The acoustic hood serves to protect against mechanical and thermal hazards.

- The acoustic hood is an essential safety component of the product.
- The elements of the acoustic hood must be locked with the provided special locks during operation and in stand-by mode.
- Operation with an open acoustic hood is not permissible.
- The locking key for the acoustic hood is a component of the overall safety concept. Access to the key must only be possible for personnel who have been briefed in the safe operation of the machine and the contents of the instruction manual.



Fig. 7: Acoustic hood, rear view (example)

2.8.5 Belt guard

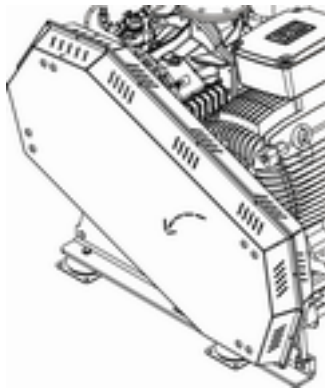


Fig. 8: Belt guard

2.8.6 Cover of the sheave

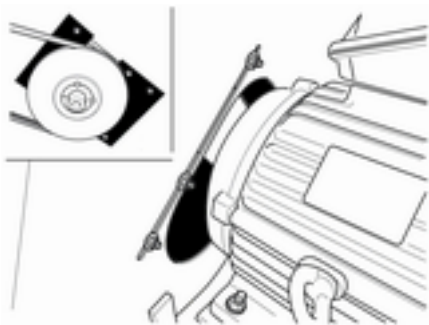


Fig. 9: Cover

2.9 Safety classification



The belt guard serves to protect against rotating components.

- A belt guard is always used in machines without an acoustic hood. It serves to protect against rotating components.



The cover serves to protect against rotating components.

- The belt guard features two plastic covers.
- These serve to protect the rotating sheaves and prevent persons from reaching directly into the belt drive.

The following symbols and notices are displayed on the machine. They relate to the immediate vicinity in which they are located.

Unreadable signage



WARNING!

There is a risk from unreadable signage!

There is a risk of injury resulting from dirty or unreadable signs. It may be impossible to recognise hazards and to follow the necessary operating information.

- Keep all safety, warning and operating information in a thoroughly readable condition.
- Replace damaged signs or stickers immediately.

Safety and warning signs



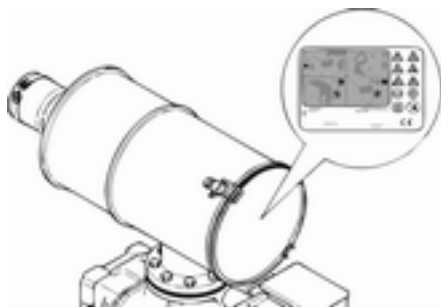
The layout of warning signs involves a set of stickers affixed to the machine. These constitute warning, instruction and prohibition signs. Furthermore, signs relating to lubricants and their handling are only visible when the acoustic hood is closed.

Fig. 10: Layout of warning signs



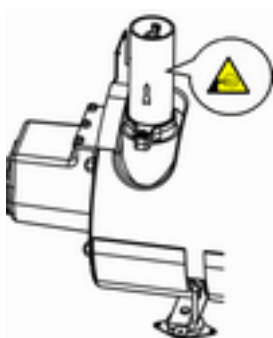
Placement of the sticker set on the acoustic hood.

Fig. 11: Position on the acoustic hood



Placement of the sticker set on the intake silencer.

Fig. 12: Position on the belt guard model



Warning sign on the AERZEN safety valve.

Fig. 13: Position on the AERZEN safety valve

Access for unauthorised persons forbidden



Only persons given authorisation by the operator may enter the hazard area.

Electrical voltage



Only qualified electrical personnel may work in the signposted working area.

Unauthorised persons are not permitted to enter the signposted working area or open the signposted cabinet.

Automatic start-up



The sudden start-up of operational machines in the rest position is possible at any time.

Take heed of the stand-by mode! A sudden start is possible.

Hot surfaces



Hot surfaces, such as hot machine parts, containers or materials - but also hot liquids - are not always noticeable. Do not touch them without protective gloves.

Hand injuries



Keep hands away from areas that carry this warning sign.

There is a risk that hands could be crushed, trapped or injured in some other way.

Gas emission



Risk from sudden gas emission.

The opening of the safety valve results in the emission of gas and accompanying noise emissions. There is a risk of hearing damage and injuries to eyes or skin.

Pressure in the piping



Pipelines may be placed under pressure.

Before carrying out disassembly work, deactivate the pressure in the pipelines.

Draw-in of gas



Pipelines can suck in large volumes of air in the immediate vicinity of the intake openings.

Avoid the air-intake area. Shut down the machine before undertaking any activities in this area.

2.10 Instruction signs

Wear hearing protection



In areas where this symbol is displayed there is a risk of hearing damage. Therefore, wear hearing protection when in these areas.

Information on wearing hearing protection

< 80 dBA	Hearing protection is not prescribed as mandatory but should be worn as a matter of personal responsibility.
80 to 85 dBA	Hearing protection is recommended
> 85 dBA	Hearing protection must be worn



Observe the instruction manual



Only use the labelled machine once you have read the instruction manual.

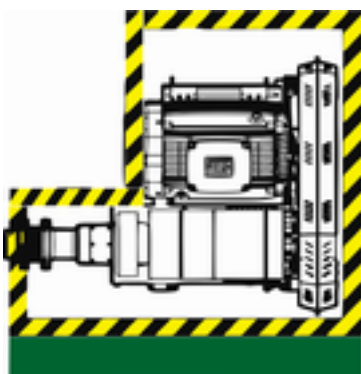
2.11 Hazards in the operating and/or display area





-  Hazard area
-  Operating and/or display area

The hazard area is located in the marked zone (in the acoustic hood interior zone). The opening of acoustic hood elements and protective covers during operation is not permissible. Opening is permissible only for maintenance work or for troubleshooting and provided all safety precautions are observed. The operating and/or display area is the position marked in green (example).

Fig. 14: Hazard area and operating and/or display area (top-down view)



-  Hazard area
-  Operating and/or display area

The hazard area is located in the marked zone. The opening of the protective cover is not permissible. The operating and/or display area is the position marked in green (example).

Fig. 15: Hazard area and operating and/or display area (top-down view)

2.12 Securing the machine against restarting

Sudden restart

**DANGER!**

An unauthorised or unregulated restart can have fatal consequences.

An unauthorised or unregulated restart of the machine can lead to serious or fatal injuries. There may be people located in the hazard zone. Activating the energy supply and starting the machine could result in those people being fatally injured.

- Prevent the machine from restarting by:
 - disconnecting the electrical power supply.
 - activating the EMERGENCY STOP function
 - operating the main circuit breaker
 - attaching a padlock to the main circuit breaker
 - checking and ensuring that the machine is completely disconnected from the power source
 - displaying a sign on the machine that prohibits a machine start
 - displaying a sign on the remote station that prohibits a machine start
- Before restarting, ensure that safety devices are installed and functioning correctly and that there are no potential hazards to the safety of any persons.

EMERGENCY STOP button (option)

- 1.** ➤ Press the EMERGENCY STOP button
 - ⇒ The power supply is shut off.
- 2.** ➤ Activate the main circuit breaker.
 - ⇒ The machine is free of current.
- 3.** ➤ Attach a padlock to the main circuit breaker.
- 4.** ➤ Ensure that the machine is completely disconnected from the power source.
- 5.** ➤ Inform supervisory personnel of work in the hazard area.

6. ➤ Place a sign on the machine and (where applicable) remote station that notifies persons of the work being carried out in the hazard area and forbids activation of the machine. The sign must contain the following information:
- Shut-down on:
 - Shut-down at:
 - Shut-down by:
 - Important: Do not switch on!
 - Important: Only switch on the machine once it has been ensured that there is no risk to personal safety.

EMERGENCY STOP feature (operator-installed)



The particular approach to preventing a restart is dependent on the operator-installed EMERGENCY STOP feature.

1. ➤ Secure the machine against restarting in accordance with the operator's instructions.
2. ➤ Follow the instructions of the responsible supervisory personnel.
3. ➤ Once all work has been completed, ensure that there is no risk to personal safety.
4. ➤ Ensure that all safety and protective equipment is installed and operational.

2.13 Environmental protection

Environmentally hazardous materials



ENVIRONMENT!

Improper handling of environmentally hazardous materials presents a threat to the environment!

Incorrect handling of environmentally hazardous materials, particularly in the case of improper disposal, can cause considerable damage to the environment.

- Always observe the information below on the handling of environmentally hazardous materials and their disposal.
- If environmentally hazardous materials are inadvertently released into the environment, take appropriate action immediately. If in doubt, inform the responsible local authority about the damage and seek advice on taking appropriate measures.

The following environmentally hazardous materials are used:

**Lubricants**

Lubricants such as greases and oils contain poisonous substances. They must not be released into the environment. Disposal must be carried out by a certified waste management company.

AERtronic batteries

Batteries contain poisonous heavy metals. They require special waste treatment and must be deposited at local collection points or disposed of by specialist companies.

Electronics

Electrical and electronic components may contain poisonous material. These components must be collected separately and deposited at local collection points or disposed of by specialist companies.

Anti-corrosion agents

Anti-corrosion agents may contain poisonous substances. They must not be released into the environment. Disposal must be carried out by a certified waste management operator.

3 Design and operation

3.1 Overview of assemblies

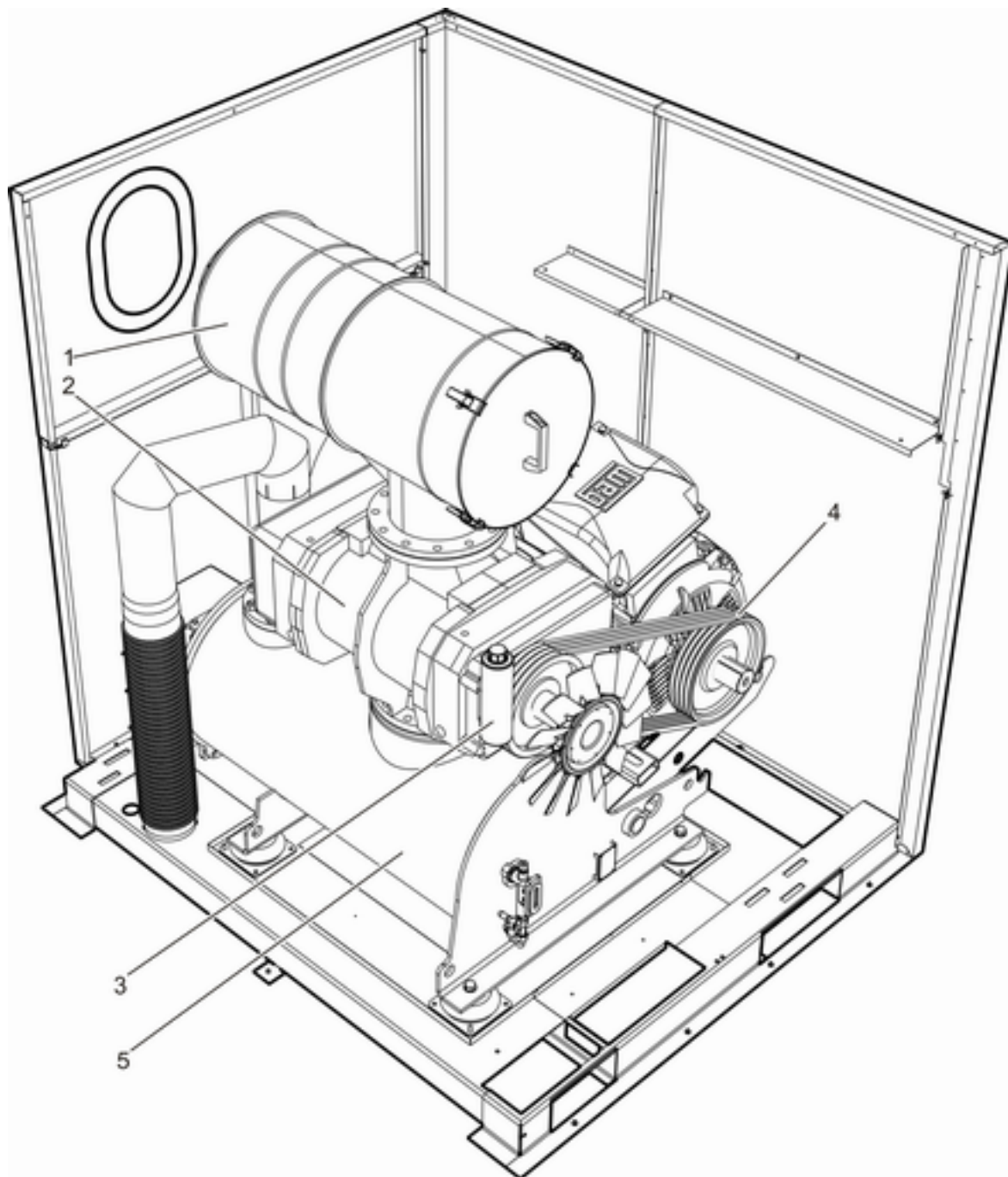


Fig. 16: Acoustic hood with oil system

- 1 Intake side
- 2 Machine stage
- 3 Oil system
- 4 Drive system
- 5 Discharge side

3.2 Overview of assemblies

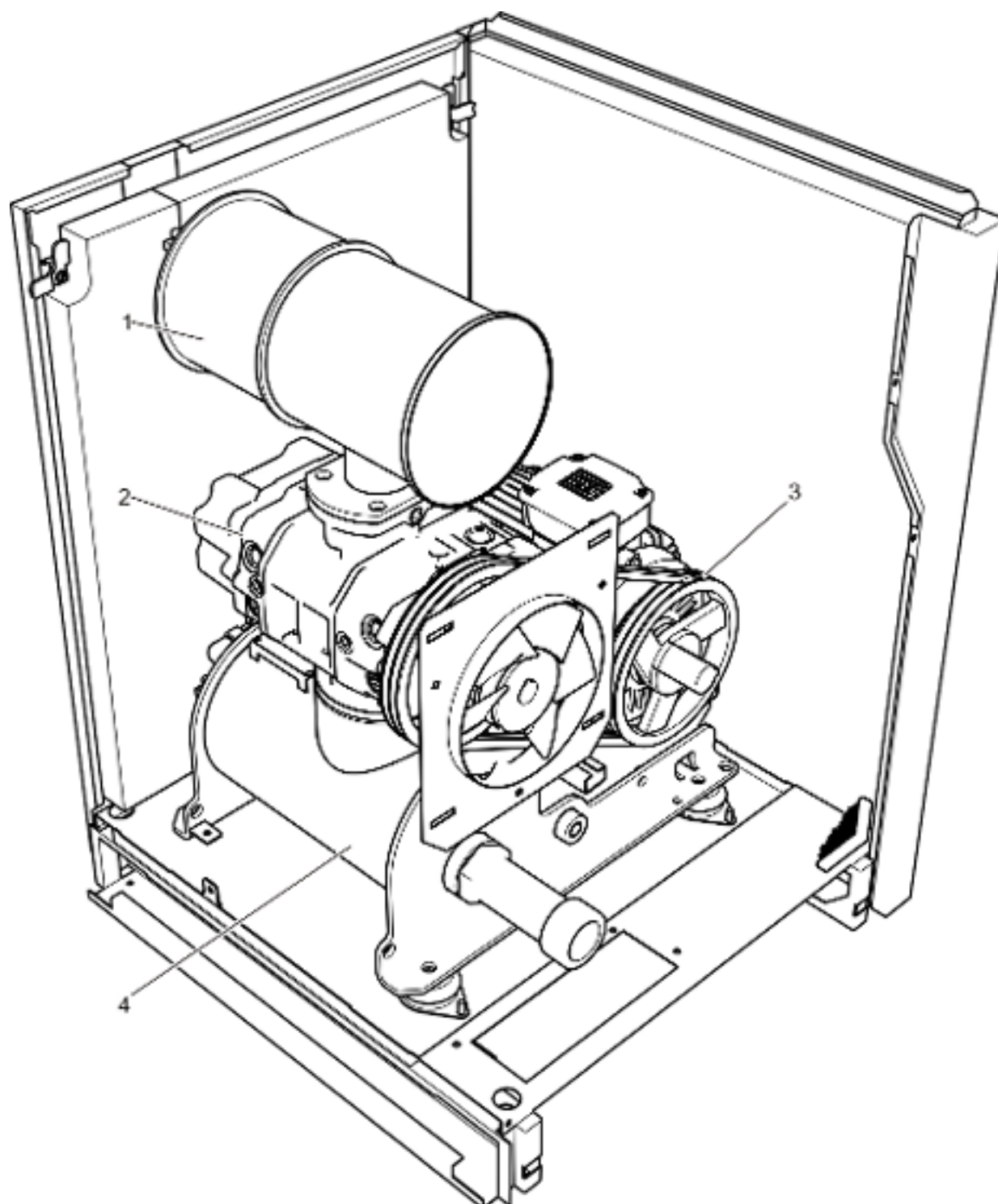


Fig. 17: Acoustic hood without oil system

1 Intake side
2 Machine stage

3 Drive system
4 Discharge side

3.3 Overview of assemblies

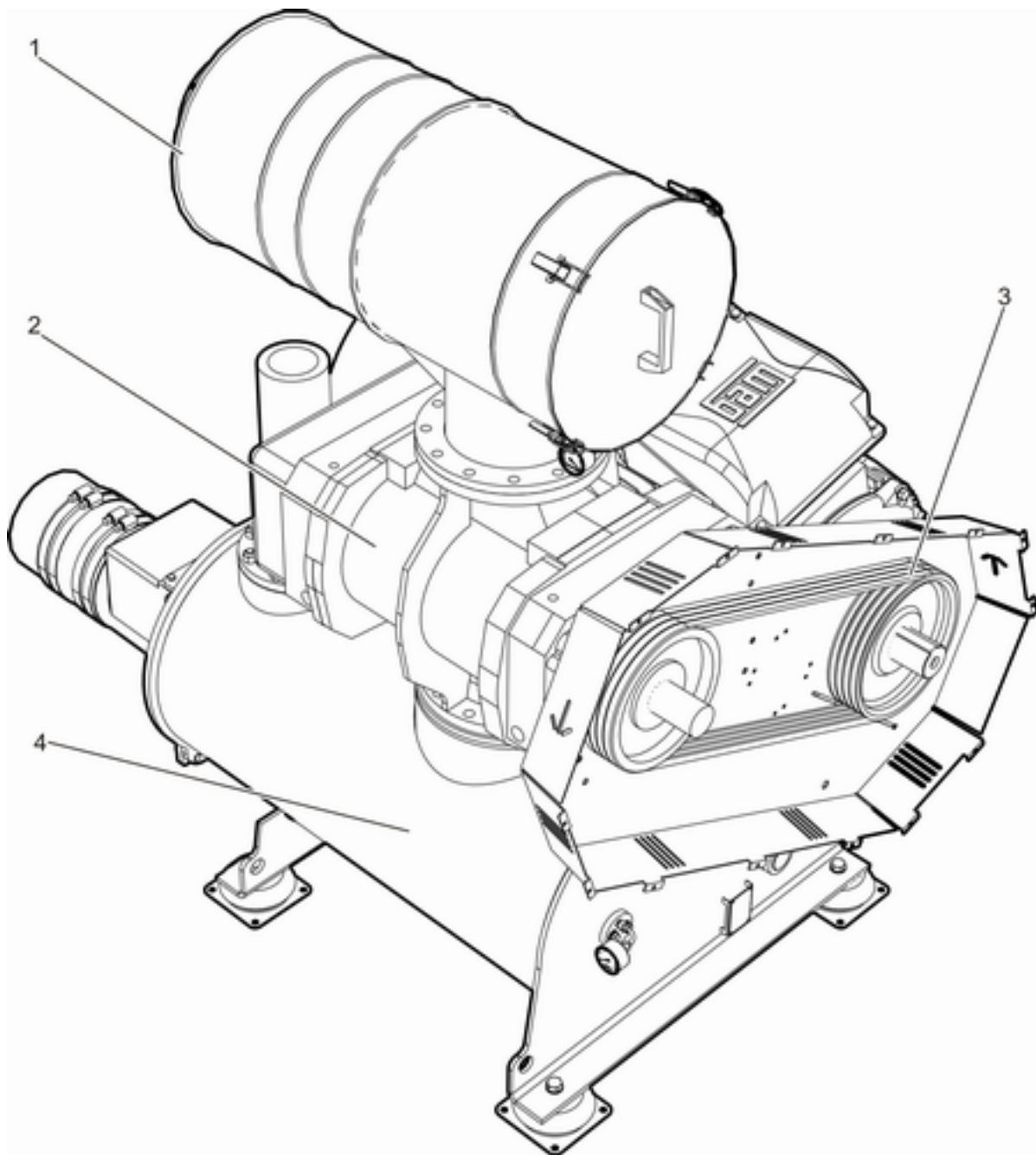


Fig. 18: Overview

- 1 Intake side
- 2 Machine stage

- 3 Drive system
- 4 Discharge side



3.4 Operating principle

The medium to be conveyed is connected using an elastic rubber sleeve or the compensator of the discharge-side connection casing.

The medium to be conveyed enters through the intake silencer. This offers the possibility of a intake-side pipe connection. There is a replaceable filter element located inside the intake silencer. Dirt levels in the filter element can be displayed using a service indicator or the control system display.

The positive displacement blower conveys and compresses the medium to be conveyed. The medium then flows through the discharge silencer, via a non-return flap, into the customer's system. The positive displacement blower is powered by a drive motor using a belt drive. The belt drive derives tension automatically from the weight of the motor. The drive motor is powered by connecting its power lines in the terminal box.

A safety valve is installed on the base support or on the connection housing. The working pressure can be displayed by a pressure gauge or in the control system screen.

The acoustic hood is ventilated by a fan.

3.5 Operating modes

On-site operation

Operation of the machine is carried out directly on site.

Remote operation

Operation of the machine is carried out via control station.

Automatic operation

Automatic operation of the machine is carried out by sensors or a system switch.

Load operation

Load operation is the operating mode in which the machine processes the specified operating data.

3.6 Operating methods

3.6.1 Operating information for pneumatic conveyance

Pneumatic conveyance

When the machine is being used for the purposes of pneumatic conveyance, pressure surges must not occur when switching between different delivery lines.

Pressure surges can be prevented by making the switching process for the intake-side and discharge-side valves take at least five seconds. This pre-accelerates the gas column in the pipework. The gas can no longer accelerate suddenly. This prevents damage to the machine.

The distance between the switchover valve and the intake-side flange must be at least $10 \times \text{DN}$. DN = nominal diameter of the pipework.

This safety note applies to both pressure and vacuum mode.

3.6.2 Operating information for air-separation systems

Operating information for air-separation systems

When the machine is being used in air-separation systems with alternating air-separation columns, pressure surges must not occur when switching between different delivery lines.

Pressure surges can be prevented by making the switching process for the intake-side and discharge-side valves take at least five seconds. This pre-accelerates the gas column in the pipework. The gas can no longer accelerate suddenly. This prevents damage to the machine.

The distance between the switchover valve and the intake-side flange must be at least $10 \times \text{DN}$. DN = nominal diameter of the pipework.

This safety note applies to both positive pressure and vacuum pressure mode.

3.6.3 Description of assemblies

For the purposes of explaining its functionality, the machine is divided into several assemblies. Each assembly consists of a number of components which, combined, perform a specific machine function. One assembly can consist of sub-assemblies and additional components.

3.6.3.1 Intake side

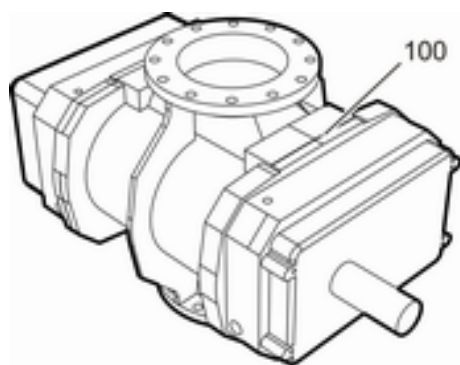


3410 Intake silencer, housing
3470 Intake silencer, filter element

The intake side assembly comprises the components of the conveying system's intake side. The intake side assembly includes all components located upstream of the machine stage gas inlet. The medium to be conveyed is drawn into the machine stage by these components. An intake silencer serves to reduce noise emissions. A filter ensures clean intake gas.

Fig. 19: Intake side

3.6.3.2 Machine stage

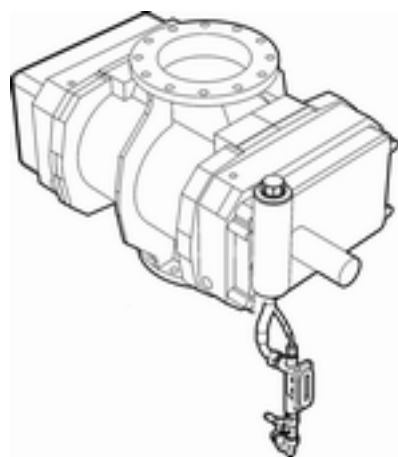


100 Machine stage

The machine stage is the core of the machine and includes all components for gas compression. The gas compression process takes place in the machine stage.

Fig. 20: Machine stage

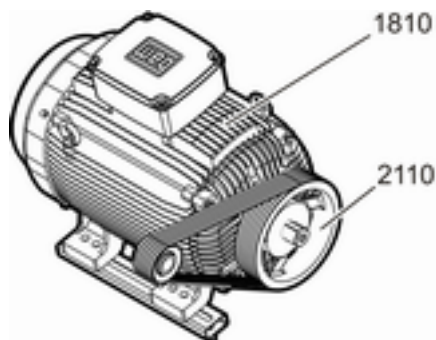
3.6.3.3 Oil system



The oil system contains all components necessary for providing lube oil to the machine stage.

Fig. 21: Oil system

3.6.3.4 Drive system

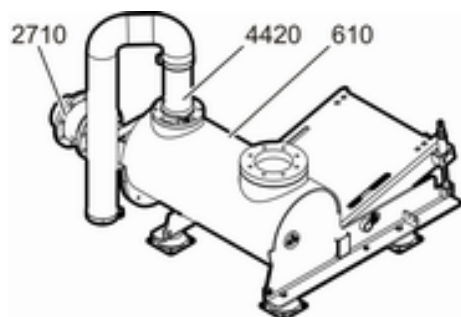


- 1810 Motor
- 2110 Belt drive

The drive system comprises the drive motor and the drive elements, e.g. the belts and sheaves. The drive system provides a high revolution speed for the rotational motion of the machine stage.

Fig. 22: Drive system

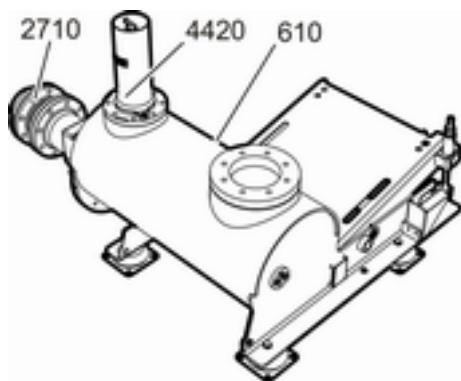
3.6.3.5 Discharge side



- 610 Base support
- 4420 Safety valve
- 2710 Flexible pipe connection

The discharge-side assembly represents the components of the discharge-side conveying system. The discharge-side assembly includes all components fitted downstream from the machine stage gas outlet. All components are pressurised during operation and have hot surfaces. A discharge silencer serves to reduce noise emissions.

Fig. 23: Discharge side with base support



- 610 Base support
- 4420 Safety valve
- 2710 Flexible pipe connection

The discharge-side assembly represents the components of the discharge-side conveying system. The discharge-side assembly includes all components fitted downstream from the machine stage gas outlet. All components are pressurised during operation and have hot surfaces. A discharge silencer serves to reduce noise emissions.

Fig. 24: Discharge side with base support

3.7 Control elements (optional)

3.7.1 Factory-installed control element

Factory-installed control element



Observe the AERtronic instruction manual.

The AERtronic instruction manual is included with the product.

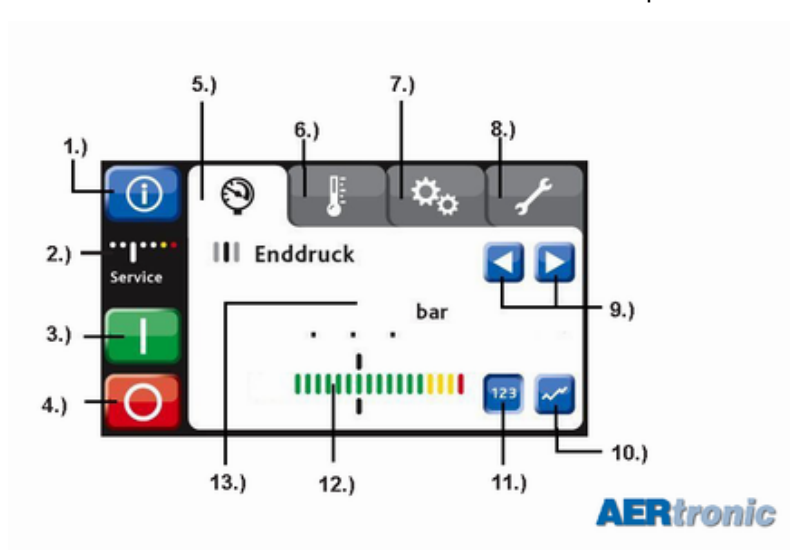


Fig. 25: Operator interface

- 1 Information menu
- 2 Service display
- 3 Local/ LOCATION / START
- 4 Local/ LOCATION / STOP
- 5 Pressure ranges register
- 6 Temperature ranges register
- 7 Additional operating parameters register
- 8 Service and setup register
- 9 Selection buttons of the given display menu within a register
- 10 Graphic representation
- 11 Numerical representation
- 12 Bar graph display
- 13 Measurement value display

3.7.2 Customer-installed control element

Customer-installed control element



Depending on the model and version - with or without a corresponding controller - the control elements are not part of the scope of delivery. The installation and design of the control elements is then the responsibility of the customer.

3.8 Accessories

The accessories are the total collection of components belonging to the machine or to the supplementary equipment.

3.8.1 Drive motor

Motor connection requirements



The cable and lead sheathing must be resistant to the normal wear expected due to the movement of the hinged motor support and the effects of contaminants in the atmosphere.

General requirements

- Fine-core cable is recommended for the connecting leads.
- The connecting hardware must be suitable for the cross-section and type of the connecting leads.
- Cables, leads and connections must not be subjected to excessive bending and tensile forces. Install the connecting cable via a stayed cable bridge (not provided) to prevent the terminal box being subjected to forces or stress.
- Install cables and leads in such a way that they cannot sustain any external damage.
- Avoid contact with the machine, excessive friction and excessive radiant heat.
- The connecting cable must be resistant to light movements, e.g. the changes in the rotational speed of the motor.

General requirements

- Fine-core cable is recommended for the connecting leads.
- The connecting hardware must be suitable for the cross-section and type of the connecting leads.
- It may be necessary to remove the intake console and the acoustic hood cover to connect the motor, depending on the size and output of the machine.
- Cables, leads and connections must not be subjected to excessive bending and tensile forces. Install the connecting cable via a stayed cable bridge (not provided) to prevent the terminal box being subjected to forces or stress.
- Install cables and leads in such a way that they cannot sustain any external damage.
- Avoid contact with the machine, excessive friction and excessive radiant heat.
- The connecting cable must be resistant to light movements, e.g. the changes in the rotational speed of the motor.

Requirements for the electricity network



NOTICE!

There is a risk of material damage from voltage fluctuations / drops!

Voltage fluctuations / drops beyond the tolerance interval may lead to serious damage to the drive system.

Requirements for operating positive displacement machines with electric induction motors in a three-phase AC supply system:

- Use suitable protective equipment that will shut the motor down and safeguard it against an automatic restart if impermissible electrical operating data is detected.
- Connect the motor and control voltage to a stable common network to ensure that the power contactor is no longer latched if the power supply fails.
- Comply with voltage and frequency limits. ↪ *Chapter 11.9.1 „Voltage fluctuations“ on page 194*

Connection

- Only authorised electricians may perform the connection.
- Electricians must observe all applicable regulations when connecting the drive motor.
- Observe the tightening torques of the terminal screws.
- Secure all connections against inadvertent release or loosening.
- Ensure that the nominal electrical data is complied with during operation.

Control circuit types

- Star-delta connection
- Pole changing
- Speed control using frequency converter
- Direct start

Permissible starting frequency

up to 160 kW	6 starts per hour
from 200 kW	3 cold starts or 2 warm starts per hour

Refer to the operating manual provided by the drive motor manufacturer for further specifications and information.

3.8.1.1 Drive motor - factory installation

Factory installation



Observe the information on the type plate and in the drive motor instruction manual.

Refer to the drive motor instruction manual for electrical operating data, maintenance intervals and suitable lubricants.

3.8.2 AERtronic

AERtronic



Fig. 26: AERtronic Display

The AERtronic is used as a control device and as a display and monitoring device.

The AERtronic is fitted with a colour graphics display with a touch-screen interface.

When starting for the first time, these settings can be changed.

Other handling and operation of the controller is defined on the display; the user is guided through the menu by prompts in a structured manner.

The AERtronic includes all the functions necessary for start and shut-down procedures and displays the operating parameters and prompts.

Observe the operating manual for the purposes of commissioning and operation!

AERZEN reserves the right to change, expand or improve the hardware and software of this product as required. This does not include any obligation to update units already shipped.

3.8.3 Instrumentation

The instrumentation consists of several assemblies.

- 1.) Pressure and temperature sensors in conjunction with the AERZEN AERtronic controller.
- 2.) Pressure and temperature switches in conjunction with the display instruments.

Shut-down locking

- The shut-down devices are set at the factory.
- All shut-downs must be self-locking. Once the shut-down has been given clearance, the machine must not be able to start automatically.
- Prior to a restart, the cause of the fault must be determined and eliminated. Start-up must then take place manually.

**NOTICE!**

The switching points of the switches/sensors are fixed and must not be changed.

Pressure and temperature switches

If, to safeguard the machine, an intake pressure, discharge pressure or discharge temperature switch is used, it must also be ensured that the drive motor switches off when the limit switch is triggered.

Contacts open → Drive motor off.

Pressure switch (optional)

It is also possible to use an additional pressure switch. A calibrated gauge is used to adjust the switching limit point. The scale on the switch only serves as a guide.

3.8.4 Frequency converter**Description**

Observe the frequency converter manufacturer's operating manual!

**NOTICE!**

- If the electric motor is driven by frequency converters, we strongly recommend using an engine throttle and power choke. These are specifically designed for the frequency converter and filter dangerous harmonics from the actuator current. This prevents damage to the motor winding. The electromagnetic compatibility of the system is also improved. Reactions of the frequency converter in the current are reduced.
- The maximum current limit of the motor must not be exceeded. Observe the information on the motor name plate.
- To prevent operational faults the function "Interception circuit" must not be parameterised in the control of the frequency converter. When the frequency converter is switched off, a restart should only be possible after a complete shut-down of the blower or compressor.
- The machine must shutdown without braking. The activation of a brake ramp or quick stop is not permissible.

For machine use, observe the following

- Take into account the electrical and mechanical properties of the drive motor.
- The minimum frequency must always be fixed. This frequency must never fall below the fixed minimum during operation.
- The maximum frequency is to be set by taking into account the maximum rotational speed of the motor and the maximum machine speed.
- The run-up time of the drive motor from standstill up to minimum speed can be 3 to 6 seconds.
- The frequency converter must be designed with a constant load torque for operation with a working machine.
- Never exceed maximum and or drop below minimum speed thresholds.
- When exceeding the value, e.g. due to excessively long cables, frequency converter type etc. a motor throttle or motor filter coil to match the frequency converter is to be used.



NOTICE!

Not using these components can lead to damage of the motor isolation and a motor breakdown.

- The highest admissible voltage increase speed of the motor is 1,200 V/ μ s.
- The maximum rotational changeover speed must not exceed 1 Hz per second during operation.
- Minimum frequency = 20 Hz // maximum frequency = 50 Hz results in a control time of 30 seconds from minimum to maximum.

Pole changing

For a motor speed changeover from a high to a low speed, the drive motor must have reached zero rotational speed each time.

Changeover from a low to a high speed can take place directly and instantaneously.

3.8.5 Machine terminal box

Terminal box

The machine's terminal box contains the electrical and electronic components that are not located directly on the machine (e.g. sensors).

It contains terminals for connecting electrical and electronic components with the external power supply.

When the terminal box is closed, accidental or unintended contact with voltage-carrying components is not possible.

The distribution cabinet is locked due to internal components which are charged with dangerous voltage. It can only be opened using special tools (distribution cabinet key, triangular/ square wrench).

3.8.6 Discharge pressure gauge

Positive pressure mode



Fig. 27: Gauge

The gauge displays the discharge pressure of the compressed gas.

It is a display instrument without a switching function.

The gauge is connected on the discharge side.

3.8.7 Nitrogen gauge

Nitrogen mode



Fig. 28: Gauge

The gauge is used when conveying nitrogen.

The gauge displays the pressure in the inlet pipe.

It is a display instrument without a switching function.

The gauge is connected on the intake side.

3.8.8 Maintenance indicator

Positive pressure mode



Fig. 29: Variation a)

The maintenance indicator shows the dirt levels in the intake filter.

The maintenance requirements of the intake filter depend on the dirt levels of the medium taken in.

Replace the filter element when the following display values are reached and no later:

At -45 mbar (red display field): replace intake filter

After the filter has been changed, reset the pointer to its initial position by "pressing" the reset button.



Fig. 30: Variation b)

When the level of contamination increases, the red trailing pointer will be pulled over with the black pointer and stay at the maximum intake pressure.

Replace the filter element when the trailing pointer reaches the red area of the scale.

Once the filter has been replaced, reposition the trailing pointer between 0 and -10 mbar.

3.8.9 Intake silencer

Intake silencer



Fig. 31: Opening intake silencer with filter

The intake silencer contains the intake filter. The intake filter prevents harmful particulate matter entering the conveying chamber of the machine.

The intake filter corresponds to filter class G4



NOTICE!

Risk of machine damage! Never operate the machine without the intake filter.

Machine damage caused by the intake filter



NOTICE!

There is a risk of machine damage from the use of contaminated, damaged or non-original intake filters!

Heavily contaminated or damaged intake filters reduce performance. They affect functionality and may cause machine failure. Copies and reproductions of intake filters do not have the necessary properties.

- Inspect for damage.
- Comply with maintenance intervals.
- Only use original replacement parts.

3.8.10 Discharge silencer

Discharge silencer

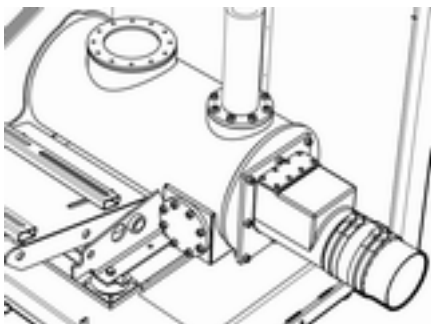


Fig. 32: Discharge silencer

The base support serves as the base for the whole bodywork of the machine. The base support also acts as a discharge silencer. The discharge silencer is an absorption-agent-free component. The acoustic energy inside the discharge silencer is reduced by means of air deflection.

3.8.11 Safety valve

AERZEN safety valve



Fig. 33: Safety valve



Observe the valve instruction manual. It is included with the product.

The safety valve is used for the conveyance of air.

The safety valve is set at the factory.

If the set value is exceeded, the valve opens and releases excess conveyed material into the atmosphere.

The safety valve is NOT a control component and is not to be used as such.

The safety valve can be used up to a temperature of 200°C.



NOTICE!

Risk of premature wear and tear and breakdown!
The valve is not intended for controlling the operating data!

The deactivation of the valve, e.g. by increasing the opening pressure, may lead to serious material damage! Risk of total machine failure!

The valve outlet must not be made narrower or closed. Keep the cross-section unobstructed!

3.8.12 Non-return flap

Non-return flap



Fig. 34: Non-return flap

The non-return flap prevents the compressed conveyed medium from entering the machine stage once the compressor has been switched off. This prevents the machine stage from running "in reverse".

3.8.13 Start-up relief device for DN80 to DN400

Start-up relief device

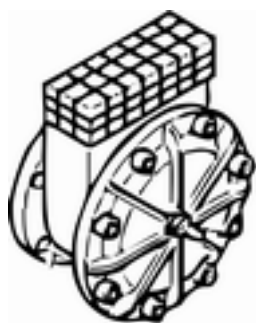


Fig. 35: DN 80 to DN 400



NOTICE!

Risk of premature wear and tear and breakdown!
The start-up relief is not intended for controlling the operating data!

The use of the start-up relief device as a controller for operating data leads to premature wear and tear and breakdown!

The start-up relief device can be used in machines that are run by an electric motor with a "star-delta connection".

This allows for a relieved start-up against existing mains pressure.

In the case of drives with pole-changing motors, it is also possible to use a start-up relief device with a solenoid valve.

This provides a relieved start-up at higher speeds.

After a correct set-up, the start-up relief device operates maintenance-free.



The start-up relief is not necessary for drives with frequency converters.

3.8.14 Start-up relief device for DN50 to DN80

Start-up relief device

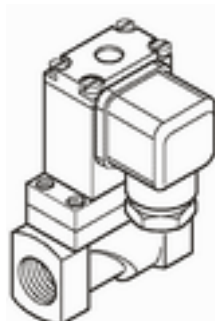


Fig. 36: DN 50 / 80



NOTICE!

Risk of premature wear and tear and breakdown!
The start-up relief device is not intended for controlling the operating data!

A solenoid valve offers the possibility of relieved start-up for DN 50/80 ("star-delta connection"). The valve closes if voltage is present.

The valve may only close after the switch from "star to delta".

For pole changing: In "star-double-star starting", the solenoid valve is to be switched so that it opens before the high-speed operation and closes after ramping up.



The start-up relief device is not necessary for drives with frequency converters.

3.8.15 Belt drive

Belt drive



Fig. 37: Belt drive

The belt pulleys are mostly fitted and aligned in the factory.

The belt pulley for the machine stage is fitted to the drive shaft. The position and orientation of this belt pulley therefore affects the alignment of the drive motor belt pulley.

Check the alignment:

- Before first commissioning
- According to the maintenance plan
- After replacing the pulley(s)

The maximum permitted belt pulley offset is 0.5 mm.



It is extremely important that only original replacement parts be used for the purposes of belt-pulley operation!

Only use replacement parts that are recommended and approved by AERZEN!

Original replacement parts



NOTICE!

Risk of material damage! Pulleys must only come from one manufacturer and from one production batch.

- Otherwise varying belt tensions can occur which can result in uneven running and premature wear.
- As a result of a risk of snapping, the belt pulleys must be suitable for the peripheral speed encountered!

3.8.16 Acoustic hood

Acoustic hood

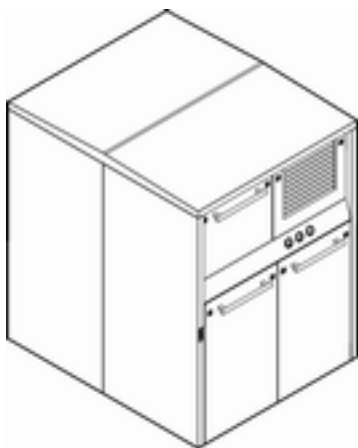


Fig. 38: Acoustic hood, version diagram

The acoustic hood serves to reduce noise and acts as an isolating safety device.

The acoustic hood is a component for product safety with lockable door elements.

Always keep the acoustic hood closed during operation.

The key must only be accessible for authorised personnel.

An earthing strap or threaded hole is located on the outer edge of the floor tray.

Lock



Operation with an open acoustic hood is not permissible!

- Always lock the elements of the acoustic hood with the key provided.
- The key must only be accessible for trained persons.

Fan

The acoustic hood is ventilated by a mechanical fan.

The fan is connected at the factory. The fan is activated in parallel with a machine start.

Intake from a pipeline

The acoustic hood makes intake-side suction possible from the system pipeline.

The pipeline is guided through the acoustic hood to the machine through prefabricated openings.

The following steps must be complied with: ↪ *Chapter 5.3 „Installation“ on page 93*

Acoustic hood heater

**NOTICE!**

There is a risk of material damage from low ambient temperatures!

Provide acoustic hood heating at ambient temperatures of under -10°C!

This prevents damage to the machine by heating up the housing and preheating the lube oil and medium to be conveyed.

3.9 Required tools

The following tools are required:

Auxiliary materials, aids

including collection containers for oil, drain hose, cleaning rags.

Conveyor rails

The conveyor rails must be made of steel. They act as slide-in modules in the forklift tunnel of the acoustic hood. The cables are pulled by the conveyor rails and joined above the machine using the lifting beams.

Drills

Drills for making fastening holes.

Electric drill

Electric drills, e.g. for drilling fixing holes.

General measurement tools and equipment

For example a steel ruler, plumb line, folding yardstick, spirit level.

General tool kit

including various screwdrivers, combination wrenches, set of socket spanners, set of Allen wrenches, hammers.

Lifting beams

Transverse truss required for crane transport for absorbing cable force.

Lifting equipment

For lifting loads, e.g. ropes, belt anchorages, shackles, eyebolts with nuts.

Locking key

The locking key is a component of the overall safety concept. This must be stored safely and should only be made accessible to trained personnel. It is intended for the proper opening and closing of the acoustic hood elements.

Oil funnel

The oil funnel is used for the precise filling of lubricant oil.

Ratchet wrench

The ratchet wrench is used to adjust the hinged motor support fastener.

Test pump

The test pump is used to simulate system pressure in the measurement lines during commissioning. This allows for the operation of the pressure switch or the pressure sensors to be checked.

Tools for authorised electricians

Basic electrical engineering equipment, e.g. multimeter, voltage detector, insulated tools.

Transport equipment

for transporting packaged units and the machine, e.g. with lift trucks, forklifts.

4 Transport, packaging and storage

4.1 Transport

4.1.1 Safety instructions

Improper transport

**WARNING!****Risk of injury and damage from improper transport!**

Improper transport may result in personal injury.

- Proceed with caution upon delivery and unloading of the machine and during in-house transport.
- Observe the symbols and information on the packaging.
- Only use the intended anchorage points.
- Observe the machine's centre of gravity.
- Attach lifting equipment accordingly and hang the load so that it is balanced.
- Remove the packaging shortly before setting up the machine.

Industrial trucks

**WARNING!****There is a risk of fatal injury from industrial trucks!**

Transport with industrial trucks can result in objects and other loads falling accidentally and causing serious or fatal injury. There is also the risk of the driver failing to see persons and running them over.

- Industrial trucks should only be operated by trained drivers (e.g. forklift drivers).
- Only walk past an industrial truck if the driver has signalled that he has recognised the person in his path.
- Only use approved industrial vehicles with sufficient load carrying capacity.
- Never transport materials over persons or the areas in which persons are located.

Suspended loads



WARNING!

There is a risk of fatal injury from suspended loads!

During lifting work, loads may swing out and fall. This can result in serious or fatal injury.

- Never walk under or into the range of a suspended load.
- Move loads under supervision only.
- Observe lashing points.
- Ensure that the lashing equipment is fitted securely.
- Do not hang lashing equipment on protruding machine parts or on the lugs of attached components.
- Only use approved hoists and lashing equipment with sufficient load carrying capacity.
- Do not use damaged hoists such as ropes or pulleys.
- Do not attach hoists such as ropes or belts to sharp edges and corners and do not knot or twist them.
- Set down the load when leaving the work area.

Disregard for the machine's centre of gravity



WARNING!

There is a risk of the unit toppling and falling over if there is disregard for the machine's centre of gravity!

If the machine's centre of gravity is disregarded the packaged unit may topple and cause life-threatening injury.

- Take into account the machine's centre of gravity.
- Observe the packaging information on the machine's centre of gravity.
- Attach lashing equipment in such a way that it is located above the centre of gravity.
- Raise the load carefully and ensure that it does not topple. If necessary, change the position of the lashing equipment.

Risk of slipping

CAUTION!
Risk of injury due to slipping on the packaging foil!

The packaging foil features a slippery surface that can cause persons to slip on it. Moisture, creases, edges and tension straps on the packaging foil entail a risk of slipping or stumbling. The packaging foil is not suitable for supporting weight. A fall may result in injury.

- Never stand on the packaging foil.
- Never lean on the packaging foil or use it for support.

Requirements for staff

Requirements for transport:

Transport of packaged units

Personnel: ■ Trained persons

Transport of unpacked machines

Personnel: ■ Service personnel

Requirements for staff

When checking storage criteria, you require the following:

Personnel: ■ Service personnel

When checking and applying preservation, you require the following:

Personnel: ■ Service personnel

Protective equipment

Requirements for transport:

Protective equipment: ■ Protective work clothing
 ■ Safety shoes
 ■ Protective gloves

Protective equipment

Preservation requires:

Protective equipment: ■ Protective work clothing
 ■ Safety shoes
 ■ Protective gloves
 ■ Light respiratory protection

Special tools

Requirements for transport:



NOTICE!

Risk of damage to the machine! Chains, steel cables and similar equipment are not suitable lifting equipment.

Special tool: ☐ Lifting equipment
☐ Transport equipment

Special tool: ☐ Lifting beams
☐ Locking key
☐ Conveyor rails

Dimensions of the conveyor rails

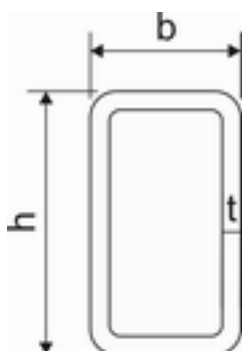


Fig. 39: Rectangular hollow profile

Nominal diameter Discharge nozzles	Profile dimensions H x W x D (mm)	Profile length (mm)
DN 50	80 x 60 x min. 4	950
DN 80	80 x 60 x min. 4	1285
DN 100	100 x 80 x min. 4	1870
DN 125	100 x 80 x min. 4	1870
DN 150	120 x 80 x min. 6	2520
DN 200	120 x 80 x min. 6	2520
DN 250	120 x 80 x min. 8	2750
DN 300	120 x 80 x min. 10	3350

Material: S 235 JR



Profile length of at least 150 mm longer than the dimensions of the acoustic hood.

4.1.2 Delivery method

4.1.2.1 Delivery of the machine

The machine is shipped using a freight forwarder. In accordance with the given requirements the machine is sealed in foil and may be additionally packed in wood.

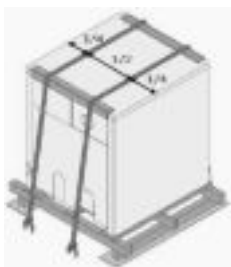
Transport on a truck


Fig. 40: Transport on a truck

1. ➤ Strap the packaged unit to the truck in accordance with the diagram.
2. ➤ Always use appropriate edge protection to avoid damage to the packaged unit.

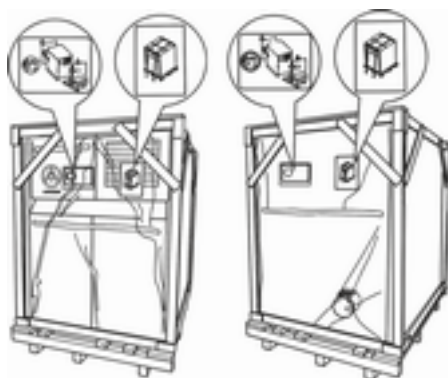
4.1.3 Packaging
4.1.3.1 Symbole auf der Verpackung
Symbols on the packaging


Fig. 41: Symbols on the front/rear side

The following symbols are displayed on the packaging. Always observe these symbols during transport.

Explanations
Centre of gravity


Fig. 42: Centre of gravity

1. ➤ Displays the centre of gravity and weight of the machine.
Observe the location of the centre of gravity for lifting work and transport.

Transport on a truck

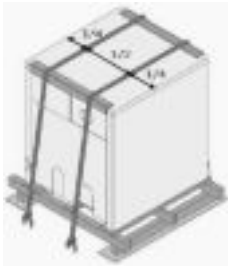


Fig. 43: Transport on a truck

2. ➤ Strap the packaged unit to the truck in accordance with the diagram.
3. ➤ Always use appropriate edge protection to avoid damage to the packaged unit.

Explanations

Transport without a pallette

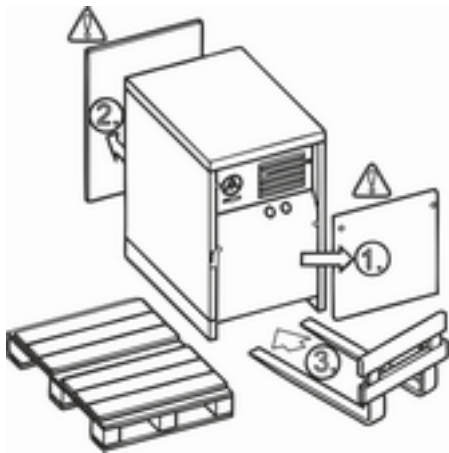


Fig. 44: Transport without a pallette

Comply with the order (pos.1-pos.3) of the work stages.

1. ➤ Open the operating side of the acoustic hood (pos.1).
2. ➤ Open the rear side of the acoustic hood (pos.2).
3. ➤ Separate the machine from the transport pallet by removing the holding screws.
4. ➤ Drive the fork of the forklift under the machine (pos.3).



WARNING!

Risk of injury if the machine topples or falls!
Observe the machine's centre of gravity.

5. ➤ Determine the machine's centre of gravity by raising it carefully.
6. ➤ Transport the machine so that it is balanced. The machine must not lean to one side.
7. ➤ Remove the lifting equipment at the installation area.

4.1.3.2 Handling packaging

Handling packaging

The various packaged items are packed in accordance with the anticipated transport conditions. In as far as it is possible, environmentally-friendly materials are used for the packaging.

The packaging is intended to protect individual components from transport damage, corrosion and other forms of damage. For this reason, do not destroy the packaging and only remove it shortly before assembly.

Only remove packaging for transport to the installation area if it has been expressly permitted.

Removing packaging


Packaging materials made of solid wood (e.g. wooden pallets, wooden crates) comply with the IPPC standard. They are re-usable. When disposing of the material, national and local requirements must be complied with.

From the machine

1. ➔


CAUTION!

Risk of injury from rough packaging material and protruding nails!

Remove packaging material.

2. ➔

Loosen the packaging foil and remove it.

3. ➔

Separate the machine from the transport pallet by removing the fastening screws.

4. ➔


ENVIRONMENT!

Packaging materials are valuable resources. They can be used several times or recycled and then re-used. The improper disposal of packaging materials can present a risk to the environment.

5. ➔

Sort packaging according to the material used and dispose of it properly. ➔ *Chapter 10.3 „Disposal“ on page 174*

From the machine

1. ➔

Loosen the packaging foil and remove it.

2. ➔

Separate the machine from the transport pallet by removing the fastening screws.

3. ➔


ENVIRONMENT!

Packaging materials are valuable resources. They can be used several times or recycled and then re-used. The improper disposal of packaging materials can present a risk to the environment.

4. ➔

Sort packaging according to the material used and dispose of it properly. ➔ *Chapter 10.3 „Disposal“ on page 174*

4.1.4 Transport inspection

Completeness



Checking for completeness

Check the goods for completeness immediately after delivery. Register missing parts and contact the manufacturer.

Check the delivery for completeness on the basis of the packing slip.

- The packing slip is provided with the product.

Transport damage



Transport damage

Register transport damage claims as soon as damage is discovered. Compensation claims for damage are only valid within the applicable claim periods.

Check the delivery immediately for transport damage.

In case of perceptible external damage, proceed as follows:

- Do not accept the delivery or only accept it under certain conditions.
- Note the scope of the damage in the transport documents or on the delivery docket provided by the carrier.
- Register the claim.

4.1.5 Transport of packaged units

4.1.5.1 Transport using industrial vehicles

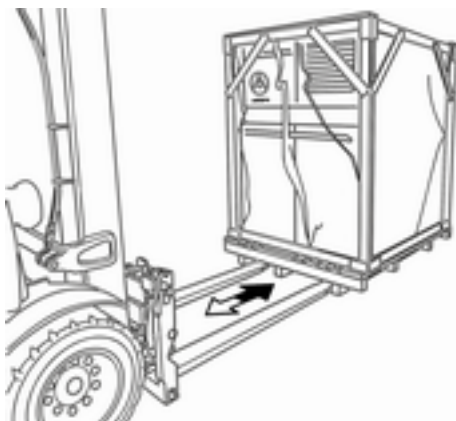


Fig. 45: Transport with acoustic hood

1. ➤



NOTICE!

Risk of toppling loads! The transport of packaged units may only be carried out using lifting equipment that reaches under the machine and fits into the transport pallet fully.

2. ➤

Insert the equipment into the provided opening in the transport pallet.

3. ➤

Take into account the centre of gravity! See the labelling on the packaging.

4. ➤



DANGER!

Risk of fatal injury from toppling components!

Determine the packaged unit's centre of gravity by raising it carefully.

5. ➤

Transport the machine so that it is balanced. The packaged unit must not lean to one side.

4.1.5.2 Transport using a crane

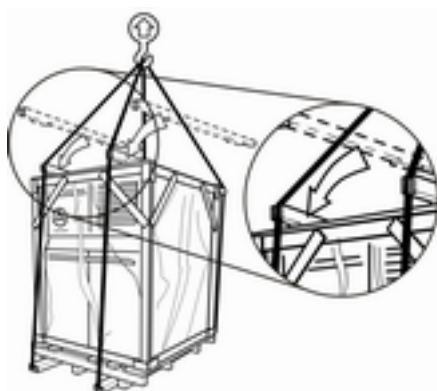


Fig. 46: Transport of packaged units

1. ➤

Guide the conveyor rails through the openings of the transport pallet.

2. ➤

Place the lifting beams on to the acoustic hood. Span length of a minimum of 150 mm longer than the dimensions of the acoustic hood.

3. ➤

Guide lifting equipment, such as cables or straps through the conveyor rails and join them above the machine using the lifting beams.

4. ➤

Take into account the centre of gravity! See the labelling on the packaging.

5. ➤



DANGER!

Risk of fatal injury from toppling components!

Determine the packaged unit's centre of gravity by raising it carefully.

6. ➤ Transport the machine so that it is balanced. The packaged unit must not lean to one side.

4.1.5.3 Transport using industrial vehicles

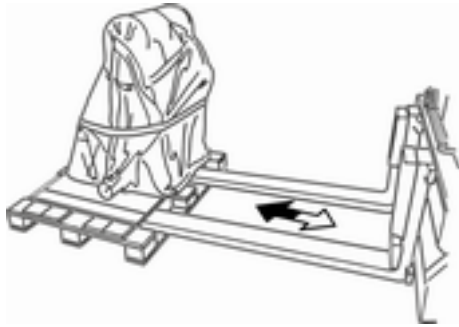


Fig. 47: Transport with belt guards

1. ➤



NOTICE!

Risk of toppling loads! The transport of packaged units may only be carried out using lifting equipment that reaches under the machine and fits into the transport palette fully.

2. ➤

Insert the equipment into the provided opening in the transport palette.

3. ➤

Take into account the centre of gravity! See the labelling on the packaging.

4. ➤



DANGER!

Risk of fatal injury from toppling components!

Determine the packaged unit's centre of gravity by raising it carefully.

5. ➤

Transport the machine so that it is balanced. The packaged unit must not lean to one side.

4.1.5.4 Transport using a crane



Fig. 48: Transport of packaged units



DANGER!

Risk of fatal injury from toppling components!



NOTICE!

Risk of damage to the machine from lifting equipment such as cables or straps.

Transport of the packaged unit with a crane is not permissible! The transport palette is not designed for crane transport.

4.1.6 Transport to the installation site

4.1.6.1 Transport using industrial vehicles

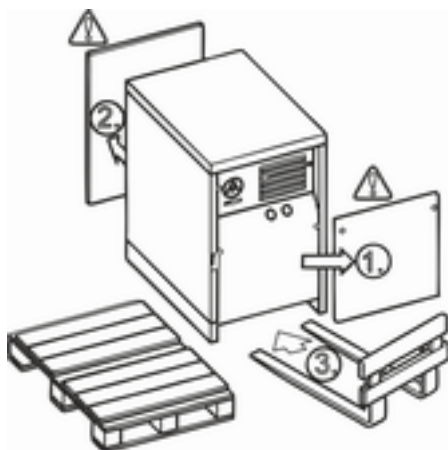


Fig. 49: Transport with acoustic hood

1. ➤ Completely remove packaging material.
2. ➤ Open the operating side of the acoustic hood (pos.1).
3. ➤ Open the rear side of the acoustic hood (pos.2).
4. ➤ Separate the machine from the transport pallet by removing the holding screws.
5. ➤ Drive the transport fork under the machine (pos.3).
6. ➤ Take into account the centre of gravity! See the labelling on the packaging.

7. ➤



DANGER!

Risk of fatal injury from toppling components!

Determine the machine's centre of gravity by raising it carefully.

8. ➤ Transport the machine so that it is balanced. The machine must not lean to one side.
9. ➤ Remove the lifting equipment at the installation area.



DANGER!

Risk of fatal injury from toppling components!

Transport of the packaged unit using an industrial vehicle is not permissible!

4.1.6.2 Transport using a crane

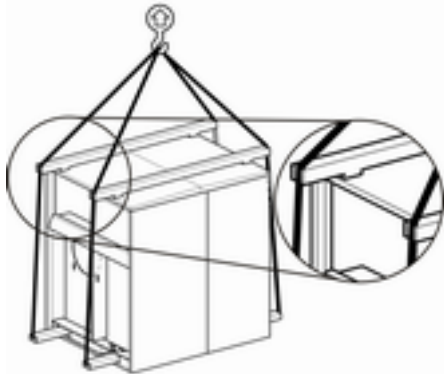


Fig. 50: Transport with acoustic hood

1. ➤ Completely remove packaging material.
2. ➤ Remove the front and rear elements of the acoustic hood and store them safely.
3. ➤ Guide the conveyor rails through the openings of the forklift tunnel.
4. ➤ Place the lifting beams on to the acoustic hood. Span length of a minimum of 150 mm longer than the dimensions of the acoustic hood.
5. ➤ Guide lifting equipment, such as cables or straps through the conveyor rails and join them above the machine using the lifting beams.
6. ➤ Separate the machine from the transport palette by removing the holding screws.
7. ➤ Take into account the centre of gravity! See the labelling on the packaging.

8. ➤



DANGER!

Risk of fatal injury from toppling components!

Determine the machine's centre of gravity by raising it carefully.

9. ➤ Transport the machine so that it is balanced. The machine must not lean to one side.
10. ➤ Remove the lifting equipment at the installation area.

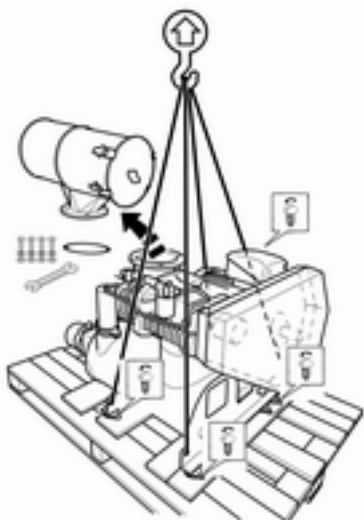


Fig. 51: Transport with belt guards

1. ➤ Completely remove packaging material.
2. ➤ Separate the machine from the transport palette by removing the holding screws.

3. ➤



NOTICE!

Risk of machine damage if the material in the intake nozzle falls! Inspect for cleanliness.

Dismantle the intake silencer on the flange joint.

4. ➤



NOTICE!

Risk of damage from the force exerted by lifting equipment on accessory components!

Only transport the machine with the hinged motor support fixed in place.

Attach the lifting equipment carefully to the fastening device.



5. ➤ Take into account the centre of gravity! See the labelling on the packaging.

6. ➤

**DANGER!**

Risk of fatal injury from toppling components!

Determine the machine's centre of gravity by raising it carefully.

7. ➤ Transport the machine so that it is balanced. The machine must not lean to one side.

8. ➤ Remove the lifting equipment at the installation area.

9. ➤ Mount the intake silencer.

4.2 Storage and preservation

4.2.1 Storage

Storage notes

Store the packaged unit under the following conditions:

- Keep flange connections closed. Avoid entry of foreign substances.
- Do not store outdoors.
- Store in a dry and dust-free place.
- Do not expose it to any aggressive media.
- Protect the packaged unit from exposure to the sun.
- Avoid mechanical vibrations.
- Avoid extreme temperature fluctuations.
- Avoid adverse water affects.
- Storage temperature: -10 to +40 °C.
- Relative humidity: maximum 80 %.
- If a vibration-free storage area is not available, move the movable components by 2 - 3 rotations every 6 - 8 weeks.

**NOTICE!**

Risk of corrosion! To avoid potential damage to the machine, an inspection of the overall scope of supply should be undertaken by the manufacturer every 2 years.



There may be information on the packaged unit regarding storage that goes beyond the requirements listed here. Comply with this information.

Storage information for periods of over 12 months

Additional measures:

- Packaging with VPI paper.
- Sealed in PVC foil.

Storage information for periods of over 12 months in a tropical climate

Additional measures:

- Drying agent (VPI power in a bag) inside the packaging.
- Packaging with VPI paper.
- Sealed in PVC foil.



Storage in air-conditioned rooms with minimum humidity has a positive influence on corrosion protection!

Packaging during storage

- Inspect the general condition of the packaging regularly. Immediately rectify damage to the packaging. If necessary, refresh or replace the anti-corrosion protection ➔ „Carrying out preservation treatment“ on page 88
- After opening the packaging:
 - Inspect uncoated parts for sufficient corrosion protection.
 - Protect against humidity and damaging environmental influences.
 - Sealing flaps from the connection openings must not be removed.
- Replace the drying agent regularly in accordance with climactic conditions.



NOTICE!

Risk of corrosion! Customised packaging is required for tropical climate zones and in the case of special customer requirements.

Damaged packaging



NOTICE!

Risk of corrosion! As a result of damaged packaging, moisture and damaging environmental influences could directly affect the product.

Measures in case of damaged packaging

- Immediately rectify damage to the packaging. If necessary, refresh or replace the preservation material.
- Dry the machine, if necessary.
- Inspect the drying agent, replace if necessary.
- Repair or replacement of the packaging.



4.2.2 Preservation

Preservation

Factory preservation protects the product for a certain time period in accordance with the relevant storage and packaging information.

Factory preservation/standard

Conveying chamber	BIO-CHEM food tech oil	biodegradable, does not contaminate groundwater
Oil chamber	Mobil SHC 626	operating lubricant oil
Shelf-life	up to 12 months	with compliance with storage conditions
Repeat	after 12 months	
Extended shelf-life (no standard)	more than 12 months	only with suitable long-term preservation and packaging

Preservation from assembly to commissioning

Treat the conveying chamber and move the rotors by 2-3 rotations.	more than 6 weeks of non-use	avoidance of corrosive and standstill damage
---	------------------------------	--

Preservation after period of non-use

Preservation of conveying chamber, oil chamber	more than 6 months	special preservation measures necessary
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Carrying out preservation treatment

Preservation measures:

1. ➤ Open the packaging. Check the machine for good accessibility.

2. ➤



WARNING!

Risk of poisoning from inhaling oil vapour!

Preservation treatment of the conveying chamber:

spray suitable preservative oil over the intake nozzle at the machine stage.



NOTICE!

Risk of filter damage!

Do not spray preservative oil into the intake filter. Never treat filter elements with preservative oil!

3. ➤



WARNING!

Risk of poisoning from inhaling oil vapour!

Preservation treatment of the oil chamber:

Spray suitable preservative oil into the machine stage through the oil fill opening and oil drain opening.

⇒ Let excess preservative oil flow out of the oil drain opening.

4. ➤ Seal the oil fill opening and oil drain.

5. ➤



WARNING!

Risk of poisoning from inhaling oil vapour!

Treat the outer, uncoated surfaces with suitable preservative oil.

6. ➤ Inspect the sealing flaps.
7. ➤ Check and restore the packaging.

5 Set-up and installation

5.1 Safety instructions

Improper set-up/installation

**WARNING!****Risk of injury from improper set-up and installation!**

Improper set-up and installation can result in serious injury or damage.

- Before beginning any work, ensure there is sufficient space for installation.
- Check the tidiness and cleanliness of the work area.
- Only use commercially-available tools or, if necessary, special tools.
Unsuitable or damaged tools may cause injury!
- Secure components against falling or tipping over during the installation.
- Install components correctly.
- Comply with the specified screw-tightening torques.

Electrical system

**DANGER!****Risk of fatal injury from electrical current!**

There is a risk of fatal injury from touching live components. Live electrical components may make uncontrolled movements and cause extremely serious, or even fatal injury.

- Before beginning work, switch off the electric power supply and secure it against restarting.

Electrostatic charges

**WARNING!****Risk of injury from electrostatic charges!**

The belt drive may generate electrostatic charges.

- Before commissioning put in place equipotential bonding.
- Only use electrically-conductive belts.

Requirements for staff

Requirements for set-up and installation:

Set-up and installation of electrical components



Personnel: ■ Authorised electricians

Set-up and installation of mechanical components

Personnel: ■ Service personnel

Protective equipment

Requirements for set-up and installation:

Protective equipment: ■ Protective work clothing
■ Safety shoes
■ Protective gloves
■ Safety goggles
■ Industrial hard hat

Special tools

Requirements for set-up and installation:

Special tool: ■ Tools for authorised electricians
■ Electric drill
■ Drills
■ General tool kit
■ General measurement tools and equipment

Special tool: ■ Locking key

5.2 Requirements for the installation site

Ground properties

Inspect the ground properties. These should be as follows:

- stable
- even
- free of vibrations
- without any incline
- without holes



NOTICE!

Risk of deformation of the acoustic hood substructure! Do not install or mount the machine on "hollow" or lamellar foundations.



Subsurface requirements for the cement floor.

The cement floor should have a recommended surface pressure resistance of 30 - 40 N/mm².

Flatness tolerance according to DIN 18202

	Distance between measuring points in (m)					
	0.1	1	4	10	>15	/
Dimension tolerance in (mm)	2	4	10	12	15	/

Angular tolerance according to DIN 18202

	Distance between measuring points in (m)					
	up to 1	over 1 up to 3	over 3 up to 6	over 6 up to 15	over 15 up to 30	over 30
Dimension tolerance in (mm)	±6	±8	±12	±16	±20	±30

Surroundings

- Ensure there is a suitable fresh air supply.
- Avoid heat accumulation.



NOTICE!

Risk of corrosion! There must not be any excessive levels of dust, acids, steam or explosive or flammable gases at the installation site!

Installation with belt guards

The machine is only suitable for indoor installation.

Machine installation site

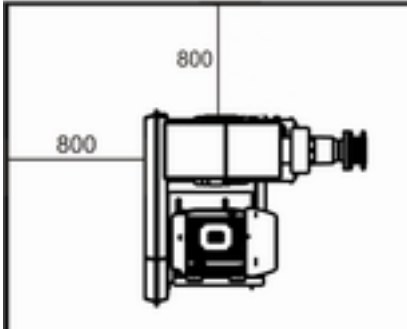


Fig. 52: Overall dimensions

- Comply with the overall dimensions for maintenance work. Observe the installation drawing.
- Provide measures for sound insulation.
- Take the following precautionary measures:
 - If possible, switch off the machine before entering the operating area. Otherwise wear hearing protection.
 - Provide appropriate signage at the installation site.
 - The installation site must only be accessible for trained persons.
 - Choose an installation site where the duration of time persons spend in the immediate vicinity of the machine is extremely limited.

Installation with acoustic hood

The machine is suitable for indoor and outdoor installation.

Machine installation site

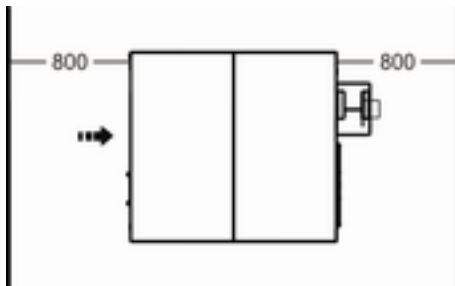


Fig. 53: Overall dimensions

- Comply with the overall dimensions for maintenance work. Also consult the installation drawing.
- Take the following precautionary measures:
 - If possible, switch off the machine before entering the operating area.
 - Otherwise wear hearing protection.
 - The installation site must only be accessible for trained persons.
 - Provide appropriate signage at the installation site.
 - Choose an installation site where the duration of time persons spend in the immediate vicinity of the machine is extremely limited.

5.3 Installation

Models with acoustic hoods;
aligning and dowelling



Fig. 54: Spirit level alignment

1. ➤ Carefully align the machine.
2. ➤ Position it so that it is balanced.

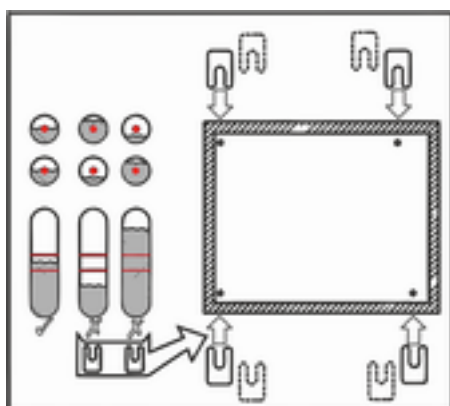


Fig. 55: Shim alignment

3. ➤



NOTICE!

Risk of total machine damage! Installing a machine at an angle may, as a result of an undefined oil level, can lead to a total machine loss. Observe the level and angle tolerances.

If necessary, use the intended shims on the bolting surfaces.



Fig. 56: Mounting holes

4. ➤ Recommendation: Drill and dowel four mounting holes and screw the machine into these.

Models without acoustic hoods; aligning and dowelling

1. ➤ Carefully align the machine.
2. ➤ Position it so that it is balanced.
3. ➤



NOTICE!

Risk of irreversible machine failure! Installing a machine at an angle may, as a result of an undefined oil level, can lead to a total machine loss. Observe the level and angle tolerances.

If necessary, use the intended shims on the bolting surfaces.

4. ➤ A single bolt per machine foot is sufficient.
Drilling, dowelling and screwing tight the mounting holes

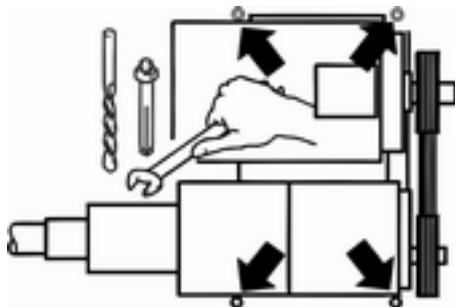


Fig. 57: Mounting holes

5.4 Connecting the system pipeline

System pipeline



NOTICE!

Risk of machine damage! The connected pipeline must not exert forces or moments that affect the machine.

Secure and fasten the system pipeline.



Observe the labelling and dimensions on the installation drawing.

Bushings/2 clamps



Fig. 58: 2 clamps

1. ➤ Remove the sealing cover from the connection openings.
2. ➤ Connect the system pipeline.
⇒ Make sure that the clamps are offset by 180° to one another.

Bushings/4 clamps



Fig. 59: 4 clamps

3. ➤ Connect the system pipeline.
⇒ Make sure that the clamps are offset by 180° to one another.

Connection of a compensator

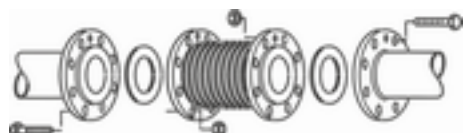


Fig. 60: Connection of a compensator

4. ➤ Connect the system pipeline.
5. ➤ Close off the pipeline duct using a shim.

5.5 Connecting the drive motor

5.5.1 Preparing the connection

Preparation with acoustic hood

1. ➤ ➤ Chapter 3.8.1 „Drive motor“ on page 60

2. ➤



DANGER!

Risk of fatal injury in the case of incorrect electrical connection data!

Compare the electrical connection data of the drive motor with those of the operator-side grid.

3. ➤ Shut down the power from the operator-side grid.
4. ➤ Observe the cable routing on the installation drawing!

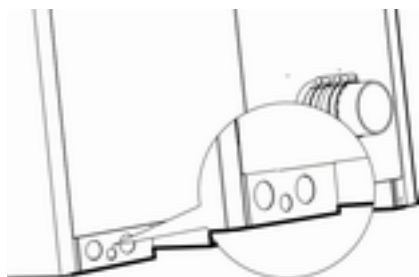


Fig. 61: Position on the acoustic hood

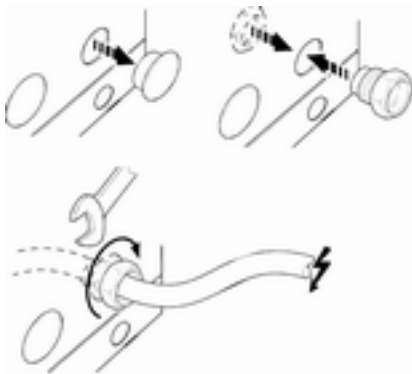


Fig. 62: Preparation

5. ➤ Prepare the cable feedthroughs.

6. ➤



DANGER!

Risk of fatal injury from electric current!

Check that there is no live current in the connection cable.

7. ➤ Lay the connection cable through the cable feedthroughs.

5.5.2 Routing cables

Routing the connection cable

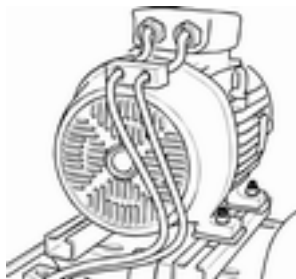


Fig. 63: Cable laying alignment

1. ➤ Route the connection cable in accordance with the installation drawing.

2. ➤



NOTICE!

Risk of damage! The minimum bending radius must not be undershot!

Observe the bending radii.

⇒ Bending radius of the connection cable = 15 x cable sheath diameter

5.5.3 Connecting the drive motor

Motor connection

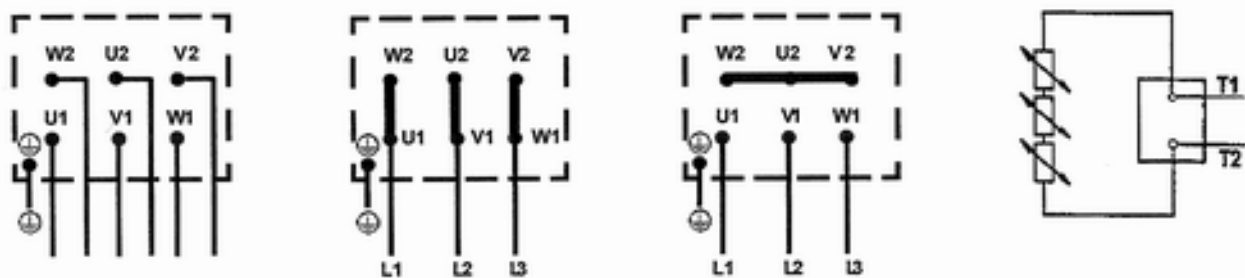


Fig. 64: Connection layout

Star-delta connection

Delta connection

Star connection

Thermal winding shield

1. ➤ Open the motor terminal box.
2. ➤ Check the alignment of the terminal box.
⇒ The terminal box must be aligned with openings for the cable feedthroughs facing in the direction of the motor fan.
3. ➤ Attach a screwed cable gland to the terminal box.
4. ➤ Guide the motor cable through the screwed cable gland.
5. ➤ Connect the cable connections with the motor terminals correctly, in accordance with the connection layout.
6. ➤ Close the terminal box.
7. ➤ Ensure that the connection cable is not damaged by the movement of the hinged motor support.

5.6 Connecting the drive motor

5.6.1 Preparing the connection

Preparation with belt guards

1. ➤ ➤ Chapter 3.8.1 „Drive motor“ on page 60.

2. ➤


DANGER!

Risk of fatal injury in the case of incorrect electrical connection data!

Compare the electrical connection data of the drive motor with those of the grid operator.

3. ➤ Shut down the power from the operator-side grid.

4. ➤


DANGER!

Risk of fatal injury from electric current!

Check that there is no live current in the connection cable.

5.6.2 Routing cables

Routing the connection cable

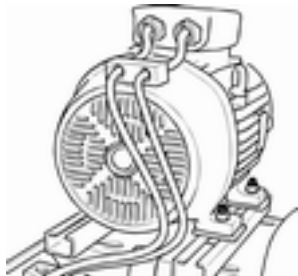


Fig. 65: Routing cables

1. ➤ Route the connection cable in accordance with the installation drawing.

2. ➤



NOTICE!

Risk of damage! The minimum bending radius must not be undershot!

Observe the bending radii.

⇒ Bending radius of the connection cable = 15 x cable sheath diameter

5.6.3 Connecting the drive motor

Motor connection

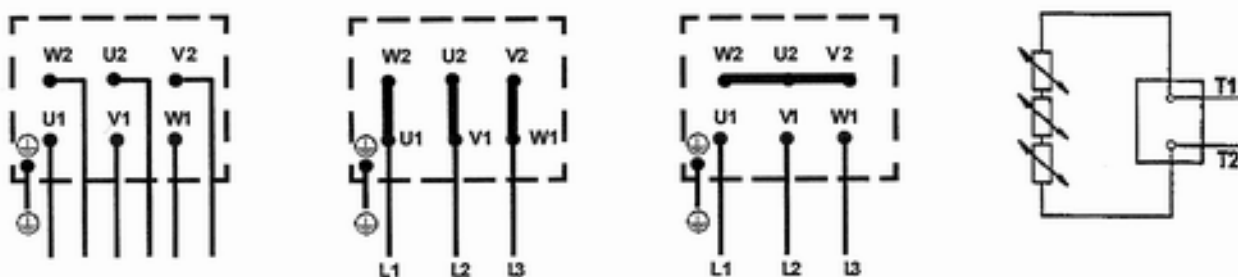


Fig. 66: Connection layout

Star-delta connection

Delta connection

Star connection

Thermal winding shield

1. ➤ Open the motor terminal box.
2. ➤ Check the alignment of the terminal box.
 - ⇒ The terminal box must be aligned with openings for the cable feedthroughs facing in the direction of the motor fan.
3. ➤ Attach a screwed cable gland to the terminal box.
4. ➤ Guide the motor cable through the screwed cable gland.
5. ➤ Connect the cable connections with the motor terminals correctly, in accordance with the connection layout.
6. ➤ Close the terminal box.
7. ➤ Ensure that the connection cable is not damaged by the movement of the hinged motor support.

5.7 Connecting the machine's terminal strip

Machine terminal strip

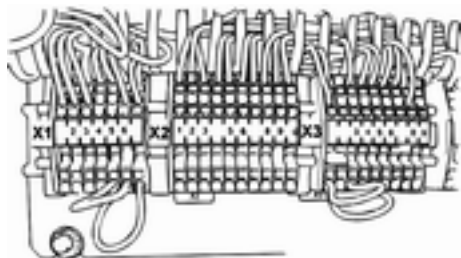


Fig. 67: Terminal box connections

1. → Open the terminal box.

2. → Observe the wiring scheme.

The wiring scheme can be found in the terminal box or in the product documentation.

3. →



DANGER!

Risk of fatal injury from electrical current!

Ensure that the connecting cable is not live.

4. →



Connection layout according to the AERZEN wiring scheme!

Guide the external connecting cable to the terminal box.

5. →

Guide the connecting cable correctly through the cable entry (dummy cover) to the terminals.

6. →

The cable entry (dummy cover) can be equipped on site with screwed cable glands.

7. →

Close the terminal box properly.

5.8 Connecting the earthing

Connecting the earthing

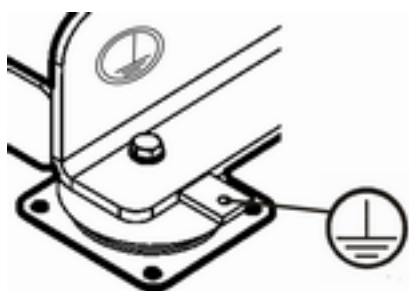


Fig. 68: Example connection

1. →



The exact position of these connections can be found in the installation drawing.

Earth the machine on the provided connections.

2. →

Observe the cross-sections of the earthing strap! ↗ Chapter 11.9.2 „Earthing strap cross-sections “ on page 194.

3. →

Beware of uncovered metal contact surfaces.

4. →

Screw contacts tightly together.

5.9 Connecting the earthing

Connecting the earthing

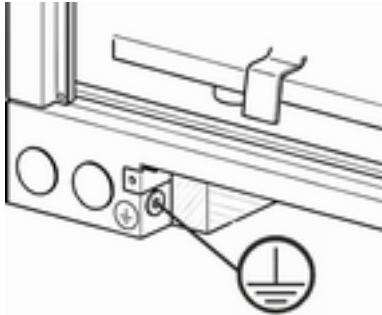


Fig. 69: Example connection


1. ➤



The exact position of these connections can be found in the installation drawing.

Earth the machine on the provided connections.

2. ➤

Observe the cross-sections of the earthing strap!
See  Chapter 11.9.2 „Earthing strap cross-sections“ on page 194.

4. ➤

Beware of uncovered metal contact surfaces.

5. ➤

Screw contacts tightly together.

5.10 Laying the insulation mat

Laying the insulation mat

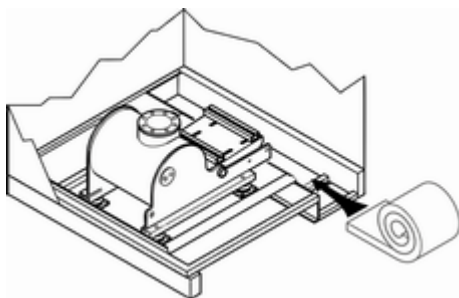


Fig. 70: Laying of the insulation mat

- Depending on the scope of delivery, the insulation mat is delivered separately.
- Lay the insulation mat in the exhaust duct of the acoustic hood.

6 Initial start-up

6.1 Safety instructions

Improper commissioning

**WARNING!****Risk of injury from improper commissioning!**

Improper commissioning may lead to serious injury and considerable material damage.

- Before commissioning, ensure that all installation work has been carried out and completed in accordance with the information and notes in this instruction manual.
- Before commissioning, ensure that there are no persons in the hazard area.

Requirements for staff

Requirements for commissioning:

Commissioning of electrical components

Personnel: ■ Authorised electricians

Commissioning the frequency converter:

Personnel: ■ Authorised electricians with additional qualifications

Commissioning of mechanical components

Personnel: ■ Service personnel

Protective equipment

Requirements for commissioning:

Protective equipment: ■ Protective work clothing
■ Safety shoes
■ Hearing protection
■ Protective gloves
■ Safety goggles
■ Industrial hard hat

Special tools

Requirements for commissioning:

Special tool:

- Ratchet wrench
- Oil funnel
- Test pump
- General tool kit
- General measurement tools and equipment
- Tools for authorised electricians

Special tool:


- Locking key

6.2 Preparation for commissioning

Preparation


1. ➤ Check that the machine has been correctly installed. See requirements at the installation site ↗ *Chapter 5.2 „Requirements for the installation site“ on page 91.*
2. ➤ Check that the packaging has been fully removed.
3. ➤ Check that all seals and covers on the piping connections have been removed.
4. ➤ Check that the piping connections are clean. Remove any dirt, dust or foreign matter from the intake area.
5. ➤ Ensure that the inlet and exhaust air openings on the acoustic hood are unobstructed.

Ventilation

6. ➤  *Take the ambient temperature into consideration. Operating conditions ↗ Chapter 11.4 „Technical performance data“ on page 181*

Ensure that the installation site is adequately ventilated.

Take noise protection into consideration.

7. ➤  *Natural vibrations and sound emissions may be induced in piping and foundations!*

Prevent natural vibrations and associated sound emissions with suitable measures, e.g. insulation.

Ventilating the manometer

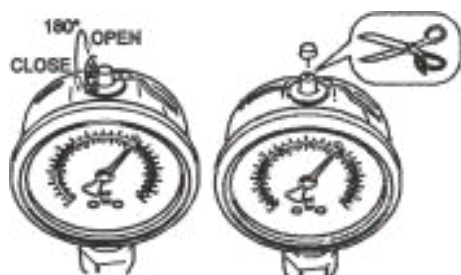


Fig. 71: Ventilating the manometer

Maintenance indicator (a)



Fig. 72: Variation a)

Maintenance indicator



Fig. 73: Variation b)

Aligning the sheaves

Connecting the piping

8. ▶ Prepare the manometer in line with its specific design.

- Cut off the rubber connections on the upper section.
- Turn the bleeder flap to OPEN.

9. ▶ Set to zero.

- Press the front reset button and set the pointer to the zero position.

10. ▶ Set to zero.

- Remove the plugs on the front.
- Adjust the set screw using a screwdriver.
- Observe the “+” and “-” markings.
- Position the red trailing pointer between 0 and -10 mbar.

11. ▶ Check the alignment of the sheaves.

- The maximum permitted sheave offset is 0.5 mm.

12. ▶ Connect the depressurised system piping.

Removing the sealing plugs

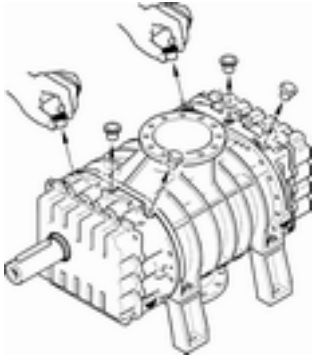


Fig. 74: Sealing plug configuration

- 13.** Remove the sealing plugs from the balancing holes.



The sealing plugs may be coated in machine paint as part of the manufacturing process.

The number of sealing plugs varies depending on the machine type!

Depending on the design, they may already have been removed before shipping.



NOTICE!

Risk of damage if sealing plugs are not removed! If sealing plugs are not removed, there is a risk that the machine will start to leak oil. Lube oil could enter the conveying chamber.

No lube oil



Fig. 75: Do not fill with lubricant oil

- 14.**



NOTICE!

Risk of damage! Lube oil must not enter these bore holes!

These bore holes are solely intended to discharge leaking gases. Filling with oil results in the need for considerable repairs.

Checking the acoustic hood fan

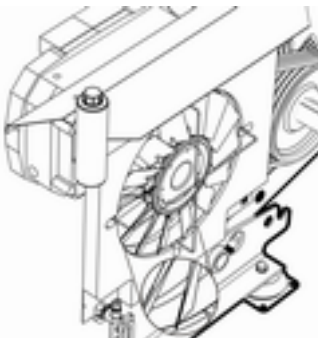


Fig. 76: Fan cover

- 15.** Check the fan wheel for smooth movement and contact-free operation.

If necessary, adjust the cover plate.

Frequency converter installation and connection

16.



Observe the manufacturer's instruction manual!

Position and assemble the frequency converter.

- Connect it according to the manufacturer's instructions.
- See also the assembly group description for frequency converters. ↗ *Chapter 3.8.4 „Frequency converter“ on page 63*

Checking the EMERGENCY STOP function

17.

Check whether the EMERGENCY STOP function is in place and installed.

- Check for correct operation.
- Enter the test result in the test book.

Preparing the hinged motor support

Disassemble the transport safety lock.

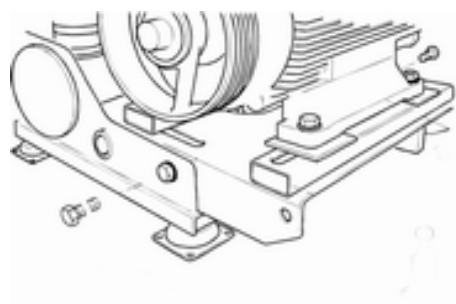


Fig. 77: Example: DN50

Disassemble the transport safety lock.

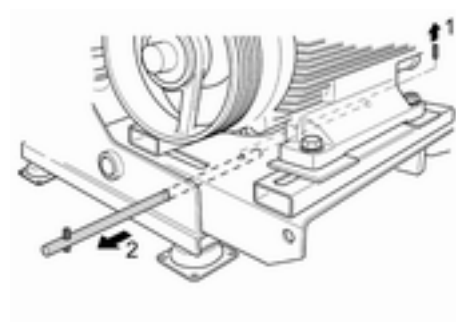


Fig. 78: Example: DN80

Handling without lifting device

1.

Remove the safety screws for transport.

2.

- 1.) Remove the split pin.
 - 2.) Disassemble the safety rod for transport.
- ⇒ The safety rod later acts as an aid for supporting the hinged motor support.

Preparing the hinged motor support

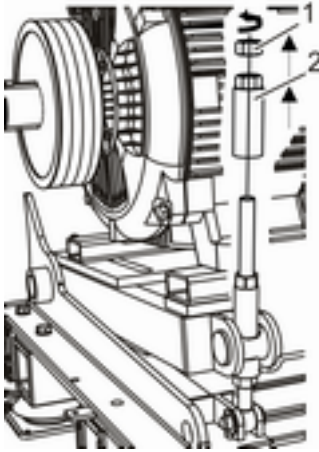


Fig. 79: Hinged motor support preparation

Handling with lifting device

- ➔ Remove counternut the (pos.1) and locking sleeve (pos.2).

6.3 Performing commissioning

6.3.1 Filling oil, version featuring oil system

Filling with oil



Fig. 80: Version with oil system

1. ➔ Open the maintenance elements of the acoustic hood.

2. ➔



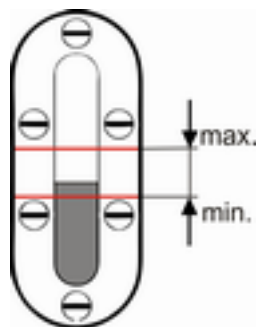
When working with operating materials such as lube oil, wear personal protective equipment.



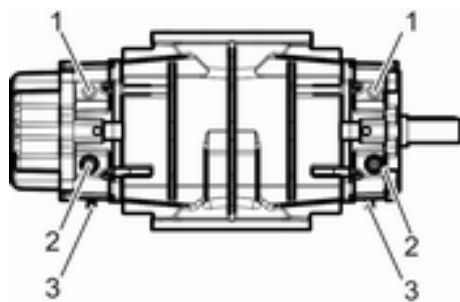
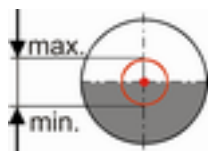
ENVIRONMENT!

Environmental risks from incorrect handling of lubricants!

Fill with lube oil. ↗ Chapter 8.3.1 „First oil filling“ on page 136

**Checking the acoustic hood's oil level.***Fig. 81: Acoustic hood oil level display*

- 3.** → Check the lube oil level on the acoustic hood's oil level display and adjust as necessary.

Check the machine stage's oil level*Fig. 82: Machine stage**Fig. 83: Oil level display (item 2)*

- 4.** → Check the lube oil level on the machine stage's oil level displays (item 2) and adjust as necessary.

6.3.2 Filling with oil, models without oil system

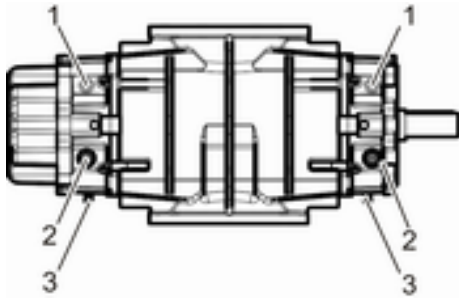


Fig. 84: Machine stage GM3S-GM80L

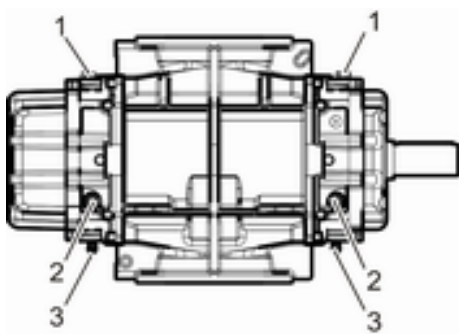


Fig. 85: Machine stage GM90L-GM400L

1. ➔



When working with operating materials such as lube oil, wear personal protective equipment.



ENVIRONMENT!

Environmental risks from incorrect handling of lubricants!

Loosen the RED-marked locking screw (pos. 1). Fill with lube oil. ➔ „Filling with oil“ on page 137

Checking the oil level

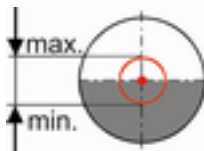


Fig. 86: Oil level display (Pos. 2)

2. ➔

Check the lube oil level and correct it if necessary.

6.3.3 Establishing an electrical connection

1. ➔



DANGER!

Risk of fatal injury from electric current!

Supply electrical components with electricity.

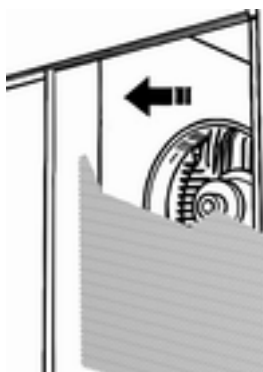
See ➔ Chapter 5.5 „Connecting the drive motor“ on page 95.

2. ➔

Connect and activate motor overload protection. ➔ Chapter 11.9.3 „Motor overload protection“ on page 194

3. ➔

Observe the permissible starting frequency of the drive motor. ➔ „Permissible starting frequency“ on page 61

**Checking direction of rotation/
models with acoustic hood***Fig. 87: Motor direction of rotation***4.** →**WARNING!**

Risk of injury from rotating components!

**NOTICE!**

Risk of machine damage from incorrect direction of rotation!

Check the direction of rotation **without belts** in place.

- If in place, remove the perforated plate cover of the drive motor's sheave.
- Observe the sign with direction of rotation on the machine stage and on the drive motor.
- Start the drive motor briefly (approx. 1 to 2 seconds).
- Viewed towards the front of the drive shaft, the drive motor turns anti-clockwise.
 - Direction of rotation is correct = continue commissioning.
- From the viewing position, the drive motor turns right in front of the drive shaft.
 - Direction of rotation is incorrect = correct the electrical connection.
- Where applicable, attach the perforated plate cover of the drive motor.

Checking the direction of rotation/ models without acoustic hood

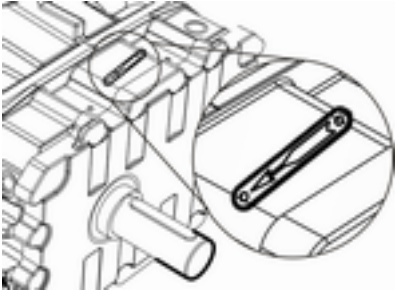


Fig. 88: Direction of rotation

5. ➔



WARNING!

Risk of injury from rotating components!



NOTICE!

Risk of machine damage from incorrect direction of rotation!

Check the direction of rotation **without belts** in place.

- Remove the cover from the belt guard.
- Observe the sign with direction of rotation on the machine stage.
- Start the drive motor briefly (approx. 1 to 2 seconds).
- Viewed towards the front of the drive shaft, the drive motor turns anti-clockwise.
 - Direction of rotation is correct = continue commissioning.
- From the viewing position, the drive motor turns right in front of the drive shaft.
 - Direction of rotation is incorrect = correct the electrical connection.
- Mount the cover of the belt guard.

Disconnecting the electrical power supply

6. ➔



WARNING!

Risk of injury from an automatic start-up!

Deactivate the machine and secure it against restarting.

6.3.4 Handling the hinged motor support *with* lifting device

Fitting the belt

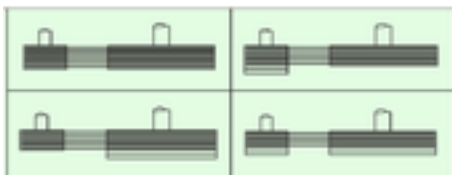


Fig. 89: Permissible belt layout

1. ➔



WARNING!

Risk of injury from moving or rotating components!

Observe and comply with the permissible groove layout.

Loosening the self-locking nut

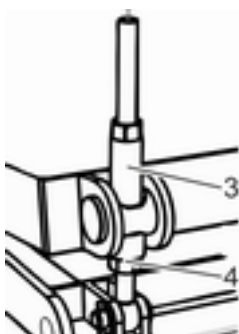


Fig. 90: Loosening the self-locking nut

2. ➔



NOTICE!

Prevention of wear and tear on belts.

Screw the self-locking nut (pos.4) all the way downwards.

⇒ The hinged motor support can be adjusted to the correct position.

Pre-tensioning belts

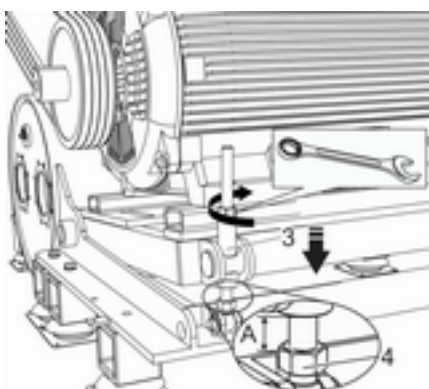


Fig. 91: Pre-tensioning belts

3. ➔



CAUTION!

Risk of injury from tensioning components!

Turn guide bushing (pos.3) clockwise with the ratchet wrench until the belts are pre-tensioned.

⇒ The hinged motor support is partly held by the belt drive and rests lightly on the guide bushing (pos.3).

Adjusting the guide bushing

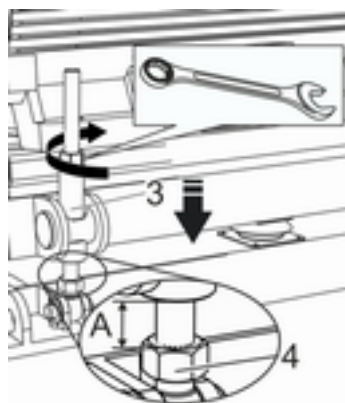


Fig. 92: Adjusting the guide bushing

4. ➔

Set gauge A.

- Set self-locking nut (pos.4) to gauge A. Turn guide bushing (pos.3) on to the self-locking nut (pos.4) using the ratchet wrench.

DN/discharge side	Gauge A in mm
80	20
100	25
125	30
150	35
200	40
250	45
300	50
Delta Blower G5	

Tensioning the belts

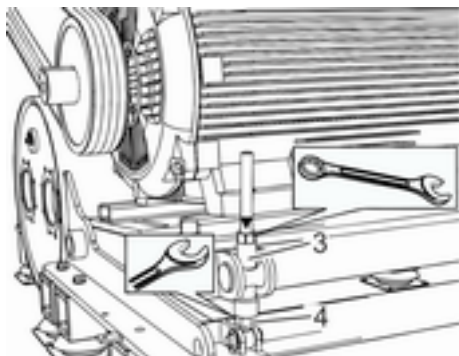


Fig. 93: Tensioning the belts

5. ➤



CAUTION!

Risk of injury from moving and rotating components!

Tension the belts.

- Secure the guide bushing (pos.3) with the self-locking nut (pos.4).
- The hinged motor support is supported entirely by the belt drive.

6.3.5 Handling hinged motor support *without* lifting device

Raising the hinged motor support of the DN50

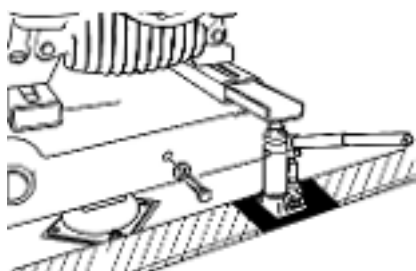


Fig. 94: Example: DN50

1. ➤ Insert the lifting bracket in the motor's attachment rail.



NOTICE!

Only use hydraulic lifts on solid, level ground.

Position the hydraulic lift securely.

2. ➤



WARNING!

Risk of shearing and crushing from moving loads!

Slowly raise the hinged motor support by pumping the hydraulic lift.

3. ➤



WARNING!

Risk of injury from the hydraulic lift tipping up or slipping!

Raise the hinged motor support in small steps and always support it with timbers! This prevents the sudden downward movement of the hinged motor support if the hydraulic lift tips up or slips.

Raising the hinged motor support of the DN80

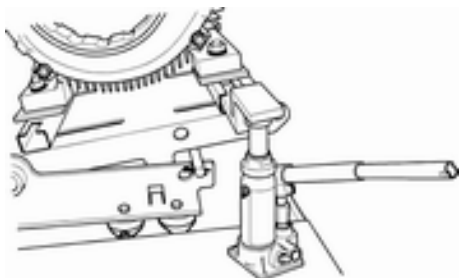


Fig. 95: Example: DN80

4. → Insert the lifting bracket in the motor's attachment rail.



NOTICE!

Only use hydraulic lifts on solid, level ground.

Position the hydraulic lift securely.

5. →



WARNING!

Risk of shearing and crushing from moving loads!

Slowly raise the hinged motor support by pumping the hydraulic lift.

6. →



WARNING!

Risk of injury from the hydraulic lift tipping up or slipping!

Raise the hinged motor support in small steps. While doing so, use the transport safety rod to brace the hinged motor support in the recess of the base support. This prevents the sudden downward movement of the hinged motor support if the hydraulic lift tips up or slips.

7. → Raise the hinged motor support until the belts can be fitted.

Fitting the belt

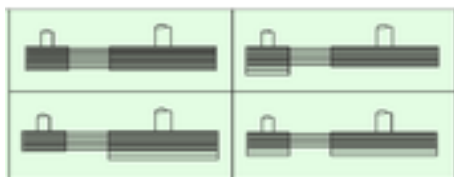


Fig. 96: Permissible belt layout

8. →



CAUTION!

Risk of injury from tensioning components!

Fit the belt. Observe and comply with the permissible groove layout.

Tensioning the belts

9. →



WARNING!

Risk of injury from tensioning, moving or rotating components!

Release the hydraulic lift carefully and slowly.

⇒ The hinged motor support is lowered.

If released too quickly, the hinged motor support drops suddenly.

The belts are tightened by the weight of the motor.

- 10.** ▶ Completely remove the hydraulic lift and other auxiliary equipment and store them safely for future maintenance purposes.

11. ▶



NOTICE!

Risk of damage to the belt drive! The hinged motor support must not rest on the base support, the transport securing rod or similar equipment.

Completely remove the hydraulic lift, transport securing rod and other auxiliary equipment and store them safely for future maintenance purposes.

6.3.6 Carrying out a test run

Check the oil level.

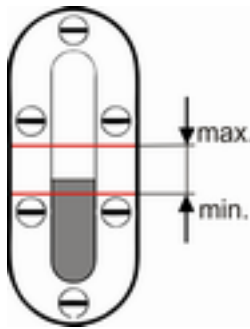


Fig. 97: Oil level display

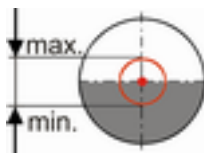


Fig. 98: Oil level display

- 1.** ▶ Check the lube oil level on the oil level displays.
- 2.** ▶ If the lube oil level is at the same position between all the oil displays' min.-/max. marks:
 - ⇒ the oil level is OK.
- 3.** ▶ If the lube oil level is not at the same position between the oil displays' min.-/max. marks:
 - ⇒ correct the machine's alignment. Observe the filling quantities.

4. →


CAUTION!

Risk of injury from moving components!

Carry out a test run of the belt drive and check that it is operating correctly.

Characteristics:

- quiet, even operation.
- even load.
- no excessive vibrations.
- no whistling noises.
- no increased wear.

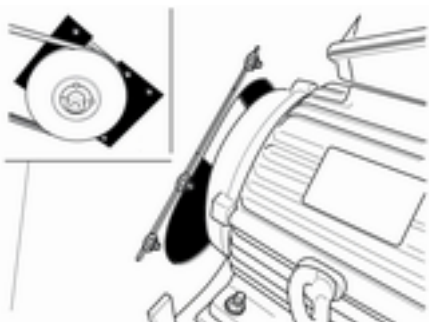
**Checking the protective cover/
models without acoustic hood**


Fig. 99: Protective cover

**Adjusting the protective cover/
models without acoustic hood**


Fig. 100: Adjusting the protective cover

5. →

Check the spacing of the pre-mounted protective cover for the motor drive shaft.

- The protective cover should be at a distance of approx. 10 mm from the motor drive shaft.
- By loosening the fastening screws, the protective cover can be moved.
- Check the protective cover for firm seating and, if necessary, tighten it.

6. →

If the protective cover is supplied separately, adjust the cover plates accordingly. The cover plates can be snapped off at the required length.

Assembling and adjusting the protective cover/models without acoustic hood

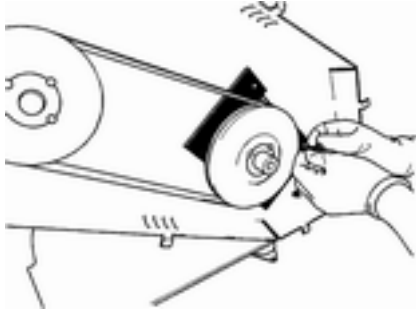


Fig. 101: Assembly/adjusting

Assembling the acoustic hood Connecting the power supply

7. ▶



WARNING!

Risk of injury from rotating components!

Assemble the protective cover after tensioning the belts.

- The protective cover should be at a distance of approx. 10 mm from the motor drive shaft.
- Operation is only permissible with a mounted cover!

8. ▶

Close the maintenance element of the acoustic hood.

9. ▶



WARNING!

Risk of injury from electric current!

Supply electrical components with electricity.

Inspecting shut-downs

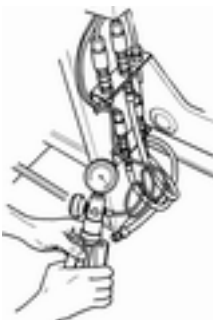


Fig. 102: Test pump

Opening the system line Checking the safety valve

10. ▶

Check the correct operation of all pressure switches/sensors that can trigger a shut-down.

- Connect the test pump to the corresponding measurement line.
- Simulate the tripping pressure.
- Check to see if a shut-down process is triggered.
- Remove the measurement line from the test pump.
- Fit the measurement line to the measuring point on the machine.

11. ▶

Open valves on the system side.

12. ▶

Check the safety valve for correct operation.

Starting briefly
13.

WARNING!

Risk of injury from rotating components!


WARNING!

Risk of injury from pressurised components!

Do not loosen or remove any locking screws or pipe connections.

Switch on the drive motor.

- After approx. 20 seconds, switch it off.
- Make sure the motor coasts down smoothly.

Checking the frequency converter for correct operation
14.

Read and follow the manufacturer's operating instructions!

DANGER!

Risk of fatal injury from electric current and residual energy for all work performed on frequency converters!

See also the assembly group description for frequency converters. ↗ *Chapter 3.8.4 „Frequency converter“ on page 63*
Starting the drive motor
15.

WARNING!

Risk of injury from rotating components!

As long as there are no malfunctions: restart the drive motor.

- Check the EMERGENCY STOP function.
- Check the machine's protective equipment.

Checking after first commissioning
16.

WARNING!

Risk of injury from pulling or opening pressurised lubricating and control oil pipes.

Perform the following checks:

↗ *Chapter 6.4 „Performing checks after commissioning“ on page 119*

Acoustic hood protection

17.▶



WARNING!

Risk of injury if protective equipment is not present.

Correctly close the elements of the acoustic hood.

- Store the acoustic hood key safely.
- Only allow access for authorised personnel.

Belt protection

18.▶



WARNING!

Risk of injury if protective equipment is not present.

Mount the belt protection cover.

Operational readiness

19.▶

If there are no malfunctions, the machine is ready for operation.



After the first few hours of operation, preservative oil may gather in the parting faces as a result of the machine warming up.



6.4 Performing checks after commissioning

Inspection	After the first 3 op. hrs	After the first 25 op. hrs
Screws	after the machine has cooled down, re-tighten if necessary	
Safety valve	Check for correct operation	
Oil level	check and, if necessary, correct	check and, if necessary, correct
Aligning the sheaves		check, correct if necessary
Condition of the belts		check, change if necessary, establish cause
Control system, fault transmitter, pressure and temperature sensors	check for correct operation	
Motor overload protection	connected and active	
Accumulation of preservative oil		check, remove if necessary
op. hrs = operating hours		

7 Operation

7.1 Safety instructions

Improper operation



WARNING!

Risk of injury from improper operation!

Improper operation may lead to serious injury and considerable material damage.

- Carry out all activities in accordance with the information and notes in this instruction manual.
- Before beginning work, observe the following:
 - Ensure that all covers and safety devices are installed and operating correctly.
 - Ensure that there are no persons in the hazard area.
- Never deactivate or bypass safety devices during operation.

Open acoustic hood



WARNING!

Risk of injury from operation with an open acoustic hood!

Open acoustic hoods may lead to dangerous situations and cause injury during machine operation.

- Always keep the acoustic hood closed during operation.

Adjusting valves



DANGER!

Risk of injury when adjusting valves!

When the machine is running and an attempt is made to adjust a valve, body parts may be injured by rotating components. Take into account the stand-by mode and/or automatic start-up

Only make adjustments if:

- The machine is not running.
- The machine is secured against a restart.

Explosion and fire hazards



DANGER!

There is a risk of explosion and fire from ignition hazards!

Avoid allowing ignition hazards (open flames, flying sparks, weld spatter) into the vicinity of the machine. Sparks and incandescent or flammable objects could be sucked in through the supply air openings on the acoustic hood or through the intake silencer. The fan may ignite these elements causing fire or an explosion.

- Avoid ignition hazards.
- Never carry out work that generates sparks while the machine is in operation.
- Ventilate the installation site properly.

Requirements for staff

Requirements for operation:

Operating the machine

Personnel: ■ User

Adjusting valves

Personnel: ■ User

■ Authorised electricians

Protective equipment

Requirements for operation:

Protective equipment: ■ Protective work clothing
 ■ Safety shoes
 ■ Hearing protection

Special tools

Adjusting the valves requires:

Special tool: ■ General tool kit

Special tool: ■ Locking key

7.2 Shut-down in case of emergency

In hazardous situations, the movements of components must be stopped as quickly as possible and the electric power supply must be shut off.

Shut-down in case of emergency

In an emergency, proceed as follows:

1. ➤ Activate the EMERGENCY STOP immediately.
2. ➤ Inform the responsible staff.
3. ➤ Switch off the main circuit breaker and secure it against restarting.
4. ➤ Assign qualified personnel the task of rectifying the fault.
5. ➤



WARNING!

An unauthorised or unregulated restart can have fatal consequences.

Before commissioning, ensure that all safety devices are installed and operational.

7.3 Switching on

Operating modes

Depending on the operating mode, the machine can be switched on in the following ways:



*If possible, start up the machine without load!
Observe the control circuit types!*

When starting and stopping the drive motor, observe all of the machine's protective measures. Power take-offs must be actuated by a potential-free contact or be actuated directly. The start-up of the power take-offs runs in parallel to the drive motor.

AERtronic

The starting and stopping of the drive motor must be carried out by AERtronic. A potential-free contact is already in place.

7.3.1 On-site operation

On-site manual operation



DANGER!

Risk of injury if protective equipment is missing!

Manually activate the starter switch on the machine on site.

⇒ The machine starts and comes on stream.

7.3.2 Remote operation

Via remote station


DANGER!

Risk of fatal injury if protective equipment is missing!


WARNING!

Risk of injury if the machine starts suddenly!

Activate the starter switch in the remote station.

⇒ The machine is started remotely and comes on stream.

Remote station with AERtronic

- Remotely via potential-free contact
- Remotely via MODBUS RTU
- Remotely via PROFIBUS DP

7.3.3 Automatic operation

Automatic activation


DANGER!

Risk of fatal injury if protective equipment is missing!


WARNING!

Risk of injury if the machine starts suddenly!

The starting command is carried out by sensors or a system switch.

⇒ The machine starts automatically and comes on stream.

7.4 Displaying operating parameters

AERtronic (optional)



Fig. 103: AERtronic display



A detailed explanation is contained in the separate operating manual AS-002.

Analogue instruments (optional)

Depending on their design, analogue instruments display the given operating data, e.g. discharge pressure, discharge temperature, oil pressure.

Control system (optional)

Depending on the customer's control system, additional operating parameters can be recorded and displayed.

7.5 Switching off

Operating mode

Depending on the operating setup, the machine can be switched off in the following ways:

7.5.1 On-site operation

On-site manual operation



WARNING!

Risk of injury from unbraked shut-down!

Manually activate the cut-out switch on the machine.

- ⇒ The machine is switched off and shuts down. The machine does not stop immediately.

7.5.2 Remote-controlled operation

Via remote station



WARNING!

Risk of injury from unbraked shut-down!

Activate the cut-out switch in the remote station.

- ⇒ The machine is switched off and shuts down. The machine does not stop immediately.

7.5.3 Automatic operation

Switching off automatically



WARNING!

Risk of injury from unbraked shut-down!

The shut-down command is carried out by sensors or a system switch.

- ⇒ The machine is switched off and shuts down. The machine does not stop immediately.

7.5.4 Switching off in nitrogen operation

Switching off in nitrogen operation

1.



Switch off as described above!

Switch off the machine.

2.



DANGER!

Risk of fatal injury from gas leaks!

For longer downtimes disconnect the unit from the gas network.

- ⇒ Otherwise there is a possibility that gas leaks will occur during downtime.

7.6 Decommissioning



Decommissioning means the shut-down of a machine for a longer period.

Measures

1. ➤ Switch off the machine properly and secure it against an unintentional start.
2. ➤ Disconnect fuses.
3. ➤ Close the shut-off valves of the delivery lines.
4. ➤ Prevent condensate from entering the machine.
5. ➤ For a downtime of over six weeks: preserve the conveying chamber.

Avoiding damage caused by down-time and corrosion



For a downtime of over six weeks

Preserve the conveying chamber. ↪ „Preservation“ on page 87

Move the rotors every six weeks by 2-3 rotations.

7.7 Measures for recommissioning

7.7.1 Commissioning after adjustment works

after adjustments

Work stages ↪ „Commissioning“ on page 129

7.7.2 Commissioning after maintenance work

after maintenance

Work stages ↪ Chapter 8.5 „Commissioning after maintenance“ on page 165

7.7.3 Commissioning after fault rectification

After fault rectification

Work stages ↪ Chapter 9.5 „Commissioning after malfunction rectification“ on page 170

7.8 Adjusting valves



DANGER!

Risk of injury when adjusting valves or equipment!

Preparation/models with acoustic hood

1. ➤ Agree adjustments with the responsible staff at the location.
2. ➤ Switch off the machine.
3. ➤ Activate the EMERGENCY STOP function.
4. ➤ Switch off the main circuit breaker and secure it against restarting.
5. ➤ Ensure there is no live electricity.
6. ➤ Open the maintenance elements.

Preparation/models without acoustic hood

1. ➤ Agree adjustments with the responsible staff at the location.
2. ➤ Switch off the machine.
3. ➤ Activate the EMERGENCY STOP function.
4. ➤ Switch off the main circuit breaker and secure it against restarting.
5. ➤ Ensure there is no live electricity.
6. ➤ Disassemble the belt guard.

7.8.1 Adjusting the start unloading device

DN 80 to DN 400


Fig. 104: Start unloading device

The start unloading device is preset with a maximum closing time at the factory. An adjustment is only necessary if the start unloading device does not close or the closing time is too long.

🔗 Chapter 11.10.3 „Start-up unloading device DN 80 to DN 400“ on page 195

Settings with star-delta starting


The start unloading device closes fully after:

- the switch from star to delta.
- the nominal speed is reached.

The closing procedure can be both heard and seen (on the gauge for discharge pressure).

Setting the closing time

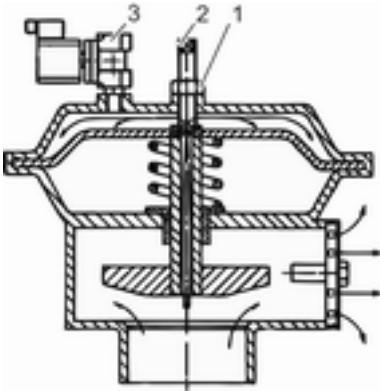


Fig. 105: Start unloading device positions

1. ➤ Open the maintenance elements.
2. ➤ Loosen the counternut (pos.1).
3. ➤ Move the spindle (pos.2) clockwise.
⇒ The closing time is reduced.
4. ➤ Move the spindle (pos.2) anti-clockwise.
⇒ The closing time is extended.
5. ➤ Set the closing time.
6. ➤ Tighten counternut (pos.1).
7. ➤ Mount all protective hardware and covers.
8. ➤ Close the maintenance elements.
9. ➤



NOTICE!

Risk of damage! Observe the starting frequency of the drive motor!

Start the machine.

10. ➤ Check the closing time.
11. ➤ If the closing time is in the permissible adjustment range:
⇒ adjustments are complete.
12. ➤ If the closing time is not in the permissible adjustment range:
⇒ repeat the adjustment steps.

Settings for pole changing

Set start unloading device to a lower speed in accordance with star-delta starting.



The closing time in the lower speed range must be set as long as possible, so that an acceptably long closing time is still available for the upper speed range.

If this is not possible, then an additional solenoid valve is used.

The solenoid valve (pos.3) keeps the start unloading device open to the atmosphere when ramping up to "high-speed" mode directly.

Reasons for the above:

- The differences in conveyed amounts are too large.
- High-speed operation is started from low-speed operation in "star-double-star starting".

The solenoid valve (pos.3) keeps the start unloading device open to the atmosphere during star-double-star starting.

The solenoid valve closes after ramping up.

7.8.2 Commissioning after adjustments

Commissioning

1. ➤ Inform the responsible on-site person about the result of the work carried out and agree commissioning steps with that person.
2. ➤ Check all previously loosened screw connections for tightness.
3. ➤ Ensure that there are no persons in the hazard area.
4. ➤ Re-attach all safety hardware.
5. ➤ Remove all used tools, materials and other equipment from the workspace.
6. ➤ Release the safety on the main circuit breaker and activate it.
7. ➤ Release the EMERGENCY STOP function.
 - ⇒ Start operation in accordance with the instruction in the "Operation" chapter. ↪ *Chapter 7.3 „Switching on“ on page 122*
8. ➤ Inform the responsible on-site person about the result of the work carried out.

8 Maintenance

8.1 Safety instructions

Improperly performed maintenance work



WARNING!

Risk of injury from improperly performed maintenance work!

Improperly performed maintenance may lead to serious injury or material damage.

- Only perform maintenance work when the machine has been decommissioned.
- Secure against a restart.
- Allow the machine to cool down to the ambient temperature.
- Before beginning work, ensure that there is sufficient space for installation work.
- Check the tidiness and cleanliness of the work area.
- Only perform maintenance work with suitable tools.
- Ensure removed components are re-installed correctly.
- Re-install all fastening elements and observe the screw tightening torques.

Securing the machine against restarting



WARNING!

An unauthorised or unregulated restart can have fatal consequences.

An unauthorised or unregulated restart of the machine can lead to serious or fatal injuries. There may be people located in the hazard area.

- Before beginning work, switch off the energy supply and secure it against restarting.

Electrical system



DANGER!

Risk of fatal injury from electrical current!

There is a risk of fatal injury from touching live components. Live electrical components may make uncontrolled movements and cause extremely serious injury.

- Before beginning work, switch off the electric power supply and secure it against restarting.

Rotating or moving components**WARNING!****Risk of injury from rotating or moving components!**

Rotating or moving components can cause serious injuries.

- Never touch rotating or moving components.
- Never reach into the clamping area of the belts, for example.
- Keep a safe distance from rotating or moving components.
- Wear tight-fitting protective work clothing with low tensile strength within the hazard area.

Hot operating materials**WARNING!****Risk of injury from hot operating substances!**

Operating substances may reach high temperatures during operation. Skin contact with hot operating substances causes serious burns.

- For all work performed with hot operating substances, always wear protective work clothing and protective gloves.
- Before any work with operating substances, check whether they are hot. If necessary, allow them to cool down to the ambient temperature.

Requirements for staff

The maintenance work described here may only be performed by the designated personnel. The personnel entrusted with the respective maintenance tasks are listed in the maintenance plan.

For the preparation of the maintenance plan, the following is necessary:

- Personnel:
- Authorised electricians
 - Service personnel

For cleaning after maintenance, the following is necessary:

- Personnel:
- User

Commissioning after maintenance requires:

- Personnel:
- Authorised electricians
 - Service personnel



Protective equipment

For maintenance, the following is necessary:

- Protective equipment:
- Protective work clothing
 - Safety shoes
 - Protective gloves
 - Safety goggles
 - Industrial hard hat

Special tools

For maintenance the following is necessary:

- Special tool:
- Ratchet wrench
 - Oil funnel
 - General tool kit
 - General measurement tools and equipment
 - Auxiliary materials, aids

- Special tool:
- Locking key

8.2 Maintenance schedule

The following section describes the maintenance work that is required for optimal and fault-free operation of the machine.

If regular inspections reveal an increased level of abrasion, reduce the maintenance intervals in accordance with the signs of wear and tear. For questions on maintenance work and intervals contact the manufacturer. See contact details.

8.2.1 Maintenance schedule for normal operation

Interval	Maintenance work	Personnel
After the first 500 op. hrs	<p>Replace the lube oil. (Not when using Delta Lube 06!)</p> <p>↳ Chapter 8.3.5 „Changing oil“ on page 148</p> <p>For a gas-tight shaft seal, change the grease. ↳ Chapter 8.3.4 „Replacing the grease on gas-tight drive shafts“ on page 147</p>	Service personnel
Weekly	Check the differential pressure.	User
	Check the intake filter for contamination. (display unit, max. permissible -45 mbar)	User
	Check the oil level. ↳ Chapter 8.3.2 „Checking the oil level“ on page 139 If necessary, correct it. ↳ Chapter 8.3.3 „Correcting the oil level“ on page 141	User
	If the maximum value (-45 mbar) is exceeded, change the intake filter. ↳ Chapter 8.3.6 „Replacing the intake filter“ on page 155	Service personnel
	Check the belt guard for total stability and for damage and contamination. ↳ Chapter 8.3.16 „Checking the belt guard“ on page 164	User
	Remove any dirt from the outer belt guard.	
	If it is insufficiently stable or damaged, contact customer service.	Manufacturer's customer service division
Relubrication intervals for the drive motor	Observe the instruction manual and signage of the drive motor!	Service personnel
After every 4,000 op. hrs or every 6 months	Check and clean the inlet and exhaust air openings on the acoustic hood. ↳ Chapter 8.3.15 „Checking the inlet and exhaust air openings on the acoustic hood“ on page 163	Service personnel
	Check that the acoustic hood fan is operating correctly. ↳ Chapter 8.3.15 „Checking the inlet and exhaust air openings on the acoustic hood“ on page 163	
	Check that the safety valve is operating correctly and clean it. ↳ Chapter 8.3.11 „Checking the AERZEN safety valve“ on page 160	Service personnel
	Check the condition of the belts. If necessary, replace them. ↳ Chapter 8.3.9 „Replacing belts, version with lifting device“ on page 156	Service personnel
	Check the condition of the belts. If necessary, replace them. ↳ Chapter 8.3.10 „Replacing belts, version without lifting device“ on page 158	
	Inspect the sheaves for unusual wear and tear or obvious damage. Inspect for alignment and stability. ↳ Chapter 8.3.7 „Checking the sheaves“ on page 155	

Interval	Maintenance work	Personnel
	<p>Replace the lube oil at a discharge temperature of over 140 °C. (Not when using Delta Lube 06!) ↪ Chapter 8.3.5 „Changing oil“ on page 148</p> <p>When using AERZEN special rotary piston oil with a gas-tight shaft seal, replace the grease at a discharge temperature of over 140 °C. ↪ Chapter 8.3.4 „Replacing the grease on gas-tight drive shafts“ on page 147</p> <p>Replace grease when using lube oil with an ISO VG 220 viscosity class in conjunction with a gas-tight shaft seal. ↪ Chapter 8.3.4 „Replacing the grease on gas-tight drive shafts“ on page 147</p>	
	If necessary, replace the sheaves.	Manufacturer's customer service division
After every 8,000 op. hours or 12 months	Lube oil: Replace Delta Lube 06: only for pressure differentials > 800 mbar ↪ Chapter 8.3.5 „Changing oil“ on page 148	Service personnel
	For a gas-tight shaft seal, change the grease. ↪ Chapter 8.3.4 „Replacing the grease on gas-tight drive shafts“ on page 147	Service personnel
	Replace the lube oil. (Not when using Delta Lube 06!) ↪ Chapter 8.3.5 „Changing oil“ on page 148	Service personnel
	Replace intake filter. ↪ Chapter 8.3.6 „Replacing the intake filter“ on page 155	Service personnel
	Check the control system for correct operation.	Manufacturer's customer service division
After every 16,000 op. hrs or every 2 years	<p>Replace the belts. ↪ Chapter 8.3.9 „Replacing belts, version with lifting device“ on page 156</p> <p>Replace the belts. ↪ Chapter 8.3.10 „Replacing belts, version without lifting device“ on page 158</p> <p>Check the alignment of the sheaves. If necessary, correct it. ↪ Chapter 8.3.7 „Checking the sheaves“ on page 155</p> <p>Check non-return flap for wear and tightness. If necessary, replace them. ↪ Chapter 8.3.13 „Checking the non-return flap“ on page 161</p> <p>Check flexible pipe connections on the discharge and intake sides for tightness. If necessary, replace them. ↪ Chapter 8.3.17 „Checking pipelines for tightness“ on page 164</p> <p>Lube oil: Replace Delta Lube 06. ↪ Chapter 8.3.5 „Changing oil“ on page 148</p>	Service personnel
After every 20,000 op. hrs or every 3 years	<p>Check hose lines for tightness. Replace if necessary.</p> <p>Recommendation: replace hose lines every 6 years.</p>	Service personnel



Interval	Maintenance work	Personnel
	Recommended main inspection/maintenance. Inspection, changing of replacement and expendable parts. Entire machine check.	Manufacturer's customer service division

op. hrs = operating hours

8.3 Maintenance work

Preparation

1. ➔ Agree maintenance work with the responsible staff at the location.
2. ➔ Switch off the machine.
3. ➔ Activate the EMERGENCY STOP function.
4. ➔ Switch off the main circuit breaker and secure it against restarting.

5. ➔



DANGER!

Risk of injury from electric current!

Ensure there is no live electricity.

6. ➔



DANGER!

Risk of injury during maintenance work!

Open the maintenance elements.

7. ➔



DANGER!

Risk of injury during maintenance work!

Open the belt guard cover.

8.3.1 First oil filling

8.3.1.1 Version *with* oil system

Filling with oil



Fig. 106: Filling with oil

1. ➤ Check the drain valve for firm seating.
2. ➤ Check that the sealing cap of the drain valve is firmly in place.
3. ➤ Open the oil container.
4. ➤ Ensure that the ventilation pipe in the oil filling container is unobstructed.

5. ➤



CAUTION!

Risk of skin irritation from lube oil!



ENVIRONMENT!

Environmental risks from incorrect handling of lubricants!

Observe the oil quantity ↗ *Chapter 11.7.4 „Lubricant quantities“ on page 191* and specification ↗ *Chapter 11.7.1 „Lubricant oil specifications“ on page 187.*

First, fill 3/4 of the listed quantity of oil.

6. ➤ Wait 5 - 10 minutes. The lube oil continues to flow.
 - ⇒ The oil level regulates itself in the oil system and in the oil chambers.
7. ➤ Check the oil level.

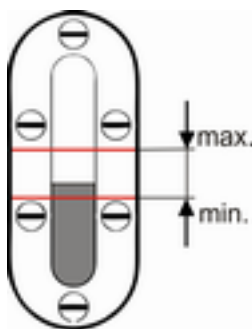


Fig. 107: Acoustic hood sight glass

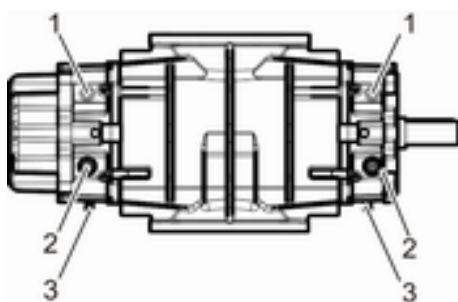


Fig. 108: Machine stage sight glasses

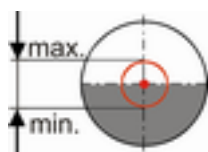


Fig. 109: Oil level display (item 2)

8. ➤ Check the lube oil level on the machine stage's oil level displays (item 2) and adjust as necessary.
9. ➤ Fill the rest of the lube oil up to the mark on the acoustic hood's sight glass. Observe the after-run time of the lube oil.
⇒ The oil level is correct when it is between min. and max.
10. ➤ Close the oil filling container.
11. ➤


ENVIRONMENT!

Risk of environmental damage from incorrect storage of lube oil!

Clean the workspace thoroughly.

Dispose of residual lube oil in an environmentally-friendly way.

Clean all auxiliary equipment.

8.3.1.2 Version *without* oil system

Filling with oil

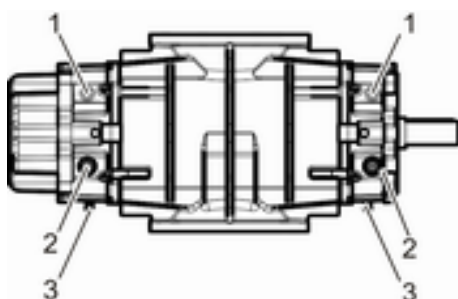


Fig. 110: GM 3S - GM 80L

- 1 Oil fill openings, marked in red
- 2 Oil level displays
- 3 Drain valves

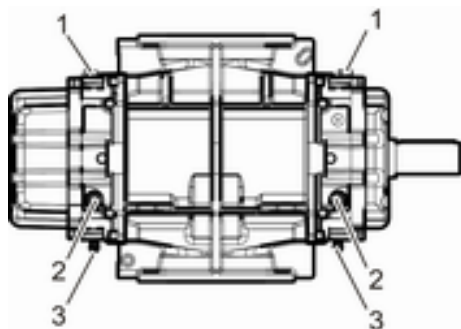


Fig. 111: GM 90S - GM 400L

1. ➤ Check the drain valves (pos. 3) for firm seating.
2. ➤ Check the sealing caps of the drain valves (pos. 3) for firm seating.
3. ➤ Open the oil fill openings (pos. 1) – the RED-marked locking screws.
4. ➤ Observe the oil quantity distribution.

Guide value:

- 1/3 of the entire lube oil quantity in the driving side.
 - 2/3 of the entire lube oil quantity in the wheel side.
- The display in the oil level sight glass is crucial.

5. ➤



CAUTION!

Risk of skin irritation from lube oil!



ENVIRONMENT!

Environmental risks from incorrect handling of lubricants!

Observe the oil quantity ☞ *Chapter 11.7.4 „Lubricant quantities“ on page 191* and specification ☞ *Chapter 11.7.1 „Lubricant oil specifications“ on page 187.*

Fill with lube oil. To do this, fill with approx. 3/4 of the entire oil quantity. Fill this reduced total oil quantity according to the oil quantity distribution (approx. 1/3 driving side, approx. 2/3 wheel side) into both oil chambers.

6. ➤ Observe the oil level. Wait 5 - 10 minutes. The lube oil continues to flow.
 - ⇒ The oil level regulates itself in the oil system and in the oil chambers.
7. ➤ Check the lube oil level.
8. ➤ Fill the rest of the lube oil up to the mark on the sight glass.
 - ⇒ The oil level is correct when it is between min. and max.
9. ➤ Close the oil fill opening (pos. 1) tightly with a seal.
10. ➤

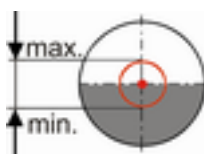


Fig. 112: Sight glass for oil level display (pos. 2)



ENVIRONMENT!

Risk of environmental damage from incorrect storage of lube oil!

Clean the workspace thoroughly.

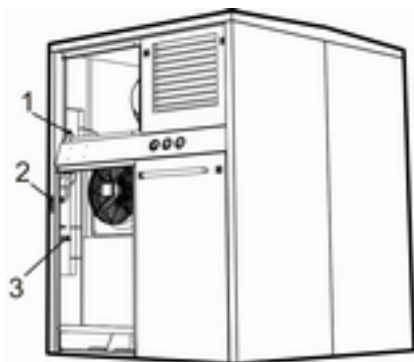
Dispose of residual lube oil in an environmentally-friendly way.

Clean all auxiliary equipment.

8.3.2 Checking the oil level

8.3.2.1 Version *with* oil system

Version with oil system



- 1 Oil fill opening (oil filling container)
- 2 Oil level display
- 3 Oil drain

Fig. 113: Oil system

Checking the oil level

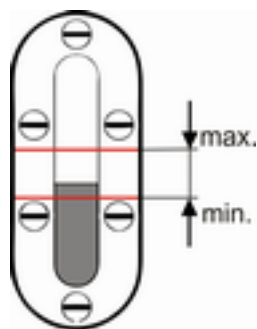


Fig. 114: Acoustic hood sight glass

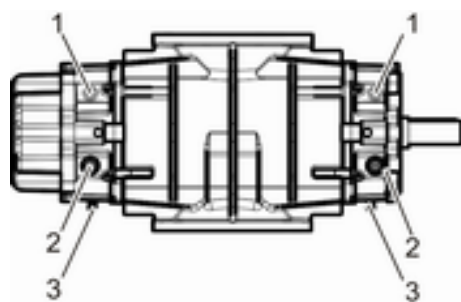


Fig. 115: Machine stage sight glasses

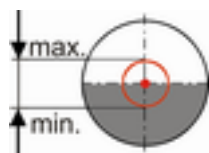


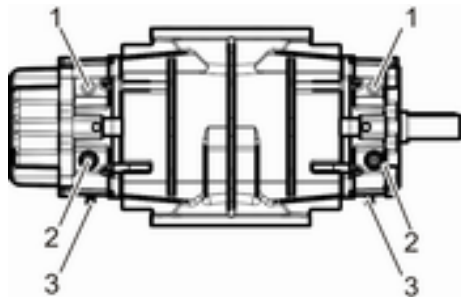
Fig. 116: Oil level display (item 2)

1. ➡ Check the lube oil level and correct it if necessary.

2. ➡ Check the lube oil level on the machine stage's oil level displays (item 2) and adjust as necessary.

8.3.2.2 Version *without* oil system

Version without oil system



- 1 Oil fill openings, marked in red
- 2 Oil level displays
- 3 Drain valves

Fig. 117: GM 3S - GM 80L

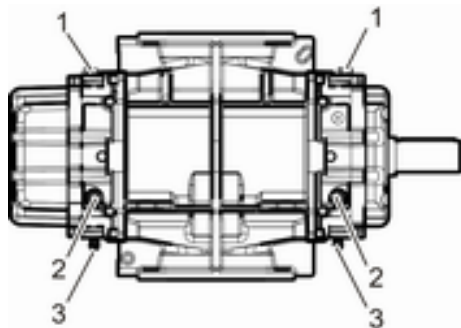
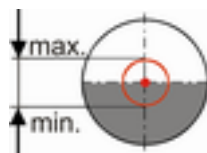


Fig. 118: GM 90S - GM 400L

Checking the oil level



→ Check the lube oil level and correct it if necessary.

Fig. 119: Sight glass for oil level display

8.3.3 Correcting the oil level

8.3.3.1 Oil level too high

Draining oil/version with oil system

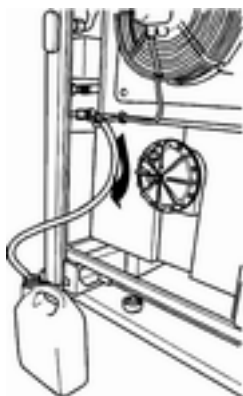


Fig. 120: Draining oil

1. ➔



WARNING!

Risk of scalding from hot lube oil!



NOTICE!

Material damage to the drain hose from lube oil temperatures over 60°C!

Allow the lube oil to cool down to the ambient temperature.

2. ➔



Observe the volume of the waste oil and the oil-resistant receptacle. ➔ „Machine lube oil levels“ on page 191

Have a receptacle ready.

3. ➔

Open the oil opening on the oil filling container.

⇒ Lube oil flows out more evenly from the oil drain.

4. ➔

Feed the drain hose into the receptacle.

5. ➔



CAUTION!

Risk of skin irritation from old lube oil!

Remove the sealing cap from the drain valve.

Twist the drain hose onto the drain valve.

⇒ The drain valve opens automatically.

6. ➔



CAUTION!

Risk of slipping from oil spillage!

Guide excess lube oil into the receptacle.



Fig. 121: Fitting the drain hose

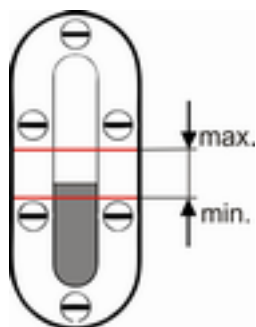


Fig. 122: Sight glass for oil level display

7. ➤ Observe and check the oil level.
8. ➤ If the permissible oil level is reached, remove the drain hose.
⇒ The drain valve closes automatically.
9. ➤ Screw the sealing cap onto the drain valve.
10. ➤ Close the oil fill opening.
11. ➤



ENVIRONMENT!

Risk of environmental damage from waste oil!

Collect waste lube oil and residual oil properly and dispose of it in an environmentally-friendly manner.

Clean the workspace thoroughly.

Clean all auxiliary equipment.

Draining oil/version without oil system

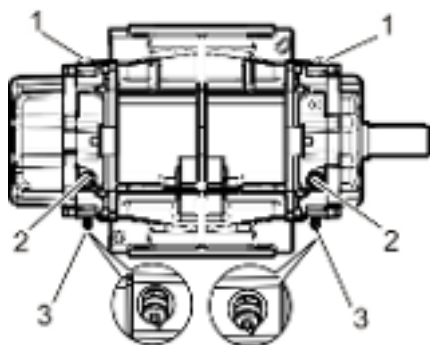


Fig. 123: Oil drain

3 Drain valves

1. ➤



WARNING!

Risk of scalding from hot lube oil!

Allow the lube oil to cool down to the ambient temperature.

2. ➤



Observe the volume of the waste oil and the oil-resistant receptacle. ➤ „Machine lube oil levels“ on page 191.

Have a receptacle ready.

3. ➤ Select an oil chamber with an excessively high filling capacity.
4. ➤ Open the oil fill opening.
⇒ Lube oil flows out more evenly from the oil drain.

5. ➔


CAUTION!

Risk of skin irritation from old lube oil!



A locking screw or a shut-off valve can be used as an alternative to the drain valve.

The oil chamber can be opened by:

- removing the locking screw or by
- removing the sealing plug on the shut-off valve. Open the shut-off valve.

Remove the sealing cap from the drain valve.

If the sealing cap is very tightly in place, secure the drain valve using a wrench and loosen the sealing cap with an additional wrench.

6. ➔


NOTICE!

Material damage to the drain hose from lube oil temperatures over 60°C!

Feed the drain hose into the receptacle.

7. ➔

Twist the drain hose onto the drain valve.

⇒ The drain valve opens automatically.

8. ➔


CAUTION!

Risk of slipping from oil spillage!

Guide any excess lube oil into the receptacle.

9. ➔

Observe and check the oil level.

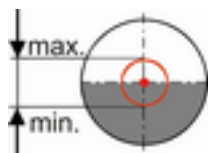


Fig. 124: Sight glass for oil level display

- 10.** ▶ If the oil level has been corrected, remove the drain hose.
 ⇒ The drain valve closes automatically.



A locking screw or a shut-off valve can be used as an alternative to the drain valve.

The oil chamber can be closed by:

- *mounting the locking screw with a new sealing ring or by*
- *closing the shut-off valve. Seal the output of the shut-off valve with sealing plugs.*

- 11.** ▶ Screw the sealing cap onto the drain valve.

- 12.** ▶ Close the oil fill opening.

- 13.** ▶



ENVIRONMENT!

Risk of environmental damage from waste oil!

Collect waste lube oil and residual oil properly and dispose of it in an environmentally-friendly manner.

Clean the workspace thoroughly.

Clean all auxiliary equipment.

8.3.3.2 Oil level too low

Filling oil/version with oil system



Fig. 125: Filling with oil

- 1.** ▶ Check the drain valve for firm seating.
- 2.** ▶ Check the sealing cap of the drain valve for firm seating.
- 3.** ▶ Open the oil filling container.
- 4.** ▶ Ensure that the ventilation pipe in the oil filling container is unobstructed.

5. ➔


CAUTION!

Risk of skin irritation from lube oil!


ENVIRONMENT!

Environmental risks from incorrect handling of lubricants!

Specifications ↗ Chapter 11.7.1 „Lubricant oil specifications“ on page 187

Fill the lube oil in stages and in small quantities.

6. ➔ Observe the oil level. Wait 5 - 10 minutes. The lube oil continues to flow.

⇒ The oil level regulates itself in the oil system and in the oil chambers.

7. ➔ Check the oil level.

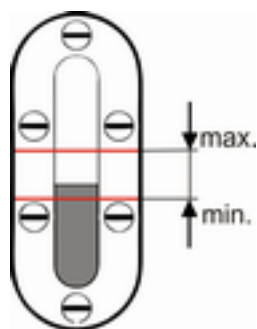


Fig. 126: Acoustic hood sight glass

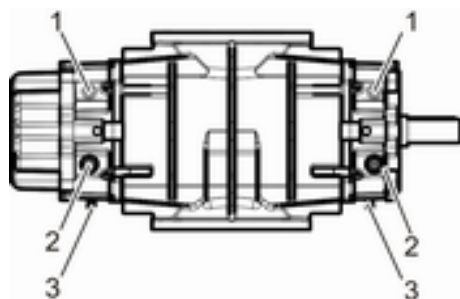


Fig. 127: Machine stage sight glasses

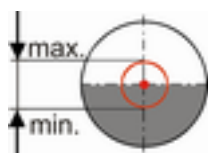


Fig. 128: Oil level display (item 2)

8. ➔ Check the lube oil level on the machine stage's oil level displays (item 2) and adjust as necessary.

9. ➔ If the lube oil level is between the min./max. marks:

⇒ the oil level is OK.

10. ➔ If the lube oil level is beyond the min./max. marks:

⇒ Correct the oil level.

11. ➤ Close the oil filling container.

12. ➤



ENVIRONMENT!

Risk of environmental damage from incorrect storage of lube oil!

Clean the workspace thoroughly.

Dispose of residual lube oil in an environmentally-friendly way.

Clean all auxiliary equipment.

Filling oil/version without oil system

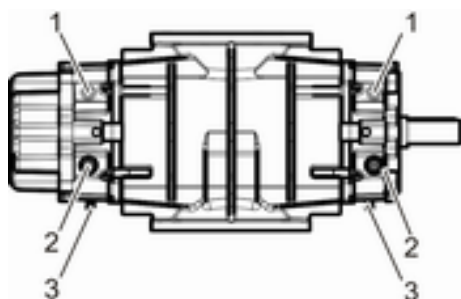


Fig. 129: GM 3S - GM 80L

- 1 Oil fill openings, marked in red
- 2 Oil level displays
- 3 Drain valves

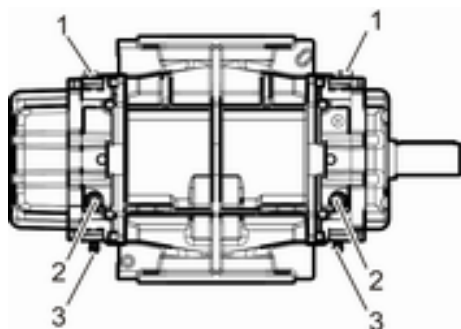


Fig. 130: GM 90S - GM 400L

- 1. ➤ Select the required oil chamber.
- 2. ➤ Check the drain valve (pos. 3) for firm seating.
- 3. ➤ Check sealing cap of the drain valve (pos. 3) for firm seating.
- 4. ➤ Open the oil fill opening, the RED-marked locking screw.
- 5. ➤



CAUTION!

Risk of skin irritation from lube oil!



ENVIRONMENT!

Environmental risks from incorrect handling of lubricants!

Observe the specifications ↗ *Chapter 11.7.1 „Lubricant oil specifications“ on page 187.*

Fill the lube oil in stages and in small quantities.

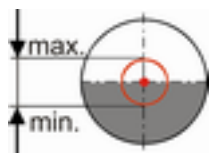


Fig. 131: Sight glass for oil level display (pos. 2)

6. ➤ Observe the oil level. Wait 5 - 10 minutes. The lube oil continues to flow.
 - ⇒ The oil level regulates itself in the oil system and in the oil chambers.
7. ➤ Check the lube oil level.
8. ➤ If the lube oil level is between the min.-/max. marks:
 - ⇒ the oil level is OK.
9. ➤ If the lube oil level is beyond the min.-/max. marks:
 - ⇒ Correct the oil level.
10. ➤ Close the oil fill opening tightly with a seal.
11. ➤ If necessary, repeat the process at the other oil chamber.
12. ➤

**ENVIRONMENT!**

Risk of environmental damage from incorrect storage of lube oil!

Clean the workspace thoroughly.

Dispose of residual lube oil in an environmentally-friendly way.

Clean all auxiliary equipment.

8.3.4 Replacing the grease on gas-tight drive shafts

The replacement of grease is only required for the gas-tight version of the drive shaft (optional).



Press the grease a few operating hours before the lubricating oil change. The used, excess grease reaches the oil chamber of the machine stage and is discharged with the lubricating oil change.

Pressing the grease

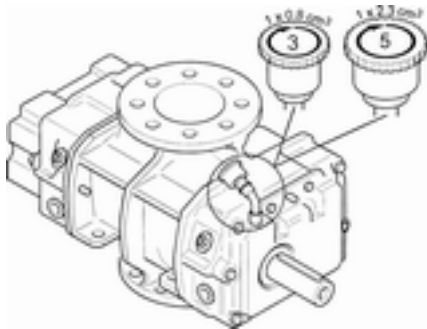


Fig. 132: Stauffer lubricator

1. ➤



WARNING!

Risk of burning from hot housing surfaces!

Allow the housing surfaces to cool down to ambient temperature.

2. ➤

Press the grease by turning the Stauffer lubricator.



CAUTION!

Risk of skin irritation from escaping grease!

Observe the grease amount and number of turns. ➤ „Grease filling quantity for machine stage“ on page 192

3. ➤

After pressing the required amount of grease, turn the Stauffer lubricator one revolution backwards. The volume of grease can then expand when it is heated.

4. ➤

Open the Stauffer lubricators and fill them with grease. Observe the specification of the grease. ➤ Chapter 11.7.3 „Grease specifications“ on page 190

8.3.5 Changing oil

8.3.5.1 Draining oil/version with oil system

Draining oil/version with oil system

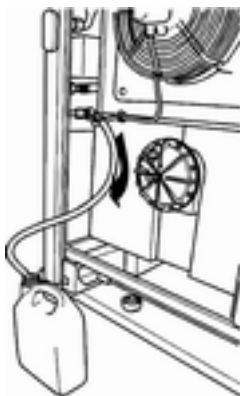


Fig. 133: Draining oil

1. ➤



WARNING!

Risk of scalding from hot lube oil!



NOTICE!

Material damage to the drain hose from lube oil temperatures over 60°C!

Allow the lube oil to cool down to the ambient temperature.

2. ➤



Observe the volume of the waste oil and the oil-resistant receptacle. ➤ „Machine lube oil levels“ on page 191

Have a receptacle ready.



Fig. 134: Fitting the drain hose

3. ➤ Open the oil opening on the oil filling container.
⇒ Lube oil flows out more evenly from the oil drain.

4. ➤ Feed the drain hose into the receptacle.

5. ➤


CAUTION!

Risk of skin irritation from old lube oil!

Remove the sealing cap from the drain valve.

Twist the drain hose onto the drain valve.

⇒ The drain valve opens automatically.

6. ➤


CAUTION!

Risk of slipping from oil spillage!

Guide all emerging lube oil into the receptacle.

7. ➤ Remove the drain hose.

⇒ The drain valve closes automatically.

8. ➤ Screw the sealing cap onto the drain valve.

9. ➤ Close the oil filling container.

10. ➤


ENVIRONMENT!

Risk of environmental damage from waste oil!

Collect waste lube oil and residual oil properly and dispose of it in an environmentally-friendly manner.

Clean the workspace thoroughly.

Clean all auxiliary equipment.

Filling with oil



Fig. 135: Filling with oil

1. ➤ Check the drain valve for firm seating.
2. ➤ Check the sealing cap of the drain valve for firm seating.
3. ➤ Open the oil filling container.
4. ➤ Ensure that the ventilation pipe in the oil filling container is unobstructed.
5. ➤



CAUTION!

Risk of skin irritation from lube oil!



ENVIRONMENT!

Environmental risks from incorrect handling of lubricants!

Observe the oil quantity ↗ *Chapter 11.7.4 „Lubricant quantities“ on page 191* and specification ↗ *Chapter 11.7.1 „Lubricant oil specifications“ on page 187*.

First, fill 3/4 of the listed total quantity of lube oil.

6. ➤ Wait 5 - 10 minutes. The lube oil continues to flow.
⇒ The oil level regulates itself in the oil system and in the oil chambers.
7. ➤ Check the oil level.

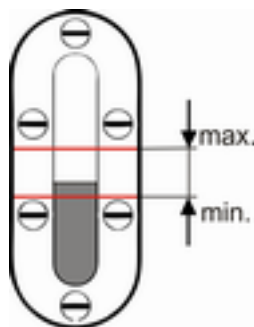


Fig. 136: Sight glass for oil level display

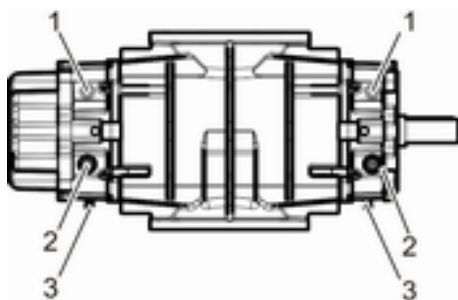


Fig. 137: Machine stage sight glasses

- 1 Oil fill openings, marked in red
- 2 Oil level displays
- 3 Drain valves

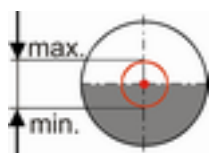


Fig. 138: Oil level display (item 2)

8. ➤ Check the lube oil level on the machine stage's oil level displays (item 2) and adjust as necessary.
9. ➤ If the lube oil level is between the min.-/max. marks:
⇒ The oil level is OK.
10. ➤ If the lube oil level is beyond the min.-/max. marks:
⇒ Correct the oil level.
11. ➤ Close the oil filling container.
12. ➤



ENVIRONMENT!

Risk of environmental damage from incorrect storage of lube oil!

Clean the workspace thoroughly.

Dispose of residual lube oil in an environmentally-friendly way.

Clean all auxiliary equipment.

8.3.5.2 Draining oil/version *without* oil system

Draining oil/version without oil system

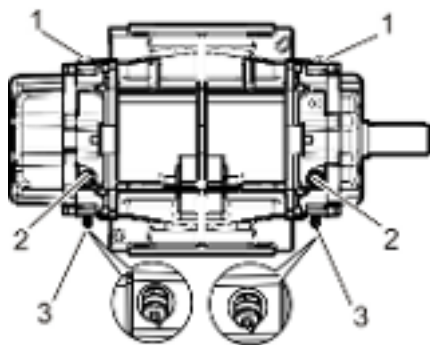


Fig. 139: Oil drain

- 1 Oil fill openings, marked in red
- 2 Oil level displays
- 3 Drain valves

1. ➤



WARNING!

Risk of scalding from hot lube oil!

Allow the lubricating oil to cool down to ambient temperature.

2. ➤



Observe the volume of the waste oil and the oil-resistant receptacle. ➤ „Machine lube oil levels“ on page 191

Have a receptacle ready.

3. ➤

Open the oil fill opening.

⇒ Allowing air to circulate in the oil chambers makes the lube oil drain more smoothly from the drain valves.

4. ➤



CAUTION!

Risk of skin irritation from old lube oil!

Remove the sealing cap from the drain valve.



A locking screw or a shut-off valve can be used as an alternative to the drain valve.

The oil chamber can be opened by:

- removing the locking screw or by
- removing the sealing plug on the shut-off valve. Open the shut-off valve.

5. ➤



NOTICE!

Material damage to the drain hose from lube oil temperatures over 60 °C!

Place the drain hose into the receptacle.

6. ➤

Twist the drain hose onto the drain valve.

⇒ The drain valve opens automatically.

7. ➡


CAUTION!

Risk of slipping from oil spillage!

Guide all emerging lube oil into the receptacle.

8. ➡

Remove the drain hose.

⇒ The drain valve closes automatically.



A locking screw or a shut-off valve can be used as an alternative to the drain valve.

The oil chamber can be closed by:

- *mounting the locking screw with a new sealing ring*
- or by*
- *closing the shut-off valve. Seal the output of the shut-off valve with sealing plugs.*

9. ➡

Screw the sealing cap onto the drain valve.

10. ➡

Close the oil fill opening.

11. ➡

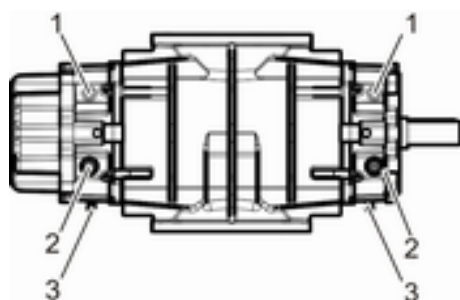

ENVIRONMENT!

Risk of environmental damage from waste oil!

Collect waste lube oil and residual oil properly and dispose of it in an environmentally-friendly manner.

Clean the workspace thoroughly.

Clean all auxiliary equipment.

Filling with oil


- 1 Oil fill openings, marked in red
- 2 Oil level displays
- 3 Drain valves

Fig. 140: GM 3S - GM 80L

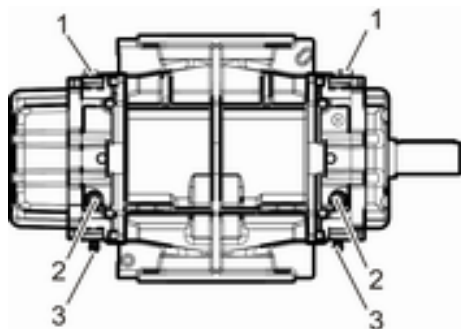


Fig. 141: GM 90S - GM 400L

1. ➤ Check the drain valves (pos. 3) for firm seating.
2. ➤ Check the sealing caps of the drain valves (pos. 3) for firm seating.
3. ➤ Open the oil fill openings (pos. 1), the RED-marked locking screws.
4. ➤ Observe the oil quantity distribution.

Guide value:

- 1/3 of the entire lube oil quantity in the driving side.
 - 2/3 of the entire lube oil quantity in the wheel side.
- The display in the oil level sight glass is crucial.

5. ➤



CAUTION!

Risk of skin irritation from lube oil!



ENVIRONMENT!

Environmental risks from incorrect handling of lubricants!

Observe the oil quantity ↗ *Chapter 11.7.4 „Lubricant quantities“ on page 191* and specification ↗ *Chapter 11.7.1 „Lubricant oil specifications“ on page 187.*

Fill with lube oil. To do this, fill with approx. 3/4 of the entire oil quantity. Fill this reduced total oil quantity according to the oil quantity distribution (approx. 1/3 driving side, approx. 2/3 wheel side) into both oil chambers.

6. ➤ Observe the oil level. Wait 5 - 10 minutes. The lube oil continues to flow.
 - ⇒ The oil level regulates itself in the oil system and in the oil chambers.
7. ➤ Check the lube oil level.
8. ➤ Fill the rest of the lube oil up to the mark on the sight glass.
 - ⇒ The oil level is correct when it is between min. and max.
9. ➤ Close the oil fill opening (pos. 1) tightly with a seal.
10. ➤



ENVIRONMENT!

Risk of environmental damage from incorrect storage of lube oil!

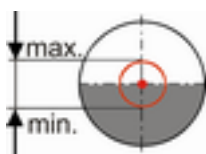


Fig. 142: Sight glass for oil level display (pos. 2)

Clean the workspace thoroughly.

Dispose of residual lube oil in an environmentally-friendly way.

Clean all auxiliary equipment.

8.3.6 Replacing the intake filter

Replacing the intake filter

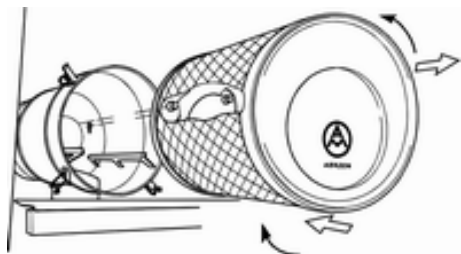


Fig. 143: Replacing the intake filter

1. ➔



CAUTION!

Risk of air contamination from scattered dust particles.

Open the cap locks of the intake silencer.

2. ➔

Remove the maintenance flap.

3. ➔

Loosen the intake filter by turning it anti-clockwise and remove it.

4. ➔



NOTICE!

Risk of machine damage from objects inside the intake silencer that enter the intake opening.

Remove residual dust inside the intake silencer.

5. ➔

Replace the intake filter.

6. ➔

Fasten the intake filter in place by turning it clockwise. Check that it is aligned correctly.

7. ➔

Fasten the maintenance flap on the housing of the intake silencer using the catch.

8. ➔

Reset the maintenance indicator (in accordance with the given variation).

8.3.7 Checking the sheaves

For wear and tear and damage

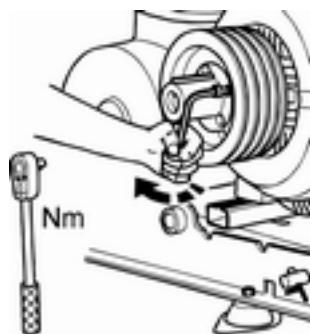


Fig. 144: Sheaves

1. ➔

Check for unusual wear and tear or obvious damage.

2. ➔

Check for correct alignment and stability.

3. ➔

If necessary, replace the sheaves.

4. ➔

Assemble the sheaves.

5. ➔

Fit the belt.

8.3.8 Moving and checking the protective cover of the sheaves

Moving on models without acoustic hood

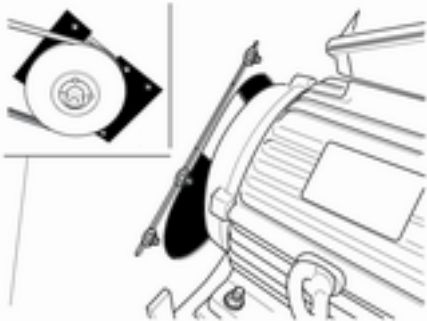


Fig. 145: Protective cover

1. ➤ Loosen the fitting of the protective cover before lifting the hinged motor support.
⇒ The protective cover can now be moved.
2. ➤ Lift the hinged motor support, e.g. for changing the belts.
3. ➤ Lower the hinged motor support.
⇒ The weight of the motor creates tension in the belts.
4. ➤ Push the protective cover in the direction of the motor shaft and tighten it.

Testing on models without acoustic hood

1. ➤ Check the spacing of the protective cover of the motor shaft.
During operation, the protective cover should be at a distance of approx. 10 mm from the motor drive shaft.
2. ➤ Check the protective cover for firm seating and, if necessary, tighten it.

8.3.9 Replacing belts, version *with* lifting device

Raising the hinged motor support

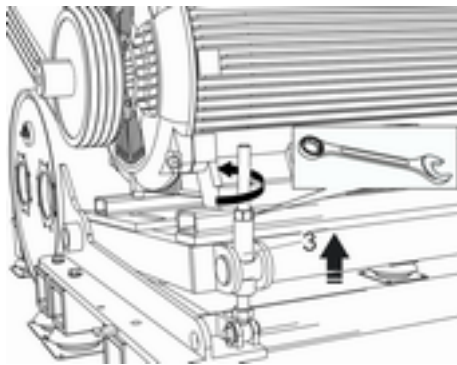




Fig. 146: Raising the hinged motor support

1. ➤  **WARNING!**
Risk of injury from moving or rotating components!

Lift the hinged motor support using the hinge jig.
2. ➤ Turn guide bushing (pos.3) anti-clockwise using the ratchet wrench.
⇒ The hinged motor support is raised.
3. ➤ Raise the hinged motor support until the belts are fully relieved of tension.

4. ➤  **Only replace belts as a set!**

5. ➤ Replace belts.

WARNING!

Risk of getting caught by rotating sheaves!

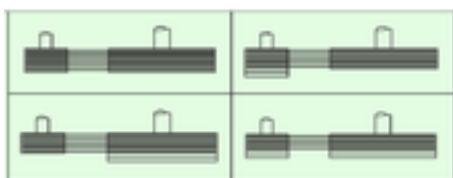
6. ➤ Observe the permissible groove layout.


Fig. 147: Permissible belt layout

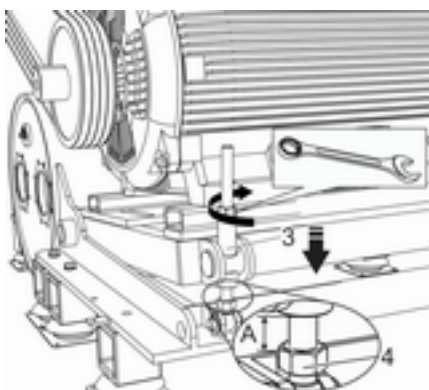
Pre-tensioning belts


Fig. 148: Pre-tensioning belts

7. ➤

CAUTION!

Risk of injury from tensioning components!

Turn guide bushing (pos.3) clockwise with the ratchet wrench until the belts are pre-tensioned.

⇒ The hinged motor support is partly held by the belt drive and rests lightly on the guide bushing (pos.3).

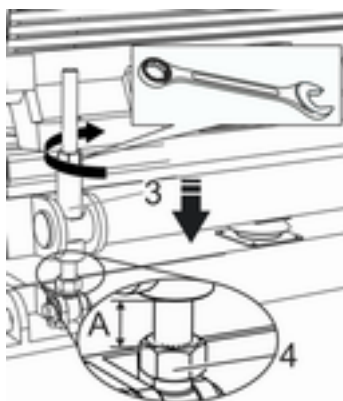
Adjusting the guide bushing


Fig. 149: Adjusting the gauge of the guide bushing

8. ➤ Set gauge A.

- Set self-locking nut (pos.4) to gauge A. Turn guide bushing (pos.3) on to the self-locking nut (pos.4) using the ratchet wrench.

DN/discharge side	Gauge A in mm
80	20
100	25
125	30
150	35
200	40
250	45
300	50
Delta Blower G5	

Tensioning the belts

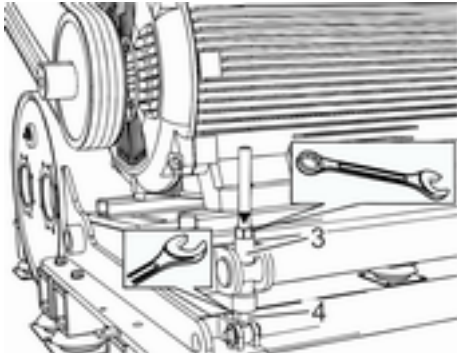


Fig. 150: Tensioning the belts

9. ➤



CAUTION!

Risk of injury from moving and rotating components!

Tension the belts.

- Secure the guide bushing (pos.3) with the self-locking nut (pos.4).
- The hinged motor support is supported entirely by the belt drive.

Checking the protective cover

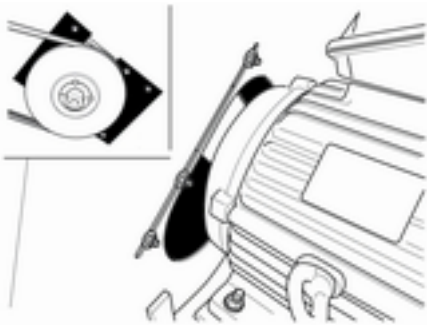


Fig. 151: Protective cover of the sheaves

10. ➤

Check the spacing of the protective cover of the motor shaft.

The protective cover should be at a distance of approx. 10 mm from the motor drive shaft.

By loosening the fastening screws, the protective cover can be moved.

Check the protective cover for firm seating and, if necessary, tighten it.

8.3.10 Replacing belts, version *without* lifting device

Raising the hinged motor support of the DN50

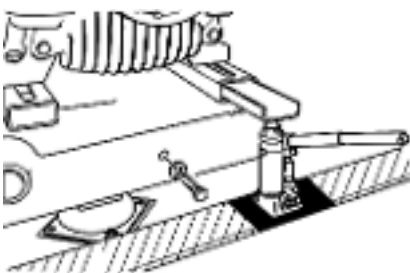


Fig. 152: Example: DN50

1. ➤

Insert the lifting bracket in the motor's attachment rail.



NOTICE!

Only use hydraulic lifts on solid, level ground.

Position the hydraulic lift securely.

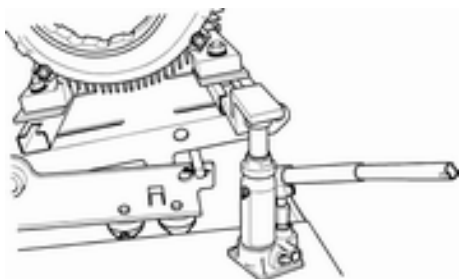
2. ➤



WARNING!

Risk of shearing and crushing from moving loads!

Slowly raise the hinged motor support by pumping the hydraulic lift.

**Raising the hinged motor support of the DN80***Fig. 153: Example: DN80***3.****WARNING!**

Risk of injury from the hydraulic lift tipping up or slipping!

Raise the hinged motor support in small steps and always support it with timbers! This prevents the sudden downward movement of the hinged motor support if the hydraulic lift tips up or slips.

4.

Insert the lifting bracket in the motor's attachment rail.

**NOTICE!**

Only use hydraulic lifts on solid, level ground.

Position the hydraulic lift securely.

5.**WARNING!**

Risk of shearing and crushing from moving loads!

Slowly raise the hinged motor support by pumping the hydraulic lift.

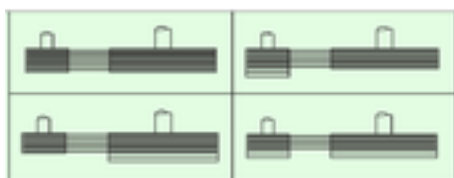
6.**WARNING!**

Risk of injury from the hydraulic lift tipping up or slipping!

Raise the hinged motor support in small steps. While doing so, use the transport safety rod to brace the hinged motor support in the recess of the base support. This prevents the sudden downward movement of the hinged motor support if the hydraulic lift tips up or slips.

7.

Raise the hinged motor support until the belts can be fitted.

Fitting the belt*Fig. 154: Permissible belt layout***8.****CAUTION!**

Risk of injury from tensioning components!

Fit the belt. Observe and comply with the permissible groove layout.

Tensioning the belts

9. ➤



WARNING!

Risk of injury from tensioning, moving or rotating components!

Release the hydraulic lift carefully and slowly.

⇒ The hinged motor support is lowered.

If released too quickly, the hinged motor support drops abruptly.

The belts are tautened by the weight of the motor.

10. ➤



NOTICE!

Risk of damage to the belt drive! The hinged motor support must not rest on the base support, the transport securing rod or similar equipment.

Completely remove the hydraulic lift, transport safety rod and other auxiliary equipment and store them safely for future maintenance purposes.

8.3.11 Checking the AERZEN safety valve

Movement test

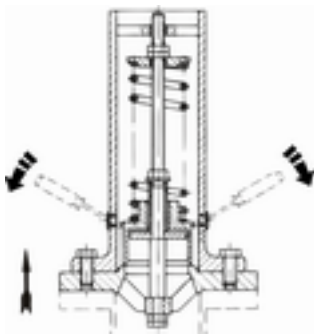


Fig. 155: using a screwdriver

■ G2", G3", DN 50, DN 80, DN 125

1. ➤ Remove the protective caps or locking screws from the maintenance holes in the protective cylinder.
2. ➤ Guide a screwdriver into each hole.
3. ➤ Raise the valve bell with the screw drivers using leverage force.
 - ⇒ The valve's opening function must be operational and the valve must move.
4. ➤ Lower the valve bell.
5. ➤ Remove the screwdrivers.
 - ⇒ An intact valve will close.
6. ➤ Insert the protective caps or sealing screws into the maintenance holes in the protective cylinder.

Movement test

■ DN 150, DN 200, DN 300

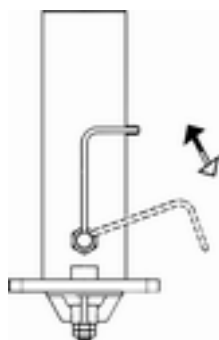


Fig. 156: using the stirrup

1. ➤ Raise the valve bell using the stirrup.
 - ⇒ The valve's opening function must be operational and the valve must move.
2. ➤ Release the pressure on the stirrup and lower the valve bell.
 - ⇒ An intact valve will close.

8.3.12 Checking that sealing plugs have been removed

Checking balancing holes

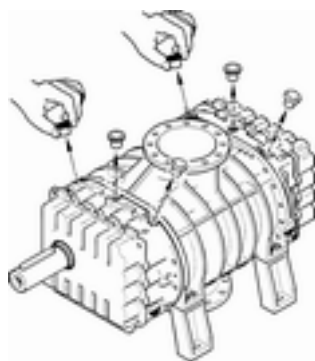


Fig. 157: Sealing plug configuration

1. ➤ Check that the (plastic) sealing plugs have been removed from the balancing holes.



The sealing plugs are coated in machine-colour paint as part of the manufacturing process.

The number of sealing plugs varies depending on the machine type!

Depending on the design, they may already have been removed before shipping or during preparations for commissioning.

- ⇒ If there are no more sealing plugs in place: Finish the check.
2. ➤ The balancing holes are sealed.
 - ⇒ Remove the sealing plugs. Finish the check.

8.3.13 Checking the non-return flap

Checking for wear and tear and tightness



Fig. 158: Non-return flap

1. ➤ Loosen the fastening screws.



Light impact on the flange cover of the non-return flap loosens the sealing and makes disassembly easier.

2. ➤ Remove the non-return flap from the housing.
3. ➤ Carry out a visual inspection.

4. ➤ If no damage and/or hardening is visible, the sealing is acceptable.
⇒ Re-use the non-return flap.
5. ➤ If damage and/or hardening is visible, the sealing is not acceptable.
⇒ Replace the non-return flap.

Assembling the non-return flap

1. ➤ Remove dirt, grease and used sealing agent from the flange surface.
2. ➤ Apply sealing agent (liquid surface sealant) to the flange surface of the housing.
3. ➤ Guide the non-return flap into the housing.



*Remove any bleeding sealing agent with a cloth.
Observe the curing time of the sealing material!*

4. ➤ Screw on the flange cover.

8.3.14 Cleaning the nozzle of the start-up relief device

Cleaning the nozzle

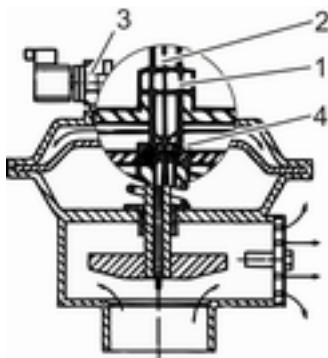


Fig. 159: Start-up relief device

1. ➤ Loosen the counternut (pos. 1).
2. ➤ Remove the spindle (pos. 2).
⇒ The nozzle (pos. 4) in the hole is accessible.

3. ➤



WARNING!

Risk of injury from escaping dirt particles!

Blow compressed air into the nozzle (pos. 4).

⇒ Unobstructed cross-section of the nozzle.

4. ➤ Mount the spindle (pos. 2).
5. ➤ Setting the closing time of the start-up relief device. ➤ Chapter 11.10.3 „Start-up unloading device DN 80 to DN 400“ on page 195
6. ➤ Secure the spindle (pos. 2) with the nut (pos. 1).



8.3.15 Checking the inlet and exhaust air openings on the acoustic hood

Checking the inlet and exhaust air openings

1. ➤ Visual inspection of the supply air and exhaust air openings on the acoustic hood.
2. ➤ Clean the openings. Remove dirt.

Checking fan operation

1. ➤ Check the direction of flow in the operating position with a closed acoustic hood. Observe the information in the installation drawing.
2. ➤ If exhaust air is extracted from the acoustic hood, the check is finished.
⇒ The acoustic hood fan is operating correctly.
3. ➤ If no exhaust air emerges from the acoustic hood, the fan is malfunctioning.
⇒ Replace the fan.

Replacing the fan

1. ➤ Open the maintenance elements of the acoustic hood.
2. ➤

**WARNING!**

Risk of injury from rotating components!

Loosen the screws for attaching the fan.

3. ➤ Pull the fan from the shaft and replace it.
4. ➤ Seal the screw for attaching with liquid thread locker.
5. ➤ Screw on the fan.
6. ➤ Close the maintenance elements of the acoustic hood.
7. ➤ Check the cooling air flow during machine operation.

8.3.16 Checking the belt guard

Damage and stability

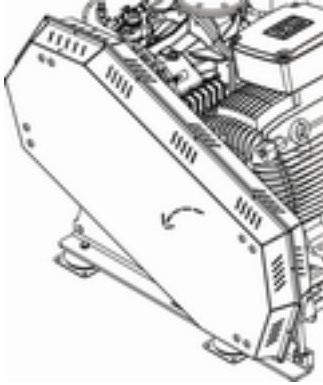


Fig. 160: Belt guard

1. ➤



WARNING!

Risk of injury from hot surfaces!

Check for damage and thorough stability.

(stable on the base support and machine stage)

2. ➤

Remove dirt from the belt guard.

3. ➤

If necessary, tighten the belt guard fastener. If damaged, replace it.

4. ➤

Beware of any lubricant bleeding out of the drive motor. If lubricant bleeds out, inform the responsible staff at the location.

Seal any leaks.

8.3.17 Checking pipelines for tightness

Checking discharge-side pipelines for tightness

1. ➤

Check pipelines for tightness (visual inspection).



Ensure that the pipelines have been depressurised!

2. ➤

If there are leaks

⇒ Replace seals or bushing.

3. ➤

Reinforce the pipelines if necessary.

4. ➤

Disassemble leaking pipe connections.

5. ➤

Use new seals or bushing.

6. ➤

Assemble pipe connections.

8.4 Cleaning after maintenance

Cleaning after maintenance work

1. ➤



NOTICE!

Risk of damage! Do not use high pressure cleaners, steam jet pumps, grease removal agents, thinners, compressed air etc. as cleaning methods.

2. ➤

Dust and dirt must be cleaned with suitable cloths.



3. ➤ Clean components susceptible to scratches, display units and touch panels of control systems, gauges etc. with a soft, wet towel.
4. ➤ Remove all cleaning agents from the immediate vicinity of the machine before commissioning.
5. ➤ Dispose of cloths in an environmentally-friendly way.

8.5 Commissioning after maintenance

Commissioning after maintenance

1. ➤ Inform the responsible on-site person about the result of the work carried out and agree commissioning steps with that person.
2. ➤ Check all previously loosened screw connections for tightness.
3. ➤ Mount all protective hardware and covers that were previously removed.
4. ➤ Remove all used tools, materials and other equipment from the workspace.
5. ➤ Clean the workspace. Remove operating substances, operating material, processing material and similar materials and dispose of them appropriately.
6. ➤ Ensure that there are no persons in the hazard area.
7. ➤ Release the main circuit breaker and activate it.
8. ➤ Release the EMERGENCY STOP function.
 - ⇒ Start operation in accordance with the instructions in the "Operation" chapter.
9. ➤ Inform the responsible on-site person about the result of the work carried out.

8.6 Checks after maintenance work

Inspection	After the first 3 op. hrs	After the first 25 op. hrs
Safety valve	check for correct operation	
Oil level	check and, if necessary, correct	check and, if necessary, correct
Aligning the sheaves		check, if necessary correct
op. hrs = operating hours		

9 Malfunctions

The following chapters describe possible causes of faults and steps to be taken to rectify them.

If faults cannot be rectified using the following instructions, contact the manufacturer.

9.1 Safety instructions

Improper fault rectification



WARNING!

Risk of injury due to improper operation fault rectification!

Improper fault rectification may lead to serious injury or material damage.

- Only rectify faults after decommissioning the machine.
- Secure the machine against restarting.
- Allow the machine to cool down to the ambient temperature.
- Before beginning work, ensure that there is sufficient space for installation work.
- Check the tidiness and cleanliness of the work-space.
- Only attempt to rectify faults with suitable tools.
- Ensure removed components are re-installed correctly.
- Re-install all fastening elements and observe the screw tightening torques.
- Before restarting, check that:
 - All safety and protective equipment is installed and functioning correctly.
 - There are no persons in the hazard area.

Electrical system



DANGER!

Risk of fatal injury from electrical current!

There is a risk of fatal injury from touching live components. Live electrical components may make uncontrolled movements and cause extremely serious injury.

- Before beginning work, switch off the electric power supply and secure it against restarting.

**Securing the machine against restarting****WARNING!**

An unauthorised or unregulated restart can have fatal consequences.

An unauthorised or unregulated restart of the machine can lead to serious or fatal injuries. There may be people located in the hazard area.

- Before beginning work, switch off the energy supply and secure it against restarting.

Requirements for staff

The fault rectification work described here may only be performed by the designated personnel. The personnel entrusted with the respective fault rectification tasks are listed in the table of fault descriptions in addition to their designated tasks.

Requirements in the event of malfunctions and for preparations for fault rectification work:

- Personnel:
- Authorised electricians
 - Service personnel

For commissioning after rectification of a malfunction, the following is necessary:

- Personnel:
- Authorised electricians
 - Service personnel

Protective equipment

For fault rectification work the following is necessary:

- Protective equipment:
- Protective work clothing
 - Protective gloves
 - Safety shoes



Special tools

For fault rectification work the following is necessary:

- Special tool:
- General tool kit
 - Ratchet wrench
 - Tools for authorised electricians
 - General measurement tools and equipment

- Special tool:
- Locking key

Behaviour in the event of faults

1.  **DANGER!**
Risk of injury during fault rectification!
2. In the event of a malfunction, activate the EMERGENCY STOP immediately.
3. Switch off the main circuit breaker and secure it.
4. Immediately inform the responsible staff on location about the fault.
5.  **DANGER!**
Risk of fatal injury from electric current!
6. Ensure there is no live current.
7. Ground and short-circuit the unit.
8. Cover or shut off adjacent live parts.
9. Establish the cause of the fault.

9.2 Fault displays


AERtronic (optional) fault message




Fig. 161: AERtronic display

Control system fault message

Depending on the customer's control system, additional fault messages can be recorded and displayed.

 A detailed explanation of fault messages is contained in the separate operating manual AS-002.

9.3 Fault diagnosis and troubleshooting

If, among the faults listed here, a fault occurs that can only be rectified by the manufacturer, contact customer service immediately.  Chapter 1.4.2 „Customer service“ on page 11



Fault description	Cause	Remedy	Personnel
<i>Abnormal running sounds</i>	Sheaves are not aligned properly.	Check and, if necessary, correct alignment. ↗ <i>Chapter 8.3.7 „Checking the sheaves“ on page 155</i>	Service personnel
	Bearing damage.	Replace bearings.	Manufacturer's customer service division
	Foreign bodies in gear wheels.	Check gear wheels, rectify the damaged areas and if necessary, replace them.	Manufacturer's customer service division
	Shaft deflection.	Locate shaft deflection, replace it.	Manufacturer's customer service division
<i>Start unloading device does not close.</i>	Nozzle is contaminated.	Clean the nozzle. ↗ <i>Chapter 8.3.14 „Cleaning the nozzle of the start-up relief device“ on page 162</i>	Service personnel
<i>The machine becomes too hot.</i>	Intake filter contaminated (display unit: max. -45 mbar).	Replace intake filter. ↗ <i>Chapter 8.3.6 „Replacing the intake filter“ on page 155</i>	Service personnel
	The ambient temperature is too high.	Ensure there is adequate ventilation.	User
	Openings of the acoustic hood for supply air and exhaust air are contaminated.	Clean the openings. ↗ <i>Chapter 8.3.15 „Checking the inlet and exhaust air openings on the acoustic hood“ on page 163</i>	User
	The acoustic hood fan is malfunctioning.	Replace the fan. ↗ <i>„Replacing the fan“ on page 163</i>	Service personnel
	The permissible operating data have been exceeded.	Check and comply with the operating data.	User
	Foreign bodies on the belt guard.	Remove dirt.	User
<i>Oil present in conveyed medium.</i>	Wear and tear on seals.	Replace seals.	Manufacturer's customer service division
	Oil level too high.	Correct the oil level. ↗ <i>Chapter 8.3.3 „Correcting the oil level“ on page 141</i>	Service personnel
	Balancing holes are sealed.	Remove the sealing cap. ↗ <i>Chapter 8.3.12 „Checking that sealing plugs have been removed“ on page 161</i>	Service personnel

Fault description	Cause	Remedy	Personnel
<i>Intake volume is too low.</i>	Intake filter contaminated (display unit: max. -45 mbar).	Replace the intake filter. ↗ Chapter 8.3.6 „Replacing the intake filter“ on page 155	Service personnel
<i>Intake volume is too low.</i>	Intake piping is leaking.	Seal intake piping.	Service personnel
<i>The motor requires too much power.</i>	The operating data differs from the order data.	Check operating data, comply with correct data.	User
	Mechanical damage.	Replace malfunctioning components.	Service personnel
<i>Belts are vibrating.</i>	Wear and tear on belts.	Replace the belts. ↗ Chapter 8.3.9 „Replacing belts, version with lifting device“ on page 156 Replace the belts. ↗ Chapter 8.3.10 „Replacing belts, version without lifting device“ on page 158	Service personnel
	Sheaves are not aligned properly.	Check and, if necessary, correct them. ↗ Chapter 8.3.7 „Checking the sheaves“ on page 155	Service personnel
<i>Machine turns in reverse after being shut down.</i>	Non-return flap is leaking or malfunctioning.	Replace the component. ↗ Chapter 8.3.13 „Checking the non-return flap“ on page 161	Service personnel
<i>Medium leak at the safety valve.</i>	Safety valve not opening or closing.	Replace the safety valve	Service personnel

9.4 Status and error messages (component suppliers)

Control system fault message

Depending on the customer's control system, additional fault messages can be recorded and displayed.

9.5 Commissioning after malfunction rectification

Commissioning after fault rectification

1. ➤ Check all previously loosened screw connections for tightness.
2. ➤ Mount all protective hardware and covers that were previously removed.
3. ➤ Remove all used tools, materials and other equipment from the workspace.
4. ➤ Clean the workspace. Remove operating substances, operating material, processing material and similar materials and dispose of them appropriately.
5. ➤ Inform the responsible on-site person about the result of troubleshooting.
6. ➤ Ensure that there are no persons in the hazard area.



- 7.** ➤ Release the main circuit breaker and activate it.
- 8.** ➤ Release the EMERGENCY STOP function.
- 9.** ➤ Confirm the removal of the fault in the control system.
- 10.** ➤ Start operation in accordance with the instructions in the "Operation" chapter. ➤ *Chapter 7.3 „Switching on“ on page 122*
- 11.** ➤ Inform the responsible on-site person about the result of the work carried out

9.6 Checks after malfunction rectification

Inspection	After the first 3 op. hrs	After the first 25 op. hrs
Safety valve	check for correct operation	
Oil level	check and, if necessary, correct	check and, if necessary, correct
Aligning the belt pulley		Check and, if necessary, correct
op. hrs = operating hours		

10 Disassembly and disposal

Protecting the environment and conserving resources are among AERZEN'S foremost priorities.

Once the machine's service life is over, it must be disassembled and disposed of in an environmentally-friendly way. The following is a set of recommendations for environmentally-friendly disposal.

10.1 Safety instructions

Improper disassembly



WARNING!

Risk of injury from improper disassembly!

Stored residual energy, sharp components, edges and corners on or in the machine or on the necessary tools can cause injury.

- Before beginning work, ensure there is sufficient space.
Allow the machine to cool down to the ambient temperature.
- Proceed with caution when working with open, sharp-edged components.
- Ensure the tidiness and cleanliness of the workspace! Components and tools that are loosely stacked or lying around can cause accidents.
- Disassemble components correctly. Take into consideration the weight of each component. If necessary, use hoists.
- Secure components, so they do not topple or fall.
- If in doubt, contact the manufacturer.

Electric current



DANGER!

Risk of fatal injury from electrical current!

Disassembly of live components can cause serious or fatal injury.

- Switch off the power to the operating cable.
- Check there is no live current.

Disassembling the delivery line

WARNING!
Risk of injury from compressed conveyed materials!

For the disassembly of pressurised components such as pipes, containers, hoses or valves, hot conveying material escapes with a strong gas flow. This can result in serious injury.

- Before beginning work, fully relieve pressurised components of pressure.
- Check that components are not pressurised.
- Only disassemble pressurised components when they are not under pressure.

For conveyance of nitrogen

DANGER!
Risk of suffocation from escaping residual gas!

Opening piping and screws can allow gas to escape freely into the atmosphere, potentially leading to suffocation.

- Minimise residual gas as much as possible.
- Ventilate the work environment properly.
- Make a record of disassembly works after approval measurement by the operator

Requirements for staff

Requirements for disassembly:

Disassembly of electrical components

Personnel: ■ Authorised electricians

Personnel: ■ Authorised electricians with additional qualifications

Requirements for disassembly:

Disassembly of mechanical components

Personnel: ■ Service personnel

Protective equipment

Requirements for disassembly:



- Protective equipment:
- Protective work clothing
 - Safety shoes
 - Hearing protection
 - Protective gloves
 - Safety goggles
 - Industrial hard hat

Special tools

Requirements for disassembly:

- Special tool:
- General tool kit
 - Tools for authorised electricians
 - Auxiliary materials, aids
 - Lifting equipment
 - Transport equipment

- Special tool:
- Locking key

10.2 Disassembly

Preparing for disassembly:

1. ➤ Immediately inform the responsible staff on site about the disassembly.
2. ➤ Switch off the machine and secure it against restarting.
3. ➤ Seal off the pressure line and remove it.
4. ➤ Physically separate the entire electric power supply from the machine. Release stored residual energy.
5. ➤ If necessary, disconnect the machine control system from a connected process control system.
6. ➤ Remove operating and auxiliary materials and residual processing materials and dispose of them in an environmentally-friendly way.
7. ➤ In addition, clean assemblies and components thoroughly. Dismantle them in accordance with local regulations for occupational safety and environmental protection.
8. ➤ Remove the machine's foundation bolts.
9. ➤ During disassembly, there should be a general sorting of parts in accordance with disposal categories. ➤ „Categories for sorting“ on page 176

10.3 Disposal

The machine is composed primarily of steel, casting material and various non-ferrous metals. In general, metallic materials are fully recyclable.

Proper disposal

In as far as no agreement has been made on the return or disposal of the machine, send dismantled components for recycling:

- Scrap metals.
- Send plastics for recycling.
- Sort and dispose of other components according to material composition.

Improper disposal

ENVIRONMENT!
Environmental risk from improper disposal!

Improper disposal can present a risk to the environment.

- Have insulating materials, electronic waste, electronic components, auxiliary materials and chemicals disposed of by professional waste disposal companies.
- If in doubt, contact the local authorities or specialist companies for information on environmentally-friendly waste disposal.

Oil and lubricants

ENVIRONMENT!
Environmental risk from oil!

The improper disposal of oil and lubricants can present a risk to the environment.

- Collect oil carefully, store it and dispose of it properly or recycle it.
- If in doubt, contact the local authorities or specialist waste disposal companies for information on environmentally-friendly waste disposal.

Battery

ENVIRONMENT!
Environmental risk from batteries!

The improper disposal of batteries, e.g. from the control system, can present a risk to the environment.

- Collect batteries and dispose of them properly at local collection points.
- If in doubt, contact the local authorities or specialist waste disposal companies for information on environmentally-friendly waste disposal.



Disposal

Requirements for personnel

Disposal requirements:

Personnel: ■ Skilled staff for industrial waste

Protective equipment

Disposal requirements:

Protective equipment: ■ Protective work clothing
■ Safety shoes
■ Hearing protection
■ Protective gloves
■ Safety goggles
■ Industrial hard hat

Special tools

Disposal requirements:

Special tool: ■ Lifting equipment

Categories for sorting

Scrap iron	Non-ferrous metal (except for scrap iron)	Insulation material	Electronic waste (encoder electronics)	Auxiliary materials and chemicals
Scrap ■ Scrap steel ■ Foundry scrap ■ Scrap from non-rusting steels ■ Stainless steel scrap	Aluminium	Various isolators (in terminal boxes)	Electrical tools	Lubricant and gear oils Grease
Used metal/2A materials ■ Steel beams ■ Steel sheets	Copper	Voltage and current transformers	Measurement, control and regulatory systems	Cleaning agents and solvents
Machines made of metal ■ Without electronics	Brass	Electric cables and leads		Paint residue
	Motor windings	Instrument wiring		Anti-corrosion agents
		Surge absorbers		Cloths (soaked in agents or chemicals)



Scrap iron	Non-ferrous metal (except for scrap iron)	Insulation material	Electronic waste (encoder electronics)	Auxiliary materials and chemicals
		Heat insulation materials		AERtronic batteries
<p>This does not include:</p> <ul style="list-style-type: none"> ■ Hazardous adhesions ■ Sealed hollow parts (due to danger of deflagration or hazardous contents) 	<p>Valve disposal</p> <ul style="list-style-type: none"> ■ Remove the medium before disposal! Neutralise residual medium in the valves. 		<p>This does not include:</p> <ul style="list-style-type: none"> ■ PCB capacitors 	<ul style="list-style-type: none"> ■ Solvents, cleaning agents and paint residue must not be allowed to mix! ■ Sort oils separately according to emulsions and solvents. ■ Agents and chemicals must be collected in separate, labelled containers.

Disposal of accessories**Motor**

- For safety reasons, disposal may only be carried out by specialists for industrial waste or by return to the manufacturer!
- The encoder electronics are electronic waste.

Frequency inverter**DANGER!**

Danger due to explosion of the capacitor and the formation of toxic gases!

- For safety reasons, disposal may only be carried out by specialists for industrial waste or by return to the manufacturer!
- The encoder electronics are electronic waste.

11 Technical specifications

11.1 Dimensions and weights

General information

The following dimensions and weights relate to standard variants and can vary depending on the specific design.

Exact details can be found on the installation drawing.

Information on weight can be found on the packing note and the designation on the type plate.

Dimensions, including packaging, are included in the forwarding order.

Tab. 3: Dimensions and weights

Positive pressure operation						
Size	Width (W) mm	Depth (D) mm	Height (H) mm	Nominal diameter DN	Weight without acoustic hood, without motor and without belt drive approx. kg	Weight with acoustic hood, excluding motor and belt drive approx. kg
GM 3 S	800	800	1055	50	160	220
GM 4 S	925	1135	1280	80	210	320
GM 7 L	925	1135	1280	80	210	320
GM 10 S / DN80	925	1135	1280	80	240	350
GM 10 S / DN100	1250	1350	1500	100	350	510
GM 15 L	1250	1350	1500	100	360	530
GM 25 S	1250	1350	1500	125	420	580
GM 30 L	1500	1800	1900	150	660	980
GM 35 S	1500	1800	1900	150	760	1040
GM 50 L / DN150	1500	1800	1900	150	810	1130
GM 50 L / DN200	1700	2055	2111	200	840	1310
GM 60 S	1700	2055	2111	200	1000	1460
These dimensions and weights relate to the standard design and are approximate values. The information can vary depending on the order.						

**Positive pressure operation**

Size	Width (W) mm	Depth (D) mm	Height (H) mm	Nominal diameter DN	Weight without acoustic hood, without motor and without belt drive approx. kg	Weight with acoustic hood, excluding motor and belt drive approx. kg
GM 80 L	1900	2200	2308	250	2720	3570
GM 90 S	1900	2200	2308	250	2780	3630
GM 130 L	2100	2850	2345	300	2265	3230
GM 150 S	2100	2850	2345	300	2510	3470

These dimensions and weights relate to the standard design and are approximate values. The information can vary depending on the order.

11.2 Dimension specifications sheet

An accompanying dimension specifications sheet is provided with the product documentation.

These documents contain important dimensions for installation and set-up.



11.3 Operating data

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11.4 Technical performance data

Tab. 4: Operating and application limits

Positive pressure operation			
Size	Differential pressure max. mbar	volume flow max. m ³ /h	Motor rating max. kW
GM 3 S	1000	247	7.5
GM 4 S	1000	282	15
GM 7 L	700	493	15
GM 10 S / DN80	1000	542	22
GM 10 S / DN100	1000	696	30
GM 15 L	700	1038	30
GM 25 S	1000	1452	55
GM 30 L	700	2082	75
GM 35 S	1000	2418	90
GM 50 L / DN150	700	2610	75
GM 50 L / DN200	700	3306	90
GM 60 S	1000	3540	132
GM 80 L	700	5034	160
GM 90 S	1000	5418	200
GM 130 L	700	8040	200
GM 150 S	1000	9120	355
These operating limits are maximum values. Difficult operating conditions can adversely affect these data.			

Environmental limits

Data	Value	Unit
Temperature range	-10 to 40	°C
Relative humidity	0 to 80	%
Chemical-free atmosphere		

Maximum installation elevation

Data	Value	Unit
max. installation elevation above NN*	1000	m

If installing at a different elevation, observe the order-specific design data sheets.

Type plate(s) and placement

Environmental limits

Data	Value	Unit
Temperature range	-10 to 40	°C
Mounting of acoustic hood heating	less than -10	°C
Relative humidity	0 to 80	%
Chemical-free atmosphere		

operating period

Data	Value	Unit
Maximum continuous operating period	24	hrs
Pause until next operation	/	hrs

11.5 Type plate(s) and placement

Placement on the machine stage

Manufacturer/type plate on the machine stage.

Pos.1 Manufacturer plate

Pos.2 Type plate

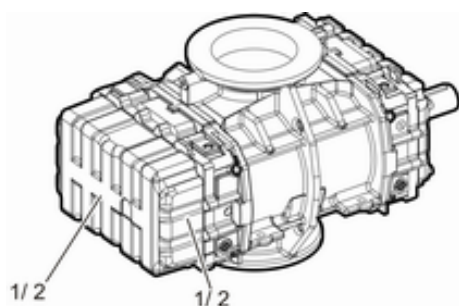


Fig. 162: Layout example

Manufacturer plate - pos.1

Manufacturer plate



Fig. 163: Manufacturer plate

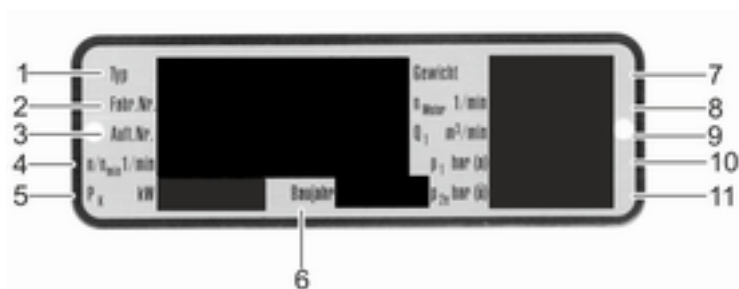
Type plate - pos.2


Fig. 164: Type plate

- Pos.1 Machine type
- Pos.2 Factory/serial number
- Pos.3 Order no.
- Pos.4 Machine rotational speed
- Pos.5 Power consumption
- Pos.6 Year of manufacture
- Pos.7 Weight
- Pos.8 Motor rotational speed
- Pos.9 Conveyed amount
- Pos.10 Intake pressure (absolute) - p1
- Pos.11 Positive pressure, discharge - p2e

Placement on the acoustic hood


Fig. 165: Acoustic hood signage

The manufacturer/type plate is on the operating side of the acoustic hood.

Pos.1 / acoustic hood Manufacturer and type plate

Type plate(s) and placement

Manufacturer and type plate - pos.1



Fig. 166: Acoustic hood manufacturer/performance data plate

- Pos.1 Manufacturer, including address
- Pos.2 Designation
- Pos.3 Machine type
- Pos.4 Customer order no.
- Pos.5 Serial number
- Pos.6 Year of manufacture
- Item 7 max. intake pressure (absolute)-p1
- Item 8 max. discharge pressure (absolute) -p2
- Item 9 Nominal power of motor
- Item 10 Machine weight (total)

Type designation

The type designation is derived from the following table:

Tab. 5: Explanation using example: **GM 90 S**

Designation	Explanation	Details
GM	Product designation	Positive displacement blower
90	Maximum flow volume in m ³ /min (approx.)	
S	Design	L: Pressure differences up to 700 mbar S: Pressure differences up to 1,000 mbar

Safety valve signage

When using the AERZEN safety valve the type plate is on the valve housing.

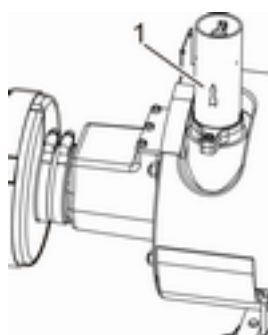


Fig. 167: Signage

Safety valve type plate

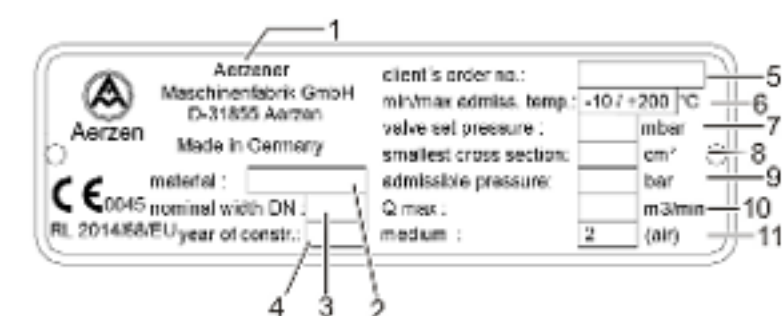


Fig. 168: Manufacturer/performance data plate

- Pos.1 Manufacturer, including address
- Pos.2 Material
- Pos.3 Nominal diameter
- Pos.4 Year of manufacture
- Item 5 Customer order no.
- Pos.6 Application temperatures
- Pos.7 Valve set pressure
- Pos.8 Narrowest cross-section
- Pos.9 Maximum permissible pressure
- Pos. 10 max. flow rate
- Pos. 11 Medium type

11.6 Noise emissions

Information on noise emissions

This information is determined in accordance with the performance data. ↪ Chapter 11.4 „Technical performance data“ on page 181.

No-load operation or operation below the maximum performance values reduces noise emissions.

Machines without an acoustic hood have considerably higher noise emissions. Observe the measures for noise emission reduction ↪ Chapter 5.2 „Requirements for the installation site“ on page 91



Measurement requirements

- applied basic standard DIN EN ISO 2151
- measured according to basic standard DIN EN ISO 3744
- with acoustic hood
- connected, insulated pipelines
- tolerance: ± 2 dB(A)

Positive pressure

Size	A-weighted sound pressure level, L_{pA} dB(A)
GM 3 S	72
GM 4 S	72
GM 7 L	72
GM 10 S / DN 80	74
GM 10 S / DN 100	74
GM 15 L	75
GM 25 S	75
GM 30 L	77
GM 35 S	77
GM 50 L / DN 150	77
GM 50 L / DN 200	78
GM 60 S	80
GM 80 L	82
GM 90 S	83
GM 130 L	86
GM 150 S	86

11.7 Operating materials

11.7.1 Lubricant oil specifications

Lube oil specification



Choice of lubricants

When operating the machine, only use lubricants that comply with this specification!

The quality of lube oil has a considerable effect on the service life of the machine.

When selecting the type of lube oil, the application conditions and the relevant additives and viscosity class are decisive.

Taking the operating conditions into account, only use the following oils with the corresponding viscosities and additives.

* Ambient temperature = the temperature in the immediate vicinity of the machine all year round.

Low-load operation

Using these machines for "**low-load operation with minor pressure differences**" requires prior consultation with AERZEN Customer Service or the sales company. To select a suitable lubricant, the operating conditions, load and operating data need to be taken into account.

Lube oil properties

Tab. 6: General requirements of the lube oil properties

Kinematic viscosity at operating oil temperature.	min. 10 - 13 cSt (mm ² /s)
Kinematic viscosity at -10°C	min. ≤ 3,500 cSt (mm ² /s)

Tab. 7: Minimum properties of the oil additive

EP wear-protection additives for use in rolling bearing drives
Oxidisation stability up to 110°C oil sump temperature
Foam suppressor
Detergent for deposit solutions
Neutrality with regard to seal materials of fluoropolymer elastomer (Viton)
Neutrality with regard to one-component resin primers
Sufficient shear stability

11.7.1.1 Lube oils

Tab. 8: Standard first oil filling

Delta Lube 06	
Intake temperature (machine stage)	up to 50°C
Final compression temperature (machine stage)	up to 140°C
Ambient temperature*	no constraints
This lube oil is used as initial oil filling for standard use conditions.	

11.7.1.1.1 Alternative lube oils

Tab. 9: One or two-shift operation/intermittent operation

AERZEN special rotary piston oil	
Intake temperature (machine stage)	up to 50°C
Final compression temperature (machine stage)	up to 140°C
Ambient temperature*	no constraints

Tab. 10: Continuous operation: 24 hours a day

ISO VG 150	
Fully-synthetic poly-alpha-olefin (PAO), drive or compressor oil	
Intake temperature (machine stage)	up to 50°C
Final compression temperature (machine stage)	up to 140°C
Ambient temperature*	no constraints
Example: MOBIL SHC 629	

Tab. 11: Operation with a final compression temperature of over 140°C

ISO VG 220	
Synthetic lube oil with a base oil of type polyglycol	
Continuous oil temperature	120°C - 140°C
Final compression temperature (machine stage)	over 140°C
Ambient temperature*	no constraints
Example: ESSO Glycolube 220, ARAL Degol GS 220	

11.7.1.2 Changing oil types

Delta Lube 06, AERZEN special rotary piston oil --> fully synthetic PAO lubricants

The AERZEN lubricants (Delta Lube 06, AERZEN special rotary piston oil) are fully compatible with fully synthetic PAO lubricants.

Measures: If you change to another oil type, no specific measures need be taken. However, to preserve the working properties of the new oil, the oil that is replaced should be drained completely and, after 100 operating hours and in addition to any scheduled oil changes, a full oil change including oil filter change (if there are any filters) should be performed. Only oil of the same type should be used for topping up.

Delta Lube 06, AERZEN special rotary piston oil, fully synthetic PAO lubricants --> polyglycol oils (PAG)

The AERZEN lubricants (Delta Lube 06, AERZEN special rotary piston oil) as well as PAO lubricants are **not** compatible with polyglycol oils (PAG) or perfluorinated polyether oils, e.g. Fomblin.

Measures: In order to change the oil type, the machine must be completely dismantled and the entire oil system thoroughly cleaned of residue. A rinsing is recommended before first commissioning. Only oil of the same type should be used for topping up.

11.7.2 Lubricant oil in the food and pharmaceutical industry

For rotary piston blowers, lubricating oils can be used which have approval according to the specification USDA H1.

Operational experience is **only** available for the following lubricating oils.

AERZEN issues no approval for any other oils.

It is recommended that you carry out an oil analysis after 1,000 op. hrs in coordination with the oil manufacturer.

ISO VG 100

Continuous oil temperature	up to 100°C
----------------------------	-------------

Compressor discharge temperature	up to 120°C
----------------------------------	-------------

Lubricant to be used: **Klüberöl 4UH1-100 N**

ISO VG 220

Continuous oil temperature	over 100°C
----------------------------	------------

Compressor discharge temperature	over 120°C
----------------------------------	------------

Lubricant to be used: **Klüberöl 4UH1-220 N**

11.7.3 Grease specifications



Only for the gas-tight version of the drive shaft!

Tab. 12: Greases for the gasket of the drive shaft

Grease KHC-2P-30

Using the lubricating oils according to AERZEN lubricating oil specification, excluding polyglycols

Filling at the factory

KLÜBER PETAMO GHY 133 N

Grease MPG2K-40

Using the a polyglycol oil according to AERZEN lubricating oil specification

Filling at the factory

KLÜBER SYNTHESO PROBA 270

Information on grease

- Avoid mixing different greases.
- Lubrication is only permitted with the same grease.
- If these greases are not available, completely remove the grease and replace it with another grease in accordance with KHC-2P-30 or MPG2K-40.
- Observe the seal compatibility with Viton!



11.7.4 Lubricant quantities

Machine lube oil levels



The following values for lube oil levels are guide values. The main factor in determining the oil fill quantity is the displays of the relevant oil level pointer.

Tab. 13: Version with oil system

Total oil quantity			
Oil level middle sight glass on the acoustic hood			
Operating material	Machine type	Filling quantity, approx.	Unit
Lube oil	GM 3 S	0.55	Litre (l)
	GM 4 S	1.00	
	GM 7 L	1.00	
	GM 10 S	1.40	
	GM 15 L	1.40	
	GM 25 S	1.75	
	GM 30 L	1.75	
	GM 35 S	3.75	
	GM 50 L	4.50	
	GM 60 S	7.50	
	GM 80 L	7.50	
	GM 90 S	12.50	
	GM 130 L	12.50	
	GM 150 S	12.00	

Tab. 14: Version without oil system

Total oil quantity			
Oil level at centre of sight glasses on machine stage			
Operating material	Machine type	Filling quantity, approx.	Unit
Lube oil	GM 3 S	0.55	Litre (l)
	GM 4 S	0.55	
	GM 7 L	0.55	
	GM 10 S	0.86	
	GM 15 L	0.86	



Total oil quantity			
Oil level at centre of sight glasses on machine stage			
Operating material	Machine type	Filling quantity, approx.	Unit
	GM 25 S	1.20	
	GM 30 L	1.20	
	GM 35 S	3.00	
	GM 50 L	3.50	
	GM 60 S	6.50	
	GM 80 L	6.50	
	GM 90 S	11.50	
	GM 130 L	11.50	
	GM 150 S	11.00	

Grease filling quantity for machine stage



Only for the gas-tight version of the drive shaft!

Operating material	Machine type	Filling quantity, approx.	Unit
Grease	GM 3 S	5	cm ³
	GM 4 S	5	
	GM 7 L	5	
	GM 10 S	5	
	GM 15 L	5	
	GM 25 S	5	
	GM 30 L	5	
	GM 35 S	10	
	GM 50 L	10	
	GM 60 S	10	
	GM 80 L	10	
	GM 90 S	10	
	GM 130 L	10	
	GM 150 S	20	

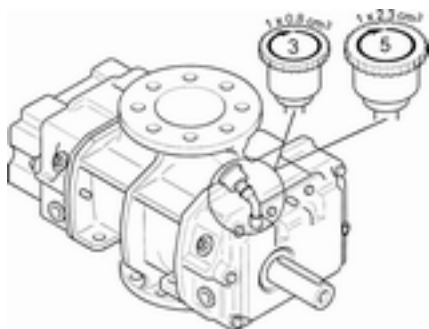
**Stauffer lubricators**

Fig. 169: Stauffer lubricator

Tab. 15: Grease amount per Stauffer lubricator for each rotation

Stauffer lubricator size	Rotation	Grease amount in cm ³
3	1	0.8
5	1	2.3

Drive motor grease quantity

Observe the separate motor documentation and the information on the type plate of the motor.

Operating material	Motor size	Filling quantity, approx.	Unit
Grease	Observe the information in the motor documentation and on the type plate!		

11.8 Coating**Corrosion protection**

The housing surfaces receive the following coatings to protect them against corrosion:

Standard coating

Undercoat	Corrosion protection on alkyd resin basis
End coating	Alkyd resin surface coating

Coating for increased corrosion protection

Undercoat	Corrosion protection on 2-component, epoxy resin, micaceous iron oxide basis
Intermediate coating	
End coating	Polyurethane surface coating



11.9 Electrical details

11.9.1 Voltage fluctuations

Permissible voltage fluctuations

Permissible voltage fluctuations are described in the international standard IEC 60038 subject to country-specific supply voltage tolerances.

Machine use only in a stable three-phase power supply. Voltage fluctuations or drops beyond the tolerance level may cause serious damage to the drive system.

11.9.2 Earthing strap cross-sections

Earthing strap

	kW	mm ²
to	55	14
to	200	70
to	315	2 x 70

11.9.3 Motor overload protection

Setting value

Max. ... % value, nominal motor current

110 %

11.10 Accessory information

11.10.1 Intake filter

Technical data

Intake filter		Unit
Filter resistance in clean condition	> 10	mbar
max. filter resistance	45	mbar

11.10.2 Start unloading device DN 50 to DN 80

Technical data

Start unloading device		
Voltage	230	V
Frequency	50	Hz
Protection type	IP 65	

**Start unloading device**

Power	8	W
open without current		

11.10.3 Start-up unloading device DN 80 to DN 400**Technical data**

Start-up unloading device DN 80 to DN 400		Unit
Voltage	230	V
Frequency	50	Hz
Protection type	IP 65	
Power	8	W
closed without current		

11.10.4 Balancing grade**Balancing type**

The vibration behaviour of the machines is determined not only by the balancing grade of the drive shafts but also by the balancing grade of the drive elements.

The drive shafts of the pistons and rotors are balanced according to the half-key principle. Sheaves and couplings must therefore correspond to balancing type "H".

12 Notes on the Declaration of Conformity



This document is provided for informational purposes only and gives an account of the contents of the Declaration of Conformity. The original document is provided with the product or is sent in a separate document.



CE MRL 1012_1

Declaration of Conformity

pursuant to the EC Machinery Directive 2006/42/EC, Annex II 1A

Translation of Original Declaration of conformity

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 Reherweg 28
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Product

Designation

Type

Serial no.

Order no.

Year of construction

We hereby declare that the above product complies with all applicable provisions of the Machinery Directive 2006/42/EC.

The aforementioned product fulfils the requirements of the following applicable directives:

► Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast) 2006/42/EC

The following harmonised standards were applied:

► DIN EN ISO 12100:2011-03 Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)

► DIN EN 1012-1:2011-02 Compressors and vacuum pumps - Safety requirements - Part 1: Air compressors; German version EN 1012-1:2010

Information on

Managing director

Signature

Location, date of issue

Signatory

27.10.2014, Dsld CE MRL 1012_1 01_2014_1_en_GB

13 Glossary

•Bar chart display	A bar chart display is a display method which uses a scale to represent the size of a signal with a representative bar that changes in length depending on the signal size.
•Belt run	The belt section between two sheaves is termed a "belt run".
•Discharge temperature	Temperature measured at the discharge sockets of the machine stage.
•EMERGENCY STOP function	<p>A function intended to alleviate the danger of impending hazards in terms of injury or damage to persons and machines during operation or to reduce the danger of hazards that are already present.</p> <p>A function that is activated by one single action by an individual person.</p> <p>The purposeful shut-down of the machine to avoid a dangerous situation. Voltage-carrying components are still active.</p> <p>Emergency stop.</p>
•Machine	A machine is an assembly of linked parts or components, at least one of which moves. A machine is fitted or intended to be fitted with a drive system. The machine has a proper intended use and is assembled for a specific purpose. Another technical term for "machine" is "unit".
•Machine stage	A machine stage is an incomplete machine. It is an assembly that almost constitutes a machine, but that does not fulfil a specific function. A machine stage is only intended to be installed in and added to other machines or other incomplete machines.
•Modbus RTU	Modbus RTU transfers data in binary form. This ensures a good data throughput rate. The data cannot be evaluated directly by persons, rather they must first be converted into a readable format.
•PROFIBUS-DP	PROFIBUS DP involves the communication of central control equipment via a fast serial connection with decentralized input /output modules.
•Sentinel filter	<p>Another filter downstream from a filter</p> <p>It fulfils an end cleaning function and a safety function.</p>
•Stop category 0	<p><u>Stop category 0.</u></p> <p>Shut-down by means of immediate interruption of the power supply to the machine.</p> <p>Shut-down by means of mechanical separation (uncoupling) of components that pose a danger and their mechanical drive elements and, if necessary, by means of a braking procedure.</p>
Oil system	The oil system is used in a multitude of acoustic hoods. It comprises a filling vessel, an additional oil level display on the acoustic hood and the oil pipe connection.



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Customer Reference: 506752 - English River
Aerzen Reference: SQ-20-020859c

Submitted by: Nikita Assilamehoo
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SCOPE OF SUPPLY

Membrane Air Blower - Tags : 22-B-201 - A/B/C

3 Aerzen Generation 5 Blower Package - GM 3S DN 50 - Pressure - including:

Aerzen GM 3S Blower
Drive Motor: 10hp, 1800rpm, TEFC, 575V/60Hz

Base with integrated reactive type discharge silencer
Intake filter silencer
Hinged motor support as automatic belt tensioning device
Set of vibration isolation mounts
Narrow v-belt drive with guard - 1 set
Spring loaded relief valve preset to: 950 mbar
Discharge manifold with externally accessible integrated check valve
Flexible connector with clamps for schedule 40 pipe, discharge
Acoustic Enclosure - Indoor/Outdoor

Instruments

Pressure gauge c/w isolation ball valve (3x)
Dirty filter indicator (3x)

Optional Accessories

Motor Protection - 1 Thermistor/Ph

Optional Spare Parts

1 Year Maintenance Kit (1 x V-Belt Set, 1 x Intake Filter)
2 Year Maintenance Kit (1 x V-Belt Set, 1 x Oil Change (Delta Lube), 2 x Air Filter)

Connection Points:

Intake Connection: Local
Discharge Connection: DN 50 - 2"

Exclusions: See page 2

Customer Reference: 506752 - English River
Aerzen Reference: SQ-20-020859c

PERFORMANCE DATA

Aerzen Blower Package - GM 3S DN 50 - Pressure

Configuration:

G5

		Spike	VFD MIN	Build-out	Design	Min	Min Temp
Conditions:	ICFM	112	35	112	54	33	112
Flow at inlet conditions	m³/min	3.18	0.99	3.17	1.53	0.93	3.17
	lcfm	112	35	112	54	33	112
Inlet pressure (abs.)	bar	0.950	0.950	0.950	0.950	0.950	0.950
	Psi	13.8	13.8	13.8	13.8	12.8	13.8
Pressure differential	mbar(g)	620	620	450	320	300	450
	Psig	9.0	9.0	6.5	4.6	4.4	6.5
Inlet temperature	°C	25	25	25	25	25	15
Discharge temperature	°C	101	144	78	69	75	66
Blower speed	RPM	4263	2096	4100	2311	1703	4082
Blower maximum speed	RPM	4800	4800	4800	4800	4800	4800
% of maximum blower speed		89%	44%	85%	48%	35%	85%
Power required at shaft (with accessories) **	kW	5.1	2.4	3.7	1.5	1.0	3.7
	HP	6.8	3.2	4.9	1.9	1.3	5.0
Total Power (Wire to Air):	HP	7.5	3.6	5.5	2.2	1.5	5.7
Motor rating	HP	10.0					
Motor speed	RPM	1760	865	1693	954	703	1686
Motor frequency	Hz	60	30	58	33	24	57

Noise level without acoustic hood dB(A) 96
Noise level with acoustic hood dB(A) 66

Tolerances as per EN 10204, in accordance with standard ISO 1217:

Flow at inlet conditions / Power required at shaft +/- 5%

Blower package noise level:

Free field measurement at 1m from the complete blower package (tolerance +/- 2 dB(A))

Tests and measurements:

Blower stage: 1.5 hour flow test at the factory (Germany) on a calibrated test bed, at maximum operating conditions and according to DIN 1945. acceptance tolerance: +/- 5%.
A complete test report is available upon request.

On Site Commissioning

Available upon request, charges to be advised.

- Any commissioning activity is subject to two weeks prior notice and completion of commissioning checklist.
- Any on-site activity outside the time indicated will be billed according to the Aerzen Standard Rate Sheet

Exclusions

Control Panels, Motor Starters, Piping and Electrical Connections

* Unloading valves are required for reduced voltage starters

Warranty

Blowers including accessories are warranted for a period of 12mo / max 18mo after delivery and after provisional acceptance of the work against defects in workmanship and design. This warranty does not cover wearing parts unless such parts are defective during shipping / commissioning.
As per Aerzen standard warranty terms.

** Power at shaft excludes drive motor and belt drive

Customer Reference: 506752 - English River
Aerzen Reference: SQ-20-020859c

Submitted by: Nikita Assilamehoo
nikita.assilamehoo@aerzen.com

SCOPE OF SUPPLY

Process Air Blower - Tags : 16-B-401 - A/B

2 Aerzen Generation 5 Blower Package - GM 7L DN 80 - Pressure - including:

Aerzen GM 7L Blower
Drive Motor: 15hp, 1800rpm, TEFC, 575V/60Hz

Base with integrated reactive type discharge silencer
Intake filter silencer
Hinged motor support as automatic belt tensioning device
Set of vibration isolation mounts
Narrow v-belt drive with guard - 1 set
Spring loaded relief valve preset to: 750 mbar
Discharge manifold with externally accessible integrated check valve
Flexible connector with clamps for schedule 40 pipe, discharge
Acoustic Enclosure - Indoor/Outdoor

Instruments

Pressure gauge c/w isolation ball valve (2x)
Dirty filter indicator (2x)

Optional Accessories

Motor Protection - 1 Thermistor/Ph

Optional Spare Parts

1 Year Maintenance Kit (1 x V-Belt Set, 1 x Intake Filter)
2 Year Maintenance Kit (1 x V-Belt Set, 1 x Oil Change (Delta Lube), 2 x Air Filter)

Connection Points:

Intake Connection: Local
Discharge Connection: DN 80 - 3"

Exclusions: See page 2

Customer Reference: 506752 - English River
Aerzen Reference: SQ-20-020859c

PERFORMANCE DATA

Aerzen Blower Package - GM 7L DN 80 - Pressure

Configuration:

G5

		Spike	VFD MIN	Build-out	Design	Min	Min Temp	MAX FLOW	
Conditions:	ICFM	200	63	200	160	110	200	211 SCFM	250 SCFM
Flow at inlet conditions	m ³ /min	5.67	1.78	5.66	4.53	3.11	5.66	6.56	7.78
	lcfm	200	63	200	160	110	200	232	275
Inlet pressure (abs.)	bar	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
	Psi	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
Pressure differential	mbar(g)	620	620	520	520	520	520	620	520
	Psig	9.0	9.0	7.5	7.5	7.5	7.5	9.0	7.5
Inlet temperature	°C	25	25	25	25	25	15	25	25
Discharge temperature	°C	101	143	87	90	99	75	98	83
Blower speed	RPM	3727	1839	3643	3091	2402	3626	4167	4678
Blower maximum speed	RPM	4800	4800	4800	4800	4800	4800	4800	4800
% of maximum blower speed		78%	38%	76%	64%	50%	76%	87%	97%
Power required at shaft (with accessories) **	kW	8.7	4.1	7.2	6.0	4.6	7.1	9.8	9.6
	HP	11.6	5.5	9.6	8.0	6.2	9.5	13.1	12.9
Total Power (Wire to Air):	HP	12.7	6.3	10.5	8.9	6.8	10.5	14.6	14.3
Motor rating	HP	15.0							
Motor speed	RPM	1406	694	1374	1166	906	1368	1572	1765
Motor frequency	Hz	48	24	47	40	31	46	53	60

Noise level without acoustic hood dB(A) 90
Noise level with acoustic hood dB(A) 74

Tolerances as per EN 10204, in accordance with standard ISO 1217:

Flow at inlet conditions / Power required at shaft +/- 5%

Blower package noise level:

Free field measurement at 1m from the complete blower package (tolerance +/- 2 dB(A))

Tests and measurements:

Blower stage: 1.5 hour flow test at the factory (Germany) on a calibrated test bed, at maximum operating conditions and according to DIN 1945. acceptance tolerance: +/- 5%.
A complete test report is available upon request.

On Site Commissioning

Available upon request, charges to be advised.

- Any commissioning activity is subject to two weeks prior notice and completion of commissioning checklist.
- Any on-site activity outside the time indicated will be billed according to the Aerzen Standard Rate Sheet

Exclusions

Control Panels, Motor Starters, Piping and Electrical Connections

* Unloading valves are required for reduced voltage starters

Warranty

Blowers including accessories are warranted for a period of 12mo / max 18mo after delivery and after provisional acceptance of the work against defects in workmanship and design. This warranty does not cover wearing parts unless such parts are defective during shipping / commissioning.
As per Aerzen standard warranty terms.

** Power at shaft excludes drive motor and belt drive

Customer Reference: 506752 - English River
Aerzen Reference: SQ-20-020859d

Submitted by: Nikita Assilamehoo
nikita.assilamehoo@aerzen.com

SCOPE OF SUPPLY

WAS Blower - Tag : TBD

1 Aerzen Generation 5 Blower Package - GM 7L DN 80 - Pressure - including:

Aerzen GM 7L Blower
Drive Motor: 15hp, 1800rpm, TEFC, 575V/60Hz

Base with integrated reactive type discharge silencer
Intake filter silencer
Hinged motor support as automatic belt tensioning device
Set of vibration isolation mounts
Narrow v-belt drive with guard - 1 set
Spring loaded relief valve preset to: 750 mbar
Discharge manifold with externally accessible integrated check valve
Flexible connector with clamps for schedule 40 pipe, discharge
Acoustic Enclosure - Indoor/Outdoor

Instruments

Pressure gauge c/w isolation ball valve (1x)
Dirty filter indicator (1x)

Optional Accessories

Motor Protection - 1 Thermistor/Ph

Optional Spare Parts

1 Year Maintenance Kit (1 x V-Belt Set, 1 x Intake Filter)
2 Year Maintenance Kit (1 x V-Belt Set, 1 x Oil Change (Delta Lube), 2 x Air Filter)

Connection Points:

Intake Connection: Local
Discharge Connection: DN 80 - 3"

Exclusions: See page 2

Customer Reference: 506752 - English River
Aerzen Reference: SQ-20-020859d

PERFORMANCE DATA

Aerzen Blower Package - GM 7L DN 80 - Pressure

Configuration:		G5				Min Temp	
		Design	VFD MIN	MAX P		MIN P	MAX P
Conditions:	SCFM	210.0	37.6	65.0	65.0	65.0	65.0
Flow at inlet conditions	m ³ /min	6.54	1.17	2.02	2.02	1.93	1.93
	lcfm	230.9	41.3	71.3	71.3	68.1	68.1
Inlet pressure (abs.)	bar	0.950	0.950	0.950	0.950	0.950	0.950
	Psi	13.8	13.8	13.8	13.8	13.8	13.8
Pressure differential	mbar(g)	520	520	620	520	520	620
	Psig	7.5	7.5	9.0	7.5	7.5	9.0
Inlet temperature	°C	25	25	25	25	15	15
Discharge temperature	°C	85	144	136	114	102	124
Blower speed	RPM	4068	1458	1956	1871	1810	1893
Blower maximum speed	RPM	4800	4800	4800	4800	4800	4800
% of maximum blower speed		85%	30%	41%	39%	38%	39%
Power required at shaft (with accessories) **	kW	8.1	2.8	4.4	3.5	3.4	4.3
	HP	10.9	3.7	5.9	4.7	4.6	5.8
Total Power (Wire to Air):	HP	11.9	4.2	6.7	5.4	5.2	6.6
Motor rating	HP	15.0					
Motor speed	RPM	1765	633	849	812	785	821
Motor frequency	Hz	60	22	29	28	27	28

Noise level without acoustic hood dB(A) 90
Noise level with acoustic hood dB(A) 73

Tolerances as per EN 10204, in accordance with standard ISO 1217:

Flow at inlet conditions / Power required at shaft +/- 5%

Blower package noise level:

Free field measurement at 1m from the complete blower package (tolerance +/- 2 dB(A))

Tests and measurements:

Blower stage: 1.5 hour flow test at the factory (Germany) on a calibrated test bed, at maximum operating conditions and according to DIN 1945. acceptance tolerance: +/- 5%.
A complete test report is available upon request.

On Site Commissioning

Available upon request, charges to be advised.

- Any commissioning activity is subject to two weeks prior notice and completion of commissioning checklist.
- Any on-site activity outside the time indicated will be billed according to the Aerzen Standard Rate Sheet

Exclusions

Control Panels, Motor Starters, Piping and Electrical Connections

* Unloading valves are required for reduced voltage starters

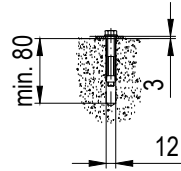
Warranty

Blowers including accessories are warranted for a period of 12mo / max 18mo after delivery and after provisional acceptance of the work against defects in workmanship and design. This warranty does not cover wearing parts unless such parts are defective during shipping / commissioning.
As per Aerzen standard warranty terms.

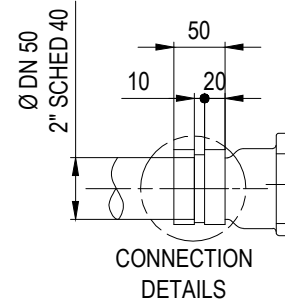
** Power at shaft excludes drive motor and belt drive

NOTICE: THIS DRAWING AND ALL INFORMATION HEREIN IS THE PROPERTY OF AERZEN CANADA INC. AND ITS SUBSIDIARIES AND SHALL NOT BE REPRODUCED BY ANY MEANS IN WHOLE OR IN PART OR USED AS THE BASIS FOR MANUFACTURE WITHOUT WRITTEN PERMISSION.

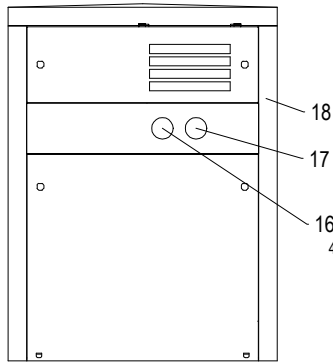
for straddling dowels A/B 12/15 - Liebig - dowel
(not included in Aerzen's scope of supply)



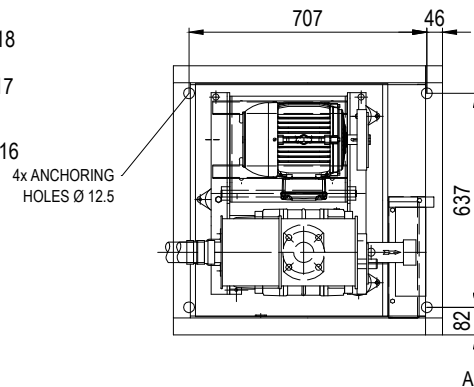
ANCHORING DONE BY OTHERS
ANCHORING DETAILS



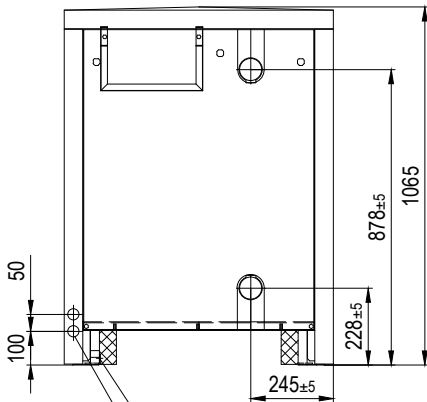
CONNECTION
DETAILS



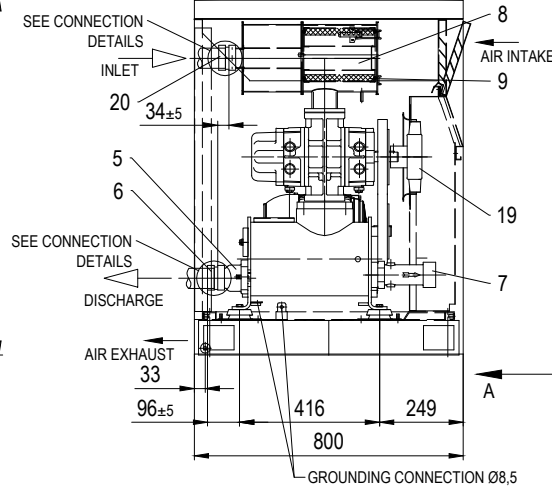
VIEW 'A-A' - FRONT OF UNIT



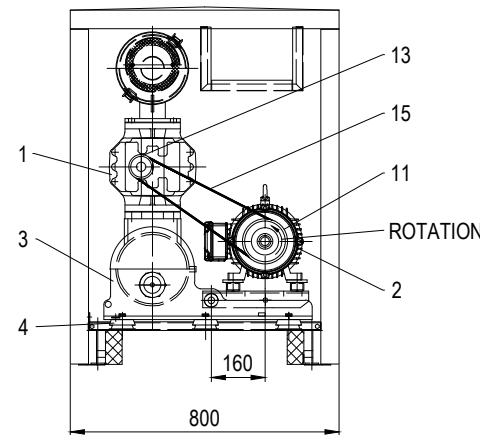
4x ANCHORING
HOLES Ø 12.5



GROUNDING CONNECTION M8
CABLE LEAD Ø 32.5




GROUNDING CONNECTION Ø8.5



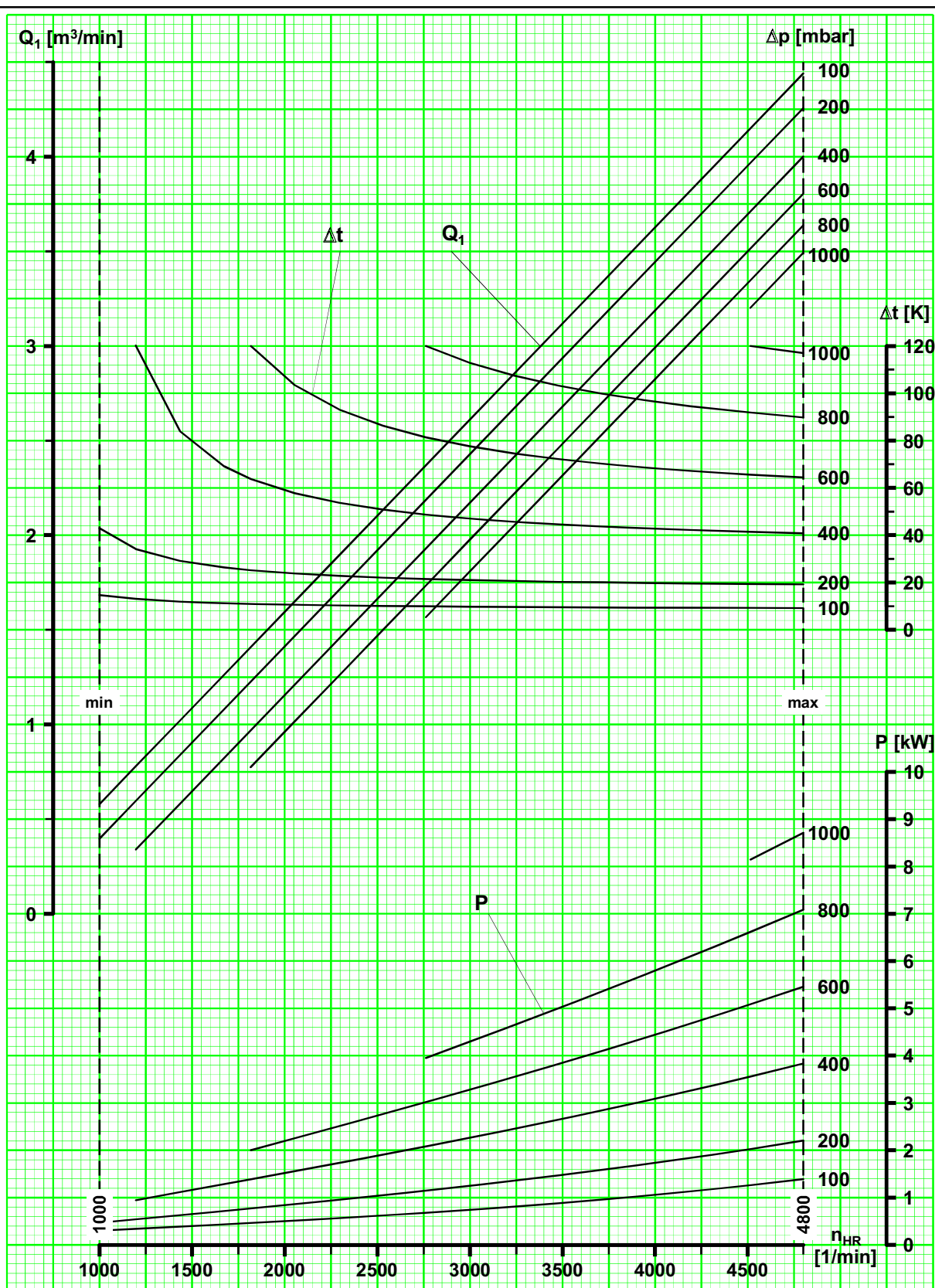
NOTE	QTY.	POS	DESCRIPTION
	1	1	BLOWER - GM 3S - 70 KG
D	1	2	ELECTRIC MOTOR - WEG 180T REPRESENTED
	1	3	BASEFRAME / DISCHARGE SILENCER - DN 50
	3	4	VIBRATION ISOLATORS - DN 50
	1	5	CONNECTION HOUSING WITH CHECK VALVE - DN 50
	1	6	DISCHARGE FLEXIBLE SLEEVE - DN 50 / 2" SCHED 40
	1	7	PRESSURE RELIEF VALVE - DN 50 - SET TO 950 mbar
	1	8	INLET FILTER / SILENCER - DN 50
	1	9	INLET FILTER ELEMENT - G5 DN 50
E	1	10	BELT GUARD - DN 50
	1	11	DRIVER SHEAVE
E	1	12	DRIVER BUSHING
	1	13	DRIVEN SHEAVE
E	1	14	DRIVEN BUSHING
	1	15	V-BELT SET
	1	16	FILTER MAINTENANCE INDICATOR - WIKA
	1	17	DISCHARGE PRESSURE GAUGE WITH BALL VALVE - WIKA
	1	18	ACOUSTIC ENCLOSURE - G5 DN 50 - INDOOR
	1	19	MECHANICAL FAN - DN 50 - MOUNTED ON BLOWER SHAFT
G	1	20	INLET FLEXIBLE SLEEVE - DN 50 / 2" SCHED 40

NOTES:

- UNIT ASSEMBLY WEIGHT WITHOUT MOTOR: 220 KG
- PAINT: AERZEN STANDARD BLUE
- 1M CLEARANCE IS RECOMMENDED AT THE FRONT OF THE UNIT FOR MAINTENANCE ACCESS
- MOTOR: WEG 180T REPRESENTED
- NOT SHOWN ON DRAWING
- FOR VARIABLE SPEED APPLICATIONS, CONSTANT TORQUE VFD ARE REQUIRED
- OPTIONAL

 AERZEN AERZEN CANADA INC 1995 MONTÉE LABOSSIERE, VAUDREUIL QC J1V 8P2 (450) 424-3966 P.H. (450) 424-3965 F.X.		TITLE DELTA - GM 3S DN 50 - PRESSURE	
		DWG NO. 22G-9217	
DRAWN BY		REVIEWED BY	
DATE		REV	
FEBRUARY 08, 2011		B	
SCALE: NONE		SHEET: 1 OF 1	

REVISION DETAILS			
REV	DRAWN BY	DATE	REVISION
1		18-10-12	UPDATE ON GENERAL APPROPRIATE DRAWING
2		08-02-11	RELEASE



Q_1 : Ansaugvolumenstrom (Luft)
bei $p_1 = 1,0$ bar und $t_1 = 20^\circ\text{C}$

n_{HR} : Hauptrotordrehzahl

n_V : Antriebswellendrehzahl

P : Leistungsbedarf an der Kupplung

t : Temperaturerhöhung

p : Druckerhöhung

intake volume flow (air)
at $p_1 = 1.0$ bar and $t_1 = 20^\circ\text{C}$

main rotor speed

drive shaft speed

power required at the coupling

temperature rise

pressure difference

débit aspiré (air)
pour $p_1 = 1,0$ bar et $t_1 = 20^\circ\text{C}$

vitesse du rotor principal

vitesse de l'arbre d'entraînement

puissance absorbée à l'accouplement

élévation de température

pression différentielle

Leistungsdiagramm - Überdruck - für Drehkolbengebläsestufe

performance diagram - overpressure - for stage of rotary piston blower

courbes de fonctionnement - fonctionnement en pression - pour étage de surpresseur à pistons rotatifs

GM 3 S

$n_V / n_{HR} = 1$

04/2016
TRD - Halle mann

G2 - 402 - XL
SAP - 4000323870 - 00

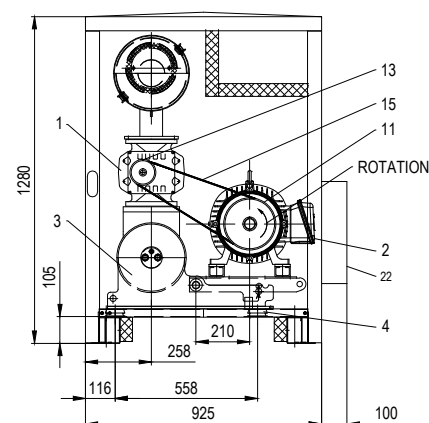
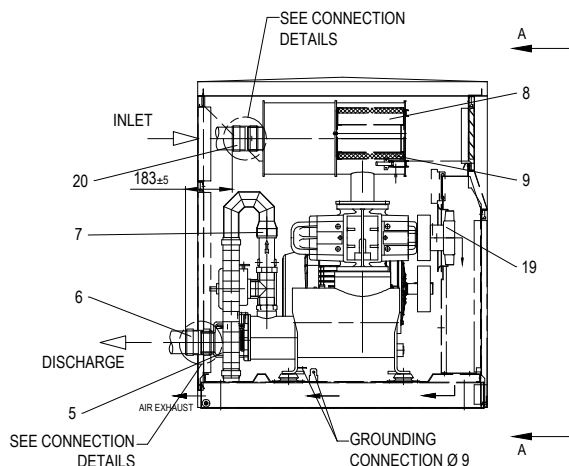
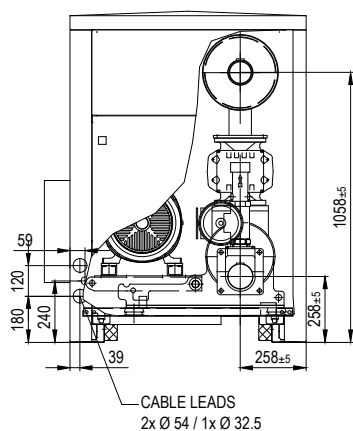
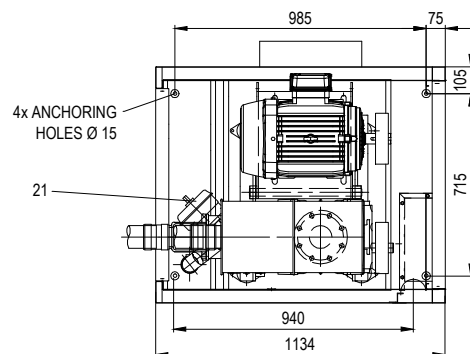
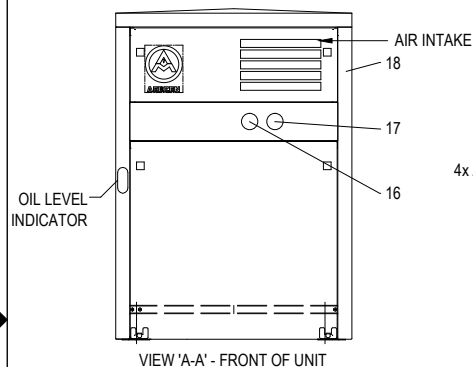
CAUTION
BLOWER PACKAGES MUST BE CAREFULLY LEVELED.
USE OIL LEVEL ON SIGHT GLASSES OF THE BLOWER
STAGE. USE SHIMS TO ADJUST LEVEL IF NECESSARY.
PLEASE REFER TO THE OPERATING AND INSTALLATION
INSTRUCTIONS MANUAL (DOCUMENT # G4-006) FOR
MORE DETAILS.

Ø DN 80
3" SCHED 40
2x 50
2x 5
10
CONNECTION
DETAILS

NOTE	QTY.	POS	DESCRIPTION
	1	1	BLOWER - GM 7L - 80 KG
D	1	2	ELECTRIC MOTOR: TECO WESTINGHOUSE REPRESENTED
	1	3	BASEFRAME / DISCHARGE SILENCER - DN 80
	4	4	VIBRATION ISOLATORS - DN 80
	1	5	CONNECTION HOUSING WITH CHECK VALVE - DN 80
	1	6	DISCHARGE FLEXIBLE EPDM SLEEVE - DN 80 / 3" SCHED 40
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	1	8	INLET FILTER / SILENCER - DN 80
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	1	11	DRIVER SHEAVE
E	1	12	DRIVER BUSHING
	1	13	DRIVEN SHEAVE
E	1	14	DRIVEN BUSHING
	1	15	V-BELT SET
	1	16	FILTER MAINTENANCE INDICATOR - WIKA
	1	17	DISHARGE PRESSURE GAUGE WITH BALL VALVE - WIKA
	1	18	ACOUSTIC ENCLOSURE - G5 DN 80 - INDOOR INSTALLATION
	1	19	MECHANICAL FAN - MOUNTED ON BLOWER SHAFT - GM 4S/7L
G	1	20	INLET FLEXIBLE EPDM SLEEVE - DN 80 / 3" SCHED 40
	1	21	UNLOADING VALVE
	1	22	MOTOR EXTENSION BOX 4" - 022-MBOX00004

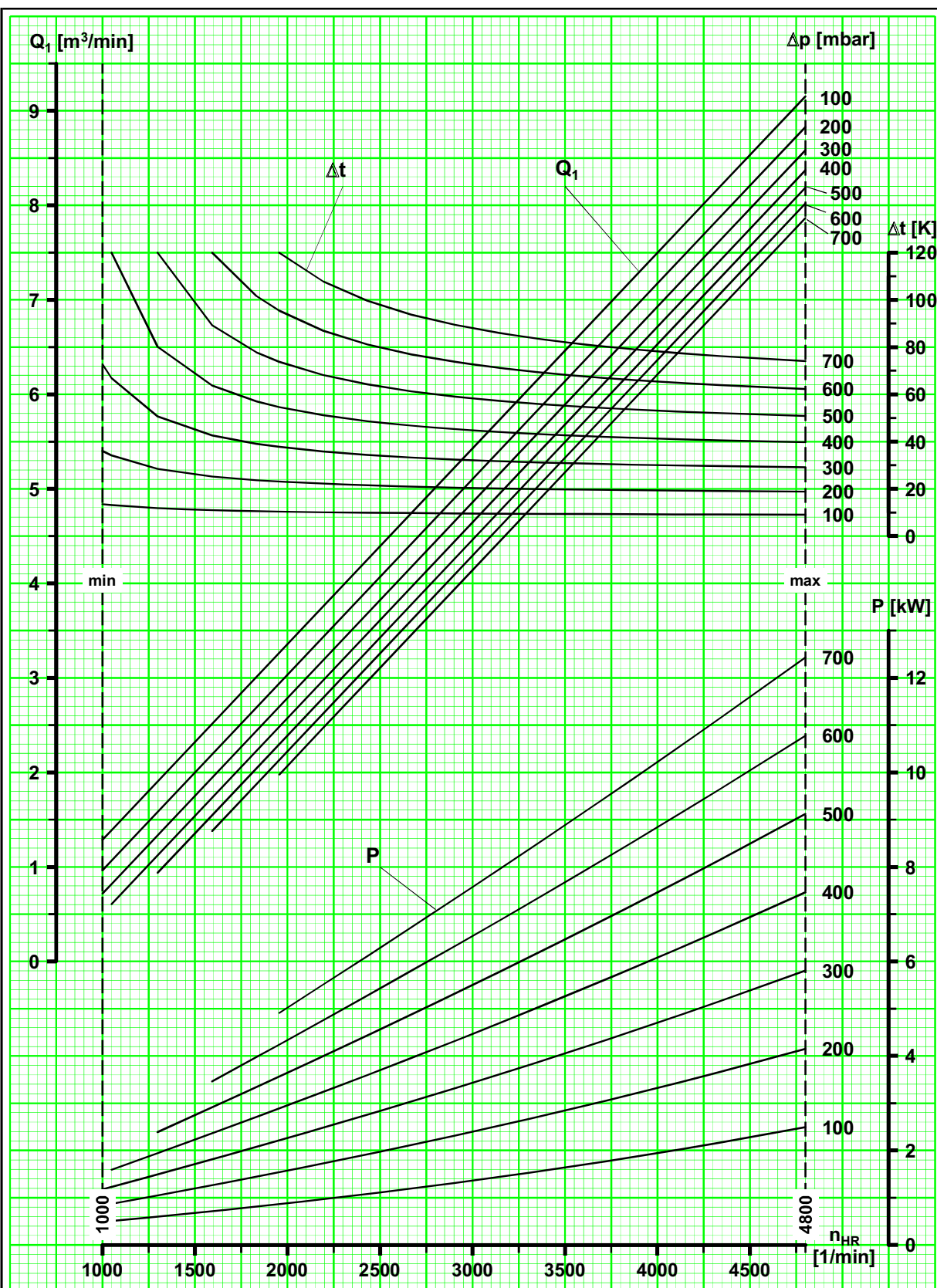
NOTES:

- A. UNIT ASSEMBLY WEIGHT WITHOUT MOTOR : 360 KG
- B. PAINT: PACKAGE - AERZEN STANDARD BLUE
- C. 1M CLEARANCE IS RECOMMENDED AT THE FRONT & REAR OF THE PACKAGE FOR MAINTENANCE ACCESS
- D. MOTOR: TECO WESTINGHOUSE REPRESENTED
- E. NOT SHOWN ON DRAWING
- F. FOR VARIABLE SPEED APPLICATIONS, CONSTANT TORQUE VFD ARE REQUIRED
- G. OPTIONAL



TITLE			DELTA - GM 7L DN 80 - PRESSURE		
DWG NO.			ZG-00799		
DRAWN BY			REVIEWED BY		
DATE			REV		
JUNE 16, 2020			A		
SCALE: NONE		SIZE: A		SHEET: 1 OF	

ENGINEER STAMP	REVISION DETAILS					
	REV	DRAWN BY	DATE	REVIEWED	DATE	DETAILS
	A	-	-	-	-	RELEASE
	-	-	-	-	-	-
	-	-	-	-	-	-
-	-	-	-	-	-	-



Q_1 : Ansaugvolumenstrom (Luft)
bei $p_1 = 1,0$ bar und $t_1 = 20^\circ\text{C}$

n_{HR} : Hauptrotordrehzahl

n_V : Antriebswellendrehzahl

P : Leistungsbedarf an der Kupplung

t : Temperaturerhöhung

p : Druckerhöhung

intake volume flow (air)
at $p_1 = 1,0$ bar and $t_1 = 20^\circ\text{C}$

main rotor speed

drive shaft speed

power required at the coupling

temperature rise

pressure difference

débit aspiré (air)
pour $p_1 = 1,0$ bar et $t_1 = 20^\circ\text{C}$

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courbes de fonctionnement - fonctionnement en pression - pour étage de surpresseur à pistons rotatifs

GM 7 L

$n_V / n_{HR} = 1$

04/2016
TRD - Halle mann

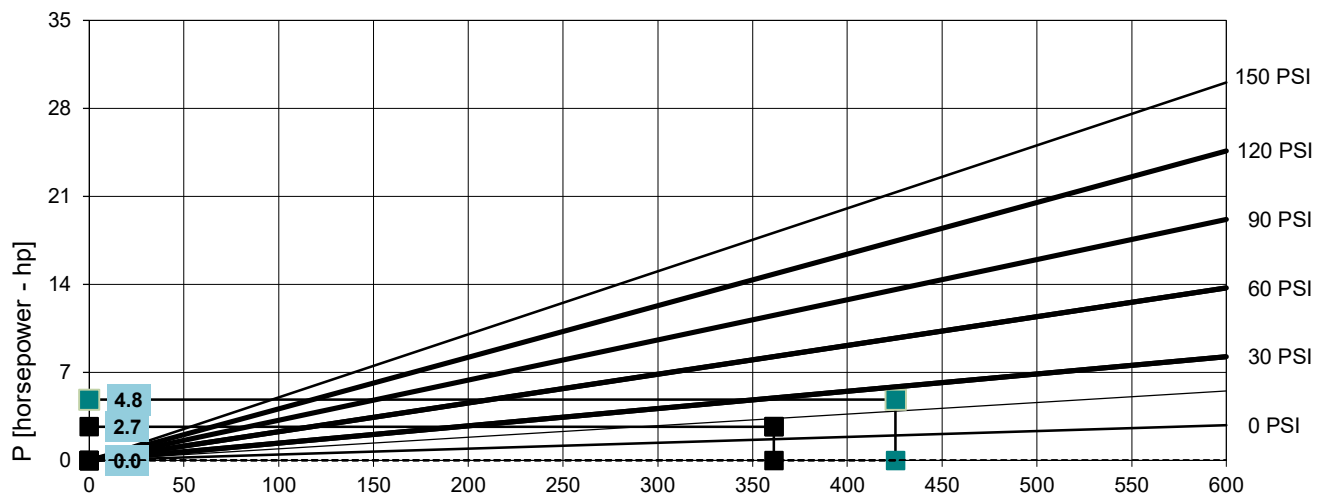
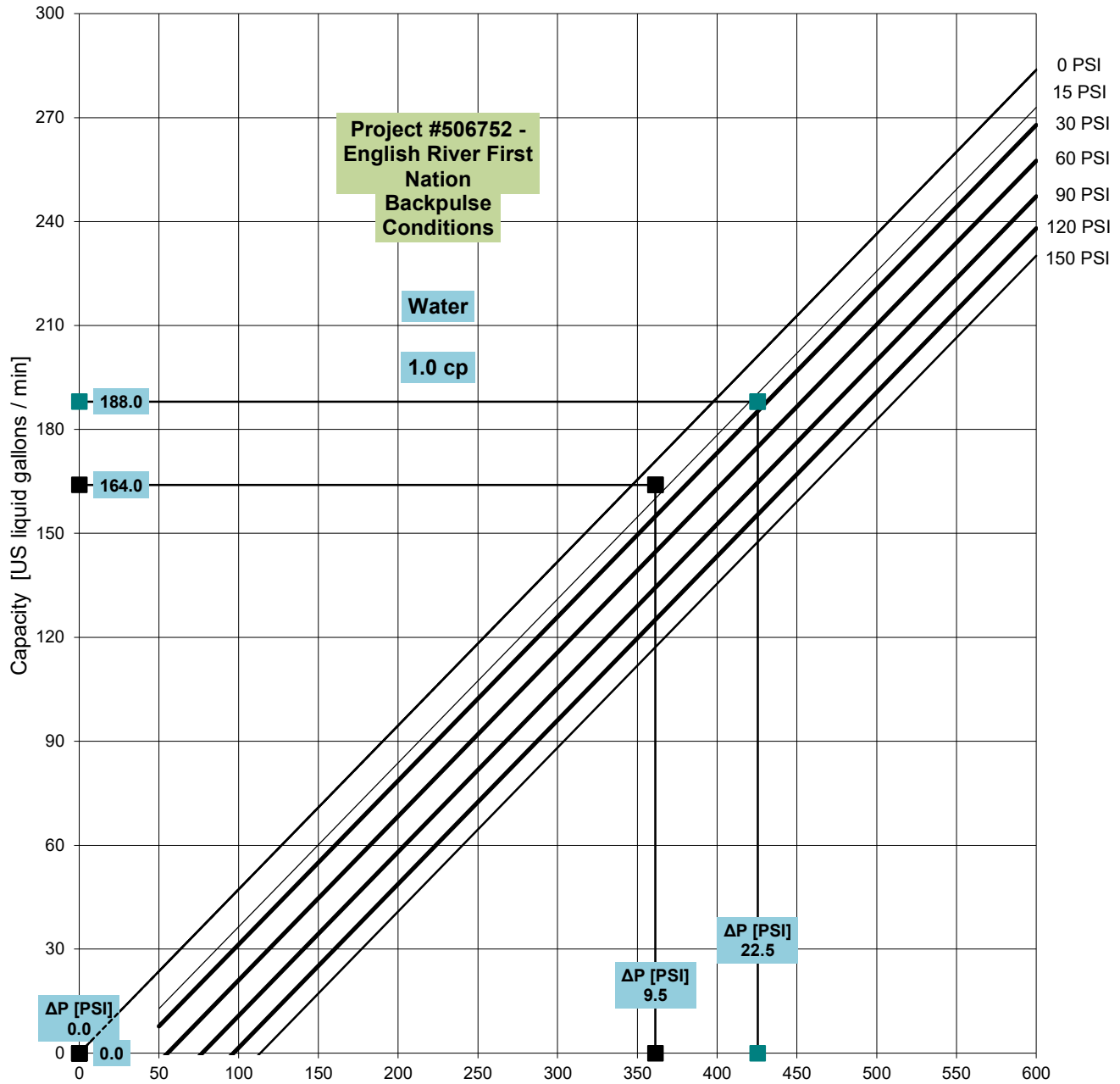
G2 - 406 - XL
SAP - 4000323895 - 00

Performance curve

PL 200 Lobe Type D



BÖRGER®



S-0103-16-ARI

Base lines: Water (60°F)

[rpm]

printed in 8/19/2020 by Boerger LLC - USA

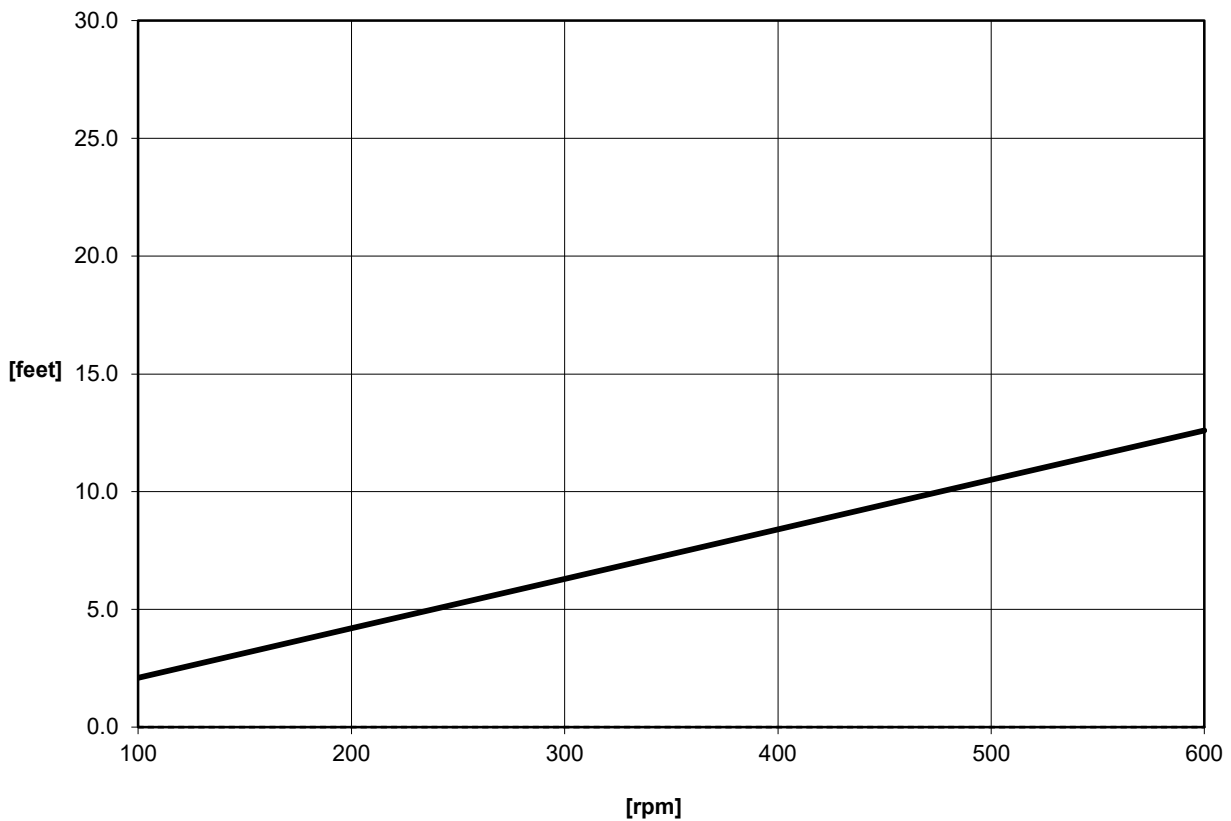


PL 200

D

US18.1-020518-ARI

n [min ⁻¹] # [rpm]	100	200	300	400	500	600
NPSH - r [ft.wc]	2.1	4.2	6.3	8.4	10.5	12.6
NPSH - a [ft.wc]	32.8	32.8	32.8	32.8	32.8	32.8
Delta [ft.wc]	30.7	28.6	26.5	24.4	22.3	20.2

**NPSH-a**

Fluid pressure at pump inlet in Feet Water Column [ft.wc]

NPSH-r

Decrease of pressure due to fluid acceleration inside pump [ft.wc]

NPSH-a > NPSH-r

Delta > 0

Pump runs smooth and works with design flow

NPSH-a < NPSH-r

Delta < 0

Runs with noise, flow is beneath design flow - short-term operation allowed

NPSH-a < 0

Flow of fluid impossible

SUEZ Water Technologies & Solutions Canada
3239 Dundas Street West
Oakville, ON L6M 4B2
CAN

RFQ Reference : PL200 ZMOD
RFQ Date : 11:44 09/04/2020
Recipient :
E-Mail :
Phone :
Customer No. : 100256
Payment Terms : Net 75
Std. Delivery ARO : 10Week(s)
Inquire For Faster Delivery
Shipping Type : UPS Ground
Terms of Delivery : FOB Minneapolis, MN /FOB

Outside Sales : Scott Mulinix
E-Mail : smu@boerger.com
Phone : 612-435-7327
Inside Sales : James Connell
E-Mail : jco@boerger.com
Phone : 612-435-7334
Fax : 612-435-7301
Prepared By : JKCFDJ
Price Firm Until : 12/03/2020

Line Part / Label

Quantity

Conveying Product

Product: Water
Specific Product: -
Viscosity: 1 cp
Solid Content: - %
Solid Size: - in
Density/SG: 1.0 -
Product Temp.: Ambient °F
ph-value: Neutral
Addl Notes:

Operational Characteristics

Location: Closed Building, Dry
Specific Location: -
Hazardous Area: Not Classified
Ambient Temp.: Ambient °F
Operating Mode: Continuous -
Suction Pressure: Flooded psi
Discharge Pressure: - psi
Differ. Pressure: - psi
NPSHa: - ft
Addl Notes:

Performance Data

	<u>GPM</u>	<u>PSI</u>	<u>RPM</u>
Min. Capacity:	25	21.8	80
Nom. Capacity:	-	-	-
Max. Capacity:	245	21.8	545

Additional Notes

1.00 7510000004 2
PL 200 Assembly

1.05 PP2SARCAEBEDCCC16 2
Börger Rotary Lobe Pump PL200
Casing:
One-piece Blockcasing from
Grey Cast Iron ASTM A48-40 B
Axial casing protection liners from Hard Metal

Rotor geometry:
Tri-lobe, entirely elastomer coated, screw form,
for almost pulsation-free operation
Rotor coating: Buna-N

Quotation

No.: 30019609

Page: 2

Date: 09.04.2020

Line	Part / Label	Quantity
	Solid Passing Capability D = 1.6" Displacement: 47.52 gal/100 rev	
	Shaft seal: single-acting mechanical seals, type LW Material code according EN 12756 [DIN 24960]: Q2 Q2 P G Seal faces: SISIC/SISIC Dynamic O-rings: Buna-N Seal holding bushes: AISI 316L Stationary O-Rings: Buna-N	
1.10	1300000204 PL200 to 3in ANSI Flange B2 Configuration 001-344 Galvanized CS	2
1.15	1300000167 PL200 to 3in ANSI Flange B3 Configuration 001-389 Galvanized CS	2
1.20	5301000640 Nord SK32-210TC-2.96 Inline Reducer 1750rpm/591rpm	2
1.25	5110003901 Baldor VEM3770T-CU 7.5hp,1770rpm,Premium Eff,TEFC 3ph,60Hz,230/460V,213TC,1.15SF F2 Junction Box	2
1.30	2500000105 PL 200 ZMOD Assembly Painted ZMOD-L Base Frame, Gear Plate Coupling and Coupling Guard	2

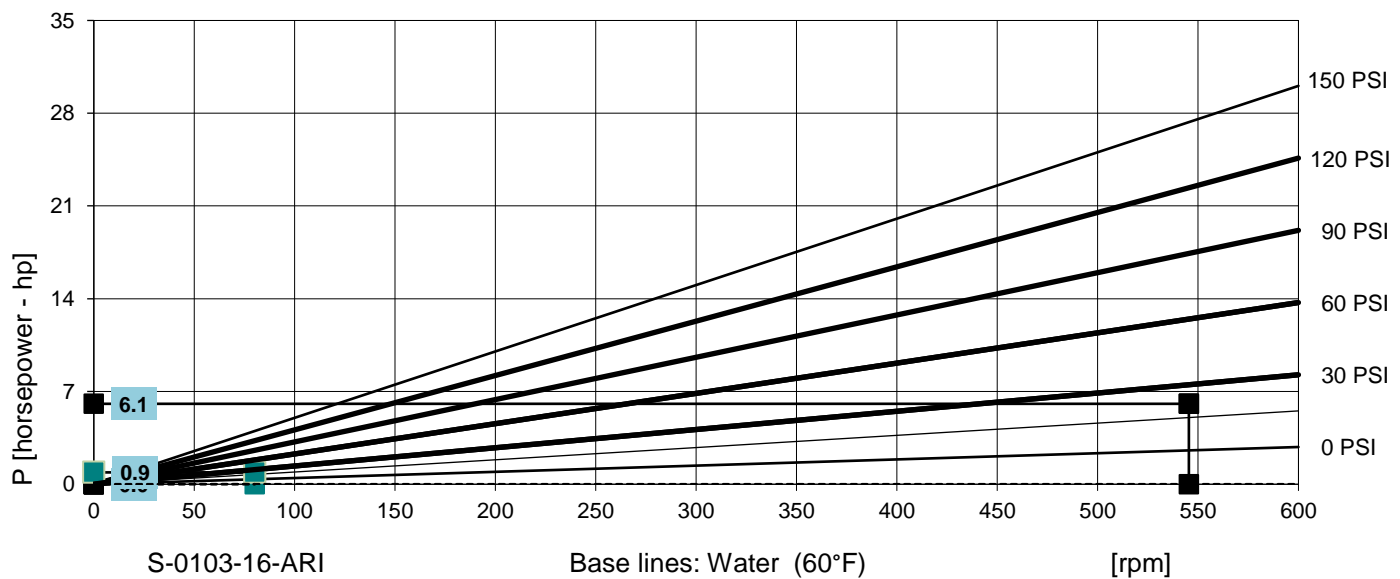
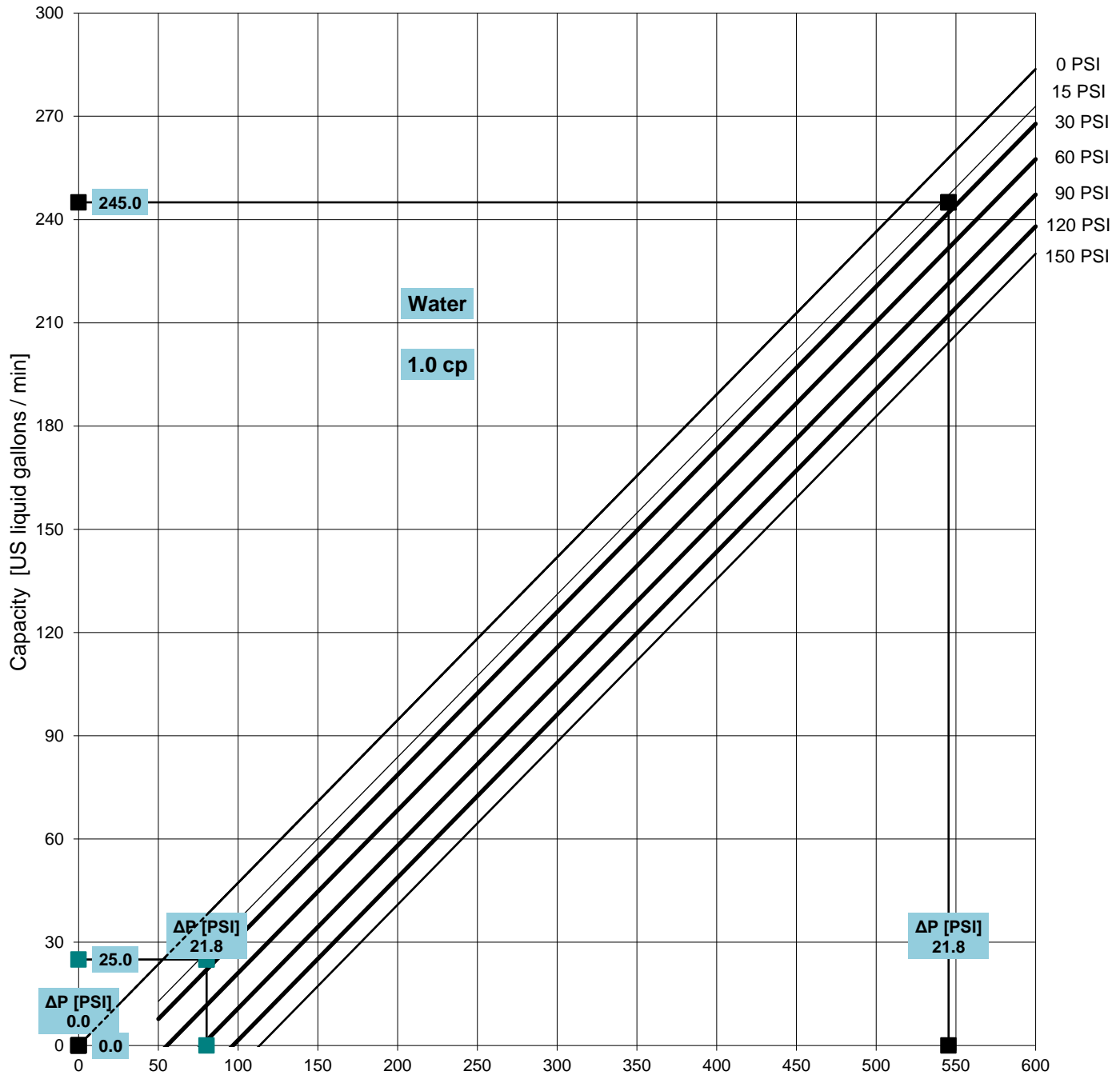
Notes:

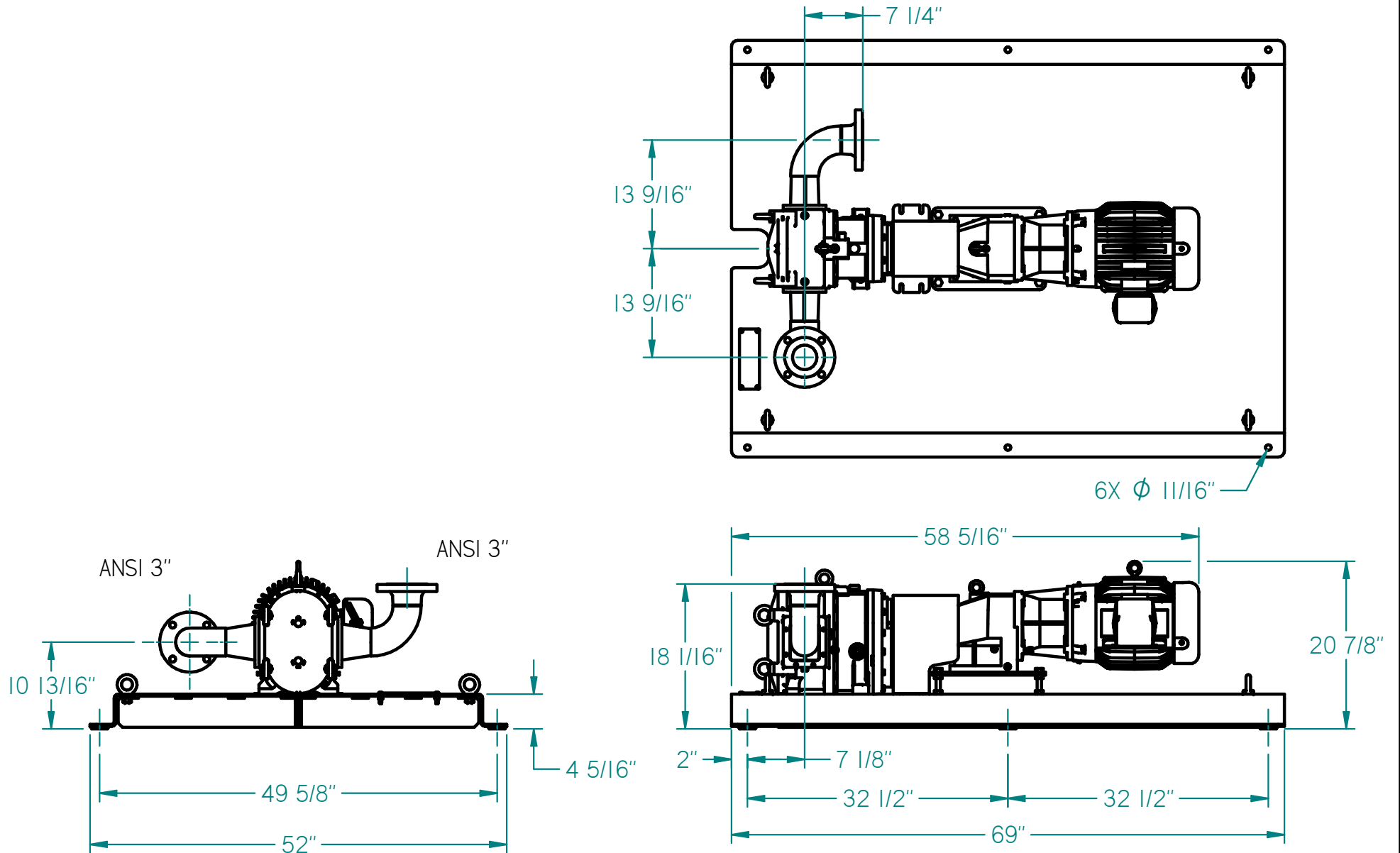
1. BOERGER, LLC's standard Terms and Conditions apply and are an integral part of this quotation unless specifically noted otherwise in this proposal.
2. Delivery, installation, wiring, field painting, start-up and instructional services are not included unless specifically noted otherwise in this proposal.
3. Anchor bolts, pressure gauges, valves, drainage piping, starters, variable frequency drives and control equipment or any other items are not included unless specifically noted otherwise in this proposal.
4. BOERGER, LLC will review plans and specifications and will offer technical assistance and certified pump drawings for construction. The responsibility for pump station layout, access, seismic calculations including local PE stamp, etc., shall be by others.
5. This proposal is offered as an acceptable pumping system based upon descriptive items listed above. Deviations from the equipment described could result in price adjustment.
6. A BOERGER, LLC field engineer may be provided, as noted above, in a supervisory capacity only. Any and all costs associated with labor, set-up, etc., for the tests are to be by contractor.
7. Credit Card purchases will incur a 3% Processing Fee.



Boerger, LLC
2860 Water Tower Place
Chanhausen, MN 55317
USA

Phone: 612.435.7300
Fax: 612.435.7301

E-Mail: america@boerger.com
Website: www.boerger.com





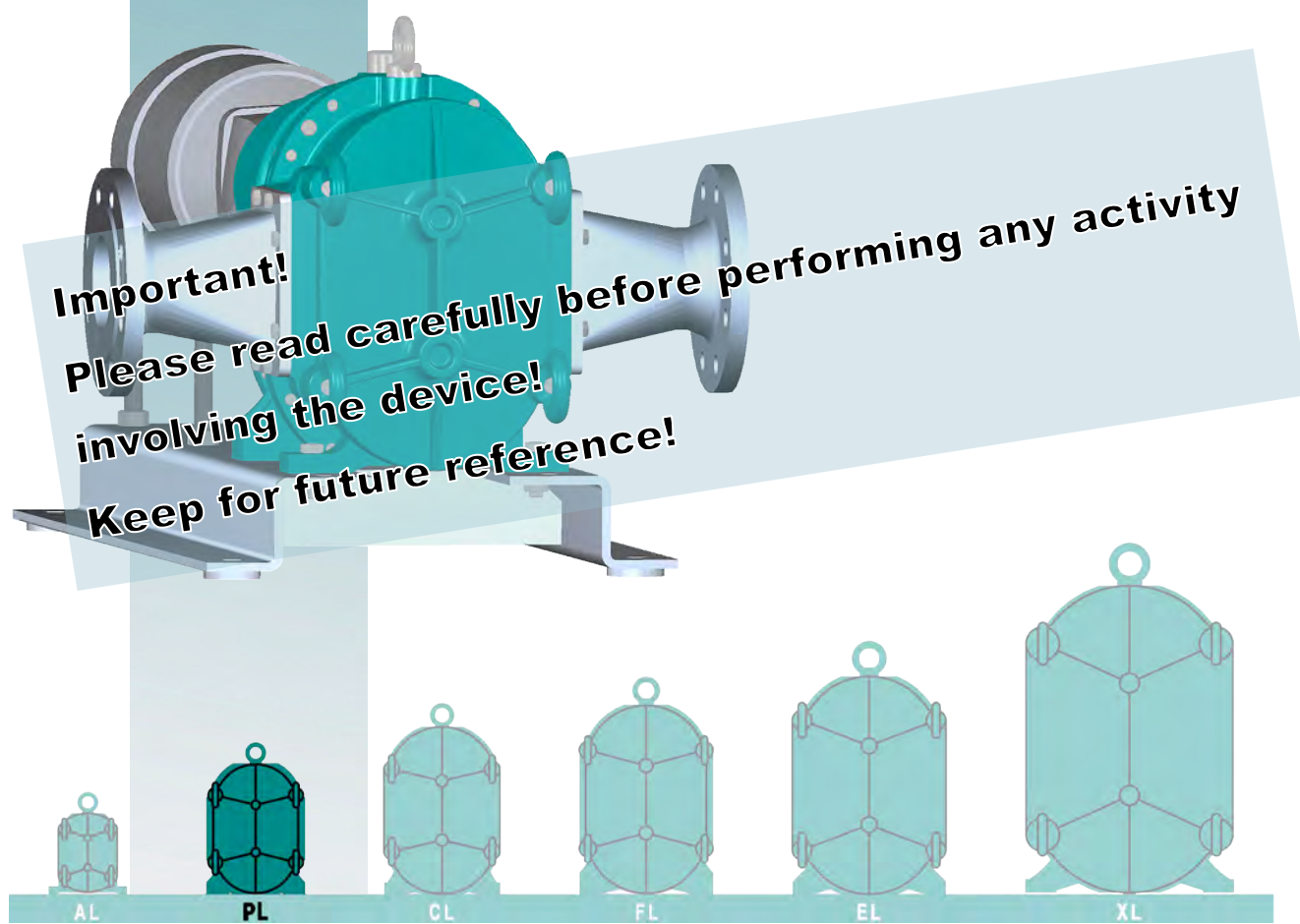
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF Boerger, LLC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF Boerger, LLC IS PROHIBITED.	BOERGER, LLC			 THIRD-ANGLE PROJECTION		
	2860 Water Tower Place Chanhassen, MN 55317 TEL: 612-435-7300 FAX: 612-435-7301					
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED		NAME	DATE	Model: PL200 Gear: Nord SK32-210TC Power: 7.5 HP VEM3770T		
	DRAWN	MLindquist	07/05/17			
TOLERANCES ± 1/2"	CHECKED			SIZE	DWG. NO.	REV
DO NOT SCALE DRAWING	SHEET 1 OF 1			A	SD-001-361	0

Operating Manual

Börger Rotary Lobe Pump

Classic

PL Series



Börger Worldwide

Europe	Germany - Head Office -	Börger GmbH Benningsweg 24 46325 Borken-Weseke, Germany Germany	Phone Fax E-mail Internet	+49 (0) 2862 / 91030 +49 (0) 2862 / 910346 info@boerger.de www.boerger.de
	France	Börger France S.A.R.L. 9 rue des Prés 67670 Wittersheim France	Phone Fax E-mail Internet	+33 (0) 3 / 88515468 +33 (0) 3 / 88515413 info@borger.fr www.borger.fr
	Great Britain/ Ireland	Börger UK Ltd. East Wing - Old School Watling St. Gailey Staffordshire ST19 5PR, United Kingdom	Phone Fax E-mail Internet	+44 (0) 1902 / 798977 +44 (0) 1902 / 798979 uk@boerger.com www.boerger.com
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(Stamp)				

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Product Specifications

Unit:

Product group: Rotary lobe pump
Type: PL 100, PL 200, PL 300, PL 400

Precise product specifications for your unit, with the exception of control units, can be found in the data sheet enclosed with this operating manual.

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1 General Information

1.1 Introduction

This operating manual is an important aid for the correct and safe operation of the rotary lobe pump.

It contains important information for operating the rotary lobe pump in a safe, proper and economical manner.

Adhering to these instructions will help avoid associated dangers, reduce repair costs and downtimes and increase the reliability and service life of the rotary lobe pump.

The operating manual must be made available at all times. All personnel who work on or with the rotary lobe pump must read and adhere to the manual. This work includes:

- Operation and troubleshooting
- Maintenance (machine care, maintenance and repairs)
- Transportation

1.2 Notes on copyrights and property rights

This operating manual must be treated as confidential. It may only be made accessible to authorized persons. The manual may only be passed on to third parties following written approval from Börger GmbH.

All documents are protected according to the copyright laws. The distribution and reproduction of documents, in whole or in part, plus the exploitation and distribution of all associated content is forbidden unless expressly authorized in writing.

Violations will be prosecuted and may lead to claims for compensation. All rights for exercising industrial property rights are reserved by Börger GmbH.

1.3 Information for the operator

The operating manual is an integral part of the rotary lobe pump. The operator (i.e. the responsible party) is responsible for making the operating personnel aware of this manual.

Additionally, the operator is obligated to ensure the notice and observance of national regulations for accident prevention and environmental protection, plus the notice and observance of supervision and reporting duties taking special operational aspects into account, e.g. regarding work organization, work processes and personnel.

Aside from the operating manual and the currently valid accident prevention regulations in the country of operation and at the installation site, all recognized special regulations for safe and proper operation must be observed.

The operator is not permitted to make or advise any changes, modifications or alterations to the rotary lobe pump without approval from Börger GmbH.

Any spare parts used must comply with the technical requirements specified by Börger GmbH. This is always guaranteed when original spare parts are used.

Only original spare parts may be used during the warranty period, failing which the warranty is void.

Only trained or instructed personnel may be assigned to operate, maintain, repair or transport the rotary lobe pump. Clearly define the personnel responsible for operation, maintenance, repair and transportation.

1.4 Training and instruction

As the operator, you are obligated to inform and, if necessary, instruct operating personnel in regard to the applicable legal and accident prevention regulations, as well as the available safety equipment on the rotary lobe pump. This obligation also applies to all other safety equipment on and around the rotary lobe pump. The different technical qualifications of the operating personnel must be taken into account.

The operating personnel must have fully understood the instructions, and adherence to the instructions must be guaranteed. Only then can your personnel work safely and be fully aware of associated risks.

Adherence to instructions must be checked on a regular basis. As the operator, you should therefore have each instructed staff member confirm their training participation in writing.

Sample training topics and a sample form for confirming participation in the training / instruction can be found on the following pages.

Börger GmbH, their regional subsidiaries or your local sales partner will be happy to help you regarding staff instruction. They can also carry out training on the functionality, commissioning, maintenance and repair of the rotary lobe pump on request.

Contact us for a detailed quotation.

1.5 Sample training topics

1. Operational safety
Accident prevention regulations General legal regulations General safety instructions Measures in the event of emergencies Safety instructions for operating the rotary lobe pump Using the safety equipment on the rotary lobe pump Safety equipment on and around the rotary lobe pump Explanation of symbols and signs <hr/> <hr/>
2. Operating the rotary lobe pump
Using the operating elements on the rotary lobe pump Explanation of the operating manual for operating personnel Specific experiences in using the rotary lobe pump Troubleshooting / dealing with malfunctions <hr/> <hr/>
3. Repair and maintenance regulations
Correct handling of cleaning agents and lubricants Specific experiences regarding repair, maintenance, cleaning and care of the rotary lobe pump <hr/> <hr/>

Confirmation of Training		
Training topic:		
Date:	Trainer:	Trainer signature:
No.	Surname, first name	Signature
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2 Safety

2.1 General information

The rotary lobe pump has been developed and constructed according to current state-of-the-art technology and recognized safety guidelines in observance of the valid safety regulations in the country of manufacture.

However, operation of the rotary lobe pump may endanger the operating person and cause damage to the pump or other material assets in the following circumstances:

- When operated by untrained or uninstructed personnel
- When not used properly
- When not maintained or repaired properly

2.2 Notes on signs and symbols

The following terms, signs and symbols are used in this operating manual, and indicate particularly important information.



Danger!

Warns of an immediate hazardous situation with unavoidable serious injuries or death as a result if the instructions shown are not strictly adhered to.



Warning!

Warns of a hazardous situation with the possible risk of subsequent serious injuries or death if the instructions shown are not strictly adhered to.



Caution!

Warns of a possible hazardous situation with the risk of subsequent moderate or light injuries and material damage if the instructions shown are not strictly adhered to.

**Notice**

Indicates a possible hazardous situation or unsafe, dangerous work processes that may lead to damage to the machine or surrounding area.

**Note**

Offers useful information on safe and proper operation.

- Bullet points describe work and / or operational steps. These steps must be carried out from the top down.

— Indents indicate lists.

All instructions and symbols attached directly to the rotary lobe pump (e.g. warning signs, operational signs, all component designations etc.) must be strictly adhered to. They may not be removed and must be kept completely legible.

Some of the diagrams and photographic images used in this operating manual, which are only used to illustrate a function or a particular work step, show a different type of rotary lobe pump. However the functional principle or work step is the same.

2.3 Proper use

The rotary lobe pump is a self-priming, valveless positive displacement pump.

The rotary lobe pump delivers the pumped medium specified in the data sheet continuously, at speed-proportional flow rates, in a gentle, low-pulsation procedure.



Note

The rotary lobe pump or entire unit is configured exclusively for the operating conditions entered in your request / order and specified in the order confirmation and enclosed data sheet.

Therefore, proper use of the pump is restricted to the specified pumped medium, temperatures, speeds and pump output only.

Observe the technical specifications in the data sheet.

Proper use includes compliance with the instructions on

- safety,
- operation and control,
- repairs and maintenance,

specified in this operating manual.

Any other use or use over and above these specifications is deemed as improper use. The operator of the rotary lobe pump is solely liable for any resulting damage.

2.4 Residual risk

Even when all safety instructions are adhered to, there are residual risks involved in operating the rotary lobe pump as detailed below.

All persons that work on and with the rotary lobe pump must be aware of these residual risks and observe the associated instructions to avoid accidents or damage caused by these residual risks.

It may be necessary to remove on-site safety equipment during installation and modifications. This causes a residual risk and potential danger that each operating person must be aware of:

**Warning!****Risk of hand injuries when operating the rotary lobe pump!**

Automatic movements of the rotary lobe pump during operation may cause hand injuries.

The operating person is obligated to check that all safety equipment is installed and fully functional before operating the rotary lobe pump.

**Warning!****Risk of serious injuries caused by the pumped medium spouting out or escaping gases!**

Gases or liquids may escape uncontrollably from seals and screw connections.

Especially when the quick-release cover is opened, liquid can spout out at the cover when the pump is pressurized.

Take the appropriate precautions.

**Warning!****There may be a considerable danger from the drive of a complete unit, e.g. due to an electric current for an electric drive.**

Please read and observe the residual risks described in the operating manual for the drive of this unit.

2.5 Description of the safety equipment

The rotary lobe pump is equipped with the required safety equipment according to the applicable legal guidelines in the country of manufacture, current state-of-the-art technology and recognized safety regulations.

2.5.1 Coupling guard

The rotating shafts between the drive and rotary lobe pump are connected by a coupling, and must be secured by a fixed safety guard against reaching in and blockages caused by falling parts.

Börger GmbH delivers units with couplings and drives including a screw-fixed coupling guard as standard.

This coupling guard may not be removed, and must always be reinstalled carefully following removal due to maintenance.

If your rotary lobe pump is delivered without an installed drive, you must attach the enclosed coupling guard (or another suitable coupling guard) after the drive is installed.

This also applies to the V-belt / chain guards on overhead mounted drive assemblies and the coupling lantern on hydraulic units.

2.5.2 Intermediate chamber

The intermediate chamber separates the hydraulic pump part from the timing gear. It is used for monitoring the integrity of the mechanical seals on rotary lobe pumps with single-acting mechanical seals.

Overflowing caused by penetrating pumped medium indicates that the mechanical seals must be replaced immediately in order to prevent the pumped medium from entering the gear unit.

The vent hole in the intermediate chamber must not be sealed or plugged.

When the vent hole is closed tightly or has become blocked, emerging pumped medium cannot escape and will penetrate the gear unit if the mechanical seal is defective. This could damage the gear unit.

2.5.3 Optional monitoring devices

Optional monitoring devices are listed and described in chapter 8 *Accessories*.

2.6 Markings and signs on the rotary lobe pump


Meaning:

Nameplate according to DIN EN 809 ¹⁾

Location:

In a clearly visible position on the rotary lobe pump

¹⁾ Different address possible, e.g. when delivered through a subsidiary.

CE marking not applicable for incomplete machines where only a declaration of incorporation may be delivered, and in certain other cases.


Meaning:

Protective ground connection

Location:

On the base frame, to the right of the quick-release cover


Meaning:

Do not touch rotating pump parts

Location:

In a clearly visible position on the rotary lobe pump


Meaning:

Please read the operating manuals carefully before performing any activity involving the device! Keep for future reference!

Location:

In a clearly visible position on the packaging of the operating manual

2.7 Markings and signs to be attached by the operator

The operator is obligated to label the pumped medium and the flow direction on the rotary lobe pump (see chapter 4.3.5.1).

The operator may also be required to attach additional markings and signs on or around the rotary lobe pump. These additional markings and signs may relate to regulations for wearing personal protective equipment (ear protection), for example.

2.8 Safety instructions for operating personnel

The rotary lobe pump may only be operated while it is in perfect working condition and only for its intended purpose, in a safe and risk-conscious manner having regard to this operating manual. All malfunctions must be rectified immediately, especially those affecting safety.

Every person assigned with commissioning, operation or maintenance work must have fully read and understood this operating manual beforehand – specifically chapter 2, *Safety*. Consulting the manual during work is already too late. This applies especially to personnel that only work occasionally on the pump.

The operating manual must always be kept accessible next to the rotary lobe pump.

No liability will be assumed for any damage and accidents caused by non-compliance with the operating manual.

Adhere to the applicable accident prevention regulations and all other generally recognized safety regulations and guidelines for occupational health at work.

Clearly specify the responsible parties for the various maintenance and repair tasks and adhere thereto. Only then can handling errors be avoided, especially in dangerous situations.

The operator must make personal protective equipment mandatory for operating and maintenance personnel. This especially applies to safety shoes, protective goggles and gloves. Always wear this protective equipment when working on the rotary lobe pump.

Keep long hair tied and do not wear loose clothing or jewelry. There is always a danger of getting caught, pulled in or dragged along by moving parts.

If malfunctions occur on the rotary lobe pump:

- Bring the rotary lobe pump to an immediate halt.
- Secure the pump against accidental restart.
- Report the malfunction to the responsible department / person.

This especially applies to safety-related alterations to the rotary lobe pump.

Observe the maintenance instructions when carrying out maintenance on the rotary lobe pump.

Work on the rotary lobe pump may only be carried out by trained, reliable personnel. Personnel in training or requiring instruction, as well as persons currently in vocational training, may only operate the rotary lobe pump under the constant supervision of an experienced staff member.

2.9 Safety instructions for maintenance and rectifying malfunctions on the rotary lobe pump

Adhere to the prescribed intervals for regular maintenance and inspections or those specified in the operating manual.

Aside from the special tools specified in the spare parts list, suitable customary workshop equipment is essential for carrying out maintenance work.

Modifications, repairs, maintenance and troubleshooting may only be carried out when the rotary lobe pump is switched off. Accidental restarting of the unit must be prevented completely.

To the extent necessary, amply secure the surrounding area when performing maintenance. Cordon off the working area with a red and white safety chain and a warning sign.

Large assemblies and components must be carefully attached and secured to hoists when they are removed or replaced so that associated dangers are minimized. Only appropriate hoists and lifting media in technically perfect working condition with sufficient load capacities may be used.

Never stand under suspended loads.

At the start of maintenance, repairs or machine care, clean any dirt or cleaning agents off the connections and screw connections. Do not use any aggressive cleaning agents. Use lint-free cleaning cloths.

During installation, always tighten any screw connections that have been loosened for maintenance and repair work. Tighten to the prescribed torque, where this is specified.

Dispose of operating materials and replacement parts in a safe and environmentally-friendly manner.

2.10 Information on special dangers

2.10.1 Oil, grease and other chemical substances

When handling oil, grease and other chemical substances, pay attention and adhere to the applicable regulations and safety data sheets issued by the respective manufacturer relating to storage, handling, correct use and disposal.

2.10.2 Noise

The A-weighted equivalent continuous noise level on the workstations is below 80 dB(A) during normal operation of the rotary lobe pump. Higher noise levels may occur at the pump installation site due to local conditions. In this case, the operator is obligated to provide operating personnel with appropriate protective equipment.

3 Product Description

3.1 Construction of the rotary lobe pump

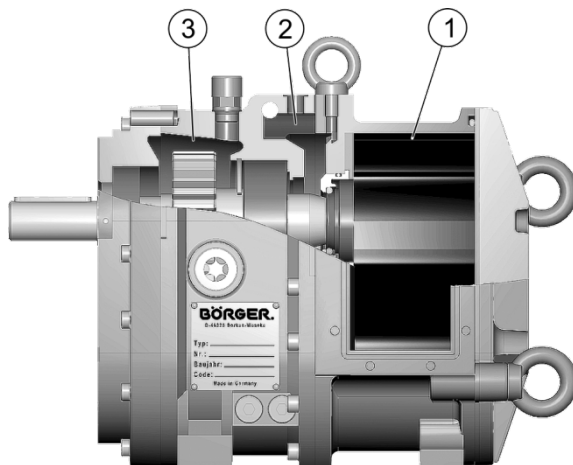


Figure 3.1-1
Rotary lobe pump components

Components:

- 1 Pump chamber
- 2 Intermediate chamber
- 3 Gear chamber

Construction

of the rotary lobe pump (standing):

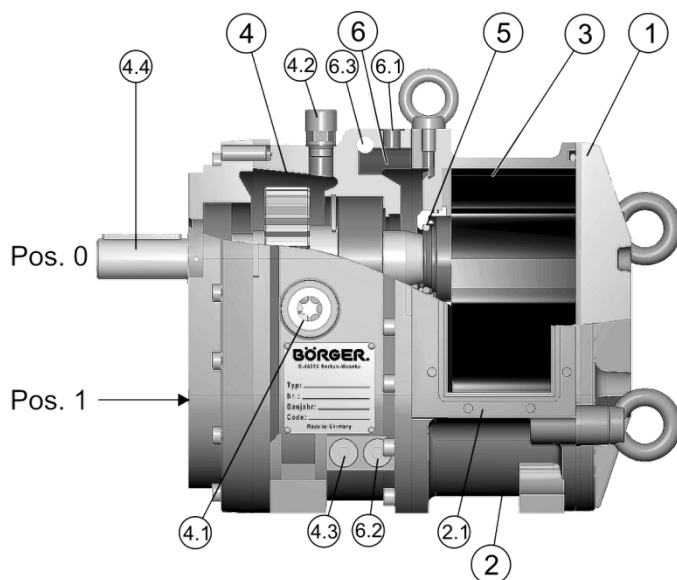
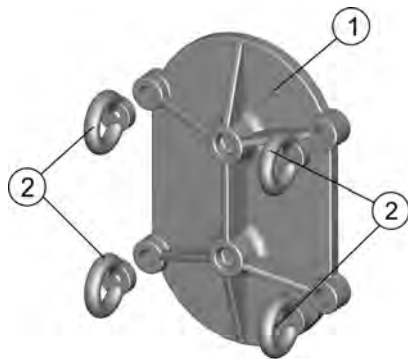


Figure 3.1-2
Construction of the rotary lobe pump

- 1 Quick-release cover**
- 2 Pump casing**
 - 2.1 Connection flange, inlet (suction side) and outlet (pressure side)
- 3 Rotor**
- 4 Timing gear**
 - 4.1 Oil sight glass
 - 4.2 Breather, oil filler for gear unit
 - 4.3 Oil drain for gear unit
 - 4.4 Two shafts with parallel axes; drive shaft can optionally be at position 0 or 1 (see chapter 3.1.4)
- 5 Shaft seal on pump chamber**
- 6 Intermediate chamber (quench)**
 - 6.1 Filler for quench fluid
 - 6.2 Drain for quench fluid
 - 6.3 Breather

3.1.1 Quick-release cover



- 1 Quick-release cover
- 2 Ring nuts

Figure 3.1.1
Quick-release cover

The Börger MIP principle (Maintenance in Place) starts with the quick-release cover (1):

This cover enables easy access to the interior of the pump casing and to all parts subject to wear in the pump.

The suction line and pressure line remain connected.

The cover can be removed after loosening the four ring nuts (2), see chapter 6.3.1 / 6.3.2.

The pump can be inspected, maintained and repaired directly at its point of installation.

Descriptions for other cover versions, e.g. the Variocap and the cover with groove for the temperature sensor, can be found in the supplementary operating manual in the *appendix*, if these versions were delivered.

3.1.2 Pump casing

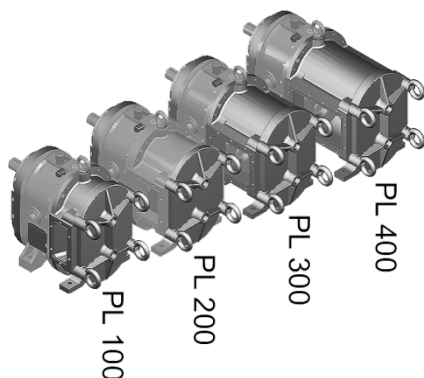


Figure 3.1.2 Depths

The PL rotary lobe pump is available in four casing depths. The performance data of your rotary lobe pump depends on this depth, among other things (see chapter 3.3).

The block-type, one-piece pump casing is equipped as standard with an internal casing protection plate towards the gear unit and one towards the quick-release cover.

The pump chamber can also be completely covered with optional radial casing liners.







The pump casing is manufactured from high-quality gray cast iron, spheroidal cast iron and stainless steel.

The **eighth, ninth and tenth positions of the type code** indicate the relevant pump casing design and equipment.

3.1.3 Rotors

A wide variety of different rotors are available for Börger rotary lobe pumps. The rotor type on your rotary lobe pump depends on the operating conditions and the properties of the pumped medium.

The **thirteenth position of the type code** on the nameplate indicates the rotor **design**.

	Type A...	Dual-lobe, linear, polymers Position 9.4 in the spare parts list
	Type D...	Tri-lobe, screw profile, polymers Position 9.7 in the spare parts list
	Type I...*	Optimum rotor, dual-lobe, screw profile, polymers Position 9.5 in the spare parts list
	Types IS*, IE*	Optimum rotor, dual-lobe, screw profile, steel / stainless steel Position 9.5 in the spare parts list
	Type J...*	Premium rotor, dual-lobe, linear, polymers Position 9.6 in the spare parts list
	Types JS, JE	Premium rotor, dual-lobe, linear, steel / stainless steel Position 9.6 in the spare parts list

* not available for PL 400

The rotor **material** used in your rotary lobe pump with regard to the resistance to the pumped medium is defined according to the attached data sheet and the **fourteenth position of the type code**.

A supplementary operating manual for special rotors with the relevant descriptions can be found in the appendix if these versions were delivered.

3.1.4 Timing gear

The rotors are driven synchronously and exactly through the carrier shafts by two gear wheels.

The shafts on the rotary lobe pump are seated on one side inside the carrier gear unit. As the gear unit is completely separate from the pump chamber, disassembly is not necessary for any maintenance work.

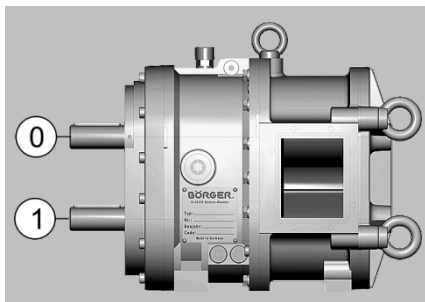


Figure 3.1.4
Drive shaft position

Depending on the ordered version, the drive shaft is installed in position 0 or position 1.

The rotary lobe pump can also be delivered with two drive shafts, e.g. a pump driven mechanically by means of the PTO shaft, where the direction of rotation can be changed by switching the PTO shaft.

The **fifth position of the type code** on the nameplate indicates the design and position of the drive shaft.

The timing gear is equipped with a breather system to compensate for increased pressure due to rising temperatures. The breather system must always be installed on the highest point of the pump, compare the illustrations of the pump versions for the different mounting positions in chapter 3.1.7.

3.1.5 Shaft seal on pump chamber

Börger rotary lobe pumps are equipped as standard with mechanical seals designed specifically for this pump type. These are used to completely seal off the pump chamber from the gear unit, or from the intermediate chamber (see chapter 3.1.6).

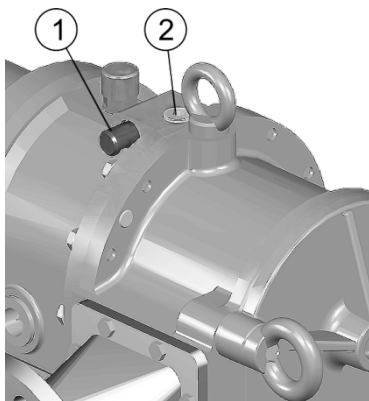
These seals can be quickly accessed through the pump chamber without removing the pump, and can be replaced easily.

Mechanical seals are available in a variety of material combinations.

The shaft seal of the pump chamber on your rotary lobe pump is described in the attached data sheet and is indicated by the **twelfth position of the type code**.

Information about any special seals that apply to your pump can be found in the additional documentation in the appendix.

3.1.6 Intermediate chamber (quench)



- 1 Breather
- 2 Fill hole with screw plug

Figure 3.1.6 Breather

The pump chamber and gear chamber are separated by an intermediate chamber filled with quench fluid as standard.

The heat-absorbing quench fluid prevents the mechanical seals from running dry and captures any pumped medium that enters the intermediate chamber due to leaks in the mechanical seals. This **quench** function also prevents the gear unit from being damaged by intrusion of the pumped medium.

The rotor / shaft connection is also lubricated with quench fluid, thus preventing corrosion.

The intermediate chamber is sealed from the gear unit with DUO lip seals. The lip seal material is indicated by the **seventh position of the type code**.

To compensate an increase in pressure at rising temperatures, the intermediate chamber features a breather at the side (1, at the side on standing versions) with a vent hole.



Notice

Risk of damage to the gear unit when the vent hole is closed!

The vent hole is also used for monitoring the integrity of the mechanical seals, and must not be closed or plugged off. If the quench fluid overflows at the vent hole, this indicates a seal malfunction.

When the vent hole is closed tightly or has become blocked, emerging pumped medium cannot escape and will penetrate the gear unit if the mechanical seal is defective. This could damage the gear unit.

The vent hole on the intermediate chamber can be positioned in a visible location via a pipe extension for special applications, e.g. on submerged pumps.

Optionally, the rotary lobe pump can also be supplied with a safety plug in the fill hole of the intermediate chamber. The safety plug must be able to move out without pressure when the quench is overfilled. There is no breather on the side on this version. The fill hole may only be closed with the optional safety plug.

3.1.7 Designs / mounting positions

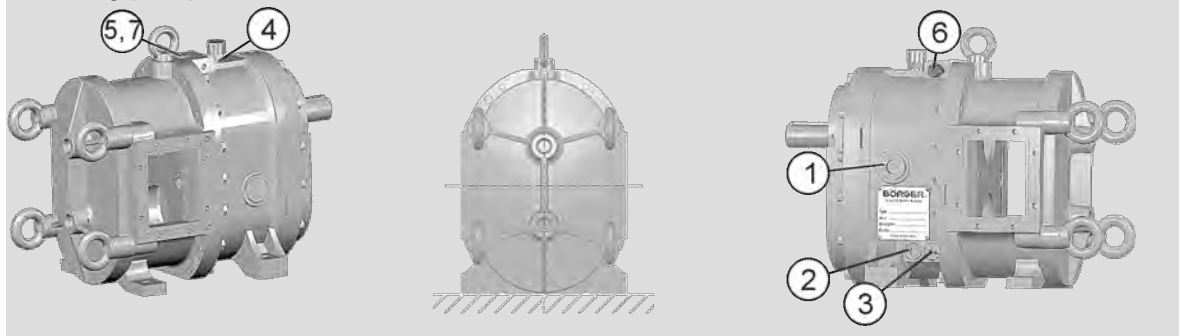
Depending on the mounting position, the position of the oil sight glass, breathers, fill holes as well as the drain holes for the gear unit and for the intermediate chamber can vary. For the M2, M3, M5 and M6 mounting positions, the fill hole for the intermediate chamber is closed with the breather (with small extension pipe on the M5 / M6).

The mounting position is indicated by the **seventeenth position of the type code**:

- 1 Oil level check on gear unit (oil sight glass / oil dipstick)
- 2 Oil drain for gear unit
- 3 Drain from intermediate chamber
- 4 Fill hole for gear unit, with breather system
- 5 Fill hole on intermediate chamber
- 6 Breather for the intermediate chamber
- 7 Intermediate chamber fill level indicator

For mounting position M1, type code 1:

Standing pump, feet at bottom, horizontal shafts



For mounting position M2, type code 2:

Vertical pump, quick-release cover at bottom, feet at side, vertical shafts, drive shaft pointing upwards

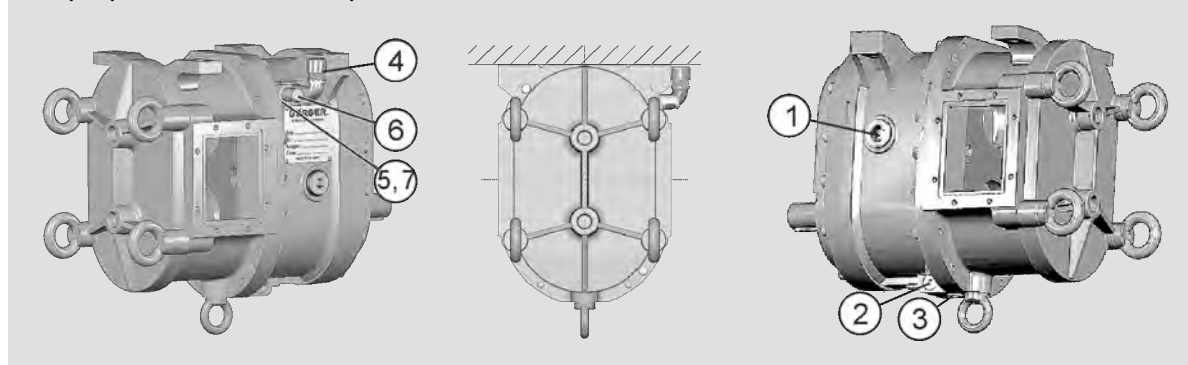


On submerged pumps (special version), the fill holes and breathers have been relocated with pipe extensions to the visible area or, depending on usage, are optionally closed completely.

- 1 Oil level check on gear unit (oil sight glass / oil dipstick)
- 2 Oil drain for gear unit
- 3 Drain from intermediate chamber
- 4 Fill hole for gear unit, with breather system
- 5 Fill hole on intermediate chamber
- 6 Breather for the intermediate chamber
- 7 Intermediate chamber fill level indicator

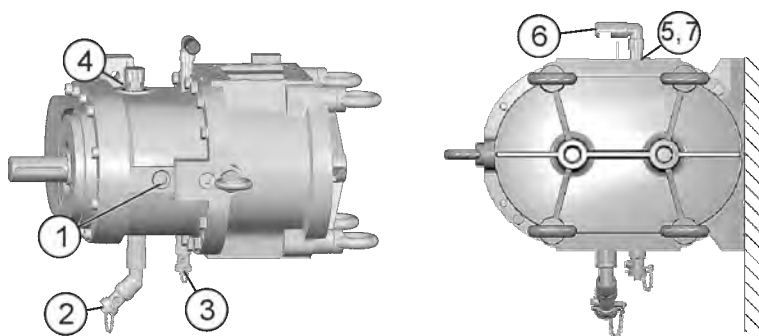
For mounting position M3, type code 3:

Pump upside-down, feet upwards, horizontal shafts



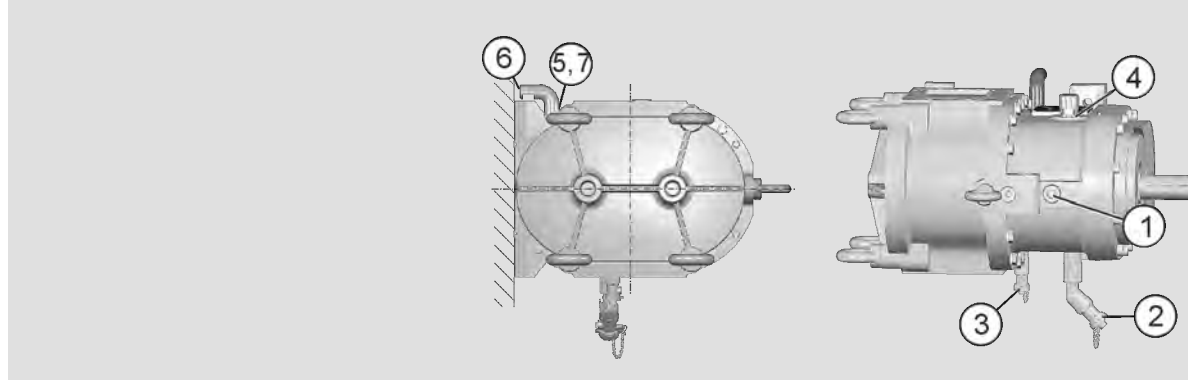
For mounting position M5, type code 5:

Pump turned 90° to the left, feet to the right, horizontal shafts



For mounting position M6, type code 6:

Pump turned 90° to the right, feet to the left, horizontal shafts



3.1.8 Pipe connections on inlet and outlet:

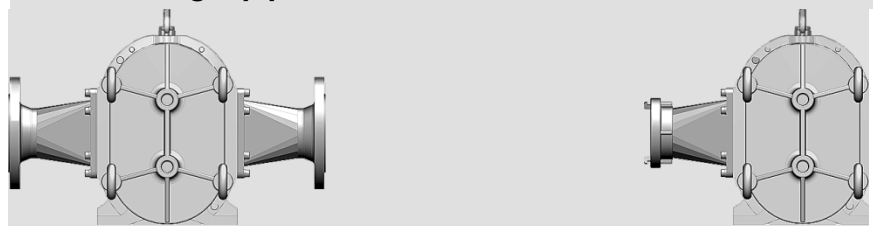
In most cases, Börger rotary lobe pumps are equipped with pipe connectors on the inlet and outlet that have been specially designed for the different mounting conditions. The inlet and outlet can be equipped with the same or different pipe connectors. Pipe connectors are available with a variety of connections, for example:

- DIN EN flange / DIN flange
- ANSI / ASME flange
- Quarter turn coupling
- Quick-release coupling, e.g. Perrot, female adapter (optional male)
- Dairy screw connections, and others

The pipe connectors can be equipped with optional additional fittings, e.g. screw socket G 1½" (½" BSPP female) or G 1" (1" BSPP female) for the connection of pressure gauges, shut-off devices or vent devices.

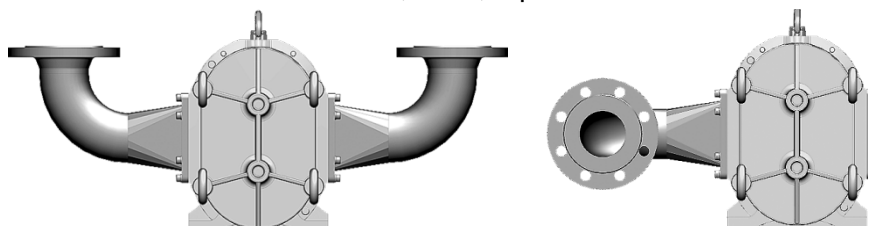
Pipe connectors (sample designs)

– *Short, straight pipe connector:*



– *90° pipe bend*

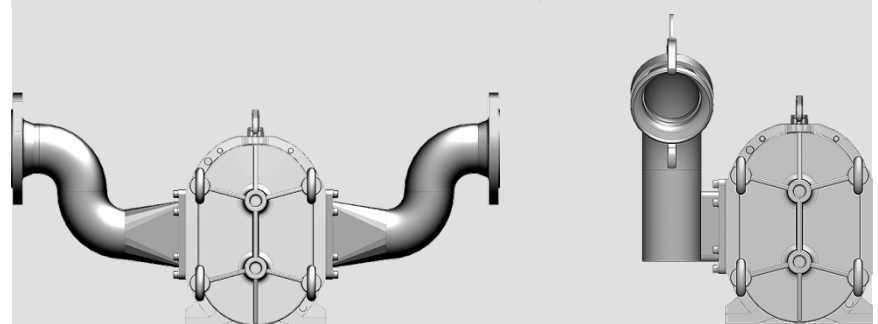
connection towards the front, back, top or bottom:



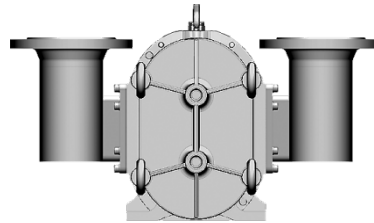
– *Gooseneck version*

– *Angled version*

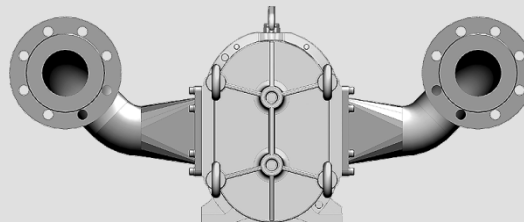
each with connection towards the front, back or side:



- **Angled version for narrow installations,**
connection towards the front, back, top or bottom:

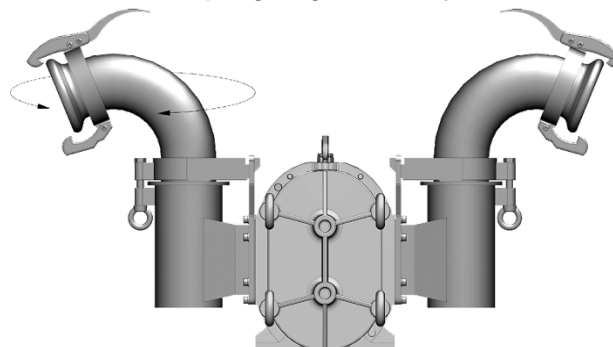


- **Double bend upwards,**
connection towards the front, back, top, bottom or side:

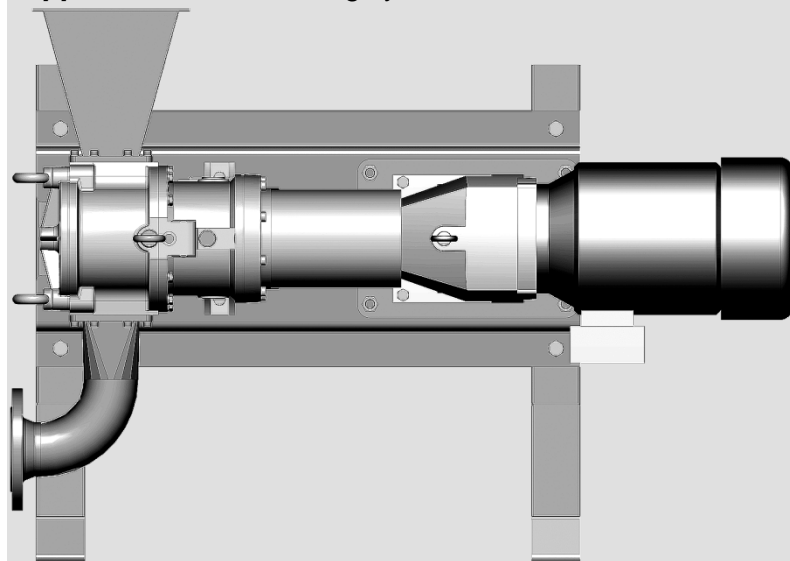


- **Continuous, fully-pivotable suction and pressure connection,**

with quick-release coupling, e.g. Perrot system:



A 90° turned rotary lobe pump can be equipped with an **intake hopper on the inlet** for highly viscous, fluid material:



3.1.9 Pump units

The majority of Börger rotary lobe pumps are delivered as a complete unit, i.e. with mounted drive fixed on a base frame. The most common unit variations are as follows:

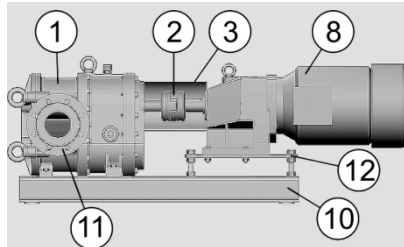


Figure 3.1.9-1
Pump unit with torsionally flexible coupling

Standard unit

- 1 Börger rotary lobe pump
- 2 Torsionally flexible coupling
- 3 Coupling guard
- 8 Drive (with gear reducer in this example)
- 10 Base frame
- 11 Pipe connector (short, straight pipe connector with flange in this example)
- 12 Motor plate

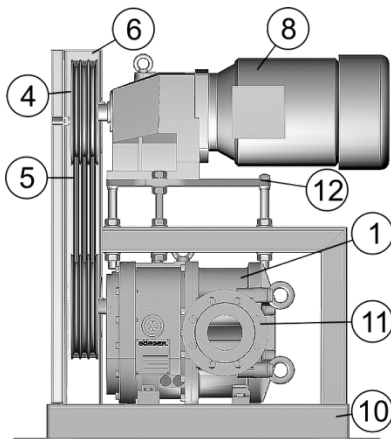


Figure 3.1.9-2
Pump unit with V-belt or chain drive

Overhead mounted drive assembly (piggyback)

- 1 Börger rotary lobe pump
- 4 V-belt pulley / chain drive
- 5 V-belt (up to five belts, depending on the drive) or chain drive
- 6 V-belt / chain guard
- 8 Drive (with gear reducer in this example)
- 10 Base frame
- 11 Pipe connector (short, straight pipe connector with flange in this example)
- 12 Motor plate

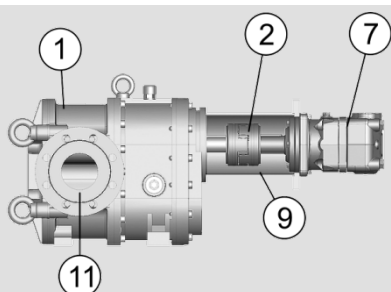


Figure 3.1.9-3
Pump unit with hydraulic drive

Pump unit with hydraulic drive

- 1 Börger rotary lobe pump
- 2 Torsionally flexible coupling
- 7 Hydraulic drive
- 9 Coupling lantern / drive fastening
- 11 Pipe connector (short, straight pipe connector with flange in this example)

3.1.10 Options and accessories

A variety of special equipment and additional accessories (cf. chapter 8) are available for the safe operation of the rotary lobe pump.

You can determine whether your rotary lobe pump has special equipment on the nameplate (**19th position onwards in type code**). You will find explanations referring to the special equipment and any delivered accessories in the appendix.



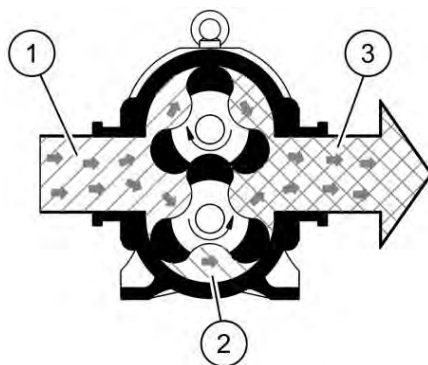
Notice

Risk of material damage due to non-compliance with the operating manuals for accessories!

If your rotary lobe pump is equipped with special equipment, then you must first read the corresponding supplementary operating manual for the equipment or accessories before carrying out any installation, commissioning or repair work on the pump.

Otherwise, you run the risk of damaging the rotary lobe pump.

3.2 Operating principle of a rotary lobe pump



- 1 Suction chamber
- 2 Transfer from suction chamber to pressure chamber
- 3 Pressure chamber

Börger rotary lobe pumps are self-priming, valveless, positive displacement pumps.

The rotors are turned in opposite directions via an external drive using two parallel shafts.

The geometry of the rotors results in a complete separation of the suction chamber (1) and pressure chamber (3).

The synchronous rotation of the rotor pairs creates a vacuum on the priming side of the pump, which can be defined by the direction of rotation of the drive. This vacuum draws the liquid into the pump chamber.

The dynamic transfer (2) from the suction chamber to the pressure chamber allows low-pulsation pumping, and nearly pulsation-free pumping when screw rotors are used.

Figure 3.2 Operating principle

The pumped medium is forced into the pressure lines on the pressure side (3) through the rotating, intermeshing rotors.

Depending on the rotor type, up to six chamber charges are displaced with each drive rotation.

The symmetrical construction of the rotary lobe pump means that the flow direction can be changed by reversing the direction of rotation, provided this is allowed by the system.

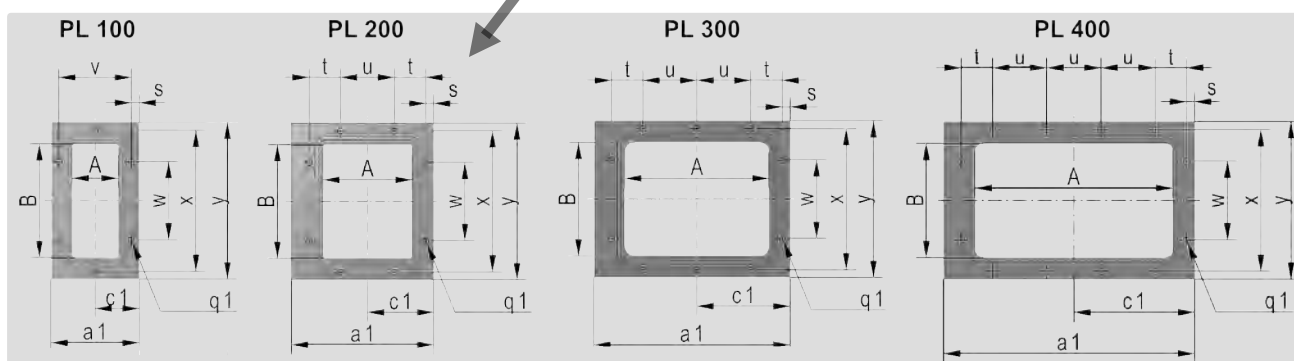
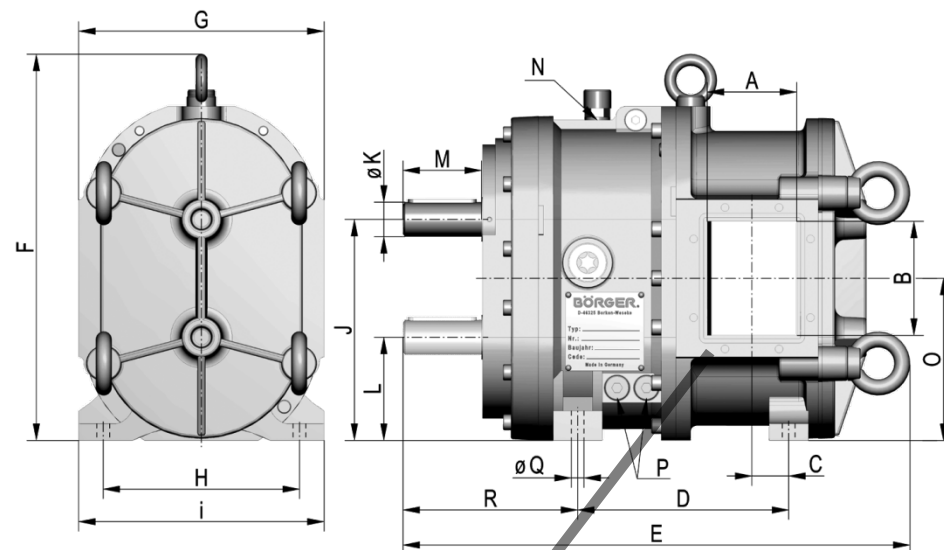
When the rotor pair is at a standstill, the pump seals off almost completely.

3.3 Technical data

Börger rotary lobe pumps are configured individually for the application requirements. This leads to a wide range of variations that have been optimized for specific applications. Therefore, only some of the standard versions can be listed here as examples. Detailed specifications for your rotary lobe pump or unit can be found in the data sheet and the **individual dimensional drawing** sent when the pump was ordered. Please contact Börger customer service if you require a copy of this drawing.

3.3.1 Dimensions

3.3.1.1 Pump without attachment parts

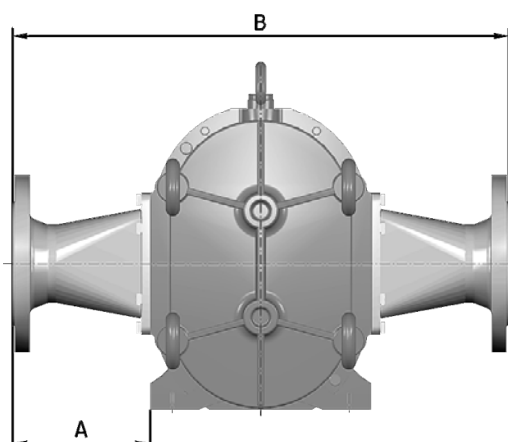


Dimensions of standard Classic PL rotary lobe pump in mm / inches (approx.)

PL...	A	a1	B	C	c1	D	E	F	G	H	i	J	Ø K	L	M	N	O	P
100	47 1.85	90 3.54	116 4.56	15 .59	45 1.77	160 6.30	460 18.11	393 15.47	250 9.84	200 7.87	250 9.84	225 8.86	35 1.38	105 4.13	80 3.15	G½" ½" BSPP	165 6.5	G½" ½" BSPP
200	91 3.58	145 5.71	116 4.56	37.5 1.48	67.5 2.66	215 8.46	515 20.28	393 15.47	250 9.84	200 7.87	250 9.84	225 8.86	35 1.38	105 4.13	80 3.15	G½" ½" BSPP	165 6.5	G½" ½" BSPP
300	147 5.79	200 7.87	116 4.56	65 2.56	95 3.74	270 10.63	570 22.44	393 15.47	250 9.84	200 7.87	250 9.84	225 8.86	35 1.38	105 4.13	80 3.15	G½" ½" BSPP	165 6.5	G½" ½" BSPP
400	201 7.91	255 10.04	116 4.56	92.5 3.64	122.5 4.82	325 12.79	625 24.61	393 15.47	250 9.84	200 7.87	250 9.84	225 8.86	35 1.38	105 4.13	80 3.15	G½" ½" BSPP	165 6.5	G½" ½" BSPP

PL...	Ø Q	q1	R	s	t	u	v	w	x	y	Weight:
100	13 .51	M8x15	178 7.01	8 .31	—	—	74 2.91	80 3.15	144 5.67	160 6.30	approx. 96 kg 211.2 lb
200	13 .51	M8x15	178 7.01	8 .31	32 1.25	55 2.16	—	80 3.15	144 5.67	160 6.30	approx. 107 kg 235.9 lb
300	13 .51	M8x15	178 7.01	8 .31	32 1.25	55 2.16	—	80 3.15	144 5.67	160 6.30	approx. 116 kg 255.7 lb
400	13 .51	M8x15	178 7.01	8 .31	32 1.25	55 2.16	—	80 3.15	144 5.67	160 6.30	approx. 129 kg 287.4 lb

3.3.1.2 Pipe connectors



The pipe connectors are designed according to the dimensional drawing created for the order.

We deliver short, straight pipe connectors as standard, with flanges (selectable) according to:

- DIN EN 1092-1,
for some pipe diameters (pump side) according to former DIN 2633, PN 10/16
- ANSI/ASME B 16.5 RF Class 150

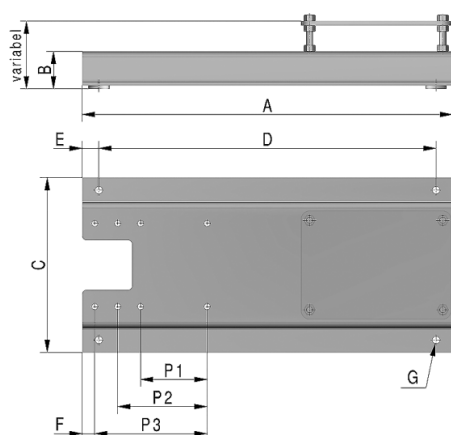
Short, straight pipe connectors with connection flange and O-ring seal, dimensions in mm / inches (approx.)

Nominal diameter:	Size															
	PL 100				PL 200				PL 300				PL 400			
	DIN / EN		ANSI / ASME		DIN / EN		ANSI / ASME		DIN / EN		ANSI / ASME		DIN / EN		ANSI / ASME	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
DN 50 (2")	176 6.92	602 23.70	195 7.68	640 25.20	156 6.14	562 22.13	175 6.89	600 23.62	—	—	—	—	—	—	—	—
DN 65 (2½")	141 5.55	532 20.94	166 6.54	582 22.91	176 6.93	602 23.7	201 7.91	652 25.67	200 7.84	650 25.59	225 8.86	700 27.56	—	—	—	—
DN 80 (3")	146 5.75	542 21.34	166 6.54	582 22.91	156 6.14	562 22.13	175 6.89	600 23.62	236 9.29	722 28.42	256 10.08	762 30.00	—	—	—	—
DN 100 (4")	146 5.75	542 21.34	170 6.69	590 23.23	136 5.35	522 20.55	160 6.3	570 22.44	201 7.91	652 25.67	225 8.86	700 27.56	221 8.7	692 27.24	245 9.64	740 29.13
DN 125 (5")	176 6.92	602 23.70	210 8.27	670 26.38	151 5.94	552 21.73	185 7.28	620 24.41	161 6.34	572 22.52	195 7.68	640 25.2	188 7.4	626 24.65	222 8.74	694 27.32
DN 150 (6")	176 6.92	602 23.70	210 8.27	670 26.38	181 7.13	612 24.09	215 8.46	680 26.77	166 6.54	582 22.91	200 8.87	650 25.59	191 7.52	632 24.88	225 8.86	700 27.56
DN 200 (8")	236 9.29	722 28.43	276 10.87	802 31.57	251 9.88	752 29.61	291 11.46	832 32.76	196 7.71	642 25.276	236 9.29	722 28.42	221 8.7	692 27.24	261 10.28	772 30.39

When using two 2 mm (.08") gaskets, 4 mm (.16") must be added to the specified **B** dimensions and 2 mm (.08") to the specified **A** dimensions.

Deviations in individual dimensions within an acceptable tolerance due to production cannot be ruled out.

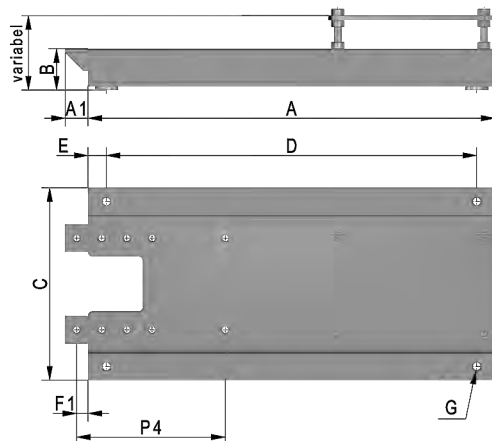
3.3.1.3 Base frame (standard version)



Base frame for PL 100 to 300, dimensions (mm / inches)

A	B	C	D	E	F	G	P1	P2	P3
890 35.04	90 3.54	420 16.54	810 31.89	40 1.57	30 1.18	17.5 .69	160 6.30	215 8.46	270 10.63

Weight: approx. 40 kg (88.18 lb)



Base frame for PL 400, dimensions (mm / inches)

A	A1	B	C	D	E	F1	G	P4
890 35.04	50 1.97	90 3.54	420 16.54	810 31.89	40 1.57	25 .98	17.5 .69	325 12.79

Weight: approx. 41 kg (**90.38 lb**)

3.3.1.4 Complete unit

The dimensions can be found in the specific dimensional drawing created for the order. The dimensions and weights of the drive and coupling etc. can be found in the corresponding manufacturer's documentation.

The weight of the complete pump unit or pump (as delivered) is specified in the data sheet.

3.3.2 Performance data and maximum loads

The specification of the pump output for which the rotary lobe pump was actually configured can be found in the data sheet.

The **geometric displacement volume** of the pump series is as follows:

PL 100 up to approx. 0.9 liters (**.238 gal**) per rotation

PL 200 up to approx. 1.8 liters (**.475 gal**) per rotation

PL 300 up to approx. 2.7 liters (**.713 gal**) per rotation

PL 400 up to approx. 3.6 liters (**.951 gal**) per rotation

The actual pump output depends on several factors, such as pressure, viscosity, speed and pump configuration.

The working pressure and differential pressure for which your rotary lobe pump unit was designed are also specified in the data sheet.

The following limits should be taken into account, especially for rotary lobe pumps delivered without drives:

Limits

PL...	Flow rate Q [m³/h] / [gpm]		Speed n [rpm]		Vacuum p _s	Working pressure
	Recommended	Permitted	Recommended	Permitted	Max.	Max.
100	8-24 35-106	3-33 13-145	150-450	50-600	-0.7 bar 21" HG vac	12 ¹⁾ bar 174 ¹⁾ psi
200	16-48 70-211	6-66 26-291	150-450	50-600	-0.7 bar 21" HG vac	10 ¹⁾ bar 145 ¹⁾ psi
300	24-72 106-317	9-99 40-436	150-450	50-600	-0.7 bar 21" HG vac	6 ¹⁾ bar 87 ¹⁾ psi
400	36-80 159-352	12-130 53-572	150-450	50-600	-0.7 bar 21" HG vac	4 bar 58 psi

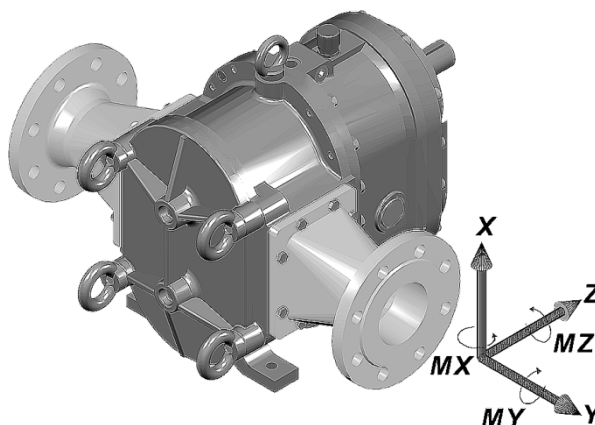
¹⁾ Pumps that are switched in series can have a higher maximum permitted working pressure (see data sheet).

Maximum differential pressure Δp , depending on the speed

PL...	Speed n [rpm]:					
	100	200	300	400	500	600
100	10 (12 ¹⁾) bar 145 (174 ¹⁾) psi	10 (12 ¹⁾) bar 145 (174 ¹⁾) psi	10 (12 ¹⁾) bar 145 (174 ¹⁾) psi	10 (12 ¹⁾) bar 145 (174 ¹⁾) psi	10 bar 145 psi	8 bar 116 psi
200	8 (10 ¹⁾) bar 116 (145 ¹⁾) psi	8 (10 ¹⁾) bar 116 (145 ¹⁾) psi	8 (10 ¹⁾) bar 116 (145 ¹⁾) psi	8 (10 ¹⁾) bar 116 (145 ¹⁾) psi	8 bar 116 psi	5 bar 72 psi
300	6 bar 87 psi	6 bar 87 psi	6 bar 87 psi	6 bar 87 psi	4 bar 58 psi	2 bar 29 psi
400	2 bar ²⁾ 29 psi ²⁾	2 bar ²⁾ 29 psi ²⁾	2 bar ²⁾ 29 psi ²⁾	2 bar ²⁾ 29 psi ²⁾	1 bar ²⁾ 14.5 psi ²⁾	1 bar ²⁾ 14.5 psi ²⁾

¹⁾ On special versions, when expressly agreed upon

²⁾ Deviations only on special versions, when expressly agreed upon



Forces and torques on metal pipe connectors (short, straight pipe connectors)

Specified values valid for / acc. to:	Pipe nominal diameter (mm)	Forces				Torques			
		N max				Nm max			
		F _x	F _y	F _z	F(total)	M _x	M _y	M _z	M _(total)
Børger rotary lobe pump	50, 65, 80, 100, 125, 150, 200	6400	8900	6400	12600	1330	1150	1600	2300
EN 14847	200	930		1320		500		735	

The values F_x, F_y and F_z or M_x, M_y and M_z may never be used simultaneously as maximum values.

The specified values are calculated, and may deviate in practice due to casting tolerances and structural changes. Therefore, the limits specified in terms of EN ISO 14847 for pipe diameter 200 should not be exceeded.

**Notice****Risk of material damage due to stress in the pipes!**

Börger rotary lobe pumps are robust, and are constructed for use with high loads. However, the pump must not be used as an anchor point for the pipe under any circumstances.

In particular, misalignment between the pump flange and pipe must not occur, see chapter 4.3.

Even at low vibrations, the stress generated on the pipe during pump operation can lead to cracks on weaker components / weld seams.

4 Transportation, Storage and Installation



Warning!

Dangerous crush injuries are possible during transportation of the rotary lobe pump.

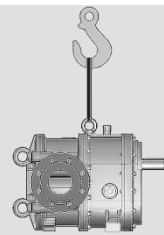
The pump may tilt over and fall due to improper lifting and transportation.

Only use hoists, cranes, auxiliary tools and protective equipment that are suitable for the load.

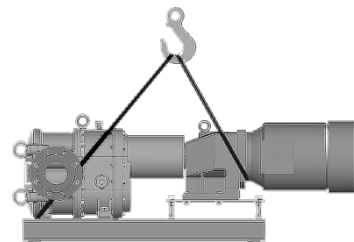
Never stand under suspended loads.

Observe the weight of the rotary lobe pump unit according to the delivery documentation / data sheet.

The ring bolt on the rotary lobe pump must not be used to lift the complete unit (rotary lobe pump with drive).

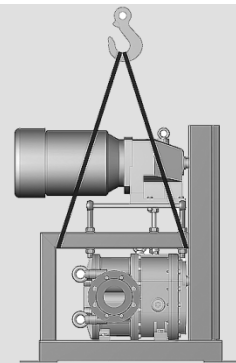


A pump without attachment parts can be lifted using the ring bolt.



Standard pump units with electric drives can be transported safely using the methods shown here, for example.

(Schematic drawing; observe specifications for the inclination angle in accordance with the hoist instructions!)



Overhead mounted drive assemblies can be transported safely as shown here.

- If a special base frame with additional lifting lugs was delivered, use the lugs accordingly.

4.1 As-delivered condition

The rotary lobe pump or complete rotary lobe pump unit is delivered in a pre-assembled, packed state. Optional accessories may be included in separate packaging.

- Observe the applicable delivery conditions for the order.
- Check that the delivery is complete when you receive it.
- Inspect the delivery immediately for any signs of transport damage.
- Ensure that the unit is not put into operation in the event of incorrect or incomplete delivery, or transport damage.
- Inform the shipping agent immediately of any transport damage and contact Börger GmbH.

4.2 Storage / interim storage

4.2.1 Storage

If the rotary lobe pump is not used immediately, then appropriate storage conditions are as important as the correct installation and maintenance for subsequent trouble-free operation.

- Always adhere to the following storage conditions for the rotary lobe pump:
 - The storage room must be evenly ventilated and free of dust and vibrations.
 - The relative humidity must be below 65% and the temperature between 15 °C and 25 °C (**59 °F and 77 °F**)
 - Avoid exposure to direct heat sources (sunlight, heating).
- Repair any damage to the external coating, galvanized components and corrosion protection on bare metal parts caused by external influences.
- Protect the rotary lobe pump from cold, moisture, contamination and mechanical influences.

Close the inlet and outlet connections in particular (flange, coupling etc.), plus any other openings to the interior of the pump with covers impermeable to moisture.

- When the pump is stored for longer periods, rotate the rotating parts several times after about six months (or more often, depending on the storage conditions). This way the gears, bearings and shaft seals are moved and coated again with lubricant.
- Before commissioning / recommissioning at a later date, remove all protective covers and anti-corrosion coatings.

If the device was stored for two years or more, or if the storage conditions detailed above could not be met:

- Replace the lubricants before commissioning.
- Check the O-rings that come into contact with the medium, the elastomer rotors and the mechanical seals and replace them if necessary.



Note

Börger GmbH recommends contacting Börger customer service in these cases.

- Observe the drive manufacturer's instructions for storing the drive.

4.2.2 Interim storage

For the interim storage of a used pump, the following applies:

- Clean the rotary lobe pump thoroughly.
- Apply suitable corrosion protection to the rotary lobe pump.
- Follow the storage instructions as detailed in chapter 4.2.1.

4.3 Installation



Note

The pipe lengths and nominal diameters must have been defined before the pump was configured.

Check that the original pipe layout has been adhered to before installing the pump.

A change in pipe diameter, length etc. can completely change the suction and pressure conditions in the system.

Börger rotary lobe pumps are configured for different mounting positions. Refer to the diagram in chapter 3.1.7 for the mounting position of your rotary lobe pump.

Depending on the design, it may be necessary to replace the temporary shipping plugs in the intermediate chamber and gear unit with the breather (intermediate chamber) and the breather system (gear unit).

- Check all specifications in the technical data sheet and only install the rotary lobe pump if it is suitable for the intended application.
- Apart from the performance data on the rotary lobe pump, also check that the materials are compatible with the pumped medium.
- If available, replace the temporary shipping plug on the intermediate chamber with the breather and that on the gear unit with the breather system. Refer to the design diagram in chapter 3.1.7.

If your rotary lobe pump was delivered **on a base frame without a drive:**

- Connect the rotary lobe pump to a suitable drive. Observe the appropriate speed and sufficient torque, and take all necessary parameters into account, such as viscosity, the solid content of the medium, pump pressure, displacement volume and desired flow rate.
- Attach a suitable cover (coupling guard) for the rotating parts.

If your rotary lobe pump was delivered **without a drive or base frame**:

- Attach the rotary lobe pump to a solid, rigid surface.
- Connect the rotary lobe pump to a suitable drive, see the previous section.

If your rotary lobe pump was delivered **without pipe connectors**:

(with standard rectangular flanges on the inlet and outlet), the appropriate pipe connectors must be attached as follows:

- Use the following components accordingly:
 - Flange screws (spare parts list, position 58)
 - Spring washers (spare parts list, position 54) for securing the flange screws
 - Seals made from materials compatible with the pumped medium

O-ring seals (spare parts list, position 25.1) must be used as standard, and are to be installed into the O-ring groove on the pump inlet / pump outlet. Optionally, gaskets are also used (spare parts list, position 25.2), e.g. for agricultural pumps.

- Gradually tighten the flange screws used to install the pipe connectors on the pump inlet and outlet crosswise so that the leak tightness of the connection is guaranteed. Observe the maximum torque specified below. Make sure that the seals and the spring washers are not damaged and not to squeeze out the rubber gaskets (NBR, EPDM, FKM).



Torque specifications

O-ring seals and PTFE-based gaskets

M8 steel screws	25 Nm (221 in-lbs)
------------------------	-------------------------------

M8 stainless steel screws, property class 70	20 Nm (177 in-lbs)
---	-------------------------------

The torque cannot be attained when using gaskets made of NBR, EPDM or FKM. For these seals, gradually tighten the screws crosswise, however only insofar that the seals are not squeezed out.

4.3.1 Positioning



Notice

Risk of damage caused by frost!

Protect the rotary lobe pump and pipe connectors against frost. Ice particles from the pipes can cause damage if they enter the pump chamber.

Standard rotary lobe pump units are installed ready for operation on a rigid base frame together with elastic shaft connections, a coupling guard and pipe connectors.

The recommended space required for maintenance is 1.0 m x 1.0 m **(3.28 ft x 3.28 ft)**.

A space of at least 0.8 m x 0.8 m **(2.62 ft x 2.62 ft)** is necessary to access the pump easily for maintenance and repair work, see figure 4.3.1.

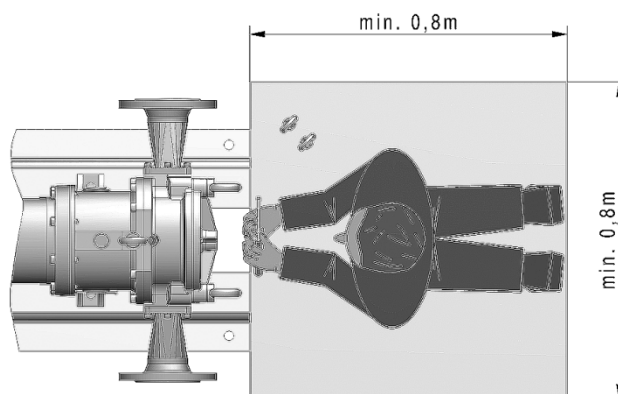


Figure 4.3.1 Service space



Note

Ensure that there is sufficient circulation of air around the drive; see the drive manufacturer's operating manual.

4.3.1.1 Versions with base frames



Note

The nuts underneath the base frame must be accessible with a wrench from the front and back. If realignment is required or a pump is reinstalled on the base frame (e.g. following repairs or replacement), then it must be possible to hold the nuts in place with a wrench.

Only set the base frame in concrete if a suitable special base frame has been delivered as agreed upon in advance.

The surface must be solid, level, clean and dry.

- Position the base frame without subjecting it to stress.
- Compensate for any unevenness in the floor, e.g. by using washers.
- Install the base frame onto the reinforced surface without subjecting it to stress, e.g. using four suitable M12x160 anchor bolts and appropriate resin capsules or four other safe fixing systems suitable for the surface and the application.

4.3.1.2 Other versions

- Mobile pumps must be operated on a solid surface and be secured in place. Double-check this.
- Pumps that are operated on a vehicle must be fixed to the vehicle frame. Double-check this.
- When installing special pump versions (e.g. submerged pumps), check whether a supplementary operating manual is enclosed in the appendix and, if so, follow the instructions.

4.3.2 Installing the inlet and outlet

Suitable seals are required for installing the inlet and outlet pipe connectors to the pipes / hoses, i.e. gaskets are required on flange connections. These must be resistant against the pumped medium.

The type, design, nominal diameter and nominal pressure of the connection flanges (or any special connections) are specified in the order confirmation / data sheet. Only suitable counter flanges / connectors may be attached in combination with the appropriate seals.

The pipes to be connected must correspond to the specifications in the order (material, DN, PN, NPSH_A value etc.).



Note

Pipes to be connected and any additional components such as valves, check valves etc. must not subject the pump and flange connections to stress. All components must be supported as close to the pump as possible according to the valid general technical rules.



Note

In order to avoid cavitation, the rotary lobe pump should only have to negotiate a minimal priming height or no priming height at all. The NPSH value on the system (NPSH_{avail.} / NPSH_A) must always be sufficiently larger than the required NPSH value on the pump (NPSH_{req.} / NPSH_R). The following applies here:

$NPSH_{avail.} \geq NPSH_{req.} + 0.5 \text{ m (1.64 ft)}$ or **$NPSH_A \geq NPSH_R + 0.5 \text{ m (1.64 ft)}$** .

Depending on the application (e.g. when used with gas-emitting media) and pipe construction, it may be advisable to equip the pipe system with vents at high points.

Ensure that no pockets of air can build up in front of or behind the pump.

- Clean all connection flanges and all other connections before installation and ensure that they are not damaged.

- On flange connections, ensure that the flanges are positioned exactly face to face, even without being fixed by screws. They must not be inclined, nor pressed together, nor spring backwards due to tensile forces.
- Prevent any stress on the pipes connected to the pump by taking suitable measures.
- Use seals that are suitable for the connections.
- Install the connections to the matching pieces on the pipes or hoses without stress. When necessary, apply the appropriate torque for the connection. Consult the manufacturer's instructions for coupling connections, e.g. Perrot couplings and dairy screw connections, etc.

4.3.3 Aligning the unit

4.3.3.1 On versions with torsionally flexible couplings

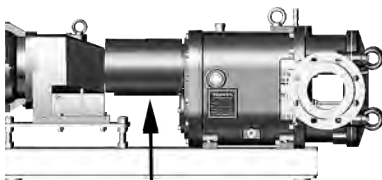
In order to rule out damage caused by displacement, you must check the alignment of the coupling on pump units with gear motors mounted on a base frame after the pump is installed.

- Refer to the manual from the coupling manufacturer in the appendix.



Note

The coupling guard is a safety-relevant component. It prevents personnel from reaching into rotating parts.



- Loosen the fastening screws of the coupling guard.
- Bend up the coupling guard shown here slightly.
- Lift off the coupling guard.
- Check the alignment of the coupling in several positions using a suitable tool (straightedge, laser-optical sensor).
- When necessary, carefully correct any misalignment according to the specifications of the coupling manufacturer, e.g. using the adjusting screws on the motor plate.

- Reattach the coupling guard correctly. Fasten all fastening screws tightly.
- Check the screws used to fasten the pump to the base frame and retighten them, if necessary.

4.3.3.2 On overhead mounted drive assemblies

The correct belt pre-tension or chain tension is necessary for correct belt drive or chain drive functionality and a long service life for the V-belts / chains.

- Observe the specifications from the V-belt or chain manufacturer in the appendix.



Note

The V-belt / chain guard is a safety-relevant component.
It prevents personnel from reaching into rotating parts.

- After receiving your rotary lobe pump with belt drive or chain drive, check that the V-belt or chain is positioned correctly and that the pre-tension is correct according to the manufacturer's specifications.
- Check the screws used to fasten the pump to the base frame and retighten them, if necessary.

4.3.4 Electrical, hydraulic and PTO shaft connection

4.3.4.1 Electrical connection

The rotary lobe pump must be completely installed before establishing the electrical connections.



Note

A machine must be integrated in an emergency stop system.

It is only permissible to do without an emergency stop device if the emergency stop device would not reduce the stopping time and if it would not enable the special measures required to deal with the risk to be taken. The normal shutdown equipment must then be labeled accordingly.



Danger!

Risk of fatal injury due to electric shock!

Electrical connections may only be installed by qualified electricians.

Pay particular attention to all instructions and safety regulations contained in the operating manuals for electronic components in the appendix.

- Connect all electrical monitoring devices and the drive according to the operating manuals from the manufacturers.
- Ground the rotary lobe pump. Use the grounding terminal on the base frame.

4.3.4.2 Hydraulic connection



Warning!

Danger of injuries due to hydraulic oil spurting out under pressure!

Hydraulic connections may only be installed by qualified technicians.

Pay particular attention to all instructions and safety regulations contained in the operating manuals for hydraulic components.

- Connect the hydraulic connections on pump versions with a hydraulic drive according to the operating manual from the drive manufacturer.

4.3.4.3 PTO shaft connection



Warning!

Danger of crushing / injuries when connecting the PTO shaft!

PTO shaft connections may only be installed by qualified technicians.

Pay particular attention to all instructions and safety regulations contained in the operating manuals for PTO shaft components.

- On pump versions with a PTO shaft drive, connect the suitable PTO shaft - which has to be mounted properly to the drive - with the corresponding shaft end of the rotary lobe pump according to the operating manual from the PTO shaft manufacturer.



Note

Ensure that the drive connection side of the PTO shaft is connected to the drive and the driving side is connected to the pump.

Check the length of the PTO shaft and adjust it when necessary, especially when the pump is mounted on a frame for a three-point hitch and driven by tractor hydraulics.

4.3.5 Checking the pump functions



Warning!

Risk of serious hand injuries due to rotating parts!

Do not reach into the rotating parts under any circumstances when checking the direction of rotation as detailed below.



Notice

Risk of material damage (to the system) when operating the rotary lobe pump with incorrect direction of rotation!

The rotary lobe pump must not be put into operation during the following function test.

Ensure that all valves and shut-off devices are closed.



Notice

Risk of damage to the rotary lobe pump due to frictional heat caused by dry run!

A rotary lobe pump with rubber-coated rotors should not run dry, **i.e. without pumped medium**, for longer than 15 seconds at a normal speed under any circumstances. Otherwise, the frictional heat would cause damage to the pump components.

Ensure that the drive is switched on only briefly for the function test and switched off again in time.

4.3.5.1 Flow direction

The flow direction on Börger rotary lobe pumps can be reversed, and is defined by the direction of rotation on the drive.

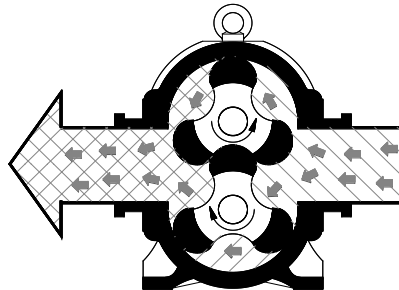


Figure 4.3.5.1-1
Flow direction RL
(View of quick-release cover)

Flow direction from **right to left**, when the **upper** shaft turns counter-clockwise, as shown here.

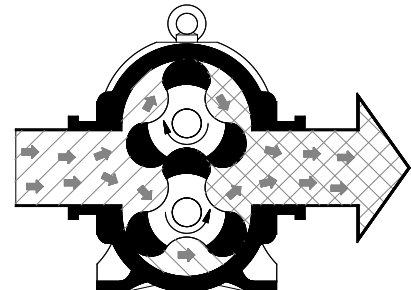


Figure 4.3.5.1-2
Flow direction LR
(View of quick-release cover)

Flow direction from **left to right**, when the **upper** shaft turns clockwise, as shown here.

On non-standing versions (cf. chapter 3.1.7), the flow direction according to figures 4.3.5.1-1 and -2 applies correspondingly when looking at the quick-release cover.

- After establishing the electrical connections or the drive, check the **direction of rotation** of the rotary lobe pump and correct it, if necessary:
 - Open the quick-release cover according to chapter 6.3.2.
 - Check the direction of rotation on the drive, for example by pressing the switch briefly so that the direction of rotation of the pump can just be determined.
 - Switch the drive off again immediately.
 - If the direction of rotation is incorrect, change the direction of rotation of the drive or switch the PTO shaft for versions with two drive shafts.
- Mark the selected **flow direction** (RL or LR) on the pump using the adhesive label provided.
- Attach the cover-side casing protection plate and quick-release cover in accordance with chapter 6.3.2.

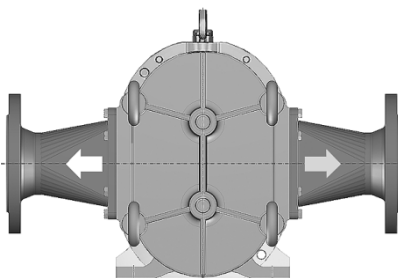


Figure 4.3.5.1-3
Marking of flow direction

4.3.5.2 Smooth running following storage and long downtimes

Following long storage periods and downtimes, check that the mechanical seals (standard seals) and rotors run smoothly before commissioning the pump again (cf. chapter 6.3.3 regarding smooth running of the rotors):

- Open the quick-release cover according to chapter 6.3.2.
- Attach a hexagon socket wrench or ratchet to one of the hexagon socket head cap screws that fasten the rotors to the shafts and rotate the shaft. The shafts and rotors must not become jammed.
- On used pumps, remove any foreign bodies that may cause the rotors to jam. If this does not solve the problem, then removal and possibly replacement of the mechanical seals or rotors is necessary (see chapter 6).
- Attach the cover-side casing protection plate and quick-release cover in accordance with chapter 6.3.2.

4.3.6 Preparation for commissioning

- Ensure that you have removed the **transport lock from the breather system** on the drive if one was present according to the operating manual of the drive manufacturer. Adhere to all instructions from the drive manufacturer regarding commissioning.
- If your pump was delivered with special **accessories**, then ensure that these accessories are installed correctly and ready for operation. This especially applies to devices used for safety and monitoring system functionality. Adhere to the relevant operating manuals in the appendix.
- Check the **oil level in the pump gear unit**.
On standing versions, the oil level must reach at least halfway up the oil sight glass. If this is not the case, the gear oil (cf. data sheet) must be refilled according to chapter 6.2.2.
- If your pump was delivered with a **temporary shipping plug on the intermediate chamber**, replace this with the breather; cf. the description of the position of the breather in chapter 3.1.7.

- Check the **level of quench fluid** in the intermediate chamber. On standing versions, the fluid must reach at least halfway up the top shaft. If this is not the case, the quench fluid (cf. data sheet) must be refilled according to chapter 6.2.2.



Note

The quench fluid is used for monitoring the integrity of the mechanical seals, and for the protection, lubrication and cooling of the mechanical seals (cf. chapters 3.1.5 / 3.1.6) as well as the rotor / shaft connections.

- Check whether the delivered quench fluid (see enclosed data sheet) is suitable or whether an alternative fluid must be used in order to observe environmental protection regulations, or for biological or other reasons.
This fluid must be compatible with the pumped medium, and must not adversely affect the O-rings of the mechanical seals. Consult Börger GmbH regarding this, if necessary.



Notice

Risk of damage to the gear unit when the intermediate chamber is closed tightly!

The vent hole in the intermediate chamber is used for monitoring the integrity of the mechanical seals.

When the vent hole is closed tightly or has become blocked, emerging pumped medium cannot escape and will penetrate the gear unit if the mechanical seal is defective. This could damage the gear unit.

- Make sure that if the intermediate chamber overflows, the fluid can escape unobstructed through the **breather**.
- Provide suitable measures to collect any fluid escaping at the breather in the event of a seal leakage (e.g. drip pan).

**Note**

Take suitable precautions when using hazardous pumped media, e.g. by attaching a closed overflow system with a secure breather system which guarantees the functionality of the leak monitor and venting, instead of the breather.

- Check that the **coupling guard** is positioned correctly and fixed securely.
- Ensure that the **supply lines** to the drive are connected and secured according to the relevant regulations.
- Check that the rotary lobe pump unit is **grounded**.
- Check that the **pipe connectors** are attached correctly and do not leak. (Torque for the connection between pump and pipe connector can be found in the introduction in chapter 4.3).
- Check that all **screws**, which may have become loose during transportation and installation, are tight.
- Rectify all errors determined by this check.

5 Operation

**Notice****Risk of severe damage to the rotary lobe pump caused by running against closed valves!**

The rotary lobe pump should not be run against closed valves under any circumstances.

Running against closed valves will cause lasting damage to your rotary lobe pump.

**Notice****Risk of permanent damage if the pressure / temperature / speed limits are exceeded!**

The pressure on the outlet must not exceed the permissible pressure of the pipe system and rotary lobe pump, and must not overload the drive unit and its elastic connections.

The temperature values may not exceed or fall below the limits.

The maximum drive speeds may not be exceeded.

Otherwise, permanent damage to the components cannot be ruled out.

**Notice****Risk of damage due to blockage of the drive shaft!**

Long-fibrous particles and other foreign bodies which might result in a blockage of the drive shaft must not enter the pump chamber. Take the appropriate precautions if necessary (install a macerator / stone trap upstream).

**Notice****Risk of damage to the mechanical seal due to a lack of quench fluid!**

The heat-absorbing quench fluid prevents the mechanical seals from running dry and captures any pumped medium that enters the intermediate chamber due to leaks in the mechanical seals.

This **quench** function also prevents the gear unit from being damaged by intrusion of the pumped medium.

Make sure that the fill level in the intermediate chamber is sufficient.

**Note**

Rotary lobe pumps are self-priming positive displacement pumps. However, we recommend filling the pump with medium for suction operation before switching it on. This shortens the priming process and prevents dry run with increased wear. Suitable equipment for filling and venting may be required in the suction and pressure lines. The pump should be prepared so that venting is possible directly behind the pump, on the pressure side, during the initial priming process. If the suction line is flooded with medium (e.g. gravity feed), only the pipes need to be free and all valves open to ensure the unrestricted transportation of pumped medium and any air remaining in the pipe.

5.1 Qualifications for operating personnel

The operating personnel must have been informed or instructed on the applicable legal and accident prevention regulations as well as the safety equipment on and around the rotary lobe pump.

The operating personnel must have fully understood the instructions, and adherence to the instructions must be guaranteed. Only then can all personnel work safely and in full awareness of the associated risks.

- Appoint only trained or instructed personnel.
- Clearly define the personnel responsible for operation, installation, maintenance and repair.
- In addition, also specify the area of responsibility for the operating persons and allow them to reject unsafe instructions from others.

5.2 Commissioning



Note

There might be residues of soft soap in the rotary lobe pump as a result of the manufacturing process and test runs. Dirt caused by packaging and transport cannot be ruled out.

If necessary, thoroughly rinse the rotary lobe pump with a suitable agent as part of the test run (chapter 5.2.1) while adhering to the limits before commissioning the pump for the first time.

5.2.1 Test run with pumped medium

This test run may only be made when all measures detailed in chapter 4 are completed, all errors have been rectified and the functional check without medium (chapter 4.3.5) has shown the desired direction of rotation and the required smooth running.

Observe the information in chapter 6.3.3 for checking the smooth running of the rotors.

- Open any pipe shut-off devices on the pressure side and suction side.
- First, switch on all additional devices, especially those with measurement and control functions relevant to safety.
- Switch on the pump drive.
- Check all pipe connectors, the quick-release cover, etc., for leaks.

- Check the correct functionality and display on all additional devices, especially the dry run monitoring.
- Check that the pump runs quietly and vibration-free. If the pump or drive emits uneven, rattling sounds, then the cause must be determined.
- Check the power consumption of the drive.
Compare the values with those in the drive operating manual.
- Check the development of noises and temperature on the drive.
- Check the connections for leaks.

After a short run-in period, the rotary lobe pump delivers the flow rate that corresponds to the technical data under the prevailing operating conditions.

5.2.2 Complete commissioning

The rotary lobe pump can be operated properly when all functions run correctly and no leaks are detected.



Note

A checklist for commissioning Börger rotary lobe pumps can be found in chapter 9.7.

5.3 Normal operation

Börger rotary lobe pumps are suitable for continuous operation. The specified operating cycle for which the rotary lobe pump was designed can be found in the enclosed data sheet.

- Ensure that no imbalances are caused by improper cleaning, product residue or foreign bodies.
- On pumps that operate with a frequency converter, make sure that the operating speed is sufficiently below the maximum permissible speed (speed limit based on pump configuration, see enclosed data sheet).

5.4 Downtimes

- Leave the pumped medium in the pump during normal downtimes, provided the type of medium does not prevent this (e.g. the medium hardens when cooling down).
- Clean the pump in these cases, and before long downtime periods.

5.5 Malfunctions



Notice

Permanent damage to components due to a delayed shutdown of the system in the event of malfunctions!

In the event of a malfunction, shut down the pump and all upstream and downstream system components immediately until the cause has been rectified. Otherwise, permanent damage to the components cannot be ruled out.

Troubleshooting

The pump does not start, or runs with difficulty after a downtime	Possible causes	Remedial action
	Pressure-side pipes blocked or closed	<ul style="list-style-type: none"> • Open the shut-off devices • Clean the pressure line
	Sediment of the pumped medium has been deposited in the pump chamber following a lengthy downtime of the rotary lobe pump	<ul style="list-style-type: none"> • Clean the pump chamber
	Long-fibrous or film-like particles have become wrapped around the rotors	<ul style="list-style-type: none"> • Remove all foreign bodies • If necessary, install a macerator (Multicrusher, Multichopper) upstream
	Incorrect parameterization of the control unit or frequency converter	<ul style="list-style-type: none"> • Correct the settings • Check that the frequency converter is suitable (it must emit a constant torque)
	Polymer rotors have expanded and press too strongly against the casing wall	<ul style="list-style-type: none"> • Determine the chemical composition and temperature of the pumped medium and use rotors made from suitable materials (test plates for testing the expansion are available from Börger GmbH)
	Drive output too low	<ul style="list-style-type: none"> • Install a more powerful drive

The pump does not generate suction	Possible causes	Remedial action
	Incorrect flow direction / direction of drive rotation	<ul style="list-style-type: none"> ● Change the direction of drive rotation
	Suction line closed or blocked	<ul style="list-style-type: none"> ● Open the shut-off devices ● Clean the suction line
	Suction connection is leaky	<ul style="list-style-type: none"> ● Tighten the screws on the flange connection cross-wise with uniform strength ● Check / replace the seal ● Check the pipes for damage and rectify, if necessary ● Rule out any leaks on components (pressure gauges, ball valves etc.)
	Suction line completely empty	<ul style="list-style-type: none"> ● Provide a flooded suction line / start-up volume ● Lower the pump / prevent emptying of the pump chamber, e.g. with 90° pipe bend (see chapter 3.1.8)
	Suction height too large (> 8 m / 26.25 ft)*	<ul style="list-style-type: none"> ● Lower the pump*
	Pipe diameter too large*	<ul style="list-style-type: none"> ● Adjust the pipe diameter to the pump output of the rotary lobe pump*
	Cross-linked pipes: several / all lines open	<ul style="list-style-type: none"> ● Only open the shut-off devices of the applicable suction and pressure lines on which the pump is to operate
	Viscosity of pumped medium too high*	<ul style="list-style-type: none"> ● Reduce the viscosity when possible* ● Change the pump position* or install an auger upstream
	Build-up of air pockets (pump could not discharge air on pressure side)	<ul style="list-style-type: none"> ● Provide venting

* Observe the information in chapters 2.3 and 4.3.2.

Continued The pump does not generate suction...	Possible causes	Remedial action
	Rotors have been destroyed	
	— By wear	<ul style="list-style-type: none"> ● Replace the rotors
	— By dry run	<ul style="list-style-type: none"> ● Replace the rotors <i>Notice: If the rotors were damaged due to dry run, the mechanical seals should also be replaced.</i> ● Determine the cause of dry run and eliminate it
	— By foreign bodies	<ul style="list-style-type: none"> ● Replace the rotors ● Install a macerator (Multicrusher, Multichopper) and a stone trap upstream, if necessary
	Wear on casing liners	<ul style="list-style-type: none"> ● Replace worn parts



Note

Observe the note regarding the sequence of the measures at the end of this chapter.

The pump emits rattling noises	Possible causes	Remedial action
	Speed too high* (pump chambers only partially filled)	<ul style="list-style-type: none"> • Reduce the speed • Install larger suction lines*
	Foreign bodies in priming area	<ul style="list-style-type: none"> • Remove foreign bodies • Install a stone trap upstream, if necessary
	Line blocked on suction side	<ul style="list-style-type: none"> • Clean the line • If necessary, install a macerator (Multicrusher, Multichopper) upstream
	Suction height too large (> 8 m / 26.25 ft)*	<ul style="list-style-type: none"> • Lower the pump*
	Gas-emitting medium	<ul style="list-style-type: none"> • Reduce the speed • Reduce the suction height
	Pipe not supported / not supported near the pump	<ul style="list-style-type: none"> • Support the pipes sufficiently, taking the weight of the pumped medium into account
	Coupling not aligned correctly	<ul style="list-style-type: none"> • Align the coupling
	Cam ring (coupling) worn	<ul style="list-style-type: none"> • Replace the cam ring
	Damage to the pump gear unit or drive gear unit	<ul style="list-style-type: none"> • Contact the manufacturer

* Observe the information in chapters 2.3 and 4.3.2.

Liquid escapes from the vent hole	Possible causes	Remedial action
	Temperature-related expansion with too much fluid in intermediate chamber	<ul style="list-style-type: none"> • Drain some of the quench fluid out of the intermediate chamber
	Rotor seal damaged	<ul style="list-style-type: none"> • Replace the rotor seal
	Shaft seal on product side damaged	<ul style="list-style-type: none"> • Replace the mechanical seals or MultiSeal cartridges

Pump output below the nominal value	Possible causes	Remedial action
	Suction height too large (> 8 m / 26.25 ft)*	<ul style="list-style-type: none"> ● Lower the pump*
	Suction line diameter too large / too small*	<ul style="list-style-type: none"> ● Adjust the pipe diameter to the pump output of the rotary lobe pump*
	Pressure line diameter too small*	<ul style="list-style-type: none"> ● Adjust the pipe diameter to the pump output of the rotary lobe pump*
	Shut-off devices not open / not open completely, pipes blocked	<ul style="list-style-type: none"> ● Open the shut-off devices ● Clean the pipes
	Counter-pressure too high for other reasons	<ul style="list-style-type: none"> ● Reduce the counter-pressure ● Install pressure monitoring equipment
	Speed too low*	<ul style="list-style-type: none"> ● Increase the speed*
	Viscosity of pumped medium too high*	<ul style="list-style-type: none"> ● Reduce the viscosity when possible* ● Change the pump position* or install an auger upstream
	Rotors have been destroyed	
	— By wear	<ul style="list-style-type: none"> ● Replace the rotors
	— By dry run	<ul style="list-style-type: none"> ● Replace the rotors <i>Notice: If the rotors were damaged due to dry run, the mechanical seals should also be replaced.</i> ● Determine the cause of dry run and eliminate it
	— By foreign bodies	<ul style="list-style-type: none"> ● Replace the rotors ● Install a macerator (Multicrusher, Multichopper) and a stone trap upstream, if necessary
	Wear on casing liners	<ul style="list-style-type: none"> ● Replace worn parts

* Observe the information in chapters 2.3 and 4.3.2.

**Note**

In the event of decreased pump output, Börger GmbH recommends first checking the condition of the rotors. Replace the rotors when they exhibit signs of significant wear. If these measures are not successful and the original pump output is still not reached following the installation of new rotors, the pump casing components must be inspected.

If one of the gear-side and cover-side casing protection plates exhibits significant signs of wear, it must be replaced, whereby the cover-side casing protection plate can be turned once before replacing it. If a gap still remains between the rotor body tips and the radial casing wall following the installation of new rotors – while the pump output remains too low – then we also recommend replacing the MIP radial casing liners if these are installed on the pump.

You have the option of retrofitting your pump with the innovative MIP casing and its replaceable, radial casing liners at a later date. Contact Börger customer service for more information.

Before replacing wear parts, take advantage of the possibility of increasing the speed of the pump drive (and thus, the pump output). On electric motors, this can be an increase in frequency on your frequency converter (this can also be above the mains frequency).

For example, the speed can be varied on some drive types by adjusting the drive speed (hand wheel on the control gear motor or gas lever on the combustion motor) or oil quantity (on hydraulic drives). Consider the maximum loads as detailed in chapter 3.3.2. If in doubt, contact Börger customer service regarding the physical limitations of your unit.

**Note**

Contact Börger GmbH if there are other kinds of malfunctions / any other possible causes for malfunctions.

6 Maintenance and Repairs

The *Maintenance and Repairs* chapter is divided into sections on machine care, maintenance and inspection, and repairs.

The instructions described in this chapter are to be understood as the minimum requirements.

Depending on the operating conditions, further work may be necessary to maintain the rotary lobe pump in an optimum condition.

Information on maintenance and repairs for special assemblies can be found in the supplier documentation in the appendix.

The maintenance and repair tasks detailed in this chapter may only be carried out by trained personnel employed by the operator.

Observe the assembly drawing, the spare parts list and the wear parts list in chapter 9.2 to 9.4 when carrying out repairs or ordering spare parts.

Any spare parts used must comply with the technical requirements specified by Börger GmbH, especially if they come into contact with the medium. **This is always guaranteed when original spare parts are used.** Only original spare parts may be used during the warranty period, failing which the warranty is void.

Read and strictly comply with the applicable regulations, manufacturer's safety data sheets and operator's instructions in respect of the storage, handling, use and disposal of oils, grease and other chemical substances.

Dispose of operating materials and replaced parts in a safe and environmentally-friendly manner.

6.1 Machine care

Appropriate machine care helps to maintain the functionality of the rotary lobe pump unit on a long-term basis.

In general, regular cleaning of dust and deposits from all surfaces is sufficient.

**Caution!****Risk of burns!**

The gear casing and, when the medium has reached certain temperatures, also the pump casing, can become hot and should not be touched during operation.

Only clean the rotary lobe pump when it is at a standstill.

Allow the rotary lobe pump to cool down completely, if necessary.

Avoid dust formation as this contributes to heat build-up.

**Notice****Improper cleaning of the rotary lobe pump can lead to malfunctions and damage!**

Do not use water jets.

Do not use aggressive cleaning agents, solvents or sandpaper, as these can damage the metallic and plastic surfaces, casing coating and seals.

Do not use metal objects such as scrapers and screwdrivers for cleaning coated machine parts.

Never clean sensitive components with hard scrubbing and strong mechanical pressure.

- Only clean the rotary lobe pump by wiping or brushing it. Use lint-free cleaning cloths.
- When required, use a standard aqueous industrial cleaner.
- Keep all markings on the rotary lobe pump in a legible state at all times.

6.2 Maintenance and inspection

6.2.1 Maintenance and inspection plan



Note

Also observe the maintenance intervals detailed in the operating manuals for the drive, coupling, V-belts etc., which are included in the appendix.

In the event of a malfunction, shut down the rotary lobe pump immediately until the cause has been rectified.

The following intervals are **guidelines**. These intervals can be significantly reduced depending on the operating conditions.

Inspection / maintenance	Interval (approx.)	Operating hours (approx.)	Measures
Cleaning the outer surfaces	N		See chapter 6.1 <i>Machine care</i>
Visual check for leaks*	D	24	Replace the seals, if necessary
Audible check for smooth running	D	24	Check the suction line, rectify any cavitation Check the rotors and replace, if necessary
Checking the functions and flow rate	W	168	Replace wear parts, if necessary
Checking the oil level of the gear unit on the oil sight glass	M	720	Refill, if necessary
Checking the pump and components for tight fit and possible damage	¼ Y	2160	Fasten loosened parts tightly, replace damaged parts
Checking the level of the quench fluid in the intermediate chamber	½ Y	4320	Refill, if necessary
Changing the lubricants	2 Y	10,000	See chapter 6.2.2

* Includes check of any overflowing quench fluid

N = when necessary **M** = monthly
D = daily **Y** = yearly
W = weekly

6.2.2 Lubricant fill level and changing the lubricants

The intervals for changing the lubricants can vary significantly and be reduced considerably depending on the operating conditions, such as high levels of humidity, high temperatures / temperature variations, aggressive atmospheres etc.



Caution!

Danger to health caused by contact with the pumped medium!

The quench fluid can contain pumped medium.

When using dangerous or health-endangering pumped media, take all necessary safety measures when draining and checking the fill level of the intermediate chamber.

- Check the oil level and oil quality in the timing gear on the oil sight glass on a regular basis, according to chapter 6.2.1 or more often depending on the operating conditions. Also check the level and quality of the quench fluid in the intermediate chamber.
- Use an oil dipstick, when necessary.



Note

The quench fluid can rise to the rim of the vent hole due to its **quench function** and depending on the operating temperature.

A leak of the mechanical seal can only be assumed if the liquid overflows. The fill levels specified below relate to optimal volumes of pure lubricants.

Fill levels:

Mounting position	Type code 17th position	Gear unit	Intermediate chamber
M1 standing	1	Center of oil sight glass	Top shaft, center to covered
M2 vertical	2	Completely filled ¹⁾	Lower edge, test bore ²⁾
M3 upside-down	3	Center of oil sight glass	Top shaft, center to covered
M5, M6 turned 90°	5, 6	Center of oil sight glass	Approximately up to the bend in the filler

¹⁾ In this case: Expansion of the gear oil caused by the temperature cannot be compensated. The operating temperature must not exceed the temperature specified in the order.

²⁾ For submerged pumps: approx. 10 cm (3.94") below the edge of the extension pipe

- Change both lubricants after approximately 10,000 operating hours (or earlier, depending on the operating conditions) or after two years, whichever occurs first.
- Change the lubricants earlier if they are heavily contaminated.

**Notice****Risk of material damage caused by using wrong lubricants!**

Observe the detailed specifications and instructions on changing the lubricants in the **lubricant list in the appendix**, which is part of this operating manual, as well as the specifications in the data sheet regarding the lubricants used.

Regarding the **quench fluid**, especially consider:

Due to the possibility, though unlikely, of quench fluid entering the pump chamber and thus intruding on the process itself, the quench fluid must be compatible with the pumped medium in addition to the other materials (O-rings).

- Observe the repair instructions in chapter 6.3.1.
- Shut down the rotary lobe pump.
- Use a safe drip pan when draining used lubricant.

- Position of drain and fill holes: see chapter 3.1.7.
- Observe the following fill quantities:

Fill quantities:

Mounting position	Type code 17th position	Gear unit	Intermediate chamber
M1 standing	1	approx. 1.5 l (.396 gal)	approx. 0.7 l (.185 gal)
M2 vertical	2	approx. 2.2 l (.581 gal)	approx. 0.8 l (.211 gal)
M3 upside-down	3	approx. 1.5 l (.396 gal)	approx. 0.7 l (.185 gal)
M5, M6 turned 90°	5, 6	approx. 1.0 l (.264 gal)	approx. 0.6 l (.159 gal)

- Properly re-insert the screw plug with the sealing washer / the breather, with the opening facing downwards (cf. chapter 4.3.6).
- Reattach the breather system on the gear unit correctly (cf. chapter 4.3.6).
- When restarting after completing maintenance, observe the instructions in chapter 5.

6.3 Repairs

6.3.1 Notes on repair work



Warning!

Risk of serious hand injuries due to rotating parts!

Shut down the rotary lobe pump before carrying out repair work on the rotary lobe pump and accessories.

Secure the pump against accidental restart, e.g. by disconnecting the electrical drive from the power supply.

**Warning!****Risk of serious injuries caused by pumped medium spouting out!**

Liquid – when it is still pressurized – can spout out of the gap opening behind the cover while dismounting.

Therefore, wear protective clothing (gloves, goggles) when opening the cover and take all necessary precautions.

**Warning!****Danger to health caused by contact with the pumped medium!**

You may come into contact with the pumped medium when carrying out repair work.

Adhere to all possible safety regulations relating to the pumped medium.

When necessary, flush the pump and pipes before opening the quick-release cover.

**Warning!****Risk of serious injuries caused by falling heavy parts!**

Wear suitable protective clothing, especially safety shoes.

Secure heavy parts using suitable hoists.

**Caution!****Risk of burns!**

The gear casing and, when the medium has reached certain temperatures, also the pump casing can become hot and should not be touched during operation.

Allow the system to cool down completely, if necessary.

**Note**

Observe the assembly drawing of the rotary lobe pump in chapter 9.3.

Repair work on the rotary lobe pump may only be carried out by qualified, authorized specialists employed by the operator.

- Shut down the rotary lobe pump.
- Close all valves and shut-off devices so that no pumped medium can enter the pump.
- Only replace worn components, seals, screws, nuts etc., but especially the wetted parts, with original spare parts according to the following instructions.

6.3.2 Opening and closing the quick-release cover

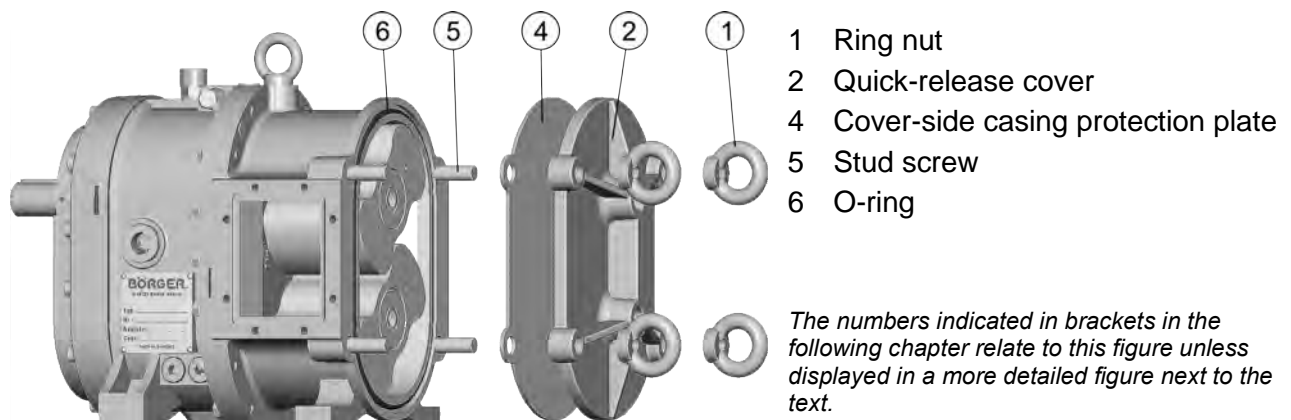


Figure 6.3.2-1 Opening and closing the quick-release cover

All parts on the rotary lobe pump that are subject to wear are accessible after the quick-release cover has been removed.

- Read and follow the safety instructions detailed in chapter 6.3.1.
- Switch off the drive and secure it against accidental restart.
- Close all valves and shut-off devices so that no pumped medium can enter the pump.

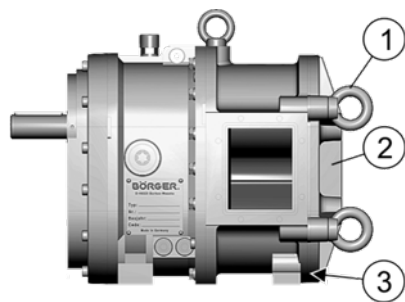
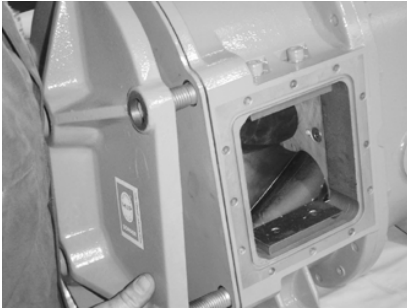


Figure 6.3.2-2



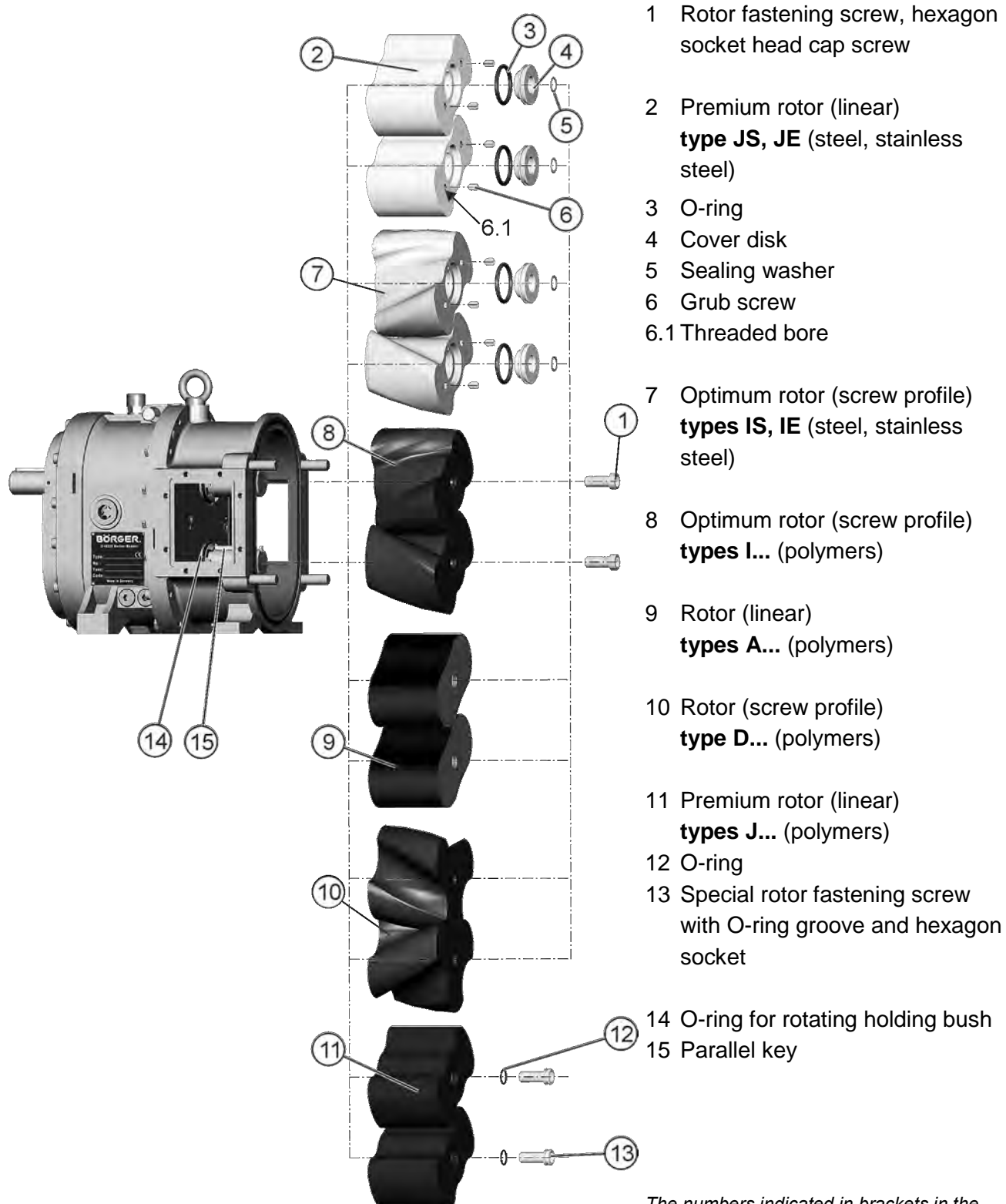
Opening the quick-release cover:

- Use a suitable **cover** to prevent the medium from spouting out.
- Place a **drip pan** underneath.
- Loosen the four ring nuts (1) uniformly by approx. 5 mm (.20") using a wrench.
- Initially, only open the cover (2) at the bottom (3 on standing versions) by a small gap (approx. 5 mm / .20") to allow all residual pressure to escape and catch any pumped medium that spouts out.
- Completely undo the four ring nuts (1).
- Remove the quick-release cover (2).
- Remove the cover-side casing protection plate (4).

**Closing the quick-release cover:**

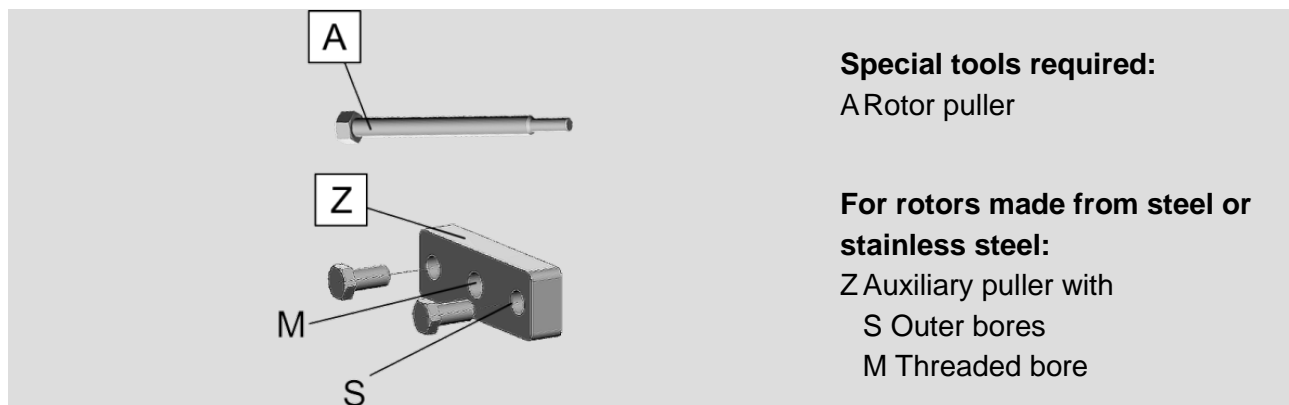
- Check the O-ring (6). Replace the O-ring (6) if it shows signs of damage.
- Press the O-ring seal (6) carefully into position.
- Attach the cover-side casing protection plate (4).
- Push the quick-release cover (2) over the stud screws (5) and fasten it with the four ring nuts (1).
- Tighten the ring nuts (1) crosswise with uniform strength using a wrench. Take care not to damage the O-ring (6) or to push it out of position. Make sure that the ring nuts (1) are fastened tight enough so they cannot be loosened by hand.

6.3.3 Replacing the rotors



The numbers indicated in brackets in the following chapter relate to this figure unless displayed in a more detailed figure next to the text.

Figure 6.3.3 Replacing the rotors



Notice

Risk of lasting damage due to

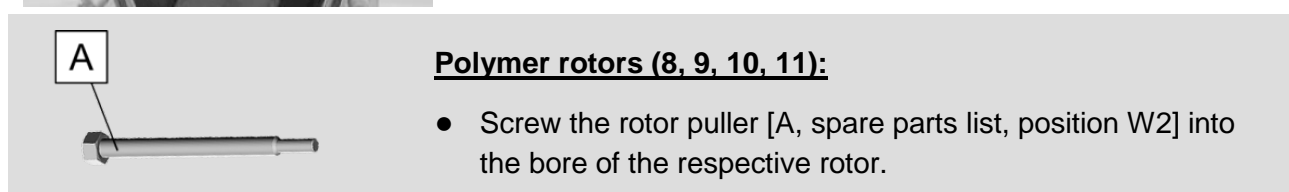
- improper cleaning
- switching on without rotors installed!

If the rotors are not properly installed, the parallel keys cannot reliably fix the rotating seal holding bushes. This may cause permanent damage to the rotary lobe pump.

Do not use pressurized fluid in the pump chamber for cleaning purposes.

Never switch the rotary lobe pump on, even for testing or cleaning, if the rotors are not properly installed, see also chapter 2.9.

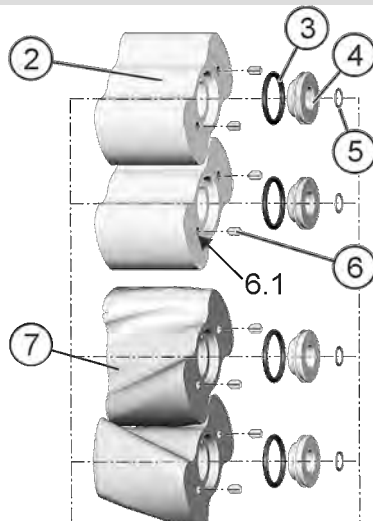
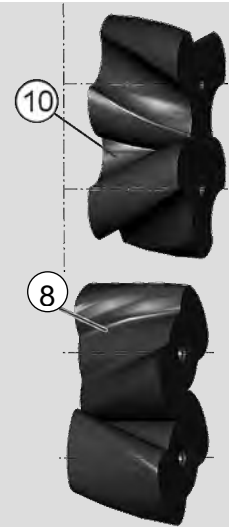
- Shut down the rotary lobe pump and open the quick-release cover in accordance with chapter 6.3.2.
- Block the rotors by clamping an object with no sharp edges between the rotors, e.g. a lint-free cloth.
- Loosen the hexagon socket head cap screws (1, 13) on both rotors using a 14 mm hexagon socket wrench.





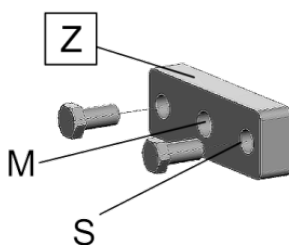
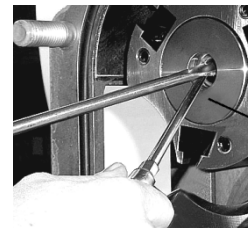
- Remove the rotor.

For screw rotors (8, 10) use two rotor pullers [A] simultaneously and remove the screw rotors (8, 10) in pairs by pulling them off in alternate, uniform steps.

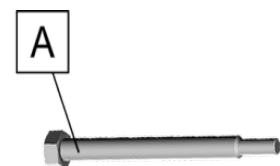


Rotors made from steel, stainless steel (2, 7):

- In each case, remove the sealing washer (5).
- Remove the respective cover disk (4) and O-ring (3) using a suitable hook or two slotted screwdrivers.
- Unscrew the grub screws (6) from the threaded bores (6.1) using a 6 mm hexagon socket wrench.

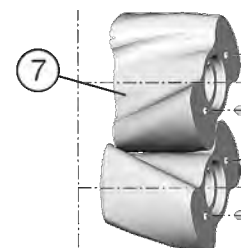


- Screw two screws (M12x30) into the threaded bores (6.1) of the grub screws (6) through the outer bores (S) of the auxiliary puller [Z].
- Screw the rotor puller [A] into the center bore (M) of the auxiliary puller [Z].



- Remove the rotor.

For the screw rotors (7) use two rotor pullers [A] and auxiliary pullers [Z] simultaneously and remove the screw rotors (7) in pairs by pulling them off in alternate, uniform steps.

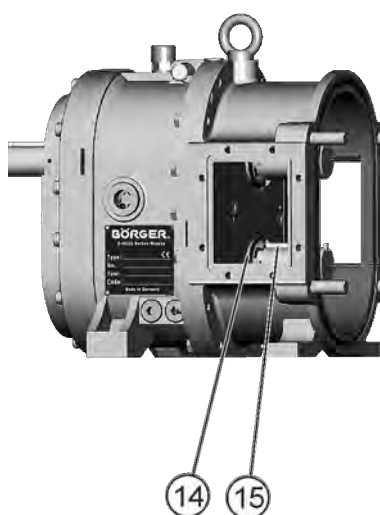




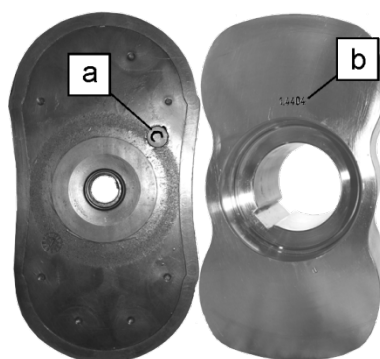
Note

Some quench fluid may escape from between the rotating holding bush and shaft as a result of the normal lubricating function. This is not a malfunction.

- Clean and oil the shafts.



- Check the O-rings (14) on the rotating holding bushes and replace them when necessary as detailed in chapter 6.3.4. (Börger GmbH recommends: Always replace the O-rings as well in this situation.)
- Check the condition and correct positioning of the parallel keys (15) in the shafts; cf. chapters 6.3.4 and 9.6.



- Compare the quality symbol on the front of the rotors that describes the material with the type code table. Only use rotors made from suitable materials and of the correct type.

[a] Polymers: Letter according to the 14th position of the type code

[b] Stainless steel: Hard stamping of the material number

- Attach the new rotors:

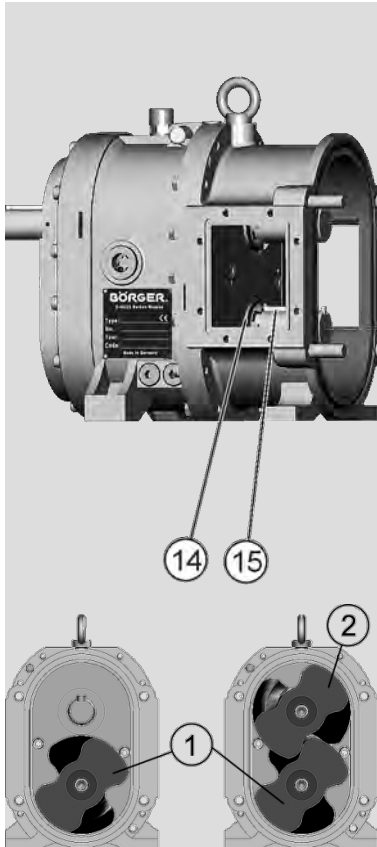


Figure 6.3.3-2

Screw rotors, types IS, IE, I..., D, (7, 8, 10):

- Attach the rotors uniformly in pairs, one clockwise and one counter-clockwise screw rotor each.



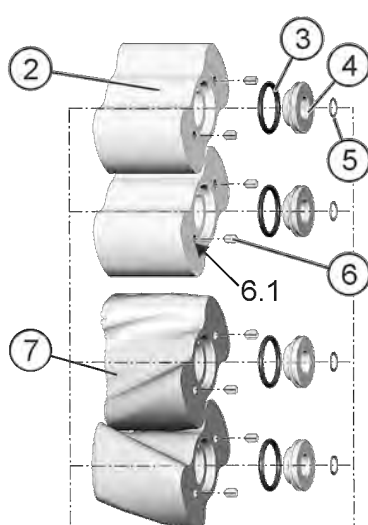
Note

Optimum rotors, types IS, IE, I... (7, 8)

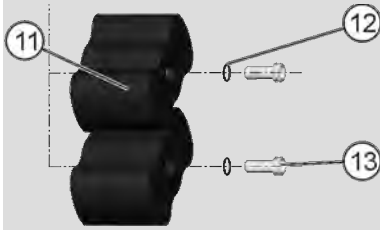
can also be inserted one after the other. For polymer rotors pay attention to the exact positioning so that the rubber coating is not damaged:

- Rotate the shafts so that the parallel keys (15) are at 12 o'clock.
- Insert the rotor with counter-clockwise screw profile at the bottom (1 in figure 6.3.3-2).
- Make sure that the upper parallel key (15) is still at 12 o'clock and has not been moved.
- Insert the rotor with clockwise screw profile at the top (2 in figure 6.3.3-2).

Rotors made from steel, stainless steel (2, 7):



- On rotors made from steel or stainless steel (2,7), screw the grub screws (6) back into the threaded bores (6.1).
- Use new O-rings (3) and coat them depending on their resistance, e.g. with oil or flushing agent.
- Use new cover disks (4) if required.
- In each case, push on the cover disk (4) with the O-ring (3) correctly fitted into the groove so that the recess points towards the parallel key (15).
- Use new sealing washers (5) for the rotor fastening screws (1).



Premium polymer rotors, type J (11):

- Use new O-rings (12).
- Fit the O-rings (12) onto the rotor fastening screws (13) which have also been replaced if necessary. Ensure that each O-ring (12) is correctly fitted into the O-ring groove of the rotor fastening screw (13).

- Screw in the suitable rotor fastening screws (1 or 13, with sealing washer / O-ring if required) and tighten them with a torque wrench.

i

Torque specifications

M16 steel screws, 10.9	180 Nm (1,593 in-lbs)
M16 stainless steel screws A4-70	144 Nm (1,274 in-lbs)
M16 Duplex	144 Nm (1,274 in-lbs)

- Check that the newly installed rotors run smoothly. The easiest way of doing this is by turning the rotor on the drive shaft clockwise with an appropriate amount of force using a hexagon socket wrench or ratchet.

i

Note

"Smooth running" means a uniform, trouble-free true-running (concentricity) without any blocking.

When dry, **fully rubber-coated** rotors can only be rotated with a certain degree of force, as they are positioned close to the pump casing.

Providing the pumped medium and materials used allow this, the rotors can be coated with liquid (e.g. soft soap) for the smooth running check.

- Attach the cover-side casing protection plate and quick-release cover in accordance with chapter 6.3.2.
- Before releasing the rotary lobe pump, a further short test run of the correct true-running must be made, e.g. by tapping the motor switch.

6.3.3.1 Replacing the rotors of PL 400

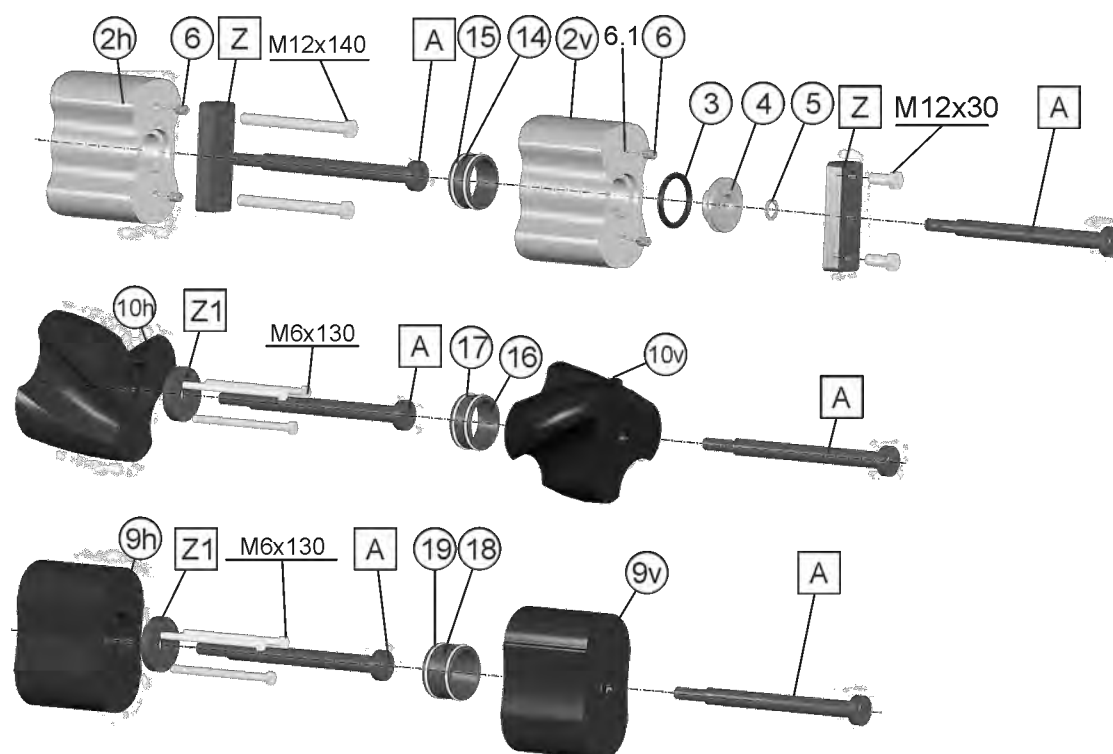


Figure 6.3.3.1
Replacing the rotors of PL400

The numbers indicated in brackets in the following chapter relate to this figure unless displayed in a more detailed figure next to the text.

Rotors, types JS, JE

- 2v Front rotors
- 2h Rear rotors
- 3 O-ring
- 4 Cover disk
- 5 Sealing washer
- 6 Grub screw
- 6.1 Threaded bore
- 14 Connecting sleeve
- 15 O-ring

Rotors, type A

- 9v Front rotor
- 9h Rear rotor
- 18 Connecting sleeve
- 19 O-ring

Rotors, type D

- 10v Front rotor
- 10h Rear rotor
- 16 Connecting sleeve
- 17 O-ring

Special tools: A Puller
Z, Z1 Auxiliary puller

On the PL 400 rotary lobe pump there are two rotors of series PL 200 on each shaft.

The rear rotors (toward the gear unit) of **types A and D** (9h, 10h) are modified designs with an open front.

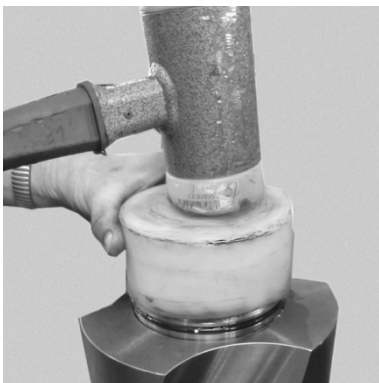
A connecting sleeve with two O-rings tightly connects the front and the rear rotors.

- Remove the front rotors as previously described in chapter 6.3.3.

- For **Premium rotors, types JS, JE**, also remove the grub screws (6) on the rear rotors (2h).
- Screw the threaded rods with nuts as a head (stop for the auxiliary puller) through the outer bores of the suitable auxiliary puller [Z, Z1] into the corresponding threaded bores of the respective rear rotor, in accordance with figure 6.3.3.1.
- Screw the rotor puller [A] into the center bore of the auxiliary puller [Z, Z1], and then remove the rotor.
- When attaching the rear rotors, and preparing to do so, proceed as described in chapter 6.3.3. For screw rotors observe the information at the end of this chapter.
- Check the connecting sleeves (14, 16 or 18) and replace them, if necessary.
- Replace the O-rings (15, 17 or 19).

i

Note

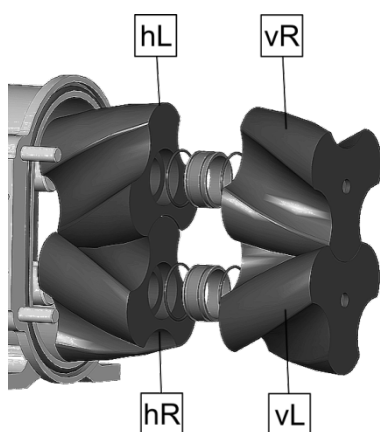


You can lubricate the O-rings and the connecting sleeves, depending on their resistance, with a type of oil or grease which is compatible with the medium to aid insertion.

Make sure that the O-rings are not pushed out of the O-ring groove during insertion.

You can use a plastic support and a plastic mallet, if necessary, but take care to insert the connecting sleeves equipped with O-rings evenly.

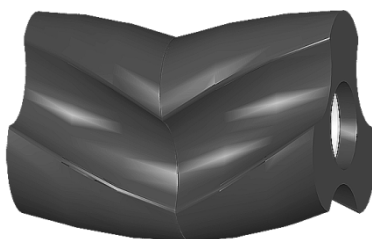
- Insert the connecting sleeves (14, 16 or 18) with the fitted O-rings (15, 17 or 19) into the front rotors.
- Observe the details which were given in chapter 6.3.3 and push the new front rotor with the connecting sleeve inserted onto the shaft up to the stop on the rear rotor, if necessary by striking it lightly with a plastic mallet.
- Complete installation and perform a smooth running check, as described in chapter 6.3.3.

**Note****Screw rotors, type D (10):**

The front pair and the rear pair of rotors each consist of a clockwise screw rotor (R) and a counter-clockwise screw rotor (L).

On each shaft, the screw profile direction of the front rotor (vR or vL) must be the opposite of the screw profile direction of the rear rotor (hL or hR).

The tips of the rotors are to be aligned with each other exactly.



6.3.4 Replacing the mechanical seals

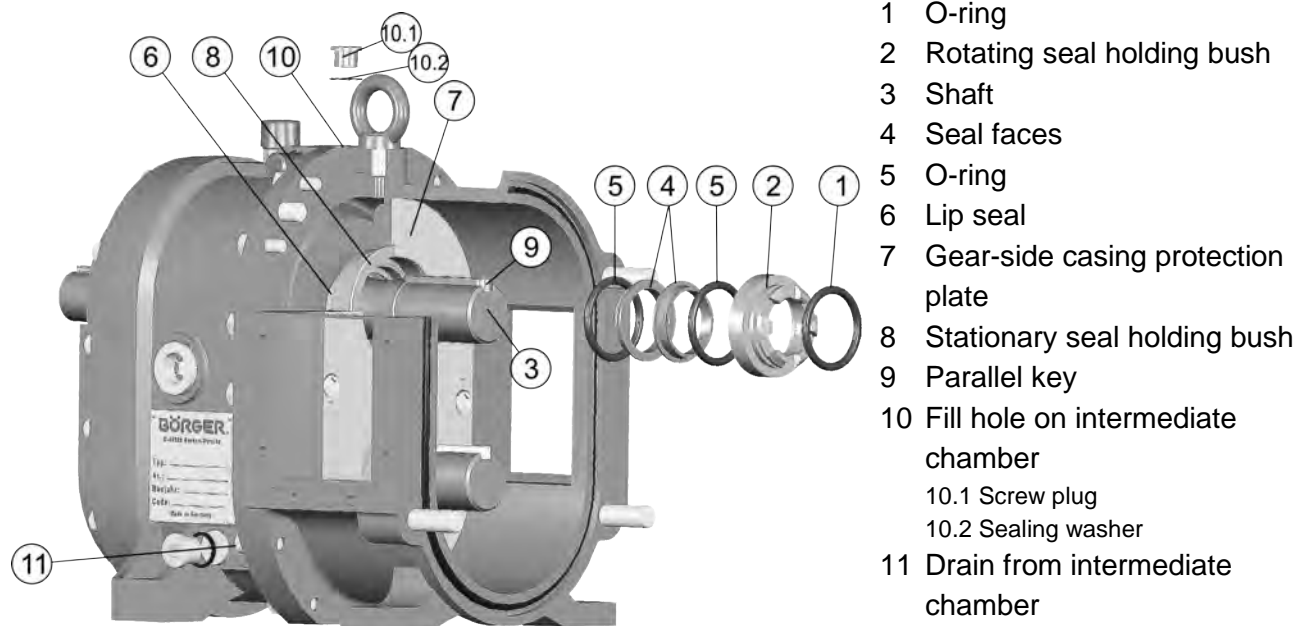
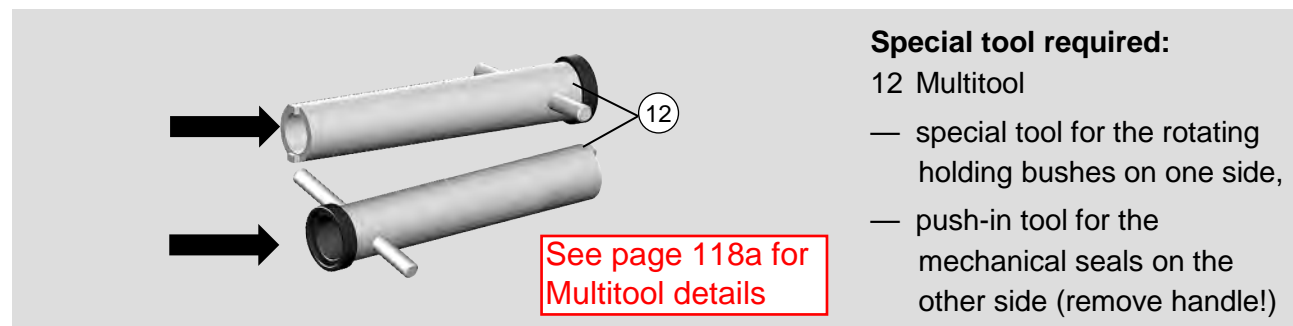


Figure 6.3.4-1 Replacing the mechanical seals

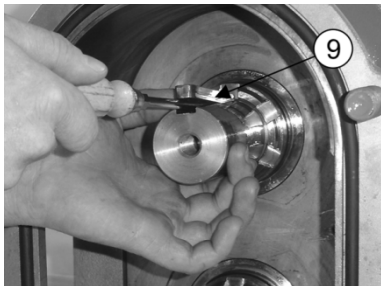
The numbers indicated in brackets in the following chapter relate to this figure unless displayed in a more detailed figure next to the text.



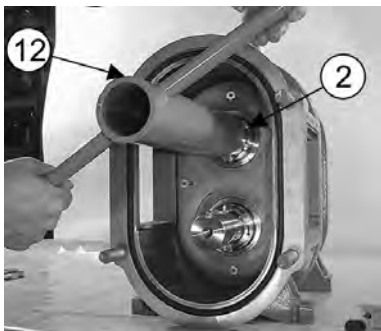
In addition to the maintenance intervals detailed in chapter 6.2.1, replacement of the mechanical seals is necessary when pumped medium enters the intermediate chamber and the quench fluid escapes.

- Switch off the drive and secure it against accidental restart.
- Close all valves and shut-off devices.

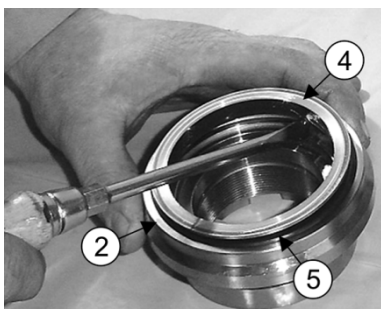
- Loosen the screw plug at the drain hole of the intermediate chamber (11) and drain the quench fluid from the intermediate chamber while adhering to the relevant safety precautions relating to the pumped medium and the quench fluid. See also chapter 3.1.7 regarding the position of the drain screw as well as chapter 6.2.2 and the lubricant list in the appendix for the quench fluid.
- Thoroughly clean the intermediate chamber following a leak in the mechanical seal in order to remove all deposits of the pumped medium from the intermediate chamber and from in front of the lip seals (6). To do this, flush a suitable liquid (water, if appropriate, **do not use high pressure!**) through the fill hole (10) with the drain (11) open.
- Open the quick-release cover according to chapter 6.3.2.
- Remove the rotors as detailed in chapter 6.3.3.



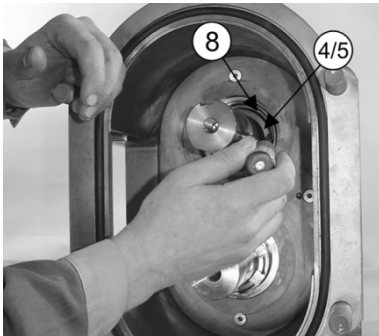
- Take precautions for pumps turned 90° to ensure the parallel key cannot fall into the inlet / outlet opening.
- Lift each of the parallel keys (9) out of the keyways of the shaft using a suitable tool (e.g. small lever). Make sure that the parallel keys are not damaged while doing this.



- Unscrew each rotating seal holding bush (2) using the special tool (Multitool, 12) and pull it off the shaft.



- Remove the seal face (4) with O-ring (5) out of the corresponding rotating seal holding bush (2).



- Remove the seal faces (4) with O-rings (5) out of the stationary seal holding bushes (8) remaining in the pump using a suitable tool (e.g. small lever).

- Clean the O-ring seats with a suitable agent that is compatible with the seal material, quench fluid and pumped medium, e.g. alcohol-based industrial cleaner.



Notice

Risk of consequential damage caused by improper handling of the new seal faces!

Make sure not to damage the sealing surfaces of the new seal faces.

The sealing surfaces must be clean and should not be scratched.

- If delivered separately, fit the O-rings (5) onto the new seal faces (4). The mechanical seals are normally equipped with O-rings on delivery.



Notice

Risk of consequential damage caused by improper handling of the new O-rings!

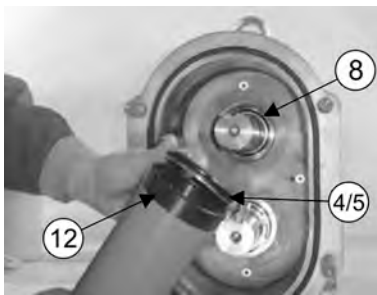
The O-rings of a mechanical seal must be installed **without oil or grease**.

Otherwise, the sealing function is compromised.

**Note**

Generally, the mechanical seals equipped with O-rings can be inserted dry. In order to ensure that they are free of grease and to aid insertion, the O-rings can be sprayed lightly, **depending on their resistance**, with a quickly-volatilizing spray cleaner (degreaser) that **leaves no residue**.

- Press one seal face (4) with O-ring (5) into each rotating holding bush (2) using the push-in tool (Multitool, 12) for mechanical seals.



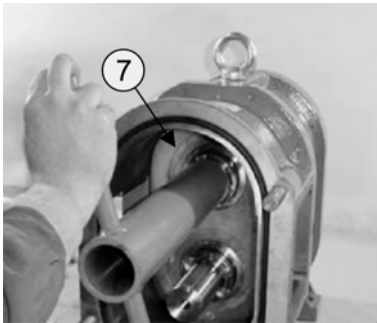
- Remove the pulling handle from the Multitool (12).
- Press both remaining seal faces (4) with O-rings (5) into the stationary holding bushes (8) using the push-in tool for mechanical seals (Multitool, 12).
- Lightly coat the clean sealing surfaces of the seal faces with suitable oil.

**Notice**

Risk of material damage if the rotating seal holding bushes are installed incorrectly!

First install one rotating holding bush with new mechanical seal completely according to the following description and secure the bush with the parallel key before installing the second rotating holding bush with new mechanical seal on the second shaft.

If the rotating holding bush with thread is not secured when the shafts are turned, the position of the holding bush can imperceptibly change while the second bush is being aligned. Use the special tool / Multitool for the installation.



- Screw in the rotating holding bush (2) flush with the gear-side casing protection plate (7) and then unscrew it until the first groove is aligned with the keyway (*figure 6.3.4-2*). The rotating holding bush (2) should then protrude by approximately 0.2 mm (.008").

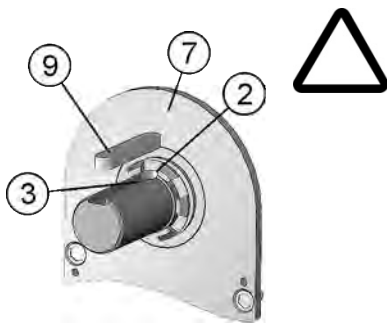


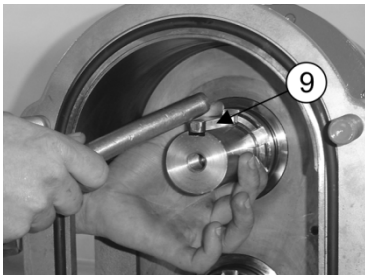
Figure 6.3.4-2

Notice

Risk of consequential damage if the rotating seal holding bush (2) is unscrewed too far!

The pre-tension on the seal faces required for a correct seal is generated by the correct setting of the rotating holding bush.

Do not unscrew the rotating seal holding bush (2) too far.



- Insert the parallel key (9) so that it fits into the groove of the rotating seal holding bush (2) and the keyway of the shaft (3).



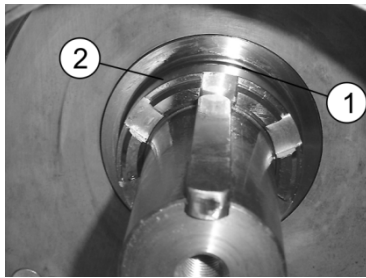
Note

If the parallel key only has one rounded side, then this must be fitted into the groove of the rotating holding bush (2).

If the parallel key has a straight front, then this must point towards the quick-release cover.

If the parallel key consists of two pieces, insert the parallel key rounded on both sides so that it fits into the rotating holding bush.

Insert the second parallel key with the straight front pointing towards the quick-release cover.



- Fit the new O-ring (1) onto the rotating seal holding bush (2). Only reuse an old O-ring when damage can be completely ruled out.

- Install the second rotating holding bush with new mechanical seal in the same way.



- Clean the fit bores of the rotors and the outer shaft surfaces.
- Lubricate the fit bores of the rotors and the outside surfaces of the shafts with a suitable oil / lubricant that is compatible with the medium, and also lubricate the O-ring (1) if its resistance allows this.

- Install the rotors as detailed in chapter 6.3.3. Observe the proper torque when doing this.
- Check that the rotors run smoothly.
- If the rotating seal holding bush was screwed in too far, then the rotors will rub against the gear-side casing protection plate and will be difficult or impossible to move.
 - Remove the rotors and unscrew the rotating holding bush by $\frac{1}{6}$ th of a turn (one groove).
- If a rotating seal holding bush was not screwed in far enough, the rotors will protrude on the pump cover side. In this case, the rotors will rub or become jammed on the cover-side casing protection plate when the ring nuts are tightened.
 - Ensure that the rotors do not protrude. If necessary, screw in the rotating holding bush further by $\frac{1}{6}$ th of a turn (one groove).

- Attach the cover-side casing protection plate and quick-release cover in accordance with chapter 6.3.2.
- Check the smooth running of the rotors again by switching on the drive briefly with the quick-release cover closed.
- Fill the intermediate chamber with quench fluid through the fill hole (10, see chapter 3.1.7 for the position of the fill holes on other models) up to at least the middle of the upper shaft (on standing versions). Adhere to chapter 6.2.2 and the lubricant list in the appendix.
- Close the fill hole of the intermediate chamber with a screw plug (10.1) and sealing washer (10.2).

6.3.5 Replacing the casing liners (optional)

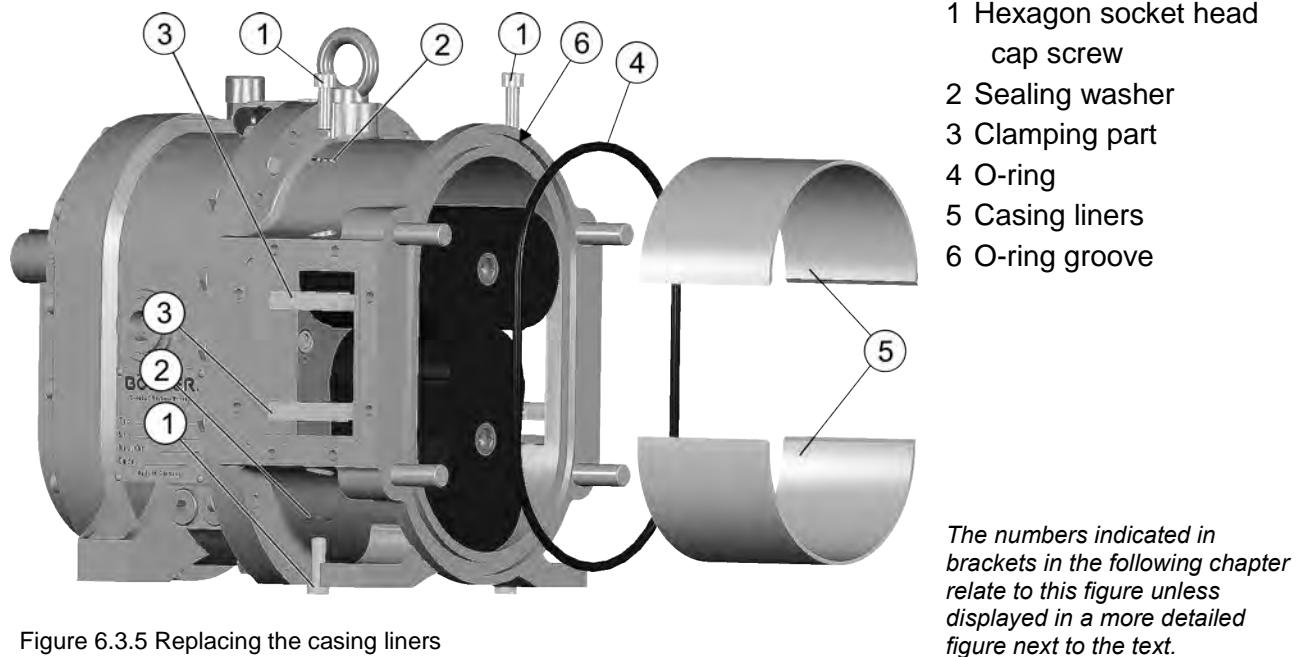


Figure 6.3.5 Replacing the casing liners

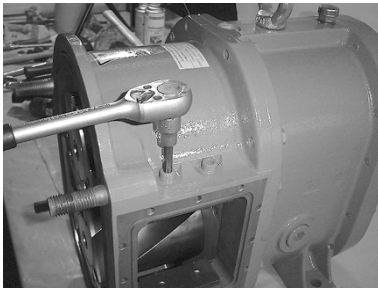
Removing the casing liners

- Shut down the rotary lobe pump and open the quick-release cover in accordance with chapter 6.3.2.

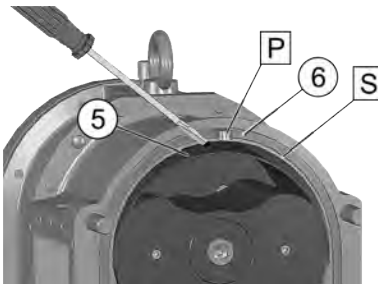


Note

The easiest way to remove the casing liners is to first remove the rotors as detailed in chapter 6.3.3.



- Loosen the clamping parts (3) used to fix the casing liners (5) in the pump casing. To do this, loosen the hexagon socket head cap screws (1) above and below the inlet and outlet openings using a suitable hexagon socket wrench, i.e.
PL 100, 200: 10 mm,
PL 300, 400: 8 mm.
- The clamping parts (3) may not always loosen easily due to deposits of the pumped medium. In most cases, hitting the screw head lightly will loosen the clamping parts.
- Sealing washers (2) are located under the hexagon socket head cap screws (1). **Replace these sealing washers.**



- In order to prevent the rim [S] between the pump opening and O-ring groove (6) from being damaged, remove the O-ring (4) and clamp a parallel key [P] or a similar object in the O-ring groove (6) before using any tools.
- To remove the corresponding casing liner (5), lever out the liner **carefully** using a small lever or slotted screwdriver.
- Pull out the radial casing liner using a pair of tongs (e.g. pipe tongs).

Installing the casing liners

- Clean the pump casing, clamping parts and contact surfaces.
- Fasten the clamping parts (3) to the corresponding bores using the screws (1) and sealing washers (2), but do not tighten the screws yet.
- Insert the casing liners (5) **symmetrically** into the pump casing. The casing liners (5) must be inserted into the gap between the gear-side casing protection plate (11 in the assembly drawing in chapter 9.3) and casing all the way to the stop at the rear wall. You can use a plastic mallet to aid insertion without damaging the casing liners (5). The complete front edge of the casing liner (5) must be flush with the pump casing.
- Secure the casing liners (5) by tightening the hexagon socket head cap screws (1) alternately and uniformly with the appropriate torque.



Torque specifications

PL 100, 200	M 12	Steel 10.9	100 Nm (885 in-lbs)
		Stainless steel A4-70	60 Nm (531 in-lbs)
PL 300, 400	M 10	Steel 10.9	50 Nm (443 in-lbs)
		Stainless steel A4-70	40 Nm (354 in-lbs)

- If you have removed the rotors, replace the O-rings on the rotating holding bushes (position 31 in the spare parts list) and, on PL 400, the O-rings on the connecting sleeves and reinstall the rotors as detailed in chapter 6.3.3. Observe the proper torque when doing this.
- Check the smooth running of the rotors by turning the rotors by hand, see chapter 6.3.3.
- Attach the cover-side casing protection plate and quick-release cover in accordance with chapter 6.3.2.

6.3.6 Replacing the gear-side casing protection plate

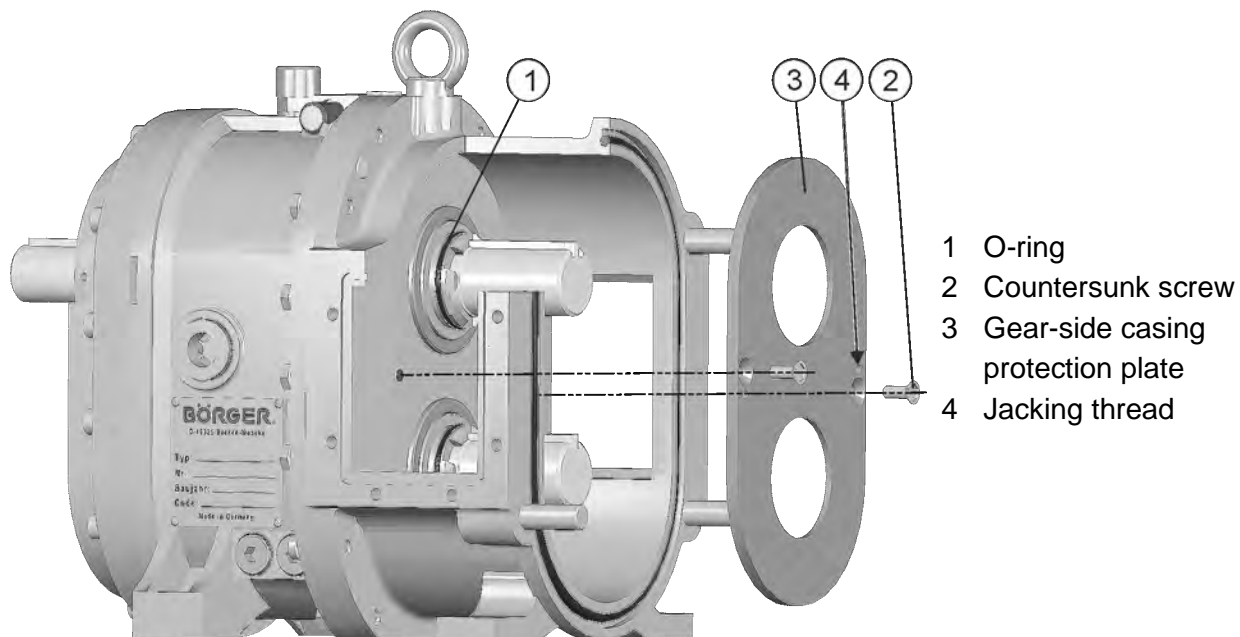


Figure 6.3.6 Replacing the gear-side casing protection plate

- Shut down the rotary lobe pump and open the quick-release cover in accordance with chapter 6.3.2.
- Remove the rotors as detailed in chapter 6.3.3.
- Unscrew the countersunk screws (2) from the gear-side casing protection plate (standard: 2 or 4 M8 / T40 Torx® screws, depending on the version).
- Screw the countersunk screws (2) into the jacking threads (4) to loosen the casing protection plate, then remove the plate.
- Clean any sealing compound from the rear wall of the pump casing.
- Apply sealing compound (position W1 in the spare parts list) to that side of the new casing protection plate which faces away from the medium. Exception: no sealing compound is used on *Longlife* casing protection plates.
- Insert the new gear-side casing protection plate and fasten it using the countersunk screws (2).
- Replace the O-rings (1, position 31 in the spare parts list) on the rotating holding bushes.
- Reinstall the rotors as detailed in chapter 6.3.3. Observe the proper torque when doing this.

- Attach the cover-side casing protection plate and quick-release cover in accordance with chapter 6.3.2.

6.3.7 Other repairs

If repairs to the rotary lobe pump are required that are not covered by the described repair and maintenance measures, we recommend contacting Börger customer service.

The factory can only accept repair orders if a completed safety certificate / declaration of decontamination accompany the device submitted for repair, as well as any necessary safety data sheets for the pumped medium and / or cleaning agent.

The relevant form is also available as a download from our website under the service menu.

6.3.8 Queries

Börger rotary lobe pumps are easy to maintain. We hope that we have clearly described all the relevant operating steps in this operating manual. However, the applications and variations of Börger rotary lobe pumps are so multi-faceted that a general operating manual cannot answer all questions entirely.

- If you have any questions, please contact Börger customer service. We will be happy to help.

We would also be grateful to receive feedback on any errors or unclear passages in this operating manual. This will help us to improve and develop this document and to offer you and all of our customers the best possible service.

6.3.9 Maintenance instructions for special equipment

- Adhere to all possible supplementary operating manuals in the appendix.

7 Disposal

7.1 Environmental protection



Caution!

Water-polluting materials

Such materials can pollute the soil and groundwater and enter the sewage system.

Comply with the legal obligations regarding waste avoidance and the proper recycling / disposal of waste during all work on and around the machine.

Water-polluting materials such as grease and lubricating oil must not pollute the soil or enter the sewage system, especially during installation, repair and maintenance work.

These materials must be collected, stored, transported and disposed of in suitable containers.

The applicable legal regulations must be strictly adhered to when disposing of operating materials or replacement materials during maintenance or decommissioning of the rotary lobe pump.

7.2 Oil, oily waste and grease

Oil, oily waste and grease pose a significant risk to the environment. Therefore, disposal of such materials must be handled by a specialist company.

- Collect any oil and oily waste and only dispose of them according to the legal requirements through authorized waste disposal companies / authorities.

7.3 Plastics

- Sort any plastic waste as thoroughly as possible.
- Dispose of plastics according to the legal requirements through authorized waste disposal companies / authorities.

7.4 Metals

- Sort and separate different metal types.
- Dispose of these metals according to the legal requirements through authorized waste disposal companies / authorities.

7.5 Electrical and electronic waste

Electrical and electronic waste must be disposed of separately. Electrical and electronic waste must not be disposed of with domestic waste.

- Only dispose of electrical or electronic waste according to the legal requirements through authorized waste disposal companies / authorities, e.g. recycling plants.

7.6 Final decommissioning

- Check which materials can be recycled and make the appropriate arrangements.

8 Accessories

The range of pump accessories provided by Börger GmbH is as multi-faceted as the areas of application for the Börger rotary lobe pump. Only the most frequently requested equipment can be mentioned below.

If your rotary lobe pump was delivered with accessories, the corresponding operating manuals can generally be found in the appendix or in the packaging of the units, if delivered as originally packed.

8.1 Frequency converter

Rotary lobe pumps can be operated with frequency converters.

As on all positive displacement pumps, only frequency converters that deliver a **constant** torque are suitable.



Note

An external drive cooler may be necessary if the motor frequency is set very low.

8.2 Monitoring equipment

8.2.1 Dry run protection with temperature sensor / conductivity sensor

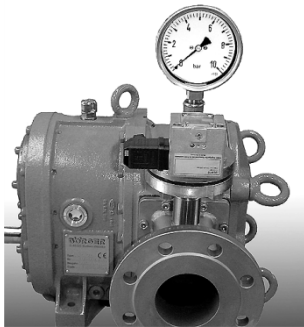
Long dry run periods (i.e. operation without pumped medium) should be avoided. This especially applies to rotary lobe pumps with rubber-coated rotors. Components on the rotary lobe pump are damaged when frictional heat is generated.

In processes in which dry running cannot be fully excluded, e.g. when containers are emptied using the rotary lobe pump, dry run protection is recommended through a temperature sensor or a conductivity sensor as a level control indicator, both in combination with a connected controller.

Temperature sensor: If the temperature in the pump chamber rises to a preset value due to a lack of pumped medium, the rotary lobe pump / system is switched off by means of a control unit. This then prevents the rotary lobe pump from running dry. PT100 temperature sensors and control units are available from Börger GmbH.

Conductivity sensors measure the electrical conductivity on the pump inlet and switch the rotary lobe pump / system off by means of a control unit when the value drops beneath a specified limit.

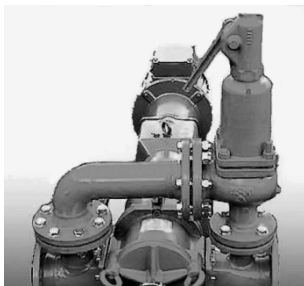
8.2.2 Pressure monitoring devices as overpressure protection



Exceeding the permissible maximum pressure can cause lasting damage to parts of the rotary lobe pump and all components. There is also a risk of leakage and subsequent risks to personnel and the environment, depending on the pumped medium.

Pressure switches / pressure monitoring devices offer protection against damage caused by overpressure. They are used to switch off the rotary lobe pump or system automatically when a preset pressure is exceeded, or to carry out other measures for reducing the pressure.

8.2.3 Pressure relief valve with bypass



By using a bypass with pressure relief valve (safety valve), it is possible to close the pressure line completely for a short period without switching off the pump.

While the pressure line is closed, the pump delivers the medium back to the suction side through the opened pressure relief valve. The causes of overpressure can now be rectified.

When the pressure decreases and the pressure line opens again, the pressure relief valve closes and operation can be continued without delay.

8.2.4 Level monitor with float switch

Float switches and floating magnetic switches are used for monitoring or controlling the fill level, and can also be used for dry run protection (depending on the version).

The *Condor* PSN-X float switch with converter (no protective ground connection) is often used for monitoring the pump processes of filling and emptying, and is stocked by Börger GmbH.

8.3 Auger feed

An auger feed installed in front of the pump inlet with a feed hopper allows non-flowing media that are just able to be pumped to be conveyed in certain cases.

9 Appendix

9.1 Data sheet

The data sheet is included separately from the operating manual.

The data sheet contains all relevant data for your Börger rotary lobe pump.

9.2 Wear parts

The following wear parts list includes the quantity, designation and position number (see assembly drawing in chapter 9.3) of the pump elements that are replaced during the corresponding installation and repair work. The complete spare parts list with article numbers (important when ordering) is found in chapter 9.4.

The rotor type and corresponding materials are indicated by the type code on the nameplate of the pump or unit (see chapters 2.6 and 9.5).

The required number of individual parts will to some extent depend on your rotary lobe pump version. Take note of the number of parts removed from the rotary lobe pump. Please contact Börger GmbH if you have any questions on this matter.

Rotor replacement

Quantity	Unit	Designation	Pos. no.
2	piece(s)	Rotors (front rotors on PL 400)	9...
0 / 2	piece(s)	Rear rotors for PL 400	9.4b, 9.6e, 9.7b
0 / 2	piece(s)	Connecting sleeve for rotors on PL 400	9.4c, 9.6c, 9.7c
0 / 4	piece(s)	O-ring 55x3 for connecting sleeve on PL 400	9.4d, 9.6d, 9.7d
1	piece(s)	O-ring 250x7 for quick-release cover	30
2	piece(s)	O-ring 54x4 for rotating holding bush	31
0 / 2	piece(s)	O-ring 54x4 for cover disk on Premium and Optimum rotors made from steel or stainless steel (types JS, JE, IS, IE)	32
0 / 2	piece(s)	Cover disk for Premium and Optimum rotors made from steel or stainless steel (types JS, JE, IS, IE)	24
0 / 2	piece(s)	Rotor fastening screw M16x40	64.1
	piece(s)	Special rotor fastening screw M16x40 with O-ring groove, for PFA rotors, type J	64.2a
0 / 2	piece(s)	Sealing washer for rotor fastening screw on Premium and Optimum rotors made from steel or stainless steel (types JS, JE, IS, IE)	74
	piece(s)	O-ring for rotor fastening screw on PFA rotors, type J	64.2b

Replacement of casing protection:

Quantity	Unit	Designation	Pos. no.
1	piece(s)	Cover-side casing protection plate	10
1	piece(s)	Gear-side casing protection plate	11
0 / 2	piece(s)	Casing liners	12.a
0 / 4 / 8	piece(s)	Hexagon socket head cap screw for clamping parts	12.c
0 / 4 / 8	piece(s)	Sealing washer for hexagon socket head cap screw on clamping part	12.d
1	piece(s)	O-ring 250x7 for quick-release cover	30
2	piece(s)	O-ring 54x4 for rotating holding bush	31
0 / 2	piece(s)	O-ring 54x4 for cover disk on Premium and Optimum rotors made from steel or stainless steel (types JS, JE, IS, IE)	32
2 / 4	piece(s)	Countersunk screw M8x16 (Standard: Torx) for casing protection plate	52
	piece(s)	O-ring for rotor fastening screw on PFA rotors, type J	64.2b
0 / 2	piece(s)	Sealing washer for rotor fastening screw on Premium and Optimum rotors made from steel or stainless steel (types JS, JE, IS, IE)	74
0 / 4	piece(s)	O-ring 55x3 for connecting sleeve on PL 400	9.4d, 9.6d, 9.7d

Replacement of mechanical seal:

Quantity	Unit	Designation	Pos. no.
2	piece(s)	Mechanical seal (2 seal faces, 2 O-rings)	15
1	piece(s)	O-ring 250x7 for quick-release cover	30
2	piece(s)	O-ring 54x4 for rotating holding bush	31
0 / 2	piece(s)	O-ring 54x4 for cover disk on Premium and Optimum rotors made from steel or stainless steel (types JS, JE, IS, IE)	32
	piece(s)	O-ring for rotor fastening screw on PFA rotors, type J	64.2b
0 / 2	piece(s)	Sealing washer for rotor fastening screw on Premium and Optimum rotors made from steel or stainless steel (types JS, JE, IS, IE)	74
0 / 4	piece(s)	O-ring 55x3 for connecting sleeve on PL 400	9.4d, 9.6d, 9.7d

Installation aids:

- Rotor **puller** (spare parts list, position W2)
- Additionally for rear rotors on PL 400: **Auxiliary puller** (spare parts list, position W3.2)
- **Multitool** (spare parts list, position W4), with special tool for rotating holding bushes on one side and push-in tool for mechanical seals on the other.

**Note on ordering spare parts**

You can order spare parts by quoting the article number from the enclosed spare parts list.

You can also quote the type code and serial number on the nameplate of the rotary lobe pump when ordering. Börger GmbH will then obtain the information for the appropriate spare parts for you from the production documents of your rotary lobe pump.

Record all modifications made to the pump equipment after the initial delivery in the type code table, such as changes to the rotor material and / or type (see chapter 9.5).

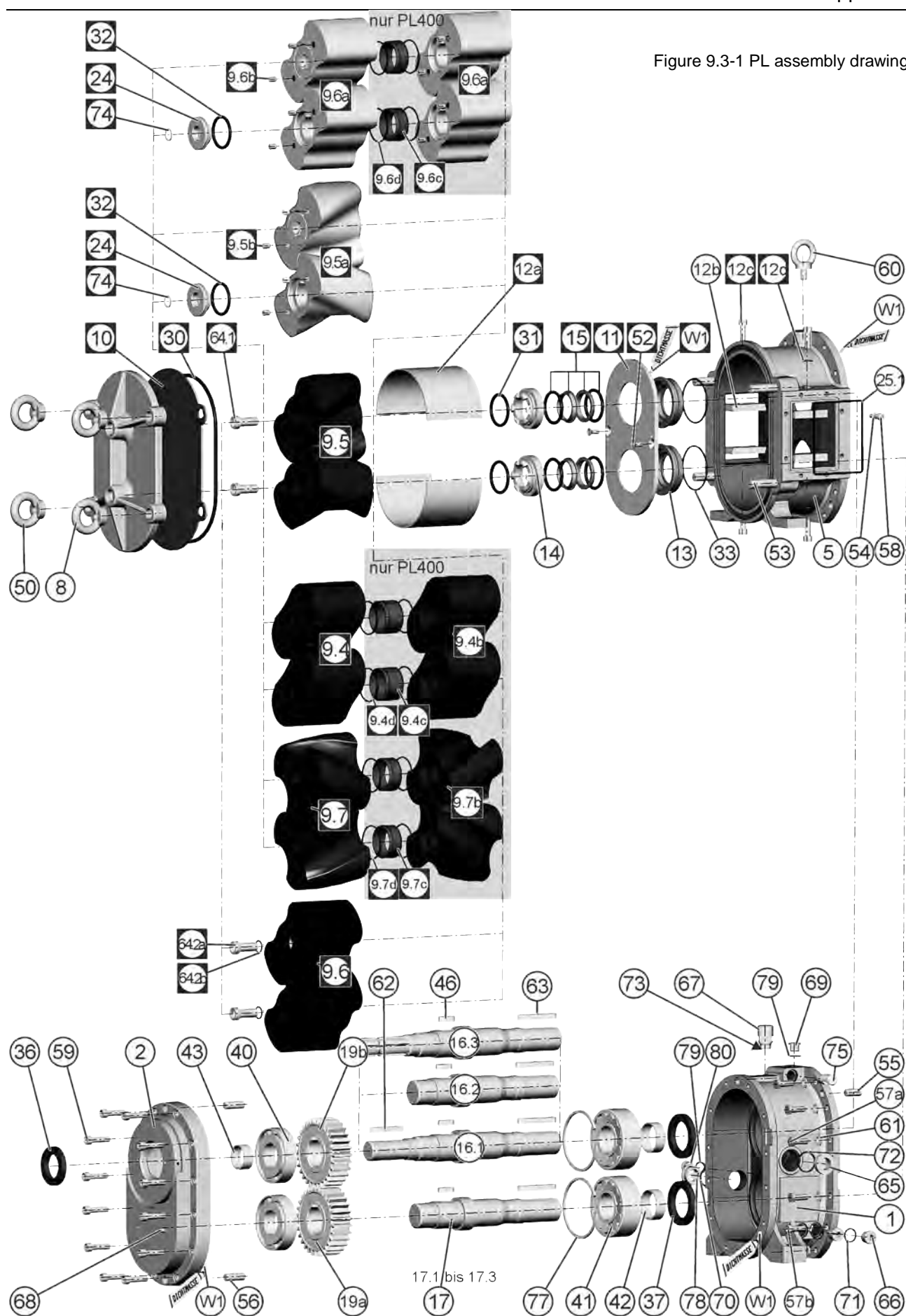
In order to avoid incorrect deliveries, always quote all modifications made when ordering spare parts.

9.3 Assembly drawing

The assembly drawing shows the positions of the spare parts detailed in the spare parts list (chapter 9.4).

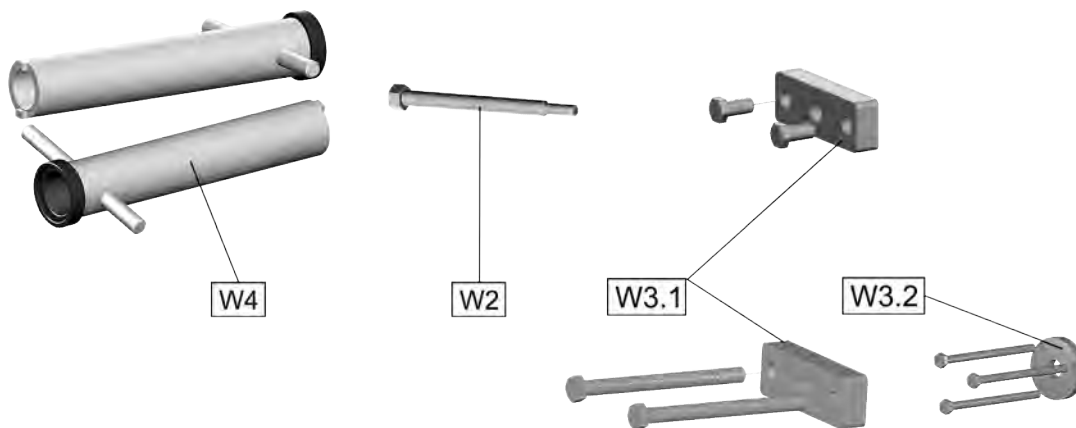
The most common wear parts are distinguished by a black border around the position number (see chapter 9.2).

Figure 9.3-1 PL assembly drawing



(see pages 118 and 118a for details)

Figure 9.3-2 Tools



9.4 Complete spare parts list

The spare parts list is universal and contains many variations of the pump elements. The positioning of the parts can be seen in the assembly drawing. The elements used in your rotary lobe pump are defined according to the type code and all additional specifications in the data sheet.

Observe the article numbers in the separate parts list of the order for special versions, e.g. steel / stainless steel rotors with temperature-dependent undersizes for applications in explosive areas.

(Parts list begins on next page)

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
1	A20008-5	Gear casing PL	0.6025	1	1	1	1
2	A20109	Gear casing cover for top or bottom drive shaft	0.6025	1	1	1	1
	A20111	Gear casing cover for top and bottom drive shaft	0.6025	1	1	1	1
	A20110	Gear casing cover for top or bottom drive shaft with bores for hydraulic drive adapter	0.6025	1	1	1	1
	A20113	Gear casing cover for upper or lower drive shaft, with bores for hydraulic lantern and additional bore G½ for installation position M2	0.6025	1	1	1	1
5	B40118-5	Pump casing, PL 100	0.6025	1	—	—	—
	B40155-5	Pump casing, PL 100	1.4409	1	—	—	—
	B40120-5	Pump casing, PL 100	Black Protection	1	—	—	—
	B40430-5	Pump casing, MIP, PL 100	0.6025	1	—	—	—
	B40165-5	Pump casing, MIP, PL 100	1.4409	1	—	—	—
	B40435-5	Pump casing, MIP, PL 100	Black Protection	1	—	—	—
	B40218-5	Pump casing, PL 200	0.6025	—	1	—	—
	B40255-5	Pump casing, PL 200	1.4409	—	1	—	—
	B40219-5	Pump casing, PL 200	Black Protection	—	1	—	—
	B40440-5	Pump casing, MIP, PL 200	0.6025	—	1	—	—
	B40265-5	Pump casing, MIP, PL 200	1.4409	—	1	—	—
	B40445-5	Pump casing, MIP, PL 200	Black Protection	—	1	—	—
	B40318-5	Pump casing, PL 300	0.6025	—	—	1	—
	B40355-5	Pump casing, PL 300	1.4409	—	—	1	—
	B40319-5	Pump casing, PL 300	Black Protection	—	—	1	—
	B40450-5	Pump casing, MIP, PL 300	0.6025	—	—	1	—
	B40365-5	Pump casing, MIP, PL 300	1.4409	—	—	1	—
	B40452-5	Pump casing, MIP, PL 300	Black Protection	—	—	1	—
	B40418-5	Pump casing, PL 400	0.6025	—	—	—	1
	B40460-5	Pump casing, MIP, PL 400	0.6025	—	—	—	1
8	B41008	Pump casing cover	0.7040	1	1	1	1
	B41008PT	Pump casing cover with groove for PT 100	0.7040	1	1	1	1
9.4	R82468	Rotor, dual-lobe, linear, PL 100	NBR	2	—	—	—
	R82468W	Rotor, dual-lobe, linear, PL 100	NBR (white)	2	—	—	—
	R82478	Rotor, dual-lobe, linear, PL 100	EPDM	2	—	—	—
	R82478W	Rotor, dual-lobe, linear, PL 100	EPDM (white)	2	—	—	—
	R82458	Rotor, dual-lobe, linear, PL 100	FPM	2	—	—	—
	R82458W	Rotor, dual-lobe, linear, PL 100	FPM (white)	2	—	—	—
	R82488	Rotor, dual-lobe, linear, PL 100	CSM	2	—	—	—
	R82783	Rotor, dual-lobe, linear, PL 100	PUR, black	2	—	—	—
	R82568	Rotor, dual-lobe, linear, PL 200	NBR	—	2	—	2
	R82568W	Rotor, dual-lobe, linear, PL 200	NBR (white)	—	2	—	2
	R82590	Rotor, dual-lobe, linear, PL 200	HNBR	—	2	—	2
	R82578	Rotor, dual-lobe, linear, PL 200	EPDM	—	2	—	2
	R82578W	Rotor, dual-lobe, linear, PL 200	EPDM (white)	—	2	—	2
	R82558	Rotor, dual-lobe, linear, PL 200	FPM	—	2	—	2
	R82793	Rotor, dual-lobe, linear, PL 200	PUR, black	—	2	—	2
	R82588	Rotor, dual-lobe, linear, PL 200	CSM	—	2	—	—
	R82618	Rotor, dual-lobe, linear, PL 300	NBR	—	—	2	—
	R82618W	Rotor, dual-lobe, linear, PL 300	NBR (white)	—	—	2	—
	R82628	Rotor, dual-lobe, linear, PL 300	EPDM	—	—	2	—

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
	R82628W	Rotor, dual-lobe, linear, PL 300	EPDM (white)	—	—	2	—
	R82608	Rotor, dual-lobe, linear, PL 300	FPM	—	—	2	—
	R82638	Rotor, dual-lobe, linear, PL 300	CSM	—	—	2	—
9.4b	R82569	Rotor, dual-lobe, linear, open front	NBR	—	—	—	2
	R82579	Rotor, dual-lobe, linear, open front	EPDM	—	—	—	2
	R82559	Rotor, dual-lobe, linear, open front	FPM	—	—	—	2
	R82794	Rotor, dual-lobe, linear, open front	PUR, black	—	—	—	2
9.4c	C79900	Sealing sleeve for rotor types A and D for PL 400	1.7225	—	—	—	2
	C79902	Sealing sleeve for rotor types A and D for PL 400	1.4571	—	—	—	2
9.4d	O55705	O-ring 55x3	NBR	—	—	—	4
	O55715	O-ring 55x3	EPDM	—	—	—	4
	O55725	O-ring 55x3	FPM	—	—	—	4
9.5	R8840L9	Optimum rotor, dual-lobe, screw profile, ccw, PL 100	NBR	1	—	—	—
	R8840R9	Optimum rotor, dual-lobe, screw profile, cw, PL 100		1	—	—	—
	R8842L9	Optimum rotor, dual-lobe, screw profile, ccw, PL 100	EPDM	1	—	—	—
	R8842R9	Optimum rotor, dual-lobe, screw profile, cw, PL 100		1	—	—	—
	R8844L9	Optimum rotor, dual-lobe, screw profile, ccw, PL 100	FPM	1	—	—	—
	R8844R9	Optimum rotor, dual-lobe, screw profile, cw, PL 100		1	—	—	—
	R8850L9	Optimum rotor, dual-lobe, screw profile, ccw, PL 200	NBR	—	1	—	—
	R8850R9	Optimum rotor, dual-lobe, screw profile, cw, PL 200		—	1	—	—
	R8852L9	Optimum rotor, dual-lobe, screw profile, ccw, PL 200	EPDM	—	1	—	—
	R8852R9	Optimum rotor, dual-lobe, screw profile, cw, PL 200		—	1	—	—
	R8854L9	Optimum rotor, dual-lobe, screw profile, ccw, PL 200	FPM	—	1	—	—
	R8854R9	Optimum rotor, dual-lobe, screw profile, cw, PL 200		—	1	—	—
	R8855L9	Optimum rotor, dual-lobe, screw profile, ccw, PL 200	1.4404	—	1	—	—
	R8855R9	Optimum rotor, dual-lobe, screw profile, cw, PL 200	1.4404	—	1	—	—
	R8855L9-U01	Optimum rotor, dual-lobe, screw profile, ccw, PL 200, 140°C	1.4404	—	1	—	—
	R8855R9-U01	Optimum rotor, dual-lobe, screw profile, cw, PL 200, 140°C	1.4404	—	1	—	—
	R8860L9	Optimum rotor, dual-lobe, screw profile, ccw, PL 300	NBR	—	—	1	—
	R8860R9	Optimum rotor, dual-lobe, screw profile, cw, PL 300		—	—	1	—
	R8862L9	Optimum rotor, dual-lobe, screw profile, ccw, PL 300	EPDM	—	—	1	—
	R8862R9	Optimum rotor, dual-lobe, screw profile, cw, PL 300		—	—	1	—
	R8864L9	Optimum rotor, dual-lobe, screw profile, ccw, PL 300	FPM	—	—	1	—
	R8864R9	Optimum rotor, dual-lobe, screw profile, cw, PL 300		—	—	1	—
9.6a	R89210	Premium rotor, dual-lobe, linear, PL 100	1.7225 hardened	2	—	—	—
	<i>R89210-U01</i>	<i>Premium rotor, PL 100, dual lobe with undersize (90°C, delivery time on request)</i>	1.7225 hardened	2	—	—	—
	<i>R89210-U02</i>	<i>Premium rotor, PL 100, dual lobe with undersize (100-120°C, delivery time on request)</i>	1.7225 hardened	2	—	—	—
	<i>R89210-U03</i>	<i>Premium rotor, PL 100, dual lobe with undersize (130-150°C, delivery time on request)</i>	1.7225 hardened	2	—	—	—
	<i>R89210-U04</i>	<i>Premium rotor, PL 100, dual lobe with undersize (160-170°C, delivery time on request)</i>	1.7225 hardened	2	—	—	—
	R89212	Premium rotor, dual-lobe, linear, PL 100	1.4404	2	—	—	—
	<i>R89212-U01</i>	<i>Premium rotor, PL 100, dual lobe with undersize (90°C, delivery time on request)</i>	1.4404	2	—	—	—
	<i>R89212-U02</i>	<i>Premium rotor, PL 100, dual lobe with undersize (100-120°C, delivery time on request)</i>	1.4404	2	—	—	—
	<i>R89212-U03</i>	<i>Premium rotor, PL 100, dual lobe with undersize (130-150°C, delivery time on request)</i>	1.4404	2	—	—	—
	<i>R89212-U04</i>	<i>Premium rotor, PL 100, dual lobe with undersize (160-170°C, delivery time on request)</i>	1.4404	2	—	—	—
	R89214	Premium rotor, dual-lobe, linear, PL 100	1.4539	2	—	—	—
	R89211	Premium rotor, dual-lobe, linear, PL 100	Black Protection	2	—	—	—

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
	R89212P	Premium rotor, dual-lobe, linear, PL 100	1.4404 plasma hardened	2	—	—	—
	R89212P-U01	<i>Premium rotor, PL 100, dual lobe with undersize (90°C, delivery time on request)</i>	1.4404 plasma hardened	2	—	—	—
	R89212P-U03	<i>Premium rotor, PL 100, dual lobe with undersize (130-150°C, delivery time on request)</i>	1.4404 plasma hardened	2	—	—	—
	R89220	Premium rotor, dual-lobe, linear, PL 200	1.7225 tempered	—	2	—	4
	R89220-U01	<i>Premium rotor, PL 200, dual lobe with undersize (90-110°C, delivery time on request)</i>	1.7225 tempered	—	2	—	4
	R89220-U02	<i>Premium rotor, PL 200, dual lobe with undersize (120°C, delivery time on request)</i>	1.7225 tempered	—	2	—	4
	R89220-U03	<i>Premium rotor, PL 200, dual lobe with undersize (130-150°C, delivery time on request)</i>	1.7225 tempered	—	2	—	4
	R89226	Premium rotor, dual-lobe, linear, PL 200	1.8850 hardened	—	2	—	4
	R89222	Premium rotor, dual-lobe, linear, PL 200	1.4404	—	2	—	4
	R89222-U01	<i>Premium rotor, PL 200, dual lobe with undersize (90-110°C, delivery time on request)</i>	1.4404	—	2	—	4
	R89222-U02	<i>Premium rotor, PL 200, dual lobe with undersize (120°C, delivery time on request)</i>	1.4404	—	2	—	4
	R89222-U03	<i>Premium rotor, PL 200, dual lobe with undersize (130-150°C, delivery time on request)</i>	1.4404	—	2	—	4
	R89222-U04	<i>Premium rotor, PL 200, dual lobe with undersize (120°C, delivery time on request)</i>	1.4404	—	2	—	4
	R89222-U05	<i>Premium rotor, PL 200, dual lobe with undersize (200°C, delivery time on request)</i>	1.4404	—	2	—	4
	R89224	Premium rotor, dual-lobe, linear, PL 200	1.4539	—	2	—	4
	R89224-U01	<i>Premium rotor, PL 200, dual lobe with undersize (90-110°C, delivery time on request)</i>	1.4539	—	2	—	4
	R89224-U02	<i>Premium rotor, PL 200, dual lobe with undersize (120°C, delivery time on request)</i>	1.4539	—	2	—	4
	R89221	Premium rotor, dual-lobe, linear, PL 200	Black Protection	—	2	—	4
	R89230	Premium rotor, dual-lobe, linear, PL 300	1.7225, hardened	—	—	2	—
	R89230-U01	<i>Premium rotor, PL 300, dual lobe undersize (90-120°C, delivery time on request)</i>	with 1.7225 tempered	—	—	2	—
	R89230-U02	<i>Premium rotor, PL 300, dual lobe with undersize (130-150°C, delivery time on request)</i>	1.7225 tempered	—	—	2	—
	R89232	Premium rotor, dual-lobe, linear, PL 300	1.4404	—	—	2	—
	R89230-U03	<i>Premium rotor, PL 300, dual lobe with undersize (130-150°C, delivery time on request)</i>	1.7225, tempered	—	—	2	—
	R89232-U02	<i>Premium rotor, PL 300, dual lobe with undersize (130-150°C, delivery time on request)</i>	1.4404	—	—	2	—
	R8970L9	Premium-profile rotor, dual-lobe, linear, ccw	1.7225, hardened	1	—	—	—
	R8970R9	Premium-profile rotor, dual-lobe, linear, cw	1.7225, hardened	1	—	—	—
	R8972L9	Premium-profile rotor, dual-lobe, linear, ccw	1.7225, hardened	—	1	—	—
	R8972R9	Premium-profile rotor, dual-lobe, linear, cw	1.7225, hardened	—	1	—	—
	R8974L9	Premium-profile rotor, dual-lobe, linear, ccw	1.7225, hardened	—	—	1	—
	R8974R9	Premium-profile rotor, dual-lobe, linear, cw	1.7225, hardened	—	—	1	—
9.6b	Z41160	Grub screw, M12x16, DIN EN ISO 4027	Steel, galvanized	4	4	4	8
	Z41162	Grub screw, M12x16, DIN EN ISO 4027	Stainless steel	4	4	4	8
9.6c	C79904	Sealing sleeve for Premium rotors for PL 400	1.7225	—	—	—	2
	C79919	Sealing sleeve for Premium rotors for PL 400	1.4571	—	—	—	2
9.6d	O55705	O-ring 55x3	NBR	—	—	—	4
	O55715	O-ring 55x3	EPDM	—	—	—	4
	O55725	O-ring 55x3	FPM (FKM)	—	—	—	4
—	R82810	Rotor, PL100, tri lobe, linear	1.7225, hardened	2	—	—	—
	R82810-U01	Rotor, PL100, tri lobe, linear with undersize	1.7225, hardened	2	—	—	—
	R82812	Rotor, PL100, tri lobe, linear	1.4404	2	—	—	—
	R82812-U01	Rotor, PL100, tri lobe, linear with undersize	1.4404	2	—	—	—

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
	R82820	Rotor, PL200, tri lobe, linear	1.7225, hardened	—	2	—	—
	R82820-U01	Rotor, PL200, tri lobe, linear with undersize	1.7225, hardened	—	2	—	—
	R82822	Rotor, PL200, tri lobe, linear	1.4404	—	2	—	—
	R82822-U01	Rotor, PL200, tri lobe, linear with undersize	1.4404	—	2	—	—
	R82830	Rotor, PL300, tri lobe, linear	1.7225, hardened	—	—	2	—
	R82832	Rotor, PL300, tri lobe, linear	1.4404	—	—	2	—
9.7	R9323L9	Rotor, tri-lobed, screw profile, ccw, PL 100	NBR	1	—	—	—
	R9323R9	Rotor, tri-lobed, screw profile, cw, PL 100		1	—	—	—
	R9326R9	Rotor, tri-lobed, screw profile, ccw, PL 100	NR/SBR	1	—	—	—
	R9326L9	Rotor, tri-lobed, screw profile, cw, PL 100		1	—	—	—
	R9324L9	Rotor, tri-lobed, screw profile, ccw, PL 100	EPDM	1	—	—	—
	R9324R9	Rotor, tri-lobed, screw profile, cw, PL 100		1	—	—	—
	R9325L9	Rotor, tri-lobed, screw profile, ccw, PL 100	FPM	1	—	—	—
	R9325R9	Rotor, tri-lobed, screw profile, cw, PL 100		1	—	—	—
	R9322L9	Rotor, tri-lobed, screw profile, ccw, PL 100	CSM	1	—	—	—
	R9322R9	Rotor, tri-lobed, screw profile, cw, PL 100		1	—	—	—
	R9321L9	Rotor, tri-lobed, screw profile, ccw, PL 100	HNBR	1	—	—	—
	R9321R9	Rotor, tri-lobed, screw profile, cw, PL 100		1	—	—	—
	R9327L9	Rotor, tri-lobed, screw profile, ccw, PL 200	NBR	—	1	—	1
	R9327R9	Rotor, tri-lobed, screw profile, cw, PL 200		—	1	—	1
	R9330L9	Rotor, tri-lobed, screw profile, ccw, PL 200	NR/SBR	—	1	—	—
	R9330R9	Rotor, tri-lobed, screw profile, cw, PL 200		—	1	—	—
	R9328L9	Rotor, tri-lobed, screw profile, ccw, PL 200	EPDM	—	1	—	1
	R9328R9	Rotor, tri-lobed, screw profile, cw, PL 200		—	1	—	1
	R9329L9	Rotor, tri-lobed, screw profile, ccw, PL 200	FPM	—	1	—	1
	R9329R9	Rotor, tri-lobed, screw profile, cw, PL 200		—	1	—	1
	R9336L9	Rotor, tri-lobed, screw profile, ccw, PL 200	FPM (R31B)	—	1	—	1
	R9336R9	Rotor, tri-lobed, screw profile, cw, PL 200		—	1	—	1
	R9342L9	Rotor, tri-lobed, screw profile, ccw, PL 200	HNBR	—	1	—	—
	R9342R9	Rotor, tri-lobed, screw profile, cw, PL 200		—	1	—	—
	R9362L9	Rotor, tri-lobed, screw profile, ccw, PL 200	1.7225 hardened	—	1	—	—
	R9362R9	Rotor, tri-lobed, screw profile, cw, PL 200		—	1	—	—
	R9363L9	Rotor, tri-lobed, screw profile, ccw, PL 200	1.4404	—	1	—	—
	R9363R9	Rotor, tri-lobed, screw profile, cw, PL 200		—	1	—	—
	R9363L9-U02	Rotor, tri-lobed, screw profile, ccw, PL 200 with undersize	1.4404	—	1	—	—
	R9363R9-U02	Rotor, tri-lobed, screw profile, cw, PL 200 with undersize		—	1	—	—
	R9331L9	Rotor, tri-lobed, screw profile, ccw, PL 300	NBR	—	—	1	—
	R9331R9	Rotor, tri-lobed, screw profile, cw, PL 300		—	—	1	—
	R9334L9	Rotor, tri-lobed, screw profile, ccw, PL 300	NR/SBR	—	—	1	—
	R9334R9	Rotor, tri-lobed, screw profile, cw, PL 300		—	—	1	—
	R9343L9	Rotor, tri-lobed, screw profile, ccw, PL 300	HNBR	—	—	1	—
	R9343R9	Rotor, tri-lobed, screw profile, cw, PL 300		—	—	1	—
	R9332L9	Rotor, tri-lobed, screw profile, ccw, PL 300	EPDM	—	—	1	—
	R9332R9	Rotor, tri-lobed, screw profile, cw, PL 300		—	—	1	—
	R9333L9	Rotor, tri-lobed, screw profile, ccw, PL 300	FPM	—	—	1	—

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
	R9333R9	Rotor, tri-lobe, screw profile, cw, PL 300	FPM	—	—	1	—
	R9337L9	Rotor, tri-lobe, screw profile, ccw, PL 300	FPM (R31B)	—	—	1	—
	R9337R9	Rotor, tri-lobe, screw profile, cw, PL 300	FPM (R31B)	—	—	1	—
	R9364L9	Rotor, tri-lobe, screw profile, ccw, PL 300	1.7225 hardened	—	—	1	—
	R9364R9	Rotor, tri-lobe, screw profile, cw, PL 300	1.7225 hardened	—	—	1	—
	R9365L9	Rotor, tri-lobe, screw profile, ccw, PL 300	1.4404	—	—	1	—
	R9365R9	Rotor, tri-lobe, screw profile, cw, PL 300	1.4404	—	—	1	—
	R9365L9-U09	Rotor, tri-lobe, screw profile, ccw, PL 300 with undersize	1.4404	—	—	1	—
	R9365R9-U09	Rotor, tri-lobe, screw profile, cw, PL 300 with undersize	1.4404	—	—	1	—
9.7b	R9335L9	Rotors, tri-lobe, screw profile, ccw, open face, with spacer ring	NBR	—	—	—	1
	R9335R9	Rotors, tri-lobe, screw profile, ccw, open face, with spacer ring	NBR	—	—	—	1
	R9339L9	Rotors, tri-lobe, screw profile, ccw, open face, with spacer ring	FPM	—	—	—	1
	R9339R9	Rotors, tri-lobe, screw profile, ccw, open face, with spacer ring	FPM	—	—	—	1
	R9338L9	Rotors, tri-lobe, screw profile, ccw, open face, with spacer ring	EPDM	—	—	—	1
	R9338R9	Rotors, tri-lobe, screw profile, ccw, open face, with spacer ring	EPDM	—	—	—	1
9.7c	C79900	Sealing sleeve for rotor types A and D for PL 400	1.7225	—	—	—	2
	C79902	Sealing sleeve for rotor types A and D for PL 400	1.4571	—	—	—	2
9.7d	O55705	O-ring 55x3	NBR	—	—	—	4
	O55715	O-ring 55x3	EPDM	—	—	—	4
	O55725	O-ring 55x3	FPM	—	—	—	4
9.8	R89215	Premium-rotor, dual lobe, linear	PFA	2	—	—	—
	R89227	Premium-rotor, dual lobe, linear	PFA	—	2	—	—
	R89235	Premium-rotor, dual lobe, linear	PFA, white	—	—	2	—
	R89233	Premium-rotor, dual lobe, linear	PFA	—	—	2	—
	Z39611	Hexagon socked head cap screw, M16 x 40, with O-ring groove	A4	2	2	2	—
	O45910	O-Ring, 21 x 2,5	FFKM	2	2	2	—
-	R83010	Orbit rotor, PL100, dual-lobe, linear	1.4404	2	—	—	—
	R83100	Orbit rotor, PL200, dual-lobe, linear	1.8550, hardened	—	2	—	—
	R83100-U05	Orbit rotor, PL200, dual-lobe, linear with undersize (200°C)	1.8550, hardened	—	2	—	—
	R83120	Orbit rotor, PL200, dual-lobe, linear	1.7225, hardened	—	2	—	—
	R83110	Orbit rotor, PL200, dual-lobe, linear with undersize (200°C)	1.4404	—	2	—	—
	R83110-U01	Orbit rotor, PL200, dual-lobe, linear	1.4404	—	2	—	—
	R83202	Orbit rotor, PL300, dual-lobe, linear	1.8550, hardened	—	—	2	—
	R83200	Orbit rotor, PL300, dual-lobe, linear	1.7225, hardened	—	—	2	—
	R83210	Orbit rotor, PL300, dual-lobe, linear	1.4404	—	—	2	—
	R83210-U01	Orbit rotor, PL300, dual-lobe, linear with Undersize	1.4404	—	—	2	—
10	B41018	Cover side casing protection plate	1.8714	1	1	1	1
	B41028	Cover side casing protection plate	1.4571	1	1	1	1
	B41028P	Cover side casing protection plate	1.4571 plasma hardened	1	1	1	1
	B41032	Cover side casing protection plate	1.4539	1	1	1	1
	B41021	Cover side casing protection plate	Black Protection	1	1	1	1
	B41039	Cover side casing protection plate	1.4034	1	1	1	1
	B41018K	Cover side casing protection plate	1.8714 Ceramic coated	1	1	1	1
	B41033	Cover side casing protection plate, re-adjustable	1.8714	1	1	1	1
	B41034	Cover side casing protection plate, re-adjustable	1.4571	1	1	1	1
	B41037	Cover side casing protection plate, for 3mm cover O-ring	1.4571	1	1	1	1
11	B41058	Gear side casing protection plate	1.7225	1	1	1	1
	B51056	Gear side casing protection plate with 4 fixing bores	1.4571	1	1	1	1

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
	B51056P	Gear side casing protection plate with 4 fixing bores	1.4571 plasma hardened	1	1	1	1
	B51059	Gear side casing protection plate with 4 fixing bores	1.4539	1	1	1	1
	B41055	Gear side casing protection plate	Black Protection	1	1	1	1
	B41065	Gear side casing protection plate	1.8550 hardened	1	1	1	1
	B51071	Gear side casing protection plate	1.4034	1	1	1	1
	B41068	Gear side casing protection plate for rotating holding bush with backflush grooves	1.7225	1	1	1	1
	B51064	Gear side casing protection plate for rotating holding bush with backflush grooves	1.4571	1	1	1	1
	B41058K	Gear side casing protection plate	1.7225 Ceramic coated	1	1	1	1
	B41057	Gear side casing protection plate with fiber stop edge	1.7225	1	1	1	1
	B41056	Gear side casing protection plate with fiber stop edge	1.4571	1	1	1	1
	B51054	Gear side casing protection plate (spare part requirements for older models only)	1.4571	1	1	1	1
12.a	B41060	Radial casing liners, PL 100	1.8714	2	—	—	—
	B41100	Radial casing liners, PL 100	1.4571	2	—	—	—
	B41102	Radial casing liners, PL 100	1.4539	2	—	—	—
	B41100P	Radial casing liners, PL 100	1.4571 plasma hardened	2	—	—	—
	B41103	Radial casing liners, PL 100	1.4034 hardened	2	—	—	—
	B41070	Radial casing liners, PL 200	1.8714	—	2	—	—
	B41110	Radial casing liners, PL 200	1.4571	—	2	—	—
	B41112	Radial casing liners, PL 200	1.4539	—	2	—	—
	B41110P	Radial casing liners, PL 200	1.4571 plasma hardened	—	2	—	—
	B41071	Radial casing liners, PL 200	Black Protection	—	2	—	—
	B41115	Radial casing liners, PL 200	1.4034 hardened	—	2	—	—
	B41080	Radial casing liners, PL 300	1.8714	—	—	2	—
	B41120	Radial casing liners, PL 300	1.4571	—	—	2	—
	B41122	Radial casing liners, PL 300	1.4539	—	—	2	—
	B41120P	Radial casing liners, PL 300	1.4571 plasma hardened	—	—	2	—
	B41123	Radial casing liners, PL 300	1.4034 hardened	—	—	2	—
	B41090	Radial casing liners, PL 400	1.8714	—	—	—	2
	B41130	Radial casing liners, PL 400	1.4571	—	—	—	2
	B41130P	Radial casing liners, PL 400	1.4571 plasma hardened	—	—	—	2
12.b	B41140	Clamping part, ccw , PL 100	1.0037	2	—	—	—
	B41143	Clamping part, cw , PL 100	1.0037	2	—	—	—
	B41270	Clamping part, ccw , PL 100	1.4571	2	—	—	—
	B41273	Clamping part, cw , PL 100	1.4571	2	—	—	—
	B41400	Clamping part, ccw , PL 100	1.4539	2	—	—	—
	B41403	Clamping part, cw , PL 100	1.4539	2	—	—	—
	B41150	Clamping part, PL 200	1.0037	—	4	—	—
	B41280	Clamping part, PL 200	1.4571	—	4	—	—
	B41410	Clamping part, PL 200	1.4539	—	4	—	—
	B41151	Clamping part, PL 200	Black Protection	—	4	—	—
	B41160	Clamping part, PL 300	1.0037	—	—	4	—
	B41290	Clamping part, PL 300	1.4571	—	—	4	—
	B41412	Clamping part, PL 300	1.4539	—	—	4	—
	B41170	Clamping part, PL 400	1.0037	—	—	—	4
	B41300	Clamping part, PL 400	1.4571	—	—	—	4

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
12.c	Z49430	Hexagon socket head cap screw, M12x30, DIN EN ISO 4762 (DIN 912)	Steel 10.9	4	4	—	—
	Z49432	Hexagon socket head cap screw, M12x30, DIN EN ISO 4762 (DIN 912)	Stainless steel (A4/70)	4	4	—	—
	Z93000	Hexagon socket head cap screw, M12x30, DIN EN ISO 4762 (DIN 912)	Steel 10.9, galvanized	—	—	8	8
	Z93100	Hexagon socket head cap screw, M12x30, DIN EN ISO 4762 (DIN 912)	Stainless steel (A4/70)	—	—	8	8
12.d	K32505	Sealing washer, A12x18x1.5	Cu (copper)	4	4	—	—
	K34002	Sealing washer, A12x19x1.6	PTFE	4	4	—	—
	Z31309	Sealing washer, A10x16x1.5	Cu (copper)	—	—	8	8
	K34001	Sealing washer, A10x16x1.6	PTFE	—	—	8	8
13	D45218	Stationary holding bush	1.0503	2	2	2	2
	D45219	Stationary holding bush	1.7225 tempered	2	2	2	2
	D45213	Stationary holding bush	1.4404	2	2	2	2
	D45231	Stationary holding bush	1.4539	2	2	2	2
	D45220	Stationary holding bush	Black Protection	2	2	2	2
	D45228	Stationary holding bush for rotating holding bush with backflush grooves	1.7225 tempered	2	2	2	2
	D45212	Stationary holding bush for rotating holding bush with backflush grooves	1.4404	2	2	2	2
	D45229	Stationary holding bush with flushing groove	1.0503	2	2	2	2
	D45230	Stationary holding bush with flushing groove	1.4404	2	2	2	2
14	D45180	Rotating holding bush with thread with division into 12	1.0503	2	2	2	2
	D45181	Rotating holding bush with thread with division into 12	1.7225 hardened	2	2	2	2
	D45182	Rotating holding bush with thread with division into 12	1.4404, plasma hardened	2	2	2	2
	D45183	Rotating holding bush with thread with division into 12	1.4539	2	2	2	2
	D45117	Rotating holding bush with thread, Delta	1.7225 hardened	1	1	1	1
15	D45008	Mechanical seal: 2 x Seal face, Duronit 2 x O-Ring 47,5 x 6,5 (D55317) NBR	Duronit/NBR	2	2	2	2
	D45314	Mechanical seal: 2 x Seal face, Duronit 2 x O-Ring 47,5 x 6,5 (D55336) HNBR	Duronit/HNBR	2	2	2	2
	D45104	Mechanical seal: 2 x Seal face, Duronit 2 x O-Ring 47,5 x 6,5 (D55327) EPDM	Duronit/EPDM	2	2	2	2
	D45105	Mechanical seal: 2 x Seal face, Duronit 2 x O-Ring 47,5 x 6,5 (D55328) EPDM (FDA)	Duronit/EPDM FDA (AP310)	2	2	2	2
	D45204	Mechanical seal: 2 x Seal face, Duronit 2 x O-Ring 47,5 x 6,5 (D55337) FPM (FKM)	Duronit/FPM	2	2	2	2
	D45310	Mechanical seal: 2 x Seal face, Duronit 2 x O-Ring 47,5 x 6,5 (D55339) FFKM	Duronit/FFKM	2	2	2	2
	D45308	Mechanical seal: 2 x Seal face, Duronit 2 x O-Ring 47,5 x 6,5 (D55340) FEPM	Duronit/FEPM	2	2	2	2
	D45333	Mechanical seal: 2 x Seal face, SiSiC 2 x O-Ring 47,5 x 6,5 (D55317) NBR	SiSiC/NBR	2	2	2	2
	D45378	Mechanical seal: 2 x Seal face, SiSiC 2 x O-Ring 47,5 x 6,5 (D55336) HNBR	SiSiC/HNBR	2	2	2	2
	D45343	Mechanical seal: 2 x Seal face, SiSiC 2 x O-Ring 47,5 x 6,5 (D55327) EPDM	SiSiC/EPDM	2	2	2	2
	D45344	Mechanical seal: 2 x Seal face, SiSiC 2 x O-Ring 47,5 x 6,5 (D55328) EPDM (FDA)	SiSiC/EPDM FDA (AP310)	2	2	2	2

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
	D45353	Mechanical seal: 2 x Seal face, SiSiC 2 x O-Ring 47,5 x 6,5 (D55337) FPM (FKM)	SiSiC/FPM	2	2	2	2
	D45373	Mechanical seal: 2 x Seal face, SiSiC 2 x O-Ring 47,5 x 6,5 (D55339) FFKM	SiSiC/FFKM	2	2	2	2
	D45375	Mechanical seal: 2 x Seal face, SiSiC 2 x O-Ring 47,5 x 6,5 (D55340) FEPM	SiSiC/FEPM	2	2	2	2
	D45380	Gleitringdichtung: 2x Gleitring TC, 2 x O-Ring 47,5 x 6,5 (D55317) NBR	TC/NBR	2	2	2	2
	D45381	Mechanical seal: 2 x Seal face TC, 2 x O-Ring 47,5 x 6,5 (D55327) EPDM	TC/EPDM	2	2	2	2
	D45382	Mechanical seal: 2 x Seal face TC, 2 x O-Ring 47,5 x 6,5 (D55337) FPM	TC/FPM	2	2	2	2
	D45383	Mechanical seal: 2 x Seal face TC, 2 x O-Ring 47,5 x 6,5 (D55340) FEPM	TC/FEPM (Vi 982)	2	2	2	2
	D45384	Mechanical seal: 2 x Seal face TC, 2 x O-Ring 47,5 x 6,5 (D55339) FFKM	TC/FFKM	2	2	2	2
16.1	W41114	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 100	1.7225	1	—	—	—
	W41116	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 100	1.4571	1	—	—	—
	W41214	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 200	1.7225	—	1	—	—
	W41216	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 200	1.4571	—	1	—	—
	W41314	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 300	1.7225	—	—	1	—
	W41316	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 300	1.4571	—	—	1	—
	W41414	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 400	1.7225	—	—	—	1
	W41416	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 400	1.4571	—	—	—	1
16.2	W41124	Short shaft, PL 100	1.7225	1	—	—	—
	W41126	Short shaft, PL 100	1.4571	1	—	—	—
	W41224	Short shaft, PL 200	1.7225	—	1	—	—
	W41226	Short shaft, PL 200	1.4571	—	1	—	—
	W41324	Short shaft, PL 300	1.7225	—	—	1	—
	W41326	Short shaft, PL 300	1.4571	—	—	1	—
	W41424	Short shaft, PL 400	1.7225	—	—	—	1
	W41426	Short shaft, PL 400	1.4571	—	—	—	1
16.3	W41104	Drive shaft with SAE male profile (six tooth PTO profile), 1 $\frac{3}{8}$ "	1.7225	1	—	—	—
	W41204	Drive shaft with SAE male profile (six tooth PTO profile), 1 $\frac{3}{8}$ "	1.7225	—	1	—	—
	W41304	Drive shaft with SAE male profile (six tooth PTO profile), 1 $\frac{3}{8}$ "	1.7225	—	—	1	—
	W41404	Drive shaft with SAE male profile (six tooth PTO profile), 1 $\frac{3}{8}$ "	1.7225	—	—	—	1
17.1	W41124	Short shaft, PL 100	1.7225	1	—	—	—
	W41126	Short shaft, PL 100	1.4571	1	—	—	—
	W41224	Short shaft, PL 200	1.7225	—	1	—	—
	W41226	Short shaft, PL 200	1.4571	—	1	—	—
	W41324	Short shaft, PL 300	1.7225	—	—	1	—
17.1	W41326	Short shaft, PL 300	1.4571	—	—	1	—

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
	W41424	Short shaft, PL 400	1.7225	—	—	—	1
	W41426	Short shaft, PL 400	1.4571	—	—	—	1
17.2	W41114	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 100	1.7225	1	—	—	—
	W41116	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 100	1.4571	1	—	—	—
	W41214	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 200	1.7225	—	1	—	—
	W41216	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 200	1.4571	—	1	—	—
	W41314	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 300	1.7225	—	—	1	—
	W41316	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 300	1.4571	—	—	1	—
	W41414	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 400	1.7225	—	—	—	1
	W41416	Drive shaft with cylindrical drive end with keyway DIN 748-1, Ø 35, PL 400	1.4571	—	—	—	1
17.3	W41104	Drive shaft with SAE male profile (six tooth PTO profile) 1 3/8"	1.7225	1	—	—	—
	W41204	Drive shaft with SAE male profile (six tooth PTO profile) 1 3/8"	1.7225	—	1	—	—
	W41304	Drive shaft with SAE male profile (six tooth PTO profile) 1 3/8"	1.7225	—	—	1	—
	W41404	Drive shaft with SAE male profile (six tooth PTO profile) 1 3/8"	1.7225	—	—	—	1
19.a	E12111	Gear wheel with keyway, center tooth	1.7225	1	1	1	1
19.b	E12110	Gear wheel with keyway, center tooth space	1.7225	1	1	1	1
24	C80004	Cover disk for Premium rotor	1.7225	2	2	2	2
	C80104	Cover disk for Premium rotor	1.4571	2	2	2	2
	C80108	Cover disk for Premium rotor	1.4539	2	2	2	2
25.1	O45760	Pump inlet/outlet seal, O-ring 110x3.5, PL 100	NBR	2	—	—	—
	O45761	Pump inlet/outlet seal, O-ring 110x3.5, PL 100	EPDM	2	—	—	—
	O45762	Pump inlet/outlet seal, O-ring 110x3.5, PL 100	FPM	2	—	—	—
	O45770	Pump inlet/outlet seal, O-ring 139x3.5, PL 200	NBR	—	2	—	—
	O45771	Pump inlet/outlet seal, O-ring 139x3.5, PL 200	EPDM	—	2	—	—
	O45772	Pump inlet/outlet seal, O-ring 139x3.5, PL 200	FPM	—	2	—	—
	O45780	Pump inlet/outlet seal, O-ring 174x3.5, PL 300	NBR	—	—	2	—
	O45781	Pump inlet/outlet seal, O-ring 174x3.5, PL 300	EPDM	—	—	2	—
	O45782	Pump inlet/outlet seal, O-ring 174x3.5, PL 300	FPM	—	—	2	—
	O45790	Pump inlet/outlet seal, O-ring 209x3.5, PL 400	NBR	—	—	—	2
	O45791	Pump inlet/outlet seal, O-ring 209x3.5, PL 400	EPDM	—	—	—	2
	O45792	Pump inlet/outlet seal, O-ring 209x3.5, PL 400	FPM	—	—	—	2
25.1	F82018	Pump inlet/outlet seal, gasket 2 mm, PL 100	NBR	2	—	—	—
	F82134	Pump inlet/outlet seal, gasket 2 mm, PL 100	EPDM	2	—	—	—
	F82144	Pump inlet/outlet seal, gasket 2 mm, PL 100	FPM	2	—	—	—
	F82057	Pump inlet/outlet seal, gasket 2 mm, PL 100	PTFE based	2	—	—	—
	F82028	Pump inlet/outlet seal, gasket 2 mm, PL 200	NBR	—	2	—	—
	F82234	Pump inlet/outlet seal, gasket 2 mm, PL 200	EPDM	—	2	—	—
	F82244	Pump inlet/outlet seal, gasket 2 mm, PL 200	FPM	—	2	—	—
	F82067	Pump inlet/outlet seal, gasket 2 mm, PL 200	PTFE based	—	2	—	—
	F82038	Pump inlet/outlet seal, gasket 2 mm, PL 300	NBR	—	—	2	—
	F82334	Pump inlet/outlet seal, gasket 2 mm, PL 300	EPDM	—	—	2	—

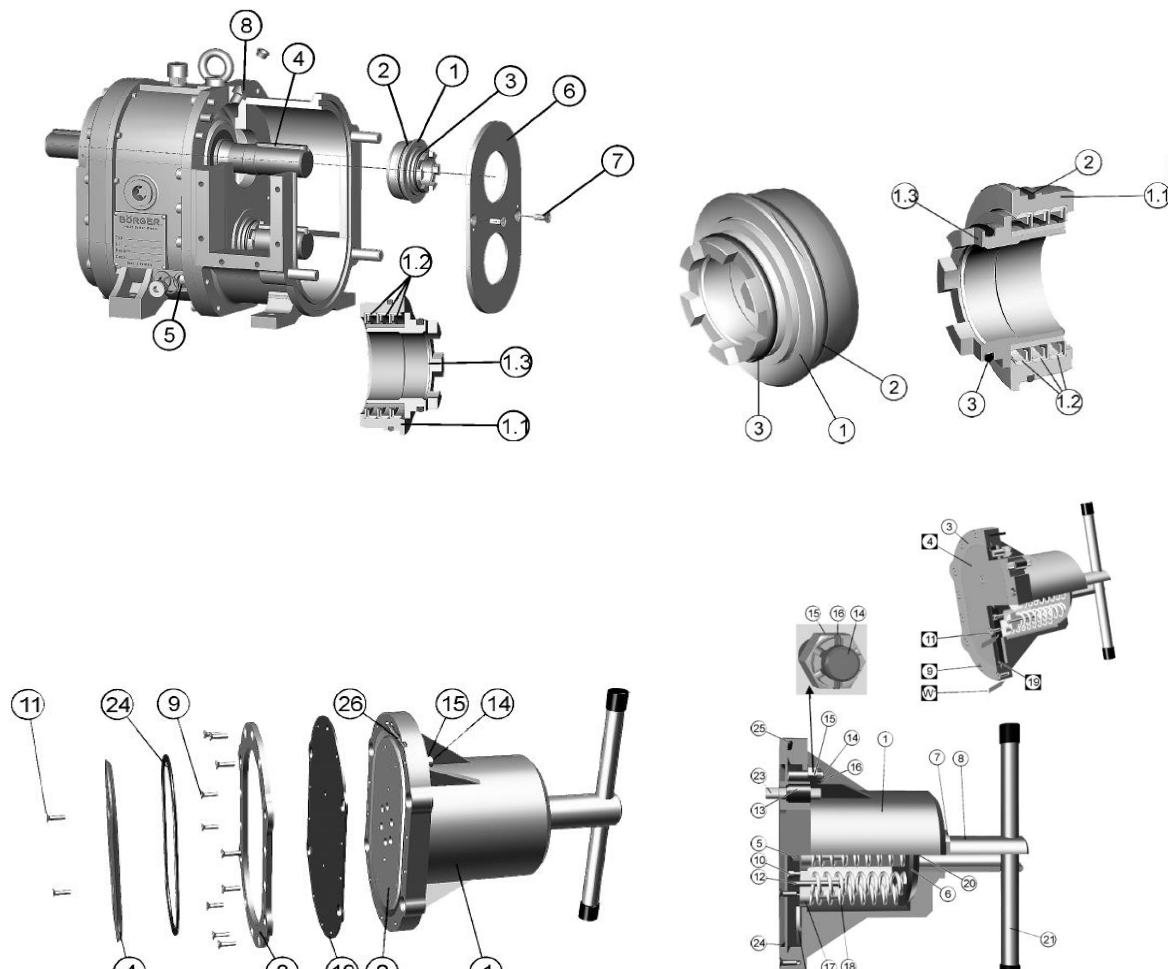
Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
	F82344	Pump inlet/outlet seal, gasket 2 mm, PL 300	FPM	—	—	2	—
	F82077	Pump inlet/outlet seal, gasket 2 mm, PL 300	PTFE based	—	—	2	—
	F82048	Pump inlet/outlet seal, gasket 2 mm, PL 400	NBR	—	—	—	2
	F82434	Pump inlet/outlet seal, gasket 2 mm, PL 400	EPDM	—	—	—	2
	F82444	Pump inlet/outlet seal, gasket 2 mm, PL 400	FPM	—	—	—	2
30	O45408	O-ring for cover, 250x7	NBR	1	1	1	1
	O45427	O-ring for cover, 250x7	HNBR	1	1	1	1
	O45424	O-ring for cover, 250x7	EPDM	1	1	1	1
	O45425	O-ring for cover, 250x7	EPDM (FDA)	1	1	1	1
	O45418	O-ring for cover, 250x7	FPM	1	1	1	1
	O45426	O-ring for cover, 250x7	CSM	1	1	1	1
	O45423	O-ring for cover, 250x7	FEPM	1	1	1	1
	O45420	O-ring for cover, 250x7	FFKM	1	1	1	1
	O45428	O-ring for cover, 250x8	NBR	1	1	1	1
	O45430	O-ring for cover, 250x8	EPDM	1	1	1	1
	O45432	O-ring for cover, 250x8	FPM	1	1	1	1
31	O45508	O-ring for rotating holding bush, 54x4	NBR	2	2	2	2
	O45552	O-ring for rotating holding bush, 54x5	HNBR	2	2	2	2
	O45524	O-ring for rotating holding bush, 54x6	EPDM	2	2	2	2
	O45525	O-ring for rotating holding bush, 54x7	EPDM (FDA)	2	2	2	2
	O45518	O-ring for rotating holding bush, 54x8	FPM	2	2	2	2
	O45545	O-ring for rotating holding bush, 54x9	FEPM	2	2	2	2
	O45537	O-ring for rotating holding bush, 54x10	FEP/FPM	2	2	2	2
	O45540	O-ring for rotating holding bush, 54x11	FFKM	2	2	2	2
	O45550	O-ring for rotating holding bush, 54x12	CSM	2	2	2	2
32	O45508	O-ring for cover disk, 54x4	NBR	0/2	0/2	0/2	0/2
	O45552	O-ring for cover disk, 54x5	HNBR	2	2	2	2
	O45524	O-ring for cover disk, 54x6	EPDM	0/2	0/2	0/2	0/2
	O45525	O-ring for cover disk, 54x7	EPDM (FDA)	2	2	2	2
	O45518	O-ring for cover disk, 54x8	FPM	0/2	0/2	0/2	0/2
	O45545	O-ring for cover disk, 54x9	FEPM	0/2	0/2	0/2	0/2
	O45537	O-ring for cover disk, 54x10	FEP/FPM	0/2	0/2	0/2	0/2
	O45540	O-ring for cover disk, 54x11	FFKM	0/2	0/2	0/2	0/2
33	O45550	O-ring for cover disk, 54x12	CSM	2	2	2	2
	O45708	O-ring for stationary holding bush, 80x3	NBR	2	2	2	2
	O45752	O-ring for stationary holding bush, 80x4	HNBR	2	2	2	2
	O45724	O-ring for stationary holding bush, 80x5	EPDM	2	2	2	2
	O45725	O-ring for stationary holding bush, 80x6	EPDM (FDA)	2	2	2	2
	O45718	O-ring for stationary holding bush, 80x7	FPM	2	2	2	2
	O45745	O-ring for stationary holding bush, 80x8	FEPM	2	2	2	2
	O45737	O-ring for stationary holding bush, 80x9	FEP/FPM	2	2	2	2
	O45740	O-ring for stationary holding bush, 80x10	FFKM	2	2	2	2
36	O45750	O-ring for stationary holding bush, 80x11	CSM	2	2	2	2
	S16508	Lip seal with dust protection lip, DIN 3760 form AS, 45x70x10	NBR	1/2	1/2	1/2	1/2
	S16509	Lip seal with dust protection lip, DIN 3760 form AS, 45x70x10	FPM	1/2	1/2	1/2	1/2
37	S16108	DUO double lip oil seal, 55x80x10	NBR	2	2	2	2
	S16118	DUO double lip oil seal, 55x80x10	FPM	2	2	2	2
40	S14608	Cylindrical roller bearing, NJ2309, DIN 5412	1.3505	2	2	2	2
	S14618	Cylindrical roller bearing (extra long life) NJ2309, DIN 5412 / ISO 281	1.3505	2	2	2	2

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
41	S14508	Self-aligning roller bearing, 22310, DIN 635	1.3505	2	2	2	2
41	S14518	Self-aligning roller bearing (extra long-life), 22310, DIN 635 / ISO 281	1.3505	2	2	2	2
42	S16008	Inner ring as shaft protection sleeve, 50x55x20	1.3505 hardened	2	2	2	2
	S16009	Inner ring as shaft protection sleeve, 50x55x20	1.4034 hardened	2	2	2	2
43	S16708	Inner ring as shaft protection sleeve, 40x45x20.5	1.3505 hardened	1/2	1/2	1/2	1/2
	S16709	Inner ring as shaft protection sleeve, 40x45x20.5	1.4034 hardened	1/2	1/2	1/2	1/2
46	S14324	Parallel key, gear wheel, DIN 6885-1, 14x9x32	Steel	2	2	2	2
50	Z32208	Cover nut, ring nut, M16, DIN 582	Steel, galvanized	4	4	4	4
	Z32209	Cover nut, ring nut, M16, DIN 582	Stainless steel	4	4	4	4
	Z50349	Cover nut, hexagon nut M16, DIN EN ISO 4032	Steel, galvanized	4	4	4	4
52	Z38250	Countersunk screw, M8x16 according to DIN EN ISO 7046-2, but with Torx® driving (former DIN 965)	Stainless steel (A4)	2/4	2/4	2/4	2/4
	Z73582	Countersunk screw, M8x16, Duplex, DIN EN ISO 10642 (DIN 7991)	1.4539 (Duplex)	2/4	2/4	2/4	2/4
53	Z32108	Stud screw, M16x45, DIN 939	Steel galvanized	4	4	4	4
	Z32110	Stud screw, M16x45, DIN 939	Stainless steel	4	4	4	4
54	Z39412	Spring washer B8 (former DIN 127)	Steel galvanized	12	16	20	24
	Z39329	Spring washer B8 (former DIN 127)	Stainless steel (A4)	12	16	20	24
55	Z33508	Dowel pin, 14x32, DIN EN ISO 8735 Form A	Steel	2	2	2	2
56	Z33608	Dowel pin, 14x40, DIN EN ISO 8735 Form A	Steel	2	2	2	2
57a	Z39208	Hexagon head screw, M10x30, DIN EN ISO 4017 (DIN 933)	Steel galvanized	13	13	13	13
	Z39209	Hexagon head screw, M10x30, DIN EN ISO 4017 (DIN 933)	Stainless steel	13	13	13	13
57b	Z49801	Hexagon socket head cap screw, M10x30, DIN 6912	Steel galvanized 8.8	1	1	1	1
	Z49802	Hexagon socket head cap screw, M10x30, DIN 6912	Stainless steel (A4)	1	1	1	1
58	Z39411	Hexagon socket head cap screw, M8x25, DIN EN ISO 4762 (DIN 912)	Steel galvanized	12	16	20	24
	Z39328	Hexagon socket head cap screw, M8x25, DIN EN ISO 4762 (DIN 912)	Stainless steel	12	16	20	24
59	Z39408	Hexagon socket head cap screw, M10x40, DIN EN ISO 4762 (DIN 912)	Steel galvanized	12	12	12	12
	Z39410	Hexagon socket head cap screw, M10x40, DIN EN ISO 4762 (DIN 912)	Stainless steel	12	12	12	12
60	Z39508	Eye bolt M12, DIN 580	Steel galvanized	1	1	1	1
	Z39509	Eye bolt M12, DIN 580	Stainless steel	1	1	1	1
61	Z39525	Spring washer, bent, A10 (former DIN 127)	Steel galvanized	13	13	13	13
	Z39530	Spring washer, bent, A10 (former DIN 127)	Stainless steel (A4)	13	13	13	13
62	Z39018	Parallel key for drive shaft, DIN 6885-1, A10x8x70	Steel	01/2	01/2	01/2	01/2
For rubber or polymer coated rotors	63	S14339	Parallel key, 14x9x24 for rotating holding bushes DIN 6885-1, C45K, special form	Steel	2	—	—
		S14349	Parallel key, 14x9x134 (70/64) DIN 6885-1, C45K	Steel	—	2	—
		SET-PF-PL300	Parallel key-Set PL300 (Order Z38121 + Z38113)	Steel	—	—	2
		SET-PF-PL400-V	Parallel key-Set PL400 (Order Z38109 + Z39034)	Steel	—	—	2
For metal rotors		S14325	Parallel key, 14x9x24 for rotating holding bushes DIN 6885-1, C45K, special form with division into 12	Steel	2	—	—
		Z39069	Parallel key, 14x9x88 for rotating bushes DIN 6885-1, C45K, special form with division into 12	Steel	—	2	—
		SET-PF-PL300	Parallel key-Set PL300 (Order Z38118 + Z38115)	Steel	—	—	2
		SET-PF-PL400-V	Parallel key-Set PL400 (Order Z38109 + Z38106)	Steel	—	—	2
64	Z39608	Hexagon socket head cap screw, M16x40, DIN 6912	Steel (10.9)	2	2	2	2
	Z39603	Hexagon socket head cap screw, M16x40, DIN 6912	1.4571	2	2	2	2
	Z39610	Hexagon socket head cap screw, M16x40, DIN 6912	1.4539 (Duplex)	2	2	2	2
65	Z18508	Oil sight glass, G 1 A (1" BSP male)	Brass	1	1	1	1

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400
	Z18509	Oil sight glass, G 1 A (1" BSP male)	Stainless steel	1	1	1	1
66	Z19308	Screw plug, G ½ A (½" BSP male), for oil drain, DIN 908	Steel galvanized	2	2	2	2
	Z19310	Screw plug, G ½ A (½" BSP male), for oil drain, DIN 908	Stainless Steel	2	2	2	2
67	Z19108	Breather, G ½ A (½" BSP male)	Steel galvanized	1	1	1	1
	Z18408	Oil sight glass, G ½ A (½" BSP male) (for 90° turned pumps)	Brass	1	1	1	1
68	Z41150	Grub screw, M8x12, EN ISO4027	Steel galvanized	4	4	4	4
69	Z29401	Screw plug, G ¾" male (¾" BSP male), DIN 908	Steel galvanized	1	1	1	1
70	K22108	Sealing washer, A33x39x2 (for screw plug, pos. 78)	Cu (copper)	1	1	1	1
71	K22408	Sealing washer, A21x26X1.5 (for pos. 66)	Cu (copper)	2	2	2	2
72	K22208	Sealing washer A33x39x1.5 (for pos. 65)	Cellulose/NBR	1	1	1	1
73	K22210	Sealing washer 21x26x1.5 for oil sight glass ½" on 90° turned pump	Cellulose/NBR	0/1	0/1	0/1	0/1
74	K32405	Sealing washer, A17x23x1.5	Cu (copper)	0/2	0/2	0/2	0/2
	K34003	Sealing washer, A16x25x1.6	PTFE	0/2	0/2	0/2	0/2
	O45900	O-ring, 23x3, for PTFE rotor	FEP/FPM	0/2	0/2	0/2	0/2
	O45905	O-ring, 23x3, for PTFE rotor	FFKM	0/2	0/2	0/2	0/2
75	MECH-3025	Breather with G ¾" male thread / (¾" BSP male)	Aluminum, anodized bright	1	1	1	1
77	K23008	Snap ring, J 110, DIN 472	Steel	2	2	2	2
78	Z22815	Screw plug for gear unit, G 1 A (1" BSP male), DIN 908	Steel galvanized	1	1	1	1
	Z22820	Screw plug for gear unit, G 1 A (1" BSP male), DIN 908	Stainless steel	1	1	1	1
79	K32405	Sealing washer A17x23x1.5, DIN 7603, for pos. 69 and 80	Cu (copper)	2	2	2	2
80	Z29305	Screw plug, G ¾" male (¾" BSP male), DIN 908	Steel galvanized	1	1	1	1

Pos.	Art. no.	Item description	Material	Quantity PL			
				100	200	300	400

1	S27012	Multiseal K Cartridge composed of:					443.00
		<i>D55242 1xStationary holding bush</i>	1.4404				142.00
		<i>S16442 1x Shaft sleeve</i>	1.4404		2		146.00
		<i>S16452 1x Inner ring, 50x55x25, as shaft protection sleeve</i>	1.4034				63.40
		<i>S16462 3x Lip seal 55 x 70 x 8</i>	PTFE				119.00
2	Pos. 33	O-ring for stationary holding bush	Pos. 33 Standard Spare Part List		2		-
3	Pos. 31	O-ring for rotating holding bush	Pos. 33 Standard Spare Part List		2		-
4	U22979	Disassembly tool, PL Multiseal K	1.0037		1		45.00
-	U22994	Assembly tool	1.7225		1		18.00



Pos.	Art. no.	Item description	Material	Quantity PL				
				100	200	300	400	
1	V20521	Variocap casing	1.0037	1	1	1	1	1308.00
2	V20531	Support cover	1.0037	1	1	1	1	473.00
3	V20541	Support frame	1.0037	1	1	1	1	370.00
	V20551	Support frame	1.4571	1	1	1	1	660.00
	V20552	Support frame	1.4539	1	1	1	1	911.00
4	V20491	Intermediate support plate	1.7225, gehärtet	1	1	1	1	309.00
	V20501	Intermediate support plate	1.4571	1	1	1	1	365.00
	V20502	Intermediate support plate	1.4539	1	1	1	1	535.00
5	V20481	Guide bolt	1.7225	1	1	1	1	245.00
6	V20561	Rotor plate	1.0037	1	1	1	1	65.90
7	V20571	Locknut M56x2	1.0037	1	1	1	1	132.00
8	V20581	Adjusting spindle	2.1061	1	1	1	1	424.00
9	Z38251	Countersunk screw, M8x20 DIN EN ISO 10642	Stainless steel A4	10	10	10	10	1.20
	Z38220	Countersunk screw, M8x20, DIN EN ISO 10642	Duplex, 1.4539	10	10	10	10	14.10
10	Z39308	Hexagon socket head cap screw M 8x20, DIN EN ISO 4762	Steel, 10.9	6	6	6	6	0.40
11	Z38251	Countersunk screw, M8x20 nach DIN EN ISO 7046-2 Torx (ISR-T40), ähnl. DIN 965	Stainless steel A4	2	2	2	2	1.20
	Z38220	Countersunk screw, M8x20, DIN EN ISO 10642	Duplex, 1.4539	2	2	2	2	14.10
12	Z39350	Hexagon socket head cap screw M8x65, DIN EN ISO 4762	Steel, 8.8	4/6/8	4/6/8	4/6/8	4/6/8	0.60
13	V20631	Spacer	1.0037	4	4	4	4	17.70
14	Z32108	Stud screw M16x45, DIN 939	Steel galvanized		4			2.60
15	V20651	Castle nut M16, DIN 935	Steel galvanized	4	4	4	4	1.80
16	V20661	Clamping bush 4x20, DIN EN 8752	Steel	4	4	4	4	0.20
17	V20671	Spring holder	1.0037	4/6/8	4/6/8	4/6/8	4/6/8	31.70
18	V20681	Tool spring	1.8159	4/6/8	4/6/8	4/6/8	4/6/8	35.10
19	V20511	Dichtungsmembran	EPDM/PTFE	1	1	1	1	47.90
20	V10631	Grease nipple	Steel galvanized	1	1	1	1	0.70
21	V40711	Adjusting lever	1.4301	1	1	1	1	10.00
22	V40721	Plug GPN 280, Ø 26	PE	2	2	2	2	1.00
23	Z32109	Stud screw M16x55, DIN 939	Steel galvanized	4	4	4	4	2.90
24	V20731	O-Ring 224,4x6 mm	FEP/FPM	1	1	1	1	101.00
25	V20735	Rope 115 mm, Ø 6 mm	NBR	0 / 1	0 / 1	0 / 1	0 / 1	7.00

Pos.	Art. no.	Tool / installation aid	Material	Quantity PL ...			
				..100	..200	..300	..400
W1	U22308	Sealing compound (50 ml tube)		1	1	1	1
	U22208	Sealing compound (200 ml tube)		1	1	1	1
W2	U22918	Rotor puller	1.0038 (~ASTM A570-36)	1	1	1	1
W3.1	U22930	Auxiliary puller for dual-lobe rotors made from steel / stainless steel (Premium, Optimum) *	1.0038 (~ASTM A570-36)	0 / 1	0 / 1	0 / 1	0 / 1
W3.2	U22958	Auxiliary puller for rear rotors, types A and D, for PL 400 **	1.0038 (~ASTM A570-36)	—	—	—	0 / 1
W4	U22111***	Multitool, push-in tool for mechanical seal and special tool for rotating holding bush	1.0038 (~ASTM A570-36)	1	1	1	1

*to be used with two M12x30 screws or, for rear rotors (Premium, Optimum made from steel / stainless steel) on PL 400, with two M12x140 threaded rods with M12 nuts as a head (as a stop for the auxiliary puller)

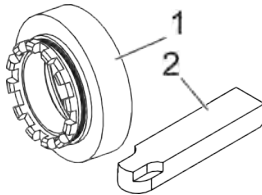
**to be used with three M6x130 threaded rods with M6 nuts as a head (as a stop for the auxiliary puller)

There is a wide variety of attachment parts, such as the coupling guard and pipe connectors, which are delivered depending on the order. This means that not all variations can be listed here. Always quote the Börger order number or pump number according to the nameplate when ordering spare parts.

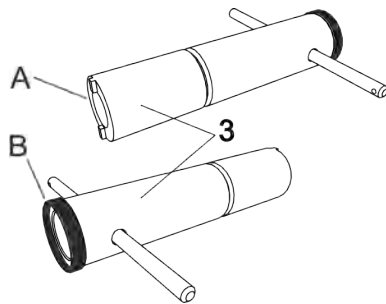
***New Multitool for 12-slot rotating holding bush. If using old style Multitool (U22102), now requires #U22115 turning adapter

Multitool for Rotating Holding Bushes with 12 Grooves

- **Multitool for rotating seal holding bush with 12 grooves**
(AL, PL, HAL, HPL and B-MX series)
- **Reversible adapter for 12/6 grooves**



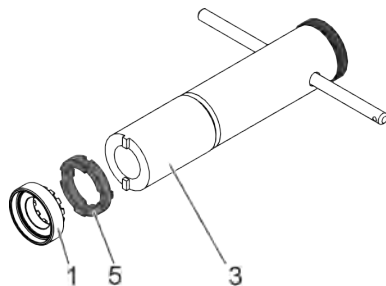
Börger has designed the rotating seal holding bushes with 12 grooves with adapted parallel keys for finer adjustment of the mechanical seals.



A new Multitool (3) is available for these rotating seal holding bushes. It includes:

- Special tool (A) for rotating seal holding bushes with 12 grooves
- Push-in tool (B) for mechanical seals (remove handle!)

Reversible adapter



Multitool with 12 grooves

With the reversible adapter (5), Multitools with 12 grooves can also be used for rotating seal holding bushes with 6 grooves.

Multitool with 6 grooves

With the reversible adapter (5), Multitools with 6 grooves can also be used for rotating seal holding bushes with 12 grooves.

Material information on spare parts list

Material	Description	~ Equivalent US market
EN-JL1040	Gray cast iron (EN-GJL-250), DIN EN 1561 (former designation GG 25 / 0.6025)	ASTM A48-40 B, UNS F12801
EN-JS1030	Spheroidal graphite cast iron (EN-GJS-400-15), DIN EN 1563 (Sphäroguss®; former designation GGG 40 / 0.7040)	ASTM A536, 60-40-18, UNS F32800
EN-JS1060	Spheroidal graphite cast iron (EN-GJS-600-3), DIN EN 1563 (Sphäroguss®; former designation GGG 60 / 0.7060)	A48-45 B, ASTM A536 80-55-06, UNS F33800
1.0038	Non-alloy structural steel, hot rolled, DIN EN 10025-2 (former designation St 37)	ASTM A570-36
1.0503	Non-alloy steel for quenching and tempering as per DIN EN 10083-2 (former designation C45)	AISI 1045, UNS G10450
1.2379	Secondary hardening, 12% Cr cold work tool steel	AISI D2
1.3505	Ball and roller bearing steel (100Cr6), DIN EN ISO 683-17	AISI 52100
1.4034	Martensitic stainless steel (X5CrNi18-10), DIN EN 10088	AISI 420 C
1.4301	Austenitic stainless steel, DIN EN 10088, (V2A)	AISI 304
1.4404	Austenitic stainless steel (X2CrNiMo17-12-2), DIN EN 10088	AISI 316 L, UNS S31603
1.4462	Austenitic-ferritic duplex steel (X2CrNiMoN22-5-3), DIN EN 10088	ASTM A182 F-51 318LN, UNS S 31803
1.4517	Corrosion-resistant austenitic-ferritic steel casting (GX2CrNiMoCuN25-6-3-3), DIN EN 10283 (Duplex)	ASTM A 890
1.4539	Superaustenitic stainless steel (X1NiCrMoCu25-20-5), DIN EN 10088, (A5)	AISI 904 L, UNS N 08904
1.4571	Austenitic stainless steel (X6CrNiMoTi17-12-2), DIN EN 10088, (V4A)	AISI 316 Ti
1.6220	Steel casting for pressure purposes with specified low temperature properties, G20Mn5 V, DIN EN 10213, (formerly 1.1120, GS2 20 Mn5, DIN 17182)	Steel casting, ~ ASTM A352 LCB
1.7218	Alloy steel for quenching and tempering (25CrMo4), DIN EN 10083-3	AISI 4130
1.7225	Alloy steel for quenching and tempering (42CrMo4V), DIN EN 10083-3	AISI 4140/4142
1.8714	Hard metal (non-wearing special structural steel, trade names: Hardox®, XAR® 400)	—
CSM	Chlorine-sulphonyl-polyethylene rubber	CSM
Duronit®	Ledeburitic chilled cast iron (60-65 HRC)	Duronit®
EPDM	Ethylene-propylene-diene rubber (trade marks e.g. Vistalon®, Keltan®)	EPDM
FEPM	Tetrafluorine-ethylene-propylene rubber (trade marks e.g. Aflas®, Viton extreme®)	FEPM
FFKM	Perfluoro rubber (previously FFKM; trade marks e.g. Chemraz®, Kalrez®)	FFKM
FKM	Fluoro rubber (previously FPM; trade mark e.g. Viton®)	FKM
HNBR	Hydrogenated acrylonitrile-butadiene rubber (trade marks e.g. Therban®, Zetpol®)	HNBR
HPM™	Bearing material made of PTFE, reinforced with full-length, high-strength coiled fibers, encapsulated in high-strength epoxy resin	HPM™
NBR	Acrylonitrile-butadiene rubber (trade mark e.g. Buna N®)	NBR
NR	Natural rubber	NR
PE	Polyethylene	PE
PFA	Perfluoroalkoxy (trade marks e.g. Teflon®, Symalit®, Hyflon®)	PFA
PTFE	Polytetrafluoroethylene (trade mark e.g. Teflon®)	PTFE
PU / PUR	Polyurethane	PU / PUR
SBR	Styrene-butadiene rubber (trade marks e.g. Buna S®, Solprene®)	SBR
SiSiC	Reaction-bonded, silicium-infiltrated silicon carbide with extreme abrasion resistance	SiSiC
TC	Tungsten carbide (normally bonded e.g. with 6% nickel = TC-6N)	TC

9.5 Type code table

The following type code table can be used to identify your pump version.

Observe the additional descriptions in the delivery note, invoice or data sheet for special variations that are not included in the type code.

The letter **X** at any position of the type code indicates that your pump is equipped with a special part at this position, for instance a part made from a different material than those listed in our regular type code.

To facilitate the quick and accurate ordering of spare parts, record the necessary details and all modifications to the pump equipment in the space provided at the end of the type code table. Always indicate any modifications explicitly on every spare part order.

Type code	1 Equipment group	2 Type	3 Size	4 Gear design	5 Drive shafts	6 Flow direction	7 Lip seals, inner rings	8 Casing	9 Casing protection plates	10 Casing liners	11 Holding bushes	12 Mechanical seals	13 Rotors / blades	14 Rotor / blade material	15 O-rings	16 Flange seals	17 Mounting position	18 Series index	19 Special equipment
1-3 Pump type																			
Classic AL 25	P	A	2															4	
Classic AL 50	P	A	5															4	
Classic AL 75	P	A	7															4	
Classic / Select PL 100	P	P	1															5	
Classic / Select PL 200	P	P	2															5	
Classic / Select PL 300	P	P	3															5	
Classic / Select PL 400	P	P	4															5	
Classic / Select CL 260	P	C	2															5	
Classic / Select CL 390	P	C	3															5	
Classic / Select CL 520	P	C	5															5	
Classic / Select FL 518	P	F	5															4	
Classic / Select FL 776	P	F	7															4	
Classic / Select FL 1036	P	F	1															4	
Classic FLA 518	P	L	5															4	
Classic FLA 776	P	L	7															4	
Classic FLA 1036	P	L	1															4	
Classic FLA 1540	P	L	4															4	
Classic FLA 2072	P	L	2															4	
Classic EL 1000	P	E	0															1	
Classic EL 1550	P	E	1															1	
Classic EL 2250	P	E	2															1	
Classic EL 3050	P	E	3															1	
Classic XL 1760	P	X	1															1	
Classic XL 2650	P	X	2															1	
Classic XL 3530	P	X	3															1	
Protect PL 100	P	D	1															1	
Protect PL 200	P	D	2															1	
Protect PL 300	P	D	3															1	
Protect PL 400	P	D	4															1	
Protect FL 518	P	G	5															1	
Protect FL 776	P	G	7															1	
Protect FL 1036	P	G	1															1	
4 Gear design (bearing)																			
Standard				S															
ATEX				A															
Reinforced bearing				V															
5 Drive shafts (design, position, material)																			
1x drive shaft, cylindrical with keyway, pos. 0, steel					A														
1x drive shaft, cylindrical with keyway, pos. 1, steel					B														
2x drive shaft, cylindrical with keyway, pos. 0 and 1, steel					C														
2x drive shaft with PTO profile 1½", 6 tooth, pos. 0 and 1, steel					D														
1x drive shaft with PTO profile 1½", 6 tooth, pos. 0, steel					E														
1x drive shaft with PTO profile 1½", 6 tooth, pos. 1, steel					F														
2x drive shaft with PTO profile 1½", 20 tooth, pos. 0 and 1, steel					G														
1x drive shaft with PTO profile 1½", 20 tooth, pos. 0, steel					H														
1x drive shaft with PTO profile 1½", 20 tooth, pos. 1, steel					I														
1x hollow drive shaft, cylindrical with parallel key, pos. 0, steel					J														
1x hollow drive shaft, cylindrical with parallel key, pos. 1, steel					K														
1x hollow drive shaft with PTO profile 1½", 6 tooth, pos. 0, steel					L														
1x hollow drive shaft with PTO profile 1½", 6 tooth, pos. 1, steel					M														
1x drive shaft, cylindrical with keyway, pos. 0, stainless steel					N														
1x drive shaft, cylindrical with keyway, pos. 1, stainless steel					O														
2x drive shaft with PTO profile 1½", 6 tooth, pos. 0 and 1, steel					P														
1x drive shaft with PTO profile 1½", 6 tooth, pos. 0, steel					Q														
1x drive shaft with PTO profile 1½", 6 tooth, pos. 1, steel					R														

Type code	1 Equipment group	2 Type	3 Size	4 Gear design	5 Drive shafts	6 Flow direction	7 Lip seals, inner rings	8 Casing	9 Casing protection plates	10 Casing liners	11 Holding bushes	12 Mechanical seals	13 Rotors / blades	14 Rotor / blade material	15 O-rings	16 Flange seals	17 Mounting position	18 Series index	19 Special equipment
1x drive shaft with spline profile according to former DIN 5482, pos. 0, steel					S														
1x drive shaft with spline profile according to former DIN 5482, pos. 1, steel					T														
6 Flow direction																			
From left to right (when looking at the quick-release cover)						A													
From right to left (when looking at the quick-release cover)						B													
Reversible																			
7 Lip seals, inner rings																			
Classic NBR / steel							C												
Classic FKM / steel							I												
Classic NBR / stainless steel							E												
Classic FKM / stainless steel							J												
Classic magnet-activated bearing isolator							M												
Classic PTFE / steel							P												
Select NBR / steel							R												
Select FKM / steel							S												
Select PTFE / steel							T												
8 Pump casing																			
Gray cast iron, standard								A											
Gray cast iron, nitrite hardened								B											
Spheroidal cast iron, laser hardened								C											
Stainless steel								D											
Stainless steel, plasma hardened								E											
Gray cast iron, with radial MIP liners								F											
Gray cast iron, with radial MIP liners								I											
Special steel casting								J											
Special steel casting, with radial MIP liners								K											
Gray cast iron, standard, Select								N											
Stainless steel, Select								O											
Gray cast iron, with radial MIP liners, Select								R											
Stainless steel, with radial MIP liners, Select								S											
9 Casing protection plates																			
Hard metal								A											
Stainless steel								B											
Hard metal, with fiber barrier edge								C											
Stainless steel, 1.4539								I											
Hard metal (special version for fiber barrier)								D											
Stainless steel (special version for fiber barrier)								E											
Ceramic								F											
Ceramic coated								G											
Stainless steel, plasma hardened								H											
Longlife ceramic composite								K											
10 Casing liners																			
Hard metal									A										
Stainless steel									B										
Stainless steel, 1.4539									C										
Ceramic									D										
Without									E										
Stainless steel, plasma hardened									H										
11 Holding bushes																			
Steel, standard										A									
Stainless steel										B									
Steel, hardened										C									
Stainless steel, 1.4539										D									

Type code	1 Equipment group	2 Type	3 Size	4 Gear design	5 Drive shafts	6 Flow direction	7 Lip seals, inner rings	8 Casing	9 Casing protection plates	10 Casing liners	11 Holding bushes	12 Mechanical seals	13 Rotors / blades	14 Rotor / blade material	15 O-rings	16 Flange seals	17 Mounting position	18 Series index	19 Special equipment
Steel, flushing bore											E								
Stainless steel, flushing bore											F								
Hardened steel, fiber barrier, dependent on the direction of rotation											G								
Stainless steel, fiber barrier, dependent on the direction of rotation											H								
Hardened steel, fiber barrier, independent of the direction of rotation											I								
Stainless steel, fiber barrier, independent of the direction of rotation											J								
MultiSeal K											K								
Protect PL stainless steel											L								
Protect PL stainless steel 1.4539											M								
12 Mechanical seals																			
Mechanical seal: seal faces chilled cast iron, O-rings: NBR												A							
Mechanical seal: seal faces chilled cast iron, O-rings: EPDM												B							
Mechanical seal: seal faces chilled cast iron, O-rings: FKM												C							
Mechanical seal: seal faces chilled cast iron, O-rings: FEPM												D							
Mechanical seal: seal faces chilled cast iron, O-rings: EPDM (FDA)												L							
Mechanical seal: seal faces chilled cast iron, O-rings: FFKM												Y							
Mechanical seal: seal faces SiSiC/SiSiC, O-rings: NBR												E							
Mechanical seal: seal faces SiSiC/SiSiC, O-rings: EPDM												F							
Mechanical seal: seal faces SiSiC/SiSiC, O-rings: FKM												G							
Mechanical seal: seal faces SiSiC/SiSiC, O-rings: FEPM												J							
Mechanical seal: seal faces SiSiC/SiSiC, O-rings: FFKM												Z							
Mechanical seal: seal faces SiSiC/SiSiC, O-rings: EPDM (FDA)												M							
Mechanical seal: seal faces tungsten carbide, O-rings: NBR												R							
Mechanical seal: seal faces tungsten carbide, O-rings: EPDM												S							
Mechanical seal: seal faces tungsten carbide, O-rings: FKM												T							
Mechanical seal: seal faces tungsten carbide, O-rings: FEPM												U							
Double-acting mechanical seal, O-rings: FKM												P							
Double-acting mechanical seal, O-rings: EPDM												O							
Double-acting mechanical seal, O-rings: FFKM												N							
Double-acting mechanical seal, O-rings: FFKM/FKM												Q							
Special seal (e.g. MultiSeal)												X							
13 Rotor design																			
Rotors:																			
Dual-lobe, linear													A						
Tri-lobe, linear													B						
Dual-lobe, linear, readjustable													C						
Tri-lobe, screw profile, elastomer coated													D						
Tri-lobe, linear, MIP lobe tips													E						
Tri-lobe, linear, MIP lobe tips, stainless steel rotor body													F						
Tri-lobe, screw profile, MIP lobe tips													G						
Tri-lobe, screw profile, MIP lobe tips, stainless steel rotor body													H						
Dual-lobe, screw-profile, Optimum rotors													I						
Dual-lobe, Premium rotors													J						
Dual-lobe, Premium profile rotors (version 1)													K						
Dual-lobe, Premium profile rotors (version 2)													L						
Tri-lobe, linear, MIP lobe tips, rotor body hardened													M						
Tri-lobe, screw profile, MIP lobe tips, rotor body hardened													N						
Dual-lobe, Premium profile rotors with V-shaped arranged grooves, MIP lobe tips													O						
14 Rotor material																			
Rotor material																			
NR/SBR														A					
NBR														C					
EPDM														D					

Type code	1 Equipment group	2 Type	3 Size	4 Gear design	5 Drive shafts	6 Flow direction	7 Lip seals, inner rings	8 Casing	9 Casing protection plates	10 Casing liners	11 Holding bushes	12 Mechanical seals	13 Rotors / blades	14 Rotor / blade material	15 O-rings	16 Flange seals	17 Mounting position	18 Series index	19 Special equipment
FKM														I					
PUR														P					
Stainless steel, 1.4404														E					
Steel 1.7225, tempered														S					
PTFE														T					
CSM														H					
Stainless steel, 1.4539														J					
NBR, light-colored														K					
EPDM, light-colored														L					
H-NBR														M					
15 O-rings, static																			
NBR															C				
EPDM															D				
FKM															I				
FEPM															J				
FFKM															Z				
FEP/FKM															T				
EPDM (FDA)															L				
16 Flange seals																			
NBR																C			
EPDM																D			
FKM																I			
PTFE base																T			
17 Mounting position																			
Standing pump, feet downwards (M1)																	1		
Pump vertically positioned, cover downwards, feet at the side (M2)																	2		
Pump upside-down, feet upwards (M3)																	3		
Pump turned 90° to the left, feet to the right* (M5)																	5		
Pump turned 90° to the right, feet to the left* (M6)																	6		
* when looking at the quick-release cover																			
18 Series index																			
See above																		see above	
19 Special equipment																			
Seal monitoring / conductivity measurement in intermediate chamber																			D
Temperature monitoring / temperature sensor in the casing cover																			Z
Variocap as integrated overpressure protection																			V
Quick-release cover with shaft support (integrated slide bearing)																			G
Other special equipment or more than one optional extra																			X

Modification	Date	Reason	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

9.6 Parallel keys

The following parallel key lengths must be adhered to and checked when replacing rotors on the PL pump series (Classic, Select, Protect).



Notice

Imprecise parallel key lengths can lead to misalignment of the rotating holding bush and can cause mechanical damage to the pump or to the complete unit.

Position:	Rotors:	Parallel key dimensions / article no.				
		PL 100:	PL 200:	PL 300:	PL 400:	
9.4 Type A	Dual-lobe, linear, polymers	14 x 9 x 24 mm .55 x .35 x .94" S14339	14 x 9 x 79 mm .55 x .35 x 3.11" S14349	14 x 9 x 134 (70 + 64) mm .55 x .35 x 5.28" (2.76 + 2.52") Z38121+ Z38113	14 x 9 x 190 (100 + 90) mm .55 x .35 x 7.48" (3.94 + 3.54") Z38109+ Z39034	Cover disk integrated
9.5 Type I*	Optimum rotor, dual-lobe, screw profile, polymers					
9.6 Type J*	Premium rotor, dual-lobe, linear, polymers					
9.7 Type D	Screw rotor, tri-lobe, screw profile, polymers					
9.5 Types IS*, IE*	Optimum rotor, dual-lobe, screw profile, steel / stainless steel	14 x 9 x 32 mm .55 x .35 x 1.26" S14325	14 x 9 x 88 mm .55 x .35 x 3.46" Z39069	14 x 9 x 143 (80 + 63) mm .55 x .35 x 5.63" (3.15 + 2.48") Z38118+ Z38115	14 x 9 x 198 (100 + 98) mm .55 x .35 x 7.83" (3.93 + 3.89") Z38109+ Z38106	Cover disk separate
9.6 Types JS, JE	Premium rotor, dual-lobe, linear, steel / stainless steel					
9.8 Type BE	Tri-lobe, linear, stainless steel**					

* not available for PL 400

**special version, see supplementary operating manual

9.7 Checklist for commissioning

This checklist can be used as an additional aid when commissioning a Börger rotary lobe pump. It is not a substitute for careful reading of the operating manual before commissioning the unit.



Customer:		Börger order confirmation no.:	
Machine number:		Type code:	
Your project:		Order number:	
Commissioning date:		Delivery date:	
Test point	Carried out by: (date / signature)	Checked by: (date / signature)	
1 Operating manual and appendices read and understood			
2 Application data and operating parameters according to pump data sheet correspond to application			
3 Base frame fixed correctly to solid, even surface			
4 Coupling alignment within the permitted tolerance, coupling guard attached			
5 Pipes laid correctly on suction and pressure side, pipes fixed and not leaking			
6 Optional safety equipment installed correctly, connected and functions checked			
7 Electrical connections and grounding OK, direction of pump rotation correct			
8 Oil level in drive OK, transport lock removed from breather system (if present)			
9 Oil level in pump gear unit OK; in M2 mounting position: screw plug replaced by breather system			
10 Fluid level in the intermediate chamber of the pump is OK, breather installed in the correct position and open			
11 All valves in pipes opened; check valves installed correctly			
12 Noise and vibration levels normal when drive is switched on			
13 Pipes checked for leaks again with pump switched on			
14 Check made of the flow rate achieved and the pump pressure			
15 Power consumption of drive checked to guarantee correct installation			
16 Maintenance and inspection intervals organized for the machine			

9.8 EC Declaration of Conformity / EC Declaration of Incorporation

EC Declaration of Conformity for complete units:

BÖRGER® BEWEGT WAS	
EG-Konformitätserklärung EC-Declaration of conformity Déclaration de conformité EC EG-Conformiteitsverklaring	
Börger GmbH Benningsweg 24 46325 Borken-Weseke Deutschland	
Hiermit erklären wir, dass die folgenden Produkte: Herewith we declare, that the partly completed machinery described below: Par la présente, nous déclarons ci après que les machines suivantes: Hiermee verklaren wij, dat de navolgende producten:	
Produktbezeichnung: Type of machinery: Nom type: Productomschrijving:	Drehkolbenpumpe Rotary Lobe Pump Pompes à lobes Draaizuigerpomp
Produktlinie: Productline, Ligne de produits, Productlijn:	Classic, Select, Protect
Typenbezeichnungen: Models, Modèles, Typeaanduidingen:	AL, PL, CL, FL, FLA, EL, XL
Seriennummer: Serial numbers, Numéro de série, Serial numbers:	ab / valid as from / valable dès / geldig sinds: 11XX XXXX – 1.X
Baujahr: Year of manufacture, Année de construction, Bouwjaar:	ab / valid as from / valable dès / geldig sinds: 2012
allen einschlägigen Bestimmungen der Richtlinie Maschinen (2006/42/EG) entsprechen. Die Maschinen entsprechen weiterhin allen Bestimmungen der Richtlinien Elektrische Betriebsmittel (2006/95/EG) und Elektromagnetische Verträglichkeit (2004/108/EG) . is complying with all essential requirements of the Machinery Directive (2006/42/EC) . The machinery is also in conformity with the Low Voltage Directive (2006/95/EC) and the EMC Directive (2004/108/EC) . L'ensemble de ces produits sont conformes en tous points à la directive Machine (2006/42/CE) . Nos produits sont également conformes aux directives Basse tension (2006/95/CE) et électromagnétique (2004/108/CE) . aan alle desbetreffende eisen van de machinerichtlijn (2006/42/EG) voldoen. De machines voldoen verder aan alle eisen van de richtlijn Elektrische bedrijfsmiddelen (2006/95/EG) en Elektromagnetische verdraagbaarheid (2004/108/EG) .	
Folgende harmonisierte Normen wurden angewandt: Used European standards: Les normes suivantes ont été harmonisées: Navolgende geharmoniseerde normen zijn van toepassing:	
DIN EN ISO 13857 DIN EN 809 DIN EN 12162	
Name und Adresse des Dokumentationsbevollmächtigten: The person authorised to compile the relevant technical documentation: Nom du rédacteur documentaire et adresse: Naam en Adres van de documentatiegevolmachtigde:	Ansgar Riers – Börger GmbH
Borken-Weseke, 25.04.2013 Datum Date	Alois Börger – Geschäftsführer Unterzeichner und Angaben zum Unterzeichner Authorized subscriber / Signataire et indications concernant le signataire  Unterschrift Signature
Börger GmbH Benningsweg 24 46325 Borken-Weseke GERMANY Tel: +49 10 28 63 31 08-0 www.boerger.de	

EC Declaration of Incorporation for pumps delivered separately:

	
EG-Einbauerklärung EC-Declaration of incorporation Déclaration d'incorporation EC EG-Inbouwverklaring	
<p style="text-align: right;">Bewegt was</p>	
Börger GmbH Benningsweg 24 46325 Borken-Weseke Deutschland	
<p>Hiemit erklären wir, dass die folgenden Produkte:</p> <p>Herewith we declare, that the partly completed machinery described below:</p> <p>Par la présente, nous déclarons ci après que les machines suivantes:</p> <p>Hiermee verklaaren wij, dat de navolgende producten:</p>	
Produktbezeichnung: <small>Type of machinery, Nom, type, Productomschrijving:</small>	Drehkolbenpumpe <small>Rotary Lobe Pump / Pompes à lobes / Draatzuigerpomp</small>
Produktlinie: <small>Productline, Ligne de produits, Productlijn</small>	Classic, Select, Protect
Typenbezeichnungen: <small>Model, Modèles, Types aanduidingen:</small>	AL, PL, CL, FL, FLA, EL, XL
Seriennummer: <small>Serial numbers, Numéros de série, Seriennummer:</small>	ab / valid as from / valable dès / geldig sinds: 11XX XXXX – 1.X
Baujahr: <small>Year of manufacture, Année de construction, Bouwjaar:</small>	ab / valid as from / valable dès / geldig sinds: 2012
<p>den folgenden grundlegenden Anforderungen der Richtlinie Maschinen (2006/42/EG) entsprechen:</p> <p>Anhang I, Artikel 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4 und 1.5.1.</p> <p>is complying with all essential requirements of the Machinery Directive (2006/42/EC)</p> <p>Appendix I, Article 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4 and 1.5.1.</p> <p>L'ensemble de ces produits sont conformes en tous points à la directive Machine (2006/42/CE).</p> <p>Ainsi qu'aux articles 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4, et 1.5.1.</p> <p>voltoet aan de navolgende fundamentele eisen machinerichtlijn (2006/42/EG):</p> <p>Bijlage I, Artikel 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4 en 1.5.1.</p>	
<p>Die unvollständige Maschine entspricht weiterhin allen Bestimmungen der Richtlinien Elektrische Betriebsmittel (2006/95/EG) und Elektromagnetische Verträglichkeit (2004/108/EG).</p> <p>The partly completed machinery is also in conformity with the Low Voltage Directive (2006/95/EC) and the EMC Directive (2004/108/EC).</p> <p>Nos produits sont également conformes aux directives Basse tension (2006/95/CE) et électromagnétique (2004/108/CE).</p> <p>De niet complete machine voldoet verder aan alle bepalingen van de richtlijn Elektrische bedrijfsmiddelen (2006/95/EG) en Elektromagnetische verdraagbaarheid (2004/108/EG).</p>	
<p>Die unvollständige Maschine darf erst dann in Betrieb genommen werden, wenn festgestellt wurde, dass die Maschine, in die die unvollständige Maschine eingebaut werden soll, den Bestimmungen der Richtlinie Maschinen (2006/42/EG) entspricht.</p> <p>The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of Directive (2006/42/EC) on machinery, where appropriate, and until the EC Declaration of Conformity according to Annex I A is issued.</p> <p>Cette machine est destinée à être incorporée dans une machine ou à être assemblée avec d'autres machines en vue de constituer une machine à laquelle s'applique la directive machines (2006/42/CE), et qu'elle ne peut fonctionner de manière indépendante.</p> <p>De niet complete machine mag pas dan in bedrijf genomen worden, als vastgesteld is dat de installatie, waarin de niet complete machine ingebouwd en opgenomen wordt, aan de bepalingen van de machinerichtlijn (2006/42/EG) voldoet.</p>	
<p>Der Hersteller verpflichtet sich, die speziellen Unterlagen zur unvollständigen Maschine einzelstaatlichen Stellen auf Verlangen elektronisch zu übermitteln.</p> <p>We commit to transmit, in response to a reasoned request by the market surveillance authorities, relevant documents on the partly completed machinery by our documentation department.</p> <p>Il est rappelé que la réglementation interdit la mise en service de la machine ou de l'élement concerné avant que la machine dans laquelle elle sera incorporée n'ait été déclarée conforme aux dispositions de la directive européenne 98/37/CE.</p> <p>De fabrikant verplicht zich, de specifieke bescheiden voor niet complete machines op verzoek van de rijksoverheid aan deze elektronisch te verstrekken.</p>	
<p>Die zur Maschine gehörenden speziellen technischen Unterlagen nach Anhang VII Teil B wurden erstellt.</p> <p>The related technical documentation according to Appendix VI: Part B has been made.</p> <p>Documentation de l'Annexe VII Part B.</p> <p>De bij de machine behorende specifieke bescheiden worden conform bijlage VII deel B aangeleverd.</p>	
Name und Adresse des Dokumentationsbevollmächtigten: <small>The person authorised to compile the relevant technical documentation:</small> <small>Nom du rédacteur documentaire et adresse:</small> <small>Naam en Adres van de documentatiebevoegdigde:</small>	Ansgar Riers - Börger GmbH
Borken-Weseke, 25.04.2013 Datum <small>Date</small>	Alois Börger – Geschäftsführer Untersigner und Angaben zum Untersigner <small>Authorized subscriber / Signataire et indications concernant le signataire</small>
 Unterschrift <small>Signature</small>	
<p>Börger GmbH Benningsweg 24 46325 Borken-Weseke GERMANY Tel: +49 (0) 25 62 791 03-0 www.boerger.de</p>	

9.9 Additional documentation

The **lubricant list** in the appendix is part of the operating manual.

- Follow the instructions.

Further, separate **supplementary operating manuals** for special versions are also part of this operating manual.

- Follow the instructions.

9.10 Supplier documentation

- You must completely read the separate supplier documentation and consider it accordingly to prevent damage to the equipment.



Lubricants

1 Area of validity

Unless subject to special agreements, this lubricant list is part of the operating manual and applies to all standard Børger pump versions and macerating units for industrial and agricultural use.

Deviations can be agreed upon individually for special applications. In such cases, only the agreement applies instead of this lubricant list.

On delivered drives, the corresponding operating manual and lubricant list from the drive manufacturer applies.

2 Børger gear units

2.1 Oil quality

Only CLP-quality oils containing active substances for improving corrosion protection and aging resistance and reducing wear in gear units according to DIN 51517 (part 3) are permitted for use in Børger gear units.

Additionally, the gear oils must also meet the following quality requirements:

- Suitable for lip seal material and gear casing material
- Compatible with residual oil originally used by the manufacturer
- Sufficient viscosity for the relevant temperature range

**Notice****Risk of material damage and loss of warranty when using low-quality lubricants!**

The oil classification and viscosity must be adhered to according to the factory-supplied lubricant specified in the data sheet. The lubricants used must meet the quality standards as detailed above.

Otherwise, the warranty supplied by Börger GmbH is void. Deviations are only permitted following consultation with Börger GmbH.

If the actual operating conditions on or after commissioning deviate from those specified in the order, then a change of lubricant must be considered. Any such actions must be approved by Börger GmbH.

Lubricants suitable for use in Börger gear units are listed in the table in chapter 5.1. However, the lubricant manufacturers are solely liable for the suitability and quality of their products.

According to the manufacturer's specifications, the listed lubricants are available globally in compliance with the necessary quality.

2.2 Oil change

The purity of the lubricant influences the service life of the oil and gear unit, plus general operating safety.

Therefore, always ensure that the gear unit contains clean oil.

Instructions for changing the oil / lubricant contained in the operating manual of the Börger device must be strictly adhered to.

The amount of remaining used oil in the gear unit must be kept **as low as possible**, even when the same oil type is used for the oil change.

**Note**

Gear oils of different types or from different manufacturers must not be mixed together.

When necessary, a confirmation of oil compatibility with the used oil must be obtained from the manufacturer of the new oil.

If the composition of the new oil type deviates greatly from the used oil (e.g. additives), then the used oil must be completely removed from the gear unit. **In this case, the gear unit must be flushed carefully with the new oil.** Gear oils must not become contaminated with other substances, including any residue from cleaning agents (e.g. petrol). Therefore, flushing with petrol or other cleaning agents is not permitted.

3 Börger intermediate chamber

Most Börger devices are equipped with an intermediate chamber as standard. This chamber is filled with an unpressurized fluid. This protective fluid is used for the following:

- Collection of any pumped / flow media that enter the intermediate chamber due to leaks in the mechanical seal (protection of the gear unit against penetration of pumped / flow media)
- Monitoring of the mechanical seal through periodical or continuous determination of the fill level
- Lubrication and cooling of sliding surfaces on the mechanical seal
- Air exclusion (especially important for pumped media that react negatively with air)

Any fluids with good lubricant qualities that do not react with any of the materials they come into contact with are suitable as quench fluids.

Pay attention to compatibility with the residual quench fluid when filling or refilling.

**Notice****Risk of material damage when using wrong lubricants!**

Due to the possibility, though unlikely, of quench fluid entering the pump / cutting chamber and thus intruding on the process itself, the quench fluid must be compatible with the pumped / flow medium in addition to the other materials (O-rings).

In order to rule out damage to the gear unit as comprehensively as possible, even in the exceptional case that quench fluid enters the gear unit (e.g. due to improper maintenance of the gear unit), the quench fluid should also be compatible with the gear oil.

In Börger devices, the quench fluid is:

- **Zinc-free hydraulic oil** as standard, or
- A **synthetic gear or hydraulic oil (CLP / HLP)** on ATEX versions

See table in chapter 5.2.

**Notice****Risk of material damage when using wrong lubricants!**

Versions used for special applications and / or those with special sealing materials (e.g. EPDM), can be filled with special lubricants, such as:

- Castrol Optileb HY 68 (food quality)
- Sugar-dissolving oil (Klüberfood NH 1 6-10)
- Solvents (lacquer)
- Other special lubricants

Filling with these lubricants is approved / tested specifically for the supplied version and is indicated in the data sheet. In such cases, the same quench fluid must be used exclusively when filling or refilling. Otherwise, there is a risk of material damage, which can be significant depending on the application.

4 Oil properties

4.1 Oil classifications

The oil classifications of applicable oils are specified in chapter 5 next to each lubricant.

Observe chapter 3 for details on the intermediate chamber. In certain applications, oil may not be permitted for use as a lubricant.

Explanation of classification according to DIN		
Classification according to DIN 51524-2	HLP	High-performance hydraulic oil (H), with corrosion protection (L) and high-pressure additives (EP)
	C	Can be used as lubricating oil
Classification according to DIN 51517-1 to -3	CL	Circulating oil, C-oil with corrosion protection
	CLP	Industrial gear oil, CL-oil with EP additives (high-pressure additive)
Additional letters according to DIN 51502	HC	Synthetic hydrocarbons

4.2 Operating temperatures

Compared to mineral oils, synthetic oils can be used in a wider operating temperature range, whereupon the temperature-related viscosity deviation is lower (higher viscosity index).

Therefore, only use synthetic, high-quality industrial gear oil in gear units in potentially explosive atmospheres.

Alternatively, a synthetic high-performance hydraulic oil can be used in the intermediate chamber.

We recommend adhering to the following limits for lubricants used in Börger devices:

Mineral oils	up to +80 °C (176 °F)
Hydraulic oil (zinc-free, quench only)	up to +80 °C (176 °F)
Synthetic oils	up to +100 °C (212 °F) (for short periods +110 °C (230 °F))



Note

Special lubricants for higher operating temperatures can be delivered on agreement. In this case, the agreed limits apply.

The specified values are recommended guidelines.

Consult the **technical data sheets of the relevant lubricant manufacturer** for their specified operating temperature ranges and other oil property details.

4.3 Oil service life

The general service life at average temperatures in gear units without a significant change in oil quality is approximately 2 years or 10,000 operating hours.

In potentially explosive atmospheres, an oil change should be made annually or after 8,000 operating hours.

The actual service life can increase or decrease significantly depending on the operating conditions.

Therefore, check the oil level and oil quality on a regular basis.

This also applies to the quench fluid.

5 Oil types

5.1 Applicable lubricants in Börger gear units

Viscosity class 1)	Label / DIN classification			Pour point	Flash point
ISO VG 220	ARAL	Degol BG 220	CLP	-12 °C 10.4 °F	274 °C 525.2 °F
	BP	Energol GR XP 220²⁾		-21 °C -5.8 °F	274 °C 525.2 °F
		Energol GR XP 220	CLP	-36 °C -32.8 °F	270 °C 518 °F
		Energol HTX 220	CLP HC (PAO ⁴⁾)	-21 °C -5.8 °F	226 °C 438.8 °F
	CASTROL	Alpha SP 220	CLP	-45 °C -49 °F	220 °C 428 °F
		Alphasyn T 220	CLP HC (PAO ⁴⁾)	-39 °C -38.2 °F	220 °C 428 °F
		Aphasyn HTX 220³⁾	CLP HC (PAO ⁴⁾)	-24 °C -11.2 °F	255 °C 491 °F
	ESSO	Spartan EP 220	CLP	-10 °C 14 °F	> 200 °C > 392 °F
	Klüber Lubrication	Klüberoil GEM 1-220	CLP	-27 °C -16.6 °F	240 °C 464 °F
	SHELL	Omala Oil F 220	CLP		

¹⁾ i.e. viscosity $\nu = 220 \text{ mm}^2/\text{s}$ (cSt) at 40 °C (104 °F)

²⁾ Börger factory standard, unless agreed otherwise

³⁾ Börger factory standard for ATEX versions and for Protect pumps

⁴⁾ PAO = polyalphaolefin-based fully synthetic base oils

5.2 Applicable lubricants in Börger intermediate chambers



Notice

Risk of material damage when using wrong lubricants!

Check the quench fluid specifications in the data sheet before filling / refilling the intermediate chamber.

Only use a lubricant with the same classification.

When the device was delivered with special lubricants for special applications or seal materials, only use the same fluid as originally applied by the manufacturer. This fluid has been tested for the version. Alternative quench fluids may only be used following consultation with Börger GmbH. Otherwise, there is a risk of material damage, which can be significant depending on the application.

Viscosity class 1)	Label / DIN classification		Pour point	Flash point	
ISO VG 68	ARAL	Vitam GF 68 ²⁾	HLP (only <u>zinc-free!</u>)	-18 °C -0.4 °F	258 °C 496.4 °F
		Degol BG 68	CLP	-30 °C -22 °F	242 °C 467.6 °F
	BP	Energol CS 68	C	-15 °C 5 °F	235 °C 455 °F
		Energol HTX 68	CLP HC (PAO ⁴⁾)	-42 °C -43.6 °F	270 °C 518 °F
	CASTROL	Magna 68	C	-18 °C -0.4 °F	220 °C 428 °F
		Alphasyn T 68	CL HC (PAO ⁴⁾)	-57 °C -70.6 °F	220 °C 428 °F
		Alphasyn HTX 68 ³⁾	CLP HC (PAO ⁴⁾)	-39 °C -38.2 °F	220 °C 428 °F
	ESSO	Nuray 68	C	-18 °C -0.4 °F	230 °C 446 °F
	Klüber Lubrication	Klüberoil GEM 1-68	CLP	-15 °C 5 °F	> 200 °C > 392 °F
	SHELL	Vitrea 68	C	-9 °C 16 °F	223 °C 433.4 °F

¹⁾ i.e. viscosity $\nu = 68 \text{ mm}^2/\text{s}$ (cSt) at 40 °C (104 °F)

²⁾ Börger factory standard, unless agreed otherwise

³⁾ Börger factory standard for ATEX versions

⁴⁾ PAO = polyalphaolefin-based fully synthetic base oils

We reserve the right to make technical alterations. Errors cannot be excluded.

Comparison of Oil Lubricants for Boerger Pumps, Multichoppers, Multicrushers and Rotorrakes



↓ Börger standard lubricants ↓					↓ Equivalent Lubricants from other manufacturers ↓							
Type of Pump	Pump Chamber	Mfr & Type of Lubricant	DIN Classification	Application	BP	Castrol	Chevron	Grainger	Klüber Lubrication	Lubriplate	Mobil	Shell
Standard Pumps (1) (2)	Gear:	BP Energol GR XP 220	CLP (mineral oil) DIN 51517	Standard lubricant for gear units	BP Energol GR XP 220	Castrol Alpha SP 220	Chevron Meropa 220	Grainger #4DNH4 (5 gal.) (Mobilgear 600 XP 220)	Klüberoil GEM 1-220 N	N/A	*Mobilgear 600 XP 220	Shell Omala S2 G 220
	Inter-mediate:	Aral Vitam GF 68	HLP (hydraulic oil) DIN 51524	Quench liquid, zinc-free HLP	BP Bartran HV 68 (zinc-free HLP)	Castrol Hyspin ZZ 68 (zinc-free HLP)	Chevron Clarity Hydraulic Oil AW 68 (zinc free HLP)	Grainger #2NMW4 (5 gal.) #2NMW3 (1 gal.) (Bio-Ultimax 1000) Also Grainger #21A471 (5 gal.) (Bio-Fleet Hydraulic Fluid)	N/A	Lubriplate ZF 68 (zinc-free HLP)	Mobil DTE 10 Excel 68 (zinc-free HLP) * Formerly Mobilgear 630	Shell Tellus S3 M 68** (zinc-free HLP) ** Formerly Shell Tellus S 68
Pumps w/EPDM Rubber	Gear:	BP Energol GR XP 220	CLP (mineral oil) DIN 51517	Standard lubricant for gear units	BP Energol GR XP 220	Castrol Alpha SP 220	Chevron Meropa 220	Grainger #4DNH4 (5 gal.) (Mobilgear 600 XP 220)	Klüberoil GEM 1-220 N	N/A	Mobilgear 600 XP 220 (Mobilgear 630)	Shell Omala S2 G 220
	Inter-mediate:	BP Enersyn HTX 68	CLP HC (synthetic oil) DIN 51517	Quench - EPDM & ATEX Pumps	BP Enersyn HTX 68	Castrol Alphasyn T 68	Chevron Tegra Syn Comp 68	Grainger #44N755 (1 gal.) (Super Lube Synthetic Ltweight)	Klübersynth GEM 4-68 N	Lubriplate Syn Lube 68	Mobil SHC 626	Shell Omala S4 GX 68
ATEX Pumps	Gear:	BP Enersyn HTX 220	CLP HC (synthetic oil) DIN 51517	Gear lube - ATEX & DPL Series Pumps	BP Enersyn HTX 220	Castrol Alphasyn T 220	Chevron Tegra Syn Gear 220	Grainger #6Y778 (1 quart) (Mobil SHC 630)	Klübersynth GEM 4-220 N	Lubriplate Syn Lube 220	Mobil SHC 630	Shell Omala S4 GX 220
	Inter-mediate:	BP Enersyn HTX 68	CLP HC (synthetic oil) DIN 51517	Quench - EPDM & ATEX Pumps	BP Enersyn HTX 68	Castrol Alphasyn T 68	Chevron Tegra Syn Comp 68	Grainger #44N755 (1 gal.) (Super Lube Synthetic Ltweight)	Klübersynth GEM 4-68 N	Lubriplate Syn Lube 68	Mobil SHC 626	Shell Omala S4 GX 68
DPL / Protect Pumps	Gear:	BP Enersyn HTX 220	CLP HC (synthetic oil) DIN 51517	Gear lube - ATEX & DPL Series Pumps	BP Enersyn HTX 220	Castrol Alphasyn T 220	Chevron Tegra Syn Gear 220	Grainger #6Y778 (1 quart) (Mobil SHC 630)	Klübersynth GEM 4-220 N	Lubriplate Syn Lube 220	Mobil SHC 630	Shell Omala S4 GX 220
	Barrier Fluid:	Refer to pump O & M Manual	Refer to pump O & M Manual	Refer to pump O & M Manual	Refer to pump O & M Manual	Refer to pump O & M Manual	Refer to pump O & M Manual	Refer to pump O & M Manual	Refer to pump O & M Manual	Refer to pump O & M Manual	Refer to pump O & M Manual	Refer to pump O & M Manual
Food Grade Pumps (3)	Gear:	Castrol Optileb GT 220	CLP HC (synthetic oil) DIN 51517	H1 Food Grade Gear Lubricant	N/A	Castrol Optileb GT 220	Chevron Lubricating Oil ISO FM 220	Grainger #6HHA7 (5 gal.) (Mobil SHC Cibus 220)	Klüberoil 4 UH1-220 N	Lubriplate FMO-1100 AW	Mobil SHC Cibus 220	Shell Cassida Fluid GL 220
	Inter-mediate:	Castrol Optileb HY 68 (3)	HLP HC (synthetic oil) DIN 51524 (3)	H1 Food Grade Hydraulic Oil (3)	N/A (3)	Castrol Optileb HY 68 (3)	Chevron Lubricating Oil ISO FM 68 (3)	Grainger #6HHC2 (5 gal.) (Mobil SHC Cibus 68) (3)	Klüberoil 4 UH1-68 N (3)	Lubriplate FMO-350 AW (3)	Mobil SHC Cibus 68 (3)	Shell Cassida Fluid HF 68 (3)
Pumps for Sugar (4)	Gear:	Castrol Optileb GT 220	CLP HC (synthetic oil) DIN 51517	H1 Food Grade Gear Lubricant	N/A	Castrol Optileb GT 220	Chevron Lubricating Oil ISO FM 220	Grainger #6HHA7 (5 gal.) (Mobil SHC Cibus 220)	Klüberoil 4 UH1-220 N	Lubriplate FMO-1100 AW	Mobil SHC Cibus 220	Shell Cassida Fluid GL 220
	Inter-mediate:	Klüberfood NH1 6-10 (4)	CLP HC (food grade synthetic oil) DIN 51757	Quench liquid, sugar dissolving oil	N/A (4)	N/A (4)	N/A (4)	N/A (4)	Klüberfood NH1 6-10 (4)	N/A (4)	N/A (4)	N/A (4)
Alternate Quench Liquids	Inter-mediate:	If switching to (or if pump has) DIN 51517 C-type or CLP-type mineral oil, these lubricants are acceptable (check pump Data Sheet - never mix different oils)			BP Energol CS 68	Castrol Magna 68	Chevron Meropa 68	Grainger #4DNJ9 (1 gal.) or #4DNJ8 (5 gal.) (Mobil DTE Heavy Medium)	Klüberoil GEM 1-68 N	N/A	Mobil DTE Oil Heavy Medium (Ambrex 68)	Shell Vitrea 68
Lubricant Distributor Locators→				http://www.bp.com/loadDistributorLocatorAction.do?categoryId=2200	http://www.castrol.com/castrol/iframe.do?categoryId=9021346&contentId=7038271	http://www.chevron.com/chevron/marketer-locator.aspx	www.grainger.com	http://www.klueber.com/us/en/	http://www.lubriplate.com/locator/index.asp?zipMilesLow=0&zip1=55317&zipMilesHigh=35	http://www.host Exxonmobil.com/channelpartners/ns_distributor_directory.jsp	http://www.shell.us/home/page/usa/products_services/solutions_for_businesses/shell_lubricants_tpkq/distributor_locator/app_distributor_locator.html	

1) Boerger factory standard gear and quench lubricants for Pumps and Multicrushers, when not specified otherwise. Always check the equipment Data Sheet for lubricant types.

2) Boerger factory standard quench lubricants for Multichoppers and Rotorrake, when not specified otherwise. Always check the equipment Data Sheet for lubricant types.

3) For wine pumps, quench liquid is water mixed with food grade glycerin (minimum 30% water to 70% glycerin, maximum 50% water to 50% glycerin).

4) Other sugar dissolving quench liquids for Sugar Pumps are: Fuchs Lubritech FM Sugar Dissolving Fluid; and Lubrimaxx Sugar Dissolving Oil.

NOTE: Lubricants of different types or from different manufacturers must not be mixed together. Refer to equipment Data Sheet and Boerger O & M Manual.

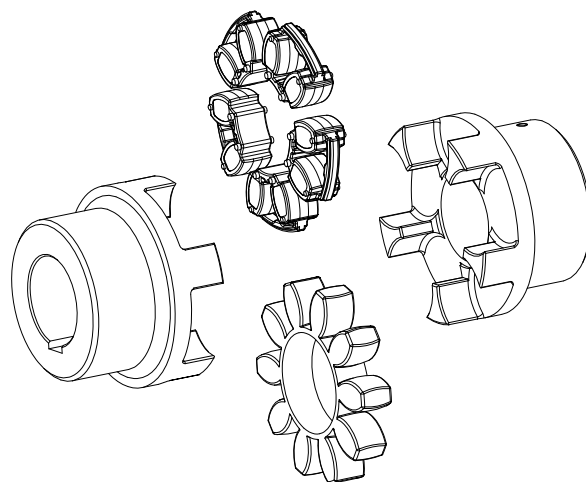


ROTEX®

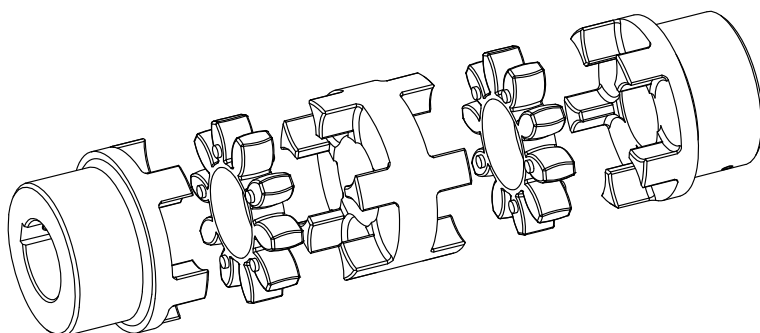
Torsionally flexible jaw-type couplings

No. 001 – shaft coupling,
No. 018 – DKM,
with taper clamping sleeve
and their combinations

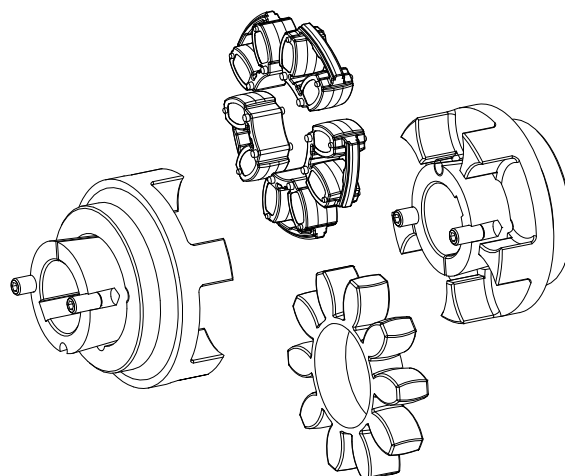
according to directive 94/9/EC
(ATEX 95) for finish bored, pilot bored
and unbored couplings



Type No. 001 – shaft coupling



**Type No. 018 – DKM
double-cardanic coupling**



Type with taper clamping sleeve



1 Technical data

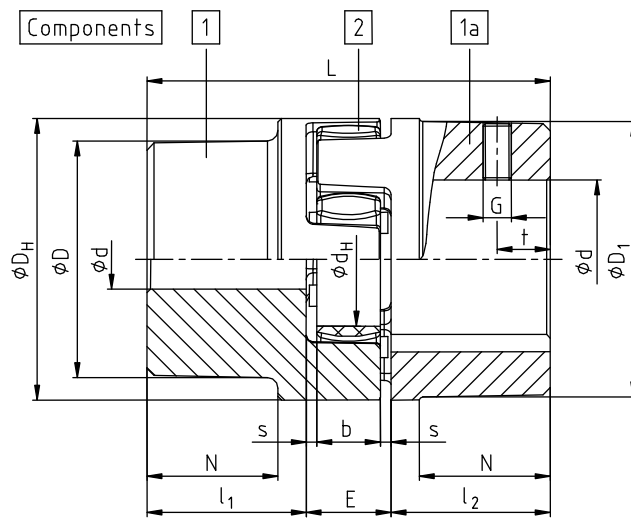


Illustration 1: ROTEX® (material: Al-D)

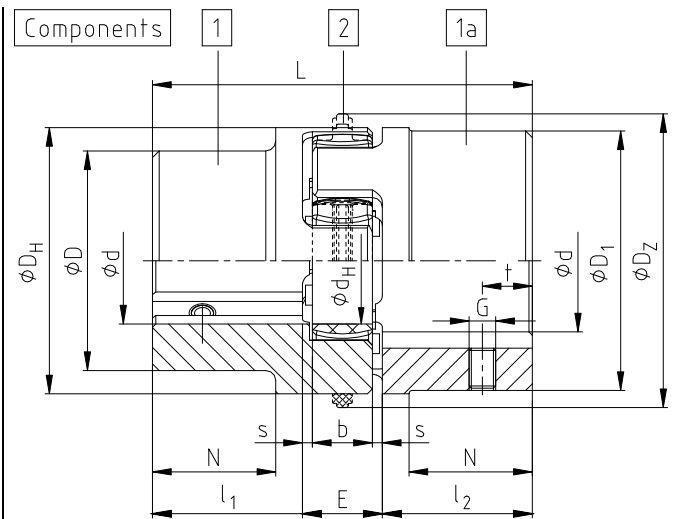


Illustration 2: ROTEX® (material: EN-GJL-250/EN-GJS-400-15)

Table 1: Material Al-D

Size	Com- ponent	Spider ¹⁾ (component 2) rated torque [Nm]			Dimensions [mm] ³⁾											
					Finish bore ²⁾ d (min-max)	General										
		92 Sh A	98 Sh A	64 Sh D		L	l ₁ ; l ₂	E	b	s	D _H	D _Z	D _{Z1} ⁴⁾	d _H	D ₁ D ₁	N
14	1a	7.5	12.5	-	6 - 16	35	11	13	10	1.5	30	-	-	10	30	-
19	1	10	17	-	6 - 19	66	25	16	12	2.0	41	-	-	18	32	20
	1a				19 - 24										41	
24	1	35	60	-	9 - 24	78	30	18	14	2.0	56	-	-	27	40	24
	1a				22 - 28										56	
28	1	95	160	-	10 - 28	90	35	20	15	2.5	67	-	-	30	48	28
	1a				28 - 38										67	

Table 2: Material EN-GJL-250 (GG 25)/EN-GJS-400-15 (GGG 40)

Size	Com- ponent	Spider ¹⁾ (component 2) rated torque [Nm]			Finish bore ²⁾ d (min-max)	Dimensions [mm] ³⁾											
		92 Sh A	98 Sh A	64 Sh D		General											
						L	l ₁ ; l ₂	E	b	s	D _H	D _Z	D _{Z1} ⁴⁾	d _H	D ₁ D ₁	N	
Cast iron EN-GJL-250																	
38	1	190	325	405	12 - 40	114	45	24	18	3.0	80	-	-	38	66	37	
	1a				38 - 48										78		
	1b				12 - 48										70		62
42	1	265	450	560	14 - 45	126	50	26	20	3.0	95	-	-	46	75	40	
	1a				42 - 55										94		
	1b				14 - 55										75		65
48	1	310	525	655	15 - 52	140	56	28	21	3.5	105	-	-	51	85	45	
	1a				48 - 62										104		
	1b				15 - 62										80		69
55	1	410	685	825	20 - 60	160	65	30	22	4.0	120	-	-	60	98	52	
	1a				55 - 74										118		
65	1	625	940	1175	22 - 70	185	75	35	26	4.5	135	-	-	68	115	61	
75	1	1280	1920	2400	30 - 80	210	85	40	30	5.0	160	-	-	80	135	69	
90	1	2400	3600	4500	40 - 97	245	100	45	34	5.5	200	218	230	100	160	81	
Nodular iron EN-GJS-400-15																	
100	1	3300	4950	6185	50 - 115	270	110	50	38	6.0	225	246	260	113	180	89	
110	1	4800	7200	9000	60 - 125	295	120	55	42	6.5	255	276	290	127	200	96	
125	1	6650	10000	12500	60 - 145	340	140	60	46	7.0	290	315	330	147	230	112	
140	1	8550	12800	16000	60 - 160	375	155	65	50	7.5	320	345	360	165	255	124	
160	1	12800	19200	24000	80 - 185	425	175	75	57	9.0	370	400	415	190	290	140	
180	1	18650	28000	35000	85 - 200	475	185	85	64	10.5	420	450	465	220	325	156	

1) Maximum torque of the coupling $T_{Kmax.}$ = rated torque of the coupling $T_{K rated} \times 2$

2) Bores H7 with keyway to DIN 6885 sheet 1 [JS9] and thread for setscrew

3) For dimensions G and t see table 6; threads for setscrews are located opposite the keyway with material Al-D and on the keyway with material EN-GJL-250/EN-GJS-400-15

4) D_{Z1} = internal diameter of housing

Please observe protection note ISO 16016.	Drawn:	28.11.13 Pz/Bru	Replaced for:	KTR-N dated 30.10.12
	Verified:	06.12.13 Pz	Replaced by:	



1 Technical data

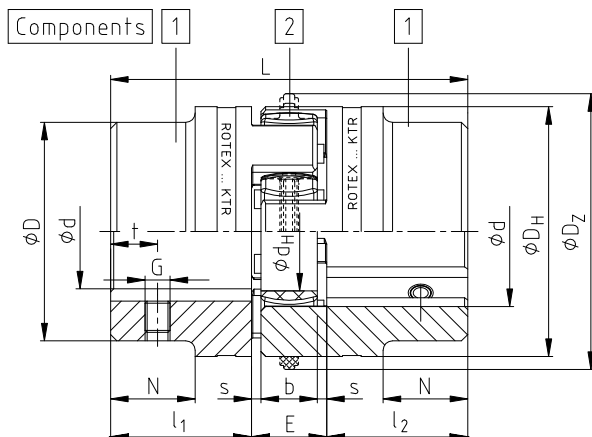


Illustration 3: ROTEX® (material: steel)

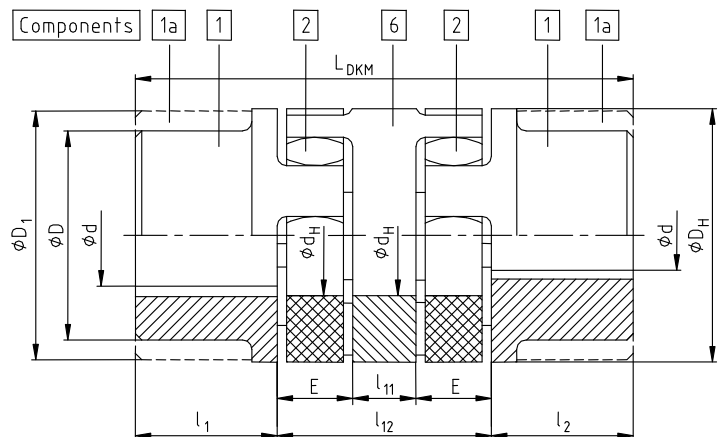


Illustration 4: ROTEX®, type DKM ⁵⁾

Table 3: Material steel

Size	Com- ponent	Spider ¹⁾ (component 2) rated torque [Nm]			Finish bore ²⁾ d (min-max)	Dimensions [mm] ³⁾										
		92 Sh A	98 Sh A	64 Sh D		General										
						L	l ₁ ; l ₂	E	b	s	D _H	D _Z	D _{Z1} ⁴⁾	d _H	D	N
14	1a	7.5	12.5	16	0 - 16	35	11	13	10	1.5	30	-	-	10	30	-
	1b					50	18.5									
19	1a	10	17	21	0 - 25	66	25	16	12	2.0	40	-	-	18	40	-
	1b					90	37									
24	1a	35	60	75	0 - 35	78	30	18	14	2.0	55	-	-	27	55	-
	1b					118	50									
28	1a	95	160	200	0 - 40	90	35	20	15	2.5	65	-	-	30	65	-
	1b					140	60									
38	1	190	325	405	0 - 48	114	45	24	18	3.0	80	-	-	38	70	27
	1b					164	70								80	-
42	1	265	450	560	0 - 55	126	50	26	20	3.0	95	-	-	46	85	28
	1b					176	75								95	-
48	1	310	525	655	0 - 62	140	56	28	21	3.5	105	-	-	51	95	32
	1b					188	80								105	-
55	1	410	685	825	0 - 74	160	65	30	22	4.0	120	-	-	60	110	37
	1b					210	90								120	-
65	1	625	940	1175	0 - 80	185	75	35	26	4.5	135	-	-	68	115	47
	1b					235	100								135	-
75	1	1280	1920	2400	0 - 95	210	85	40	30	5.0	160	-	-	80	135	53
	1b					260	110								160	-
90	1	2400	3600	4500	0 - 110	245	100	45	34	5.5	200	218	230	100	160	62
	1b					295	125								200	-

Table 4: Type DKM ⁵⁾

Size	Spider ¹⁾ (component 2) rated torque [Nm]		Dimensi- ons d, D, D ₁	Dimensions [mm] ³⁾								
	92 Sh A	98 Sh A		General								
				L _{DKM}	l ₁ ; l ₂	E	b	s	D _H	d _H	l ₁₁	l ₁₂
19	10	17	see table 1 to 3	92	25	16	12	2.0	40	18	10	42
24	35	60		112	30	18	14	2.0	55	27	16	52
28	95	160		128	35	20	15	2.5	65	30	18	58
38	190	325		158	45	24	18	3.0	80	38	20	68
42	265	450		174	50	26	20	3.0	95	46	22	74
48	310	525		192	56	28	21	3.5	105	51	24	80
55	410	685		218	65	30	22	4.0	120	60	28	88
65	625	940		252	75	35	26	4.5	135	68	32	102
75	1280	1920		286	85	40	30	5.0	160	80	36	116
90	2400	3600		330	100	45	34	5.5	200	100	40	130

1) Maximum torque of the coupling $T_{Kmax.}$ = rated torque of the coupling $T_{K rated}$ x 2

2) Bores H7 with keyway to DIN 6885 sheet 1 [JS9] and thread for setscrew

3) For dimensions G and t see table 6; threads for setscrews are located opposite the keyway with material Al-D and on the keyway with material EN-GJL-250/EN-GJS-400-15

4) D_{Z1} = internal diameter of housing

5) Type DKM not available with DZ elements.

Please observe protection note ISO 16016.	Drawn:	28.11.13 Pz/Bru	Replaced for:	KTR-N dated 30.10.12
	Verified:	06.12.13 Pz	Replaced by:	



1 Technical data

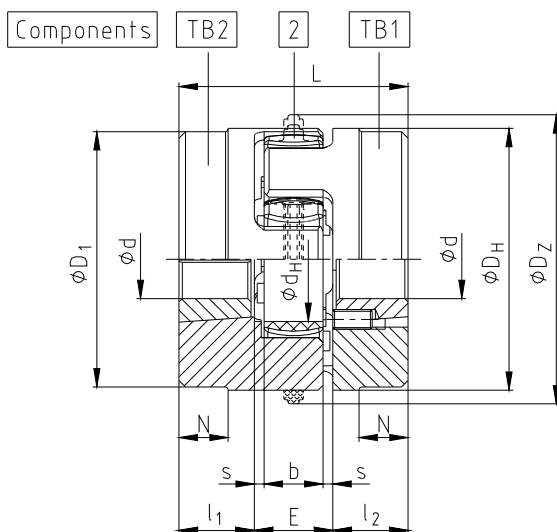


Illustration 5: ROTEX®, type with taper clamping sleeve

Coupling design:

TB1 Screwing on cam side

TB2 Screwing on collar side

Different combinations of types TB1 and TB2 are possible.

Table 5: Type with taper clamping sleeve

Size	Com- ponent	Spider ¹⁾ (component 2) rated torque [Nm]		Dimensions [mm]												Taper clam- ping sleeve
				Finish bore d (min-max)	General											
		92 Sh A	98 Sh A		L	l ₁ ; l ₂	E	b	s	D _H	D _Z	D _{Z1} ²⁾	d _H	D ₁	N	
24	1a	35	60	10 - 25	64	23	18	14	2.0	55	-	-	27	-	-	1008
28	1a	95	160	10 - 25	66	23	20	15	2.5	65	-	-	30	-	-	1108
38	1a	190	325	10 - 25	70	23	24	18	3.0	80	-	-	38	78	15	1108
42	1a	265	450	14 - 25	78	26	26	20	3.0	95	-	-	46	94	16	1610
48	1a	310	525	14 - 40	106	39	28	21	3.5	105	-	-	51	104	28	1615
55	1a	410	685	14 - 50	96	33	30	22	4.0	120	-	-	60	118	20	2012
65	1	625	940	14 - 50	101	33	35	26	4.5	135	-	-	68	115	5	2012
75	1	1280	1920	16 - 60	144	52	40	30	5.0	160	-	-	80	158	36	2517
				25 - 75												3020 ³⁾
90	1	2400	3600	25 - 75	149	52	45	34	5.5	200	218	230	100	160	14	3020
100	1	3300	4950	35 - 90	230	90	50	38	6.0	225	246	260	113	180	69	3535
125	1	6650	10000	55 - 110	288	114	60	46	7.0	290	315	330	147	230	86	4545

1) Maximum torque of the coupling $T_{Kmax.}$ = rated torque of the coupling $T_{K rated} \times 2$

2) D_{Z1} = internal diameter of housing

3) Available for type TB2 only



**ROTEX® couplings with attachments that can generate heat, sparks and static charging (e. g. combinations with brake drums, brake disks, overload systems like torque limiters, fans etc.) are not permitted for the use in hazardous areas.
A separate analysis must be performed.**



2 Advice

2.1 Coupling selection



CAUTION!

For a long-lasting and failure-free operation of the coupling it must be selected according to the selection instructions (according to DIN 740 part 2) for the particular application (see ROTEX® catalogue).

If the operating conditions (performance, speed, modifications on engine and machine) change, the coupling selection must be reviewed again.

Please make sure that the technical data regarding torque refer to the spider only. The transmittable torque of the shaft/hub connection must be reviewed by the customer and is subject to his responsibility.

For drives subject to torsional vibrations (drives with cyclic stress due to torsional vibrations) it is necessary to perform a torsional vibration calculation to ensure a reliable selection. Typical drives subject to torsional vibrations are e. g. drives with diesel engines, piston pumps, piston compressors etc. If requested, KTR will perform the coupling selection and the torsional vibration calculation.

2.2 General advice

Please read through these assembly instructions carefully before you start up the coupling. Please pay special attention to the safety instructions!



The **ROTEX®** coupling is suitable and approved for the use in hazardous areas. When using the coupling in hazardous locations please observe the special advice and instructions regarding safety in enclosure A.

The assembly instructions are part of your product. Please keep them carefully and close to the coupling. The copyright for these assembly instructions remains with **KTR Kupplungstechnik GmbH**.

2.3 Safety and advice symbols



DANGER!

Danger of injury to persons.



CAUTION!

Damages on the machine possible.



ATTENTION!

Pointing to important items.



WARNING!

Hints concerning explosion protection.



2 Advice

2.4 General hazard warnings



DANGER!

With assembly, operation and maintenance of the coupling it has to be made sure that the entire drive train is secured against accidental switch-on. You may be seriously hurt by rotating parts. Please make absolutely sure to read through and observe the following safety indications.

- All operations on and with the coupling have to be performed taking into account "safety first".
- Please make sure to switch off the power pack before you perform your work on the coupling.
- Secure the power pack against accidental switch-on, e. g. by providing warning signs at the place of switch-on or removing the fuse for current supply.
- Do not touch the operation area of the coupling as long as it is in operation.
- Please secure the coupling against accidental contact. Please provide for the necessary protection devices and covers.

2.5 Intended use

You may only assemble, operate and maintain the coupling if you

- have carefully read through the assembly instructions and understood them
- had technical training
- are authorized by your company

The coupling may only be used in accordance with the technical data (see table 1 to 5 in chapter 1). Unauthorized modifications on the coupling design are not admissible. We will not assume liability for any damage that may arise. In the interest of further development we reserve the right for technical modifications.

The **ROTEX®** described in here corresponds to the technical status at the time of printing of these assembly instructions.

3 Storage

The coupling hubs are supplied in preserved condition and can be stored at a dry and covered place for 6 - 9 months.

The features of the coupling spiders (elastomers) remain unchanged for up to 5 years with favourable stock conditions.



CAUTION!

The storage rooms may not include any ozone-generating devices like e. g. fluorescent light sources, mercury-vapour lamps or electrical high-voltage appliances.

Humid storage rooms are not suitable.

Please make sure that condensation is not generated. The best relative air humidity is less than 65 %.

4 Assembly

Generally the coupling is supplied in individual parts. Before assembly the coupling has to be inspected for completeness.

Please observe protection note ISO 16016.	Drawn: 28.11.13 Pz/Bru	Replaced for: KTR-N dated 30.10.12
	Verified: 06.12.13 Pz	Replaced by:



4 Assembly

4.1 Components of the couplings

Components of ROTEX®, shaft coupling type No. 001

Component	Quantity	Description
1	2	Hub
2	1	Spider ¹⁾
3	5 ²⁾	DZ elements ¹⁾
4	2	Setscrews DIN EN ISO 4029

1) Optionally spider or DZ elements

2) With size 180 the quantity is 6.

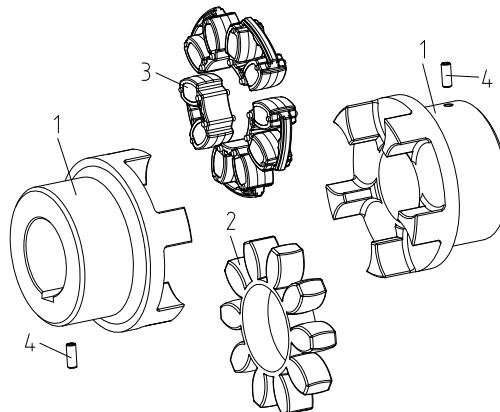


Illustration
6: ROTEX®

Components of ROTEX®, type DKM ¹⁾

Component	Quantity	Description
1	2	Hub
2	2	Spider
3	1	DKM spacer
4	2	Setscrews DIN EN ISO 4029

1) Type DKM not available with DZ elements.

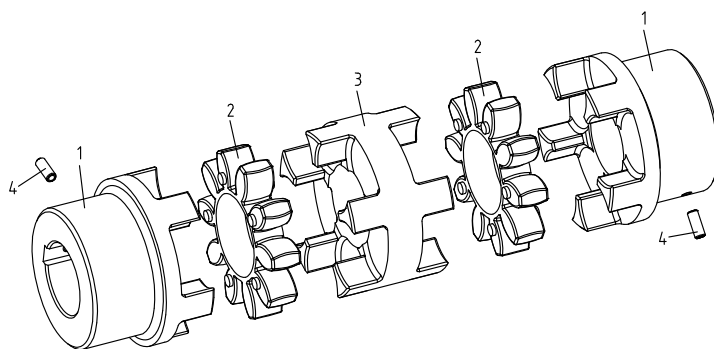


Illustration 7: ROTEX® DKM

Components of ROTEX®, type with taper clamping sleeve

Component	Quantity	Description
TB1/TB2	2	hub for taper clamping sleeve
1	2	taper clamping sleeve
2	1	Spider ¹⁾
3	5 ²⁾	DZ elements ¹⁾
4	4	Setscrews DIN EN ISO 4029

1) Optionally spider or DZ elements

2) With size 180 the quantity is 6.

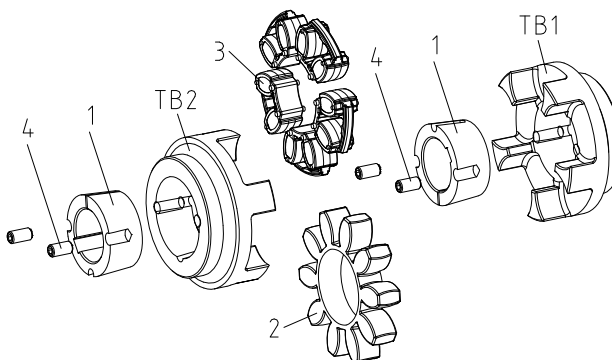


Illustration
8: ROTEX®
type with
taper
clamping
sleeve

Features of the standard spiders

Spider hardness (Shore)	92 Shore-A		95/98 Shore-A		64 Shore-D	
	T-PUR® (orange)	PUR (yellow)	T-PUR® (purple)	PUR (red)	T-PUR® (light green)	PUR (natural white ¹⁾)
Marking (colour)						

1) Natural white with green marking of teeth

Please observe protection note ISO 16016.	Drawn:	28.11.13 Pz/Bru	Replaced for:	KTR-N dated 30.10.12
	Verified:	06.12.13 Pz	Replaced by:	



4 Assembly

4.2 Advice for finish bore



DANGER!

The maximum permissible bore diameters d (see table 1 to 5 in chapter 1 - technical data) must not be exceeded. If these figures are disregarded, the coupling may tear. Rotating particles may cause danger to life.

- Hub bores machined by the customer have to observe concentricity or axial runout, respectively (see illustration 9).
- Please make absolutely sure to observe the figures for $\varnothing d_{\max}$.
- Carefully align the hubs when the finish bores are drilled.
- Please provide for a setscrew according to DIN EN ISO 4029 with a cup point or an end plate to fasten the hubs axially.

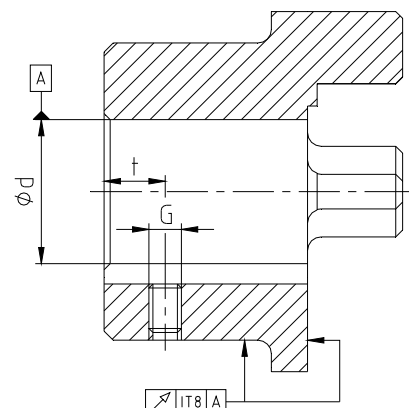


Illustration 9: Concentricity and axial runout



CAUTION!

The customer bears the sole responsibility for all machining processes performed subsequently on unbored or pilot bored as well as finish machined coupling components and spare parts. KTR does not assume any warranty claims resulting from insufficient remachining.



WARNING!

KTR supplies unbored or pilot bored coupling components and spare parts only upon explicit request of the customer. These parts are additionally labelled with the symbol Ⓢ.

Table 6: Setscrews DIN EN ISO 4029

Size	14	19	24	28	38	42	48	55	65	75	90	100	110	125	140	160	180
Dimension G	M4	M5	M5	M8	M8	M8	M8	M10	M10	M10	M12	M12	M16	M16	M20	M20	M20
Dimension t	5	10	10	15	15	20	20	20	20	25	30	30	35	40	45	50	50
Tightening torque T_A [Nm]	1.5	2	2	10	10	10	10	17	17	17	40	40	80	80	140	140	140

Table 7: Recommended fit pairs acc. to DIN 748/1

Bore [mm]		Shaft tolerance	Bore tolerance
above	up to		
	50	k6	H7 (KTR standard)
50		m6	

If a feather key is intended to be used in the hub, it should correspond to the tolerance ISO JS9 (KTR standard) with normal operating conditions or ISO P9 with difficult operating conditions (frequently alternating torsional direction, shock loads, etc.). The keyway should preferably be located between the cams. For the axial fastening by setscrews the tapping should be located on the keyway with the exception of AI-D which should be located opposite to the keyway.

The transmittable torque of the shaft/hub connection must be reviewed by the customer and is subject to his responsibility.

Please observe protection note ISO 16016.	Drawn:	28.11.13 Pz/Bru	Replaced for:	KTR-N dated 30.10.12
	Verified:	06.12.13 Pz	Replaced by:	



4 Assembly

4.3 Assembly of the hubs



ATTENTION!

We recommend to inspect bores, shaft, keyway and feather key for dimensional accuracy before assembly.

Heating the hubs lightly (approx. 80 °C) allows for an easier mounting on the shaft.



WARNING!

Please pay attention to the ignition risk in hazardous locations!



DANGER!

Touching the heated hubs causes burns.
Please wear safety gloves.



CAUTION!

With the assembly please make sure that the distance dimension E (see table 1 to 5) is observed to allow for axial clearance of the spider when in operation.
Disregarding this advice may cause damage to the coupling.

- Mount the hubs on the shaft of driving and driven side (see illustration 10).
- Insert the spider or DZ elements into the cam section of the hub on the driving or driven side.
- Shift the power packs in axial direction until the distance dimension E is achieved (see illustration 11).
- If the power packs are already firmly assembled, shifting the hubs axially on the shafts allows for adjusting the distance dimension E.
- Fasten the hubs by tightening the setscrews DIN EN ISO 4029 with a cup point (tightening torque see table 6).



ATTENTION!

If the shaft diameters with inserted feather key are smaller than the dimension d_H (see table 1 to 5) of the spider, one or two shaft ends may protude into the spider.

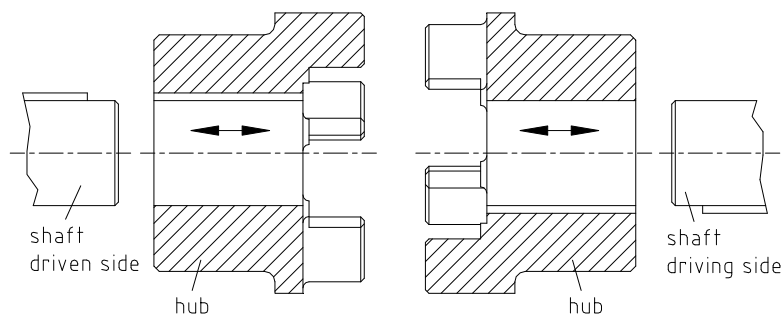


Illustration 10: Assembly of the hubs

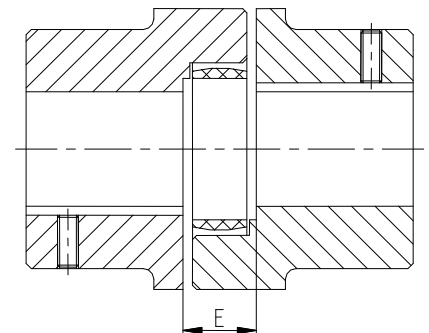


Illustration 11: Coupling assembly



4 Assembly

4.4 Assembly of the taper clamping sleeve

Assembly of the taper clamping sleeve:

Clean the contact surfaces of the taper clamping sleeves and of shaft and hub and afterwards apply thin fluid oil lightly (e. g. Ballistol Universal oil or Klüber Quietsch-Ex).

The taper clamping sleeves have axially parallel, cylindrical and smooth blind holes. Only half of these holes are located in the material of the sleeve. The other half located in the hub has threads.

Fit the coupling element and the taper clamping sleeve into each other, make sure that the bores cover each other and tighten the setscrews lightly. Fit the coupling element along with the taper clamping sleeve on the shaft and tighten the setscrews at the tightening torque indicated in table 8.

During the process of screwing the hub is mounted onto the taper sleeve and thus the sleeve is pressed onto the shaft. By light blows of the hammer the taper clamping sleeve must be pushed further into the taper bore by means of a suitable sleeve. Afterwards please tighten the setscrews again at the tightening torque indicated in table 8. This process must be performed at least once.

After the drive has operated under load for a short while please inspect if the setscrews have unscrewed.

An axial fixing of the taper lock hub (coupling hub with taper clamping sleeve) is only obtained by a proper assembly.



CAUTION!

If used in hazardous locations the setscrews have to be secured against working loose additionally to fix the taper clamping sleeves, e. g. conglomerating with Loctite (average strength).



The use of taper clamping sleeves without a feather key is not permitted in hazardous areas.



CAUTION!

Oils and greases with molybdenum disulphide or high-pressure additives, additives of Teflon and silicone as well as sliding grease paste reducing the coefficient of friction significantly must not be used.

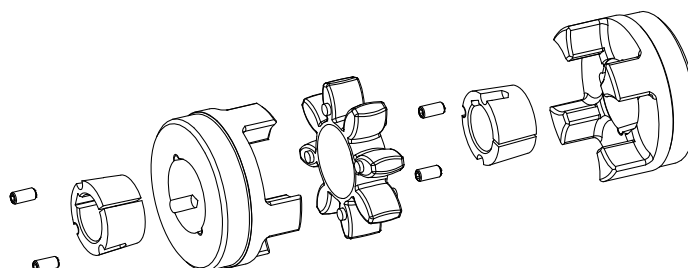


Illustration 12: ROTEX®, type with taper clamping sleeve

Disassembly of the taper clamping sleeve:

The taper clamping sleeve is released by removing the setscrews. Afterwards one of the setscrews is screwed in the thread of the sleeve used as forcing screw and tightened.

The coupling hub detached in this way can be manually removed from the shaft with the taper clamping sleeve.

Table 8:

Taper clamping sleeve	Screw dimensions				Quantity
	G [inch]	L [inch]	SW [mm]	T _A [Nm]	
1008	1/4	1/2	3	5.7	2
1108	1/4	1/2	3	5.7	2
1610	3/8	5/8	5	20	2
1615	3/8	5/8	5	20	2
2012	7/16	7/8	6	31	2
2517	1/2	7/8	6	49	2
3020	5/8	1 1/4	8	92	2
3535	1/2	1 1/2	10	115	3
4545	3/4	1 3/4	12	170	3

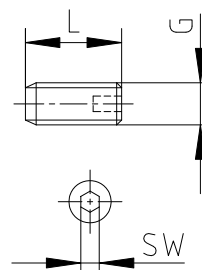


Illustration 13: Withworth setscrew (BSW)



4 Assembly

4.5 Displacements - alignment of the couplings

The displacement figures shown in tables 9 to 11 provide for sufficient safety to compensate for external influences like, for example, heat expansion or foundation settling.



CAUTION!

In order to ensure a long service life of the coupling and avoid dangers with the use in hazardous locations, the shaft ends must be accurately aligned.



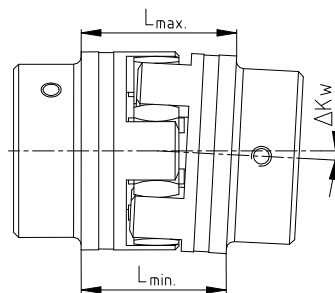
Please absolutely observe the displacement figures indicated (see tables 9 to 11). If the figures are exceeded, the coupling will be damaged.

The more accurate the alignment of the coupling, the longer is its service life.

If used in hazardous locations for the explosion group IIC (marking II 2GD c IIC T X), only half of the displacement figures (see tables 9 to 11) are permissible.

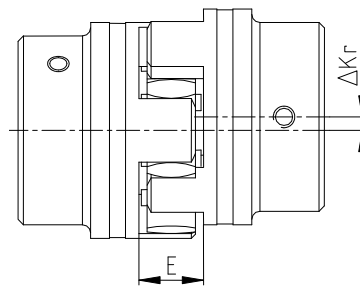
Please note:

- The displacement figures mentioned in tables 9 to 11 are maximum figures which must not arise in parallel. If radial and angular displacements arise at the same time, the permissible displacement values may only be used proportionally (see illustration 15).
- Please inspect with a dial gauge, ruler or feeler whether the permissible displacement figures of tables 9 to 11 can be observed.

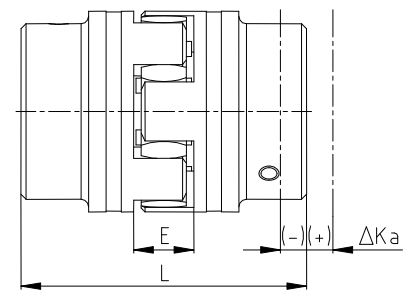


Angular displacements

$$\Delta K_w = L_{1\max} - L_{1\min} \quad [\text{mm}]$$



Radial displacements



Axial displacements

$$L_{\max} = L + \Delta K_a \quad [\text{mm}]$$

Illustration 14: Displacements

Examples for the displacement combinations given in illustration 15:

Example 1:

$$\Delta K_r = 30 \%$$

$$\Delta K_w = 70 \%$$

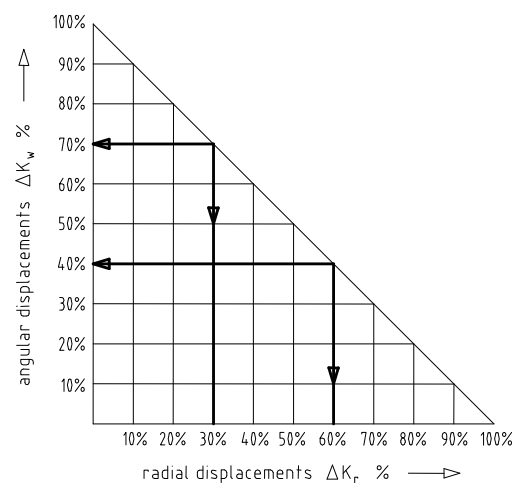
Example 2:

$$\Delta K_r = 60 \%$$

$$\Delta K_w = 40 \%$$

$$\Delta K_{\text{total}} = \Delta K_r + \Delta K_w \leq 100 \%$$

Illustration 15:
Combinations of
displacement





4 Assembly

4.5 Displacements - alignment of the couplings

Table 9: Displacement figures for 92 and 95/98 Shore-A

ROTEX® size	14	19	24	28	38	42	48	55	65	75	90	100	110	125	140	160	180
Max. axial displacement ΔK_a [mm]	-0.5	-0.5	-0.5	-0.7	-0.7	-1.0	-1.0	-1.0	-1.0	-1.5	-1.5	-1.5	-2.0	-2.0	-2.0	-2.5	-3.0
	+1.0	+1.2	+1.4	+1.5	+1.8	+2.0	+2.1	+2.2	+2.6	+3.0	+3.4	+3.8	+4.2	+4.6	+5.0	+5.7	+6.4
Max. radial displacement ΔK_r [mm] with																	
1500 rpm	0.17	0.20	0.22	0.25	0.28	0.32	0.36	0.38	0.42	0.48	0.50	0.52	0.55	0.60	0.62	0.64	0.68
3000 rpm	0.11	0.13	0.15	0.17	0.19	0.21	0.25	0.26	0.28	0.32	0.34	0.36	0.38	-	-	-	-
ΔK_w [degree]	1.2	1.2	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.2	1.2	1.2
max. angular displacement with n=1500 rpm																	
ΔK_w [mm]	0.67	0.82	0.85	1.05	1.35	1.70	2.00	2.30	2.70	3.30	4.30	4.80	5.60	6.50	6.60	7.60	9.00
ΔK_w [degree]	1.1	1.1	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.1	1.2	-	-	-	-
max. angular displacement with n=3000 rpm																	
ΔK_w [mm]	0.60	0.70	0.75	0.85	1.10	1.40	1.60	2.00	2.30	2.90	3.80	4.20	5.00	-	-	-	-

Table 10: Displacement figures for 64 Shore-D

ROTEX® size	14	19	24	28	38	42	48	55	65	75	90	100	110	125	140	160	180
Max. axial displacement ΔK_a [mm]	-0.5	-0.5	-0.5	-0.7	-0.7	-1.0	-1.0	-1.0	-1.0	-1.5	-1.5	-1.5	-2.0	-2.0	-2.0	-2.5	-3.0
	+1.0	+1.2	+1.4	+1.5	+1.8	+2.0	+2.1	+2.2	+2.6	+3.0	+3.4	+3.8	+4.2	+4.6	+5.0	+5.7	+6.4
Max. radial displacement ΔK_r [mm] with																	
1500 rpm	0.11	0.13	0.15	0.18	0.21	0.23	0.25	0.27	0.30	0.34	0.36	0.37	0.40	0.43	0.45	0.46	0.49
3000 rpm	0.08	0.09	0.10	0.13	0.15	0.16	0.18	0.19	0.21	0.24	0.25	0.26	0.28	-	-	-	-
ΔK_w [degree]	1.1	1.1	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.1	1.1	1.1
max. angular displacement with n=1500 rpm																	
ΔK_w [mm]	0.57	0.77	0.77	0.90	1.25	1.40	1.80	2.00	2.50	3.00	3.80	4.30	5.30	6.00	6.10	7.10	8.00
ΔK_w [degree]	1.0	1.0	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.0	1.1	-	-	-	-
max. angular displacement with n=3000 rpm																	
ΔK_w [mm]	0.52	0.70	0.67	0.80	1.00	1.30	1.60	1.80	2.20	2.70	3.50	4.00	4.90	-	-	-	-

Table 11: Displacement figures for type DKM only

ROTEX® size	19	24	28	38	42	48	55	65	75	90
Max. axial displacement ΔK_a [mm]	+1.2	+1.4	+1.5	+1.8	+2.0	+2.1	+2.2	+2.6	+3.0	+3.4
	-1.0	-1.0	-1.4	-1.4	-2.0	-2.0	-2.0	-2.0	-3.0	-3.0
Max. radial displacement ΔK_r [mm] with n =										
1500 rpm	0.45	0.59	0.66	0.77	0.84	0.91	1.01	1.17	1.33	1.48
3000 rpm	0.40	0.53	0.60	0.70	0.75	0.82	0.81	1.05	1.19	1.33
ΔK_w [degree] max. angular displacement with n =										
1500 rpm	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3000 rpm	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

4.6 Spares inventory, customer service addresses

A basic requirement to ensure the operational readiness of the coupling is a stock of the most important spare parts on site.

Contact addresses of the KTR partners for spare parts and orders can be obtained from the KTR homepage at www.ktr.com.



ATTENTION!

KTR does not assume any liability or warranty for the use of spare parts and accessories which are not provided by KTR and for the damages which may incur as a result.

Please observe protection note ISO 16016.	Drawn:	28.11.13 Pz/Bru	Replaced for:	KTR-N dated 30.10.12
	Verified:	06.12.13 Pz	Replaced by:	



5 Enclosure A

Advice and instructions regarding the use in  hazardous locations

5.3 Standard values of wear

In case of a backlash > X mm, the flexible spider/DZ elements must be replaced.

Reaching the limits for replacing depends on the operating conditions and the existing operating parameters.



CAUTION!

In order to ensure a long service life of the coupling and avoid dangers with the use in hazardous locations, the shaft ends must be accurately aligned.

Please absolutely observe the displacement figures indicated (see tables 9 to 11). If the figures are exceeded, the coupling will be damaged.

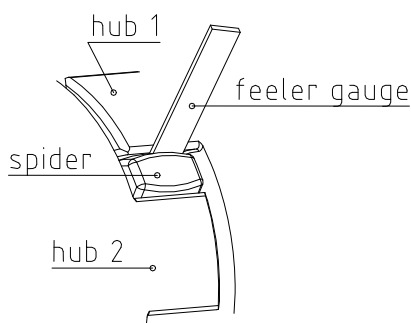


Illustration 18: Inspection of the limit of wear

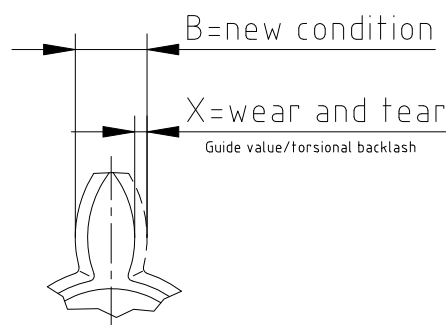


Illustration 19: Wear of spider

Table 12:

ROTEX® size	Limits of wear (friction)	ROTEX® size	Limits of wear (friction)
	X _{max.} [mm]		X _{max.} [mm]
9	2	65	5
14	2	75	6
19	3	90	8
24	3	100	9
28	3	110	9
38	3	125	10
42	4	140	12
48	4	160	14
55	5	180	14

5.4 Permissible coupling materials in hazardous locations

In the explosion groups IIA, IIB and IIC the following materials may be combined:

EN-GJL-250 (GG 25)
EN-GJS-400-15 (GGG 40)
steel
stainless steel


Semifinished products from aluminium with a magnesium share of up to 7.5% and a yield point of $R_{p0.2} \geq 250 \text{ N/mm}^2$ are permitted for the use in hazardous locations.

Aluminium diecast is generally excluded for hazardous locations.



Please observe protection note ISO 16016.	Drawn:	28.11.13 Pz/Bru	Replaced for:	KTR-N dated 30.10.12
	Verified:	06.12.13 Pz	Replaced by:	



5 Enclosure A

Advice and instructions regarding the use in  hazardous locations

5.5 marking of coupling for hazardous locations

Couplings for the use in hazardous locations are marked on at least one component completely and on the remaining components by an  label on the outside diameter of the hub or on the front side each for the operating conditions permitted. The flexible spider or DZ element is excluded. For reason of the limited space only the symbol  is stamped up to size 19.

Short labelling:
(standard)



II 2GD c IIC T X/I M2 c X

Complete labelling:
(valid for T-PUR® only)





II 2G c IIC T6, T5, T4 resp. T3 - $50\text{ °C} \leq T_a \leq +65\text{ °C}$, $+80\text{ °C}$, $+115\text{ °C}$
resp. $+120\text{ °C}$
II 2D c T 140 °C /I M2 c - $50\text{ °C} \leq T_a \leq +120\text{ °C}$

Complete labelling:
(valid for PUR only)



II 2G c IIC T6, T5 resp. T4 - $30\text{ °C} \leq T_a \leq +65\text{ °C}$, $+80\text{ °C}$ resp. $+90\text{ °C}$
II 2D c T 110 °C /I M2 c - $30\text{ °C} \leq T_a \leq +90\text{ °C}$

The labelling with explosion group IIC includes the explosion groups IIA and IIB.

If the symbol  was stamped in addition to , the coupling component was supplied unbored or pilot bored by KTR.

5.6 Start-up

Before start-up of the coupling, please inspect the tightening of the setscrews in the hubs, the alignment and the distance dimension E and adjust, if necessary, and also inspect all screw connections for the tightening torques specified, dependent on the type of coupling.



If used in hazardous locations the setscrews to fasten the hubs as well as all screw connections must be secured against working loose additionally, e. g. conglomerating with Loctite (average strength).

Finally, the coupling protection against accidental contact must be fitted.

The cover must be electrically conductive and included in the equipotential bonding. Bell housings (magnesium share below 7.5 %) made of aluminium and damping rings (NBR) can be used as connecting element between pump and electric motor. The cover may only be taken off after having stopped the unit.

During operation of the coupling, please pay attention to

- different operating noise
- vibrations occurring.

If the couplings are used in locations subject to dust explosion and in mining the user must make sure that there is no accumulation of dust in a dangerous volume between the cover and the coupling. The coupling must not operate in an accumulation of dust.

For covers with unlocked openings on the top face no light metals may be used if the couplings are used as equipment of equipment group II (*if possible, from stainless steel*).

If the couplings are used in mining (equipment group I M2), the cover must not be made of light metal. In addition, it must be resistant to higher mechanical loads than if it is used as equipment of equipment group II.

Please observe protection note ISO 16016.	Drawn: 28.11.13 Pz/Bru	Replaced for: KTR-N dated 30.10.12
	Verified: 06.12.13 Pz	Replaced by:



5 Enclosure A

Advice and instructions regarding the use in  hazardous locations

5.6 Start-up

The minimum distance „Sr“ between the protection device and the rotating parts must at least correspond to the figures mentioned below.

If the protection device is used as cover, regular openings complying with the explosion protection demands can be made that must not exceed the following dimensions:

Openings	Cover [mm]		
	Top side	Lateral components	Distance „Sr“
Circular - max. diameter	4	8	≥ 10
Rectangular - max. lateral length	4	8	≥ 10
Straight or curved slot - max. lateral length/height	not permissible	8	≥ 20



CAUTION!

If you note any irregularities with the coupling during operation, the drive unit must be switched off immediately. The cause of the breakdown must be found out by means of the table „Breakdowns“ and if possible, be eliminated according to the proposals. The potential breakdowns mentioned can be hints only. To find out the cause all operating factors and machine components must be considered.

Coupling coating:



If coated (priming, painting etc.) couplings are used in hazardous locations, the requirements on conductivity and coating thickness must be considered. In case of paintings up to 200 µm electrostatic load does not have to be expected. Multiple coatings that are thicker than 200 µm are prohibited for explosion group IIC.

5.7 Breakdowns, causes and elimination

The below-mentioned failures can lead to a use of the **ROTEX®** coupling other than intended. In addition to the specifications given in these operating and assembly instructions please make sure to avoid these failures. The errors listed can only be clues to search for the failures. When searching for the failure the adjacent components must generally be included.



If used other than intended the coupling can become a source of ignition. EC directive 94/9/EC requires special care from the manufacturer and the user.

General failures with use other than intended:

- Important data for the coupling selection were not forwarded.
- The calculation of the shaft/hub connection was not considered.
- Coupling components with damage occurred during transport are assembled.
- If the heated hubs are assembled, the permissible temperature is exceeded.
- The clearance of the components to be assembled is not coordinated with each other.
- Tightening torques have been fallen below/exceeded.
- Components are exchanged by mistake/assembled incorrectly.
- A wrong or no spider/DZ elements are inserted in the coupling.
- No original **KTR** parts (purchased parts) are used.
- Old/already worn out spiders/DZ elements or spiders/DZ elements stored for too long are used.

Please observe protection note ISO 16016.	Drawn: 28.11.13 Pz/Bru	Replaced for: KTR-N dated 30.10.12
	Verified: 06.12.13 Pz	Replaced by:



5 Enclosure A

Advice and instructions regarding the use in  hazardous locations

5.7 Breakdowns, causes and elimination

Continuation:

- The coupling used/the coupling protection used is not suitable for the operation in hazardous areas and does not correspond to EC directive 94/9/EC, respectively.
- Maintenance intervals are not observed.

Breakdowns	Causes	Hazard notes for hazardous locations	Elimination
Different operating noise and/or vibrations occurring	Misalignment	increased temperature on the spider surface; ignition risk by hot surfaces	1) Set the unit out of operation 2) Eliminate the reason for the misalignment (e. g. loose foundation bolts, breaking of the engine mount, heat expansion of unit components, modification of the mounting dimension E of the coupling) 3) Inspection of wear see item inspection
	Wear of spider, short-term torque transmission due to metal contact	Ignition risk due to sparking	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the spider 3) Inspect coupling components and replace coupling components that are damaged 4) Insert spider, assemble coupling components 5) Inspect alignment, adjust if necessary
	Screws for axial fastening of hubs working loose	Ignition risk due to hot surfaces and sparking	1) Set the unit out of operation 2) Inspect alignment of coupling 3) Tighten the screws to secure the hubs and secure against working loose 4) Inspection of wear see item inspection
Breaking of cam	Wear of spider, torque transmission due to metal contact	Ignition risk due to sparking	1) Set the unit out of operation 2) Replace complete coupling 3) Inspect alignment
	Breaking of the cams due to high impact energy/overload		1) Set the unit out of operation 2) Replace complete coupling 3) Inspect alignment 4) Find out the reason for overload
	Operating parameters do not correspond to the performance of the coupling		1) Set the unit out of operation 2) Review the operating parameters and select a bigger coupling (consider mounting space) 3) Assemble new coupling size 4) Inspect alignment
	Operating error of the unit		1) Set the unit out of operation 2) Replace complete coupling 3) Inspect alignment 4) Instruct and train the service staff



5 Enclosure A

Advice and instructions regarding the use in  hazardous locations

5.7 Breakdowns, causes and elimination

Breakdowns	Causes	Hazard notes for hazardous locations	Elimination
Early wear of spider	Misalignment	Increased temperature on the spider surface; ignition risk by hot surfaces	<ol style="list-style-type: none"> 1) Set the unit out of operation 2) Eliminate the reason for the misalignment (e. g. loose foundation bolts, breaking of the engine mount, heat expansion of unit components, modification of the mounting dimension E of the coupling) 3) Inspection of wear see item inspection
	e. g. contact with aggressive liquids/oils, ozone influence, too high/low ambient temperatures etc. causing a physical change of the spider	Ignition risk due to sparking in case of metallic contact of the cams	<ol style="list-style-type: none"> 1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the spider 3) Inspect coupling components and replace coupling components that are damaged 4) Insert spider, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Make sure that further physical modifications of the spider are excluded
	Ambient/contact temperatures which are too high for the spider, max. permissible e. g. with T-PUR® T4 = - 50 °C/ + 120 °C		<ol style="list-style-type: none"> 1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the spider 3) Inspect coupling components and replace coupling components that are damaged 4) Insert spider, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Inspect and adjust ambient/contact temperature (possibly remedy by using different spider materials)
Early wear of spider (liquefaction of material inside the spider cam)	Vibrations of drive		<ol style="list-style-type: none"> 1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the spider 3) Inspect coupling components and replace coupling components that are damaged 4) Insert spider, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Find out the reason for the vibrations (possibly remedy by spider with lower or higher shore hardness)



If you operate with a worn spider/DZ elements (see item 5.2) and with the subsequent contact of metal parts a proper operation meeting the explosion protection requirements and acc. to directive 94/9/EC is not ensured.



KTR Kupplungstechnik
GmbH
D-48407 Rheine

ROTEX®
Operating/Assembly instructions

KTR-N 40210 EN
Sheet: 21 of 21
Edition: 18

5 Enclosure A

Advice and instructions regarding the use in  hazardous locations

5.8 EC Certificate of conformity

EC Certificate of conformity

corresponding to EC directive 94/9/EC dated 23 March 1994
and to the legal regulations

The manufacturer - KTR Kupplungstechnik GmbH, D-48432 Rheine - states that the

flexible ROTEX® couplings

in an explosion-proof design described in these assembly instructions correspond to article 1 (3) b) of directive 94/9/EC and comply with the general safety and health requirements according to enclosure II of directive 94/9/EC.


According to article 8 (1) of directive 94/9/EC the technical documentation is deposited with the institution:


IBExU
Institut für Sicherheitstechnik GmbH
Fuchsmühlenweg 7

09599 Freiberg

Rheine,
Place

28.11.2013
Date

i. V. 
Reinhard Wibbeling
Head of Engineering

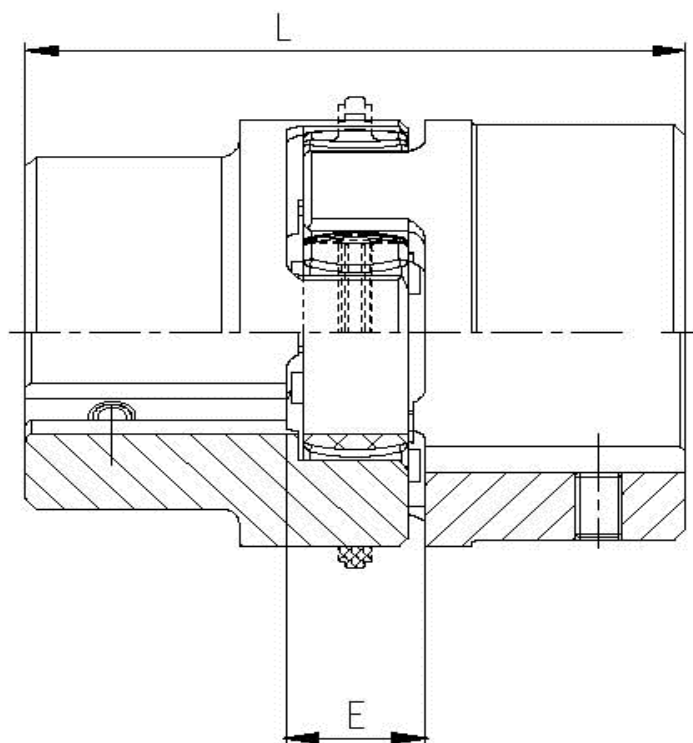
i. V. 
Michael Brüning
Product Manager

Please observe protection note ISO 16016.

Drawn: 28.11.13 Pz/Bru
Verified: 06.12.13 Pz

Replaced for: KTR-N dated 30.10.12
Replaced by:

Standard Rotex™ Coupling Axial Alignment Dimensions



Dimensions shown are for cast iron couplings with straight bore.
See KTR Rotex™ Operating/Assembly Instructions for couplings of other materials or configurations.

Coupling Size	L dimension		E dimension (ref.)	
	Millimeters	Inches	Millimeters	Inches
28	90 (-0.7/+1.5)	3.54 (-0.03/+0.06)	20	0.79
38	114 (-0.7/+1.8)	4.49 (-0.03/+0.07)	24	0.94
42	126 (-1.0/+2.0)	4.96 (-0.04/+0.08)	26	1.02
48	140 (-1.0/+2.1)	5.51 (-0.04/+0.08)	28	1.1
55	160 (-1.0/+2.2)	6.30 (-0.04/+0.09)	30	1.18
65	185 (-1.0/+2.6)	7.28 (-0.04/+0.10)	35	1.38
75	210 (-1.5/+3.0)	8.27 (-0.06/+0.12)	40	1.57
90	245 (-1.5/+3.4)	9.65 (-0.06/+0.13)	45	1.77

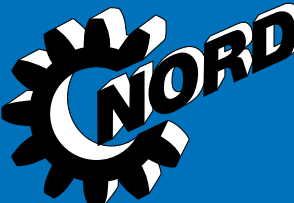
Intelligent Drivesystems



B1000

Operating & Instruction Manuals
For Gear Units

B1000


DRIVESYSTEMS



1. Importance of the operating instructions

These operating instructions are intended to provide general information and safety guidelines. It is the responsibility of the buyer, machine builder, installer and user of the NORD product to make sure that all the proper safety notes and operating instructions have been reviewed and understood. If the contents of this instruction or any applicable operating instructions are not understood, please consult NORD.



WARNING



Electric motors, gearmotors, electrical brakes, variable frequency drives, and gear reducers contain potentially dangerous high-voltage, rotating-components and surfaces that may become hot during operation. All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians.

2. Inspect incoming freight

Before accepting shipment from the freight company, thoroughly inspect the NORD equipment for any shipping and handling damage. If any goods called for in the bill of lading or express receipt are damaged, or if the quantity is short, do not accept until the freight express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight carrier or express agent at once, and request a formal review of your claim.

Claims for loss or damage in shipment must not be deducted from the NORD invoice, nor should payment of the NORD invoice be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery. NORD will try to assist in collecting claims for loss or damage during shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material.

3. Obtaining detailed operating instructions

One can receive the detailed installation and maintenance instructions by entering a serial number (or NORD order number) at the appropriate location on the NORD web site.

- Record the serial number from your gearmotor, gear reducer, or motor nameplate, or record the serial number found on your order confirmation.
- Go to www.nord.com/docs to download the appropriate operating instructions.

EXAMPLE: www.nord.com/docs



4. Intended use

NORD is a supplier of electric motors, gearmotors, reducers, electromechanical brakes, mechanical variators, and electrical variable frequency drives that are intended for commercial installations on larger systems and machines.



WARNING



NORD does not accept any liability for damage or injury caused by:

- Inappropriate use, operation or adaptation of the drive system.
- Unauthorized removal of housing covers, safety and inspection covers, guarding, etc.
- Unauthorized modifications to the drive system.
- Improper servicing or repair work on the drive system.
- Damage caused during shipment or transportation.
- Disregard of the important Safety Notes or Operating Instructions.



5. Notes concerning warranty and liability

All units are supplied according to the terms described in our standard "Conditions of Sale." The unit limited warranty is also defined in our "Conditions of Sale" and is located in the back of our product catalogs as well as the back of your order invoice.

All NORD Safety Notes and all related NORD Operating instructions shall be considered up-to-date at the time in which they were compiled by the buyer, machine builder, installer or user. NORD reserves the right to incorporate technical modifications and information updates to any safety/operating instructions that are within the scope of providing additional knowledge or clarification, communicating design changes, or product enhancements. Information updates may include any NORD product, or subsequent products purchased and supplied by NORD; No specific claims can be derived from the information or illustrations and descriptions contained in the safety notes or related operating instructions.



WARNING







NORD assumes no liability for personal injury, equipment damage or malfunctions resulting from failure to comply with any installation safety notes. The applicable national, regional, and local work regulations and safety requirements must also be complied with. Failure to comply with any safety notes or regulations may result in serious injury, damage to property, or even death.

6. Checklist for installation and operation



- ☒ Verify that the purchased NORD product has been supplied with the expected accessories & options. Check the received goods and packing slip to make sure items are properly received.
- ☒ Make sure that you have all of the required Operating Instructions for your NORD electric motor, gearmotor, reducer, electromechanical brake, mechanical variable speed drives, or electrical variable frequency drives.
- ☒ Consult NORD if you feel you are missing any documentation or if you have questions.

1. Safety & information symbols



All work including transportation, storage, installation, electrical connection, commissioning, servicing, maintenance and repair must be performed **only by qualified specialists or personnel**. It is recommended that repairs to NORD Products are carried out by the NORD Service Department. Instructions related to operational safety will be emphasized as shown.

Symbol	Meaning
	General Warning or Hazard - Severe risk or danger of personal injury or death by working around dangerously high electrical voltage or moving machinery. Proper safety precautions must be taken.
	Possible Harmful Situation - Care must be taken to avoid the possibility of damaging the drive unit, driven machine, or the environment.
	Important Note - Useful note or tip to help assure trouble-free operation.
	Material Disposal Note - Important note concerning suggested material disposal.

2. Safety warnings

 GENERAL WARNINGS 
<ul style="list-style-type: none"> All work involved in the transport, connection, commissioning and maintenance of any NORD product must be carried out by qualified and responsible technicians. All applicable national, regional, and local work regulations and safety requirements must also be complied with. NORD assumes no liability for personal injury, accidental death, or equipment damage and malfunctions resulting from failure to comply with installation or operating instructions, safety notes, or any work regulations and laws! Gear unit installation and maintenance work may only be performed when no power is available to the prime mover or motor. Electric motors, electrical brakes, and variable frequency drives, contain potentially dangerous high-voltage. Prior to installation or maintenance, shut down the power at the circuit breaker or power switch. While working on the drive, make sure the power from the prime mover is isolated or secured on "lock-out" to prevent accidental start-up and to safeguard against injury! Surfaces of motors and gear units may become hot during operation or shortly after start-up. In some instances additional protection against accidental contact may be necessary. Use caution to avoid burns or serious injury!

3. Observe published performance range & nameplate data

 HARMFUL SITUATION 
Observe the data on all reducer nameplates and verify published ratings for the NORD item/s in question. Do not operate any NORD equipment outside the published performance range. Failure to comply may result in damage to the drive unit, driven machine, or the environment.

U.S. Nameplate

NORD GEAR CORPORATION-USA / WWW.NORD.COM

SK ①

S/N ②

RATIO ③

SF ④

TORQUE ⑤

LB-IN

SPEED ⑥

RPM

⑦ MTG POS

FOR GEAR LUBRICATION SEE MANUAL

UNIGASE™

- Model/Type
- Serial Number
- Gear Ratio
- Service Factor
- Torque Rating
- Output Speed RPM
- Mounting Position

European Nameplate

Getriebebau NORD

GrbH&Co KG

D - 22934 Bargteheide

Type SK ①

No. ②

i= ③

n2= ④ min⁻¹

Siehe Wartungsanleitung



See maintenance instructions

Voir instructions d'entretien

- Model/Type
- Serial Number
- Gear Ratio
- Speed

4. Transportation and handling

Make sure that all eyebolts and lifting lugs are tight and lift only at designed points. Protect the mounting surface from possible damage during transportation.

 WARNING 
Do not attach other machinery or loads to the NORD assembly, since the supplied lifting bolts are not designed for this purpose.

If the gearmotor or assembly is equipped with two suspension eye bolts, then both locations should be used for transportation and placement of the unit; in this case the tension force of the slings must not exceed a 45° angle.

In some instances it may be appropriate to use additional lifting straps or slings in order to assure safe transportation of the assembly. Always use sufficiently rated handling equipment and ensure that adequate safety measures are taken to protect personnel from injury during transportation. Once the NORD assembly is properly installed, remove the transportation fixtures.



7. DISPOSAL

*MATERIAL DISPOSAL*

Properly dispose of all used gear units and internal parts in accordance with all local regulations. In particular, all lubricants must be properly collected and disposed.

For confirmation of specific materials used in a specific reducer or gearmotor assembly, please consult NORD with the appropriate unit identification or serial number.

Components	Material
Gear wheels, shafts, rolling bearings, parallel keys, snap rings, spacers, shims, etc.	Steel
Gear housing and housing components	Cast iron or Aluminum (depending on type and size)
Worm gears	Bronze alloy
Radial seals, sealing caps, and rubber components	Elastomers with some steel
Coupling components	Plastic or Elastomer with Steel
Housing gaskets and flat oil seals	Asbestos-free sealing or gasket material (various types used)
Gear Oil	Mineral, SHC-Synthetic or PG-Synthetic (can vary)

1. Storage



IMPORTANT NOTE



For storage periods longer than 9 months, or for storage in less than desirable conditions, please consult NORD for recommendations.

Storage for up to 9 months is possible, so long as the following conditions are observed:

- Store the gear unit in its actual mounting position in accordance with the specified oil fill-level, in a clean and dry temperature controlled area. Avoid temperature fluctuations within the range of 0°C and 40°C (32°F to 104°F) and avoid relative humidity conditions in excess of 60%.
- Protect all exposed or unpainted shaft and flange surfaces with an anti-corrosion agent or grease.
- Store in a location free from shock and vibration, to avoid false brinelling of bearing elements and raceways.
- Whenever possible, rotate the shafts periodically, by hand if necessary, to help prevent brinelling (bearing damage) and to help keep the shaft seals pliable.
- Avoid direct exposure to the sun or UV light and aggressive or corrosive materials in the environment (ozone, gases, solvents, acids, caustic solutions, salts, radioactivity, etc).

2. Commissioning

Prior to gear unit start-up, complete the following:

- Check the lubricant and be sure the gear unit is filled with the proper oil type, to the proper level, as determined by the mounting position.



IMPORTANT NOTE



Some smaller gear units are supplied as maintenance free/lubricated for life gear units. Oil level may not be checked on some of these units.

- Check the condition of all shaft seals and all assembled flange gasket areas. If any change is detected in the shape, color, hardness or permeability, or if any leaks are detected, the corresponding shaft seals and/or gaskets must be replaced.
- Remove all anti-corrosive metal protectant from otherwise bare metal surfaces. Follow product manufacturers directions and warnings during surface protection removal.
- Check the resistance of all motor and brake windings to verify the integrity of the winding insulation and inspect all terminal box openings and wire connection areas to verify that all components are dry and free of corrosion.

3. Long-Term Storage

By taking special precautions, problems such as seal leakage and reducer failure due to the lack of lubrication, improper lubrication quantity, or contamination can be avoided. The following precautions will protect gear reducers during periods of extended storage:

- Store the gear unit in its actual mounting position in accordance with the specified oil fill-level, in a clean and dry temperature controlled area. Avoid temperature fluctuations within the range of 0°C and 40°C (32°F to 104°F) and avoid relative humidity conditions in excess of 60%.
- Fill the reducer full with oil that is compatible with the product normally used or recommended during service.
- Apply grease to all unpainted or unprotected shafts, bores, keyways, flange surfaces, tapped holes, and to the exterior of all oil seals.
- Store in a location free from shock and vibration, to avoid false brinelling of bearing elements and raceways.
- Once every few months rotate the input shaft approximately 10-20 revolutions to redistribute the weight of gears and shafts and to prevent brinelling of the bearings and drying of the seal track.
- Avoid direct exposure to the sun or UV light and aggressive or corrosive materials in the environment (ozone, gases, solvents, acids, caustic solutions, salts, radioactivity, etc.)

4. Commissioning After Long-Term Storage

- Remove all anti-corrosive metal protectant from otherwise bare metal surfaces. Follow product manufacturers directions and warnings during surface protection removal.
- Drain the reducer and refill it with the proper type and amount of lubricant.
- Observe start-up and initial operation to make sure there are no seal or gasket leaks, or unusual sounds, vibration or heat rise during operation.
- Check the resistance of all motor and brake windings to verify the integrity of the winding insulation and inspect all terminal box openings and wire connection areas to verify that all components are dry and free of corrosion.



1. Installation site

Drives must be properly installed if they are to produce the rated torque. Improper installation may lead to oil leaks, reduced life, or even catastrophic failure. NORD gear drives and motors are intended to be installed at a suitable mounting site under the following conditions:

- Unimpeded airflow to and around the units.
- Accessibility to oil drain, level and breather plugs.
- On brakemotors, allow adequate space for removing the fan guard and replacing and adjusting the brake.
- Mounting surfaces must be flat, torsionally rigid, and dampened against vibration.
- Unless special measures are taken, the immediate vicinity around the gear drive or motor should not be exposed to any aggressive or corrosive substances, contaminated air, ozone, gases, solvents, acids, alkalis, salts, radioactivity, etc.

2. Mounting position

Reducer mounting position charts illustrate the standard mounting positions for horizontal and vertical mounting. All gear units are assembled with the oil fill-level, oil-drain and vent plugs installed in their proper locations, **according to the customer-specified mounting position**. For mounting orientations other than shown consult NORD Gear.


HARMFUL SITUATION


The gear reducer may not receive proper lubrication if the unit is not mounted in the position for which it is designed. Observe the mounting position designated on the reducer nameplate, or specified in the order acknowledgement. Consult NORD prior to changing mounting position in the field. While it is often possible to simply relocate the oil fill-level and vent locations, and adjust the oil fill amount, in some cases, different mounting positions may lend themselves to different internal construction features.

3. Reducer mounting

- The support foundation must be straight, level and flat. Whether the gear unit is foot-mounted or flange-mounted, NORD recommends that the straightness and flatness of the customer-supplied support foundation follow **Table 1**.
- The gear unit must be properly aligned with the driven shaft of the machine in order to prevent additional stress or load forces from being imposed upon the gear unit.
- To facilitate oil drainage it may be desirable to elevate the gear box foundation above the surrounding support structure.
- All bolting surfaces must be clean and free from contamination and corrosion.



Table 1: Recommended Straightness and Flatness of Customer-Supplied Support Foundation

Above (in)	To & Including (in)	General Tolerance on Straightness & Flatness ISO 2768-2, Tolerance Class K
0.00	0.39	+/- 0.002 in
0.39	1.18	+/- 0.004 in
1.18	3.9	+/- 0.008 in
3.9	11.8	+/- 0.016 in
11.8	39	+/- 0.024 in
39	118	+/- 0.031 in

Above (mm)	To & Including (mm)	General Tolerance on Straightness & Flatness ISO 2768-2, Tolerance Class K
0	10	+/- 0.05 mm
10	30	+/- 0.1 mm
30	100	+/- 0.2 mm
100	300	+/- 0.4 mm
300	1000	+/- 0.6 mm
1000	3000	+/- 0.8 mm

Straightness: Based upon the length of the corresponding line.



Flatness: Based upon the longer lateral surface or the diameter of the circular surface.


HARMFUL SITUATION


The responsibility for the design and construction of the support foundation is with the user. The foundation must be adequate to withstand normal operating loads and possible overloads while maintaining alignment to attached system components under such loads. **Motors and drive components mounted on prefabricated base plates can become misaligned during shipment. Always check alignment after installation.**

4. Steel foundation

An engineered structural steel foundation should be designed to provide adequate rigidity and prevent loads from distorting the housing or causing misalignment of internal gears and shafts. When foot-mounting the gear reducer, a base plate or sole plate with suitable thickness (generally equal or greater than the thickness of the drive feet) should be securely bolted to steel supports and extend under the entire gear drive assembly. When flange-mounting the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear unit or gear motor.

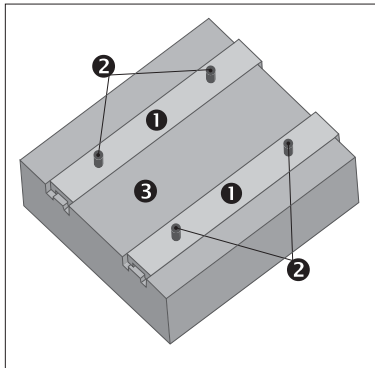

HARMFUL SITUATION


Do not weld on the gear unit or use the gear unit as an earth or ground connection for any welding procedure as this may cause permanent damage to the bearings and gears.

5. Concrete foundation

If a concrete foundation is used, allow the concrete to set firmly before bolting down the gear drive. Grout structural steel mounting pads and bolts of sufficient size into the concrete, to adequately distribute the load stress onto the concrete foundation.

Figure 1: Concrete Foundation



- ① Grouted Structural Steel Mounting Pads
- ② Mounting Bolts
- ③ Concrete Foundation

6. Bolt connections for footed & flange mounted units

NORD footed reducers and flange-mount reducers (with B5 flange) have clearance designed into the mounting holes to allow for some minor adjustments in alignment. Bolt size, strength and quantity should be verified to insure proper torque reaction capacity whatever the mounting arrangement. Tightening torque for gear reducer mounting bolts, and recommended fastener grades, are provided in Table 2.

Table 2A: Tightening Torque for Inch Reducer Mounting Bolts

Thread Size (in)	Grade SAE 5 / ASTM A449		Grade SAE 8	
	(lb-ft)	(Nm)	(lb-ft)	(Nm)
1/4-20	7.1	9.6	10.0	13.6
5/16-18	16	21	22	30
3/8-16	28	37	39	53
1/2-13	69	93	98	132
5/8-11	138	188	195	264
3/4-10	247	334	348	472
7/8-9	396	537	558	757
1-8	592	802	833	1,130
1 1/8-7	-	-	1,233	1,672
1 1/4-7	-	-	1,717	2,327
1 3/8-6	-	-	2,267	3,073
1 1/2-6	-	-	2,983	4,045
1 3/4-5	-	-	4,458	6,045

- Calculated tightening torques are based a conventional 60°, clean and dry (un-lubricated) thread, with thread-friction and head-friction equal to 0.15.
- When using inch-fasteners, NORD recommends a minimum Grade SAE 5 (ASTM A-449) for sizes up to 1-8 UNC, and Grade SAE 8 for all larger sizes.

Table 2B: Tightening Torque for Metric Reducer Mounting Bolts

Above (mm)	ISO Grade 8.8		ISO Grade 10.9		ISO Grade 12.9	
	(lb-ft)	(Nm)	(lb-ft)	(Nm)	(lb-ft)	(Nm)
M4	2.4	3.2	3.5	4.7	4.1	5.5
M5	4.7	6.4	6.9	9.3	8.1	11
M6	8	11	12	16	14	19
M8	20	27	29	39	34	46
M10	39	53	58	78	67	91
M12	68	92	100	135	110	155
M14	107	145	159	215	180	250
M16	170	230	247	335	290	390
M18	240	325	343	465	400	540
M20	339	460	487	660	570	770
M22	465	630	664	900	770	1,050
M24	583	790	848	1,150	960	1,300
M27	848	1,150	1,217	1,650	1,440	1,950
M30	1,180	1,600	1,660	2,250	1,950	2,650
M36	2,050	2,780	2,884	3,910	3,470	4,710
M42	3,297	4,470	4,639	6,290	5,560	7,540
M48	4,940	6,700	7,010	9,500	8,260	11,200

- Calculated tightening torques are based on a conventional 60°, clean and dry (un-lubricated) thread, with thread-friction and head-friction equal to 0.15.
- When using metric-fasteners, NORD recommends a minimum ISO Grade 8.8 bolt.

7. Mounting the prime mover

When the motor is not flange mounted or integrally mounted to the gearbox, it is important to properly secure and align the gear drive with respect to the driven machine before attempting to align the prime mover or motor.

- After the main gear drive is properly aligned and bolted in place, align the prime mover with respect to the reducer input shaft.
- Use shims under the feet of the prime mover as needed, and secure in place with the proper mounting bolts. Dowel pins may be field-installed to help prevent misalignment and ensure proper realignment if removed for service.



IMPORTANT NOTE



When using a high speed coupling connection between the prime mover and the reducer, check alignment per the coupling manufacturers recommendations. If the coupling is misaligned, the reducer alignment or shimming is incorrect. Re-align the gear reducer and re-check the high-speed coupling alignment before re-aligning the motor.

1. Solid shaft diameter tolerance

Reducer input and output shaft extensions have a diameter tolerance as specified in Table 1.

Table 1: Solid Shaft Diameter Tolerance

Above ø (in)	To & Including ø (in)	Tolerance (in)
0.375	1.750	+0.0000 / -0.0005
1.750	7.500	+0.0000 / -0.0010

Above ø (mm)	To & Including ø (mm)	Tolerance (mm)	ISO 286-2 Fit Class
10	18	+0.012 / +0.001	k6
18	30	+0.015 / +0.002	k6
30	50	+0.018 / +0.002	k6
50	80	+0.030 / +0.011	m6
80	120	+0.035 / +0.013	m6
120	180	+0.040 / +0.015	m6
180	190	+0.046 / +0.017	m6

2. Fitting drive elements onto the reducer solid shaft

Solid input and output shaft extensions are provided with a drill and tap feature as indicated in Table 2. When installing drive elements such as coupling hubs, pulleys, sprockets, or gears, NORD recommends using the threaded hole in the end of the shaft, along with a suitable assembly device fitted into the threaded hole.

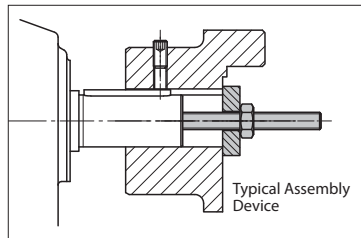


Table 2: Solid Shaft End - Threaded Holes

Above ø (in)	To & Including ø (in)	Tap size & Depth (in)
0.375	0.500	10-24 x 0.43 in
0.500	0.875	1/4-20 x 0.59 in
0.875	0.938	5/16-18 x 0.71 in
0.938	1.100	3/8-16 x 0.87 in
1.100	1.300	1/2-13 x 1.10 in
1.300	1.875	5/8-11 x 1.42 in
1.875	3.500	3/4-10 x 1.73 in
3.500	5.125	1-8 x 2.63 in
5.125	7.500	1 1/4 - 7 x 3.15

Above ø (mm)	To & Including ø (mm)	Tap Size & Depth (mm)
10	13	M4 x 10 mm
13	16	M5 x 12.5 mm
16	21	M6 x 16 mm
21	24	M8 x 19 mm
24	30	M10 x 22 mm
30	38	M12 x 28 mm
38	50	M16 x 36 mm
50	85	M20 x 42 mm
85	130	M24 x 50 mm
130	190	M30 x 60 mm



HARMFUL SITUATION



DO NOT DRIVE or **HAMMER** the coupling hub, pulley, sprocket, or gear into place. An endwise blow to the reducer shaft can generate damaging axial forces and cause damage to the reducer housing, bearings or internal components.



WARNING



To avoid serious injury the user must provide suitable safety guards for all rotating shafts and shaft components such as couplings, chain drives, belt drives, etc. All guarding must adhere to local regulations and safety standards.

3. Installing interference-fit hubs to the reducer shaft

Prior to installing any interference-fit hubs to the reducer shaft, consult with the manufacturer to determine proper assembly and fit. Interference-fits usually require heating the coupling, sprocket or gear hub, per the manufacturer's recommendations. Coupling hub installation typically follows ANSI/AGMA 9002-A86. Always make sure the reducer shaft seals are protected from the heat source. Apply uniform heat to the drive element hub to prevent distortion. NORD does not recommend heating the drive element hub beyond 212°F to 275°F (100°C to 135° C).



WARNING



When using heat to mount a drive element hub, do not use open flame in a combustible atmosphere or near flammable materials. Use suitable protection to avoid burns or serious injury.



HARMFUL SITUATION



When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close to the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tighten the belts or chains.

4. Coupling installation

The performance and life of any coupling depends upon how well it is installed. Coupling hubs are typically mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. To help obtain critical shaft alignment coupling hubs may be installed to the machine shafts prior to final shimming or tightening of the foundation bolts. Proper coupling alignment allows for thermal and mechanical shaft movement during operation and ensures that only torque (no radial load) is transmitted between the mating shafts.

Coupling gap and angular alignment

The shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement. When setting the coupling gap, insert a spacer or shim stock equal to the required spacing or gap between the coupling hub faces. Measure the clearance using feeler gauges at 90-degree intervals, to verify the angular alignment.

Parallel (or offset) alignment

Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel or offset misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90° intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel or offset misalignment.

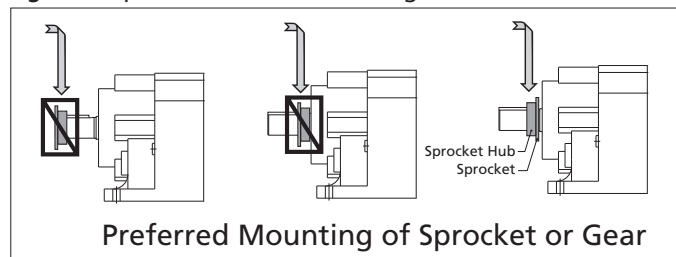
Check alignment

After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and re-check critical alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

5. Installing sheaves (pulleys), sprockets and gears

To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, gears, etc.) so that the applied load center is as close to the gear housing as possible, as shown in **Figure 2**.

Figure 2: Sprocket or Gear Mounting



Align the driver sheave or sprocket with the driven sheave or sprocket by placing a straight-edge length-wise across the face of the sheaves or sprockets. Alignment of bushed sheaves and sprockets should be checked only after bushings have been tightened. Check horizontal shaft alignment by placing one leg of a square or a level vertically against the face of the sheave or sprocket.

Always check component alignment and tension any belts or chains per the manufacturer's recommendation. The ideal belt or chain tension allows proper wrap of the driver and driven wheels, while maintaining the lowest possible tension of the belts or chain, so that no slipping occurs under load conditions. Check belt or chain tension frequently over the first 24 to 48 hours of operation.



HARMFUL SITUATION



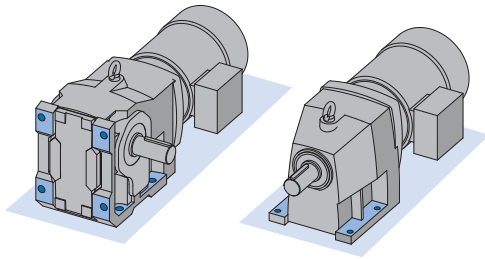
When using external chain or belt drives, make sure the reducer is sized so that the shaft and bearings have adequate capacity. To avoid unnecessary bearing loads and additional shaft deflection, mount all power take-off devices (sprockets, pulleys, etc.) so that the applied load center is as close the gear housing as possible and check component alignment and tension of any belts or chains per the manufacturer's recommendation. Do not over tension the belts or chains.

6. Outboard pinion gear alignment

Align outboard pinion gears and adjust the gear tooth clearance according to the manufacturer's recommendations, checking for acceptable outboard pinion tooth contact. The foundation bolts may have to be loosened and the gear unit moved slightly to obtain proper gear tooth contact. After the unit is moved to correct tooth contact, the prime mover may need to be realigned.

1. Foot-mounted reducers

When installing the foot-mounted gear unit, observe the flatness specifications and bolt tightening torque guidelines provided in U10060 and make sure the mating mounting surface and reducer feet are clean and free of debris. Use of shims under the feet of the gear unit may be required in order to align the output shaft to the driven equipment. Make sure that all feet are supported so that the housing will not distort when it is bolted down. Improper shimming will cause mis-alignment and may reduce the life of the gear unit or cause component failure. Dowel pins may be field-installed to help prevent misalignment and ensure proper realignment if removed for service.



IMPORTANT NOTE



Gear units may be subjected to radial loads or side pull, caused by external chain drives or belt drives. In these instances it is recommended that the mounting base be designed with a slide-plate adjustment to accommodate extra slack in the chain or the belt after the feet are loosened. When using an external chain or belt drive, make sure the reducer is sized so that the shaft and bearings have adequate capacity.

2. Flange-mounted reducers (with B5 flange)

When using the B5 flange to mount the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear reducer or gearmotor. On the B5 mounting flange NORD provides a pilot register or and the flange pilot tolerance as listed per Table 1. When the mating hole is designed with the proper fit, the flange pilot tenon provides a means of accurately positioning the reducer while the hold-down bolts are properly secured; once the reducer is secured, the tenon helps prevent movement of the reducer and it helps locate the center of the reducer output shaft.

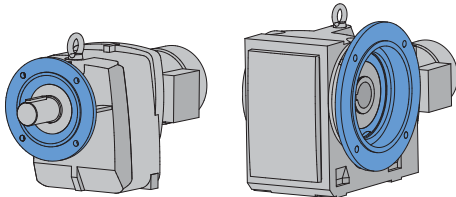


Table : Flange Pilot Tolerance

Above ø (in)	To & Including ø (in)	Tolerance (in)	ISO 286-2 Fit Class
1.969	3.150	+0.0005 / -0.0003	j6
3.150	4.724	+0.0005 / -0.0004	j6
4.724	7.087	+0.0006 / -0.0004	j6
7.087	9.055	+0.0000 / -0.0005	h6
9.055	9.843	+0.0000 / -0.0011	h6
9.843	12.402	+0.0000 / -0.0013	h6
12.402	15.748	+0.0000 / -0.0014	h6
15.748	19.685	+0.0000 / -0.0016	h6

Above ø (mm)	To & Including ø (mm)	Tolerance (mm)	ISO 286-2 Fit Class
50	80	+0.012 / -0.007	j6
80	120	+0.013 / -0.009	j6
120	180	+0.014 / -0.011	j6
180	230	+0.000 / -0.013	h6
230	250	+0.000 / -0.029	h6
250	315	+0.000 / -0.032	h6
315	400	+0.000 / -0.036	h6
400	500	+0.000 / -0.040	h6

When installing the flange mounted gear unit, observe the flatness specifications and bolt tightening torque guidelines provided in U10060. Make sure the mating mounting surface and reducer flange are clean and free of debris. Use a straight edge or parallel bar to check for high spots on the mating mounting surface and remove any raised material around the mounting holes.

Set the gear unit into place and tighten the bolts until they are snug. Before final bolt-tightening check for any material gaps between the mating surfaces and if shimming is required, use "U" shaped shims at least 2 times the width of the bolt. Avoid over shimming a very irregular surface as this will make it very difficult to achieve proper alignment.



IMPORTANT NOTE



For heavy shock applications, it is advisable to field-install dowel pins through the mounting flange connection (in addition to the mounting bolts). This will help control flange movement or flange rotation and relieve the mounting bolts from this additional stress.

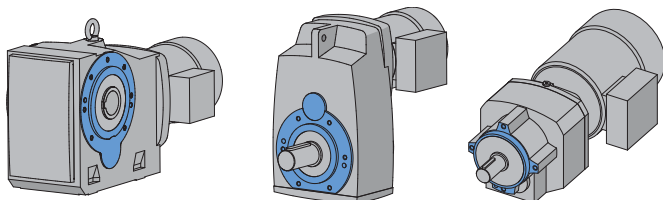


REDUCER MOUNTING FOOTED & FLANGE MOUNT GEAR UNITS



3. Flange-mounted reducers (with B14 flange)

When using the B14 flange to mount the gear unit, the bulk head plate must be engineered to minimize buckling distortions and support the cantilevered weight of the gear reducer or gearmotor. When properly installed, the output flange of the reducer housing is designed to enable the permissible torques and radial forces to be reliably transmitted by the bolt connections.



IMPORTANT NOTE



When using the B14 flange-face for mounting, if dowel pin holes are provided in addition to the threaded holes, then it is advisable to also use the proper dowel pins, to help control flange movement or flange rotation and relieve the mounting bolts from this additional stress. This is especially important for heavy shock applications.

4. Foot & flange reducer housings

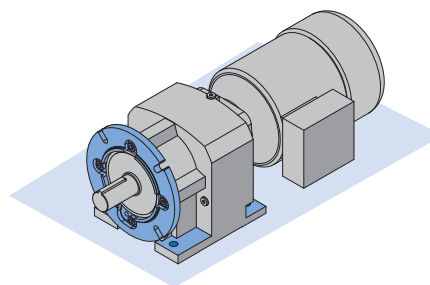
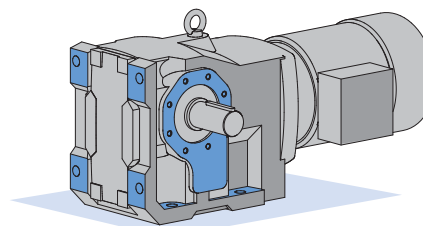
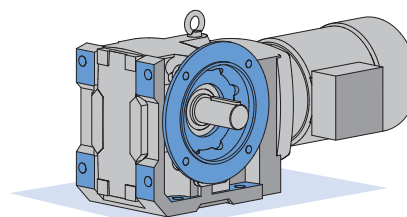
Some gear reducer housings are available with a foot and an output flange. Units with a foot and a B5 Flange are designated with the suffix XF after the primary model number and units with a B14 face-flange are designated with the suffix XZ after the primary model number. When a gear unit is provided with both a foot and a flange, the foot is considered the primary mounting surface. The flange is generally considered to be the secondary mounting option and it is intended that this surface be used for auxiliary add on elements that place minimal load stress on the reducer housing.



HARMFUL SITUATION



To prevent overstress on the main gear unit housing, never tighten the reducer mounting feet and the mounting flange against one-another. Auxiliary add-on elements that are mounted to the reducer flange, must not transmit excessive force, torque or vibration to the main gear housing.



1. Importance of proper lubrication



Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective “fluid boundary” between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise.

Most NORD reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position.

2. Standard oil type

The following tables indicate the standard oil fill type used. Please see user manual U11000 for more specific information and for optional helical and bevel gear lubricants:



Serviceable Gear Units	
Helical In-line	Standard Oil Fill: ISO VG 220, Mineral Oil
Clincher Parallel-Shaft	
Right-Angle Bevel	
NORDBLOC® Series In-line	
NORDBLOC®.1 Series In-line	
Standard Series In-line	


IMPORTANT NOTE




For shipping purposes, the following large Clincher™ gear units are supplied without oil:

- Clincher™ Sizes SK11282, SK11382 and SK12382

Maintenance-free / Lubricated For Life Gear Units	
Clincher™ sizes SK0182NB, SK0282NB & SK1382NB	Standard Oil Fill: ISO VG220 SHC/PAO Synthetic Oil
NORDBLOC® Sizes SK172, SK272, SK371F, SK372, SK373, SK320	


IMPORTANT NOTE


Maintenance-free units are supplied as sealed units with no vent-plug. Consult NORD prior to ordering if interested in ordering any of the above sizes as serviceable gear units.


IMPORTANT NOTE


Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Some units have special lubricants designed to operate in certain environments or intended to extend the service life or service temperature range of the lubricant. If in doubt about which lubricant is needed for a certain application, please contact NORD Gear.



3. Lubrication replacement

If the gear unit is filled with mineral oil, the lubricant should be replaced at least after every 10,000 operating hours or after every two years. If the gear unit is filled with synthetic oil, the lubricant should be replaced at least after every 20,000 operating hours or after every four years. Often gear reducers are exposed to extreme ambient conditions, hostile environments, wet conditions, or dirty and dusty operating areas. Especially in these situations, it is important to establish a condition-based oil service interval.

4. Oil viscosity

Viscosity, or the oil’s resistance to shear under load, is often considered the single most important property of any gear oil.

- Often one will consider making a viscosity correction to the oil to improve the performance when operating the gear unit at low temperature or high temperature.
- In cases of extreme load conditions, gear pairs and antifriction bearings may be more susceptible to sliding or scuffing wear. In these operating conditions, it may also be beneficial to consider an increased lubrication viscosity and/or a lubrication with improved antiwear additive packages.




IMPORTANT NOTE


The user should consult with their primary lubrication supplier before considering changes in oil type or viscosity.

5. Maximum oil sump temperature limit

To prevent reducer overheating, the reducer’s maximum oil sump temperature limit must not be exceeded for prolonged periods of operation (up to 3 hours continuous operation depending upon reducer size).

Oil Type	Maximum Oil Temperature Limit	
	NORD	AGMA 9005-D94
Mineral	80-85°C (176-185°F)	95°C (203°F)
Synthetic	105°C (220°F)	107°C (225°F)


IMPORTANT NOTE


Use caution when specifying gear reducers for high temperature service. If there is concern about exceeding the allowable safe operating temperatures, please consult NORD to discuss alternatives.

6. The importance of routine oil analysis

Routine oil analysis, sound lubrication practices, and good tracking of oil performance trends will help establish proper lubrication maintenance and change-out intervals. To maximize equipment reliability, NORD Gear generally recommends a condition-based lubrication maintenance program. One may take exceptions to this general recommendation on sealed-for-life or maintenance-free gear units or smaller and less costly gear units. In these instances, the replacement cost of the gear unit is often small compared to the costs associated with this type of oil analysis program.

STOP	HARMFUL SITUATION	STOP
<p>NORD suggests replacing the gear oil if oil analysis indicates any of the following:</p> <ul style="list-style-type: none"> Viscosity has changed by approximately 10% or more. Debris particles (silicon, dust, dirt or sand) exceed 25 ppm. Iron content exceeds 150-200 ppm. Water content is greater than 0.05% (500 ppm). The total acid number (TAN) tests indicate a significant level of oxidative break-down of the oil, and a critical reduction in performance; If the TAN number measured changes by more than 5% over the new oil, then an oil change would be recommended. 		

7. Mounting position and oil fill quantity

All NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. **For additional information, please see the separate mounting position diagrams and the corresponding oil fill quantity tables for the specified gear unit.**

The gearbox nametag will indicate the mounting position that was provided. **For mounting orientations other than shown in the mounting position charts, please consult NORD Gear.**

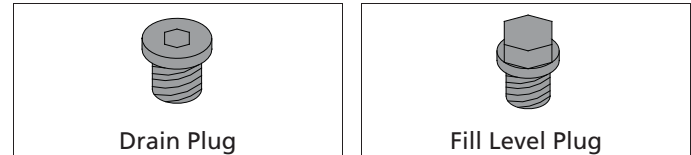
STOP	HARMFUL SITUATION	STOP
<p>Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.</p>		

8. Oil plug locations

All gear units are assembled with the oil fill-level, oil-drain and vent plugs installed in their proper locations, according to the specified mounting position. All standard plugs are metric and utilize sealing gaskets between the head of the plug and the reducer housing.

9. Drain and fill-level plugs

All reducer drain plugs are metric socket head cap screws. For easier identification, it is NORD's standard practice to provide a hex-head screw for the fill-level plug. For ease of draining the used oil from the gear reducer, use the socket head screw located at the lowest part of the gearbox.

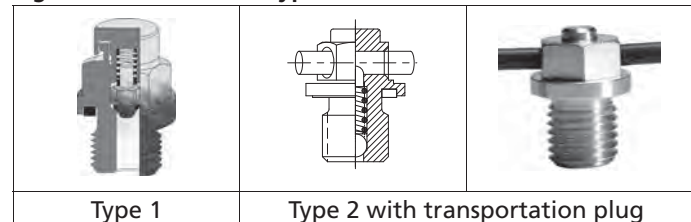


10. Vent plug locations

Reducer venting allows for air pressure differences that occur during operation, between the inner space of the reducer and the atmosphere, while ensuring leak-free operation. The AUTOVENT™ is standard for all vented gear units, unless otherwise noted.

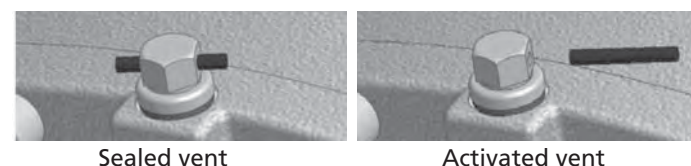
AUTOVENT™ - The AUTOVENT™ helps prevent bearing and gear damage by behaving like a check valve to block the entry of foreign material (water, dust, corrosives, etc.). The breather opens at approximately 2-3 psi during operation and closes tightly as the gearbox cools. This option is perfect for humid conditions and wash-down environments, helping to maintain proper oil cleanliness, and reducing foaming and oxidation. NORD may choose to offer one of two style options as shown in Figure 1. The Type 2 AUTOVENT™ comes closed upon delivery with a transportation sealing plug (see Warning).

Figure 1 AUTOVENT™ Types



Open Vent - An optional open vent can be supplied by NORD. The open vent comes closed upon delivery with a transportation sealing plug (see Warning).

⚠	WARNING	⚠
<p>To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up.</p>		



Filtered Vent - NORD may offer an optional filtered vent, which allows gases to permeate, but does not allow dust and debris to pass through the vent.



HELICAL & BEVEL REDUCER LUBRICATION TYPES



DRIVESYSTEMS

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Lubrication Tables – Helical and Bevel Gear Units

Standard Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG220	MIN-EP	0 to 40°C (32 to 104°F)	Mobilgear 600XP220	⬆️Ⓜ️
	PAO	-35 to 60°C (-31 to 140°F)	Mobil SHC630	⬆️Ⓜ️
	FG	-5 to 40°C (23 to 104°F)	Fuchs FM220	⬆️

Optional Oil Lubricants

ISO Viscosity	Oil Type	Ambient Temperature Range	Manufacturer Brand/Type	Notes
VG460	PAO	-35 to 80°C (-31 to 176°F)	Mobil SHC 634	-
	FG-PAO	-35 to 80°C (-31 to 176°F)	Mobil/Cibus SHC460	-
VG220	FG-PAO	-35 to 60°C (-31 to 140°F)	Mobil/Cibus SHC220	-
VG150	PAO	-35 to 25°C (-31 to 77°F)	Mobil SHC629	-

Grease Options (applied to greased bearings and seal cavities)

NLGI Grade	Grease Type/Thickener	Ambient Temperature Range	Manufacturer Brand/Type	Notes
NLGI 2	Standard (Li-Complex)	-30 to 60°C (-22 to 140°F)	Mobil Grease XHP222	⬆️Ⓜ️
	High Temp (Polyurea)	-25 to 80°C (-13 to 176°F)	Mobil Polyrex EP 2	⬆️Ⓜ️
	Food-Grade (AL-Complex)	-25 to 40°C (-13 to 104°F)	Mobil Grease FM222	⬆️

⬆️ Stocked Lubricants

Ⓜ️ Standard product on serviceable gear units

Ⓜ️ Standard product on maintenance free gear units



IMPORTANT NOTES



- The “Ambient Temperature” is intended to be an operation guideline based upon the typical properties of all the lubricant. The viscosity and other properties of the lubricant change based upon load, speed, ambient conditions, and reducer operating temperatures. The user should consult with their lubrication supplier & NORD gear before considering changes in oil type or viscosity.
- To prevent reducer overheating, observe the maximum operating oil temperature limits:
Mineral Oil: 80-85 °C (176 – 180 °F).
Synthetic Oil: 105 °C (225 °F).
- In the following instances, please consult NORD for specific recommendations:
 - ✓ Gear units will operate in high ambient temperature conditions exceeding 40 °C (104 °F).
 - ✓ Gear units will operate in cold ambient temperature conditions approaching 0 °C (32 °F) or lower.
 - ✓ Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.
 - ✓ Fluid grease is required for lubricating the gear unit.
- Observe the general lubrication guidelines outlined in user manual U10750.

Oil Formulation Codes

MIN-EP	-	Mineral Oil with EP Additive
PAO-EP	-	Synthetic Polyalphaolefin Oil with EP Additive
PAO	-	Synthetic Polyalphaolefin Oil
PG	-	Synthetic Polyglycol Oil
FG	-	Food-Grade Oil
FG-PAO	-	Food-Grade, Synthetic Polyalphaolefin Oil
FG-PG	-	Food-Grade, Synthetic Polyglycol Oil

Lubrication Notes

- Avoid using (EP) gear oils in worm gears that contain sulfur-phosphorous chemistries, as these additives can react adversely with bronze worm gears and accelerate wear.
- Food grade lubricants must be in compliance with FDA 212 CFR 178.3570 and qualify as a NSF-H1 lubricant. Please consult with lubrication manufacturer for more information.
- When making a lubrication change, check with the lubrication supplier to assure compatibility and to obtain recommended cleaning or flushing procedures.
- Do not to mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral oil or polyalphaolefin (PAO) synthetic oil.

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HELICAL & BEVEL REDUCER LUBRICATION TYPES



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Oil Cross-reference Chart

ISO Viscosity	Oil Type	Ambient Temperature Range	Mobil	Shell	Castrol	FUCHS	KLÜBER LUBRICATION
VG150	MIN-EP	0 to 25°C (32 to 77°F)	Mobilgear 600XP150	Omala 150	Alpha SP150	Renolin EP150	Klüberoil GEM 1-150N
	PAO-EP	-30 to 25 °C (-22 to 77 °F)	Mobilgear SHC150	Omala HD 150	Alphasyn EP150	Gearmaster SYN150/NA	Klübersynth EG 4-150
	PAO	-30 to 25 °C (-22 to 77 °F)	Mobil SHC629	Omala RL 150	Alphasyn T150	Geralyn SF150	Klübersynth GEM 4-150N
	PG	-25 to 25 °C (-13 to 77 °F)	Mobil Glygoyle 150	Tivela S150	Alphasyn PG150	Renolin PG150	Klübersynth GH 6-150
	FG	0 to 25 °C (32 to 77 °F)	Mobil DTE FM 150	N/A	N/A	N/A	N/A
	FG-PAO	-25 to 25 °C (-13 to 77 °F)	N/A	N/A	N/A	Cassida GL150	Klüberoil 4 UH 1-150N
	FG-PG	-25 to 25 °C (-13 to 77 °F)	Mobil Glygoyle 150	N/A	N/A	N/A	Klübersynth UH1 6-150
VG220	MIN-EP	0 to 40°C (32 to 104°F)	Mobilgear 600XP220	Omala 220	Alpha SP220	Renolin EP220	Klüberoil GEM 1-220N
	PAO-EP	-30 to 60 °C (-22 to 140 °F)	Mobilgear SHC220	Omala HD220	Alphasyn EP220	Gearmaster SYN220/NA	Klübersynth EG 4-220
	PAO	-30 to 60 °C (-22 to 140 °F)	Mobil SHC630	Omala RL220	Alphasyn T220	Geralyn SF220	Klübersynth GEM 4-220N
	PG	-25 to 60 °C (-13 to 140 °F)	Mobil Glygoyle 220	Tivela S220	Alphasyn PG220	Renolin PG220	Klübersynth GH 6-220
	FG	0 to 40°C (32 to 104°F)	Mobil DTE FM 220	N/A	N/A	Fuchs FM220	N/A
	FG-PAO	-25 to 60 °C (-13 to 140 °F)	Mobil/Cibus SHC220	N/A	N/A	Cassida GL220	Klüberoil 4 UH 1-220N
	FG-PG	-25 to 60°C (-13 to 140°F)	Mobil Glygoyle 220	N/A	N/A	Cassida WG220	Klübersynth UH 16-220
VG460	MIN-EP	0 to 40 °C (32 to 104 °F)	Mobilgear 600XP460	Omala 460	Alpha SP460	Renolin EP460	Klüberoil GEM 1-460N
	PAO-EP	-20 to 80 °C (-4 to 176 °F)	Mobilgear SHC460	Omala HD460	Alphasyn EP460	Gearmaster SYN460/NA	Klübersynth EG 4-460
	PAO	-20 to 80 °C (-4 to 176 °F)	Mobil SHC 634	Omala RL460	Alphasyn T460	Geralyn SF460	Klübersynth GEM 4-460N
	PG	-20 to 80 °C (-4 to 176 °F)	Mobil Glygoyle 460	Tivela S460	Alphasyn PG460	Renolin PG460	Klübersynth GH 6-460
	FG	0 to 40 °C (32 to 104 °F)	Mobil DTE FM460	N/A	N/A	Fuchs FM460	N/A
	FG-PAO	-20 to 80 °C (-4 to 176 °F)	Mobil/Cibus SHC460	N/A	N/A	Cassida GL460	Klüberoil 4 UH 1-460N
	FG-PG	-20 to 80 °C (-4 to 176 °F)	Mobil Glygoyle 460	N/A	N/A	Cassida WG460	Klübersynth UH1 6-460

Low-end service temperature limit may vary for a specific lubricant; Please also see the important notes on Page 1.



HELICAL IN-LINE FOOTED OIL FILL QUANTITIES



DRIVESYSTEMS

RETAIN FOR FUTURE USE

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Helical In-line footed lubrication

The following NORD Gear reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position. For additional information, please refer to the "Oil Plug & Vent Locations" documentation for your gear unit.

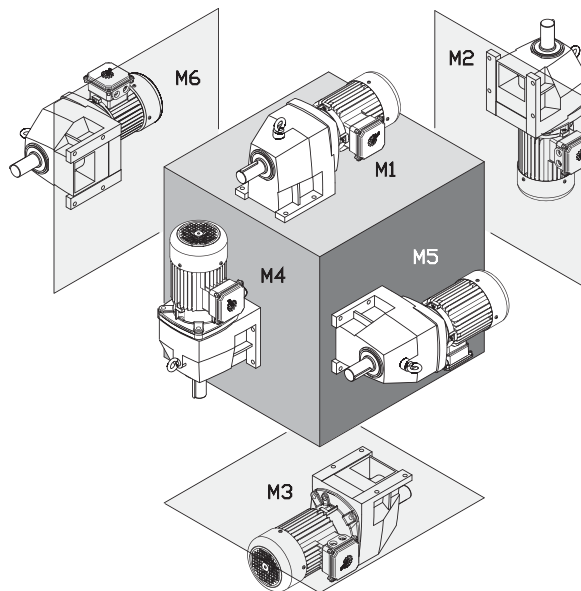


HARMFUL SITUATION



Actual oil volume can vary slightly depending upon the gear case size, mounting and ratio. Prior to commissioning the reducer, check the oil-fill level using the reducer's oil level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole.

For mounting orientations other than shown please consult NORD Gear. Reducer modifications may be required.



Type	M1		M2		M3		M4		M5		M6	
	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters	Quarts	Liters
SK02	0.160	0.150	0.630	0.600	0.740	0.700	0.630	0.600	0.420	0.400	0.420	0.400
SK03	0.320	0.300	1.06	1.000	0.850	0.800	0.950	0.900	0.630	0.600	0.630	0.600
SK11E	0.260	0.250	0.530	0.500	0.580	0.550	0.420	0.400	0.370	0.350	0.370	0.350
SK12	0.260	0.250	0.790	0.750	0.900	0.850	0.790	0.750	0.530	0.500	0.530	0.500
SK13	0.630	0.600	1.32	1.25	1.16	1.10	1.27	1.20	0.740	0.700	0.740	0.700
SK21E	0.630	0.600	1.27	1.20	1.27	1.20	1.06	1.000	1.06	1.000	1.06	1.000
SK22	0.530	0.500	1.90	1.80	2.11	2.00	1.90	1.80	1.43	1.35	1.43	1.35
SK23	1.37	1.30	2.54	2.40	2.43	2.30	2.48	2.35	1.69	1.60	1.69	1.60
SK31E	1.16	1.10	2.85	2.70	2.33	2.20	2.43	2.30	1.80	1.70	1.80	1.70
SK32	0.950	0.900	2.64	2.50	3.17	3.00	3.07	2.90	2.11	2.00	2.11	2.00
SK33N	1.69	1.60	3.07	2.90	3.38	3.20	3.91	3.70	2.43	2.30	2.43	2.30
SK41E	1.80	1.70	2.75	2.60	3.49	3.30	2.64	2.50	2.75	2.60	2.75	2.60
SK42	1.37	1.30	4.76	4.50	4.76	4.50	4.55	4.30	3.38	3.20	3.38	3.20
SK43	3.17	3.00	5.92	5.60	5.50	5.20	6.98	6.60	3.81	3.60	3.81	3.60
SK51E	2.33	2.20	4.65	4.40	4.97	4.70	4.23	4.00	3.59	3.40	3.59	3.40
SK52	2.64	2.50	7.40	7.00	7.19	6.80	7.19	6.80	5.39	5.10	5.39	5.10
SK53	4.76	4.50	9.20	8.70	8.14	7.70	9.20	8.70	6.34	6.00	6.34	6.00
SK62	6.87	6.50	15.86	15.00	13.74	13.00	16.91	16.00	15.86	15.00	15.86	15.00
SK63	13.74	13.00	15.32	14.50	15.32	14.50	16.91	16.00	13.74	13.00	13.74	13.00
SK72	10.57	10.00	24.31	23.00	19.03	18.00	27.48	26.00	24.31	23.00	24.31	23.00
SK73	21.66	20.50	21.14	20.00	23.78	22.50	28.53	27.00	21.14	20.00	21.14	20.00
SK82	14.80	14.00	37.00	35.00	28.54	27.00	46.51	44.00	33.82	32.00	33.82	32.00
SK83	31.71	30.00	32.76	31.00	35.93	34.00	39.10	37.00	34.88	33.00	34.88	33.00
SK92	26.43	25.00	77.16	73.00	49.68	47.00	80.33	76.00	54.96	52.00	54.96	52.00
SK93	56.02	53.00	73.99	70.00	62.04	59.00	76.10	72.00	51.79	49.00	51.79	49.00
SK102	38.05	36.00	83.50	79.00	69.76	66.00	107.81	102.00	75.05	71.00	75.05	71.00
SK103	78.19	74.00	75.05	71.00	78.21	74.00	102.52	97.00	70.82	67.00	70.82	67.00



DRIVESYSTEMS

HELICAL IN-LINE OIL PLUG & VENT LOCATIONS

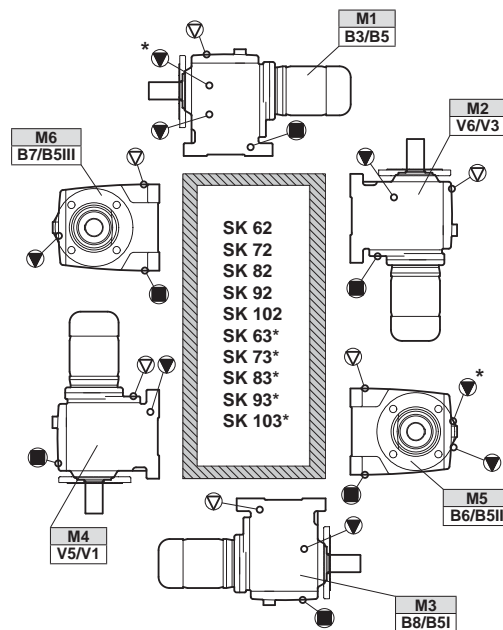
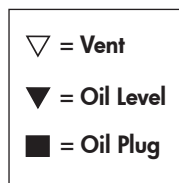
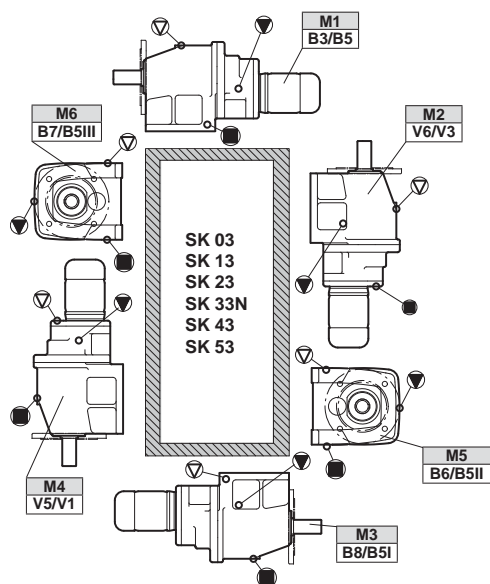
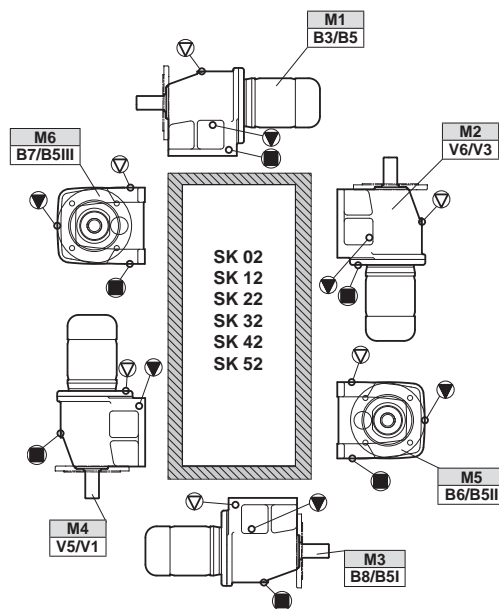
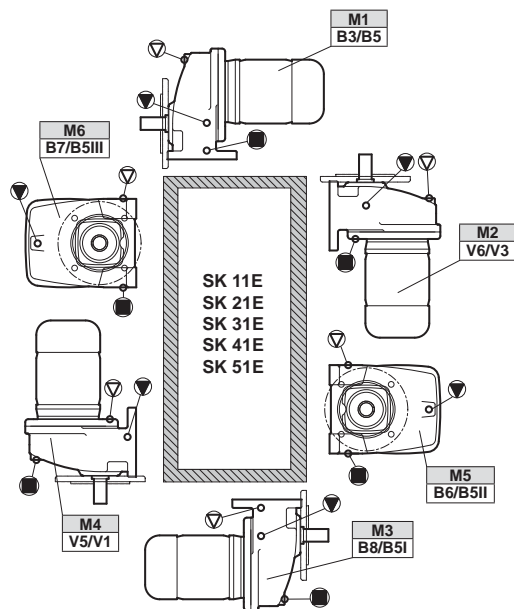


RETAIN FOR FUTURE USE

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Oil plug connections

Prior to commissioning the reducer, check the oil-fill level using the reducer's oil-level plug and drain or add additional oil as needed. The minimum acceptable oil level is 0.15 in (4mm) below the oil level hole. **For mounting orientations other than shown please consult NORD Gear. New plug locations may be required.**



* Oil level for 3 stage gear units.



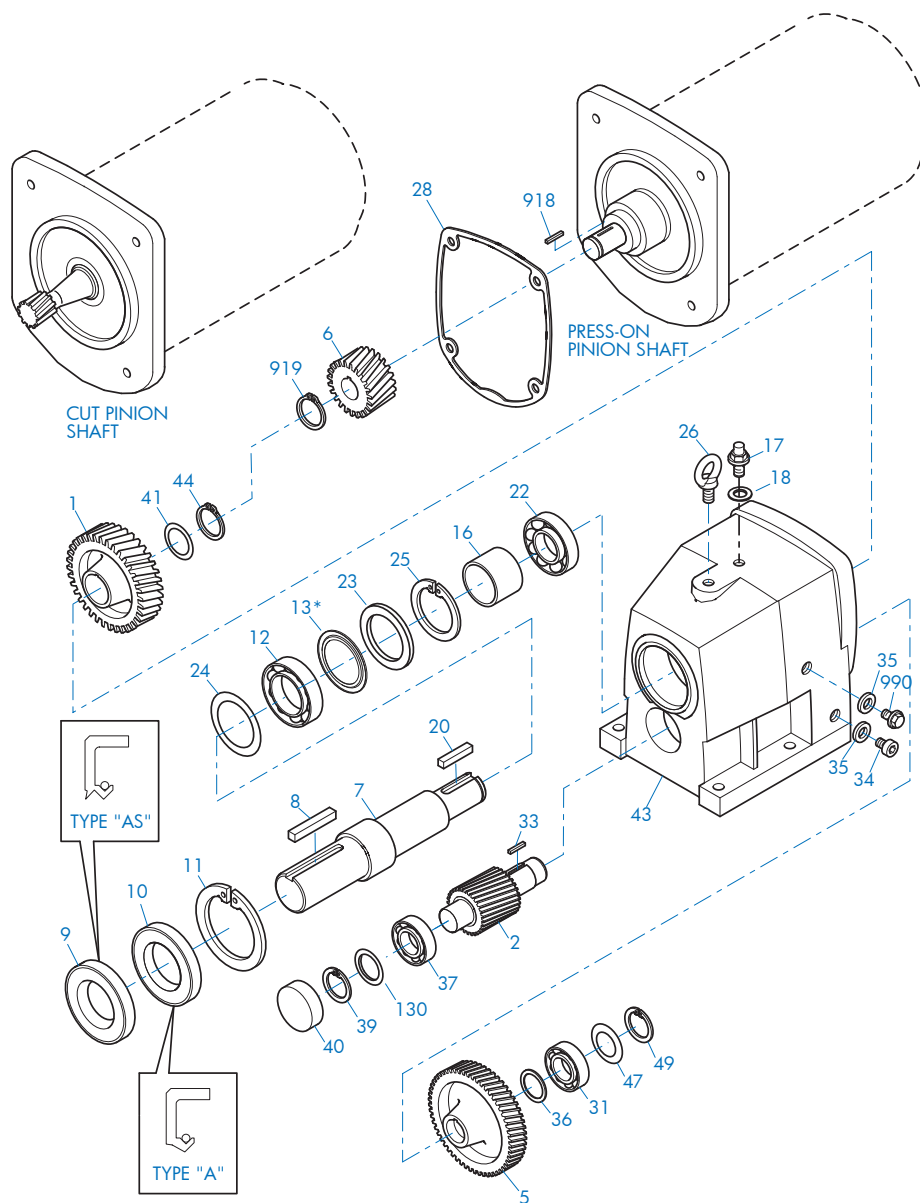
DRIVESYSTEMS

HELICAL IN-LINE PARTS LIST DRAWINGS

RETAIN FOR FUTURE USE



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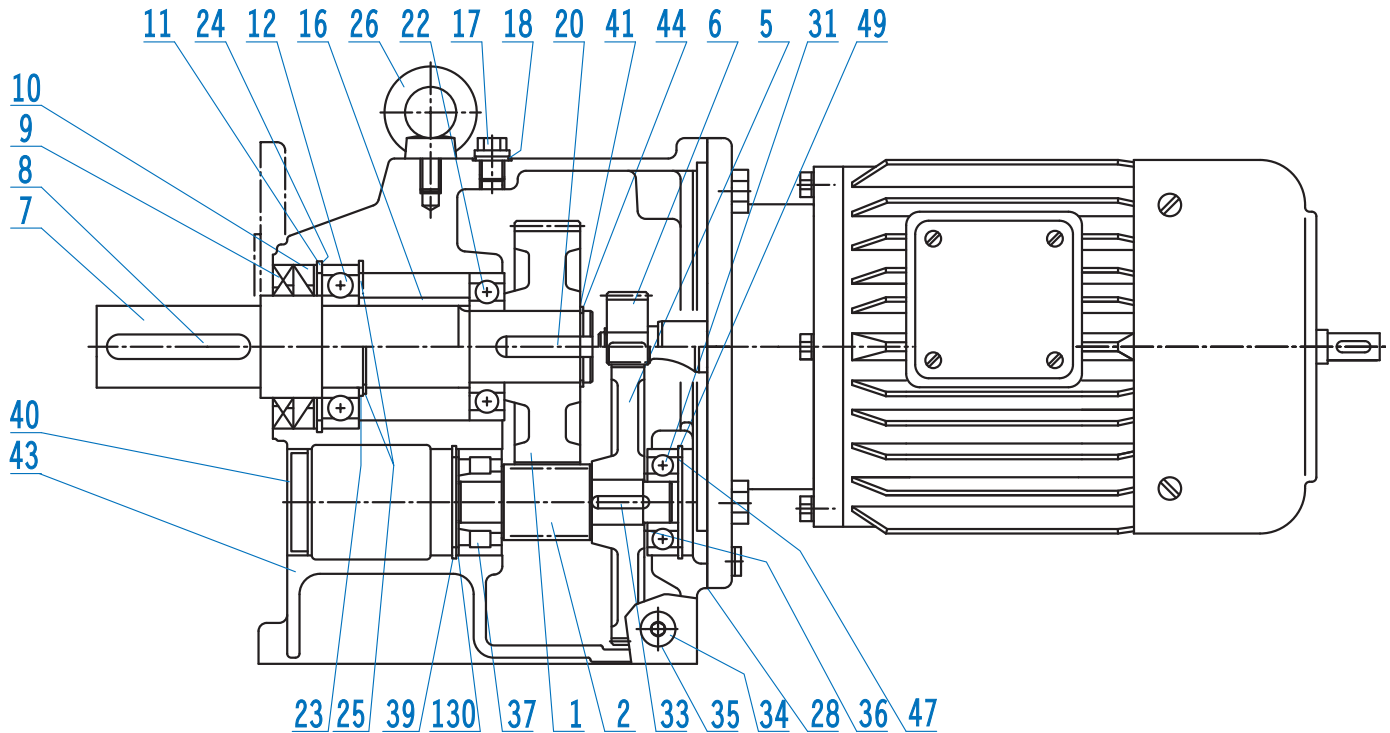
SK02 - SK52 Foot Mount

1	Gear	18	Seal	37	Anti-Friction Bearing
2	Pinion Shaft	20	Key	39	Snap Ring
5	Gear	22	Anti-Friction Bearing	40	Bore Plug
6	Pinion	23	Thrust Washer	41	Shim
7	Output Shaft	24	Shim	43	Gearcase
8	Key	25	Snap Ring	44	Snap Ring
9	Oil Seal	26	Flanged Eye Bolt	47	Shim
10	Oil Seal	28	Gasket	49	Snap Ring
11	Snap Ring	31	Anti-Friction Bearing	130	Shim
12	Anti-Friction Bearing	33	Key	918	Key
13	NILOS Ring*	34	Drain Plug	919	Snap Ring
16	Spacer	35	Gasket	990	Oil Level Plug
17	Vent Plug	36	Spacer		

* Conditionally used part

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SK02 - SK52 Foot Mount

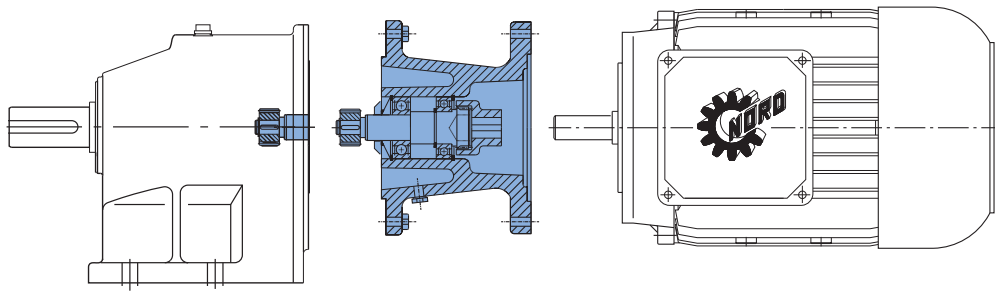
1 Gear	18 Seal	37 Anti-Friction Bearing
2 Pinion Shaft	20 Key	39 Snap Ring
5 Gear	22 Anti-Friction Bearing	40 Bore Plug
6 Pinion	23 Thrust Washer	41 Shim
7 Output Shaft	24 Shim	43 Gearcase
8 Key	25 Snap Ring	44 Snap Ring
9 Oil Seal	26 Flanged Eye Bolt	47 Shim
10 Oil Seal	28 Gasket	49 Snap Ring
11 Snap Ring	31 Anti-Friction Bearing	130 Shim
12 Anti-Friction Bearing	33 Key	918 Key
13 NILOS Ring*	34 Drain Plug	919 Snap Ring
16 Spacer	35 Gasket	
17 Vent Plug	36 Spacer	

* Conditionally used part

Troubleshooting

This section identifies some of the most common issues involved with NORD Gear speed reducers , and provides recommendations to assist you in defining and answering your questions as you work with our products. You may also contact our Engineering/Application departments if your questions are not answered in the table below.

Problem With the Reducer		Possible Causes	Suggested Remedy
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce the load.
	Improper lubrication	Insufficient lubrication	Check lubricant level and adjust up to recommended levels
		Excessive lubrication	Check lubricant level and adjust down to recommended levels.
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
Runs Noisy	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/or reinforce mounting and structure.
		Loose hold down bolts	Tighten bolts
	Failure of bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer.
	Insufficient lubricant	Level of lubricant in reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.
Output shaft does not turn	Internal parts are broken or missing	Overloading of reducer can cause damage	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected	Properly align reducer and coupling. Tighten coupling.
Oil Leakage	Worn seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.
	Unit runs hot or leaks	Overfilled reducer	Check lubricant level and adjust to recommended level.
		Vent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.
	Incorrect fill level	Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position on the name tag & verify with mounting chart in manual.



WARNING



LOCK OUT POWER before any maintenance is performed. Make absolutely sure that no voltage is applied while work is being done on the gearbox or input.

NEMA/ IEC Motor Adapters

Motor adapters allow for easy installation and removal of industry standard motors. Motor adapters consist of a coupling and an adapter housing that connects the motor to the gear reducer.

NORD Gear supplies a coupling that is to be mounted on the motor shaft. It is important that the coupling is properly positioned.

- For NEMA Input Adapters, follow the Motor Installation Instructions on pages 3-4.
- For IEC Input Adapters, the supplied coupling will mount directly against the motor shaft shoulder. No locating measurements need to be taken.



NOTE



Some of the larger IEC inputs will have a coupling spacer included to help locate the coupling. Slide the spacer against the motor shaft shoulder, slide the coupling against the spacer and tighten set screw(s).



NOTE



For the larger motor adapters (IEC160 / N250TC and larger), an Automatic Lubricator is supplied. This will need to be activated at the time of startup. For operation and activation instructions, refer to user manual U45200.

NEMA/IEC Motor Weight Limits

When mounting a motor to a NORD NEMA C-face motor adapter it is important to consider the motor's weight. Following is a table that includes the maximum motor weight the NEMA adapter can support. If the motor exceeds the listed weight it must be externally supported. When a C-face mounted motor is externally supported care must be taken to ensure that the support system does not impose additional pre-loads on the NEMA motor adapter.

NEMA Motor Weight Limit

Motor FRAME	56C	143TC	145TC	182TC	184TC	210TC
Max Weight [lb]	66	88	110	130	175	220
Motor FRAME	250TC	280TC	324TC	326TC	365TC	
Max Weight [lb]	440	550	770	1100	1540	

IEC Motor Weight Limit

Motor FRAME	63	71	80	90	100	112
Max Weight [lb]	55	66	88	110	130	175
Motor FRAME	132	160	180	200	225	250
Max Weight [lb]	220	440	550	770	1100	1540

Couplings

Couplings are made with tough abrasion resistant materials, which resist most chemicals and petroleum products. They are electrically isolated (prevent metal to metal contact) and require no lubrication or maintenance. Depending upon the size of the C-face input, NORD provides either a gear or a jaw type coupling.

NORD supplies three different types of couplings depending on the size of input: "J" style, "M" style and "Jaw" style coupling. Following are instructions on how to properly mount each type of coupling onto the motor.



NEMA/IEC INPUT ADAPTERS & THEIR COUPLINGS



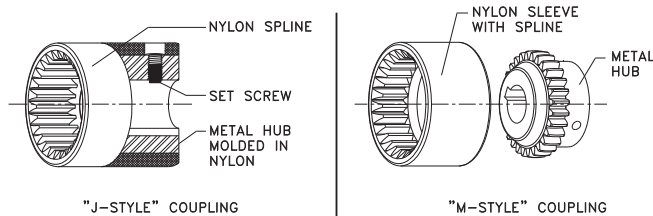
Couplings for the NEMA and IEC Adapters

Depending on the size of the input adapter to the gearbox, NORD Gear supplies two styles of couplings - BoWex® (gear tooth) and Rotex® (jaw) couplings.

BoWex® Couplings

NORD C-face adapter input shafts have a machined spline on the end. NORD incorporates two styles of BoWex® couplings, the "J" and "M" styles. The "J" style is a one-piece coupling with a metal hub and nylon spline. The "M" style is a two-piece coupling – the metal hub and a nylon sleeve. Nylon and steel components allow them to operate in high ambient temperatures without lubrication or maintenance.

- Nylon sleeves resist dirt, moisture, most chemicals and petroleum products
- No lubrication required
- Operating Conditions: -22°F - 212°F (-30°C - 100°C)
- Higher temperature coupling sleeve available up to 250°F (120°C)
- Special bore available



BoWex® Couplings Mechanical Ratings "J" Style

Coupling Type	Available Bore Sizes	Cont. / Peak Torque	Input
J14	11 mm, 14 mm 5/8 in	10/20 Nm 89/117 lb-in	IEC 63, 71 NEMA 56C
J24	19 mm, 24 mm 5/8 in, 7/8 in	20/40 Nm 117/354 lb-in	IEC 80, 90 NEMA 56C, 140TC
J28	28 mm 1-1/8 in	45-90 Nm 399/797 lb-in	IEC 100-112 NEMA 180TC

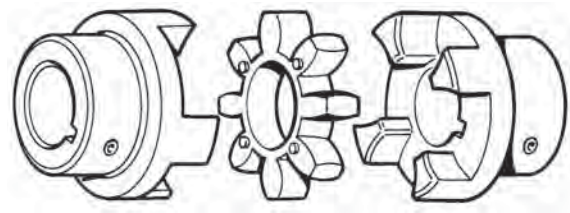
BoWex® Couplings Mechanical Ratings "M" Style

Coupling Type	Available Bore Sizes	Cont. / Peak Torque	Input
M14, M24, M28	Same as "J" Style	Same as "J" Style	Same as "J" Style
M38	38 mm 1-1/8 in, 1-3/8 in	80/160 Nm 708/1,416 lb-in	IEC 132 NEMA 180TC, 210TC
M42	42 mm 1-5/8 in	100/200 Nm 885/1,770 lb-in	IEC 160 NEMA 250TC
M48	48 mm 1-7/8 in	140/280 Nm 1,240/2,478 lb-in	IEC 180 NEMA 280TC

Rotex® Couplings

The cast iron jaw type couplings have an integral urethane "spider" that provides smooth transmission of the motor torque. A set screw on the coupling prohibits axial movement along the motor shaft.

- Excellent shock and vibration dampening
- Excellent resistance to oils and most chemicals
- No metal-to-metal contact
- Operating Conditions: -22°F - 195°F (-30°C - 90°C)
- Higher temperature material (Hytrel) spider available up to 230°F (110°C)
- Low temperature materials available upon request
- Special bores available



BoWex® Couplings Mechanical Ratings "J" Style

Coupling Type	Available Bore Sizes	Cont. / Peak Torque	Input	Spider
R19	14 mm 19 mm	17/34 Nm 150/300 lb-in	SEK/SEP 100	Urethane 98 Shore A Hardness Color: Red
R24	19 mm 24 mm	60/120 Nm 530/1,060 lb-in	SEK/SEP 100 SEK/SEP 130	
R28	32 mm 38 mm	95/190 Nm 840/1,680 lb-in	SEK/SEP 65 SEK/SEP 215	Urethane 92 Shore A Hardness Color: Yellow
R38	1.89" (48 mm) Max Bore	190/382 Nm 1,680/3,380 lb-in	-	
R42	2.44" (62 mm) Max Bore	310/620 Nm 2,740/5,480 lb-in	-	
R48	42, 48 mm 1-5/8, 1 7/8 in	310/620 Nm 2,740/5,480 lb-in	IEC 160, 180 NEMA 250T NEMA 280T SEK/SEP 300 SEK/SEP 215	
R65	60 mm 2-1/8, 2-3/8 in	625/1,250 Nm 5,530/11,060 lb-in	IEC 225 NEMA 320T NEMA 360T	
R90	65, 75, 80 mm 2-1/8, 2-3/8 in	2,400/4,800 Nm 24,240/42,480 lb-in	IEC 250, 280 IEC 315 NEMA 360TC NEMA 400TS NEMA 440TS	

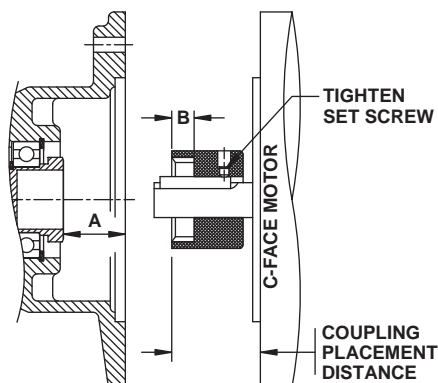


NEMA/IEC INPUT ADAPTERS & THEIR COUPLINGS



"J" Style Coupling NEMA C-face Motor Installation

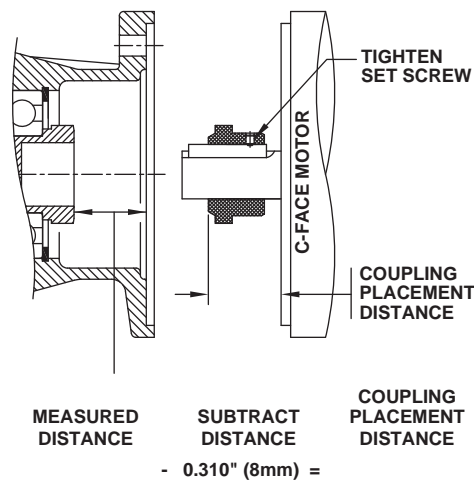
1. Measure the distance from the face of the input adapter to the face of the splined shaft and record that measurement as "A" in the equation below.
2. Measure depth of coupling engagement zone and record the measurement as "B" in the equation below.
3. Add "A" + "B" and subtract 0.08" (~2mm) from the distance. This needs to be done so that the coupling will not be preloaded after installation!
4. Use that measurement to locate the coupling from the face of the motor onto the shaft.
5. Once in place, tighten the set screw to lock the coupling in place. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
6. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



MEASURED DISTANCES		SUBTRACT DISTANCE		COUPLING PLACEMENT DISTANCE
A + B		- 0.080" (2mm)	=	
_____				_____

"M" Style Coupling NEMA C-face Motor Installation

1. Measure the distance from the face of the input adapter to the face of the splined shaft & record that measurement.
2. Subtract 0.31" (~8mm) from the distance. This needs to be done so that the coupling will not be preloaded after installation!
3. Use that measurement to locate the coupling from the face of the motor onto the shaft.
4. Once in place, tighten the set screw to lock the coupling in place. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
5. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.





NEMA/IEC INPUT ADAPTERS & THEIR COUPLINGS



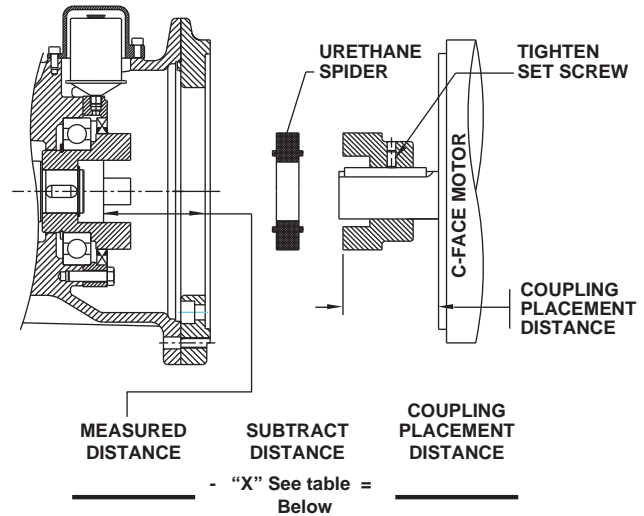
"Jaw" Style Coupling NEMA C-face Installation

1. Measure the distance from the face of the input adapter to the face of the coupling as shown and record that measurement.
2. Subtract the "X" dimension from the measured distance. This needs to be done so that the coupling will not be preloaded after installation!
3. Use that measurement to locate the coupling from the face of the motor onto the shaft.
4. The metal portion of the coupling should be heated up prior to assembly, generally 250°F to 300°F (120°C to 150°C).

**WARNING**

DO NOT HEAT THE URETHANE SPIDER.

5. Once in place, tighten the setscrew to lock coupling in place. Let the coupling cool down before placing the spider into the jaws. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
6. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



Coupling Size	"X" (Subtract this value from measured distance)
R14	0.06" (1.5 mm)
R19 & R24	0.08" (2.0 mm)
R28	0.10" (2.5 mm)
R38 & 42	0.12" (3.0 mm)
R48	0.14" (3.5 mm)
R65	0.18" (4.5 mm)
R90	0.22" (5.5 mm)



DRIVESYSTEMS

NEMA/IEC INPUT ADAPTERS & THEIR COUPLINGS

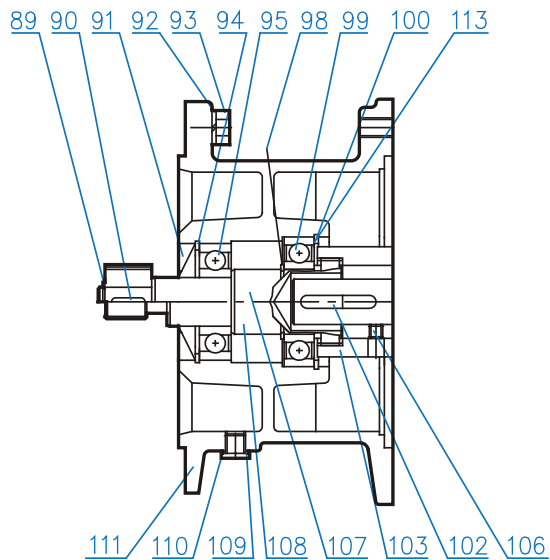


RETAIN FOR FUTURE USE

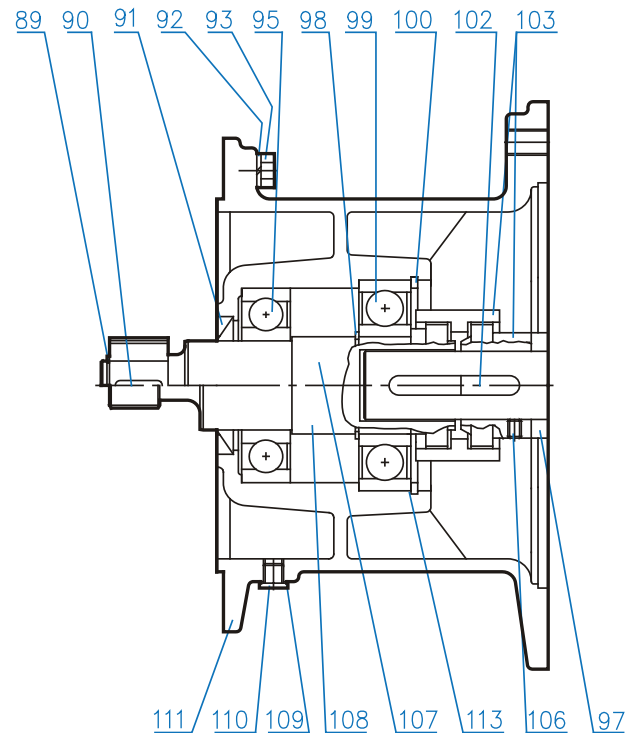
U45100 - 5 of 6

NEMA/IEC Parts List for UNICASE Gearboxes

NEMA 56C - 180TC



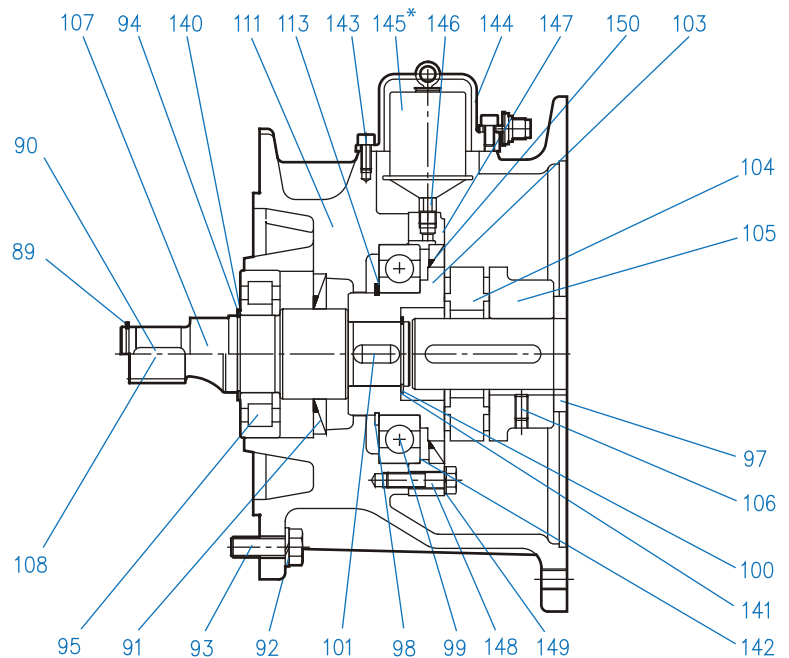
NEMA 180TC - 280TC



- 89 Circlip
- 90 Key
- 91 Shaft Seal
- 92 Washer
- 93 Hexagon Screw
- 94 Circlip
- 95 Clutch Shaft Bearing
- 97 Space
- 98 Circlip
- 99 Clutch Shaft Bearing
- 100 Circlip
- 101 Key
- 102 Key
- 103 Coupling
- 104 Coupling
- 105 Coupling
- 106 Set Screw
- 107 Clutch Shaft
- 108 Clutch Pinion Shaft
- 109 Seal
- 110 Oil-Plug
- 111 NEMA / IEC Adapter
- 112 Oil Flinger
- 113 Shim
- 140 Shim
- 141 Shim
- 142 Shim
- 143 Socket Head Screw
- 144 Cover
- 145 Automatic Lubricator*
- 146 Adapter
- 147 Bearing Cover
- 148 Hexagon Screw
- 149 Washer
- 150 Shaft Seal

* Please see U45250 for automatic lubricator Instructions.

NEMA 250TC - 400TC IEC 160 - IEC 315





NEMA/IEC INPUT ADAPTERS & THEIR COUPLINGS



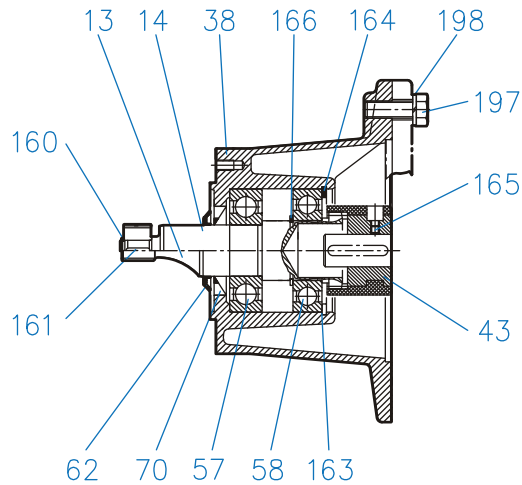
DRIVESYSTEMS

RETAIN FOR FUTURE USE

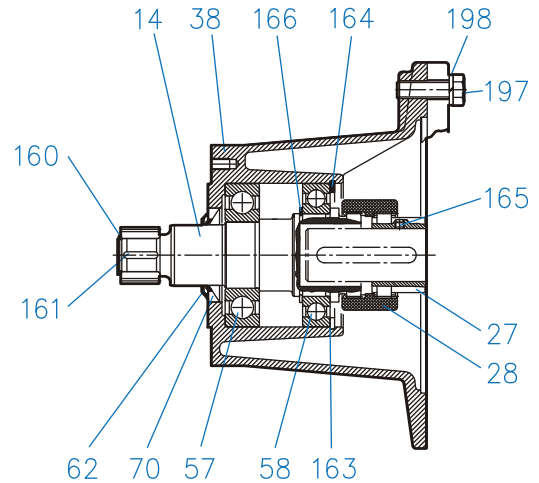
U45100 - 6 of 6

NEMA/IEC Parts List for Nordbloc Gearboxes

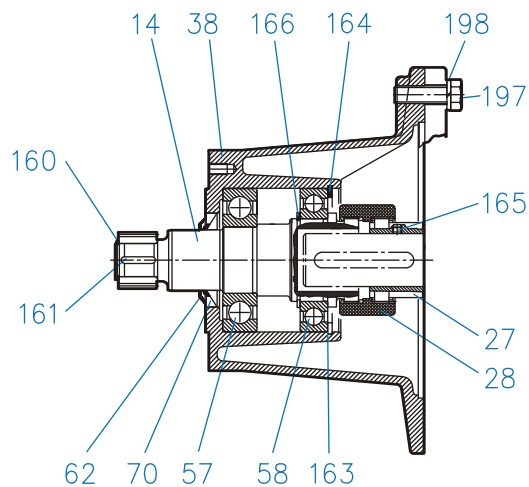
NEMA 56C - 180TC IEC 63 - IEC 112



NEMA 210TC - 280TC IEC 132-IEC 180



IEC 200



- | | |
|-----|----------------------|
| 13 | Clutch Pinion Shaft |
| 14 | Clutch Shaft |
| 26 | Coupling |
| 27 | Coupling |
| 28 | Coupling |
| 38 | IEC Adapter |
| 43 | Coupling |
| 57 | Clutch Shaft Bearing |
| 58 | Clutch Shaft Bearing |
| 62 | Oil Flinger |
| 70 | Shaft Seal |
| 101 | Key |
| 160 | Snap Ring |
| 161 | Key |
| 163 | Shim |
| 164 | Snap Ring |
| 165 | Set Screw |
| 166 | Snap Ring |
| 197 | Bolt |
| 198 | Spring Washer |

Items included in the touch-up kit

- I. No Rinse Alodine® Touch-N-Prep pen.
- II. Color matched sealer pen



WARNING



- Always wear Personal Protective Equipment (PPE), including gloves and safety glasses with side shields.
- When opening individual pens, pull safety caps straight out from pen. Do not twist or torque the cap to avoid damaging the applicator assembly.
- Do not use fingers to prime the applicator tip. Priming takes 15-30 seconds.
- Make sure the surface is clean and dry.



IMPORTANT NOTE

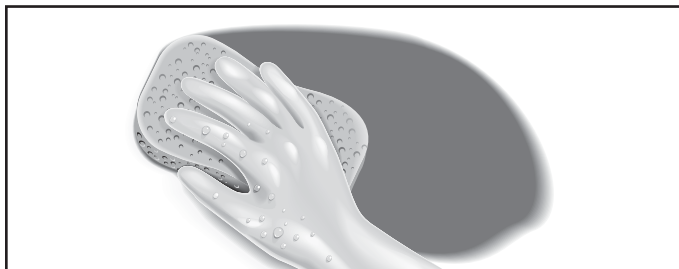


- I. Metal temperature must be above 50° F
- II. Do not excessively use abrasive pad while removing surface oxidation. Oxidation only needs to be removed from areas with exposed aluminum.
- III. Use enough product to wet surface but avoid pooling.
- IV. Do not rinse or wipe Alodine coating before the product is allowed to dry.
- V. Allow to air dry or use a blow dryer. Do not use a heat gun. Maximum drying temperature is 140°F.
- VI. Dry color will appear opaque.

Part I: Allodine® 871 Touch-N-Prep® Pen Instructions

Touch-N-Prep® pens are designed for easy and safe repair of clean, bare, or previously painted aluminum surfaces. It is a non-rinse, dry-in-place application that can be applied using the following steps:

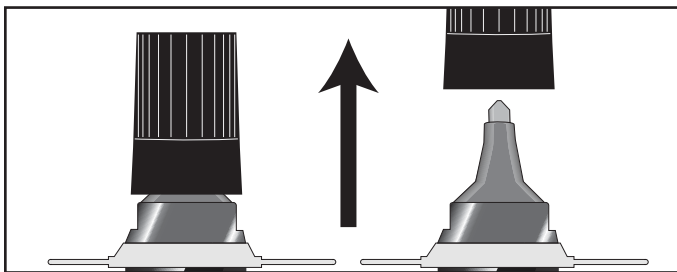
1. Surface Preparation



Before applying the coating, the treated surface must be cleaned using the following process:

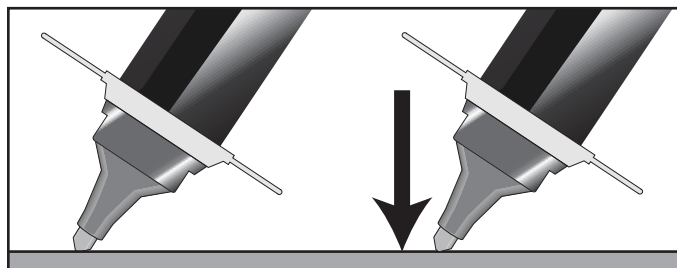
- If the scratch is more than 24 hours old use a moistened abrasive pad to remove oxides from the surface of the metal.
- Wipe substrate with a damp lint-free cloth to ensure complete removal of soils and dislodged oxides generated from the previous step.
- Allow Surface to dry before Touch-N-Prep® application.

2. Prime Applicator Tip

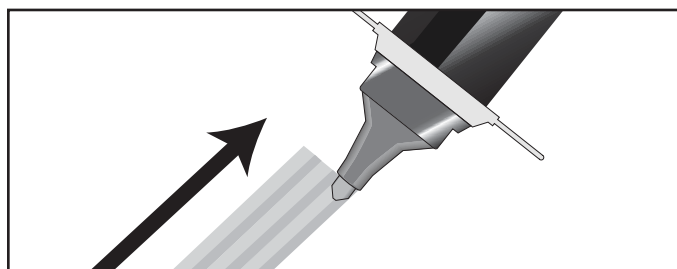


To activate, hold the Touch-N-Prep® pen upright and pop off the cap. Do not twist or turn to remove the cap, since this may result in the pen leaking. Hold the pen tip down onto a clean surface to begin the flow of solution to the tip.

3. Application

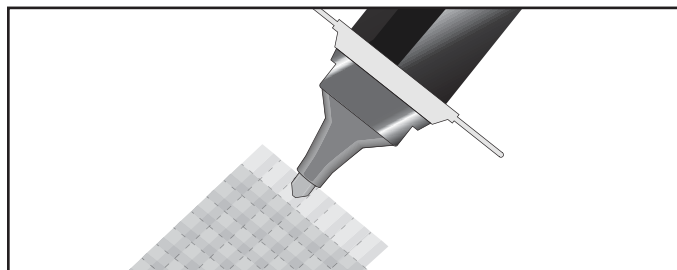


Press the pen tip down on the surface until solution fills the pen tip. Apply the Alodine® 871™ solution to the metal surface with firm, smooth, even strokes, covering all of the edges. Overlap each stroke and allow to dry.



Frequent short jabs to re wet the application rip are preferred to maintain constant coating weights and avoid over-wetting the felt tip.

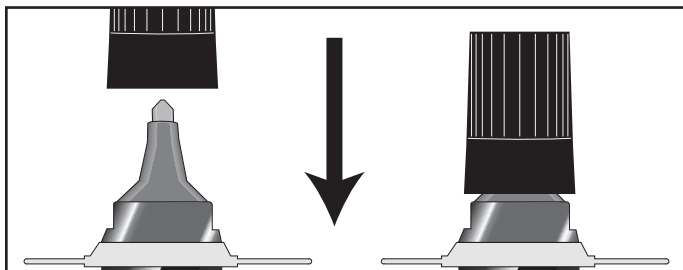
4. Re-Application



Within 5 minutes of the first coat, apply a second coat at a 90° angle to the first coat with the same smooth, firm stroke.

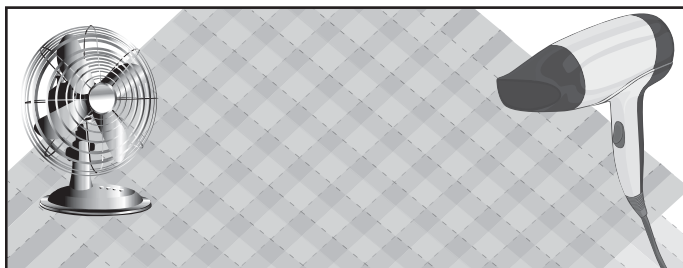


5. Prepare the Pen for Storage



Always immediately replace the cap when not in use to avoid evaporation and contamination.

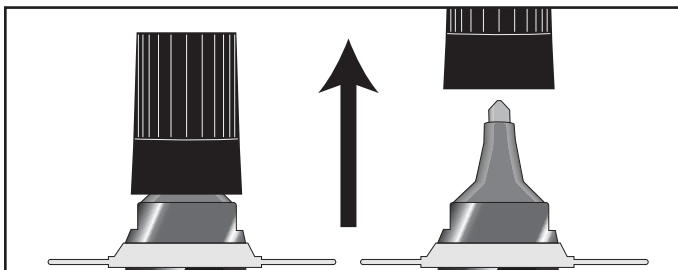
6. Drying



Allow the Alodine Touch-N-Prep® coating to air dry thoroughly.

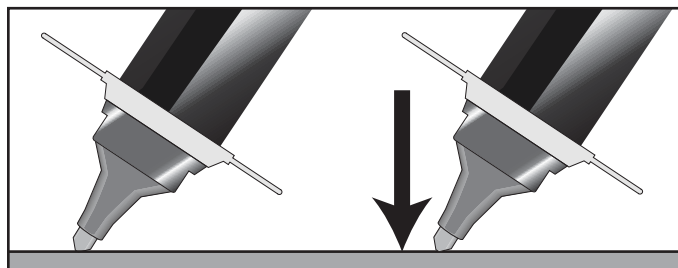
Part II: Sealer Application

1. Prime Applicator Tip



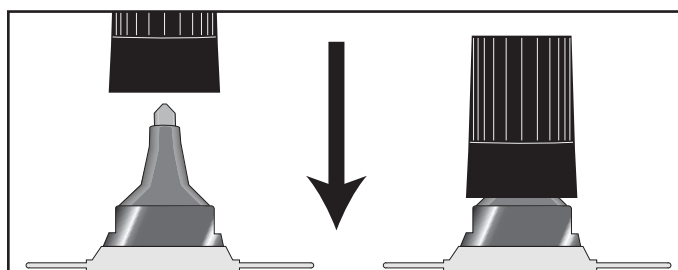
To activate, hold the pen upright and pop off the cap. Do not twist or turn to remove the cap, since this may result in the pen leaking. Hold the pen tip down onto a clean surface to begin the flow of solution to the tip.

2. Application



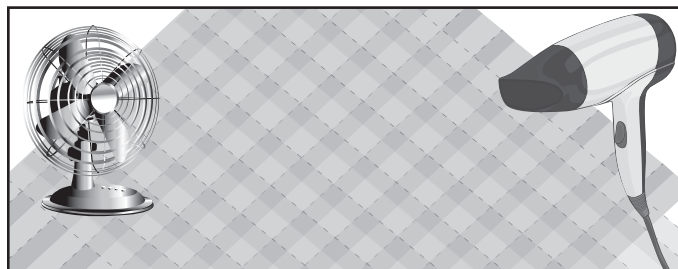
Press the pen tip down on the surface until solution fills the pen tip. Apply the sealer pen solution to the metal surface with firm, smooth, even strokes, covering all of the edges. Overlap each stroke and allow to dry.

3. Prepare the Pen for Storage



Always immediately replace the cap when not in use to avoid evaporation and contamination.

4. Drying



Allow the sealer pen coating to air dry thoroughly.



NORD GEAR CORPORATION



DRIVESYSTEMS

CONDITIONS OF SALE

WWW.NORD.COM

1. CONTRACT

Any contract between Nord Gear Corporation, hereinafter designated as Seller, and the Buyer is subject to the terms and conditions of sale hereinafter set forth. Any deviation from such terms and conditions must be specifically set forth in writing and consented to by Seller. Accordingly, the Buyer and Seller acknowledge and agree that the terms and conditions set forth below and on the face hereof shall govern Buyer's purchase of the goods described on the face hereof and shall take precedence over and represent the final agreement between Buyer and Seller, notwithstanding any inconsistent, contradictory or other prior or further conditions contained in any oral or written request or purchase order issued by Buyer or any other document furnished by Buyer in connection with its purchase of the Goods, regardless of whether such document or documents are exchanged simultaneously with this Invoice or prior or subsequent thereto. Any additional or different terms or conditions which may appear in any communication, oral or written, from Seller, its officers, employees, agents or representatives, are hereby expressly rejected and shall not be effective or binding upon the Seller, unless specifically hereafter agreed to in writing by Seller and no such additional or different terms or conditions in any document submitted to Seller by Buyer shall become part of the contract between Buyer and Seller, unless such written acceptance by Seller specifically recognizes and assents to their inclusion. Any objection by Buyer to the terms and conditions hereof shall be ineffective unless Seller is advised in writing thereof within two (2) days of the date of this Invoice.

2. CONFIRMATION

An order shall be deemed accepted only when duly confirmed by Seller, at Nord Gear Corporation's home office in Waukegan, Wisconsin, and upon such confirmation the order shall become a contract binding upon the parties hereto, their successors and assigns.

3. PRICES

Prices shown are list prices and may be subject to applicable discounts. Unless otherwise agreed upon in writing, prices are FOB factory Waukegan, Wisconsin. Prices and discounts are subject to change without notice until order is accepted. Seller's prices do not include cost of any inspection permits required.

4. LIMITED WARRANTY

Seller warrants the goods sold hereunder to be free from defects in material and workmanship under normal use and service not arising from misuse, negligence, or accident, including but not limited to the use, installation, and transportation of the goods by the Buyer, its agents, servants, employees, or by carriers. Such obligations under this warranty are limited to remedying any deficiencies in the goods at Waukegan, Wisconsin, or at such place or places in the United States of America as may be designated by Seller. THIS WARRANTY SHALL PERTAIN TO ANY PART OR PARTS OF ANY GOODS TO WHICH BUYER OR ITS ASSIGNS HAS GIVEN WRITTEN NOTICE OF CLAIMED DEFECTS TO SELLER. NORD GEAR CORP. WARRANTS ITS PRODUCTS AGAINST DEFECTS IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF 12 MONTHS FROM DATE OF INSTALLATION OR 18 MONTHS FROM DATE OF SHIPMENT WHICHEVER COMES FIRST ON ALL COMPONENTS. 36 MONTHS FROM DATE OF INVOICE OR 24 MONTHS FROM DATE OF INSTALLATION WHICHEVER COMES FIRST ON GEARS AND HOUSINGS ONLY. PARTS WHICH ARE SUBJECT TO OPERATIONAL WEAR AND TEAR, SUCH AS BELTS & TRACTION DISCS, ARE NOT COVERED BY THE LIMITED WARRANTY. Buyer shall be required to furnish Seller with details of such defects and this warranty shall be effective as to such goods which Seller's examination shall disclose to its satisfaction to have been defective and which at Seller's option shall promptly thereafter be returned to Seller or its nominees. THE LIMITED WARRANTY SET FORTH HEREIN IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. EXCEPT FOR THE EXPRESS WARRANTIES SET FORTH HEREIN, SELLER HAS MADE AND MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, AS TO THE GOODS SOLD HEREUNDER, INCLUDING, BUT NOT LIMITED TO, THEIR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. ANY DESCRIPTION OR MODEL OF THE GOODS IS FOR IDENTIFICATION OR ILLUSTRATIVE PURPOSES ONLY AND SHALL NOT BE DEEMED TO CREATE ANY WARRANTY, EXPRESS OR IMPLIED. SELLER MAKES NO REPRESENTATIONS AS TO THE CAPACITY OR PERFORMANCE OF THE GOODS SOLD HEREUNDER, EXCEPT AS SET FORTH IN THE INVOICE'S SPECIFICATIONS OR OTHER VALID AGREEMENT OR CONDITION AGREED TO BETWEEN THE PARTIES, AND ANY SUCH REPRESENTATIONS ARE EXPRESSLY CONDITIONED UPON THE CORRECTNESS OF THE DATA AND INFORMATION FURNISHED BY THE BUYER AND UPON THE GOODS BEING PROPERLY INSTALLED AND MAINTAINED. THE REMEDIES OF THE BUYER PROVIDED HEREUNDER ARE EXCLUSIVE. In no event shall the Seller be liable to the Buyer or to any other person for any loss or damage, direct or indirect, arising out of or caused by the use or operation of the goods, or for the loss of profits, business, or good will, or for any incidental, special or consequential damages. Seller shall in no event be liable to any person or firm (including any assignee or Buyer) except Buyer and its successors. Unless specifically authorized by Seller in writing, Seller shall not become responsible for any repair work done by Buyer or any other party on any goods sold. Any and all costs of the return to the Seller of such goods and all related costs to remove and re-install such goods, shall be borne by Buyer. Goods sold but not manufactured by the Seller are being warranted as to defects in material and workmanship consistent with the limited warranty policy of the original manufacturer of the goods and if there is not such a limited warranty policy, the warranty shall be limited to the provision of the preceding paragraph of Article 4 herein. Standards for the operating characteristics of the gearboxes and the gearmotors are in conformity with Seller's tests.

5. SHORTAGE AND NONCONFORMITY

Any claim of shortage or that the goods do not conform with the specifications of the order or model must be made in writing within ten (10) days after delivery of the goods (as to which such claim is made) to Buyer or its nominees, but in no event shall the claim be later than within the time limit provided by the carrier or insurance company, otherwise such claim shall be deemed waived. Buyer may not return any goods claimed to be in non-conformity without Seller's prior written authorization. Goods returned without permission will not be accepted, including for credit, and will be returned to Buyer, F.O.B. Seller's plant. Any claim based on the receipt of damaged Goods must be filed with the carrier which delivered the goods. The samples, measurements, dimensions and weights contained in the Seller's catalogs, sales manuals, photographs and drawings constitute only an approximate guide. The Seller reserves the right to make any change which the Seller, in its absolute discretion, considers necessary. While the goods will be delivered principally according to specifications or standards or quantities agreed upon, insignificant deviations or insignificant changes in construction are permissible. The same applies to partial deliveries. In the event that Buyer has a verified claim of shortage or nonconformity of the goods to the specifications of the order or the model, and if such claim has been submitted within the required time limit as set forth above, the Seller shall, at its own expense, make up for the shortage of the goods, or replace or repair the goods, as the case may be, but in no event shall Seller be or become liable to Buyer or to any other person or persons for any loss in damage, direct or indirect, arising out of or caused by such incidents or for the loss of profits, business or good will. The liability of the Seller to Buyer, if any hereunder, for breach of warranty, contract, negligence or otherwise, shall in no event exceed the amount of the purchase price of the goods sold with respect to which any damages are claimed. Shipping dates are estimates unless parties expressly agree on time of the essence.

6. FORCE MAJEURE

The obligation of the Seller shall be modified or excused, as the case may be, for reasons of Acts of God, war, governmental law regulations, strikes or lock-outs, fire, breakdown of machinery, whether in its own business enterprise, or for any other cause beyond Seller's control, the goods cannot be delivered or their delivery becomes delayed in whole or in part. In the above instances time for delivery shall be extended for the period of the delay caused, with the proviso, however, that either party may cancel in writing the undelivered portion of the order or contract if the delay exceeds six (6) months from the delivery date originally confirmed by Seller. In no event shall Seller become liable in the aforesaid instances to Buyer or any third party for consequential damages or business loss.

7. SHIPMENT AS UNIT

Each shipment by Seller shall be treated as a separate and distinct unit with respect, but only with respect to forwarding, terms of payment, and the making of claims by the Buyer: provided, however, that if the Buyer defaults in the payment of any obligation to Seller or any installments thereof, under any agreement between Buyer and Seller, or if Buyer refuses to accept any goods when tendered for delivery, the Seller may, on fifteen (15) days written notice to the Buyer, without prejudice to Seller's other lawful remedies, either defer further performance until the defaulted payments are made in full, or make future deliveries for cash in advance only, or treat the entire contract or contracts with Buyer as breached by the Buyer and pursue its remedies for breach.

8. BUYER'S REFUSAL OF DELIVERY

If Buyer refuses to accept delivery of any goods tendered for delivery, then Seller, without prejudice to Seller's other lawful remedies, may either store or cause such goods to be stored in a warehouse, for buyer's account and at Buyer's cost, risk and expense, or sell such goods (without notice) to any purchaser at public or private sale, and hold the Buyer liable for any difference between (a) the contract price of the goods, and (b) the price at which goods are resold less the costs and expense of such resale including brokerage commissions, or restocking charges.

9. GOODS IN TRANSIT

If prior to delivery or while the goods are in transit, Buyer or Seller becomes bankrupt or insolvent, or any petition in bankruptcy or for the reorganization or for a state court receivership is filed against Buyer or Seller, as the case may be, then the other party hereto may forthwith terminate this contract by giving written notice of such termination. Such termination shall not affect any claim for damages available to the Buyer, provided that if Buyer is then indebted to Seller, the amount of any such damage claim shall be abated to the extent that the indebtedness of Buyer to Seller, as actually paid in money, is abated by any order of judgement entered or any plan adopted in any bankruptcy, reorganization, receivership, or similar proceeding. Such termination shall not prejudice the Seller's rights to any amounts then due under the contract. If Buyer becomes bankrupt or insolvent or any petition in bankruptcy or for reorganizing or if a state court receivership is filed against Buyer, then, at its option Seller may take possession of any goods theretofore sold to Buyer, in connection with which the full purchase price has not been paid, analogous to the terms and provisions set forth in Paragraphs 11 and 12 hereinafter.

10. DELIVERY

(a) Any indicated dates of delivery are approximate only, but NORD Gear will attempt to meet them whenever possible. (b) NORD Gear will not be liable for any penalty clauses contained in any specifications or order submitted unless agreed to in writing by an authorized officer of NORD Gear Corporation. (c) Unless otherwise agreed, delivery of the goods to any carrier shall constitute delivery to the Buyer, and thereafter the risk of loss or damage to the goods shall be upon the Buyer. (d) If the Buyer does not give delivery instructions to the Seller at least (10) days prior to the delivery date ex factory confirmed by the Seller, the Seller may deliver the goods to a carrier of its own choosing, at Buyer's cost and risk, or, at Seller's option, may store the goods on the pier or any warehouse, at Buyer's cost and risk. Any purchase price in such event becomes due and payable within ten (10) days of such storage.

11. PAYMENT OF PURCHASE PRICE

Time of payment is of the essence under the contract. Unless otherwise provided, terms of payment are 30 days net from the date of invoice with a 1% discount if paid within 10 days of date of invoice. Upon default in any of the terms of the contract, or failure to comply with any of the conditions thereof, or upon seizure of the property under execution or other legal process, or if the Buyer becomes bankrupt or insolvent, or any petition for reorganization or for a state court receivership is filed against Buyer, or if the Buyer makes any assignment for the benefit of its creditors or otherwise sells, encumbers or disposes of the goods, or if for any other reason the Seller should deem itself insecure, the full amount of the purchase price then remaining unpaid shall at once become due and payable at the option of the Seller.

12. BUYER'S DEFAULT

Upon the Buyer's default, the Seller may dispose of the merchandise in any manner that it deems fit and, if it desires to resell same, may do so at private or public sale, with or without notice, and with or without the property being at the place of sale, subject, however, to applicable laws. The Seller or its assigns shall have the right to bid at such sale and may become the purchaser of the property. The proceeds of the sale shall first be applied to the expenses incurred in retaking, repairing, storing and selling the goods, reasonable attorney's fees included, and then shall be applied to the payment of the balance due under the contract. Any surplus amount shall be paid to the Buyer. If a deficiency results after the resale, the Buyer agrees to pay such forthwith, together with reasonable attorney's fees, for the recovery of the goods incurred by the Seller. If upon the Buyer's default, the Seller elects not to resell any goods which it may repossess, then the cost of repossession, including reasonable attorney's fees, shall forthwith be due and payable from Buyer to Seller. Buyer agrees to pay all reasonable costs and reasonable attorney's fees incurred by Seller in enforcing Seller's rights against Buyer, including Seller's right to payment of the purchase price of the goods and Buyer's payment of all other amounts owing to Seller required under this Invoice and Conditions of Sale.

13. SECURITY INTEREST AND TITLE

In states and localities which are governed by the Uniform Commercial Code, this contract shall serve as security agreement, reserving in Seller a security interest until full payment of purchase price. The provisions of the Uniform Commercial Code regarding security interest shall have preference and apply if inconsistent with other terms of the conditions of sale. In states and localities where the Uniform Commercial Code does not apply, title to the goods shall remain in the Seller or its assigns until full payment of the purchase price. Buyer agrees to execute forthwith any and all documents in such a way and form as Seller may need for filing or recording the security interest under the Uniform Commercial Code with the proper registers or offices, or for filing or recording the conditional sales contract.

14. SALES AND USE TAX

Buyer agrees to bear and pay any sales or use tax in connection with the purchase herein, and to hold the Seller harmless from payment. At the option the Seller, Buyer shall give evidence of payment or of exemption certificate.

15. INSURANCE

The Buyer shall keep the goods insured against damage by fire, water or other casualty as required by Seller, with a company acceptable to Seller, with loss payable to Seller for the total purchase price until the Seller is fully paid. Seller, if it so elects, may place said insurance at Buyer's expense; Seller may cancel such insurance at any time and without notice and may receive the return premium, if any.

16. MODIFICATION BY SELLER

Any contract may be assigned or transferred by the Seller, or the time for the making of any payment due by Buyer may be extended by Seller without derogation of any of the rights of the Seller or its assigns. Waiver by any party of any default shall not be deemed a waiver of any subsequent default.

17. RETURNED GOODS

No goods will be accepted for return unless authorized in writing by Seller. In all cases, transportation and restocking charges will be borne by Buyer.

18. PACKING

The Buyer will be charged for export packaging or other special packing desired. Cost for cartage to ship or transfer express will be added to the invoice. No credit will be allowed if no packing is required.

19. CHANGES/CANCELLATION

NORD Gear will not accept changes in specifications to a confirmed order unless such changes are requested in writing and confirmed back in writing. In addition, the purchaser must to agree to any additional charges that may arise from the change. Placing orders on hold or cancellation of orders requires Seller's written approval, and are subject to cancellation and/or restocking charges.

20. BUYER'S RESPONSIBILITY AS TO MAINTENANCE

Buyer shall use and shall require its employees and agents to use all safety devices and guards and shall maintain the same in proper working order. Buyer shall use and require its employees and agents to use safe operation procedures in operating the equipment and shall further obey and have its employees and agents obey safety instructions given by Seller. If Buyer fails to meet the obligations herein, Buyer agrees to defend, indemnify and save Seller harmless from any liability or obligation with regard to any personal injuries or property damages directly or indirectly connected with the operation of the equipment. Buyer further agrees to notify Seller promptly and in any event not later than ten (10) days after notice or knowledge of any accident or malfunction involving Seller's equipment which has caused personal injury or property damages and to cooperate fully with Seller in investigating and determining the causes of such accident and malfunction. In the event that Buyer fails to give such notice to Seller or to cooperate with Seller, Buyer shall be obligated to defend, indemnify and save Seller harmless from any such claims arising from such accident.

21. MISCELLANEOUS PROVISIONS

(a) If for any reason a provision of a contract is legally invalid, then in such event the rest of the contract shall remain in full force and effect, except that the parties shall try to replace such invalid provision closest to their original mutual intentions. (b) This Invoice and these Conditions of Sale constitute the entire agreement between the parties regarding the subject matter hereof and supercedes all prior agreements, understandings and statements, whether oral or written, regarding such subject matter. No modification to, change in or departure from, the provisions of this Invoice and Conditions of Sale shall be valid or binding on Seller, unless approved in writing by Seller. No course of dealing or usage of trade shall be applicable unless expressly incorporated into this Invoice and Conditions of Sale. Any amendments to any contract or contracts between the parties shall be valid only upon the written consent of both parties.

22. NON ASSIGNMENT BY BUYER

Contract or contracts may not be assigned by the Buyer without prior written consent of the Seller.

23. APPLICABLE LAW AND VENUE

All contracts and their interpretation are governed by the applicable, substantive laws of the State of Wisconsin. Any litigation brought by the Buyer regarding this Invoice or goods purchased hereunder may only be brought in the Circuit Court for Dane County, Wisconsin.

NORD Gear Limited

Toll Free in Canada: 800.668.4378

Nord Gear Company Terms 12/4/06

NORD Gear Corporation

Toll Free in the United States: 888.314.6673

06.09.09

www.nord.com/docs



DRIVESYSTEMS

NORD GEAR LIMITED

TERMS & CONDITIONS OF SALE



WWW.NORD.COM

1. CONTRACT

Any contract between Nord Gear Limited, hereinafter designated as Seller, and the Buyer is subject to the terms and conditions of sale hereinafter set forth. Any deviation from such terms and conditions must be specifically set forth in writing and consented to by Seller.

2. CONFIRMATION

An order shall be deemed accepted only when duly confirmed by Seller, at Nord Gear Limited's home office in Brampton, Ontario, and upon such confirmation the order shall become a contract binding upon the parties hereto, their successors and assigns.

3. PRICES

Prices shown are list prices and may be subject to applicable discounts. Unless otherwise agreed upon in writing, prices are FOB factory Brampton, Ontario. Prices and discounts are subject to change without notice until order is accepted. Seller's prices do not include cost of any inspection permits required.

4. LIMITED WARRANTY

Seller warrants the goods sold hereunder to be free from defects in material and workmanship under normal use and service not arising from misuse, negligence, or accident, including but not limited to the use, installation, and transportation of the goods by the Buyer, its agents, servants, employees, or by carriers. Such obligations under this warranty are limited to remedying any deficiencies in the goods at Brampton, Ontario, or at such place or places in Canada as may be designated by Seller. This warranty shall pertain to any part or parts of any goods to which Buyer or its assigns has, within one year from date of original factory invoice, given written notice of claimed defects to Seller. Buyer shall be required to furnish Seller with details of such defects and this warranty shall be effective as to such goods which Seller's examination shall disclose to its satisfaction to have been defective and which at Seller's option shall promptly thereafter be returned to Seller or its nominees. EXCEPT FOR THE EXPRESS WARRANTIES SET FORTH ABOVE, SELLER HAS MADE NO WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, AS TO THE GOODS SOLD HEREUNDER, INCLUDING, BUT NOT LIMITED TO THEIR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. ANY DESCRIPTION OR MODEL OF THE GOODS IS FOR IDENTIFICATION OR ILLUSTRATIVE PURPOSES ONLY AND SHALL NOT BE DEEMED TO CREATE AN EXPRESS WARRANTY. THE REMEDIES OF THE BUYER SET FORTH IN THIS SECTION ARE EXCLUSIVE. In no event shall the Seller be liable to the Buyer or to any other person for any loss or damage, direct or indirect, arising out of or caused by the use or operation of the goods, or for the loss of profits, business, or good will, or for any incidental, special or consequential damages. Seller shall in no event be liable to any person or firm (including any assignee or Buyer) except Buyer and its successors. Unless specifically authorized by Seller in writing, Seller shall not become responsible for any repair work done by Buyer or any other party on any goods sold. Any costs of the return of such goods to Seller shall be borne by Buyer. Goods sold but not manufactured by the Seller are being warranted as to defects in material and workmanship consistent with the limited warranty policy of the original manufacturer of the goods and if there is not such a limited warranty policy, the warranty shall be limited to the provisions of the preceding paragraph of Article 4 hereon. Standards for the operating characteristics of the gearboxes and the gearmotors are in conformity with Seller's test. THIS WARRANTY IS IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. THE SELLER DOES NOT ASSUME, NOR DOES IT AUTHORIZE ANY PERSON TO ASSUME, ON ITS BEHALF, ANY OTHER OBLIGATION OR LIABILITY.

5. SHORTAGE AND NONCONFORMITY

Any claim of shortage or that the goods do not conform with the specifications of the order or model must be made in writing within ten (10) days after delivery of the goods (as to which such claim is made) to Buyer or its nominees, but in no event shall the claim be later than within the time limit provided by the carrier or insurance company, otherwise such claim shall be deemed waived. The samples, measurements, dimensions and weights contained in the Seller's catalogs, sales manuals, photographs and drawings constitute only an approximate guide. The Seller reserves the right to make any changes which the Seller, in its absolute discretion, considers necessary. While the goods will be delivered principally according to specifications or standards or quantities agreed upon, insignificant deviations or insignificant changes in construction are permissible. The same applies to partial deliveries. In the event that Buyer has a verified claim of shortage or nonconformity of the goods to the specifications of the order or the model and if such claim has been submitted within the required time limit as set forth above, the Seller shall, at its own expense, make up for the shortage of the goods, or replace or repair the goods, as the case may be, but in no event shall Seller be or become liable to Buyer or to any other person or persons for any loss in damage, direct or indirect, arising out of or caused by such incidents or for the loss of profits, business or good will. Shipping dates are estimates unless parties expressly agree on time of the essence.

6. FORCE MAJEURE

The obligation of the Seller shall be modified or excused, as the case may be, for reasons of Acts of God, war, governmental law regulations, strikes or lock outs, fire, breakdown of machinery, whether in its own business enterprise, or if for any other cause beyond Seller's control, the goods cannot be delivered or their delivery becomes delayed in whole or in part. In the above instances time for delivery shall be extended for the period of the delay caused, with the proviso, however, that either party may cancel in writing the undelivered portion of the order or contract if the delay exceeds six (6) months from the delivery date originally confirmed by Seller. In no event shall Seller become liable in the aforesaid instances to Buyer or any third party for consequential damages or business loss.

7. SHIPMENT AS UNIT

Each shipment by Seller shall be treated as a separate and distinct unit with respect, but only with respect to forwarding, terms of payment, and the making of claims by the Buyer, provided, however, that if the Buyer defaults in the payment of any obligation to Seller or any installments thereof, under any agreement between Buyer and Seller, or if Buyer refuses to accept any goods when tendered for delivery, the Seller may, on fifteen (15) days' written notice to the Buyer, without prejudice to Seller's other lawful remedies, either defer further performance until the defaulted payments are made in full, or make future deliveries for cash in advance only, or treat the entire contract or contracts with Buyer as breached by the Buyer and pursue its remedies for breach.

8. BUYER'S REFUSAL OF DELIVERY

If Buyer refuses to accept delivery of any goods tendered for delivery, then Seller, without prejudice to Seller's other lawful remedies, may either store or cause such goods to be stored in a warehouse, for Buyer's account and at Buyer's cost, risk and expense, or sell such goods (without notice) to any purchaser at public or private sale, and hold Buyer liable for any difference between (a) the contract price of the goods, and (b) the price at which goods are resold less the costs and expense of such resale including brokerage commissions, or restocking charges.

9. GOODS IN TRANSIT

If prior to delivery or while the goods are in transit, Buyer or Seller becomes bankrupt or insolvent, or any petition in bankruptcy or for the reorganization or for appointment of a receiver is filed against Buyer or Seller, as the case may be, then the other party hereto may forthwith terminate this contract by giving written notice of such termination. Such termination shall not affect any claim for damages available to the Buyer, provided that if Buyer is then indebted to Seller, the amount of any such damage claim shall be abated to the extent that the indebtedness of Buyer to Seller, as actually paid in money, is abated by any order or judgment entered or any plan adopted in any bankruptcy, reorganization, receivership, or similar proceeding. Such termination shall not prejudice the Seller's rights to any amounts then due under the contract. If Buyer becomes bankrupt or insolvent or any petition in bankruptcy or for reorganization or if a state court receivership is filed against Buyer, then, at its option, Seller may take possession of any goods theretofore sold to Buyer, in connection with which the full purchase price has not been paid, analogous to the terms and provisions set forth in Paragraphs 11 and 12 hereinafter.

10. DELIVERY

(a) Unless otherwise agreed, delivery of the goods to any carrier shall constitute delivery to the Buyer, and thereafter the risk of loss or damage to the goods shall be upon the Buyer. (b) If the Buyer does not give delivery instructions to the Seller at least (10) days prior to the delivery date as factory confirmed by the Seller, the Seller may deliver the goods to a carrier of its own choosing, at Buyer's cost and risk, or, at Seller's option, may store the goods on the pier or on any warehouse at Buyer's cost and risk. Any purchase price in such event becomes due and payable within ten (10) days of such storage.

11. PAYMENT OF PURCHASE PRICE

Time of payment is of the essence under the contract. Upon default in any of the terms of the contract, or failure to comply with any of the conditions thereof, or upon seizure of the property under execution at other legal process, or if the Buyer becomes bankrupt or insolvent, or any petition for reorganization or for appointment of a receiver is filed against Buyer, or if the Buyer makes any assignment for the benefit of its creditors or otherwise sells, encumbers or disposes of the goods, or if for any other reason the Seller should deem itself insecure, the full amount of the purchase price then remaining unpaid shall at once become due and payable at the option of the Seller.

12. BUYER'S DEFAULT

Upon the Buyer's default, the Seller may dispose of the merchandise in any manner that it deems fit and, if it desires to resell same, may do so at private or public sale, with or without notice, and with or without the property being at the place of sale, subject, however, to applicable laws. The Seller or its assigns shall have the right to bid at such sale and may become the purchaser of the property. The proceeds of the sale shall first be applied to the expenses incurred in retaking, repairing, storing and selling the goods, reasonable solicitor's fees included, and then shall be applied to the payment of the balance due under the contract. Any surplus amount shall be paid to the Buyer, if a deficiency results after the resale, the Buyer agrees to pay such shortfall, together with reasonable solicitor's fees, for the recovery of the goods incurred by the Seller. If upon the Buyer's default, the Seller elects not to resell any goods which it may repossess, then the cost of repossession, including reasonable solicitor's fees, shall forthwith be due and payable from Buyer to Seller.

13. SECURITY INTEREST AND TITLE

In provinces which are governed by a Personal Property Security Act, this contract shall serve as Security Agreement, reserving in Seller a security interest until full payment of purchase price. The provisions of the Personal Property Security Act regarding security interest shall have preference and apply if inconsistent with other terms of the conditions of sale herein. In provinces where a Personal Property Security Act does not apply, title to the goods shall remain in the Seller or its assigns until full payment of the purchase price. Buyer agrees to execute forthwith any and all documents in such a way and form as Seller may need for filing or recording the security interest under a Personal Property Security Act with the proper registers or offices, or for filing or recording the Conditional Sales Contract herein.

14. SALES AND USE TAX

The Seller's prices do not include sales, use, excise or other taxes payable to any governmental authority in respect of the sale of Seller's goods. The Buyer shall pay, in addition to the Seller's price the amount of any such taxes or shall reimburse the Seller for the amount thereof that the Seller may be required to pay. At the option of the Seller, Buyer shall give evidence of payment or of exemption certificate.

15. INSURANCE

The Buyer shall keep the goods insured against damage by fire, water or other casualty as required by Seller, with a company acceptable to Seller, with loss payable to Seller for the total purchase price until the Seller is fully paid. Seller, if it so elects, may place said insurance at Buyer's expense. Seller may cancel such insurance at any time and without notice and may receive the return premium, if any.

16. MODIFICATION BY SELLER

Any contract may be assigned or transferred by the Seller, or the time for the making of any payment due by Buyer may be extended by Seller without derogation of any of the rights of the Seller or its assigns. Waiver by any party of any default shall not be deemed a waiver of any subsequent default.

17. RETURNED GOODS

No goods will be accepted for return unless authorized in writing by Seller. In all cases, transportation and restocking charges will be borne by Buyer.

18. PACKING

The Seller does not charge for standard packaging for domestic shipment. The Buyer will be charged, however, for export packaging or other special packing desired. Cost for cartage to ship or transfer express will be added to the invoice. No credit will be allowed if no packing is required.

19. EXPORT ORDER

Export orders are to be accompanied by a confirmed irrevocable Letter of Credit in Seller's favor, in Canadian currency, with an accredited Canadian bank, subject to Seller's draft, with shipping documents attached.

20. CANCELLATION

Placing orders on hold or cancellation of orders require Seller's written approval, and are subject to cancellation and/or restocking charges.

21. BUYER'S RESPONSIBILITY AS TO MAINTENANCE

Buyer shall use and shall require its employees and agents to use all safety devices and guards and shall maintain the same in proper working order. Buyer shall use and require its employees and agents to use safe operating procedures in operating the equipment and shall further obey and have its employees and agents obey safety instructions given by Seller. If Buyer fails to meet the obligations herein, Buyer agrees to indemnify and save Seller harmless from any liability or obligation with regard to any personal injuries or property damages directly or indirectly connected with the operation of the equipment. Buyer further agrees to notify Seller promptly and in any event not later than ten (10) days after notice or knowledge of any accident or malfunction involving Seller's equipment which has caused personal injury or property damages and to cooperate fully with Seller in investigating and determining the causes of such accident and malfunction. In the event that Buyer fails to give such notice to Seller or to cooperate with Seller, Buyer shall be obligated to indemnify and save Seller harmless from any such claims arising from such accident.

22. MISCELLANEOUS PROVISIONS

(a) If for any reason a provision of a contract is legally invalid, then in such event the rest of the contract shall remain in full force and effect, except that the parties shall try to replace such invalid provision with a provision closest to their original mutual intentions. (b) Any amendments to any contract or contracts require the consent in writing by both parties.

23. NON ASSIGNMENT BY BUYER

Contract or contracts may not be assigned by the Buyer without prior written consent of the Seller.

24. APPLICABLE LAW

All contracts are governed by the applicable laws of Ontario.

25. This instrument sets forth the entire understanding and agreement of the parties hereto in respect of the subject matter hereof, and all prior understandings between the parties hereto, together with all representations and obligations of such parties in respect of such subject matter, shall be superseded by and merged into this instrument.

26. The provisions of this agreement shall bind and ensure to the benefit of the parties hereto and their respective heirs, executors, administrators, successors and (subject to any restrictions or assignment herein above set forth) assigns, as the case may be.

27. The parties acknowledge that they have requested this Contract and all notices or other documents relating thereto be drafted in the English language.

Les parties reconnaissent qu'elles ont requis que ce contrat et tous les avis ou autres documents qui s'y rapportent soient rédigés en langue anglaise.

"Terms and Conditions in French available upon request."

NORD Gear Limited
Toll Free in Canada: 800.668.4378

NORD Gear Corporation
Toll Free in the United States: 888.314.6673

06.09.09

www.nord.com/docs

Product Overview

We can match our NORDAC AC vector drives with our Inverter/Vector Duty Motors and UNICASE™ Speed Reducers to provide a total AC Motor Drive solution from one trusted source.

UNICASE™ SPEED REDUCERS



HELICAL IN-LINE

- Foot or Flange Mount
- Torque up to 205,000 lb-in
- Gear ratios – 1.82:1 to over 300,000:1



NORDBLOC® HELICAL IN-LINE

- Foot or Flange Mount
- Torque up to 26,550 lb-in
- Gear ratios – 1.88:1 to over 370:1



PARALLEL HELICAL CLINCHER™

- Shaft, Flange or Foot Mount
- Torque up to 797,000 lb-in
- Gear ratios – 4.26:1 to over 300,000:1



RIGHT ANGLE HELICAL-BEVEL 2-STAGE

- Foot, Flange or Shaft Mount
- Torque up to 5,840 lb-in
- Gear ratios – 4.1:1 to 72:1



RIGHT ANGLE HELICAL-BEVEL

- Foot, Flange or Shaft Mount
- Torque up to 283,000 lb-in
- Gear ratios – 8.04:1 to over 300,000:1



RIGHT ANGLE HELICAL-WORM

- Foot, Flange or Shaft Mount
- Torque up to 27,585 lb-in
- Gear ratios – 4.40:1 to over 300,000:1



MINICASE™ RIGHT ANGLE WORM

- Foot, Flange or Shaft Mount
- Torque up to 3,540 lb-in
- Gear ratios – 5:1 to 500:1



FLEXBLOC™ WORM

- Modular bolt-on options
- Torque up to 4,683 lb-in
- Gear ratios – 5:1 to 3,000:1

HIGH PERFORMANCE MOTORS & BRAKEMOTORS



INVERTER/VECTOR DUTY

- Standard or Energy Efficient
- Integral, NEMA or Metric IEC
- 1/6 to 250 hp

NORDAC AC VECTOR DRIVES



TRIO SK300E

- Motor or remote mounted
- IP55 – washdown
- 380-460V, 3-phase, to 5hp
- 200-240V, 3-phase, to 3hp



SK500/520/530E

- Compact, high performance
- 380-480V, 3-phase, to 10hp
- 200-240V, 3-phase, to 5hp
- 200-240V, 1-phase, to 3hp
- 110-120V, 1-phase, to 1.5hp



SK700E

- Flexible high performance
- 380-460V, 3-phase, to 200hp



DRIVESYSTEMS

www.nord.com

WEST
Corona, CA (Los Angeles)
Phone: 608.849.0190

MIDWEST
Waunakee, WI (Madison)
Phone: 608.849.7300

EAST
Charlotte, NC
Phone: 608.849.0140

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Toll-Free in Canada: 800.668.4378
info.ca@nord.com

CANADA
Brampton, ON (Toronto)
Phone: 905.796.3606



**Integral Horsepower
AC Induction Motors
ODP, WPI Enclosures
TENV, TEAO, TEFC Enclosure
Explosion Proof**

Installation & Operating Manual

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Section 1

General Information

Overview

This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the **Warning and Caution** statements. A **Warning** statement indicates a possible unsafe condition that can cause harm to personnel. A **Caution** statement indicates a condition that can cause damage to equipment.

Important:

This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- IEC 34-1 Electrical and IEC72-1 Mechanical specifications
- ANSI C51.5, the National Electrical Code (NEC) and local codes and practices.

Limited Warranty

www.baldor.com/support/warranty_standard.asp

Safety Notice:

This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

- WARNING:** Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.
- WARNING:** Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.
- WARNING:** Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.
- WARNING:** Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.
- WARNING:** Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.
- WARNING:** This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.
- WARNING:** Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.
- WARNING:** Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.
- WARNING:** Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.
- WARNING:** UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.
- WARNING:** Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.

Safety Notice Continued

- WARNING:** Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.
- WARNING:** Pacemaker danger – Magnetic and electromagnetic fields in the vicinity of current carrying carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way from the area surrounding a permanent magnet motor.
- WARNING:** Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.
- WARNING:** Do not use non UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.
- WARNING:** Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.
- WARNING:** Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.
- Caution:** To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.
- Caution:** Do not over tension belts. Excess tension may damage the motor or driven equipment.
- Caution:** Do not over-lubricate motor as this may cause premature bearing failure.
- Caution:** Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.
- Caution:** If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.
- Caution:** To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.
- Caution:** If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.
- Caution:** The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.
- Caution:** Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

- Caution:** Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.

-
2. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed).
The packing provides insulation from temperature changes during transportation.
 3. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only.
A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.
 4. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation.
Do not lift the assembly using the motor lugs or eye bolts provided. Lugs or eye bolts are designed to lift motor only. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.
If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Storage

Storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment.

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate "shell" should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the "shell".

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, whichever is greater. Minimum resistance is calculated as follows: **$R_m = kV + 1$**

where: (R_m is minimum resistance to ground in Meg-Ohms and
kV is rated nameplate voltage defined as Kilo-Volts.)

Example: For a 480VAC rated motor $R_m = 1.48$ meg-ohms (use 5 M Ω).

For a 4160VAC rated motor $R_m = 5.16$ meg-ohms.

Preparation for Storage

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
2. Store in a clean, dry, protected warehouse where control is maintained as follows:
 - a. Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.
 - b. Storage temperatures of 10°C (50°F) to 49°C (120°F) must be maintained.
 - c. Relative humidity must not exceed 60%.
 - d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.
Note: Remove motor from containers when heaters are energized, reprotect if necessary.
3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.
 - a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.
 - b. Place new desiccant inside the vapor bag and re-seal by taping it closed.
 - c. If a zipper-closing type bag is used instead of the heat-sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.
 - d. Place the shell over the motor and secure with lag bolts.
4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. Storage environment must be maintained as stated in step 2.

-
5. Motors with anti-friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
 - a. Motors marked "Do Not Lubricate" on the nameplate do not need to be greased before or during storage.
 - b. Ball and roller bearing (anti-friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
 - c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant, (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute oil to bearing surfaces.
 - d. "Provisions for oil mist lubrication" – These motors are packed with grease. Storage procedures are the same as paragraph 5b.
 - e. "Oil Mist Lubricated" – These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under "Standard Condition" in Section 3, then rotate the shaft 15 times by hand.
 6. All breather drains are to be fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic "T" drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.
 7. Coat all external machined surfaces with a rust preventing material. An acceptable product for this purpose is Exxon Rust Ban # 392.
 8. Carbon brushes should be lifted and held in place in the holders, above the commutator, by the brush holder fingers. The commutator should be wrapped with a suitable material such as cardboard paper as a mechanical protection against damage.

Non-Regreaseable Motors

Non-regreaseable motors with "Do Not Lubricate" on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

All Other Motor Types

Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.
2. The motor with regreaseable bearing must be greased as instructed in Section 3 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times after greasing.
5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.
6. Bearings are to be greased at the time of removal from storage.

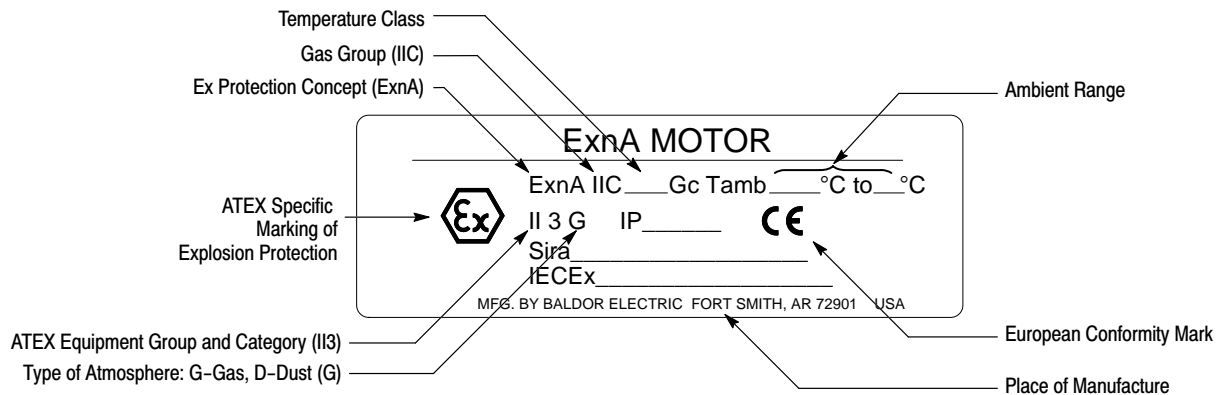
Removal From Storage

1. Remove all packing material.
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.
3. Regrease the bearings as instructed in Section 3 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

Equipment Marking for IEC Certified Product

IEC certified products have special markings that identify the protection concept and environment requirements. An example is shown in Figure 3-1.

Figure 3-1 IEC Certified Product Markings



Specific Conditions of Use:

If the motor certificate number is followed by the symbol "X", this indicates that the motor has specific conditions of use which are indicated on the certificate. It is necessary to review the product certification certificate in conjunction with this instruction manual.

Operation On Frequency Converters:

If the motor is evaluated for operation with an adjustable speed drive, the type of converter (for example PWM for Pulse Width Modulated) and safe speed ranges (for example 0–120Hz) will be specified in the certification documents or on motor nameplates. It is necessary to consult the adjustable speed drive manual for proper set up. IECEx Certificates are available online at www.iecex.com

Section 2

Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip-Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non-corrosive.
2. **Totally Enclosed and WPIL** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

IEEE841 motors are suitable for application in Class I Division 2 and Class I Zone 2 areas on sine wave power in accordance with the applicable codes and standards.

Hazardous Locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

EMC Compliance Statement for European Union

The motors described in this instruction manual are designed to comply 2004/108/EC . These motors are commercial in design and not intended for residential use.

Mounting

Location

The motor should be installed in a location compatible with the motor enclosure and specific ambient. To allow adequate air flow, the following clearances must be maintained between the motor and any obstruction:

Table 2-1 Enclosure Clearance

TEFC / TENV (IC0141) Enclosures	
Fan Cover Air Intake	180 – 210T Frame 1" (25mm)
Fan Cover Air Intake	250 – 449T Frame 4" (100mm)
	IEC 112 – 132 1" (25mm)
	IEC 160 – 280 4" (100mm)
Exhaust	Envelope equal to the P Dimension on the motor dimension sheet
OPEN/Protected Enclosures	
Bracket Intake	Same as TEFC
Frame Exhaust	Exhaust out the sides envelope A minimum of the P dimension plus 2" (50mm) Exhaust out the end same as intake.

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

When installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

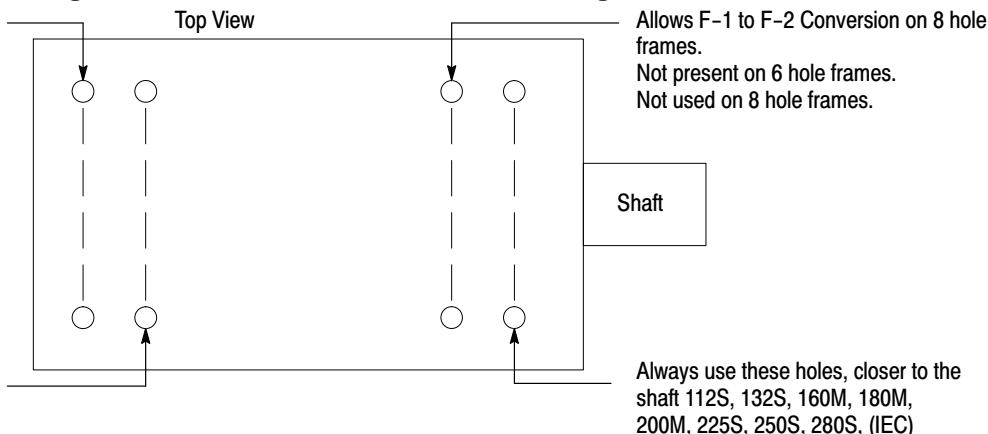
The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Frame Mounting Holes

Some motors have standardized frames containing 6 or 8 mounting holes. 6 hole frames are not suitable for field reversal of mounting from F-1 to F-2, etc. Figure 2-2 indicates the proper mounting holes to use.

Figure 2-2 6 & 8 Hole Motor Frame Mounting

For short frame designations 182, 213, 254, 284, 324, 364, 404, 444 (NEMA)



For long frame designations 184, 215, 256, 286, 326, 365, 405, 445 (NEMA)
(IEC) 112M, 132M, 160L, 200L, 225M, 250M, 280M

Caution: Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.

In the case of assemblies on a common base, any lifting means provided on the motor should not be used to lift the assembly and base but, rather, the assembly should be lifted by a sling around the base or by other lifting means provided on the base. Assure lifting in the direction intended in the design of the lifting means. Likewise, precautions should be taken to prevent hazardous overloads due to deceleration, acceleration or shock forces.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

1. Direct Coupling

For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.

2. End-Play Adjustment

The axial position of the motor frame with respect to its load is also extremely important. The standard motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.

3. Pulley Ratio

The best practice is to not exceed an 8:1 pulley ratio.

Caution: Do not over tension belts. Excess tension may damage the motor or driven equipment.

4. Belt Drive

Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

Doweling & Bolting After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor•Reliance motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Guarding Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as keys, key ways or set screws. Some satisfactory methods of guarding are:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding during normal service.

Power Connection Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

For ExnA hazardous location motors, it is a specific condition of use that all terminations in a conduit box be fully insulated. Fully insulated and lugged terminations must be bolted and provided with lock washer to prevent rotation. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

Grounding In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non-USA locations consult the appropriate national or local code applicable.

Motors with resilient cushion rings usually must be provided with a bonding conductor across the resilient member. Some motors are supplied with the bonding conductor on the concealed side of the cushion ring to protect the bond from damage. Motors with bonded cushion rings should usually be grounded at the time of installation in accordance with the above recommendations for making ground connections. When motors with bonded cushion rings are used in multimotor installations employing group fusing or group protection, the bonding of the cushion ring should be checked to determine that it is adequate for the rating of the branch circuit over current protective device being used.

There are applications where grounding the exterior parts of a motor or generator may result in greater hazard by increasing the possibility of a person in the area simultaneously contacting ground and some other nearby live electrical parts of other ungrounded electrical equipment. In portable equipment it is difficult to be sure that a positive ground connection is maintained as the equipment is moved, and providing a grounding conductor may lead to a false sense of security.

Select a motor starter and over current protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or other applicable local codes.

For motors installed in compliance with IEC requirements, the following minimum cross sectional area of the protective conductors should be used:

Cross-sectional area of phase conductors, S	Minimum cross-sectional area of the corresponding protective conductor, S_p
mm^2	mm^2
$S < 16$	S
$16 < S \leq 35$	16
$S > 35$	$0,5 S$

Equipotential bonding connection shall made using a conductor with a cross-sectional area of at least 4 mm².

Conduit Box For ease of making connections, an oversize conduit box is provided. Most conduit boxes can be rotated 360° in 90° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power Motors with flying lead construction must be properly terminated and insulated. Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within $\pm 10\%$ of rated voltage with rated frequency. (See motor name plate for ratings).
OR
2. AC power is within $\pm 5\%$ of rated frequency with rated voltage.
OR
3. A combined variation in voltage and frequency of $\pm 10\%$ (sum of absolute values) of rated values, provided the frequency variation does not exceed $\pm 5\%$ of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-4.

Figure 2-3 Accessory Connections

HEATERS

H1 ——— H2

H1 ——— H2

One heater is installed in each end of motor.
Leads for each heater are labeled H1 & H2.
(Like numbers should be tied together).

THERMISTORS



Three thermistors are installed in windings and tied in series.
Leads are labeled TD1 & TD2.

WINDING RTDS



Winding RTDs are installed in windings (2) per phase.
Each set of leads is labeled 1TD1, 1TD2, 1TD3, 2TD1, 2TD2, 2TD3 etc.

BEARING RTD



- * One bearing RTD is installed in Drive endplate (PUPEP), leads are labeled RTDDE.
- * One bearing RTD is installed in Opposite Drive endplate (FREPE), leads are labeled RTDODE.
- * Note RTD may have 2-Red/1-White leads; or 2-White/1-Red Lead.

Rotation All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.

Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn-to-turn, phase-to-phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

Note: Main power leads for CE Marked Motors may be marked U,V,W – for standard configurations, please consult connection diagrams.

Caution: The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.

Connection Diagrams

AC Motor Connection Diagram

IEC VERSUS NEMA LEAD MARKING

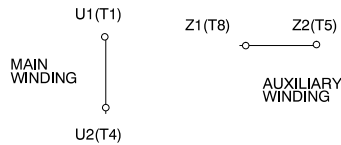
EXAMPLE COMPARISONS OF IEC AND NEMA LEADING MARKINGS FOR COMMON CONNECTION TYPES ARE SHOWN BELOW.

SINGLE PHASE MOTORS

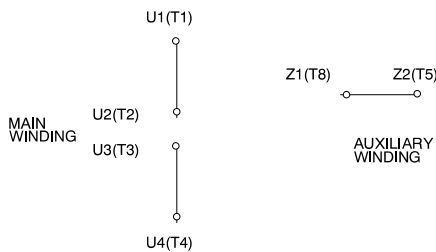
SINGLE VOLTAGE NON REVERSIBLE



SINGLE VOLTAGE REVERSIBLE



DUAL VOLTAGE REVERSIBLE



AC Motor Connection Diagram

THREE PHASE

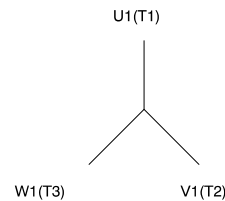
FOR SINGLE WINDING 3 PHASE MOTORS, LEAD MARKINGS CAN BE DIRECTLY TRANSLATED BETWEEN IEC AND NEMA DESIGNATIONS. FOR THESE MOTORS, THE LEAD MARKINGS ARE EQUIVALENT AS FOLLOWS:

U1=T1	U2=T4	U5=T7	U6=T10
V1=T2	V2=T5	V5=T8	V6=T11
W1=T3	W2=T6	W5=T9	W6=T12

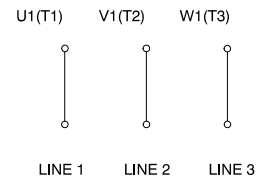
EXAMPLES OF COMMON CONNECTIONS ARE GIVEN BELOW.

THREE LEADS

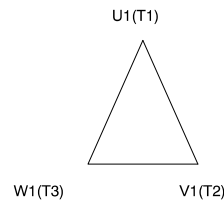
WYE CONNECT



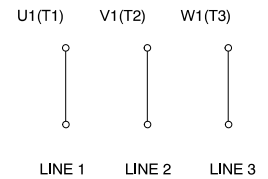
WIRING DIAGRAM



DELTA CONNECT



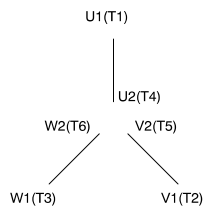
WIRING DIAGRAM



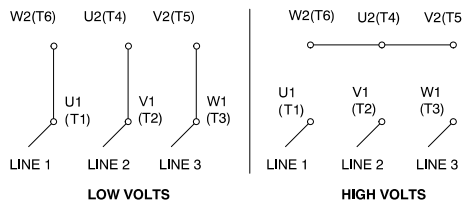
AC Motor Connection Diagram

SIX LEADS

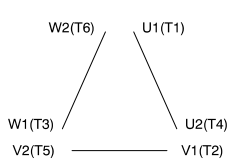
DELTA-WYE CONNECT



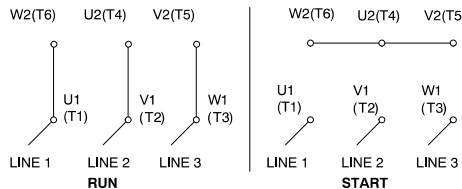
DUAL VOLTAGE-HIGH TO LOW VOLTAGE RATIO 1.73:1



WYE-DELTA CONNECT



WYE START-DELTA RUN SINGLE VOLTAGE

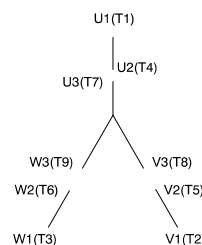


AC Motor Connection Diagram

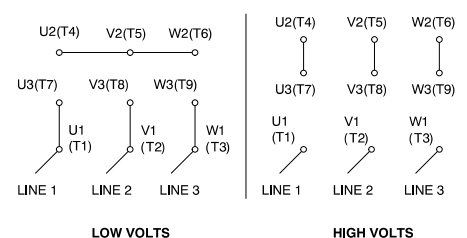
NINE LEADS

DUAL VOLTAGE-HIGH TO LOW VOLTAGE RATIO 2:1

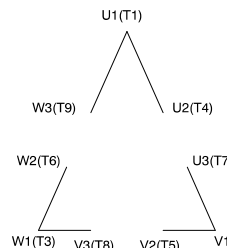
WYE CONNECT



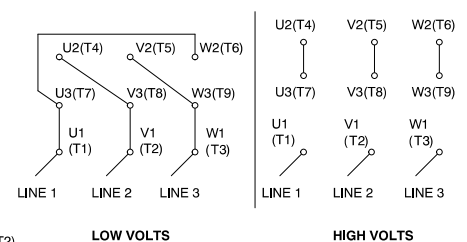
WIRING DIAGRAM



DELTA CONNECT



WIRING DIAGRAM

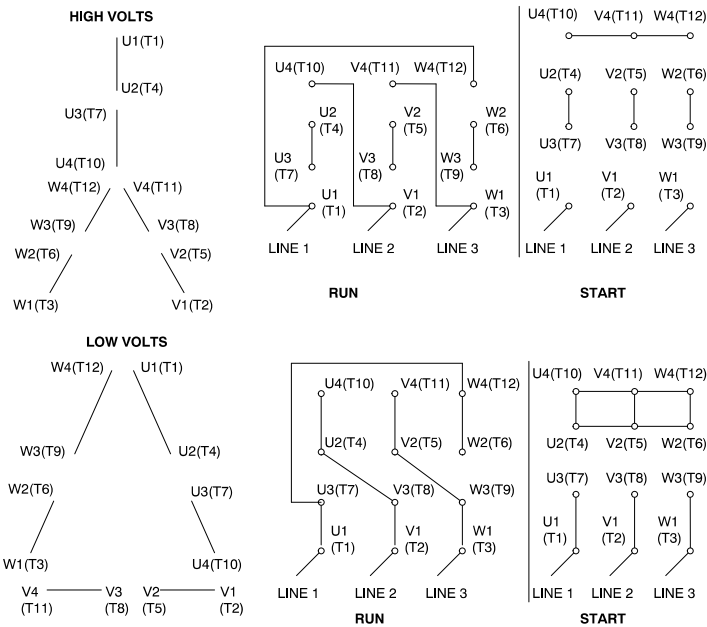


Connection Diagrams Continued

AC Motor Connection Diagram

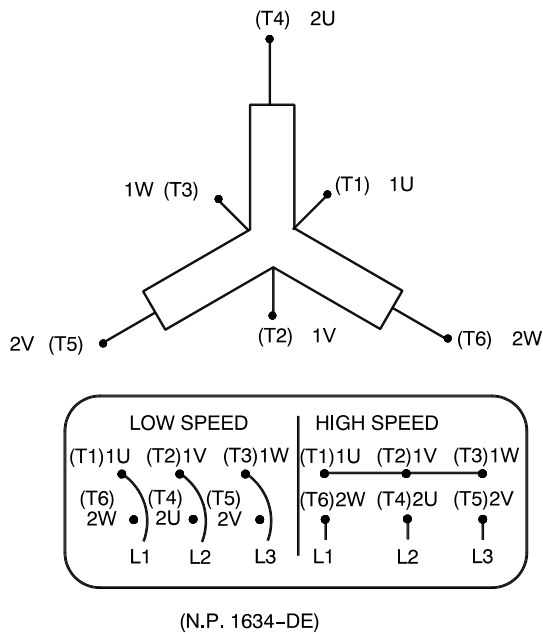
TWELVE LEADS

DUAL VOLTAGE WYE START - DELTA - RUN



AC Motor Connection Diagram

SINGLE WINDING MULTI-SPEEDS CONSTANT TORQUE



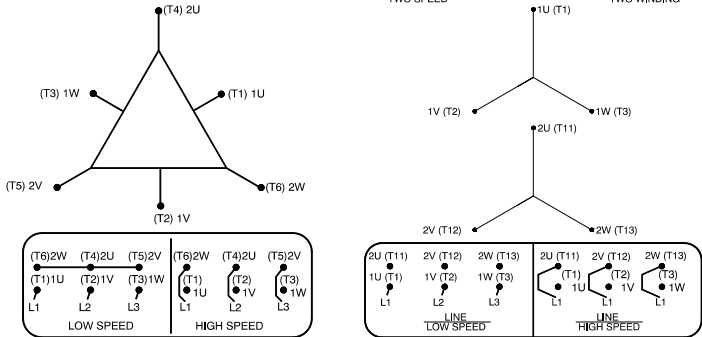
AC Motor Connection Diagram

SINGLE WINDING

MULTI-SPEEDS CONSTANT HP.

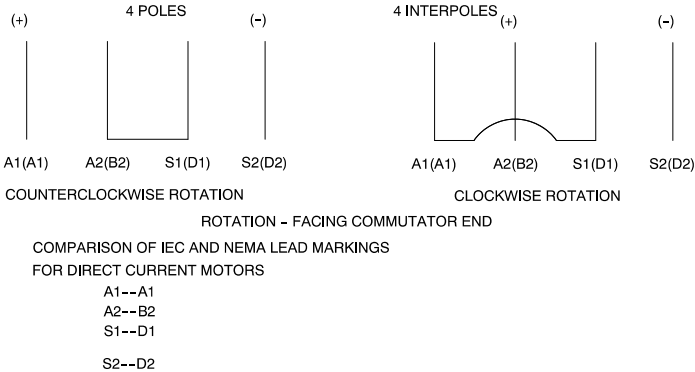
TWO SPEED

TWO WINDING



DC Motor Connection Diagram

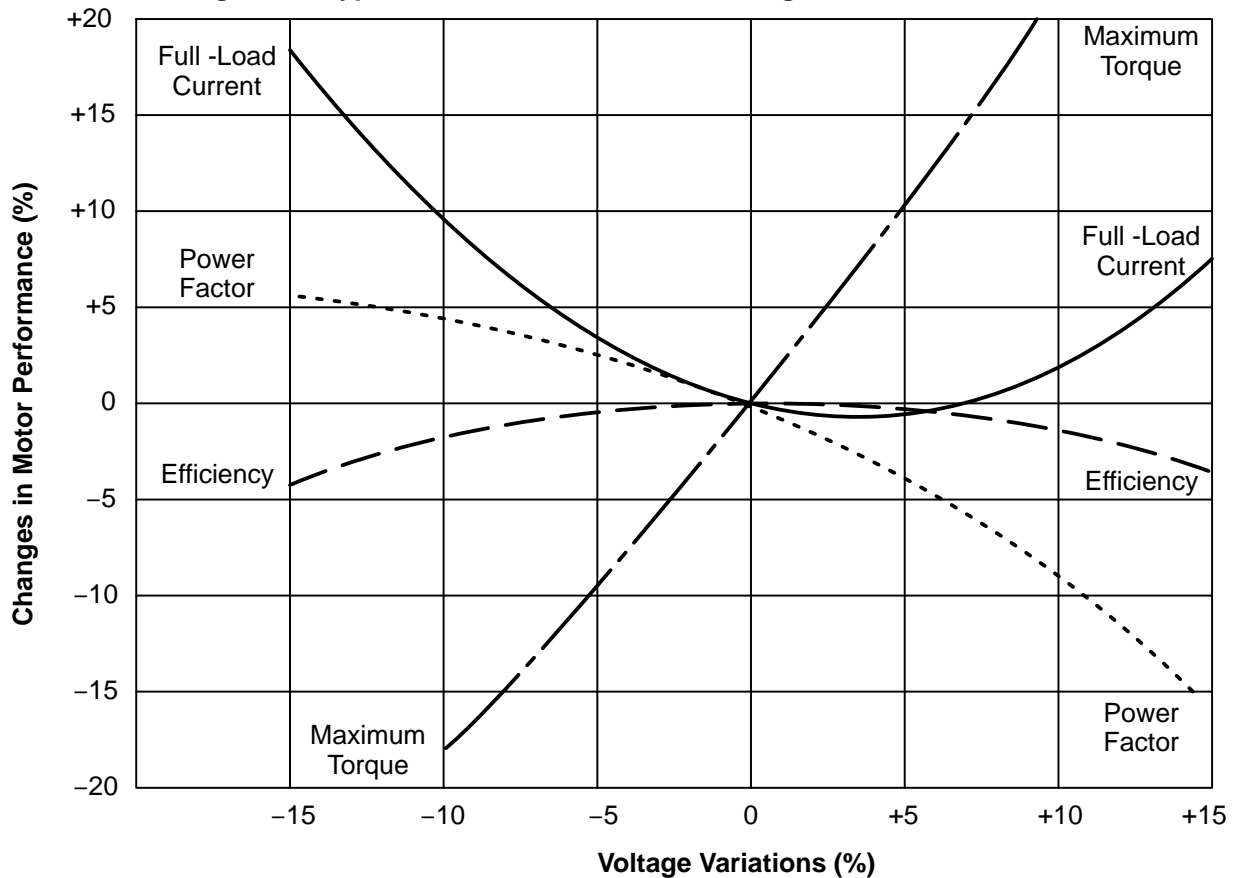
WIRING DIAGRAM TYPE "T" MOTOR



MOTOR WINDING THERMOSTATS		
CONTACTS _____ @ _____ °C		
FIGURE NUMBER _____		
CONTACT RATING		
VOLTS	CONTINUOUS AMPERES	INRUSH AMPERES
110 - 120	3.0	30
220 - 240	1.5	15
440 - 480	0.75	7.5
550 - 600	0.60	6.0

THERMOSTATS	
NORMALLY CLOSED	NORMALLY OPEN
FIGURE 1 	FIGURE 4
FIGURE 2 	FIGURE 5
FIGURE 3 	FIGURE 6

Figure 2-4 Typical Motor Performance VS Voltage Variations



Initial Lubrication Baldor•Reliance motors are shipped from the factory with the bearings properly packed with grease and ready to operate. Where the unit has been subjected to extended storage (6 months or more) the bearings should be relubricated (regreasable type) prior to starting. When motors are equipped for oil mist lubrication refer to the instruction manual for installation, operation, and maintenance of oil mist lubrication systems.

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.**

First Time Start Up Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.
11. If motor is totally enclosed fan-cooled or non-ventilated it is recommended that condensation drain plugs, if present, be removed. These are located in the lower portion of the end-shields. Totally enclosed fan-cooled "XT" motors are normally equipped with automatic drains which may be left in place as received.

Coupled Start Up This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor through the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Hazardous Locations

Hazardous locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers or flyings.

Selection Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code. In international hazardous location areas, guidance for gas / vapor / mist classification is given in IEC60079-14, or for dust in IEC61241-14. This classification process lets the installer know what equipment is suitable for installation in that environment, and identifies what the maximum safe temperature or temperature class is required. It is the customer or users responsibility to determine the area classification and select proper equipment.

Areas are classified with respect to risk and exposure to the hazard. In the US market, areas are typically classified as follows Class, Division, Group and Temperature Class. In some newer installations in the US and in most international markets, areas are classified in Zones.

Protection Concepts

Class I Division 1 / Zone 1 [Equipment Group I (mining) or II (surface), Equipment Protection Level (EPL) Gb, Mb]

Baldor offers a range of motors suitable for installation in a Division 1 or Zone 1 environment. These motors are known as explosion proof or flameproof.

Motors that are explosion proof or flameproof use specially machined flameproof joints between the end bell or bracket and the frame, as well as along the rotating shaft and at connection box covers and entries. The fit of these flameproof joints are designed to contain the combustion or quench the flame of an explosive gas atmosphere prior to it exiting the motor. These flameproof joints have lengths and widths selected and tested based on the gas group present in the atmosphere. Baldor•Reliance motors are typically designed to meet Class I (Division 1) Group C and D (explosion proof) or Ex d IIB (flameproof).

An application note regarding equipment applied in accordance with the US National Electric Code (NFPA 70-2008) – according to Article 500.8(C) Marking, sub clause (2) in the fine print note, it is noted that Equipment not marked to indicate a division is suitable for both Division 1 and Division 2 locations. These motors are not gas tight. To the contrary, this protection concept assumes that due to the normal heating and cooling cycle of motor operation that any gas present will be drawn into the motor. Since flameproof or explosion proof motors are designed to contain the combustion and extinguish any flame transmission, for this protection concept, only external surface temperatures are of concern. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions.

If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device. The ATEX directive requires that motor shutdown on thermal trip be accomplished without an intermediate software command. Where intermediate circuitry is involved the circuit shall fall within the scope of a safety, controlling and regulating device as defined in article 1(2) of European Directive 94/9/EC, and shall be covered by an appropriate EC Type Examination Certificate.

Flameproof motors, internationally referred to as Ex d use a protection concept similar to that used in Class I Division 1 motors, with minor differences in the flameproof joints and cable entry designs. Flameproof and explosion proof motors are both type tested. Representative motors are connected to a reference gas and ignited in laboratory conditions to verify that the flame is not transmitted outside the motor enclosure and to determine the maximum internal pressure encountered.

Explosion proof and Flame proof motors shipped without a conduit box require use of a certified box of suitable dimensions and that is appropriate for the classification. Openings in connection boxes must be closed with suitably certified and dimensioned device.

Class I Division 2 / Zone 2 Ex nA, [Equipment Protection Level (EPL) Gc]

This protection concept relies on having no sources of ignition present such as arcing parts or hot surfaces. For this protection concept, internal temperatures as well as external temperatures are considered. In many cases, the internal temperatures are higher than the external temperatures and therefore become the limiting factor in determination of temperature code designation. In these applications, it is very important to use a motor that has been evaluated thermally for use with an inverter or converter, if variable speed operation is desired. Thermostats used for Class I Division 2 and Ex nA motors are used to protect the motor only. For motors using flying lead construction, it is important to use connection lugs and insulate with heat shrink tubing or a double wrap of insulation grade electrical tape to avoid the risk of spark or ignition.

Class II Division 1 / Zone 21 [Equipment Group III, Equipment Protection Level (EPL) Db]

This area classification is one where the risk of ignitable concentrations of dust is present at all or some of the time. The protection concepts used for Class II Division 1 is similar to flamepath, except with additional dust exclusion paths designed for the rotating shaft. In the international designations, this concept is referred to as dust ignition proof or Ex tD. External surface temperature remains the limiting factor. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions. If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device.

Note: In the North American area classification system, Class III exists for fibers and flyings.

In the IEC designation, both dusts and flyings are absorbed into Group III.

Class II Division 2 / Zone 22 [Equipment Group III, Equipment Protection Level (EPL) Dc]

This area classification is one where the risk of exposure to ignitable concentrations of dust are not likely to occur under normal operating conditions and relies heavily on the housekeeping practices within the installation.

Sine Wave Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22 Hazardous Location.

These motors are designed to operate at or below the maximum surface temperature (or T-Code) stated on the nameplate. Failure to operate the motor properly can cause this maximum surface temperature to be exceeded. If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperatures above nameplate value
3. Voltages above or below nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Altitude above 3300 feet / 1000 meters
7. Severe duty cycles of repeated starts
8. Motor stall
9. Motor reversing
10. Single phase operation of polyphase equipment
11. Variable frequency operation

Variable Frequency Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22 Hazardous Location (motors with maximum surface temperature listed on the nameplate).

Only motors with nameplates marked for use on inverter (variable frequency) power, and labeled for specific hazardous areas may be used in those hazardous areas on inverter power. The motor is designed to operate at or below the maximum surface temperature (or T-Code) stated on the nameplate. Failure to operate the motor properly can cause this maximum surface temperature to be exceeded.

If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperature above nameplate value
3. Voltage (at each operating frequency) above or below rated nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Operation outside of the nameplate speed / frequency range
7. Altitudes above 3300 feet / 1000 meters
8. Single phase operation of polyphase equipment
9. Unstable current wave forms
10. Lower than name plate minimum carrier frequency

Thermal Limiting

Thermal limiting devices are temperature sensing control components installed inside the motor to limit the internal temperature of the motor frame by interrupting the circuit of the holding coil of the magnetic switch or contactor. They are required for most Division 1 and Zone 1 applications. For Division 2 or Zone 2 applications, motors should be selected that preclude running temperatures from exceeding the ignition temperatures for the designated hazardous material. In Division 2 or Zone 2 classified locations, thermal limiting devices should only be used for winding protection and not considered for limiting all internal motor temperatures to specific ignition temperatures.

Equipotential Bonding and Shaft Current Reduction

Larger motors (ie WP construction) may require proper bonding between motor enclosures and covers to avoid the risk of stray currents during start up. Fastening methods and bonding straps must not be modified. Bearing currents can exist in some motors for both line-fed and inverter-fed applications. Larger line-fed motors may require at least one insulated bearing to prevent a flow of current through the bearings. Do not defeat such insulation whether the motor is line-fed or inverter-fed applications. Inverter-fed motors may require additional bearing insulation or even a shaft brush. Do not defeat such features. When the motor and the coupled load are not on a common conductive baseplate, it may also be necessary to electrically bond together the stationary parts of the motor and the coupled equipment.

Repair of Motors used in Hazardous Locations

Repair of hazardous certified motors requires additional information, skill, and care. It is the customer's responsibility to select service shops with proper qualifications to repair hazardous location motors. Contact the manufacture for additional repair details. Use only original manufacturer's parts.

Repair of Explosion Proof or Flame Proof Motors Class I Division 1 and Zone 1

In the North American market, recertification programs are offered by Underwriters Laboratories and Canadian Standards Association which allow authorized service shops to mark the rebuilt motors as certified. In the international markets using IEC based requirements, repair should be undertaken only after consulting IEC60079-19 Explosive Atmospheres-Part 19 Equipment repair, overhaul and reclamation. If use of a certified repair facility is desired, consult the IECEX Repair Scheme at

http://www.iecex.com/service_facilities.htm

Explosion proof and flameproof motors achieve their safety based on the mechanical construction – flameproof joints and bearing clearance, and the electrical design including any thermal limiting devices. If it is necessary to repair a flameproof or explosion proof motor, it is critical that the mechanical flameproof joints be maintained. Consult Baldor Electric Company for flameproof joint construction details. Use only Baldor•Reliance supplied parts. Baldor does not recommend reclamation of parts. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present.

Repair of Dust Ignition Proof Motors – Class II Division 1 and 2, Zone 21 and 22.

For Dust Ignition Proof, proper sealing is required. Do not modify the motor construction to add any additional opening, and ensure that proper sealing is maintained in the connection box and at the shaft seal. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present

Repair of Class I Division 2 and Zone 2 motors

For Division 2 and Zone 2, the internal and external temperatures are of concern. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present. Use only Baldor replacement thermostats, if provided.

Section 3

Maintenance & Troubleshooting

WARNING: UL and EX Listed motors must only be serviced by UL or EX Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Perform a dielectric with stand test periodically to ensure that the integrity of the winding insulation has been maintained. Record the readings. Immediately investigate any significant decrease in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease A high grade ball or roller bearing grease should be used. Baldor motors are pregreased, normally with **Polyrex EM (Exxon Mobil)** or as stated on the nameplate. Do not mix greases unless compatibility has been checked and verified.

Relubrication Intervals Recommended relubrication intervals are shown in Table 3-2. It is important to realize that the recommended intervals of Table 3-2 are based on average use.

Refer to additional information contained in Tables 3-3, 3-4 and 3-5.

Table 3-2 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 449 incl. (315)		**	* 2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.

For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-3 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40° C	Clean, Little Corrosion
Severe	16 Plus	50° C	Moderate dirt, Corrosion
Extreme	16 Plus	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<-29° C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-4 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-5 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the “Large” bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in ³	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100–112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6318	1.52(40)	2.5	8.2
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–355)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–355)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225–280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed.

For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: Over-lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed.
This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-2 list 9500 hours for standard conditions.
2. Table 3-3 classifies severity of service as "Severe".
3. Table 3-5 shows that 1.2 in³ or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Shaker Duty Motors only

Caution: Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Table 3-6.

Lubrication should be performed before Start Up and at regular maintenance intervals. Follow these recommendations to ensure proper lubrication.

Recommended Lubricant

For ambient temperatures between -15°F to 120°F the following lubricants are recommended: Mobil PolyrexEM, Texaco Premium RB, Exxon Unirex N-2.

Do not mix greases unless compatibility has been checked and verified.

Table 3-6 Lubrication Volume

NEMA Frame Size	Volume in Cubic Inches					
	Normal Duty		Severe Duty		Extreme Duty	
	Start Up	Relub	Start Up	Relub	Start Up	Relub
184TY	1.4	0.5	1.4	0.5	2.7	0.5
215TY	1.6	0.5	1.6	0.5	4.5	1
256TY	7	1			11	2
286TY	9	1			15	3

Lubrication Frequency

Normal Duty 8 hours per day (16 hours per day in a clean environment). Lubricate every 2 months.

Severe Duty 16 hours per day or more in a dirty environment (corrosive atmosphere, chemical fumes, acids, alkalies or extreme high humidity). Lubricate every month or 700 hours of operation.

Extreme Duty operation in extremely dirty or dusty environments and high ambient temperatures exceeding 104°F (40°C). Lubricate twice a month or 350 hours of operation.

Lubrication Procedure

1. Locate the grease inlet and outlet. Clean the areas.
2. Remove the plug(s) and install a grease fitting in the inlet if grease fitting is not already installed.
3. Add the recommended amount of lubricant.
4. Run the motor for two hours with the outlet plug removed.
5. Install outlet plug.

Note: To loosen hardened grease it may be necessary to insert a rod or wire into the grease inlet and outlet holes.

Table 3-7 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings. Tighten "Thru Bolts".
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $\frac{3}{4}$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $\frac{3}{4}$ filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $\frac{3}{4}$ filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked and repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $\frac{3}{4}$ filled.

Suggested bearing and winding RTD setting guidelines for Non-Hazardous Locations ONLY

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Winding RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Motor Load	Class B Temp Rise ≤ 80°C (Typical Design)		Class F Temp Rise ≤ 105°C		Class H Temp Rise ≤ 125°C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod-Express.
• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Bearing RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Bearing Type Oil or Grease	Anti-Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.

** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as “standard” lubricants) include the following:

- | | | |
|--------------------|---------------------------|-----------------------------|
| – Texaco Polystar | – Rykon Premium #2 | – Chevron SRI #2 |
| – Mobilith SHC-100 | – Pennzoil Pennzlube EM-2 | – Chevron Black Pearl |
| – Darmex 707 | – Darmex 711 | – Petro-Canada Peerless LLG |

See the motor nameplate for replacement grease or oil recommendation.

Contact Baldor application engineering for special lubricants or further clarifications.

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FAX: 770-772-7200

ILLINOIS

CHICAGO

340 REMINGTON BLVD.
BOLINGBROOK, IL 60440
PHONE: 630-296-1400
FAX: 630-226-9420

INDIANA

INDIANAPOLIS

5525 W. MINNESOTA STREET
INDIANAPOLIS, IN 46241
PHONE: 317-246-5100
FAX: 317-246-5110

IOWA

DES MOINES

1943 HULL AVENUE
DES MOINES, IA 50313
PHONE: 515-263-6929
FAX: 515-263-6515

MARYLAND

BALTIMORE

6660 SANTA BARBARA RD.
SUITES 22-24
ELKBRIDGE, MD 21075
PHONE: 410-579-2135
FAX: 410-579-2677

MASSACHUSETTS

BOSTON

6 PULLMAN STREET
WORCESTER, MA 01606
PHONE: 508-854-0708
FAX: 508-854-0291

MICHIGAN

DETROIT

5993 PROGRESS DRIVE
STERLING HEIGHTS, MI 48312
PHONE: 586-978-9800
FAX: 586-978-9969

MINNESOTA

MINNEAPOLIS

13098 GEORGE WEBER DR, SUITE 400
ROGERS, MN 55374
PHONE: 763-428-3633
FAX: 763-428-4551

MISSOURI

ST LOUIS

13678 LAKEFRONT DRIVE
EARTH CITY, MO 63045
PHONE: 314-373-3032
FAX: 314-373-3038

KANSAS CITY

1501 BEDFORD AVENUE
NORTH KANSAS CITY, MO 64116
PHONE: 816-587-0272
FAX: 816-587-3735

NEW YORK

AUBURN

ONE ELLIS DRIVE
AUBURN, NY 13021
PHONE: 315-255-3403
FAX: 315-253-9923

NORTH CAROLINA

GREENSBORO

1220 ROTHERWOOD ROAD
GREENSBORO, NC 27406
PHONE: 336-272-6104
FAX: 336-273-6628

OHIO

CINCINNATI

2929 CRESCENTVILLE ROAD
WEST CHESTER, OH 45069
PHONE: 513-771-2600
FAX: 513-772-2219

OHIO (Continued)

CLEVELAND

8929 FREEWAY DRIVE
MACEDONIA, OH 44056
PHONE: 330-468-4777
FAX: 330-468-4778

OKLAHOMA

TULSA

5555 E. 71ST ST., SUITE 9100
TULSA, OK 74136
PHONE: 918-366-9320
FAX: 918-366-9338

OREGON

PORTLAND

12651 SE CAPPS ROAD
CLACKAMAS, OR 97015
PHONE: 503-691-9010
FAX: 503-691-9012

PENNSYLVANIA

PHILADELPHIA

1035 THOMAS BUSCH
MEMORIAL HIGHWAY
PENNSAUKEN, NJ 08110
PHONE: 856-661-1442
FAX: 856-663-6363

PITTSBURGH

159 PROMINENCE DRIVE
NEW KENSINGTON, PA 15068
PHONE: 724-889-0092
FAX: 724-889-0094

TENNESSEE

MEMPHIS

4000 WINCHESTER ROAD
MEMPHIS, TN 38118
PHONE: 901-365-2020
FAX: 901-365-3914

TEXAS

DALLAS

2920 114TH STREET SUITE 100
GRAND PRAIRIE, TX 75050
PHONE: 214-634-7271
FAX: 214-634-8874

HOUSTON

10355 W. LITTLE YORK ROAD
SUITE 300
HOUSTON, TX 77041
PHONE: 281-977-6500
FAX: 281-977-6510

UTAH

SALT LAKE CITY

2230 SOUTH MAIN STREET
SALT LAKE CITY, UT 84115
PHONE: 801-832-0127
FAX: 801-832-8911

WISCONSIN

MILWAUKEE

1960 SOUTH CALHOUN ROAD
NEW BERLIN, WI 53151
PHONE: 262-784-5940
FAX: 262-784-1215

INTERNATIONAL SALES

FORT SMITH, AR

P.O. BOX 2400
FORT SMITH, AR 72902
PHONE: 479-646-4711
FAX: 479-648-5895

CANADA

EDMONTON, ALBERTA

4053-92 STREET
EDMONTON, ALBERTA T6E 6R8
PHONE: 780-434-4900
FAX: 780-438-2600

TORONTO

OAKVILLE, ONTARIO

2750 COVENTRY ROAD
OAKVILLE, ONTARIO L6H 6R1
PHONE: 905-829-3301
FAX: 905-829-3302

MONTREAL, QUEBEC

5155 J-ARMAND BOMBARDIER
SAINT-HUBERT, QUÉBEC
CANADA J3Z 1G4
PHONE: 514-933-2711
FAX: 514-933-8639

VANCOUVER,

BRITISH COLUMBIA

1538 KEBET WAY
PORT COQUITLAM,
BRITISH COLUMBIA V3C 5M5
PHONE 604-421-2822
FAX: 604-421-3113

WINNIPEG, MANITOBA

54 PRINCESS STREET
WINNIPEG, MANITOBA R3B 1K2
PHONE: 204-942-5205
FAX: 204-956-4251

MEXICO

LEON, GUANAJUATO

KM. 2.0 BLVD. AEROPUERTO
LEON, GUANAJUATO, CP37545
MEXICO
FAX: +52 477 761 2010



BALDOR ELECTRIC COMPANY
World Headquarters
P.O. Box 2400 Fort Smith, AR 72901-2400
(479) 646-4711 Fax (479) 648-5792
www.baldor.com

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Product Information Packet

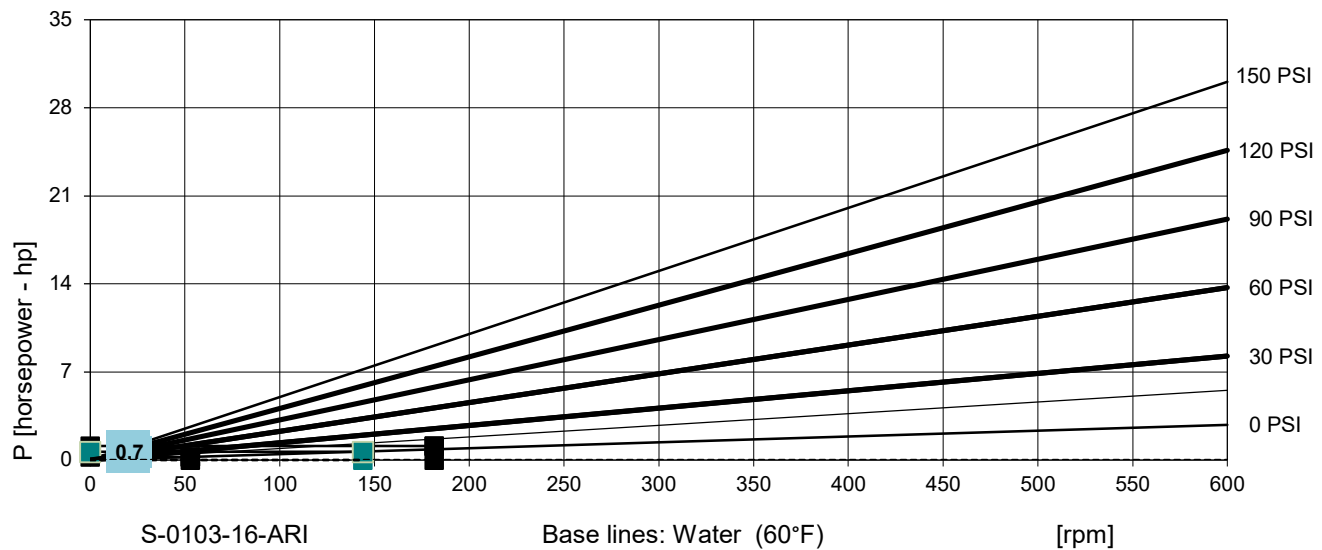
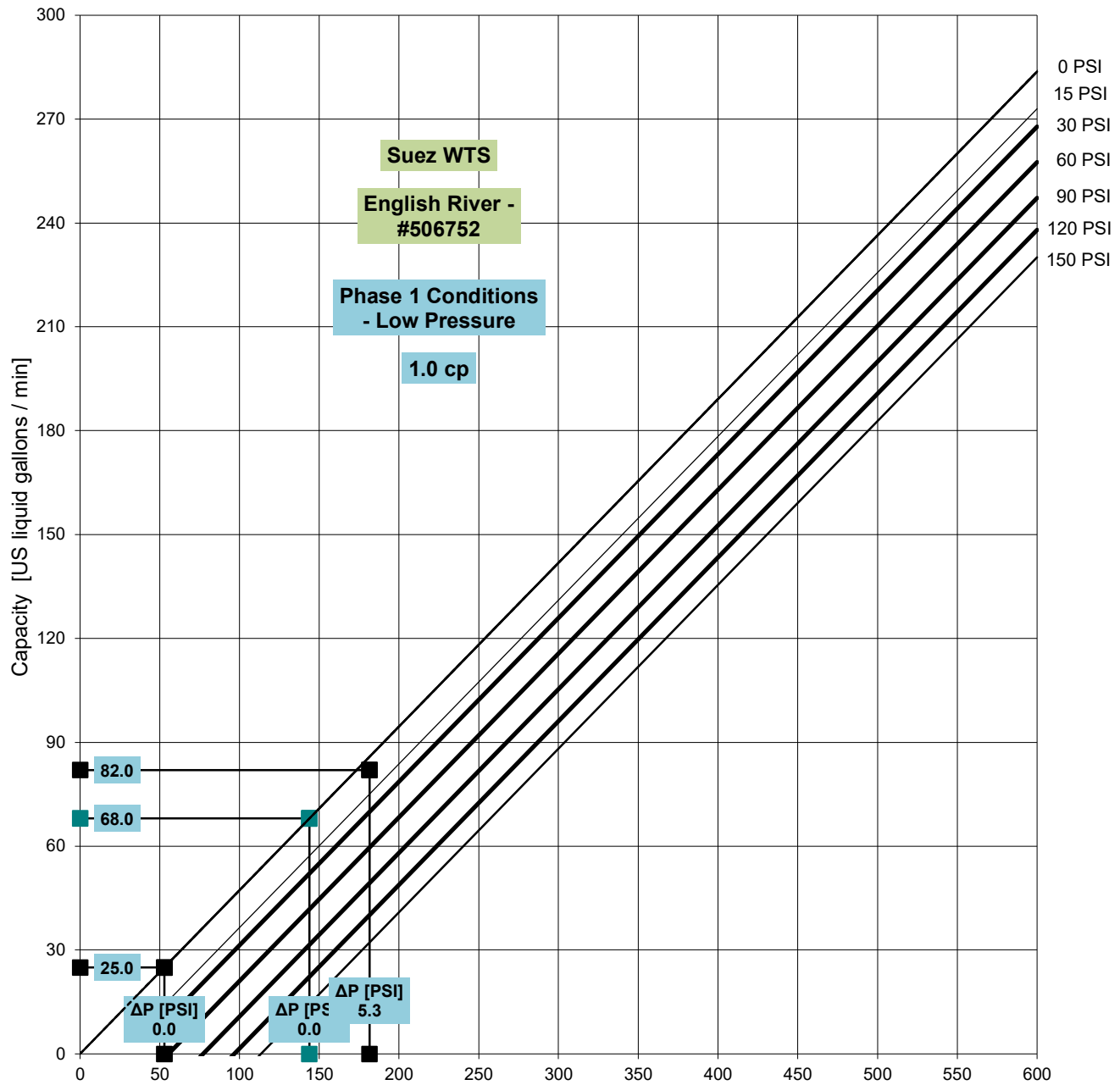
VEM3665T

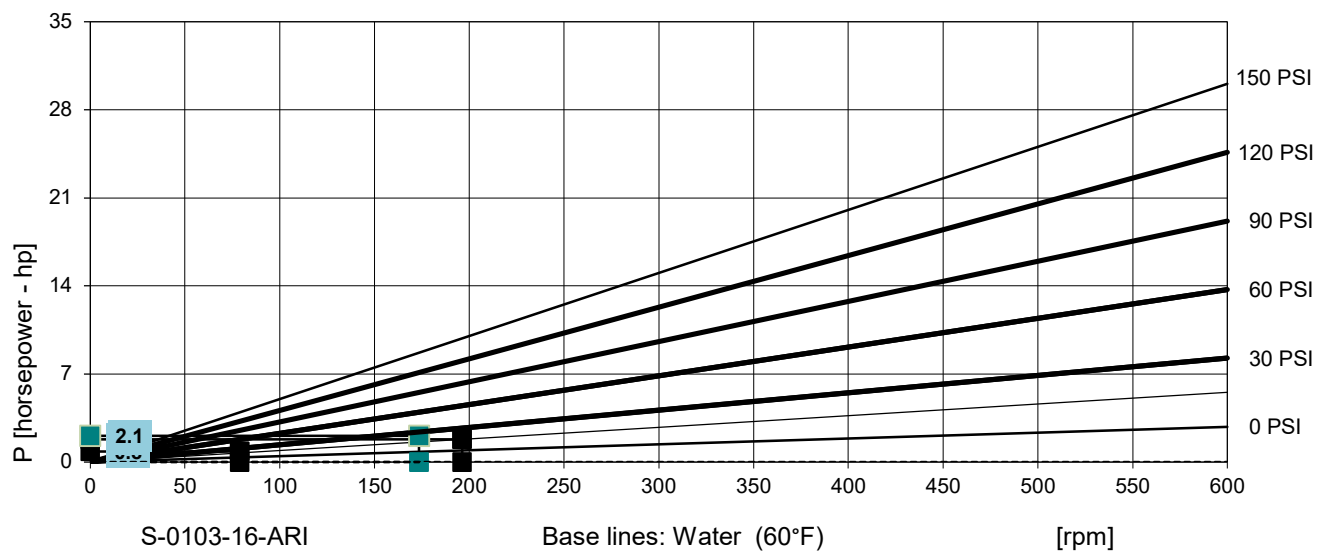
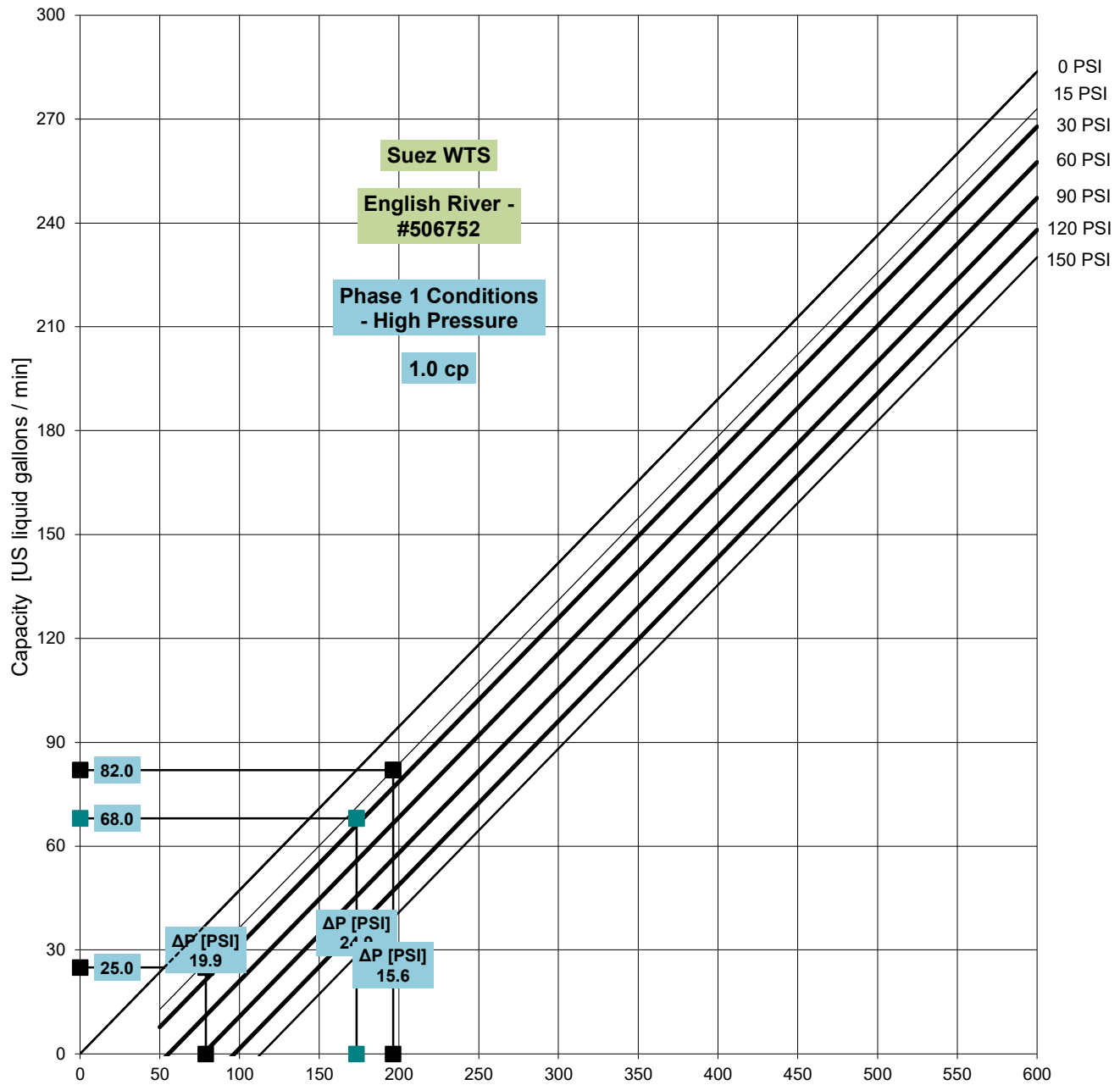
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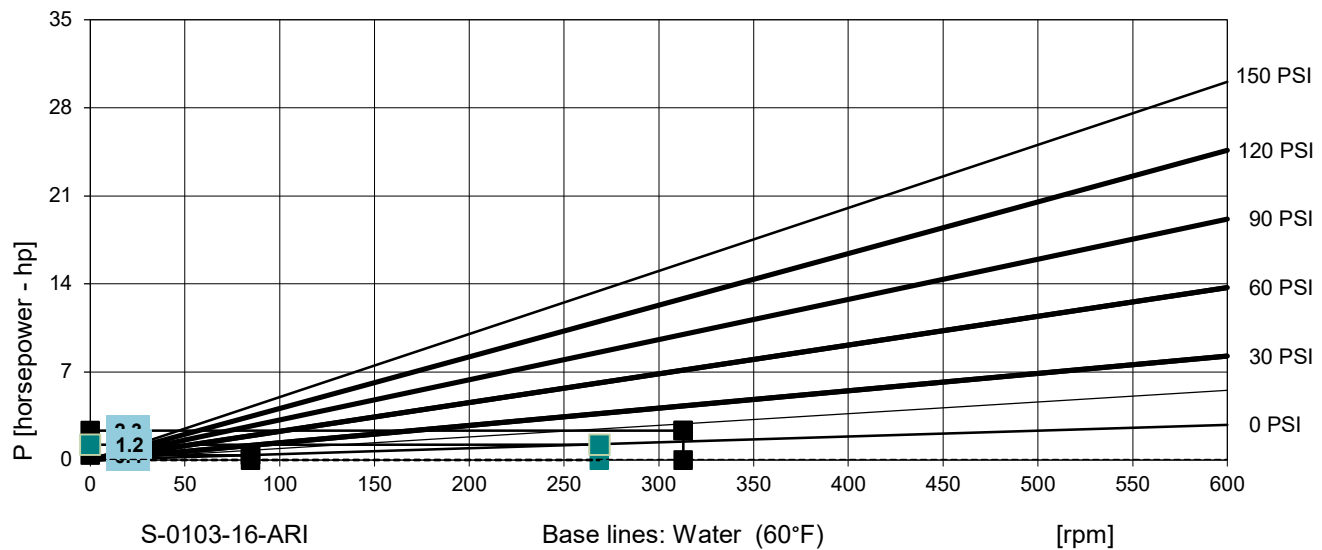
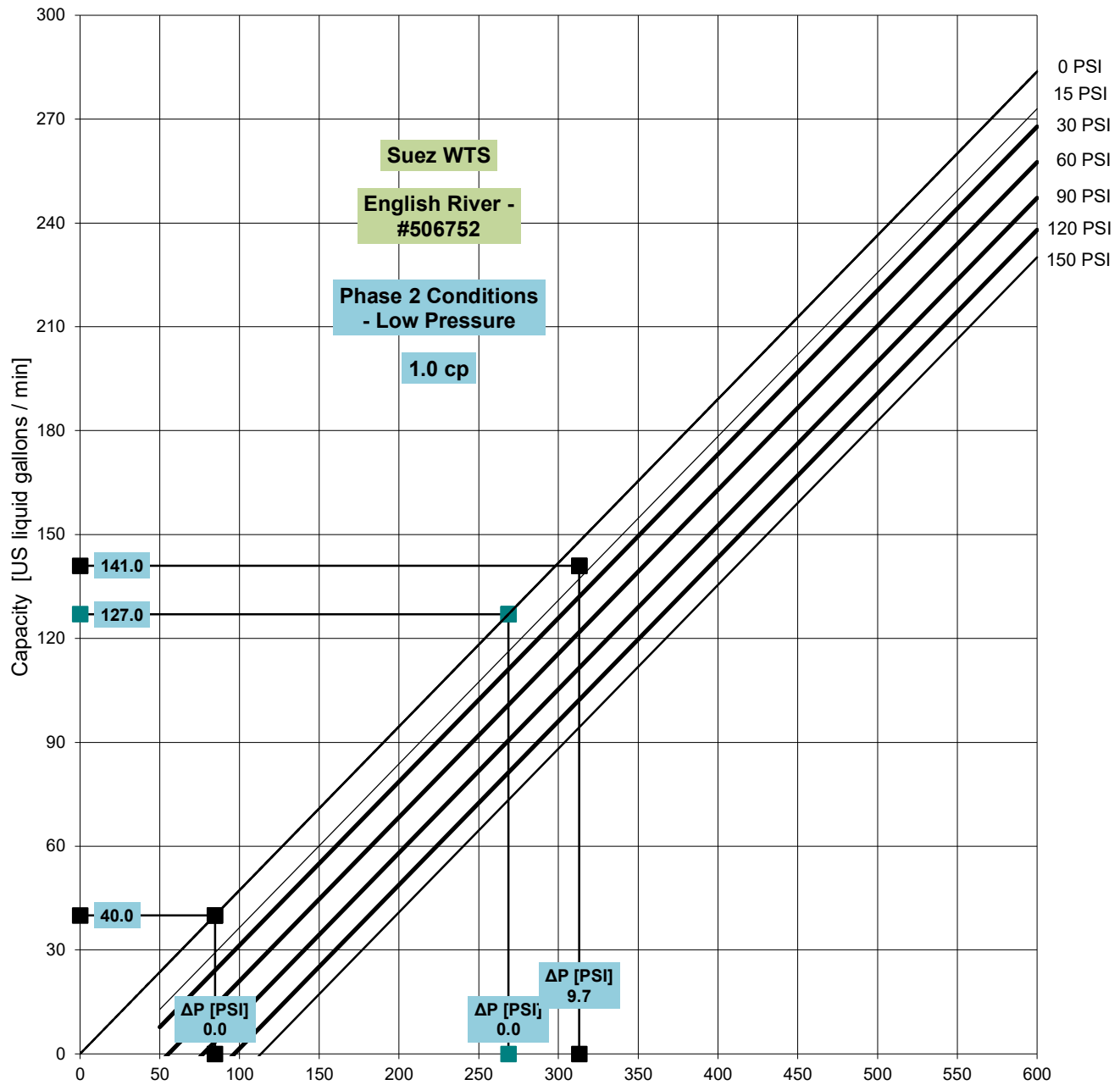
Part Detail							
Revision:	J	Status:	PRD/A	Change #:		Proprietary:	No
Type:	AC	Prod. Type:	0642M	Elec. Spec:	06WGX182	CD Diagram:	CD0005
Enclosure:	TEFC	Mfg Plant:		Mech. Spec:	06H016	Layout:	06LYH016
Frame:	184TC	Mounting:	F1	Poles:	04	Created Date:	08-04-2010
Base:	N	Rotation:	R	Insulation:	F	Eff. Date:	04-08-2016
Leads:	9#16					Replaced By:	
Literature:		Elec. Diagram:					

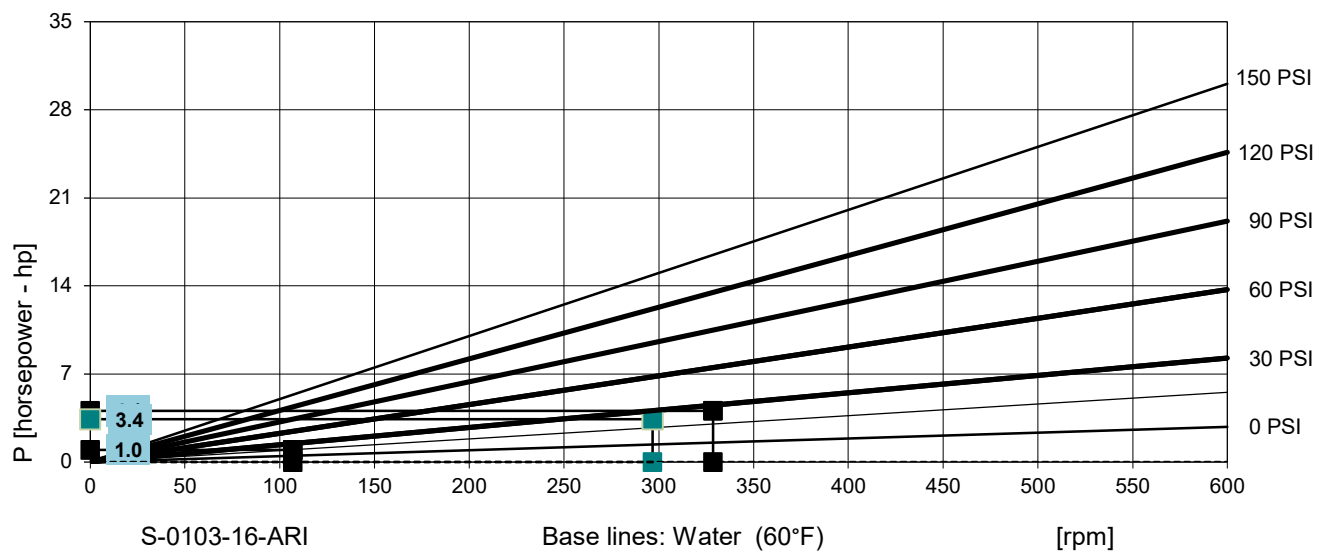
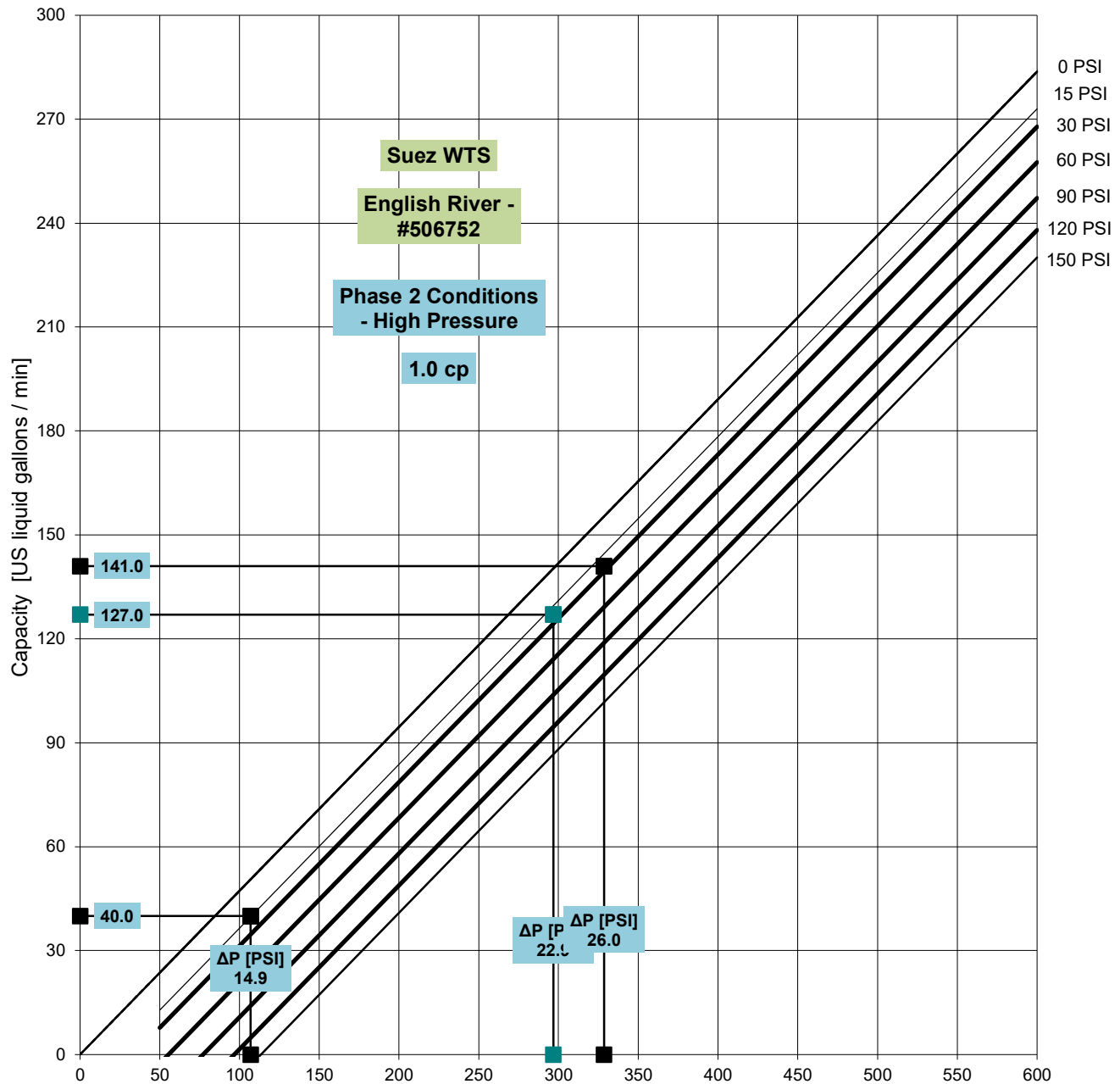
Nameplate NP3441LUA

CAT.NO.	VEM3665T												
SPEC.	06H016X182G1												
HP	5												
VOLTS	230/460												
AMP	13.2/6.6												
RPM	1750												
FRAME	184TC				HZ		60				PH		3
SER.F.	1.15		CODE		J	DES		B	CL		F		
NEMA-NOM-EFF	89.5			PF		79							
RATING	40C AMB-CONT												
CC	010A			USABLE AT 208V									14
DE	6206				ODE		6205						
ENCL	TEFC			SN									
VPWM INVERTER READY													
CT6-60H(10:1)/VT3-60H(20:1													
50Hz 5HP 190/380V 15.8/7.9A SF1.0													









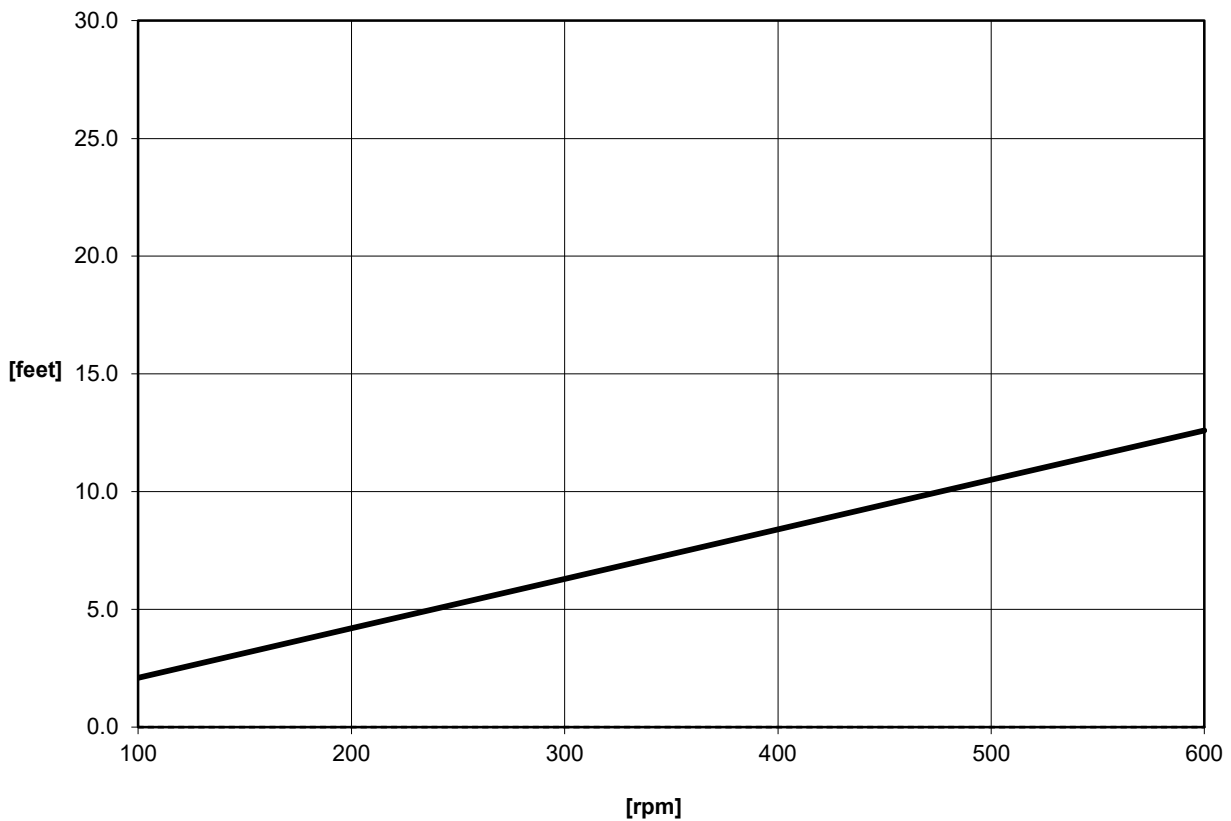


PL 200

D

US18.1-020518-ARI

n [min ⁻¹] # [rpm]	100	200	300	400	500	600
NPSH - r [ft.wc]	2.1	4.2	6.3	8.4	10.5	12.6
NPSH - a [ft.wc]	32.8	32.8	32.8	32.8	32.8	32.8
Delta [ft.wc]	30.7	28.6	26.5	24.4	22.3	20.2

**NPSH-a**

Fluid pressure at pump inlet in Feet Water Column [ft.wc]

NPSH-r

Decrease of pressure due to fluid acceleration inside pump [ft.wc]

NPSH-a > NPSH-r

Delta > 0

Pump runs smooth and works with design flow

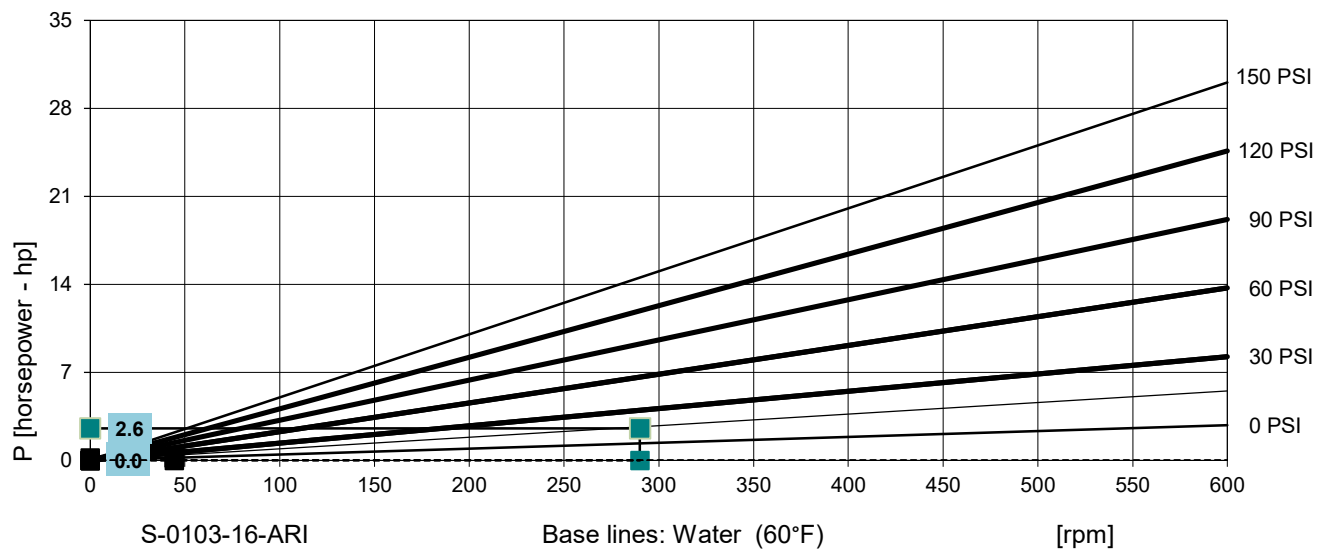
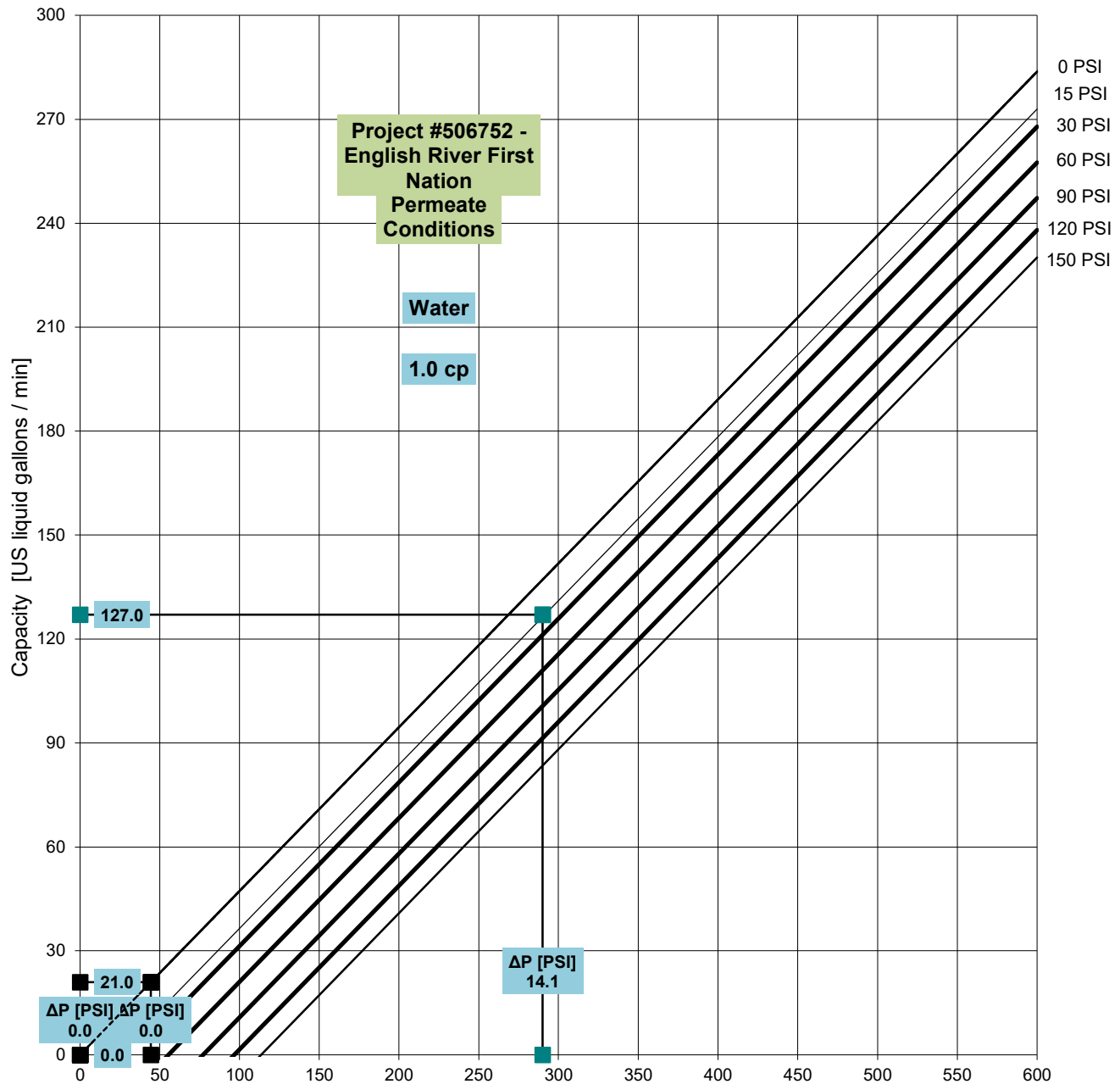
NPSH-a < NPSH-r

Delta < 0

Runs with noise, flow is beneath design flow - short-term operation allowed

NPSH-a < 0

Flow of fluid impossible



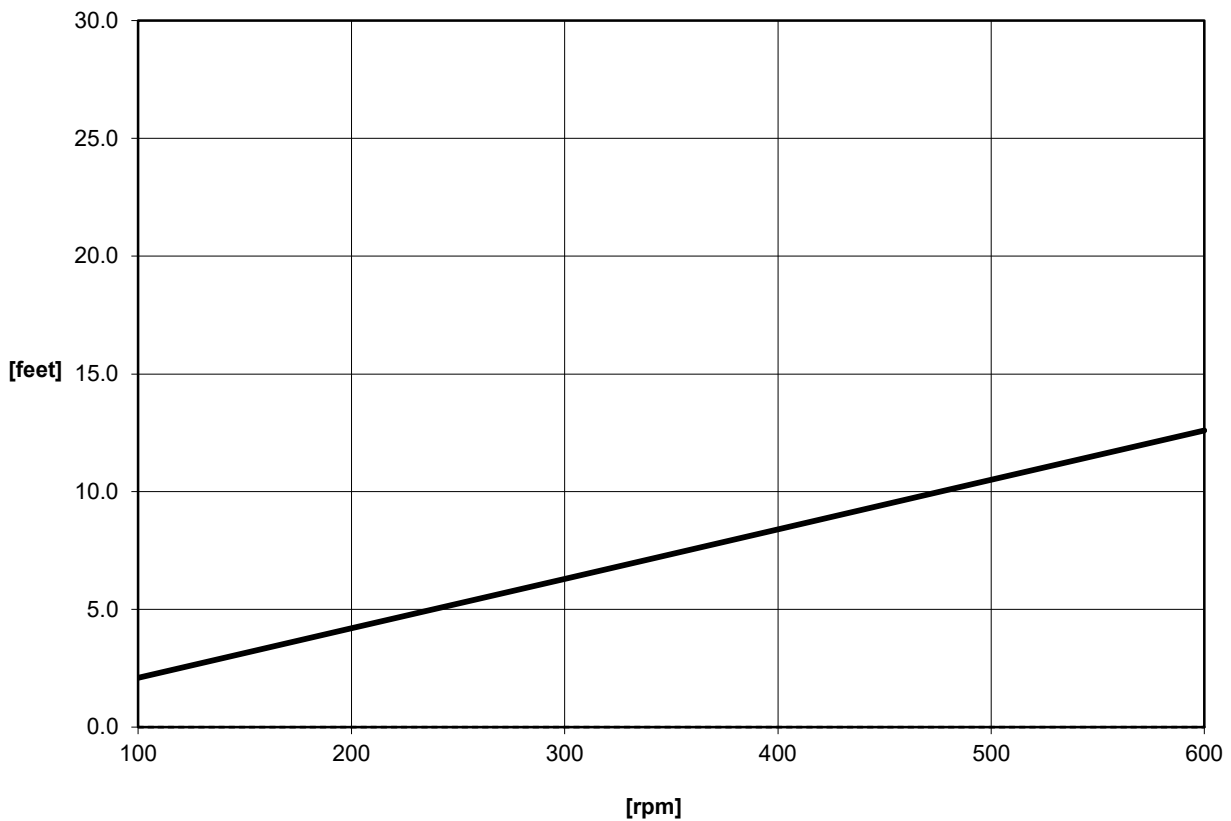


PL 200

D

US18.1-020518-ARI

n [min ⁻¹] # [rpm]	100	200	300	400	500	600
NPSH - r [ft.wc]	2.1	4.2	6.3	8.4	10.5	12.6
NPSH - a [ft.wc]	32.8	32.8	32.8	32.8	32.8	32.8
Delta [ft.wc]	30.7	28.6	26.5	24.4	22.3	20.2

**NPSH-a**

Fluid pressure at pump inlet in Feet Water Column [ft.wc]

NPSH-r

Decrease of pressure due to fluid acceleration inside pump [ft.wc]

NPSH-a > NPSH-r

Delta > 0

Pump runs smooth and works with design flow

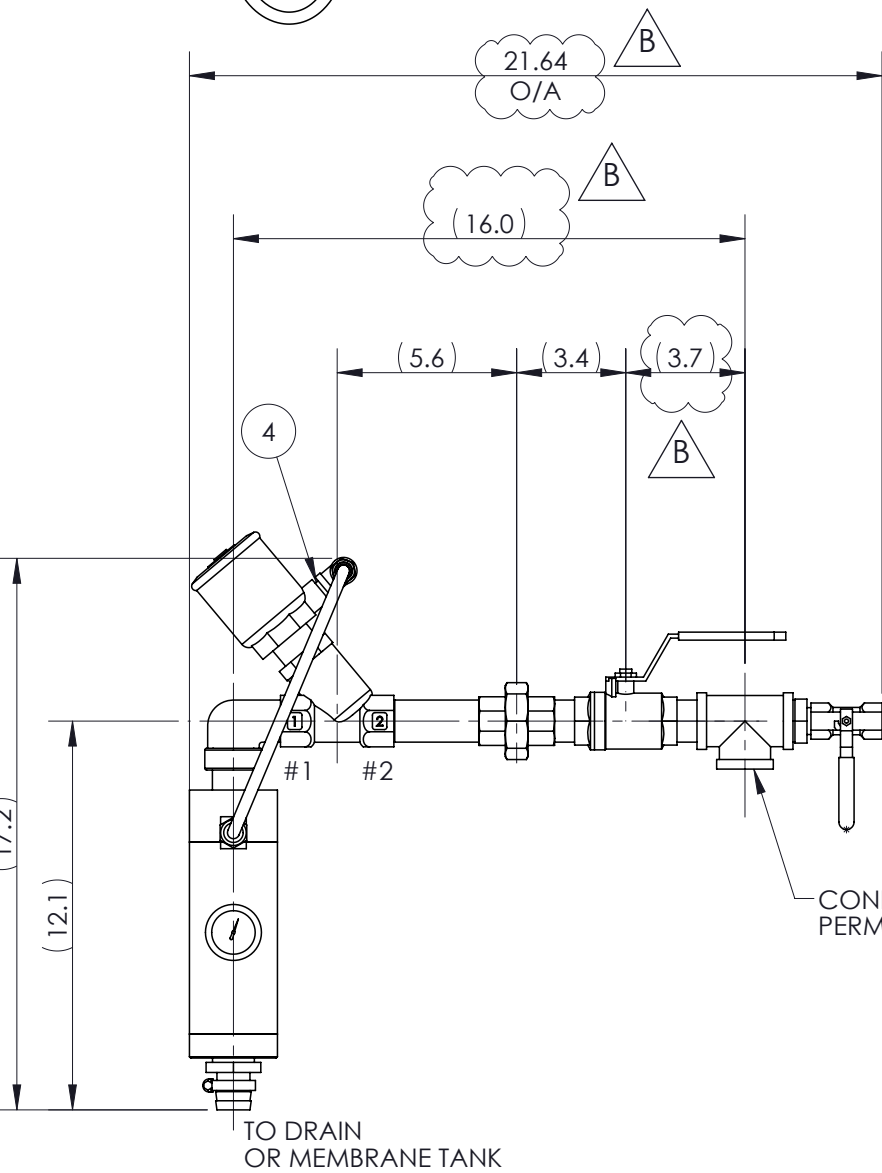
NPSH-a < NPSH-r

Delta < 0

Runs with noise, flow is beneath design flow - short-term operation allowed

NPSH-a < 0

Flow of fluid impossible

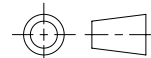


1. DIMENSIONAL TOLERANCES AS PER TITLEBLOCK, U.N.O.
2. SUEZ WT&S SPEC: MS-06030 CLASS: SS150A.
 - A. POST FAB: SEE SPEC.
 - B. CLEANING: SEE SPEC.
 - C. SPOOL DESIGN PRESSURE: 150 PSIG @ 200°F
3. ALL THREADED ENDS TO BE STANDARD N.P.T., U.N.O.
4. PTFE TEFLON TAPE TO BE USED FOR THREADED CONNECTIONS.

B	16	1	3178138	1159645	TUBE,PE,0.062,0.38,BLUE,FDA
	15	1	3067260		VALVE-BALL,316,0.50,1PC THD
	14	1	3180584		NIPPLE-RDCR HEX,316,MNPT,0.75X0.50
	13	1	3069009		TEE,316,FNPT,1.00,150#
B	12	1	3178013		EDUCTOR-VAC,HDPE,1.00,FPT,GEO,ERP.6010
	11	2	3159217		CONNECTOR-STRAIGHT,MNPTXTB,0.25X0.38,SMC
	10	1	3158122		VALVE-ANGLE,316L,1.00,A/S,FPT,NUM
	9	1	3088953		VALVE-BALL,316,1.00,2PC THD
	8	1	3078765		ADPTR-HOSE,PVC,MNPTXHSB,1.00
	7	1	3077752		ELBOW-90 STR,316,MNPTXFNPT,1.00,150
	6	1	3073385		CLAMP,HOSE,1.25" NOM,GEAR TYPE
	5	1	3069783		UNION,SS316L,150#,FNPT,1.0
B	4	1	3033020		NIPPLE,316L,S80,MNPT,0.25XCLS,TBE
	3	1	1261008		TEE,316,FNPT,0.25
	2	1	1115200		NIPPLE,316,MNPT,1.00X4.00L,TBE
	1	3	1113985		NIPPLE,316,S40,MNPT,1.00X2.00L,TBE
	ITEM	QTY.	SAP	SAP_MTKA	COMPONENT DESCRIPTION

B	REVISED AS NOTED	136201	ES	CM	KW	10 July 20
A	INITIAL DESIGN	135731	XC	RJ	SA	08 Apr 20
REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE
PROPRIETARY AND CONFIDENTIAL: THIS DRAWING AND ALL INFORMATION AND KNOWLEDGE CONTAINED OR REFERRED HEREIN ARE THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF SUEZ AND AS SUCH ARE INSTRUMENTS OF SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT. THESE INSTRUMENTS OF SERVICE SHALL NOT BE REPRODUCED, TRANSMITTED, DISCLOSED OR USED OTHERWISE IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN AGREEMENT BY SUEZ AND MUST BE IMMEDIATELY RETURNED OR DESTROYED UPON REQUEST.						

TOLERANCES UNLESS NOTED	
DECIMALS	ANGLES
.X	+/-0.5°
.XX +0/-0.13	FRAC
.XXX +/-0.062	+0/- 1/8"



CUSTOMER INFORMATION

PLMB-EJECTOR,316,1.00X0.25,PE TUBE

DRAWING NUMBER

REVISION

1319223

B

REF.:

DOC. OWNER:

PROJECT NO.

PART/MATERIAL NO.

SCALE	5
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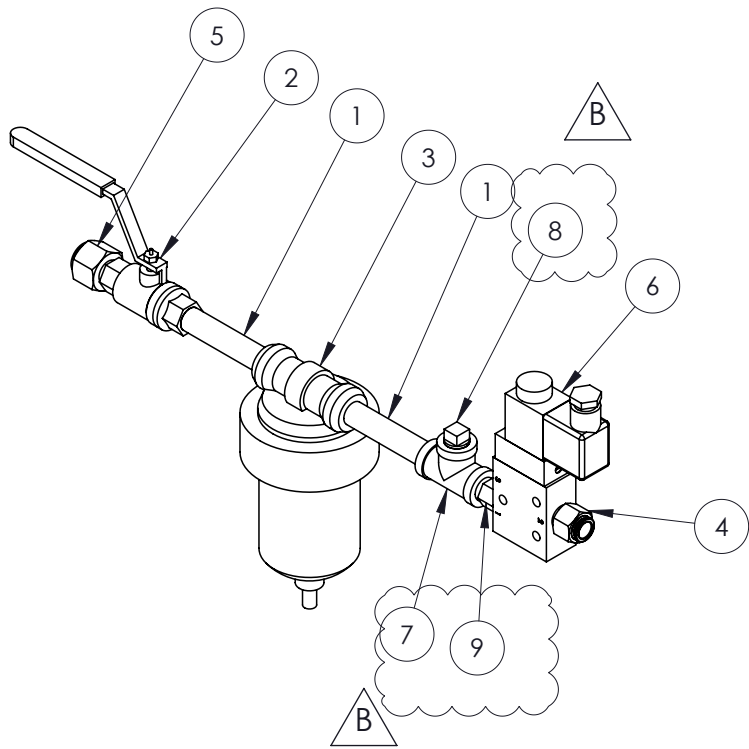
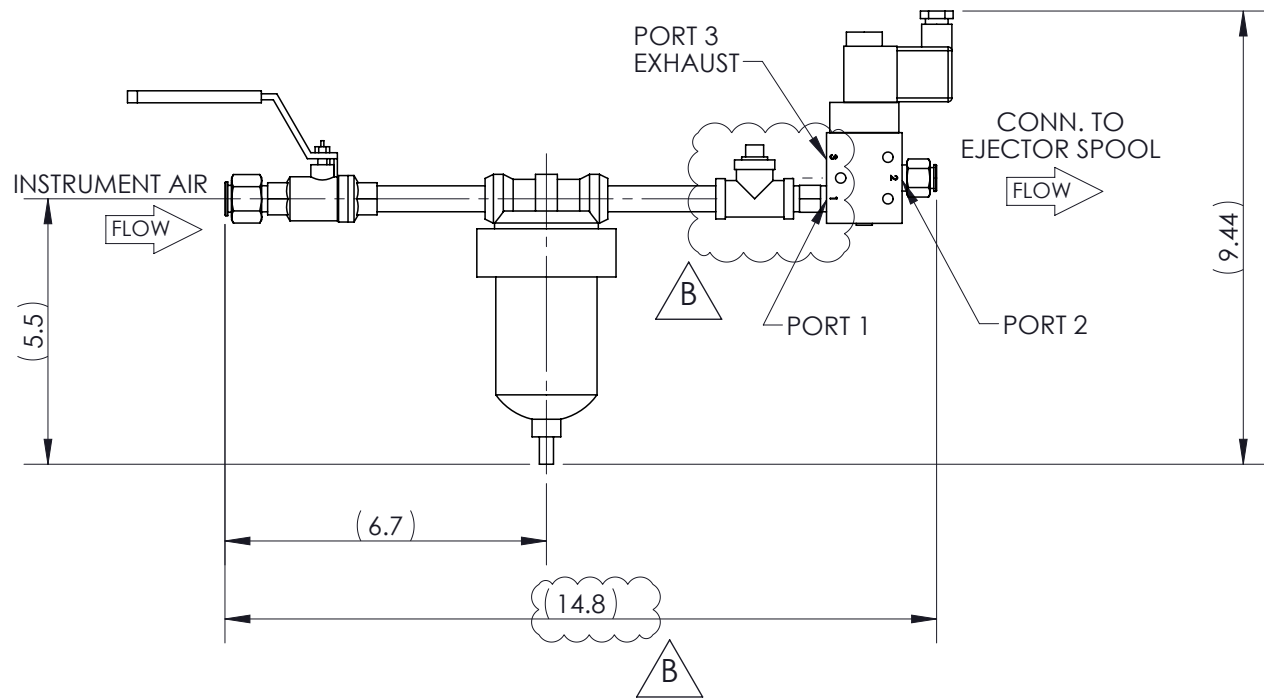
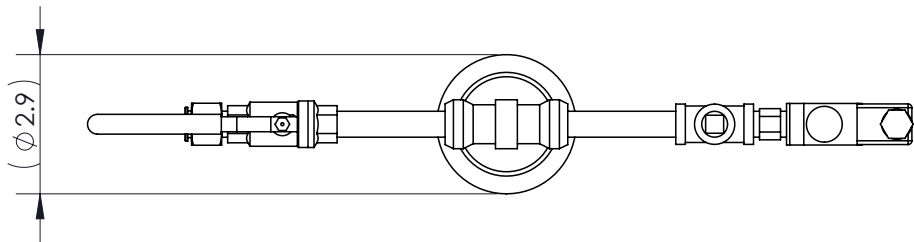
SIZE	SHEET
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1 OF 1

LAST SAVED: Tuesday, August 4, 2020 11:24:27 AM

NOTES:

- DIMENSIONAL TOLERANCES AS PER TITLEBLOCK, U.N.O.
- SUEZ WT&S SPEC: MS-06030 CLASS: SS150A.
 - POST FAB: SEE SPEC.
 - CLEANING: SEE SPEC.
 - SPOOL DESIGN PRESSURE: 150 PSIG @ 200°F
- ALL THREADED ENDS TO BE STANDARD N.P.T., U.N.O.
- PTFE TEFLON TAPE TO BE USED FOR THREADED CONNECTIONS.



9	1	3180583	NIPPLE-HEX,316,MNPT,0.25X1.4375L,TBE
8	1	3079416	PLUG-SQ,316L,150#,MNPT,0.25
7	1	1261008	TEE,316,FNPT,0.25
6	1	3178014	VALVE-SOL,316,3/2-WY,0.25,120VAC,HAF,MH
5	1	3164152	CONNECTOR-STRAIGHT,MNPTXTB,0.25X0.50,SMC
4	1	3159217	CONNECTOR-STRAIGHT,MNPTXTB,0.25X0.38,SMC
3	1	3086200	FLT-AIR,COMPRESSED,1/4",40MICRON
2	1	3067269	VALVE-BALL,316,0.25,2PC THD
1	2	1113368	NIPPLE,316,MNPT,0.25X3.00L,TBE
ITEM	QTY.	SAP NO.	COMPONENT DESCRIPTION

B	REVISED AS NOTED	136201	ES	CM	KW	10 July 20	
A	INITIAL DESIGN	135731	XC	RJ	SA	08 Apr 20	
REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE	
PROPRIETARY AND CONFIDENTIAL: THIS DRAWING AND ALL INFORMATION AND KNOWLEDGE CONTAINED OR REFERRED HEREIN ARE THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF SUEZ AND AS SUCH ARE INSTRUMENTS OF SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT. THESE INSTRUMENTS OF SERVICE SHALL NOT BE REPRODUCED, TRANSMITTED, DISCLOSED OR USED OTHERWISE IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN AGREEMENT BY SUEZ AND MUST BE IMMEDIATELY RETURNED OR DESTROYED UPON REQUEST.							

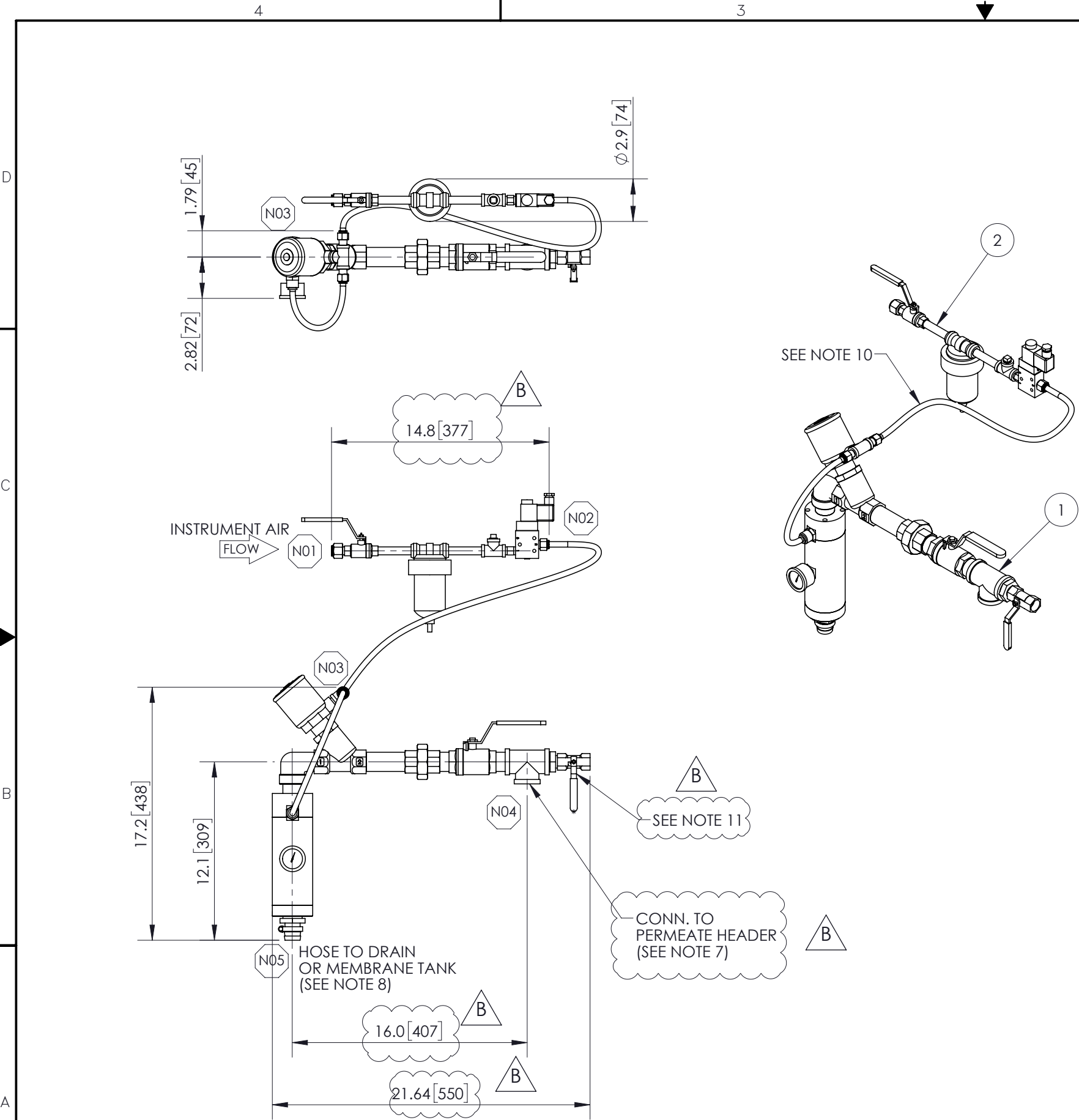
TOLERANCES UNLESS NOTED	
DECIMALS	ANGLES
.X	+/-0.5*
.XX	+0/-0.13
.XXX	+/-0.062
	FRAC
	+0/- 1/8"



CUSTOMER INFORMATION

PLMB-AIR,316,0.25,120VAC,PE TUBE

DRAWING NUMBER		REVISION
1319226		B
REF.:	DOC. OWNER:	
PROJECT NO.	PART/MATERIAL NO.	SCALE
	3178023	1:4
SIZE	SHEET	
B	1 OF 1	



NOZZLE SCHEDULE			
NOZZLE	DESCRIPTION	TYPE	SIZE
N01	PLANT INSTRUMENT AIR	ODT	0.50
N02	INSTRUMENT AIR TO EJECTOR SPOOL	ODT	0.38
N03	INSTRUMENT AIR FROM AIR SPOOL	ODT	0.38
N04	PERMEATE/AIR FROM TOP OF PERMEATE PIPE	F-NPT	1.00
N05	TO OPEN DRAIN/MEMBRANE TANK (AIR GAP)	BARB	1.00

NOTES:

- SHIPPING WEIGHT OF EJECTOR SPOOL - 11.0 LB/[5 KG]
- SHIPPING WEIGHT OF SOLENOID SPOOL - 4.5 LB/[2 KG]
- ALL PIPING & EQUIPMENT SHOWN SHALL BE FULLY SUPPORTED BY OTHERS.
- ALL VALVES & INSTRUMENTS TO BE PROPERLY TAGGED.
- PIPING MATERIAL:
 - HIGH PRESSURE: SCH. 10, 316 SS / PE TUBING
 - LOW PRESSURE: SCH. 10, 316 SS / PE TUBING
- ALL DIMENSIONS IN INCHES [MILLIMETERS]
- CONNECTION TO BE PROVIDED AT HIGHEST POINT ON PIPING BETWEEN PERMEATE HEADER AND PUMP.
- AIR GAP IS REQUIRED ON EJECTOR DISCHARGE LINE EXHAUST TO MEMBRANE TANK OR DRAIN. 1" BRAIDED HOSE RECOMMENDED (HOSE BY OTHERS).
- EJECTOR MUST BE INSTALLED VERTICALLY DOWNWARD.
- THE 3/8" PE TUBING THAT CONNECTS THE TWO SPOOLS TOGETHER IS TO BE PROVIDED AND INSTALLED ONSITE BY OTHERS. UV RATED TUBING SHOULD BE USED IF INSTALLED OUTSIDE.

11. VALVE USED AS AIR INLET FOR MEMBRANE PRESSURE DECAY TEST. TO BE CLOSED AT ALL OTHER TIMES WITH HANDLE LOCKED IN PLACE TO PREVENT ACCEDINTAL OPENING.

MM# 3178078 - W/ 24VDC SOLENOID - PLUMBING TABLE

ITEM	QTY.	SAP	DOC#	DESCRIPTION	U/M
1	1	3178020	1319223	PLMB-EJECTOR,316,1.00X0.25,PE TUBE	EA
2	1	3178022	1319225	PLMB-AIR,316,0.25,24VDC,PE TUBE	EA

MM# 3178079 - W/ 120VAC SOLENOID - PLUMBING TABLE

ITEM	QTY.	SAP	DOC#	DESCRIPTION	U/M
1	1	3178020	1319223	PLMB-EJECTOR,316,1.00X0.25,PE TUBE	EA
2	1	3178023	1319226	PLMB-AIR,316,0.25,120VAC,PE TUBE	EA

REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE
B	REVISED AS NOTED	136201	ES	CM	KW	10 July 20
A	INITIAL DESIGN	135731	XC	RJ	SA	08 Apr 20

TOLERANCES UNLESS NOTED	
DECIMALS	ANGLES
.X	+/-0.5*
.XX	+/-0.50
.XXX	+/- 1/2"



CUSTOMER INFORMATION

ASSY-EJECTOR,316,1.00X0.25,PE TUBE

DRAWING NUMBER

1319243

REVISION

B

REF.: DOC. OWNER:

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
3178078, 3178079		1:8	B	1 OF 1



8290 SERIES | Angle Body Piston Valves

Broad range of pressure operated valves for
air, water, steam, and light slurries

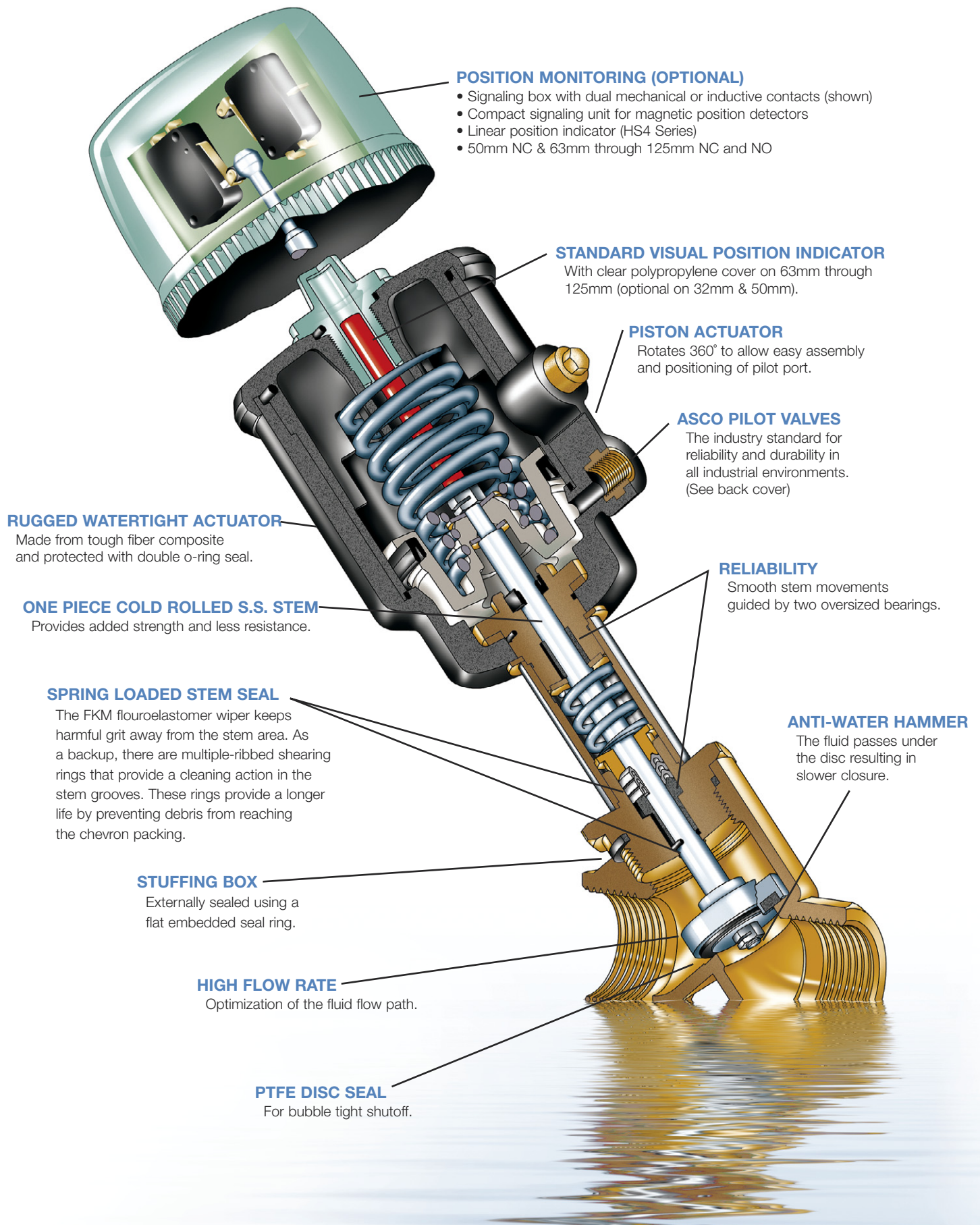
Bronze & stainless steel constructions

Sizes 3/8" through 2 1/2"



ASCO® 8290 SERIES

...tough and packed with features



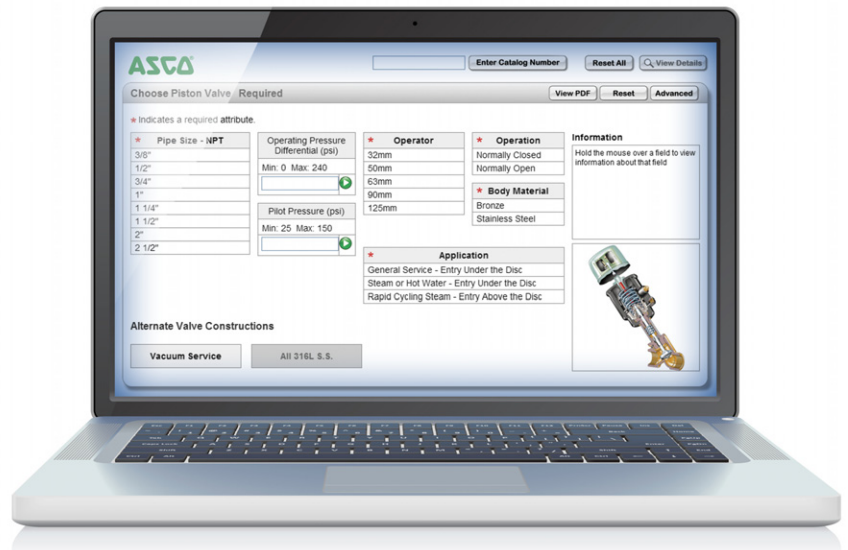
The 8290 Angle Body Piston Valve is a 2-way direct acting valve available in a normally closed or normally open construction. They have proven durability in handling aggressive fluids, such as steam, hot water, solvents, and light slurries.

The 8290 Series is pressure operated with a straight-through design available with bronze or stainless steel bodies built for demanding applications. There are many optional features including position indication and proportional control.

8290 SERIES | ASSEMBLY CONFIGURATOR

ASCO has simplified the 8290 selection process and added the ability to create assemblies using pilot valves and position indicators. After you have determined your product requirements, you can easily construct a catalog number by clicking on each feature required and clicking on the **View Details** button. A second screen will then appear providing the product catalog number, product specification, and various drawings.

You can also enter an existing catalog number that the configurator has created before to decipher the specifications of the catalog number. Type the configured catalog number into the text box next to the **Enter Catalog Number** button (CAPs only). The configurator will automatically highlight the corresponding features of the product.



In order to use the
online configurator go to:

www.ascovalve.com/8290Configurator

Angle Body Multi-Purpose Valves Air or Water Pilot Operated

Bronze or 316L Stainless Steel Bodies • 3/8" to 2 1/2" NPT

The 8290 Series consists of 2-way direct acting valves available in normally closed or normally open constructions. Built for demanding applications, these valves come in a straight-through body design made of bronze or stainless steel. There are many optional features including visual/electrical position indicator or a stroke limiter. The 8290 Series is suitable for the following applications:

- General Service (air, inert gas, water, oil, light slurries)
- Steam and Hot Water

Construction

Valve Parts in Contact with Fluids			
Part	32mm	50mm-125mm	50mm-125mm ①
Body	316L Stainless Steel	Bronze	316L Stainless Steel
Stem	316L Stainless Steel	431 Stainless Steel	431 Stainless Steel
Stuffing Box	316L Stainless Steel	Brass	303 Stainless Steel
Stuffing Box Seal	PTFE	PTFE Chevron	PTFE Chevron
Wiper Seal	FKM	FKM	FKM
Disc	316L Stainless Steel	Brass	304L Stainless Steel
Disc Seal	PTFE	PTFE	PTFE
Screw	316L Stainless Steel	-	-

① For all optional AISI 316L Stainless Steel constructions, contact ASCO

Specifications

Ambient Temperature Range: 15°F to 140°F
(32°F to 122°F for proportional and water service)

Pilot Fluid Temperature Range: 15°F to 140°F
(32°F to 122°F for proportional and water service)

Maximum Viscosity: 2,700 SSU
For higher viscosity applications, please consult ASCO.

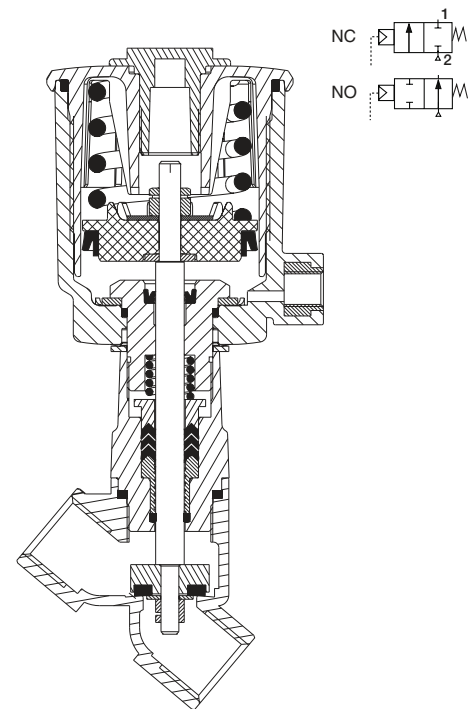
Alternate Valve Constructions

- Oxygen service, add suffix "N".
- Medium vacuum service up to 7×10^{-3} Torr, add suffix "VM".
- Visual Position Indicator for normally closed valve with 32mm or 50mm operator, add suffix "VI" (note: position indicator standard on 63mm through 125mm operators).
- NET-INOX treatment (stainless steel valve body pickled in nitric/hydrofluoric acid bath), add suffix "NI".

See inside back cover for the following constructions:

- Compact Positioners for proportional control
- Signaling Box
- Linear Position Indicator
- Stroke Limiter

Visit www.ascovalve.com/8290Configurator to create an 8290 assembly that fits your needs. Options include position indication, pilot valves, and other accessories.



Specifications

Pipe Size (in)	Orifice Size (in)	Cv Flow		Operating Pressure Differential (psi)			Max. Fluid Temp.*F	Bronze	Stainless Steel ①	Air or Water Pilot Pressure (psi)		Approx. Shipping Weight (lbs.)
				Min.	Max.	Max.				Min.	Max.	
		On-Off	Prop.		Fluids	Steam						
32 mm Operator												
Normally Closed - Entry Under the Disc ③												
3/8	3/8	2.3	-	0	240	150	366	-	8290A791	60	150	1.3
1/2	1/2	4.1	-	0	180	150	366	-	8290A792	60	150	1.4
3/4	3/4	7.6	-	0	90	90	366	-	8290A793	60	150	1.6
Normally Open - Entry Under the Disc												
3/8	3/8	2.3	-	0	240	150	366	-	8290A794	I ②	150	1.3
1/2	1/2	4.1	-	0	240	150	366	-	8290A795	I ②	150	1.4
3/4	3/4	7.6	-	0	200	150	366	-	8290A796	I ②	150	1.6
Normally Closed - Entry Above the Disc for Rapid Cycling Steam Applications												
3/8	3/8	2.3	-	0	-	150	366	-	8290A797	II ②	150	1.6
1/2	1/2	4.1	-	0	-	150	366	-	8290A798	II ②	150	1.4
3/4	3/4	7.6	-	0	-	150	366	-	8290A799	II ②	150	1.6
50 mm Operator												
Normally Closed - Entry Under the Disc ③												
1/2	1/2	5.7	5.3	0	240	150	366	8290A384	8290A393	60	150	2.7
3/4	3/4	11	8.3	0	150	150	366	8290A385	8290A394	60	150	2.9
1	1	15	-	0	90	90	366	8290A386	8290A395	60	150	3.7
Normally Open - Entry Under the Disc												
1/2	1/2	5.7	-	0	240	150	366	8290A387	8290A396	III ②	150	2.7
3/4	3/4	11	-	0	240	150	366	8290A388	8290A397	III ②	150	2.9
1	1	15	-	0	240	150	366	8290A389	8290A398	III ②	150	3.7
Normally Closed - Entry Above the Disc for Rapid Cycling Steam Applications ③												
1/2	1/2	5.7	-	0	-	150	366	8290A390	8290A399	IV ②	150	2.7
3/4	3/4	11	-	0	-	150	366	8290A391	8290A400	IV ②	150	2.9
1	1	15	-	0	-	150	366	8290A392	8290A401	IV ②	150	3.7
63 mm Operator												
Normally Closed - Entry Under the Disc												
1/2	1/2	5.7	-	0	240	150	366	8290B002	8290B045	38	150	3.6
3/4	3/4	11	8.3	0	240	150	366	8290B005	8290B048	60	150	3.9
1	1	19	17	0	150	150	366	8290B010	8290B053	60	150	4.7
1 1/4	1 1/4	32	24	0	90	90	366	8290A016	8290A059	60	150	6.0
1 1/2	1 1/2	52	33	0	60	60	366	8290A020	8290A063	60	150	8.0
2	2	68	46	0	40	40	366	8290A024	8290A067	60	150	10.0
Normally Open - Entry Under the Disc												
1/2	1/2	5.7	-	0	240	150	366	8290B026	8290B069	V ②	150	3.6
3/4	3/4	11	-	0	240	150	366	8290B027	8290B070	V ②	150	3.9
1	1	19	-	0	240	150	366	8290B028	8290B071	V ②	150	4.7
1 1/4	1 1/4	32	-	0	240	150	366	8290A030	8290A073	V ②	150	6.0
1 1/2	1 1/2	52	-	0	160	150	366	8290A032	8290A075	V ②	150	8.0
2	2	68	-	0	105	105	366	8290A034	8290A077	V ②	150	10.0
Normally Closed - Entry Above the Disc for Rapid Cycling Steam Applications												
1/2	1/2	5.7	-	0	-	150	366	8290B036	8290B079	VI ②	150	3.6
3/4	3/4	11	-	0	-	150	366	8290B037	8290B080	VI ②	150	3.9
1	1	19	-	0	-	150	366	8290B038	8290B081	VI ②	150	4.7
1 1/4	1 1/4	32	-	0	-	150	366	8290A039	8290A082	VI ②	150	6.0
1 1/2	1 1/2	52	-	0	-	150	366	8290A040	8290A083	VI ②	150	8.0
2	2	68	-	0	-	135	366	8290A042	8290A085	VI ②	150	10.0

① Available with NET-INOX treatment, add suffix "NI"; ② Minimum pilot pressure varies, see identified graph for appropriate values;
③ For Visual Position Indicator add suffix "VI".

① Available with NET-INOX treatment, add suffix "NI"; ② Minimum pilot pressure varies, see identified graph for appropriate values;
 ③ For Visual Position Indicator add suffix "VI".

Specifications

Pipe Size (in)	Orifice Size (in)	Cv Flow		Operating Pressure Differential (psi)			Max. Fluid Temp. °F	Bronze	Stainless Steel ①	Air or Water Pilot Pressure (psi) ②		Approx. Shipping Weight (lbs.)
				Min.	Max.					Min.	Max.	
		On-Off	Prop.		Fluids	Steam						
90 mm Operator												
Normally Closed - Entry Under the Disc												
1	1	19	17	0	240	150	366	8290B011	8290B054	60	150	6.5
1 1/4	1 1/4	32	24	0	180	150	366	8290A017	8290A060	60	150	7.7
1 1/2	1 1/2	52	33	0	120	120	366	8290A021	8290A064	60	150	9.5
2	2	68	46	0	90	90	366	8290A025	8290A068	60	150	16.0
Normally Open - Entry Under the Disc												
1	1	19	-	0	240	150	366	8290B029	8290B072	VII ②	150	6.5
1 1/4	1 1/4	32	-	0	240	150	366	8290A031	8290A074	VII ②	150	7.7
1 1/2	1 1/2	52	-	0	240	150	366	8290A033	8290A076	VII ②	150	9.5
2	2	68	-	0	200	150	366	8290A035	8290A078	VII ②	150	16.0
Normally Closed - Entry Above the Disc for Rapid Cycling Steam Applications												
1 1/4	1 1/4	32	-	0	-	150	366	8290A136	8290A137	VIII ②	150	7.7
1 1/2	1 1/2	52	-	0	-	150	366	8290A041	8290A084	VIII ②	150	9.5
2	2	68	-	0	-	150	366	8290A043	8290A086	VIII ②	150	16.0
125 mm Operator												
Normally Closed - Entry Under the Disc												
1 1/2	1 1/2	56	56	0	240	150	366	8290A482	8290A495	60	150	15.0
2	2	77	77	0	150	150	366	8290A485	8290A498	60	150	17.0
2 1/2	2 1/2	130	86	0	90	90	366	8290A488	8290A501	60	150	21.5
Normally Open - Entry Under the Disc												
2	2	77	-	0	240	150	366	8290A490	8290A503	IX ②	150	17.0
2 1/2	2 1/2	130	-	0	240	150	366	8290A492	8290A505	IX ②	150	21.5
① Available with NET-INOX treatment, add suffix "NI"; ② Minimum pilot pressure varies, see identified graph for appropriate values.												

① Available with NET-INOX treatment, add suffix "NI"; ② Minimum pilot pressure varies, see identified graph for appropriate values.

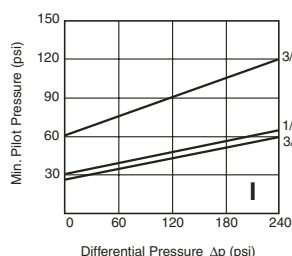
Dimensions: inches

32 mm Operator						
	ØA	B	C	D	E	ØF
in	3/8	3.62	3.66	3.21	2.17	0.93
in	1/2	3.90	3.82	3.29	2.56	1.10
in	3/4	4.21	4.11	3.46	2.95	1.26

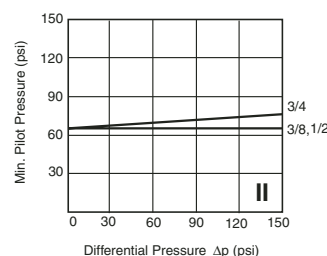


32 mm Operator Graphs for Steam and Fluids

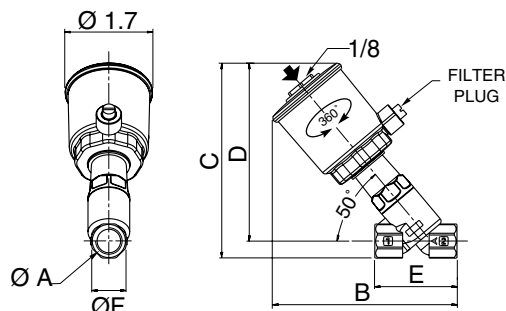
Normally Open Valve - Entry Under Disc



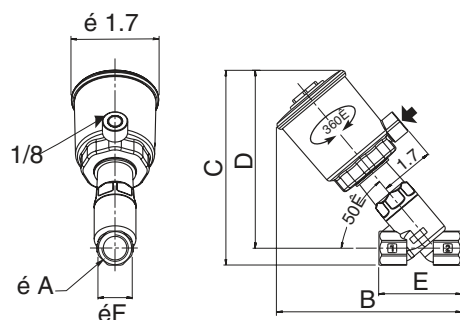
Normally Closed Valve - Entry Above Disc



Normally Open



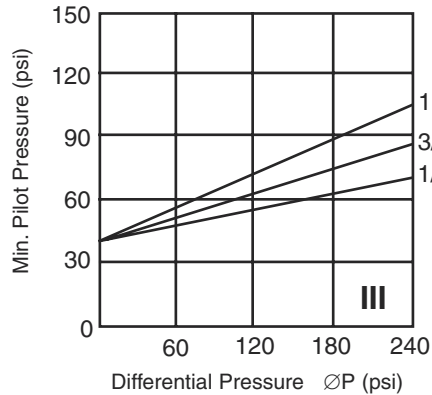
Normally Closed



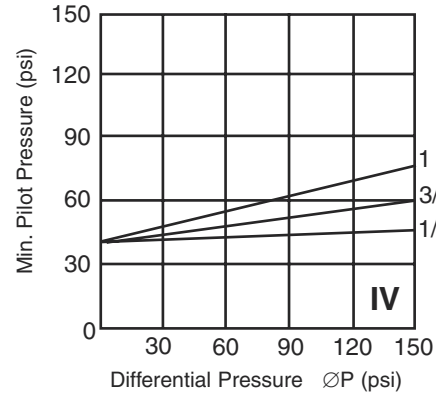
Dimensions: inches

50 mm Operator Graphs for Steam and Fluids

Normally Open Valve - Entry Under Disc



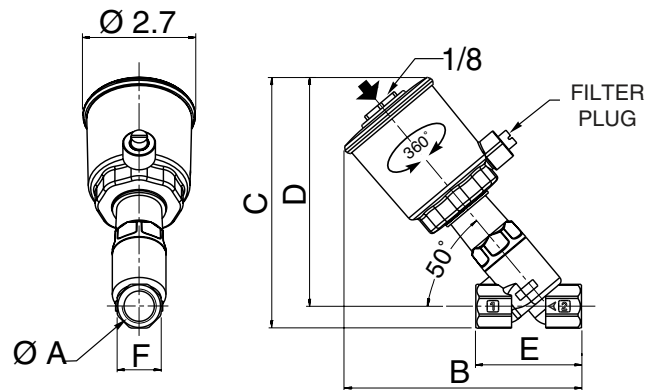
Normally Closed Valve - Entry Above Disc



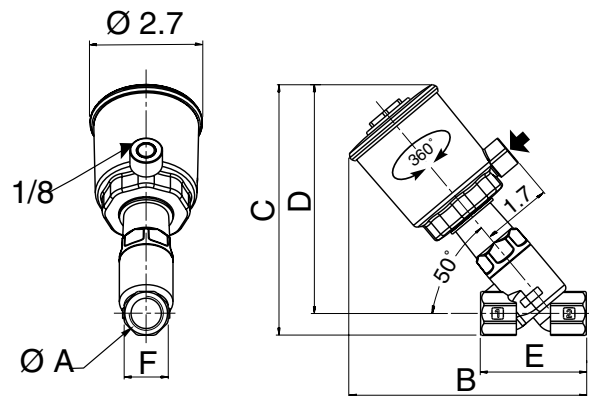
50 mm Operator						
	ØA	B	C	D	E	F
in 1/2	5.59	6.08	5.55	2.56	1.06	
in 3/4	5.92	6.26	5.63	2.95	1.26	
in 1	6.10	6.50	5.71	3.54	1.61	



Normally Open



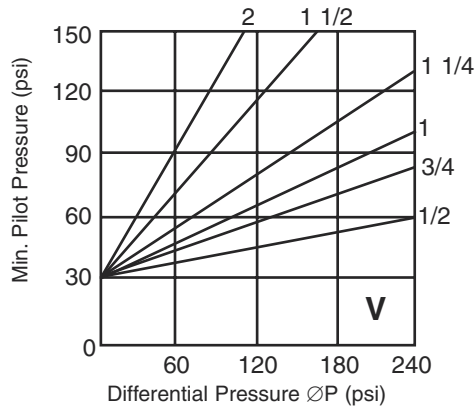
Normally Closed



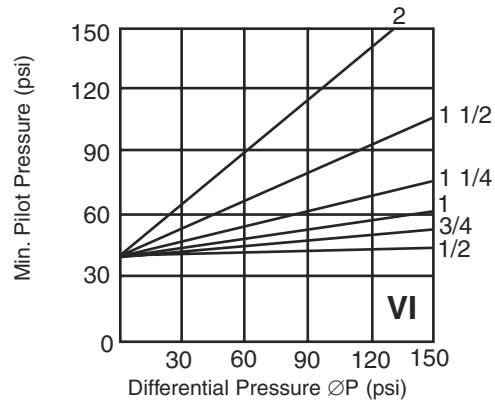
Dimensions: inches

63 mm Operator Graphs for Steam and Fluids

Normally Open Valve - Entry Under Disc



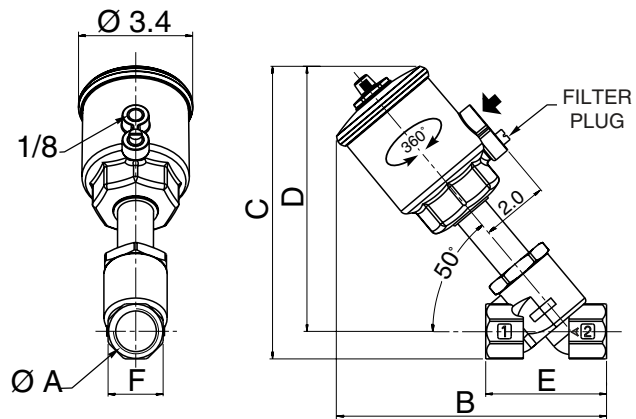
Normally Closed Valve - Entry Above Disc



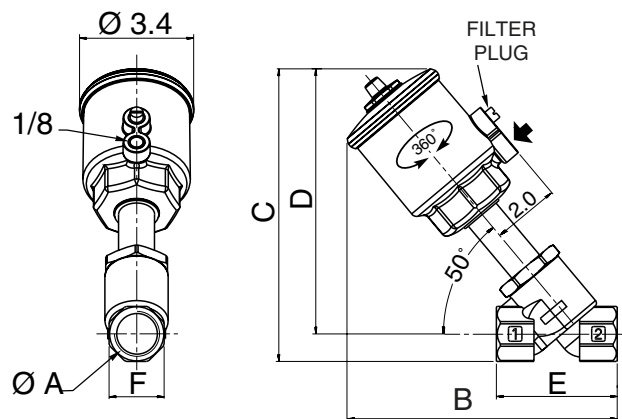
63 mm Operator						
	ØA	B	C	D	E	F
in	1/2	6.70	7.20	6.60	2.56	1.06
in	3/4	6.80	7.30	6.70	2.95	1.26
in	1	7.20	7.70	6.90	3.54	1.61
in	1 1/4	8.54	9.01	8.03	4.33	1.97
in	1 1/2	8.82	9.64	8.46	4.72	2.36
in	2	9.80	10.20	8.82	5.90	2.76



Normally Open



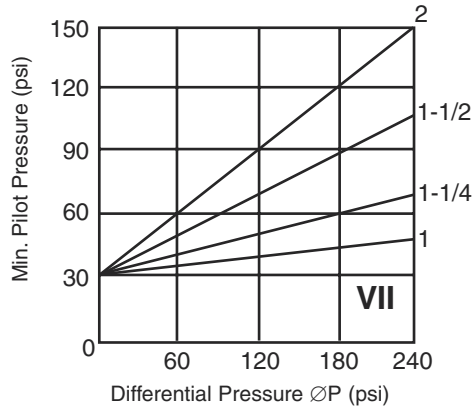
Normally Closed



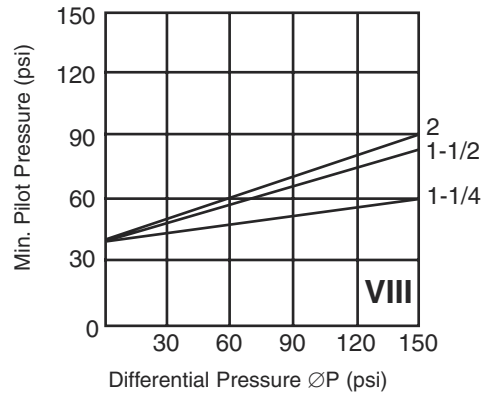
Dimensions: inches

90 mm Operator Graphs for Steam and Fluids

Normally Open Valve - Entry Under Disc

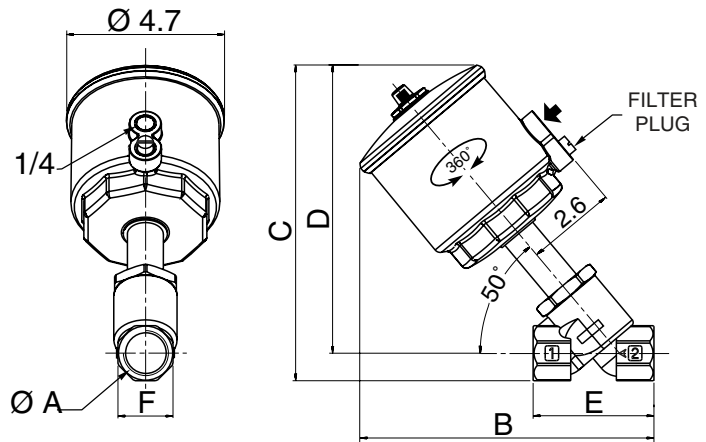


Normally Closed Valve - Entry Above Disc

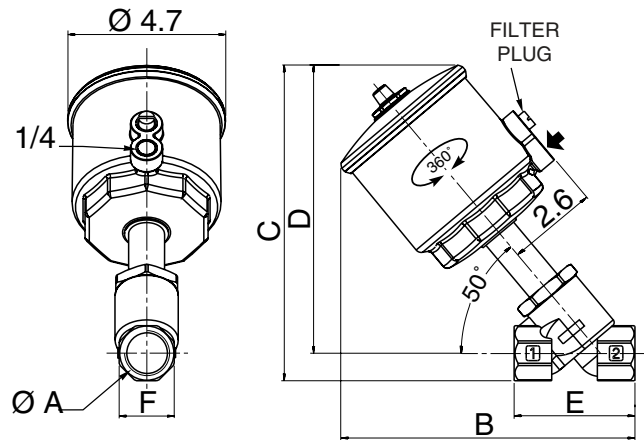


90 mm Operator						
	ØA	B	C	D	E	F
in	1	8.00	8.50	7.70	3.54	1.61
in	1 1/4	9.29	9.69	8.70	4.33	1.97
in	1 1/2	9.57	10.31	9.13	4.72	2.36
in	2	10.51	10.87	9.49	5.91	2.76

Normally Open



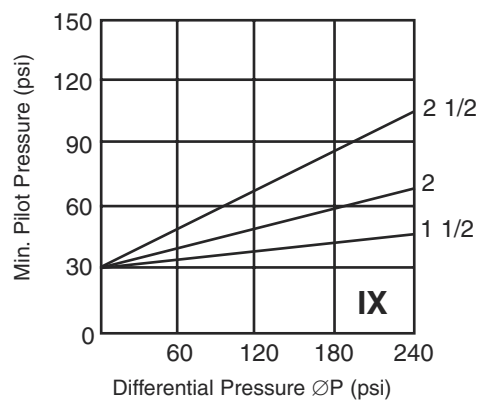
Normally Closed



Dimensions: inches

125 mm Operator Graphs for Steam and Fluids

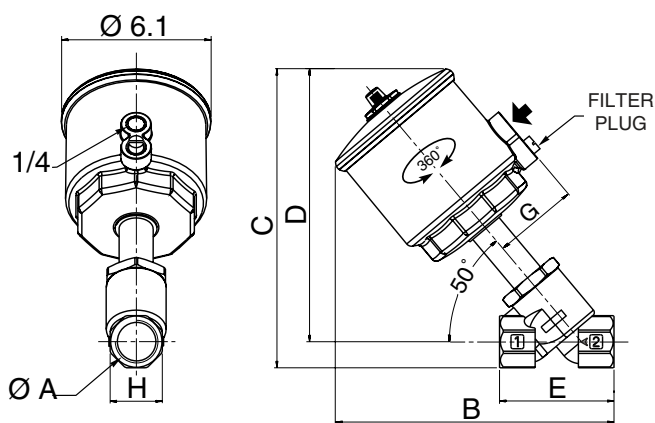
Normally Open Valve - Entry Under Disc



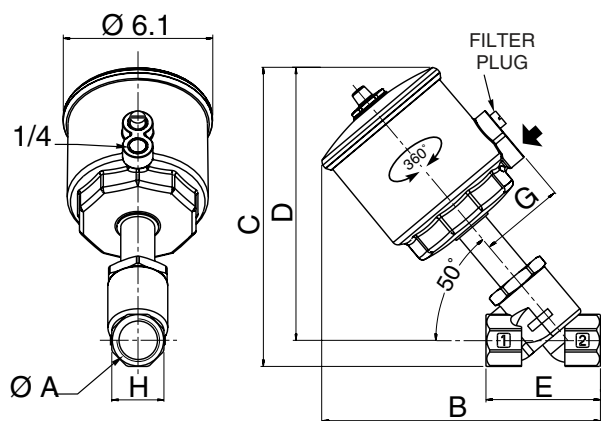
125 mm Operator							
	ØA	B	C	D	E	G	H
in 1 1/2	11.50	12.30	11.20	4.70	3.10	2.40	
in 2	12.40	12.90	11.50	6.00	3.10	2.80	
in 2 1/2	13.70	13.90	12.10	7.50	3.10	3.10	



Normally Open



Normally Closed



8290 SERIES | ACCESSORIES

Signaling Box

Supplied with two mechanical or inductive switches with LEDs and mounts on top of the valve operator in place of the standard visual indicator. As the valve cycles, cams on the signaling box lengthening stem operate the switches to provide electrical signaling of the valve position. The signaling box can rotate 360°. Assembly available on 50mm normally closed and 63mm through 125mm normally open and normally closed. (e.g., 8290A384SM2)

Switches	Add Suffix
Two Mechanical	SM2
Two Inductive	SI2
Two Intrinsically Safe	SH2



Compact Positioners for Proportional Control

Varies flow proportional to a 0-10 VDC, 0-20 mA or 4-20 mA control signal. Feedback of valve stem position via a linear potentiometer. Uses a profiled disc for flow characterization. Assembly available on 50mm through 125mm operators, normally closed with fluid entry under disc. Positioner not suitable for water piloting. (e.g., 8290A384PDB04)

Control Signal	Add Suffix
0-10 VDC	PDB04
0-20 mA	PDB05
4-20 mA	PDB06



Stroke Limiter

The stroke limiter allows Cv flow to be adjusted from 0% to 100%, and mounts on top of the 8290 Series valve in place of the position indicator. Assembly available onto 50mm (normally closed) and 63mm through 125mm normally open or normally closed valves with fluid entry under the disc. Add suffix M: (e.g., 8290B002M)



Linear Position Indicator (HS4 Series)

Supplied with two mechanical switches and mounts on top of the valve operator in place of the standard visual indicator. Provides a wiring box with 1/2" NPT conduit connections. The HS4 linear position indicator is Type 4, 4X and IP 66 suitable for indoor and outdoor use in non-hazardous locations.

Switches	Part Number
Two (2) Mechanical SPDT Gold (IS) Switches	HS4D1YCH2NGA
Two (2) Mechanical SPDT Silver (15A) Switches	HS4D1YCA2NGA



Pilot Valves

ASCO offers a variety of 3-way direct acting normally closed pilot valves to pilot 32mm through 125mm 8290 valves. Available in direct, in-line, and remote mounting.

To order, specify catalog number and voltage:

24, 120, 240 AC/60Hz or 110, 220 AC/50Hz or 6, 12, 24, 120/DC



Series 189

- Direct mount
- Swivel "Banjo" fittings, 1/8" NPT male
- Inlet for 4mm plastic tube
- DIN plug connection



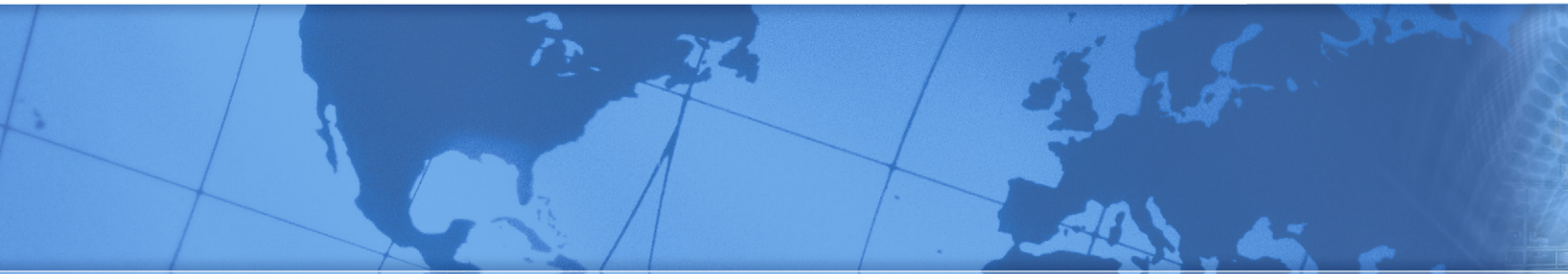
Series 8320

- In-line mount
- 1/8" or 1/4" NPT
- Brass or stainless steel
- (Explosionproof optional, add prefix EF)



Numatics® G3

- Remote mount
- 4 to 16 valves
- Compatible with AS-interface®, DeviceNet™, Profibus® DP, FOUNDATION Fieldbus™, and others
- Air service only



Global Contacts

Australia	(61) 2-9-451-7077	France	(33) 1-47-14-32-00	Netherlands	(31) 33-277-7911
Brazil	(55) 11-4208-1700	Germany	(49) 7237-9960	Singapore	(65) 6556-1100
Canada	(1) 519-758-2700	India	(91) 44-39197300	South Korea	(82) 2-3483-1570
China	(86) 21-3395-0000	Italy	(39) 02-356931	Spain	(34) 942-87-6100
Czech Republic	(420) 235-090-061	Japan	(81) 798-65-6361	United Kingdom	(44) 1695-713600
Dubai - UAE	(971) 4 811 8200	Mexico	(52) 55-5809-5640		



Valves 2016



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18	Quick Finder for Manifold Systems			
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23	2.1.1.2	BV/BR/BL 311 202	M5	ports on bottom
24	2.1.1.3	BV/BR/BL 311 243	pif 4 mm	
25	2.1.1.4	BV/BR/BL 311 301	G 1/8"	
26	2.1.1.5	BG/BZ 311 401/BG 311 701	G 1/8" - G 1/4"	panel mounting
27	2.1.1.6	BR 311 501/701	G 1/8" - G 1/4"	heavy duty
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28	2.1.2.1	BV/BR/BL 511 201	M5	
29	2.1.2.2	BV/BR/BL 511 301	G 1/8"	
30	2.1.2.3	BR 511 501/701	G 1/8" - G 1/4"	heavy duty
31	2.2	Valves for Panel Mounting		
32	2.2.1	BA 311 201/BA 311 202/BA 311 203 BA 311 243/BA 311 301	M5 pif 4 mm - G 1/8"	3/2 way
33	2.2.2	BA 511 201/BA 511 202/BA 511 301	M5 - G 1/8"	5/2 way
34	2.2.3	Ø 22mm Actuators for Panel Mounting		
35	2.2.4	BA 430 301/BA 730 301/BA 334 01	G 1/8"	3 positions
36	2.2.5	BAE 311 301/BAE 511 301	G 1/8"	pneumo-electric switch
37	2.2.6	BH 311 401/BH 320 401/BH 311 701/BH 320 701	G 1/8" - G 1/4"	3/2 way, push-pull
38	2.2.7	BH 511 401/BH 520 401/BH 511 701/BH 520 701	G 1/8" - G 1/4"	5/2 way, push-pull
39	2.2.8	BHP 320 442/462	pif 4 - 6 mm	3/2 way pneumatic reset
40	2.2.9	BHP 520 442/462	pif 4 - 6 mm	5/2 way pneumatic reset
41	2.3	Lever Actuated Valves		
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42	2.3.1.1	HV 311 501/HV 311 701/HV 311 801 HVR 320 501/HVR 320 701/HVR 320 801 HV 311 701 NPT/HVR 320 701 NPT	G 1/8" - G 1/4" 1/4" NPT	spring return indexed spring return/indexed
43	2.3.1.2	HV 311 101/HV 311 121/HV 311 181 HVR 320 101/HVR 320 121/HVR 320 181 HV 311 121 NPT/HVR 320 121 NPT	G 3/8" - G 1/2" - G 3/4" 1/2" NPT	spring return indexed spring return/indexed
	2.3.2	5/2 way valves		
44	2.3.2.1	HV 511 501/HV 511 701/HV 511 801 HVR 520 501/HVR 520 701/HVR 520 801 HV 511 701 NPT/HVR 520 701 NPT	G 1/8" - G 1/4" 1/4" NPT	spring return indexed spring return/indexed
45	2.3.2.2	HV 511 101/HV 511 121/HV 511 181 HVR 520 101/HVR 520 121/HVR 520 181 HV 511 121 NPT/HVR 520 121 NPT	G 3/8" - G 1/2" - G 3/4" 1/2" NPT	spring return indexed spring return/indexed
	2.3.3	5/3 way valves		
46	2.3.3.1	HV 53_ 501/HV 53_ 701/HV 53_ 801 HVR 53_ 501/HVR 53_ 701/HVR 53_ 801 HV 53_ 701 NPT HVR 53_ 701 NPT	G 1/8" - G 1/4" 1/4" NPT 1/4" NPT	spring return indexed spring return indexed
47	2.3.3.2	HV 53_ 101/HV 53_ 121/HV 53_ 181 HVR 53_ 101/HVR 53_ 121/HVR 53_ 181 HV 53_ 121 NPT HVR 53_ 121 NPT	G 3/8" - G 1/2" - G 3/4" 1/2" NPT 1/2" NPT	spring return indexed spring return indexed

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50	2.4.1.1	P 310 302/P 310 502	M5 - G 1/8" air spring return
51	2.4.1.2	P 310 501/P 310 701/P 310 801 P 311 501/P 311 701/P 311 801	G 1/8" - G 1/4" air spring return G 1/8" - G 1/4" mech. spring
52	2.4.1.3	P 310 101/P 310 121/P 310 181 P 311 101/P 311 121/P 311 181 P 310 121 NPT/P 311 121 NPT	G 3/8" - G 1/2" - G 3/4" air spring return G 3/8" - G 1/2" - G 3/4" mech. spring 1/2" NPT air/mech. spring return
53	2.4.1.4	P 310 701 G/P 310 121 G P 311 701 G/P 311 121 G P 310 701 G NPT/P 311 701 G NPT	G 1/4" - G 1/2" air spring, dual G 1/4" - G 1/2" mech. spring, dual 1/4" NPT air/mech. spring, dual
54	2.4.1.5	P 320 302/P 320 502 P 322 302/P 322 502	M5 - G 1/8" double pilot M5 - G 1/8" dominating
55	2.4.1.6	P 320 501/P 320 701 G/P 320 801 P 322 501/P 322 701 G	G 1/8" - G 1/4" double pilot G 1/8" - G 1/4" dominating
56	2.4.1.7	P 320 101/P 320 121/P 320 181	G 3/8" - G 1/2" - G 3/4" double pilot
	2.4.2	5/2 way valves	G-type for in-line and manifold use (dual)
57	2.4.2.1	P 510 302/P 510 502	M5 - G 1/8" air spring return
58	2.4.2.2	P 510 501/P 510 701/P 510 801 P 511 501/P 511 701/P 511 801	G 1/8" - G 1/4" air spring return G 1/8" - G 1/4" mech. spring
59	2.4.2.3	P 510 101/P 510 121/P 510 181 P 511 101/P 511 121/P 511 181 P 510 121 NPT/P 511 121 NPT	G 3/8" - G 1/2" - G 3/4" air spring return G 3/8" - G 1/2" - G 3/4" mech. spring 1/2" NPT air/mech. spring return
60	2.4.2.4	P 510 501 G/P 510 701 G/P 510 121 G P 511 501 G/P 511 701 G/P 511 121 G P 510 701 G NPT/P 511 701 G NPT	G 1/8" - G 1/4" - G 1/2" air spring, dual G 1/8" - G 1/4" - G 1/2" mech. spring, dual 1/4" NPT air/mech. spring, dual
61	2.4.2.5	P 520 302/P 520 502	M5 - G 1/8" double pilot
62	2.4.2.6	P 520 501/P 520 701/P 520 801 P 522 501/P 522 701	G 1/8" - G 1/4" double pilot G 1/8" - G 1/4" dominating
63	2.4.2.7	P 520 101/P 520 121/P 520 181 P 520 121 NPT	G 3/8" - G 1/2" - G 3/4" double pilot 1/2" NPT double pilot
64	2.4.2.8	P 520 501 G/P 520 701 G/P 520 121 G P 522 501 G/P 522 701 G P 520 701 G NPT	G 1/8" - G 1/4" - G 1/2" double pilot, dual G 1/8" - G 1/4" dominating, dual 1/4" NPT double pilot, dual
	2.4.3	5/3 way valves	G-type for in-line and manifold use (dual)
65	2.4.3.1	P 53_ 501/P 53_ 701/P 53_ 801	G 1/8" - G 1/4"
66	2.4.3.2	P 53_ 101/P 53_ 121/P 53_ 181 P 53_ 121 NPT	G 3/8" - G 1/2" - G 3/4" 1/2" NPT
67	2.4.3.3	P 53_ 501 G/P 53_ 701 G/P 53_ 121 G P 53_ 701 G NPT	G 1/8" - G 1/4" - G 1/2" dual 1/4" NPT
	2.4.4	Pneumatic and logic elements	
68	2.4.4.1	VA 341/VA 401/ES 341/ES 401	pif 4 mm, G 1/8" OR- / AND-gate
69	2.4.4.2	SE 501/SE 801/SE 8101/SE 121	G 1/8" - G 1/4" - G 1/2" Quick exhaust (valve)
70	2.4.4.3	P 311 501 SR/P 411 701 SR/ P 411 701 SR NPT	G 1/8" - G 1/4" Pneum. pressure switch 1/4" NPT Pneum. pressure switch
71	2.4.4.4	DR 501/DR 801/DR 101/D 501/D 801/D 101	G 1/8" - G 3/8" flow regulator
	2.4.5	Sub-base mounted pneumatic valves with integral pif in plate – Logic elements	
72	2.4.5.1	P 310 304/P 311 304/P 320 304/P 322 304 RP 3 344	all ports in the plate 3/2 way pif 4 mm
73	2.4.5.2	P 510 304/P 511 304/P 520 304/P 522 304 RP 5 344	all ports in the plate 5/2 way pif 4 mm
74	2.4.5.3	VA 304/ES 304 RP 2 344	all ports in the plate OR-/AND-gates pif 4 mm

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77	2.5.1.1.2	MH 311 012/ MOH 311 012/MX 311 012 MH 311 015/MOH 311 015/MX 311 015 MH 211 012/MH 211 015	M5 3/2 way direct G 1/8" 3/2 way direct M5 - G 1/8" 2/2 way direct
78	2.5.1.1.3	MH 311 305/MOH 311 305 MH 311 309/MOH 311 309 MH 211 305/MH 211 309	G 1/8" 3/2 way direct G 1/4" 3/2 way direct G 1/8" - G 1/4" 2/2 way direct
79	2.5.1.1.4	MH 311 105/MOH 311 105/MX 311 105	G 1/8" - G 1/4" 3/2 way direct PA
80	2.5.1.1.5	MH 311 014/MOH 311 014/MH 311 019/MX 311 019	G 1/8" - G 1/4" 3/2 way banjo PA
81	2.5.1.1.6	MH 311 013/MH 311 017	G 1/8" - G 1/4" 3/2 way banjo alu
82	2.5.1.1.7	MH 311 313/MH 311 317	G 1/8" - G 1/4" 3/2 way banjo alu
83	2.5.1.1.8	MD 310 301/MOD 310 301 MD 310 341/MOD 310 341	M5 single solenoid pif 4 mm single solenoid
84	2.5.1.1.9	MD 310 401/MOD 310 401 MD 310 461/MOD 310 461	G 1/8" single solenoid pif 6 mm single solenoid
85	2.5.1.1.10	MH 310 302/MOH 310 302 MH 310 502/MOH 310 502	M5 single solenoid G 1/8" single solenoid
86	2.5.1.1.11	MH 210 501/MH 210 701	G 1/8" - G 1/4" 2/2 way single solenoid
87	2.5.1.1.12	MH 310 501/MOH 310 501 MH 310 701/MOH 310 701 MH 310 801/MOH 310 801	G 1/8" single solenoid G 1/4" single solenoid G 1/4" single solenoid
88	2.5.1.1.13	MH 310 101/MOH 310 101 MH 310 121/MOH 310 121 MH 310 181/MOH 310 181 MH 310 121 NPT/MOH 310 121 NPT	G 3/8" single solenoid G 1/2" single solenoid G 3/4" single solenoid 1/2" NPT single solenoid
89	2.5.1.1.14	MH 310 501 G/MOH 310 501 G MH 310 701 G/MOH 310 701 G MH 310 701 G NPT/MOH 310 701 G NPT	G 1/8" single solenoid, dual G 1/4" single solenoid, dual 1/4" NPT single solenoid, dual
90	2.5.1.1.15	MH 310 101 G/MOH 310 101 G MH 310 121 G/MOH 310 121 G	G 3/8" single solenoid, dual G 1/2" single solenoid, dual
91	2.5.1.1.16	MH 320 501/MH 320 701/MH 320 801	G 1/8" - G 1/4" double solenoid
92	2.5.1.1.17	MH 320 101/MH 320 121/MH 320 181	G 3/8" - G 1/2" - G 3/4" double solenoid
93	2.5.1.1.18	MH 320 501 G/MH 320 701 G MH 320 101 G/MH 320 121 G	G 1/8" - G 1/4" double solenoid, dual G 3/8" - G 1/2" double solenoid, dual
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94	2.5.1.2.1	MD 311 104/RD 3__ 104/RD 3__ 144	M5 - pif 4 mm direct actuated
95	2.5.1.2.2	MH 312/MH 315/MX 315 MH 314/MH 316	M5 - G 1/8" direct actuated pif 4 mm / 6 mm direct actuated
96	2.5.1.2.3	MH 339/MH 239/R 33 R/R 33 L	G 1/4" direct modular
97	2.5.1.2.4	MD 310 343/MOD 310 343 MD 310 403/MOD 310 403 MD 310 463/MOD 310 463	pif 4 mm single solenoid G 1/8" single solenoid pif 6 mm single solenoid
98	2.5.1.2.5	MD 310 304/MOD 310 304 MD 310 404/MOD 310 404	all ports in plate single solenoid all ports in plate single solenoid
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99	2.5.1.3	MH 331 701 G/MH 331 121 G	G 1/4" - G 1/2"
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101	2.5.2.1.1	MD 510 301/MD 510 341 MD 510 401/MD 510 461	M5 - pif 4 mm single solenoid G 1/8" - pif 6 mm single solenoid
102	2.5.2.1.2	MH 510 302/MH 510 502	M5 - G 1/8" single solenoid
103	2.5.2.1.3	MH 510 501/MH 510 701/MH 510 801	G 1/8" - G 1/4" single solenoid
104	2.5.2.1.4	MH 510 101/MH 510 121/MH 510 181 MH 510 121 NPT	G 3/8" - G 1/2" - G 3/4" single solenoid 1/2" NPT single solenoid

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107	2.5.2.1.7	MD 520 301/MD 520 341 MD 520 401/MD 520 461	M5 - pif 4 mm	double solenoid
108	2.5.2.1.8	MH 520 302/MH 520 502	G 1/8" - pif 6 mm	double solenoid
109	2.5.2.1.9	MH 520 501/MH 520 701/MH 520 801	M5 - G 1/8"	double solenoid
110	2.5.2.1.10	MH 520 101/MH 520 121/MH 520 181 MH 520 121 NPT	G 1/8" - G 1/4" G 3/8" - G 1/2" - G 3/4" 1/2" NPT	double solenoid double solenoid double solenoid
111	2.5.2.1.11	MH 520 501 G/MH 520 701 G MH 520 701 G NPT	G 1/8" - G 1/4" 1/4" NPT	double solenoid, dual double solenoid, dual
112	2.5.2.1.12	MH 520 101 G/MH 520 121 G	G 3/8" - G 1/2"	double solenoid, dual
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113	2.5.2.2.1	MD 510 303/MD 510 343 MD 510 403/MD 510 463	M5 - pif 4 mm	single solenoid
114	2.5.2.2.2	MH 510 503/MH 510 703/MH 510 803	G 1/8" - pif 6 mm	single solenoid
115	2.5.2.2.3	MD 510 304/MD 510 404	G 1/8" - G 1/4"	single solenoid
116	2.5.2.2.4	MH 510 304/MH 510 504/MH 510 704 MH 510 104	all ports in the plate all ports in the plate	single solenoid single solenoid
117	2.5.2.2.5	MD 520 303/MD 520 343 MD 520 403/MD 520 463	M5 - pif 4 mm	double solenoid
118	2.5.2.2.6	MH 520 503/MH 520 703/MH 520 803	G 1/8" - pif 6 mm	double solenoid
119	2.5.2.2.7	MD 520 304/MD 520 404	G 1/8" - G 1/4"	double solenoid
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122	2.5.3.1.2	MH 53_ 501/MH 53_ 701/MH 53_ 801	G 1/8" - pif 6 mm	
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124	2.5.3.1.4	MH 53_ 501 G/MH 53_ 701 G MH 53_ 701 G NPT	G 1/8" - G 1/4" 1/4" NPT	dual dual
125	2.5.3.1.5	MH 53_ 101 G/MH 53_ 121 G	G 3/8" - G 1/2"	dual
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126	2.5.3.2.1	MD 53_ 303/MD 53_ 343 MD 53_ 403/MD 53_ 463	M5 - pif 4 mm	
127	2.5.3.2.2	MH 53_ 503/MH 53_ 703/MH 53_ 803	G 1/8" - pif 6 mm	
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129	2.5.3.2.4	MH 53_ 304/MH 53_ 504/MH 53_ 704 MH 53_ 104	all ports in the plate all ports in the plate	
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135	2.6.2.1	MMD 230 304/MMD 231 304/MMD 232 304	all ports in the plate	Double 3/2-way solenoid valves
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171	2.8.3.6	T_ 22 5__ 504	G 1/8"	all ports in plate
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179	2.9.1.1.2	MNH 310 101/MNH 311 101 MNH 310 121/MNH 311 121 MNH 310 121 NPT/MNH 311 121 NPT	G 3/8" G 1/2" 1/2" NPT	max. flow
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180	2.9.1.2.1	MNH 510 701/MNH 510 711 MNH 511 701/MNH 511 711 MNK 510 701/MNK 511 701 MNH 510 701 NPT/MNH 511 701 NPT	G 1/4" G 1/4" G 1/4" 1/4" NPT	single solenoid single solenoid single solenoid, low power
181	2.9.1.2.2	MNH 510 101/MNH 511 101 MNH 510 121/MNH 511 121 MNH 510 121 NPT/MNH 511 121 NPT	G 3/8" G 1/2" 1/2" NPT	single solenoid, max. flow single solenoid single solenoid
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217	2.11.4.1.1	MH 311 012 TT/MH 311 015 TT	M5 - G 1/8"	direct actuated
		MH 311 013 TT/ MH 311 017 TT	G 1/8" - G 1/4"	banjo
218	2.11.4.1.2	MH 310 501 TT/MOH 310 501 TT	G 1/8"	single solenoid
		MH 310 701 GTT/MOH 310 701 GTT	G 1/4"	single solenoid
		MH 320 501 TT/MH 320 701 GTT	G 1/8" - G 1/4"	double solenoid
	2.11.4.2	5-way G-type valves in-line and manifold use (dual)		
219	2.11.4.2.1	MH 510 501 GTT/MH 510 701 GTT	G 1/8" - G 1/4"	5/2, air spring return
220	2.11.4.2.2.	MH 520 501 GTT/MH 520 701 GTT	G 1/8" - G 1/4"	5/2, double solenoid
		MH 53_ 501 GTT/MH 53_ 701 GTT	G 1/8" - G 1/4"	5/3 way
	2.11.4.3	5-way valves base-mounted		
221	2.11.4.3.1	MH 510 304 TTMH 510 504 TT	all ports in plate	5/2 air spring return
		MH 510 704 TT		
222	2.11.4.3.2	MH 520 304 TT/ MH 520 504 TT	all ports in plate	5/2 double solenoid
		MH 520 704 TT		
		MH 53_ 304 TT/MH 53_ 504 TT	all ports in plate	5/3 way
		MH 53_ 704 TT		
	2.11.5	Valves with Namur Interface		
	2.11.5.1	3/2-way solenoid valves		
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	2.11.5.2	5-way solenoid valves		
224	2.11.5.2.1	MNH 510 701 TT/MNH 510 711 TT	G 1/4"	air spring return
		MNH 511 701 TT/MNH 511 711 TT	G 1/4"	spring return
225	2.11.5.2.2	MNH 520 701 TT	G 1/4"	double solenoid
		MNH 531 701 TT	G 1/4"	5/3 way
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228	2.12.1.1	HV 311 701/HVR 320 701 VES	G 1/4"	3 way
229	2.12.1.2	HV 511 701/HVR 520 701 VES	G 1/4"	5/2 way
		HV 53_ 701/HVR 53_ 701 VES	G 1/4"	5/3 way
	2.12.2	Pneumatically actuated valves made from Stainless Steel		
230	2.12.2.1	P 310 701 VES (NPT)/P 311 701 VES (NPT)	G 1/4"	3 way
		P 310 121 VES (NPT)/P 311 121 VES (NPT)	G 1/2"	3 way
231	2.12.2.2	P 510 701 VES (NPT)/P 511 701 VES (NPT)	G 1/4"	5/2 way
		P 510 121 VES (NPT)/P 511 121 VES (NPT)	G 1/2"	5/2 way
232	2.12.2.3	P 520 701 VES (NPT)/P 520 121 VES (NPT)	G 1/4" - G 1/2"	5/2 way
		P 53_ 701 VES (NPT)/P 53_ 121 VES (NPT)	G 1/4" - G 1/2"	5/3 way
	2.12.3	Solenoid valves made from Stainless Steel		
233	2.12.3.1	MH 311 015 VES	G 1/8"	direct actuated
234	2.12.3.2	MH 310 701 VES/KES / MOH 310 701 VES/KES	G 1/4"	3/2 way
		MH 310 701 NPT VES/KES	1/4" NPT	3/2 way
		MOH 310 701 NPT VES/KES	1/4" NPT	3/2 way
235	2.12.3.3	MH 310 121 VES	G 1/2"	3/2 way
		MH 310 121 NPT VES	1/2" NPT	3/2 way
		MH 320 121 VES	G 1/2"	double solenoid
236	2.12.3.4	MH 510 701 VES/MH 510 701 KES	G 1/4"	5/2 way
		MH 510 701 NPT VES/MH 510 701 NPT KES	1/4" NPT	5/2 way
		MH 510 121 VES/MH 510 121 NPT VES	G 1/2" - 1/2" NPT	5/2 way
237	2.12.3.5	MH 520 701 VES/MH 520 701 KES	G 1/4"	5/2 way
		MH 520 701 NPT VES/MH 520 701 NPT KES	1/4" NPT	5/2 way
		MH 520 121 VES/MH 520 121 NPT VES	G 1/2" - 1/2" NPT	5/2 way
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		MH 53_ 701 NPT VES/MH 53_ 701 NPT KES	1/4" NPT	5/3 way
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		MNH 311 701 NPT VES/KES	1/4" NPT	
240	2.12.4.2	MNH 510 701 VES/KES	5/2 way	single solenoid
		MNH 511 701 VES/KES		
		MNH 520 701 VES/KES	5/2 way	double solenoid
		MNH 510 701 NPT VES/KES	1/4" NPT	single solenoid
		MNH 511 701 NPT VES/KES	1/4" NPT	single solenoid
		MNH 520 701 NPT VES/KES	1/4" NPT	double solenoid
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		MNH 351 701 VES/KES		Namur-Flex
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		MNH 351 701 NPT VES/KES	1/4" NPT	Namur-Flex
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		PN 510 701 VES/PN 511 701 VES	G 1/4"	5/2 way Namur
		PN 520 701 VES	G 1/4"	5/2 way Namur
		PN 531 701 VES	G 1/4"	5/3 way Namur

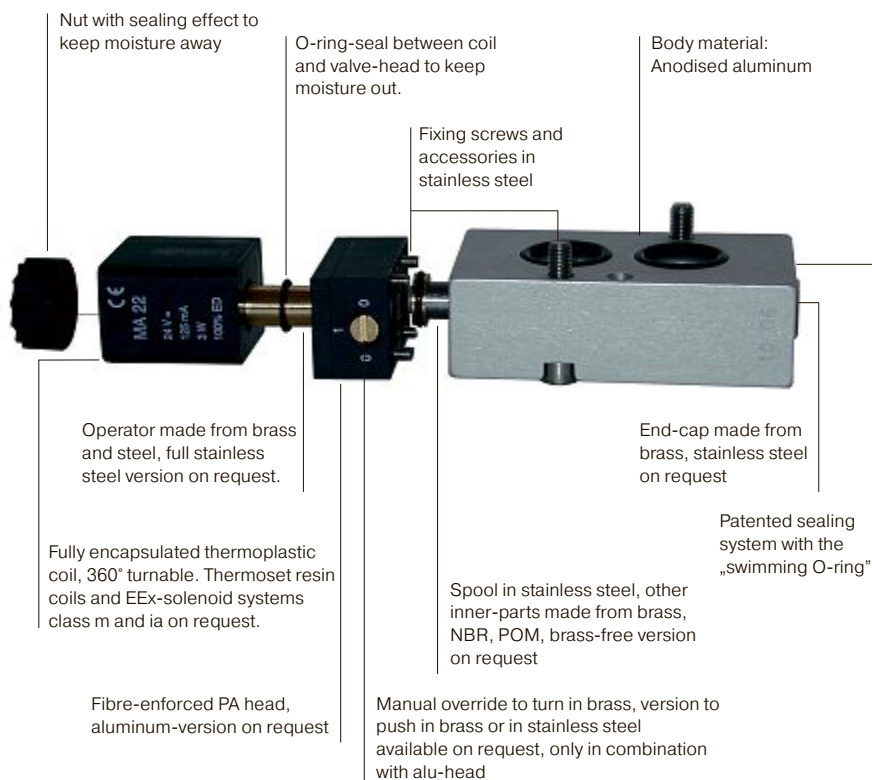
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Besides maximum flow of 1.250 NI/min at compact design there are 11 more competitive advantages of the Hafner valve series 701.



Different customers have demand for different manual overrides. Hafner offers a standard but on demand variations are an option.



Series MH

Manual override to turn by screw driver:

- Direct acting valves
- 22+ mm wide valves (by default)



Series MD

Manual override to push, momentary:

- Direct acting valves
- 16 mm wide valves (by default)
- 22+ mm wide valves



Series MF

Manual override to turn by hand:

- Direct acting valves
- 22+ mm wide valves



Series MHF

Manual override to turn by hand and recess for screw-driver use:

- Direct acting valves
- 22+ mm wide valves



16 mm



Series MHD

Manual override to push plus detent position by turning:

- Direct acting valves
- 16 mm wide valves
- 22+ mm wide valves

22+ mm



M-Version

Without manual override.

- An option for all 22 mm + wide valves



Type numbering system on the basis of MNH 510 701 24DC

MNH

Block 1

Actuation

M	Solenoid valve	Without manual override
MMD	Solenoid valve with momentary manual override	10 mm
MD	Solenoid valve with momentary manual override	normally 16 mm
MOD	Solenoid valve with momentary manual override	normally 16 mm
MH	Solenoid valve with bistable manual override	2- and 3-way n.o. normally 22 mm plus
MOH	Solenoid valve with bistable manual override	normally 22 mm plus 2- and 3-way n.o.
MEH	Solenoid valve with bistable manual override	With external pilot feed
MNH	Solenoid valve with bistable manual override	NAMUR-interface
MNOH	Solenoid valve with bistable manual override	NAMUR-interface 2- and 3-way n.o.
MK	Solenoid valve with momentary manual override	Low power
MNK	Solenoid valve with momentary manual override	Low power NAMUR-interface
P	Pneumatically actuated valve	
HV	Lever actuated valve with spring return	
HVR	Lever actuated valve indexed	
BV/BG	Stem actuated valve	
BZ	Stem actuated valve, actuation by pulling the stem	
BR	Roller lever valve	
BL	Roller lever valve with idle return	
BA	Valve for panel mounting	
BH	Push-pull button valve for panel mounting	
BHP	Push-pull button valve with pneumatic reset	
VA	OR-gate	
ES	AND-gate	
SE	Quick-exhaust valve	
DR	Flow regulator, uni-directional	
D	Flow regulator, bi-directional	
DRN	Flow regulator with NAMUR-interface	
UB	Air-recirculation block with NAMUR-interface	
SENR	Quick-Exhaust block with NAMUR-interface	
BHN	Block and block / block and bleed valves with NAMUR-interface	
ZVP	Plates for cylinder-valve combinations	
ZPN	Various accessory plates	

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Block 2

Function

First number:	2 = 2-way, 3 = 3-way or 5 = 5-way valve	
Second number:	1 = actuation by permanent signal, 2 = actuated by impulse 3 = 3-way valves 53_ = 5/3-way valves 33_ = 3/3-way valves	
Third number:	For 5/3-way and 3/3-way valves: 1 = middle position closed 2 = middle position exhausted 3 = middle position pressurized Other valves: 0 = pneumatical spring 1 = mechanical spring (MH-, MNH- and PN-valves have a combined spring)	
210	2/2-way	Pneumatic spring return
310	3/2-way	Pneumatic spring return
311	3/2-way	Combined / mechanical spring return (depends on type)
320	3/2-way	Double solenoid
510	5/2-way	Pneumatic spring return
511	5/2-way	Combined / mechanical spring return (depends on type)
520	5/2-way	Double solenoid
531	5/3-way	Centre closed
532	5/3-way	Centre exhausted
533	5/3-way	Centre pressurized

The Hafner valve type numbering system consists of at least 3 blocks.
Block 4 to be used for voltage indication or special suffixes.
Please note: This overview is not intended to be exhaustive.

701

Block 3

Size & Position of Ports

In-line valves:

	Orifice size	Ports	Position of Ports
201	2 mm	M5	Standard
202	2 mm	M5	On one side
243	2 mm	Pif 4 mm	Side of valve
301	3 mm	G 1/8"	Standard
302	3 mm	M5	On one side
341	3 mm	Pif 4 mm	Standard
401	4 mm	G 1/8"	Standard
461	4 mm	Pif 6 mm	Standard
442	4 mm	Pif 4 mm	On one side
462	4 mm	Pif 6 mm	On one side
501	5 mm	G 1/8"	Standard
502	5 mm	G 1/8"	On one side
701	7 mm	G 1/4"	Standard
711	7 mm	G 1/4"	Ports swapped (NAMUR valves only)
801	8 mm	G 1/4"	Standard
101	10 mm	G 3/8"	Standard
121	12 mm	G 1/2"	Standard
181	18 mm	G 3/4"	Standard

Direct acting valves:

	Orifice size	Ports	Position of Ports
010	1 mm	M5	Standard
012	1,2 mm	M5	Standard
015	1,2 mm	G 1/8"	Standard
305	3 mm	G 1/8"	Standard
309	3 mm	G 1/4"	Standard
014	1,2 mm	G 1/8"	Banjo-screw (port 2)
019	1,2 mm	G 1/8" – pif 6 mm	Banjo-screw (port 2)
013	1,2 mm	G 1/8"	Banjo-screw (port 2)
017	1,2 mm	G 1/8" – G 1/4"	Banjo-screw (port 2)
313	3 mm	G 1/8"	Banjo-screw (port 2)
317	3 mm	G 1/8" – G 1/4"	Banjo-screw (port 2)

Valves for manifold assembly:

	Orifice size	Ports	Position of Ports
105	1,2 mm	G 1/4" – G 1/8"	Modular system, direct acting
239	3 mm	G 1/4"	Modular system, direct acting
339	3 mm	G 1/4"	Modular system, direct acting
304	3 mm	Flange for manifold	All on one side
503	5 mm	G 1/8"	
		Flange for manifold	1,3,5 on one side as flange
504	5 mm	Flange for manifold	All on one side
703	7 mm	G 1/8"	
		Flange for manifold	1,3,5 on one side as flange
704	7 mm	Flange for manifold	All on one side
104	10 mm	Flange for manifold	All on one side

24DC

Block 4

Suffixes

Block 4 is to be used to indicate the voltage at solenoid valves or to give further information on special executions.
Block 4 can consist of several suffixes.

Voltages	6VDC, 12VDC, 24VDC, 48DC, 24VAC, 110AC, 230AC
O.S.	without coil
NPT	NPT threads
TT	Low temperature
HT	High temperature
VES	Full stainless steel
KES	Stainless steel with PA pilot-head
G	Valves can be used in-line and also on manifold plates
Ex	ATEX-approved non-electrical valve
Ex ia	ATEX-approved for Ex ia coils
Ex m	ATEX-approved for Ex m coils
Ex nA	ATEX-approved for Ex nA coils
Ex e mb	ATEX-approved for Ex e mb coils
Ex dm	ATEX-approved for Ex dm coils
Ex d	ATEX-approved for Ex d coils
EDS	Brass-free to the outside
BMF	Entirely brass-free

Please note: Valves type "G" (e.g. 701 G) can be used as an in-line valve as well as for manifold assembly.

Quick Finder for Manifold Systems

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We offer a large variety of manifold systems. In order to choose the appropriate combination of manifold plate and solenoid valves please consult the list below.

The different valves which can be assembled to one type of manifold plate are described in the same row.

Manifold systems that can be equipped with our D-Sub-terminal system are indicated by a **T** in the last column.

Valves that can be used in-line and on manifold plates are indicated by a **G**.

Modular Manifold-System indicated by a **B**.

3 way solenoid valves

position of ports			port size			manifold		3/2 way single sol.			3/2 way double sol.		comment	
1	2	3	1	2	3	type	page	type n.c.	type n.o.	page	type	page		
plate	plate	valve	G 1/8"	M5	operator	RD 3__ 104	2.5.1.2.1	MD 311 104	n.a.	2.5.1.2.1	n.a.	n.a.	direct acting	T
plate	plate	valve	G 1/8"	pif 4 mm	operator	RD 3__ 144	2.5.1.2.1	MD 311 104	n.a.	2.5.1.2.1	n.a.	n.a.	direct acting	T
plate	valve	valve	G 1/4"	M5	operator	R __	2.7.1.1	MH 312	n.a.	2.5.1.2.2	n.a.	n.a.	direct acting	
plate	valve	valve	G 1/4"	G 1/8"	operator	R __	2.7.1.1	MH 315	n.a.	2.5.1.2.2	n.a.	n.a.	direct acting	
plate	valve	valve	G 1/4"	pif 4 mm	operator	R __	2.7.1.1	MH 314	n.a.	2.5.1.2.2	n.a.	n.a.	direct acting	
plate	valve	valve	G 1/4"	pif 6 mm	operator	R __	2.7.1.1	MH 316	n.a.	2.5.1.2.2	n.a.	n.a.	direct acting	
plate	plate	valve	G 1/4"	G 1/4"	G 1/8"	R 33	2.5.1.2.3	MH 339	n.a.	2.5.1.2.3	n.a.	n.a.	direct acting	B
plate	valve	plate	G 1/8"	pif 4 mm	G 1/8"	RD 3__ 303	2.7.1.2	MD 310 343	MOD 310 343	2.5.1.2.4	n.a.	n.a.	3/2 way valves	T
plate	valve	plate	G 1/4"	pif 6 mm	G 1/4"	RD 3__ 403	2.7.1.2	MD 310 463	MOD 310 463	2.5.1.2.4	n.a.	n.a.	3/2 way valves	T
plate	valve	plate	G 1/4"	G 1/8"	G 1/4"	RD 3__ 403	2.7.1.2	MD 310 403	MOD 310 403	2.5.1.2.4	n.a.	n.a.	3/2 way valves	T
plate	plate	plate	G 3/8"	pif 4 mm	G 3/8"	RM 5__ 344	2.6.2.4		MMD 23_ 304	2.6.2.1			double 3/2 way valves	T
plate	plate	plate	G 1/4"	pif 4 mm	G 1/4"	RD 3__ 344	2.7.1.3	MD 310 304	MOD 310 304	2.5.1.2.5	n.a.	n.a.	3/2 way valves	T
plate	plate	plate	G 1/4"	pif 6 mm	G 1/4"	RD 3__ 464	2.7.1.3	MD 310 404	MOD 310 404	2.5.1.2.5	n.a.	n.a.	3/2 way valves	T
plate	valve	plate	G 1/4"	G 1/8"	G 1/4"	RB 3__ 503 G	2.7.1.4	MH 310 501 G	MOH 310 501 G	2.5.1.1.14	MH 320 501 G	2.5.1.1.18	3/2 way valves	GB
plate	valve	plate	G 3/8"	G 1/4"	G 3/8"	RB 3__ 703 G	2.7.1.4	MH 310 701 G	MOH 310 701 G	2.5.1.1.14	MH 320 701 G	2.5.1.1.18	3/2 way valves	GT
plate	valve	plate	G 3/8"	G 1/4"	G 3/8"	RB 3__ 703 G	2.7.1.4	MH 331 701 G		2.5.1.3			3/3 way valves	G
plate	valve	plate	G 1/2"	G 3/8"	G 1/2"	RB 3__ 103 G	2.7.1.5	MH 310 101 G	MOH 310 101 G	2.5.1.1.15	MH 320 101 G	2.5.1.1.18	3/2 way valves	GB
plate	valve	plate	G 1/2"	G 1/2"	G 1/2"	R 3__ 121 G	2.7.1.5	MH 310 121 G	MOH 310 121 G	2.5.1.1.15	MH 320 121 G	2.5.1.1.18	3/2 way valves	G
plate	valve	plate	G 1/2"	G 1/2"	G 1/2"	R 3__ 121 G	2.7.1.5	MH 331 121 G		2.5.1.3			3/3 way valves	G

5 way solenoid valves

position of ports			port size			manifold		5/2 single sol.		5/2 double sol.		5/3 way		
1	2+4	3+5	1	2+4	3+5	type	page	type	page	type	page	type	page	
plate	valve	plate	G 1/8"	M5	G 1/8"	RD 5__ 303	2.7.2.1	MD 510 303	2.5.2.2.1	MD 520 303	2.5.2.2.5	MD 53_ 303	2.5.3.2.1	T
plate	valve	plate	G 1/8"	pif 4 mm	G 1/8"	RD 5__ 303	2.7.2.1	MD 510 343	2.5.2.2.1	MD 520 343	2.5.2.2.5	MD 53_ 343	2.5.3.2.1	T
plate	valve	plate	G 1/4"	G 1/8"	G 1/4"	RD 5__ 403	2.7.2.1	MD 510 403	2.5.2.2.1	MD 520 403	2.5.2.2.5	MD 53_ 403	2.5.3.2.1	T
plate	valve	plate	G 1/4"	pif 6 mm	G 1/4"	RD 5__ 403	2.7.2.1	MD 510 463	2.5.2.2.1	MD 520 463	2.5.2.2.5	MD 53_ 463	2.5.3.2.1	T
plate	valve	plate	G 1/4"	G 1/8"	G 1/4"	RB 5__ 503 G	2.7.2.2	MH 510 501 G	2.5.2.1.5	MH 520 501 G	2.5.2.1.11	MH 53_ 501 G	2.5.3.1.4	GB
plate	valve	plate	G 1/4"	G 1/8"	G 1/4"	RB 5__ 503 G	2.7.2.2	MH 510 503	2.5.2.2.2	MH 520 503	2.5.2.2.6	MH 53_ 503	2.5.3.2.2	TB
plate	valve	plate	G 3/8"	G 1/4"	G 3/8"	RB 5__ 703 G	2.7.2.3	MH 510 701 G	2.5.2.1.5	MH 520 701 G	2.5.2.1.11	MH 53_ 701 G	2.5.3.1.4	GB
plate	valve	plate	G 3/8"	G 1/4"	G 3/8"	RB 5__ 703 G	2.7.2.3	MH 510 703	2.5.2.2.2	MH 520 703	2.5.2.2.6	MH 53_ 703	2.5.3.2.2	TB
plate	valve	plate	G 3/8"	G 1/4"	G 3/8"	R 5__ 803	2.7.2.5	MH 510 803	2.5.2.2.2	MH 520 803	2.5.2.2.6	MH 53_ 803	2.5.3.2.2	
plate	valve	plate	G 1/2"	G 3/8"	G 1/2"	RB 5__ 103 G	2.7.2.4	MH 510 101 G	2.5.2.1.6	MH 520 101 G	2.5.2.1.12	MH 53_ 101 G	2.5.3.1.5	GB
plate	valve	plate	G 1/2"	G 1/2"	G 1/2"	R 5__ 121 G	2.7.2.5	MH 510 121 G	2.5.2.1.6	MH 520 121 G	2.5.2.1.12	MH 53_ 121 G	2.5.3.1.5	G
plate	plate	plate	G 3/8"	pif 4 mm	G 3/8"	RM 5__ 344	2.6.2.4	MMD 510 304	2.6.2.2	MMD 520 304	2.6.2.2	MMD 53_ 304	2.6.2.3	T
plate	plate	plate	G 1/8"	pif 4 mm	G 1/8"	RD 5__ 344	2.7.2.6	MD 510 304	2.5.2.2.3	MD 520 304	2.5.2.2.7	MD 53_ 304	2.5.3.2.3	T
plate	plate	plate	G 1/4"	pif 6 mm	G 1/4"	RD 5__ 464	2.7.2.6	MD 510 404	2.5.2.2.3	MD 520 404	2.5.2.2.7	MD 53_ 404	2.5.3.2.3	T
plate	plate	plate	G 1/4"	G 1/8"	G 1/4"	R 5__ 304	2.7.2.7	MH 510 304	2.5.2.2.4	MH 520 304	2.5.2.2.8	MH 53_ 304	2.5.3.2.4	T
plate	plate	plate	G 1/4"	G 1/8"	G 1/4"	R 5__ 504	2.7.2.7	MH 510 504	2.5.2.2.4	MH 520 504	2.5.2.2.8	MH 53_ 504	2.5.3.2.4	T
plate	plate	plate	G 3/8"	G 1/4"	G 3/8"	R 5__ 704	2.7.2.8	MH 510 704	2.5.2.2.4	MH 520 704	2.5.2.2.8	MH 53_ 704	2.5.3.2.4	T
plate	plate	plate	G 3/8"	pif 8 mm	G 3/8"	R 5__ 784	2.7.2.8	MH 510 704	2.5.2.2.4	MH 520 704	2.5.2.2.8	MH 53_ 704	2.5.3.2.4	T
plate	plate	plate	G 3/8"	G 1/4"	G 3/8"	RB 5__ 704 K1	2.7.2.9	MH 510 704	2.5.2.2.4	MH 520 704	2.5.2.2.8	MH 53_ 704	2.5.3.2.4	T
plate	plate	plate	G 1/2"	G 3/8"	G 1/2"	RB 5__ 104 K1	2.7.2.10	MH 510 104	2.5.2.2.4	MH 520 104	2.5.2.2.8	MH 53_ 104	2.5.3.2.4	T

General Technical Information for Hafner Valves

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Temperature range:

Type-number	Temperature range
BV, BR, BL, BA	-20°C to +50°C
BG, BH	-10°C to +60°C
HV, HVR, P	-10°C to +60°C
MH, MNH DC-version	-10°C to +60°C
MH, MNH AC-version	-10°C to +50°C
MD, MK	-10°C to +50°C
MMD	-10°C to +50°C
TT	-50°C to +50°C

Several customer-specific items have been catered for an enlarged temperature range.

Leakage rate at 6 bar pressure:

All (100 %) of the Hafner-valves leaving the factory are individually tested on function and leakage.

The following leakage rate is allowed and a valve is still rated as good with the following:

- Internal leakage: 4 cm³ / min
- External leakage: 2 cm³ / min

For TT-valves only:

At temperatures below - 40°C the internal leakage can increase to 10 cm³ / min

General Warranty:

The general warranty is 12 month from delivery.
Warranty expires when valves have been opened.

Recommended signal length:

The recommended signal length to reach full flow is 50 msec.

Operation and required air-quality:

The valves are designed for being used with cleaned and lubricated or cleaned and unlubricated compressed air.

Required Air-quality-level in accordance to ISO 8573-1:2010: 7 – 4 – 4 for particles – water – oil

Lubrication:

Valves do not require any lubrication but lubrication in general increases the life-time of the products. Please avoid to lubricate the valves during a certain period of time and let them run dry later. For low-temperature-items: Do not lubricate as most kinds of oil and grease do not properly operate below - 25°C.

Voltage tolerance:

The general voltage tolerance of all solenoid systems is +/- 10%.

Standard materials used for Hafner-valves:

Bodies	standard VES / KES chapter 12.	anodised aluminum 1.4404
Spool		stainless steel 1.4104, operator tube 1.4305
Sealing-system	standard low temperature chapter 11. 1/4" VES / KES chapter 12. 1/2" VES chapter 12.	brass & NBR brass & PUR stainless steel, operator tube 1.4305 & PUR stainless steel, operator tube 1.4305 & FKM
Other inner parts	standard low temperature chapter 11. VES / KES chapter 12.	brass, POM, NBR brass, POM, NBR stainless steel, operator tube 1.4305 POM, FKM
Actuation elements	BA-valves HV BH BHP	PA 6.6 30 % glass filled Duroplast PF31 P/PA Duroplast PF31 P/PA ABS-plastic
Upper part solenoids	series 500 and 700 other series VES KES	PA 6.6 30 % glass filled, brass anodised aluminum, brass 1.4404 PA 6.6 30 % glass filled, stainless steel, operator tube 1.4305
PA	Polyamide	
1.4404	high graded stainless steel	
POM	Polyoxymethylene	
FKM	Fluoroelastomer	

In accordance to CETOP position paper „PP07 Machine Directive 2006/42/EC”: Single valves placed on the market are not ... within the meaning of Annex V, point 4 of Machine Directive 2006/42/EC.

The Hafner company policy is one of a continuous improvement process. We therefore reserve the right to amend, enhance and change specifications of the products presented in this document without notice.



Manufacturing Facility Halászi – Hungary

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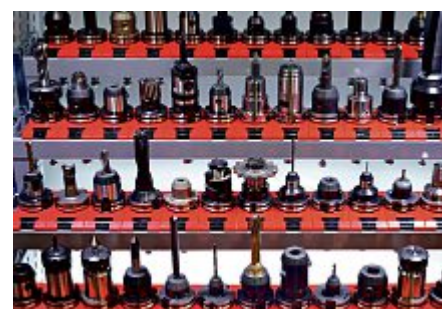
Hafner pneumatika Kft. Halászi – Hungary



1.600 m² of
manufacturing area.



Latest CNC-equipment ...



... and tools.



Work-place in assembly area.



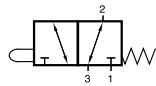
Mechanically Actuated Valves

Selected models are available for explosion hazardous environment. They are ATEX-Ex certified. For detailed information refer to chapter 2.14.

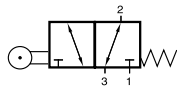


Selected models are available for low temperature application. Temperature-range: - 50° C to + 50° C. For detailed information refer to chapter 2.11.

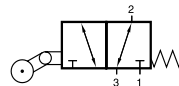
BV/BR/BL 311 201



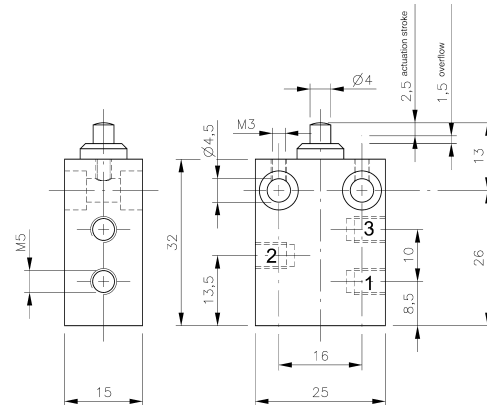
BV 311 201



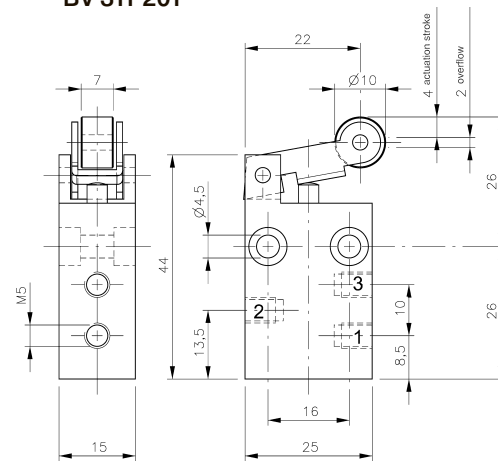
BR 311 201



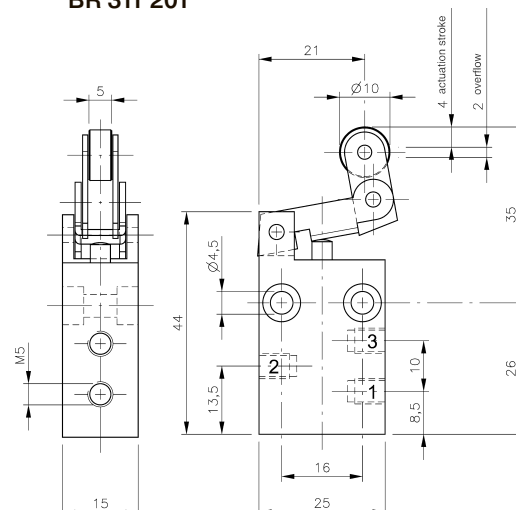
BL 311 201



BV 311 201



BR 311 201



BL 311 201

Mechanically actuated 3/2-way spool valve with mechanical spring. All ports are on the side of the valve.

If pressure is applied to port 1 the function is normally closed.

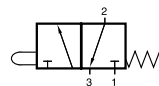
If pressure is applied to port 3 the function is normally open.

The use of the ports is interchangeable.

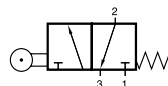
Exhaust can be throttled.

Valves can be used for technical vacuum too.

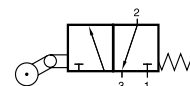
Type	Port size	Air flow	Operating press.	Actuating force	Weight
BV 311 201	M5	125 l/min	-0,9 - 10 bar	14 N	0,033 kg
BR 311 201	M5	125 l/min	-0,9 - 10 bar	9 N	0,041 kg
BL 311 201	M5	125 l/min	-0,9 - 10 bar	9 N	0,044 kg



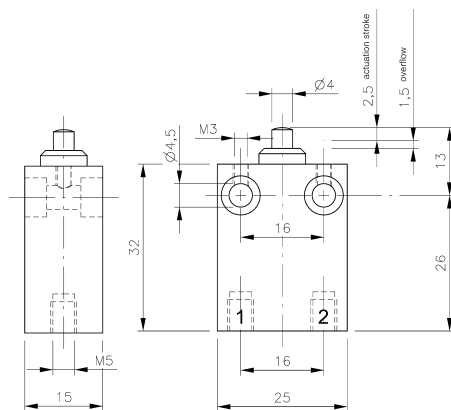
BV 311 202



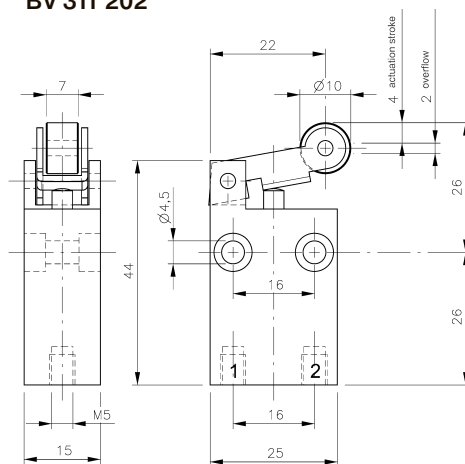
BR 311 202



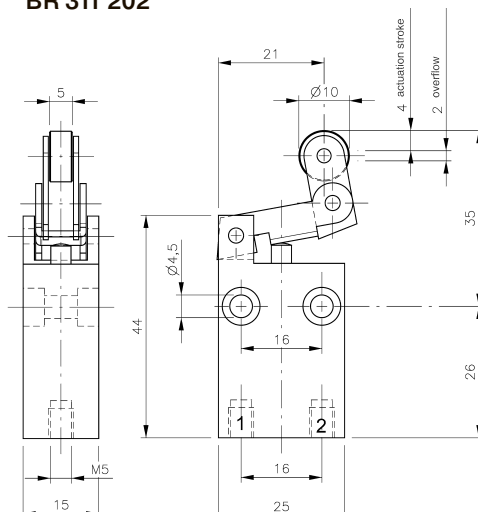
BL 311 202



BV 311 202



BR 311 202



BL 311 202



Mechanically actuated 3/2-way spool valve with mechanical spring.

All ports are at the bottom of the valve.

Function is normally closed. When operated the valve opens from 1 to 2.

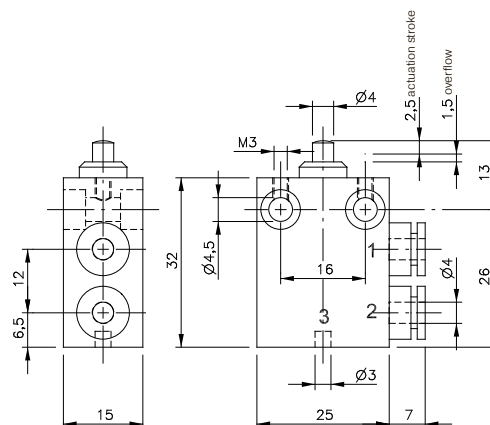
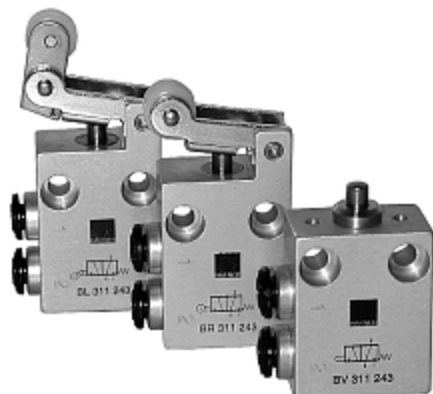
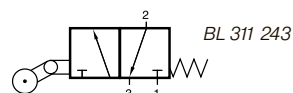
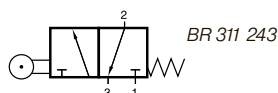
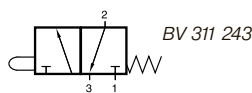
Exhaust through stem.

Normally open versions can be delivered on request.

Valves can be used for technical vacuum too.

Type	Port size	Air flow	Operating press.	Actuating force	Weight
BV 311 202	M5	115 l/min	-0,9 - 10 bar	14 N	0,033 kg
BR 311 202	M5	115 l/min	-0,9 - 10 bar	9 N	0,041 kg
BL 311 202	M5	115 l/min	-0,9 - 10 bar	9 N	0,044 kg

BV/BR/BL 311 243



BV 311 243

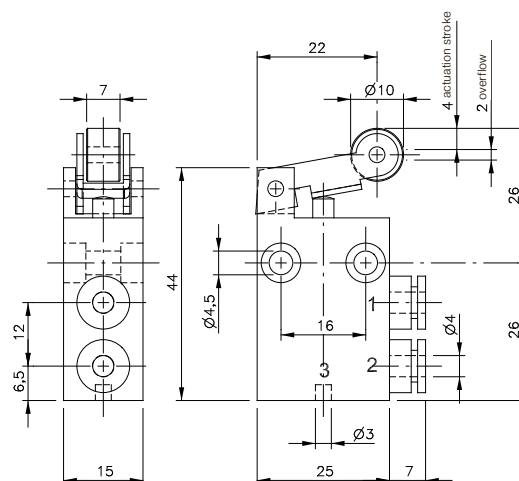
Mechanically actuated 3/2-way spool valve with mechanical spring. Ports 1 and 2 are on one side of the valve, equipped with 4 mm push-in fittings.

Function is normally closed. When operated the valve opens from 1 to 2.

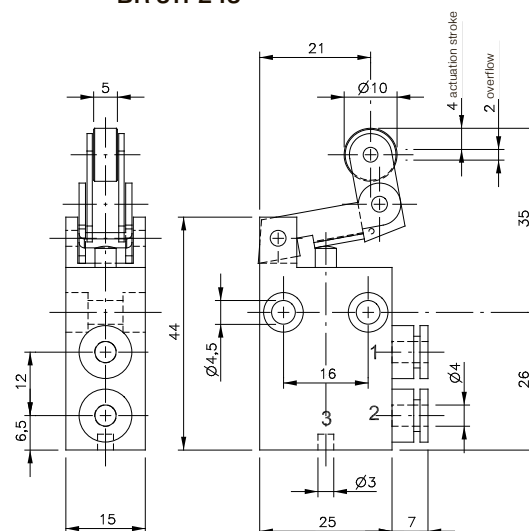
Exhaust through endcap.

Normally open versions can be delivered on request.

Valves can be used for technical vacuum too.

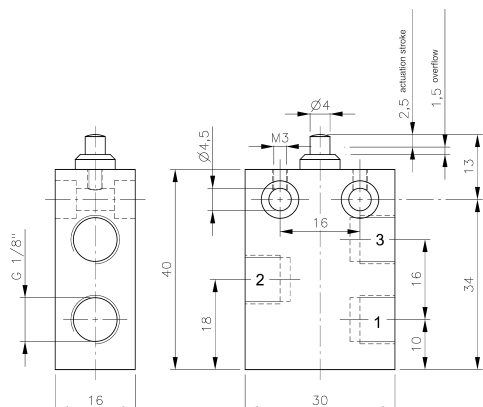
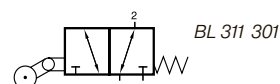
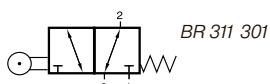
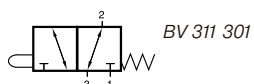


BR 311 243

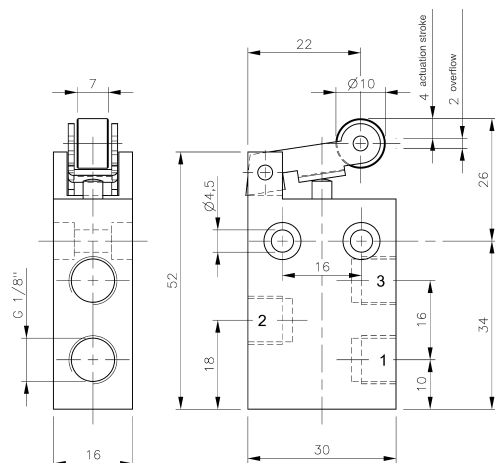


BL 311 243

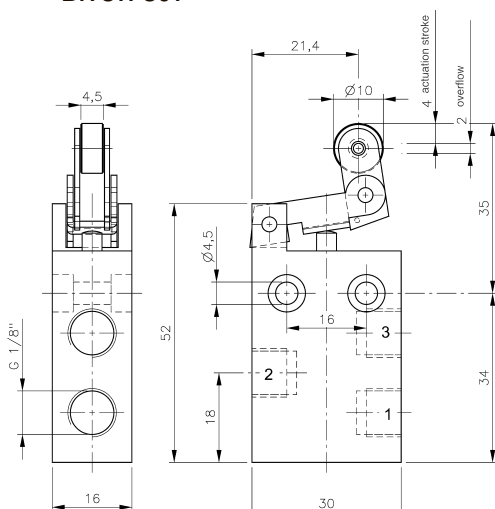
Type	Port size	Air flow	Operating press.	Actuating force	Weight
BV 311 243	pif 4 mm	115 l/min	-0,9 - 10 bar	14 N	0,033 kg
BR 311 243	pif 4 mm	115 l/min	-0,9 - 10 bar	9 N	0,041 kg
BL 311 243	pif 4 mm	115 l/min	-0,9 - 10 bar	9 N	0,044 kg



BV 311 301



BR 311 301



BL 311 301



Mechanically actuated 3/2-way spool valve with mechanical spring. All ports are on the side of the valve.

If pressure is applied to port 1 the function is normally closed.

If pressure is applied to port 3 the function is normally open.

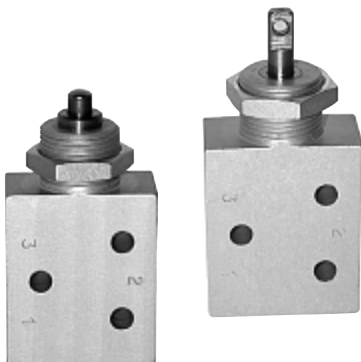
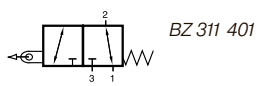
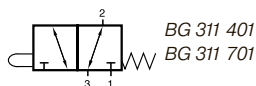
The use of the ports is interchangeable.

Exhaust can be throttled.

Valves can be used for technical vacuum too.

Type	Port size	Air flow	Operating press.	Actuating force	Weight
BV 311 301	G 1/8"	280 l/min	-0,9 - 10 bar	14 N	0,047 kg
BR 311 301	G 1/8"	280 l/min	-0,9 - 10 bar	10 N	0,059 kg
BL 311 301	G 1/8"	280 l/min	-0,9 - 10 bar	10 N	0,061 kg

BG 311 401/BG 311 701/BZ 311 401



BG 311 401 stem actuated 3/2-way spool valve with mechanical spring, G 1/8".

BG 311 701 heavy duty stem actuated 3/2-way spool valve with mechanical spring, G 1/4".

BZ 311 401 manually or mechanically actuated G 1/8" 3/2-way valve with mechanical spring. Actuated by pulling the stem.

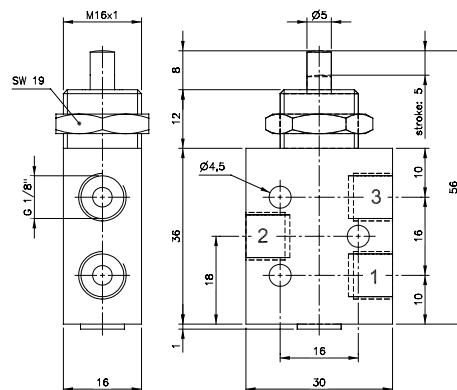
If pressure is applied to port 1 the function is normally closed.

If pressure is applied to port 3 the function is normally open.

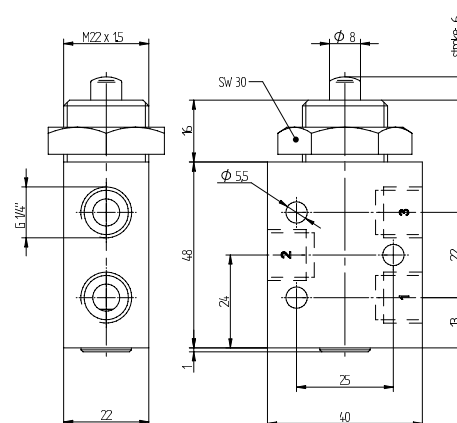
Suitable for wall or panel mounting. Nut for panel mounting M16 x 1 for G 1/8"-valves or M22 x 1,5 for G 1/4"-valves are included.

The use of the ports is interchangeable.

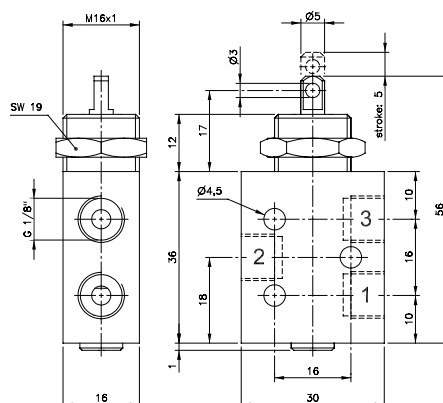
Exhaust can be throttled.



BG 311 401

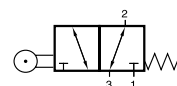


BG 311 701

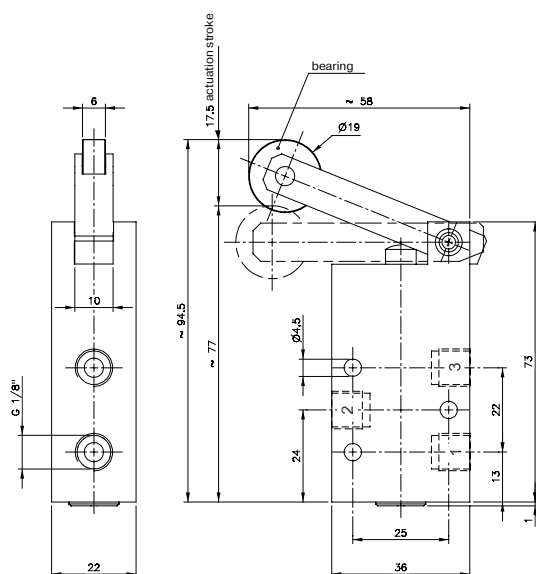


BZ 311 401

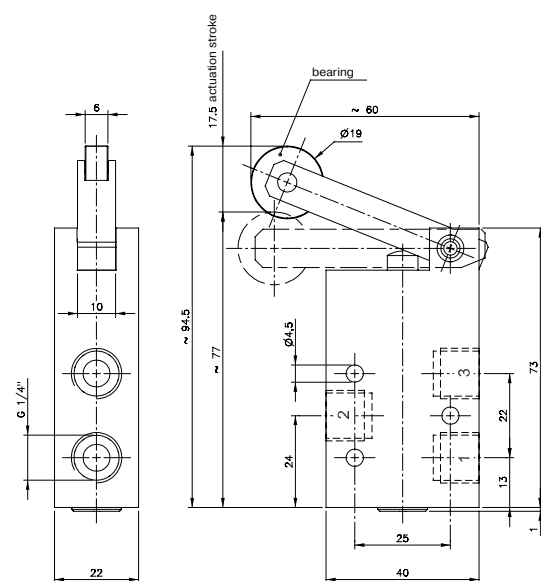
Type	Actuation	Port size	Air flow	Operating press.	Actuating force	Weight
BG 311 401	push	G 1/8"	450 l/min	2 - 10 bar	11 N	0,56 kg
BG 311 701	push	G 1/4"	1250 l/min	-0,9 - 10 bar	17 N	0,13 kg
BZ 311 401	pull	G 1/8"	450 l/min	2 - 10 bar	12 N	0,56 kg



BR 311 501
BR 311 701



BR 311 501



BR 311 701



Heavy-duty 3/2-way roller-lever spool valve with mechanical spring. High flow. Lever-construction has proven capabilities in rough environmental applications for decades.

If pressure is applied to port 1 the function is normally closed.

If pressure is applied to port 3 the function is normally open.

The use of the ports is interchangeable.

Exhaust can be throttled.

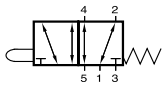
On request:
Roller-lever valves with idle return.

Low temperature version:
In this case the ports are not interchangeable,
standard: Pressure at port 1 = normally closed,
normally open version to be ordered separately.

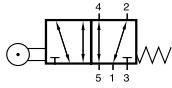
Valves can be used for technical vacuum too.

Type	Port size	Air flow	Operating press.	Actuating force	Weight	
BR 311 501	G 1/8"	650 l/min	-0,9 - 10 bar	3,5 N	0,19 kg	❄
BR 311 701	G 1/4"	1250 l/min	-0,9 - 10 bar	3,5 N	0,20 kg	❄

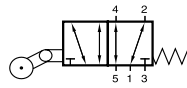
BV/BR/BL 511 201



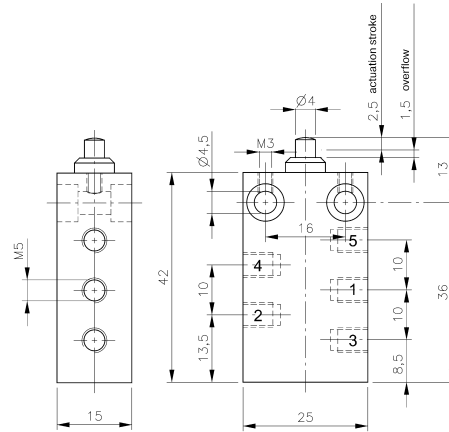
BV 511 201



BR 511 201



BL 511 201



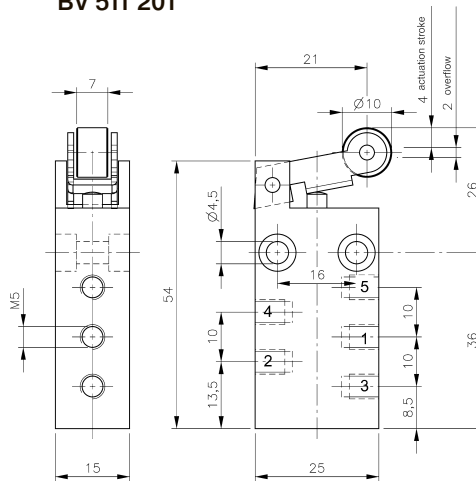
BV 511 201

Mechanically actuated 5/2-way spool valve with mechanical spring.

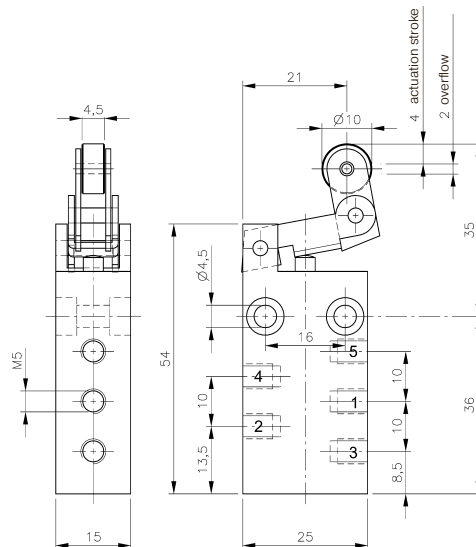
Normally open from 1 to 2 and from 4 to 5.
Operated open from 1 to 4 and 2 to 3.

Exhaust can be throttled.

Valves can be used for technical vacuum too.

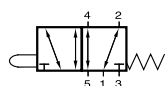


BR 511 201

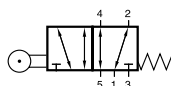


BL 511 201

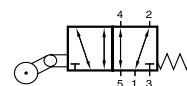
Type	Port size	Air flow	Operating press.	Actuating force	Weight
BV 511 201	M5	125 l/min	-0,9 - 10 bar	14 N	0,043 kg
BR 511 201	M5	125 l/min	-0,9 - 10 bar	9 N	0,051 kg
BL 511 201	M5	125 l/min	-0,9 - 10 bar	9 N	0,054 kg



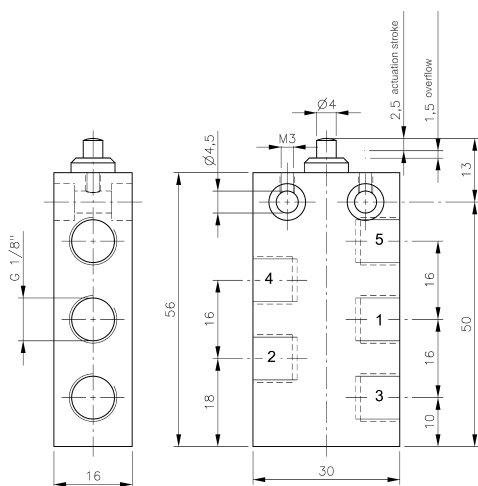
BV 511 301



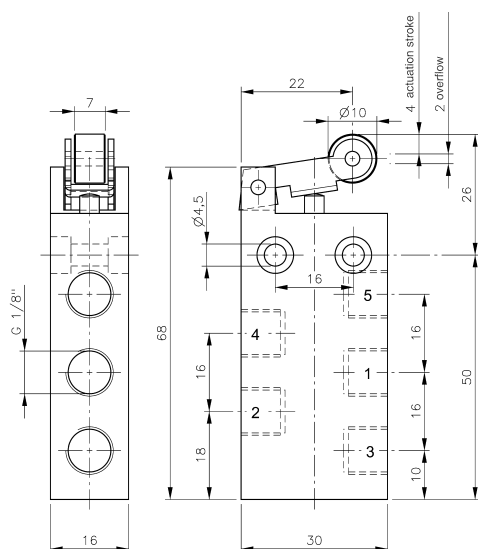
BR 511 301



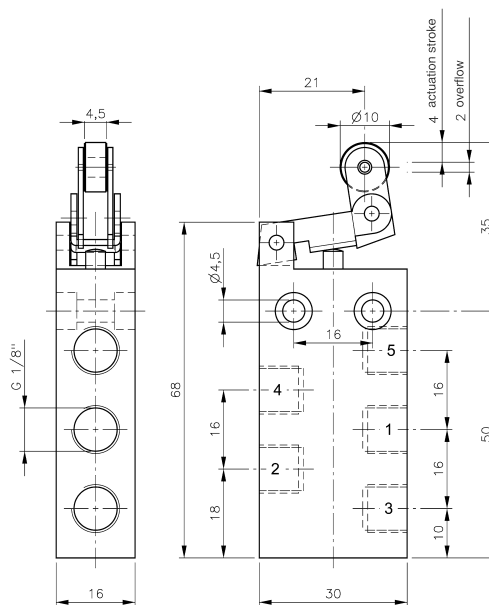
BL 511 301



BV 511 301



BR 511 301




BL 511 301

Mechanically actuated 5/2-way spool valve with mechanical spring.

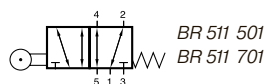
Normally open from 1 to 2 and from 4 to 5.
Operated open from 1 to 4 and 2 to 3.

Exhaust can be throttled.

Valves can be used for technical vacuum too.

Type	Port size	Air flow	Operating press.	Actuating force	Weight
BV 511 301	G 1/8"	280 l/min	-0,9 - 10 bar	14 N	0,065 kg 
BR 511 301	G 1/8"	280 l/min	-0,9 - 10 bar	10 N	0,077 kg
BL 511 301	G 1/8"	280 l/min	-0,9 - 10 bar	10 N	0,079 kg

BR 511 501/BR 511 701



Heavy-duty 5/2-way roller-lever spool valve with mechanical spring. High flow especially for the trucking and railway industry. Lever-construction has proven capabilities in railway applications for decades.

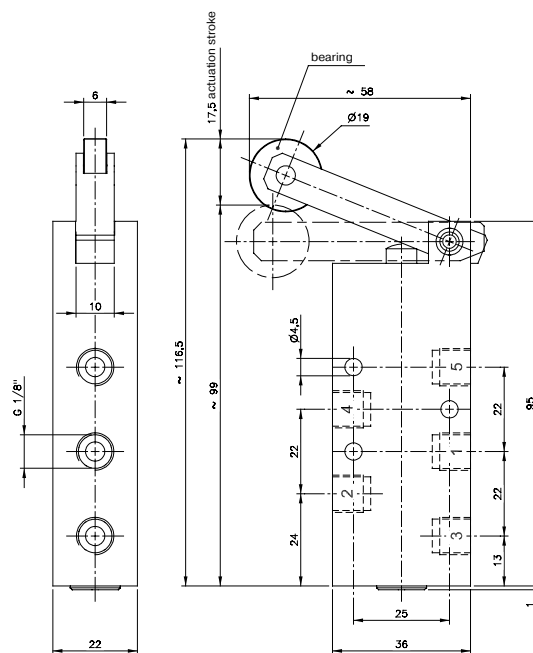
Normally open from 1 to 2 and 4 to 5.
Operated open from 1 to 4 and 2 to 3 .

Exhaust can be throttled.

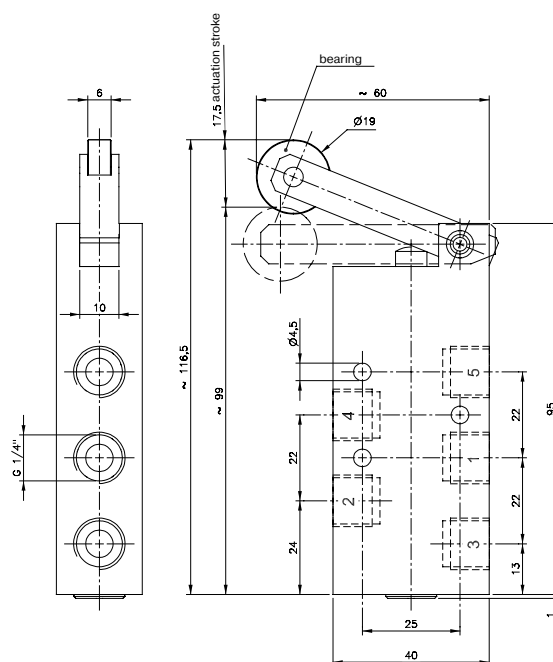
On request:
Roller-lever valves with idle return.

Low temperature version:
In this case the ports are not interchangeable,
standard: Pressure at port 1 = normally closed,
normally open version to be ordered separately.

Valves can be used for technical vacuum too.



BR 511 501



BR 511 701

Type	Port size	Air flow	Operating press.	Actuating force	Weight
BR 511 501	G 1/8"	650 l/min	-0,9 - 10 bar	3,5 N	0,23 kg
BR 511 701	G 1/4"	1250 l/min	-0,9 - 10 bar	3,5 N	0,25 kg





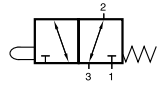
2.2 Valves for Panel Mounting

Selected models are available for explosion hazardous environment. They are ATEX-Ex certified. For detailed information refer to chapter 2.14.

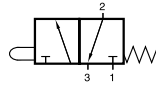


Selected models are available for low temperature application. Temperature-range: - 50° C to + 50° C. For detailed information refer to chapter 2.11.

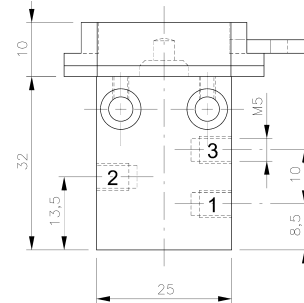
BA 311 201/BA 311 202/BA 311 203 BA 311 243/BA 311 301



BA 311 201
BA 311 301



BA 311 202
BA 311 203
BA 311 243



BA 311 201

3/2-way spool valve with mechanical spring for panel mounting.

Valves with ports 1 - 3 on the side (type 201 and 301) are similar to those described on page 2.1.1.1. and 2.1.1.4.

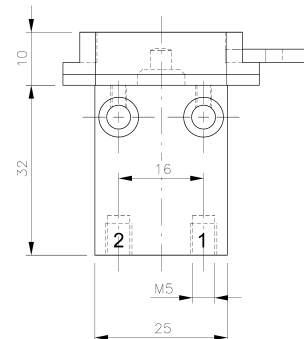
For the valve with the ports on the bottom (type 202) please refer to page 2.1.1.2.

Valves BA 311 203 and BA 311 243 have port 1 and 2 at one side and exhaust through the end-cap. BA 311 243 offers 4 mm push-in fittings at ports 1 and 2.

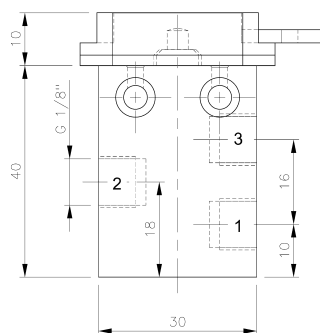
Normally open versions of BA 311 203 and BA 311 243 can be delivered on request.

The actuating elements are displayed on page 2.2.3.

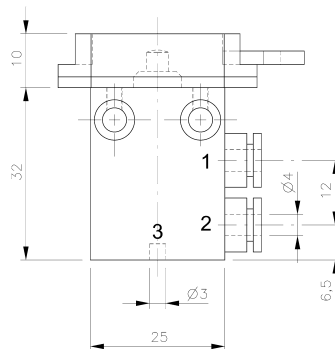
Selected valves can be used for technical vacuum too.



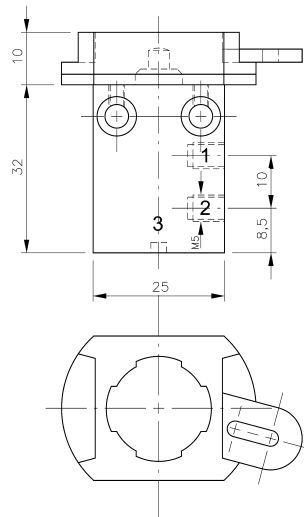
BA 311 202



BA 311 301

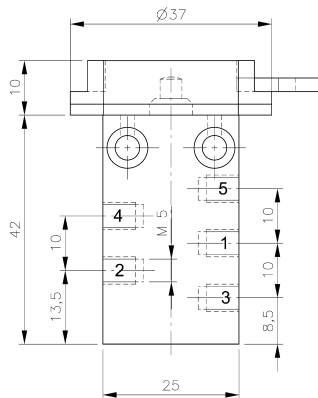
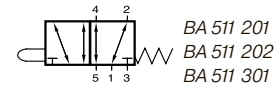


BA 311 243

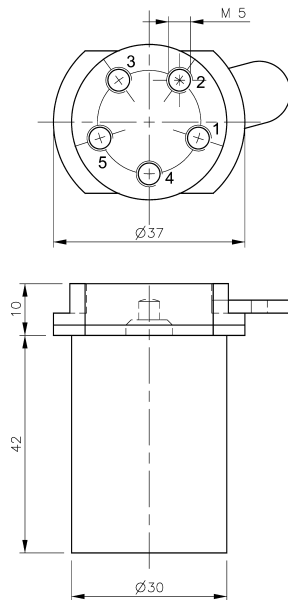


BA 311 203

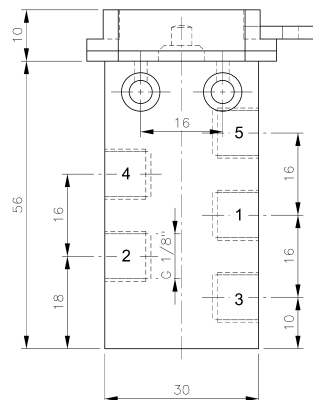
Type	Port size	Air flow	Operating press.	Actuating force	Weight
BA 311 201	M5	125 l/min	-0,9 - 10 bar	14 N	0,043 kg
BA 311 202	M5	125 l/min	0 - 10 bar	14 N	0,043 kg
BA 311 203	M5	125 l/min	0 - 10 bar	14 N	0,043 kg
BA 311 243	pif 4 mm	125 l/min	0 - 10 bar	14 N	0,043 kg
BA 311 301	G 1/8"	280 l/min	-0,9 - 10 bar	14 N	0,057 kg



BA 511 201



BA 511 202



BA 511 301

5/2-way spool valve with mechanical spring for panel mounting.

Actuating elements are displayed on page 2.2.3.

Exhaust can be throttled.

Selected valves can be used for technical vacuum too.

Type	Port size	Air flow	Operating press.	Actuating force	Weight
BA 511 201	M5	125 l/min	-0,9 - 10 bar	14 N	0,053 kg
BA 511 202	M5	125 l/min	0 - 10 bar	14 N	0,095 kg
BA 511 301	G 1/8"	280 l/min	-0,9 - 10 bar	14 N	0,075 kg

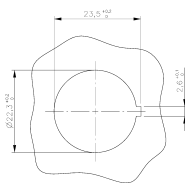


Ø 22 mm Actuators for Panel Mounting

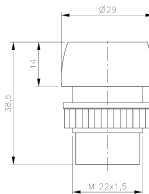


Actuating elements for valves displayed on page 2.2.1 and 2.2.2.

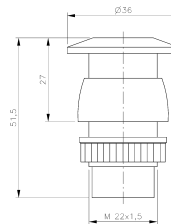
Declaration of manufacturer that actuation elements have no intrinsic ignition source can be supplied on request.



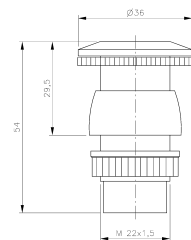
Panel mounting hole



BA 221



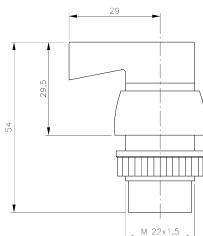
BA 222



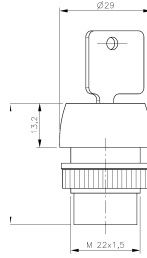
BA 223



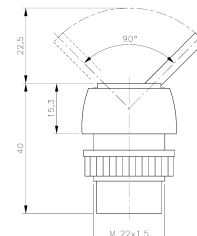
BA 221 SSK



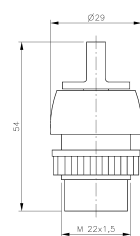
BA 224



BA 225



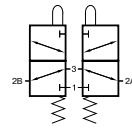
BA 226



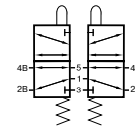
BA 227 01

Type	Actuation	Colour	Actuating force	Weight
BA 221 01	Push button	black	16 N	0,014 kg
BA 221 02	Push button	red	16 N	0,014 kg
BA 221 03	Push button	green	16 N	0,014 kg
BA 221 04	Push button	yellow	16 N	0,014 kg
BA 221 05	Push button	blue	16 N	0,014 kg
BA 221 06	Push button	white	16 N	0,014 kg
BA 222 01	Palm button	black	16 N	0,020 kg
BA 223 02*	Palm button w. detend	red	27 N	0,026 kg
BA 224 01	Rotary lever long	black	42 N/cm	0,021 kg
BA 225 00	Locking switch		25 N	0,080 kg
BA 226 01	Switch	black	16 N/cm	0,019 kg
BA 227 01	Rotary lever short	black	16 N/cm	0,018 kg
BA 221 SSK	Transparent dust protection cap for BA 221 __			0,009 kg

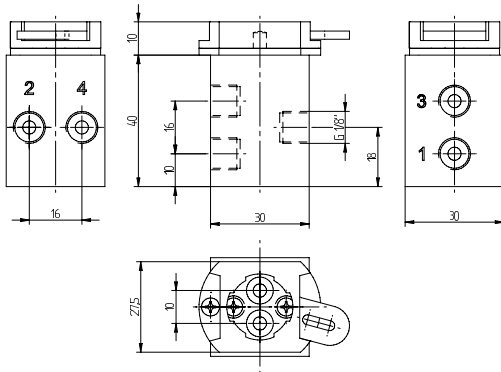
* available on request: for 30 mm panel mounting hole.



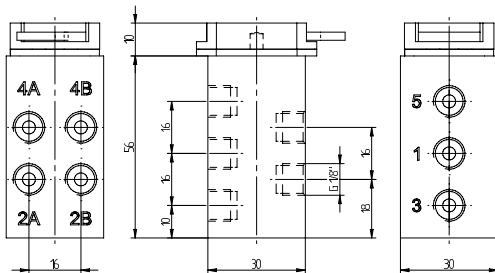
BA 430 301



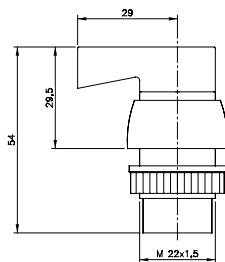
BA 730 301



BA 430 301



BA 730 301



BA 334 01



BA 430 301

4/3-way spool valve for panel mounting. Middle position exhausted. Typical application: for controlling two single-acting actuators.

BA 730 301

7/3-way spool valve for panel mounting. Typical application: for controlling two double-acting actuators.

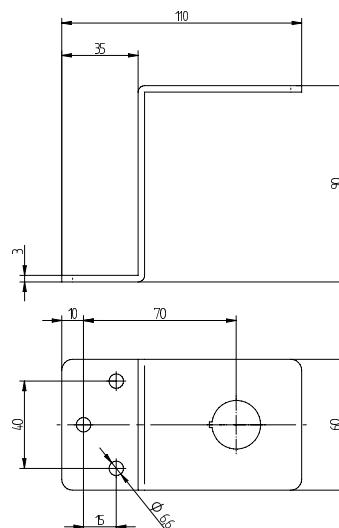
BA 334 01

3-position rotary lever long with detent.

Please note: Although the valves have a mechanic spring inside, the actuator is with detent.

BW BA 22

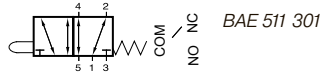
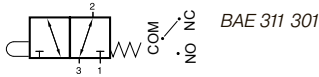
Mounting bracket to install a panel mounting valve without a control panel.



BW BA 22

Type	Function	Port size	Air flow	Operating press.	Actuating force	Weight
BA 430 301	double 3/2-way	G 1/8"	280 l/min	0 - 10 bar	14 N	0,110 kg
BA 730 301	double 5/2-way	G 1/8"	280 l/min	0 - 10 bar	14 N	0,150 kg
BA 334 01	Rotary lever long	-	-	-	42 N/cm	0,021 kg
BW BA 22	Mounting bracket	-	-	-	-	0,265 kg

BAE 311 301/BAE 511 301



The BAE 311 301 is a 3/2-way spool valve with mechanical spring for panel mounting that can either be used normally closed (pressure at port 1) or normally open (pressure at port 3).

The BAE 511 301 is a 5/2-way spool valve with mechanical spring for panel mounting.

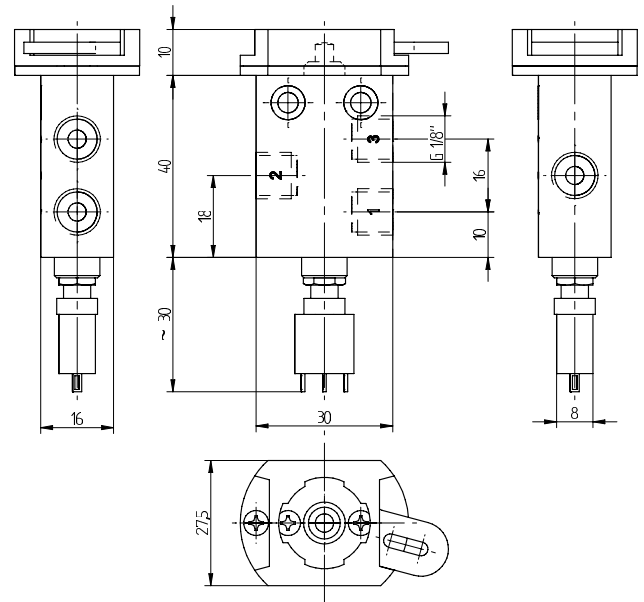
The valves include an electric switch that is actuated at the same time.

The electrical switch can be used up to 6 A / 125 VAC. Switch can be connected in two ways either normally open or normally closed.

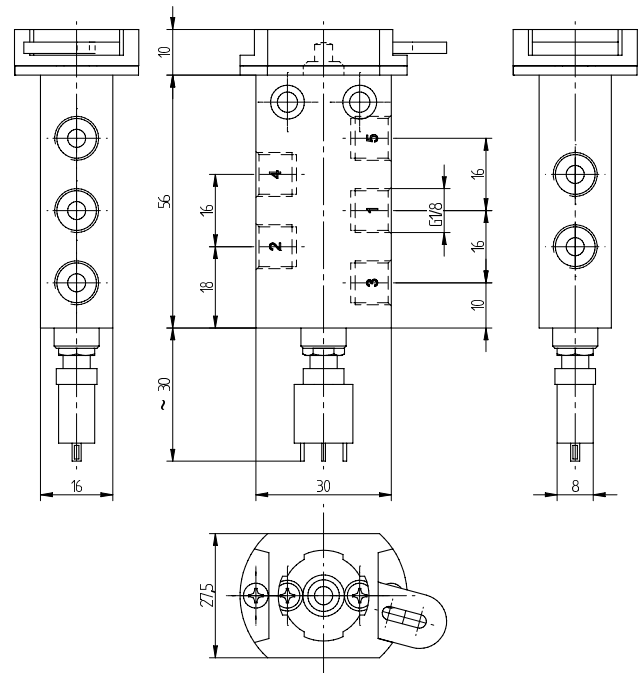
The electrical switch can also be combined with BA 311 201 and BA 511 201 on demand.

All the actuation-elements displayed on page 2.2.3 can be combined with the valve.

Please order including actuation element.



BAE 311 301

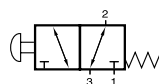


BAE 511 301

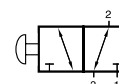
Type	Port size	Air flow	Operating press.	Actuating force	Weight
BAE 311 301	G 1/8"	280 l/min	0 - 10 bar	17 N	0,08 kg
BAE 511 301	G 1/8"	280 l/min	0 - 10 bar	17 N	0,097 kg

BH 311 401/BH 320 401 BH 311 701/BH 320 701

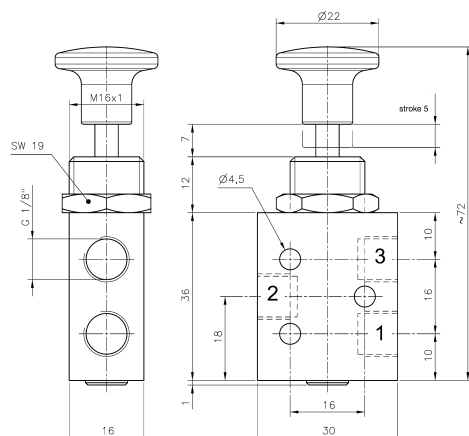
2.2.6
page 37



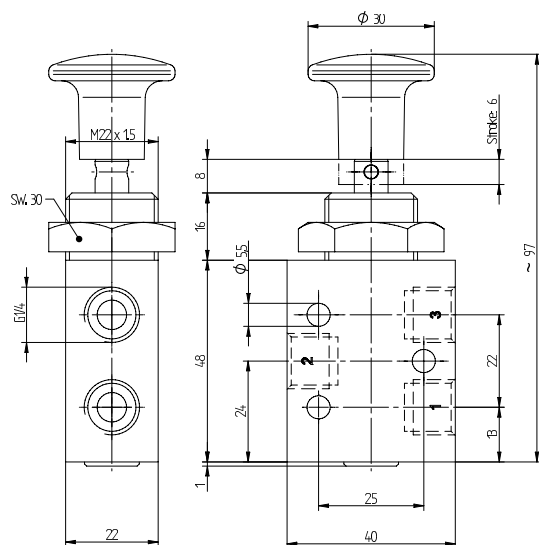
BH 311 401
BH 311 701



BH 320 401
BH 320 701



BH 311 401/BH 320 401



BH 311 701/BH 320 701



Manually actuated 3/2-way spool valve either with spring return to outer position (type 311) or with two stable positions (type 320).

If pressure is applied to port 1 the function is normally closed.

If pressure is applied to port 3 the function is normally open.

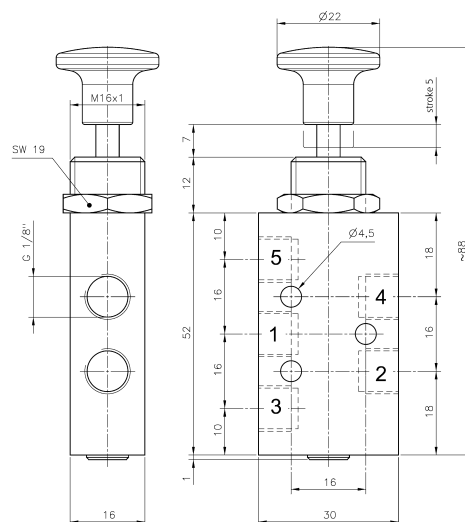
Exhaust can be throttled.

Suitable for wall or panel mounting. Nut for panel mounting, M16 x 1 for G 1/8"-valves or M22 x 1,5 for G 1/4"-valves is included.

Selected valves can be used for technical vacuum too.

Type	Port size	Air flow	Operating press.	Actuating force	Weight
BH 311 401	G 1/8"	450 l/min	1 - 10 bar	11 N	0,064 kg
BH 320 401	G 1/8"	450 l/min	1 - 10 bar	12 N	0,064 kg
BH 311 701	G 1/4"	1250 l/min	-0,9 - 10 bar	17 N	0,140 kg ❄️
BH 320 701	G 1/4"	1250 l/min	-0,9 - 10 bar	18 N	0,140 kg ❄️

BH 511 401/BH 520 401
BH 511 701/BH 520 701



BH 511 401/BH 520 401

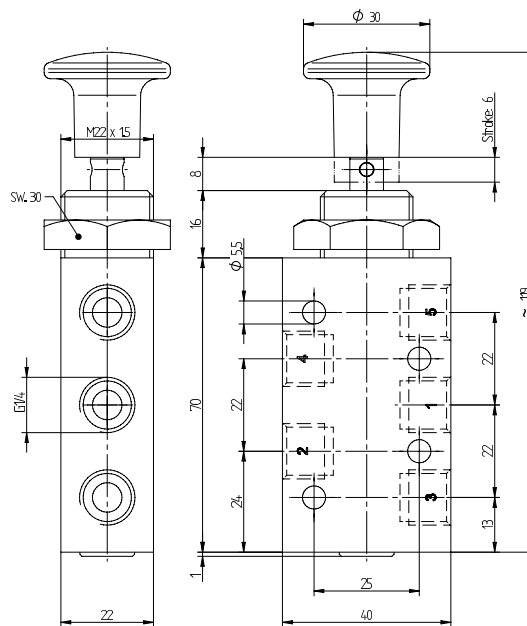
Manually actuated 5/2-way spool valve either with spring return to outer position (type 511) or with two stable positions (type 520).

Normally open from port 1 to 2 and from port 4 to 5.
Operated open from port 1 to 4 and port 2 to 3.

Exhaust can be throttled.

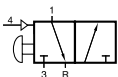
Suitable for wall or panel mounting. Nut for panel mounting, M16 x 1 for G 1/8"-valves or M22 x 1,5 for G 1/4"-valves is included.

Selected valves can be used for technical vacuum too.

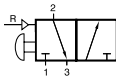


BH 511 701/BH 520 701

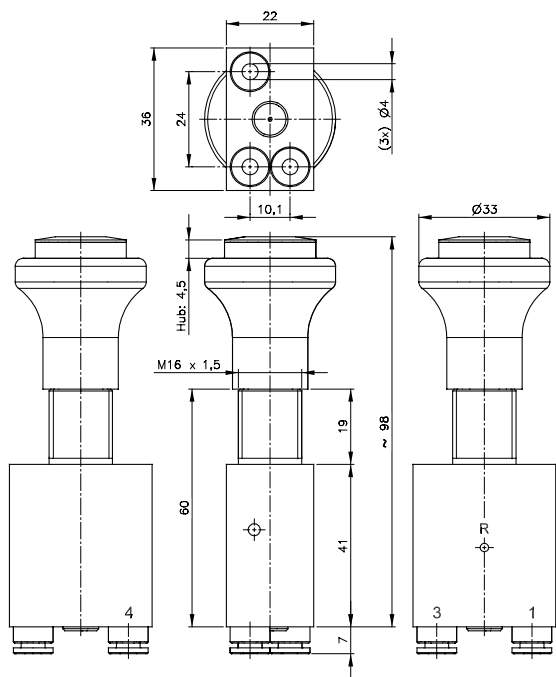
Type	Port size	Air flow	Operating press.	Actuating force	Weight
BH 511 401	G 1/8"	450 l/min	1 - 10 bar	11 N	0,080 kg
BH 520 401	G 1/8"	450 l/min	1 - 10 bar	12 N	0,080 kg
BH 511 701	G 1/4"	1250 l/min	-0,9 - 10 bar	17 N	0,180 kg ❄
BH 520 701	G 1/4"	1250 l/min	-0,9 - 10 bar	18 N	0,180 kg ❄



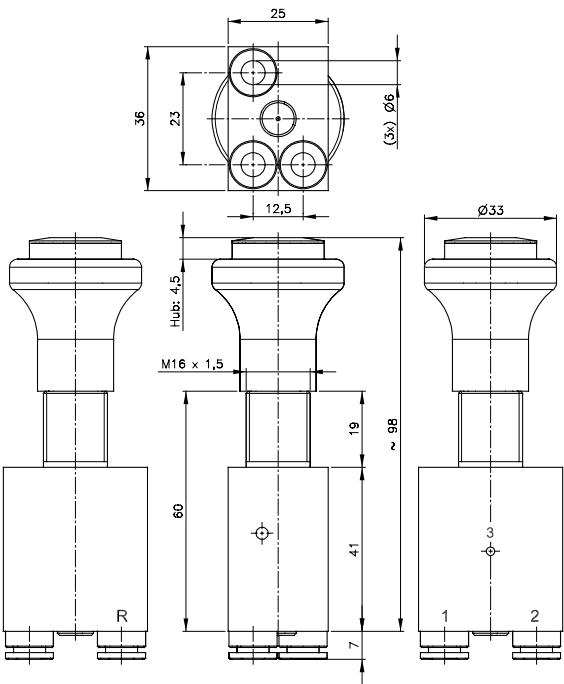
BHP 320 442



BHP 320 462



BHP 320 442



BHP 320 462



Manually actuated 3/2-way spool valve with 2 stable positions and pneumatic reset.

Ports on the bottom of the valve are equipped with integrated push-in fittings. Exhaust is undeducted. Valve is equipped with FKM seals.

If pressure is applied to port 4 (pneumatic reset-port) the stem is pulled in. The knob carries an indicator ring that sticks out when the valve is pulled = actuated.

The following knob-colours are available:

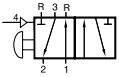
Colour code	Colour of knob	Colour of indicator
1	black	white
2	red	white
3	green	red
4	yellow	white
5	blue	white

If requested we add fixing nut DIN 439 BM 16 x 1 material: steel zinc plated.

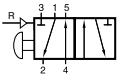
Type	Function	Ports	Air flow	Operating press.	Reset press.	Weight
BHP 320 442 _	3/2-way	pif 4 mm	300 l/min	1 - 16 bar	5 bar	0,13 kg
BHP 320 462 _	3/2-way	pif 6 mm	300 l/min	1 - 16 bar	5 bar	0,13 kg

Please add one digit for color of knob.

BHP 520 442/BHP 520 462



BHP 520 442



BHP 520 462



Manually actuated 5/2-way spool valve with 2 stable positions and pneumatic reset.

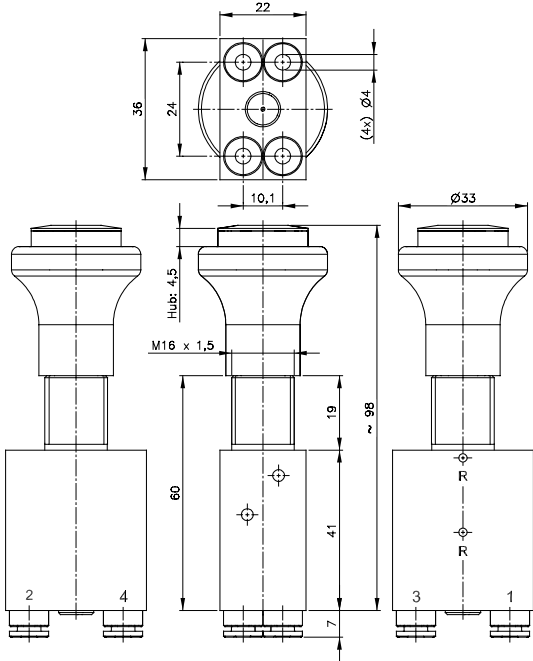
Ports on the bottom of the valve are equipped with integrated push-in fittings. Exhaust is undeducted. Valve is equipped with FKM seals.

If pressure is applied to port 4 (pneumatic reset-port) the stem is pulled in. The knob carries an indicator ring that sticks out when the valve is pulled = actuated.

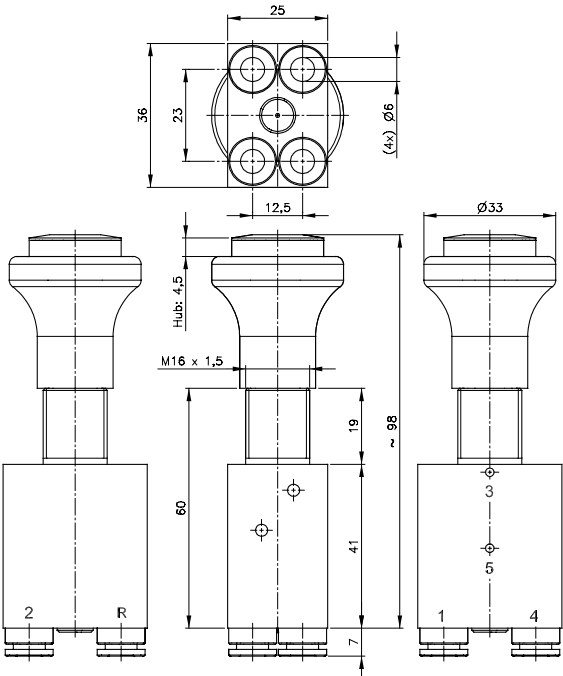
The following knob-colours are available:

Colour code	Colour of knob	Colour of indicator
1	black	white
2	red	white
3	green	red
4	yellow	white
5	blue	white

If requested we add fixing nut DIN 439 BM 16 x 1 material: steel zinc plated.

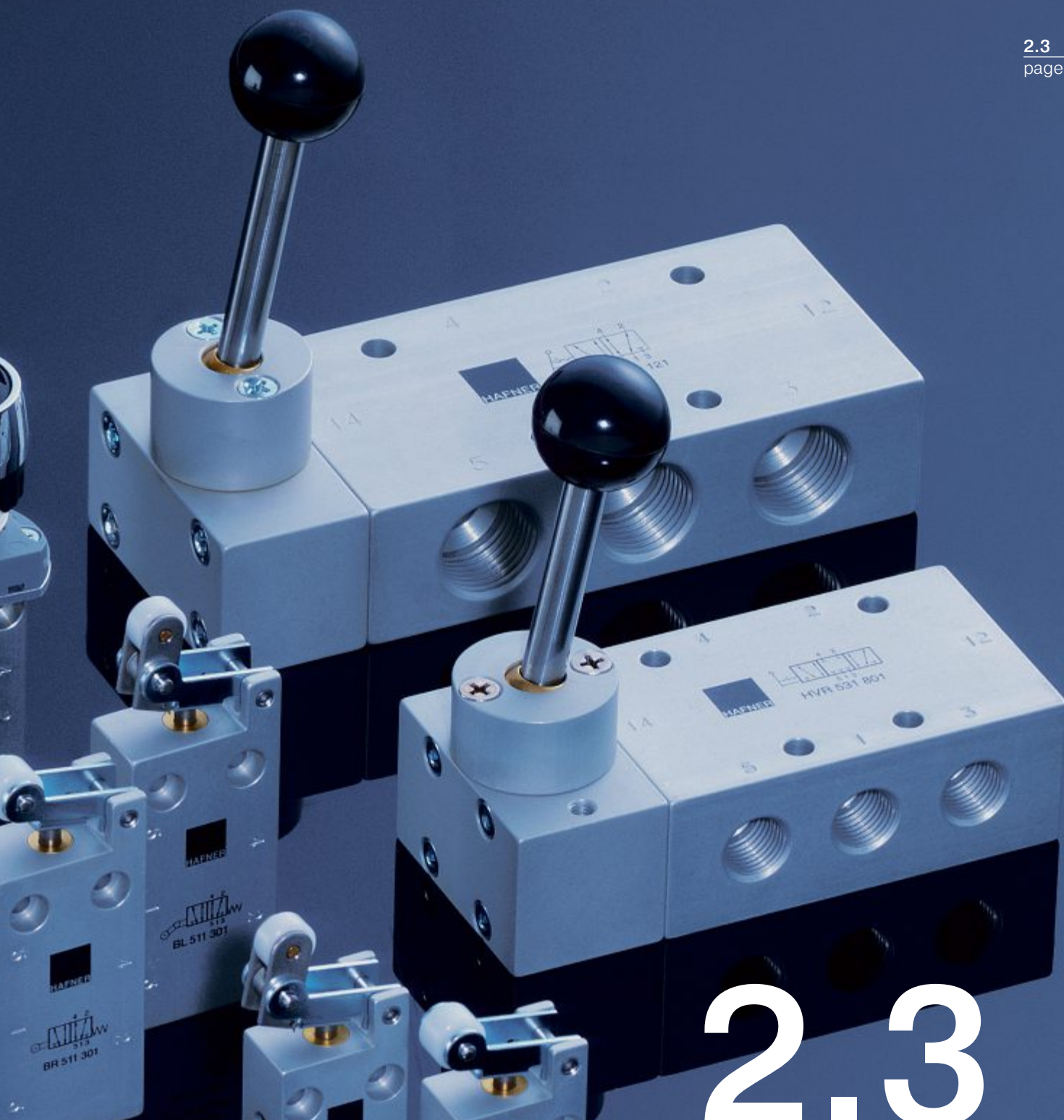


BHP 520 442



BHP 520 462

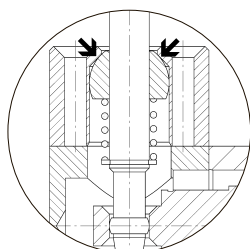
Type	Function	Ports	Air flow	Operating press.	Reset press.	Weight
BHP 520 442 _	5/2-way	pif 4 mm	300 l/min	1 - 16 bar	5 bar	0,13 kg
BHP 520 462 _	5/2-way	pif 6 mm	300 l/min	1 - 16 bar	5 bar	0,13 kg



2.3

Lever Actuated Valves

Selected valves can be used for technical vacuum too.



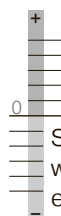
Instead of a rubber-gaitor that never lasts long, Hafner seals all the lever valves with a metallic seal.



Selected models are available for low temperature application.
Temperature-range: - 50° C to + 50° C.
For detailed information refer to chapter 2.11.

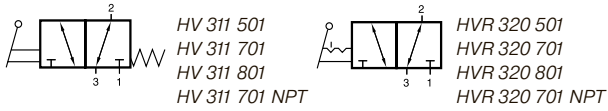


316 Selected models are available in stainless steel.
For detailed information refer to chapter 2.12.



Selected models can be equipped with FKM seals for high temperature environment up to 120 °C.

HV 311 501/HV 311 701/HV 311 801
HVR 320 501/HVR 320 701/HVR 320 801



Lever actuated 3/2-way spool valve.

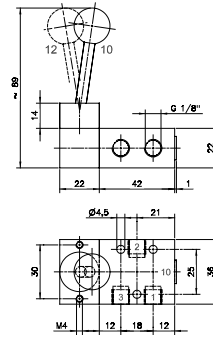
Type HV	spring return
Type HVR	indexed

If pressure is applied to port 1 the function is normally closed.

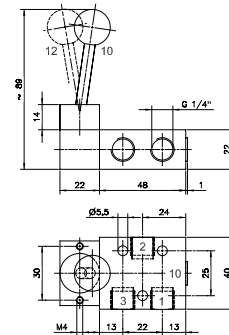
If pressure is applied to port 3 the function is normally open.

The lever is sealed by using a metal ball.

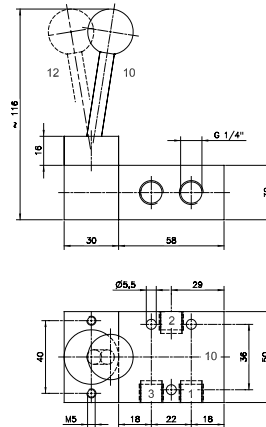
Exhaust can be throttled.









HV 311 501/HVR 320 501



HV 311 701/HVR 320 701
HV 311 701 NPT/HVR 320 701 NPT

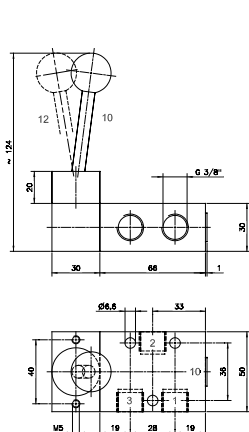


HV 311 801/HVR 320 801

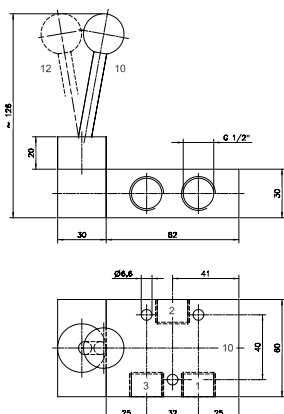
Type	Function	Port size	Air flow	Operating press.	Actuating force	Weight	
HV 311 501	spring ret.	G 1/8"	650 l/min	1 - 10 bar	20 N	0,19 kg	
HV 311 701	spring ret.	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,20 kg	 
HV 311 801	spring ret.	G 1/4"	1450 l/min	1 - 10 bar	25 N	0,46 kg	
HVR 320 501	indexed	G 1/8"	650 l/min	1 - 10 bar	20 N	0,19 kg	
HVR 320 701	indexed	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,20 kg	 
HVR 320 801	indexed	G 1/4"	1450 l/min	1 - 10 bar	25 N	0,46 kg	
HV 311 701 NPT	spring ret.	1/4" NPT	1250 l/min	1 - 10 bar	20 N	0,20 kg	
HVR 320 701 NPT	indexed	1/4" NPT	1250 l/min	1 - 10 bar	20 N	0,20 kg	

HV 311 101/HV 311 121/HV 311 181 HVR 320 101/HVR 320 121/HVR 320 181

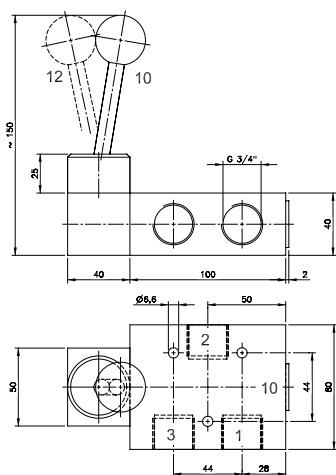
2.3.1.2
page 43



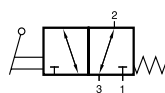
HV 311 101/HVR 320 101



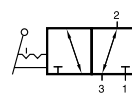
**HV 311 121/HVR 320 121
HV 311 121 NPT/HVR 320 121 NPT**



HV 311 181/HVR 320 181



HV 311 101
HV 311 121
HV 311 181
HV 311 121 NPT



HVR 320 101
HVR 320 121
HVR 320 181
HVR 320 121 NPT



Lever actuated 3/2-way spool valve.

Type HV spring return
Type HVR indexed

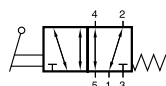
If pressure is applied to port 1 the function is normally closed.
If pressure is applied to port 3 the function is normally open.

The lever is sealed by using a metal ball.

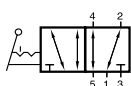
Exhaust can be throttled.

Type	Function	Port size	Air flow	Operating press.	Actuating force	Weight
HV 311 101	spring ret.	G 3/8"	2250 l/min	1 - 10 bar	25 N	0,49 kg
HV 311 121	spring ret.	G 1/2"	3000 l/min	1 - 10 bar	32 N	0,69 kg
HV 311 181	spring ret.	G 3/4"	6000 l/min	1 - 10 bar	40 N	1,31 kg
HVR 320 101	indexed	G 3/8"	2250 l/min	1 - 10 bar	25 N	0,49 kg
HVR 320 121	indexed	G 1/2"	3000 l/min	1 - 10 bar	32 N	0,69 kg
HVR 320 181	indexed	G 3/4"	6000 l/min	1 - 10 bar	40 N	1,31 kg
HV 311 121 NPT	spring ret.	1/2" NPT	3000 l/min	1 - 10 bar	32 N	0,69 kg
HVR 320 121 NPT	indexed	1/2" NPT	3000 l/min	1 - 10 bar	32 N	0,69 kg

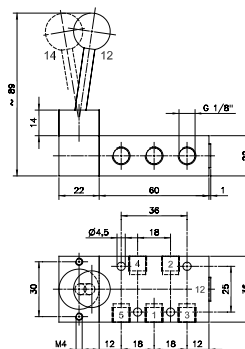
HV 511 501/HV 511 701/HV 511 801 HVR 520 501/HVR 520 701/HVR 520 801



HV 511 501
HV 511 701
HV 511 801
HV 511 701 NPT



HVR 520 501
HVR 520 701
HVR 520 801
HVR 520 701 NPT



HV 511 501/HVR 520 501

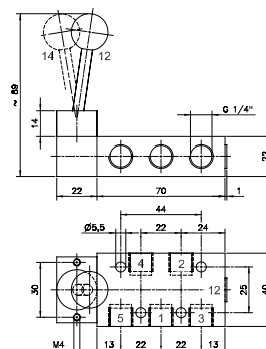
Lever actuated 5/2-way spool valve.

Type HV spring return

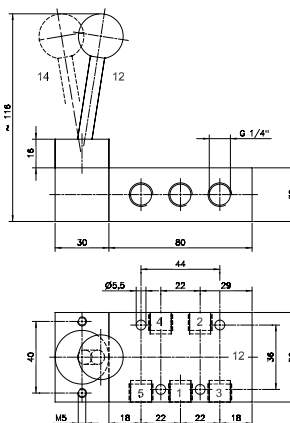
Type HVR indexed

The lever is sealed by using a metal ball.

Exhaust can be throttled.



HV 511 701/HVR 520 701
HV 511 701 NPT/HVR 520 701 NPT

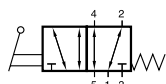


HV 511 801/HVR 520 801

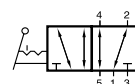
Type	Function	Port size	Air flow	Operating press.	Actuating force	Weight	
HV 511 501	spring ret.	G 1/8"	650 l/min	1 - 10 bar	20 N	0,22 kg	❄️
HV 511 701	spring ret.	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg	❄️
HV 511 801	spring ret.	G 1/4"	1450 l/min	1 - 10 bar	25 N	0,55 kg	
HVR 520 501	indexed	G 1/8"	650 l/min	1 - 10 bar	20 N	0,22 kg	❄️
HVR 520 701	indexed	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg	❄️
HVR 520 801	indexed	G 1/4"	1450 l/min	1 - 10 bar	25 N	0,55 kg	
HV 511 701 NPT	spring ret.	1/4" NPT	1250 l/min	1 - 10 bar	20 N	0,24 kg	
HVR 520 701 NPT	indexed	1/4" NPT	1250 l/min	1 - 10 bar	20 N	0,24 kg	

HV 511 101/HV 511 121/HV 511 181 HVR 520 101/HVR 520 121/HVR 520 181

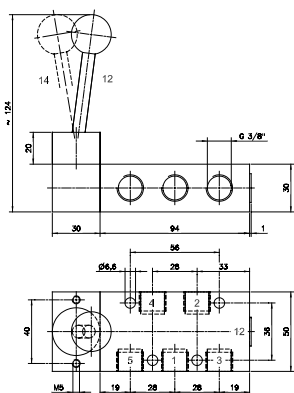
2.3.2.2
page 45



HV 511 101
HV 511 121
HV 511 181
HV 511 121 NPT



HVR 520 101
HVR 520 121
HVR 520 181
HVR 520 121 NPT



HV 511 101/HVR 520 101

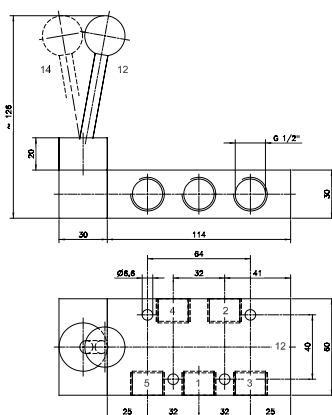


Lever actuated 5/2-way spool valve.

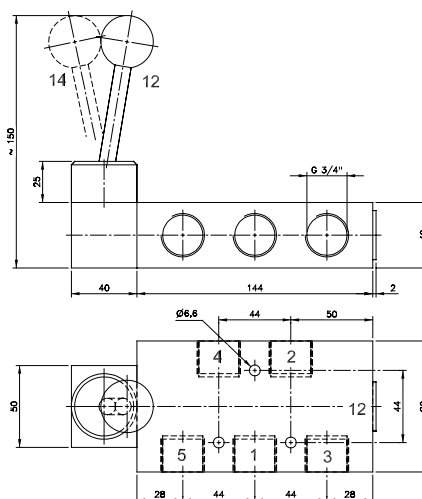
Type HV spring return
Type HVR indexed

The lever is sealed by using a metal ball.

Exhaust can be throttled.



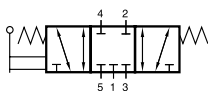
**HV 511 121/HVR 520 121
HV 511 121 NPT/HVR 520 121 NPT**



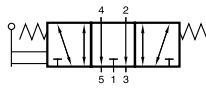
HV 511 181/HVR 520 181

Type	Function	Port size	Air flow	Operating press.	Actuating force	Weight
HV 511 101	spring ret.	G 3/8"	2250 l/min	1 - 10 bar	25 N	0,60 kg
HV 511 121	spring ret.	G 1/2"	3000 l/min	1 - 10 bar	32 N	0,79 kg
HV 511 181	spring ret.	G 3/4"	6000 l/min	1 - 10 bar	40 N	1,64 kg
HVR 520 101	indexed	G 3/8"	2250 l/min	1 - 10 bar	25 N	0,60 kg
HVR 520 121	indexed	G 1/2"	3000 l/min	1 - 10 bar	32 N	0,79 kg
HVR 520 181	indexed	G 3/4"	6000 l/min	1 - 10 bar	40 N	1,64 kg
HV 511 121 NPT	spring ret.	1/2" NPT	3000 l/min	1 - 10 bar	32 N	0,79 kg
HVR 520 121 NPT	indexed	1/2" NPT	3000 l/min	1 - 10 bar	32 N	0,79 kg

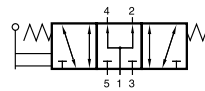
HV 53_ 501/HV 53_ 701/HV 53_ 801 HVR 53_ 501/HVR 53_ 701/ HVR 53_ 801



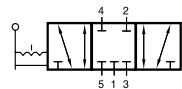
HV 531 501
HV 531 701
HV 531 801
HV 531 701 NPT



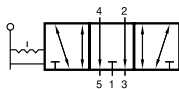
HV 532 501
HV 532 701
HV 532 801
HV 532 701 NPT



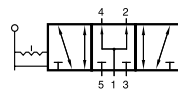
HV 533 501
HV 533 701
HV 533 801
HV 533 701 NPT



HVR 531 501
HVR 531 701
HVR 531 801
HVR 531 701 NPT



HVR 532 501
HVR 532 701
HVR 532 801
HVR 532 701 NPT



HVR 533 501
HVR 533 701
HVR 533 801
HVR 533 701 NPT



Lever actuated 5/3-way spool valve.

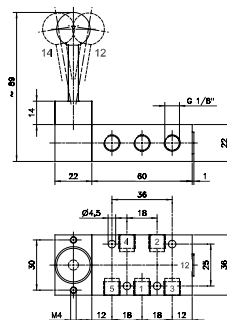
Type HV spring return to middle position
Type HVR indexed

Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurised

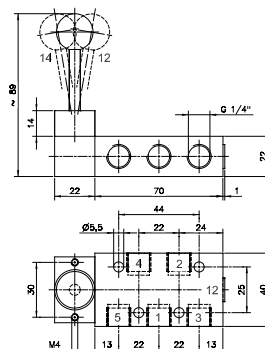
When ordering please complete the type number by 1, 2 or 3 according to the type required.

The lever is sealed by using a metal ball.

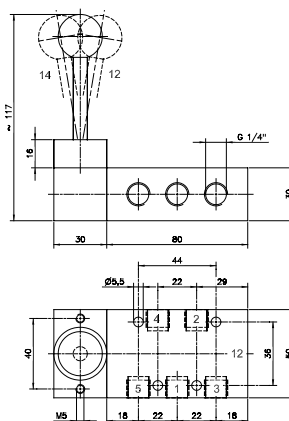
Exhaust can be throttled.



HV 53_ 501/HVR 53_ 501



HV 53_ 701/HVR 53_ 701
HV 53_ 701 NPT/HVR 53_ 701 NPT



HV 53_ 801/HVR 53_ 801

Type	Function	Port size	Air flow	Operating press.	Actuating force	Weight
HV 53_ 501	spring ret.	G 1/8"	650 l/min	1 - 10 bar	20 N	0,22 kg
HV 53_ 701	spring ret.	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg
HV 53_ 801	spring ret.	G 1/4"	1450 l/min	1 - 10 bar	25 N	0,55 kg
HVR 53_ 501	indexed	G 1/8"	650 l/min	1 - 10 bar	20 N	0,22 kg
HVR 53_ 701	indexed	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg
HVR 53_ 801	indexed	G 1/4"	1450 l/min	1 - 10 bar	25 N	0,55 kg
HV 53_701 NPT	spring ret.	1/4" NPT	1250 l/min	1 - 10 bar	20 N	0,24 kg
HVR 53_ 701 NPT	indexed	1/4" NPT	1250 l/min	1 - 10 bar	20 N	0,24 kg

2.3.3.2
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Special Products for the Paper and Railway Industry



Solenoid valve cabinet 8 stations.



Air distributor cabinet.



Block form flow regulators with 3/4" ports, offering 6.000 l/min air-flow.



HVR 520 701 L
Lever actuated 5/2-way spool valve, indexed. The user can put a padlock through the 5 mm hole of the extended spool and hereby lock the valve. Temperature range: 0°C to 120°C. Seals made from FKM.



KNORR-pneumatic series – Valves for the railway industry and commercial vehicles as well as for heavy duty applications.





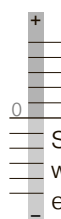
2.4

Pilot Actuated Valves

Selected valves can be used for technical vacuum too.



Selected models are available for low temperature application.
Temperature-range: - 50° C to + 50° C.
For detailed information refer to chapter 2.11.

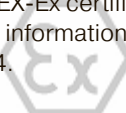


Selected models can be equipped with FKM seals for high temperature environment up to 120 °C.

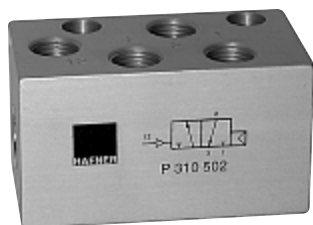
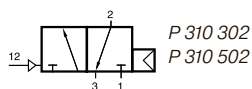


316 Selected models are available in stainless steel.
For detailed information refer to chapter 2.12.

Selected models are available for explosion hazardous environment. They are ATEX-Ex certified.
For detailed information refer to chapter 2.14.



P 310 302/P 310 502



Pneumatically actuated 3/2-way spool valve with air spring return.

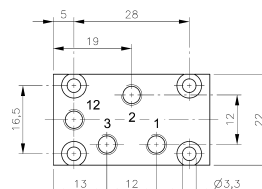
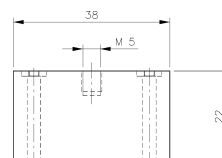
If pressure is attached to port 1 the function is normally closed.

If pressure is applied to port 3 the function is normally open.

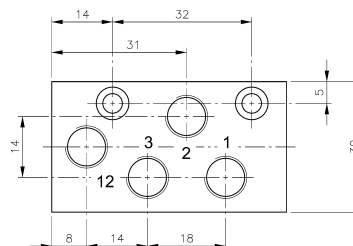
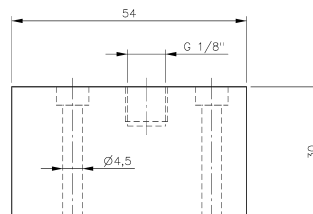
Do not attach pressure at port 2.

Operating pressure and actuating pressure should be at the same level.

Exhaust can be throttled.



P 310 302



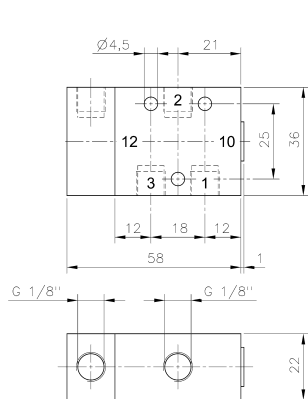
P 310 502

Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 310 302	M5	180 l/min	2 - 10 bar	the same	0,05 kg
P 310 502	G 1/8"	650 l/min	2 - 10 bar	the same	0,13 kg

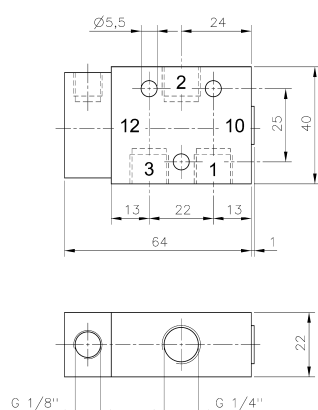


P 310 501/P 310 701/P 310 801 P 311 501/P 311 701/P 311 801

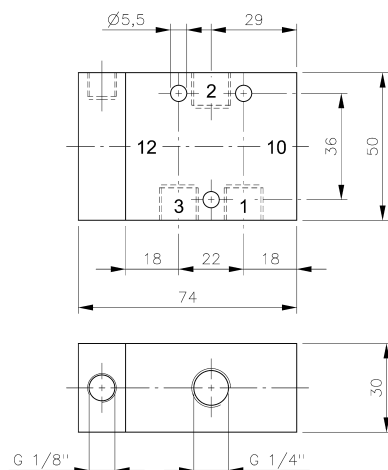
2.4.1.2
page 51



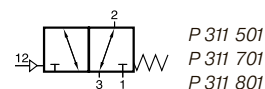
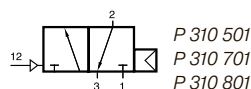
P 310 501/P 311 501



P 310 701/P 311 701



P 310 801/P 311 801



Pneumatically actuated 3/2-way spool valve.

Type P 310 __ with air-spring-return.
Operating pressure and actuating pressure
should be at the same level.

Type P 311 __ with mechanical spring return.

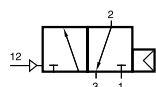
If pressure is attached to port 1 the function
is normally closed.
If pressure is applied to port 3 the function
is normally open.
Pressure can only be attached to port 2 if valve
has a mechanical spring (type P 311 __).

Exhaust can be throttled.

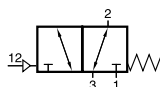
Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 310 501	G 1/8"	650 l/min	2 - 10 bar	the same	0,13 kg
P 310 701	G 1/4"	1250 l/min	2 - 10 bar	the same	0,14 kg
P 310 801	G 1/4"	1450 l/min	1,5 - 10 bar	the same	0,29 kg
P 311 501	G 1/8"	650 l/min	1 - 10 bar	3 - 10 bar	0,13 kg
P 311 701	G 1/4"	1250 l/min	1 - 10 bar	3 - 10 bar	0,14 kg
P 311 801	G 1/4"	1450 l/min	1 - 10 bar	3 - 10 bar	0,29 kg



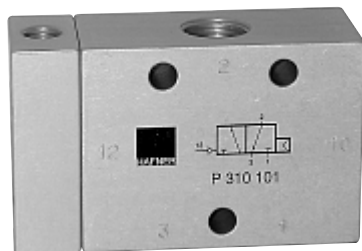
P 310 101/P 310 121/P 310 181 P 311 101/P 311 121/P 311 181



P 310 101
P 310 121
P 310 181
P 310 121 NPT



P 311 101
P 311 121
P 311 181
P 311 121 NPT



Pneumatically actuated 3/2-way spool valve.

Type P 310 __ with air-spring-return.
Operating pressure and actuating pressure should be at the same level.

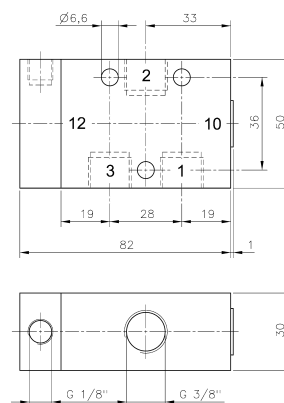
Type P 311 __ with mechanical spring return.

If pressure is attached to port 1 the function is normally closed.

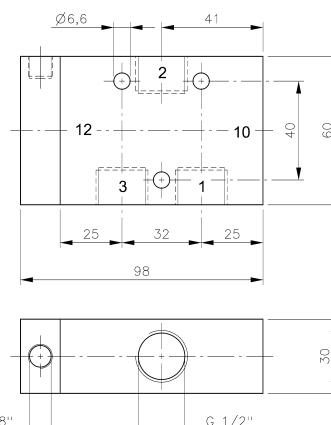
If pressure is applied to port 3 the function is normally open.

Pressure can only be attached to port 2 if valve has a mechanical spring (type P 311 __).

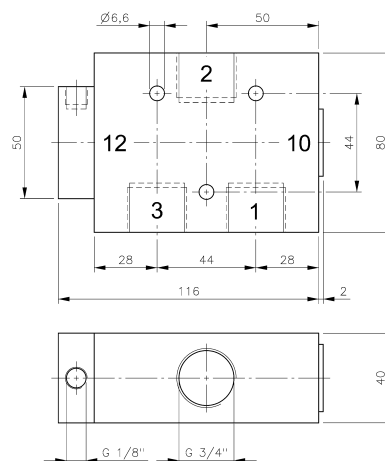
Exhaust can be throttled.



P 310 101/P 311 101



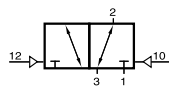
P 310 121/P 311 121
P 310 121 NPT/P 311 121 NPT



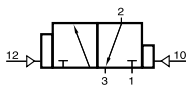
P 310 181/P 311 181

Type	Port size	Air flow	Operating press.	Actuating press.	Weight	
P 310 101	G 3/8"	2250 l/min	1 - 10 bar	the same	0,32 kg	Ex
P 310 121	G 1/2"	3000 l/min	1 - 10 bar	the same	0,45 kg	Ex 316
P 310 181	G 3/4"	6000 l/min	1 - 10 bar	the same	0,85 kg	
P 311 101	G 3/8"	2250 l/min	1 - 10 bar	3 - 10 bar	0,32 kg	
P 311 121	G 1/2"	3000 l/min	1 - 10 bar	3 - 10 bar	0,45 kg	316
P 311 181	G 3/4"	6000 l/min	1 - 10 bar	3 - 10 bar	0,85 kg	
P 310 121 NPT	1/2" NPT	3000 l/min	1 - 10 bar	the same	0,45 kg	Ex 316
P 311 121 NPT	1/2" NPT	3000 l/min	1 - 10 bar	3 - 10 bar	0,45 kg	316

P 320 302/P 320 502 P 322 302/P 322 502



P 320 302
P 320 502



P 322 302
P 322 502



Pneumatically actuated 3/2-way spool valve
actuated by impulse.

Type P 320 __ __ double pilot

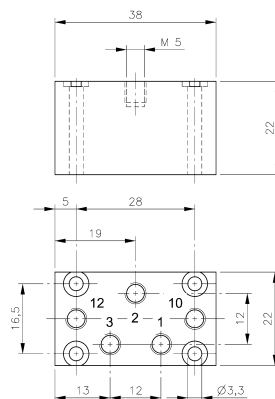
Type P 322 __ __ double pilot dominating at port 12

If signal is applied to 12 the valve is open
from 1 to 2 and 3 is blocked.

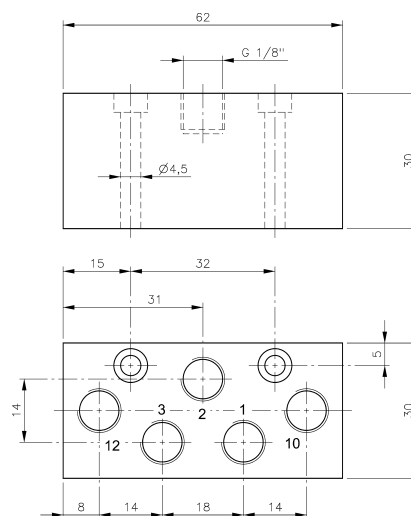
If signal is applied at 10 the valve is open
from 2 to 3.

Position is kept until next pneumatic signal is
applied.

Exhaust can be throttled.



P 320 302/P 322 302

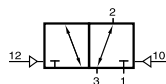


P 320 502/P 322 502

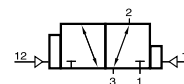
Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 320 302	M5	180 l/min	1 - 10 bar	2,5 - 10 bar	0,05 kg
P 320 502	G 1/8"	650 l/min	1 - 10 bar	2,5 - 10 bar	0,13 kg
P 322 302	M5	180 l/min	1 - 10 bar	2,5 - 10 bar	0,05 kg
P 322 502	G 1/8"	650 l/min	1 - 10 bar	2,5 - 10 bar	0,13 kg

P 320 501/P 320 701 G/ P 320 801 P 322 501/P 322 701 G

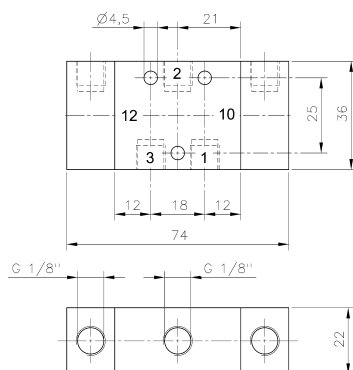
2.4.1.6
page 55



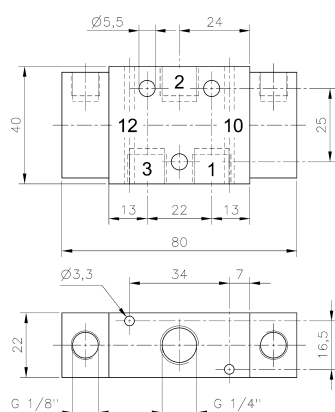
P 320 501
P 320 701 G
P 320 801



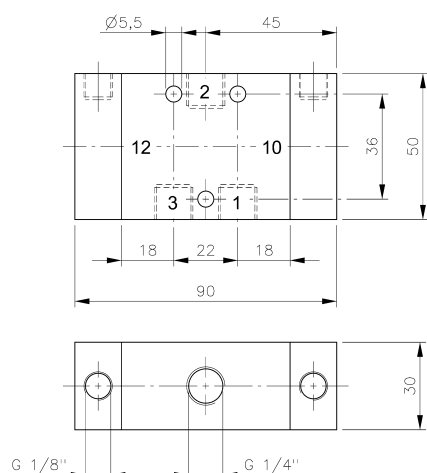
P 322 501
P 322 701 G



P 320 501/P 322 501



P 320 701 G/P 322 701 G



P 320 801



Pneumatically actuated 3/2-way spool valve
actuated by impulse.

Type P 320 ___ double pilot
Type P 322 ___ double pilot dominating at port 12
Type P 3 __ 701 G dual use, in-line and on manifold.
Plates are displayed on page 2.7.1.4.






If signal is applied to 12 the valve is open
from 1 to 2 and 3 is blocked.

If signal is applied at 10 the valve is open
from 2 to 3.

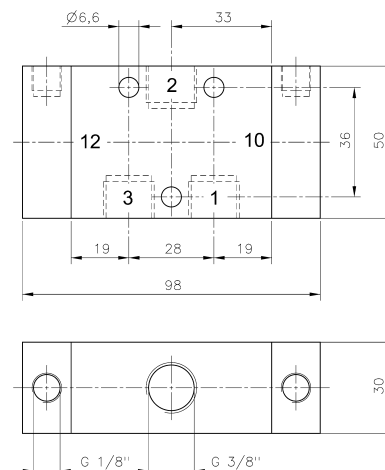
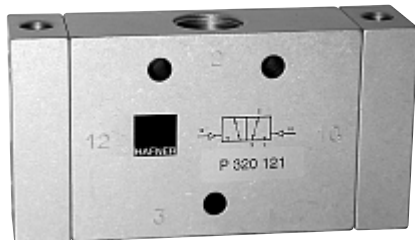
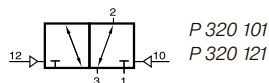
Position is kept until next pneumatic signal is
applied.

Operating pressure can also be applied to 2.

Exhaust can be throttled.

Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 320 501	G 1/8"	650 l/min	1 - 10 bar	2,5 - 10 bar	0,16 kg 
P 322 501	G 1/8"	650 l/min	1 - 10 bar	2,5 - 10 bar	0,16 kg 
P 320 701 G	G 1/4"	1250 l/min	1 - 10 bar	2,5 - 10 bar	0,17 kg 
P 322 701 G	G 1/4"	1250 l/min	1 - 10 bar	2,5 - 10 bar	0,17 kg 
P 320 801	G 1/4"	1450 l/min	1 - 10 bar	2,5 - 10 bar	0,34 kg 

P 320 101/P 320 121/P 320 181



P 320 101

Pneumatically actuated 3/2-way spool valve actuated by impulse.

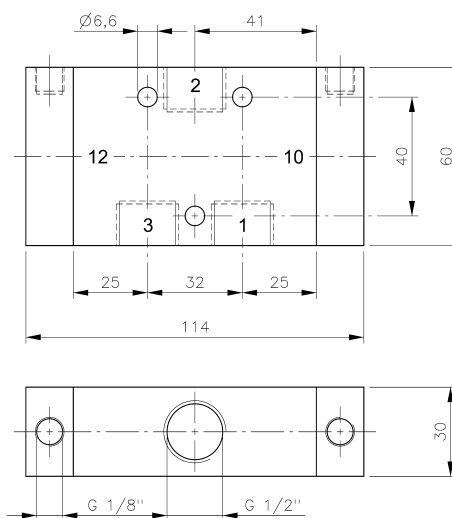
If signal is applied to 12 the valve is open from 1 to 2 and 3 is blocked.

If signal is applied at 10 the valve is open from 2 to 3.

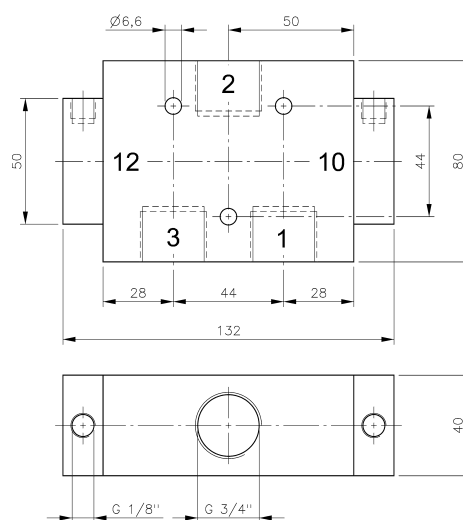
Operating pressure can also be applied to 2.

Position is kept until next pneumatic signal is applied.


Exhaust can be throttled.

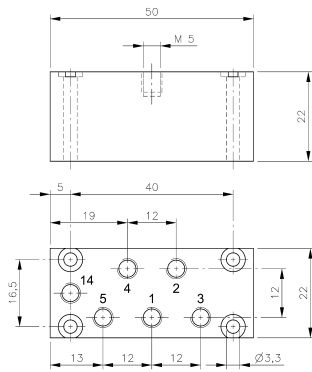
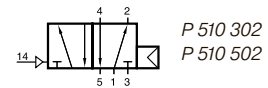


P 320 121

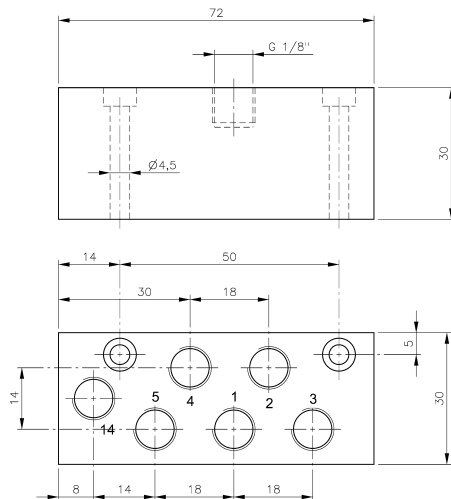


P 320 181

Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 320 101	G 3/8"	2250 l/min	1 - 10 bar	2,5 - 10 bar	0,38 kg 
P 320 121	G 1/2"	3000 l/min	1 - 10 bar	2,5 - 10 bar	0,52 kg 
P 320 181	G 3/4"	6000 l/min	1 - 10 bar	2 - 10 bar	0,88 kg



P 510 302



P 510 502



Pneumatically actuated 5/2-way spool valve actuated by permanent signal and equipped with air spring return.

Normally open from 1 to 2 and from 4 to 5.
If pressure is applied at 14 the valve is open from 1 to 4 and 2 to 3.

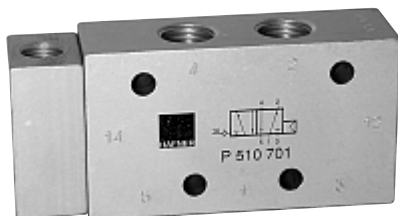
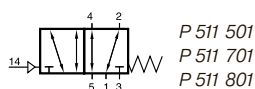
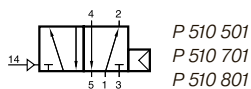
Operating pressure and actuating pressure should be at the same level.

Exhaust can be throttled.

Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 510 302	M5	180 l/min	2 - 10 bar	the same	0,07 kg
P 510 502	G 1/8"	650 l/min	2 - 10 bar	the same	0,17 kg



P 510 501/P 510 701/P 510 801 P 511 501/P 511 701/P 511 801



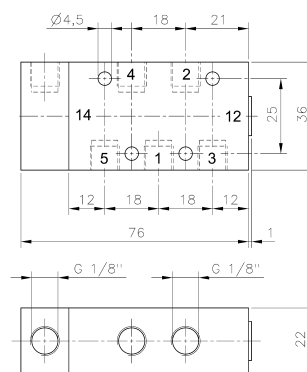
Pneumatically actuated 5/2-way spool valve.

Type P 510 __ with air-spring-return.
Operating pressure and actuating pressure should be at the same level.

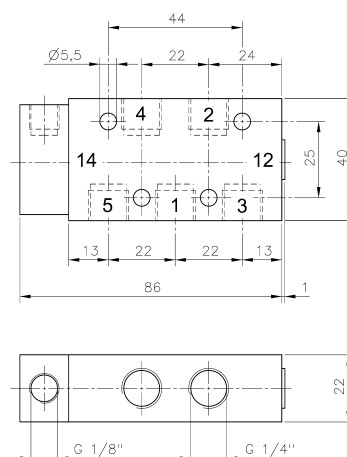
Type P 511 __ with mechanical spring return.

Normally open from 1 to 2 and from 4 to 5.
If pressure is applied at 14 the valve is open from 1 to 4 and 2 to 3.

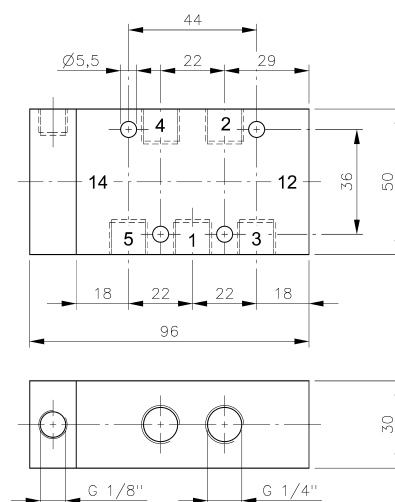
Exhaust can be throttled.



P 510 501/P 511 501



P 510 701/P 511 701



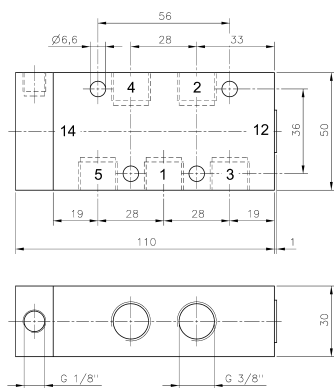
P 510 801/P 511 801

Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 510 501	G 1/8"	650 l/min	2 - 10 bar	the same	0,16 kg
P 510 701	G 1/4"	1250 l/min	2 - 10 bar	the same	0,18 kg
P 510 801	G 1/4"	1450 l/min	1,5 - 10 bar	the same	0,38 kg
P 511 501	G 1/8"	650 l/min	1 - 10 bar	3 - 10 bar	0,16 kg
P 511 701	G 1/4"	1250 l/min	1 - 10 bar	3 - 10 bar	0,18 kg
P 511 801	G 1/4"	1450 l/min	1 - 10 bar	3 - 10 bar	0,38 kg

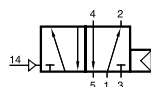


P 510 101/P 510 121/P 510 181 P 511 101/P 511 121/P 511 181

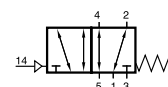
2.4.2.3
page 59



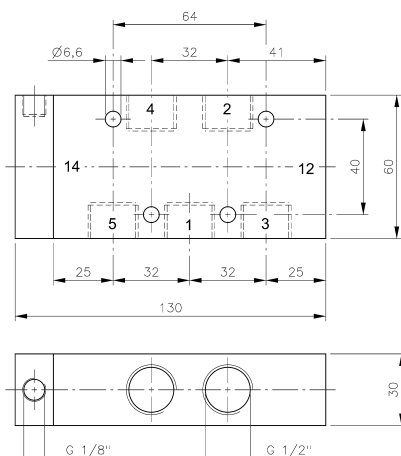
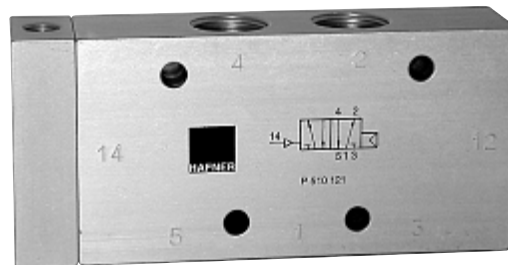
P 510 101/P 511 101



P 510 101
P 510 121
P 510 181
P 510 121 NPT



P 511 101
P 511 121
P 511 181
P 511 121 NPT



**P 510 121/P 511 121
P 510 121 NPT/P511 121 NPT**

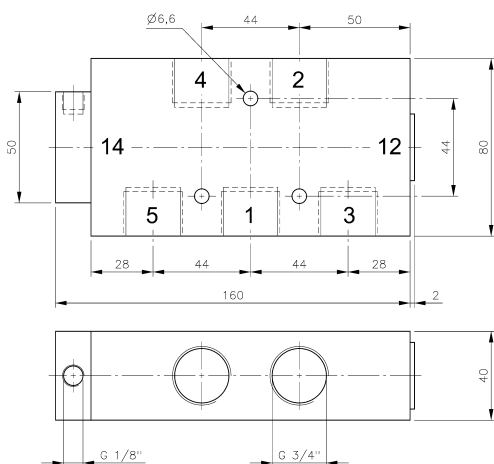
Pneumatically actuated 5/2-way spool valve.

Type P 510 __ with air-spring-return.
Operating pressure and actuating pressure
should be at the same level.

Type P 511 __ with mechanical spring return.

Normally open from 1 to 2 and from 4 to 5.
If pressure is applied at 14 the valve is open from
1 to 4 and 2 to 3.

Exhaust can be throttled.

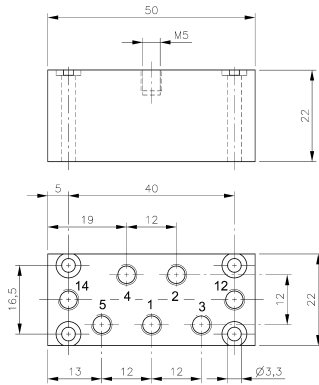
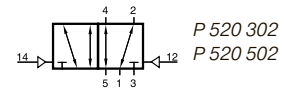


P 510 181/P 511 181

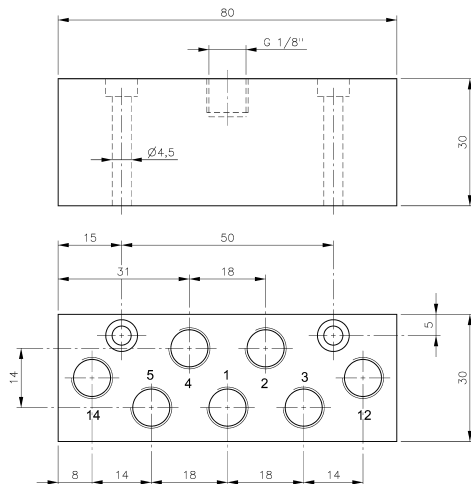
Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 510 101	G 3/8"	2250 l/min	1,5 - 10 bar	the same	0,42 kg
P 510 121	G 1/2"	3000 l/min	1 - 10 bar	the same	0,59 kg
P 510 181	G 3/4"	6000 l/min	1 - 10 bar	the same	1,18 kg
P 511 101	G 3/8"	2250 l/min	1 - 10 bar	3 - 10 bar	0,42 kg
P 511 121	G 1/2"	3000 l/min	1 - 10 bar	3 - 10 bar	0,59 kg
P 511 181	G 3/4"	6000 l/min	1 - 10 bar	3 - 10 bar	1,18 kg
P 510 121 NPT	1/2" NPT	3000 l/min	1 - 10 bar	the same	0,59 kg
P 511 121 NPT	1/2" NPT	3000 l/min	1 - 10 bar	3 - 10 bar	0,59 kg



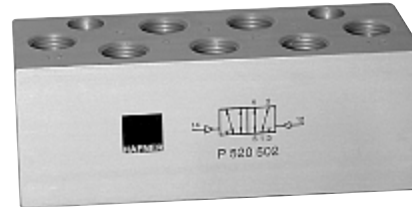
P 510 501 G/P 510 701 G/P 510 121 G
P 511 501 G/P 511 701 G/P 511 121 G



P 520 302



P 520 502



Pneumatically actuated 5/2-way spool valve
actuated by impulse.

If signal is applied to 14 the valve is open
from 1 to 4 and 2 to 3, 5 is closed.

If signal is applied to 12 the valve is open
from 1 to 2 and 4 to 5.

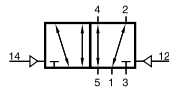
Position is kept until next pneumatic signal
is applied.

Exhaust can be throttled.

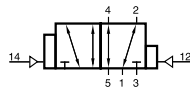
Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 520 302	M5	180 l/min	1 - 10 bar	2,5 - 10 bar	0,07 kg
P 520 502	G 1/8"	650 l/min	1 - 10 bar	2,5 - 10 bar	0,17 kg



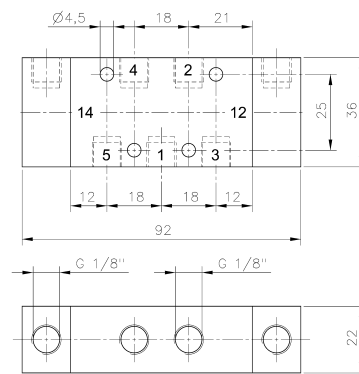
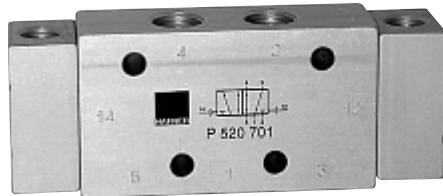
P 520 501/P 520 701/P 520 801
P 522 501/P 522 701



P 520 501
P 520 701
P 520 801



P 522 501
P 522 701



P 520 501/P 522 501

Pneumatically actuated 5/2-way spool valve.

Type P 520 ___ double pilot

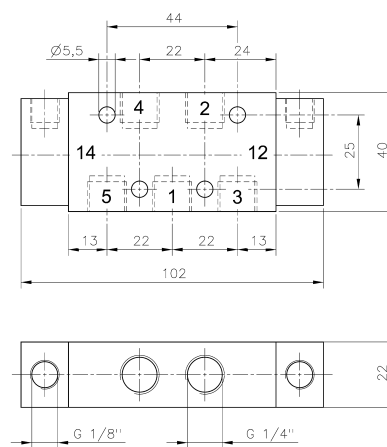
Type P 522 double pilot dominating at port 14

If signal is applied to 14 the valve is open from 1 to 4 and 2 to 3, 5 is closed.

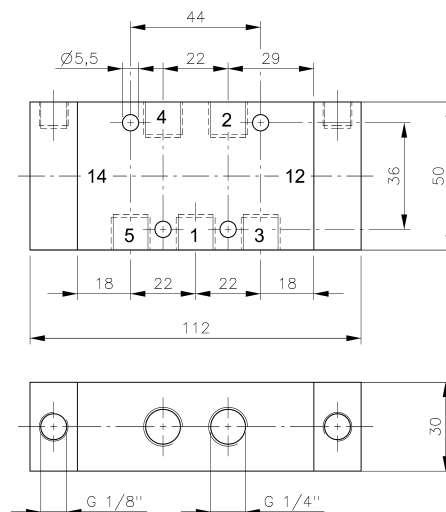
If signal is applied to 12 the valve is open from 1 to 2 and 4 to 5.

Position is kept until next pneumatic signal is applied.





Exhaust can be throttled.

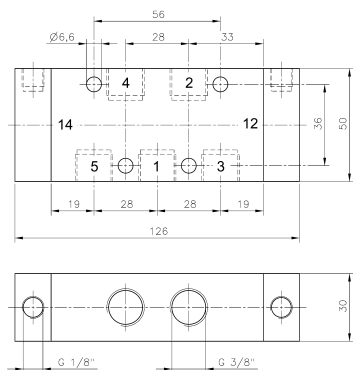
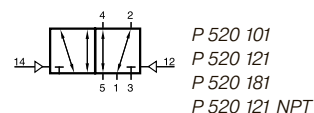


P 520 701/ P 522 701

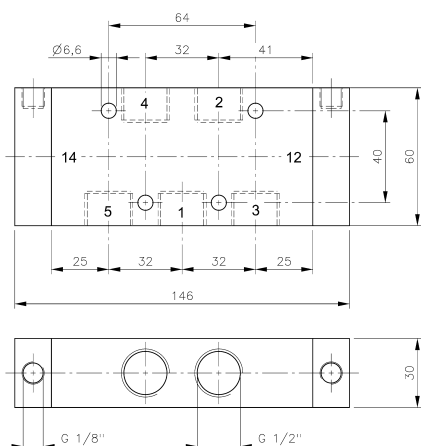


P 520 801

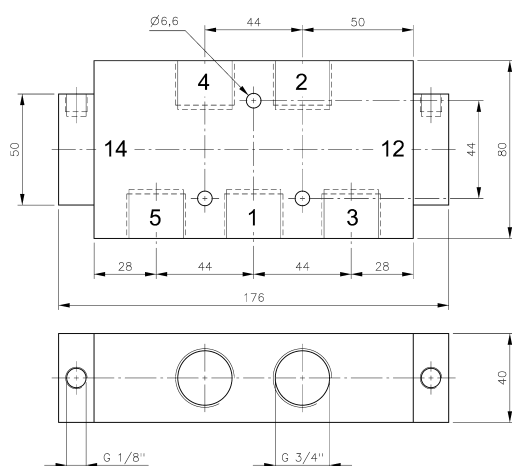
Type	Port size	Air flow	Operating press.	Actuating press.	Weight	
P 520 501	G 1/8"	650 l/min	1 - 10 bar	2,5 - 10 bar	0,20 kg	
P 522 501	G 1/8"	650 l/min	1 - 10 bar	2,5 - 10 bar	0,20 kg	
P 520 701	G 1/4"	1250 l/min	1 - 10 bar	2,5 - 10 bar	0,22 kg	 
P 522 701	G 1/4"	1250 l/min	1- 10 bar	2,5 - 10 bar	0,22 kg	
P 520 801	G 1/4"	1450 l/min	1 - 10 bar	2,5 - 10 bar	0,44 kg	



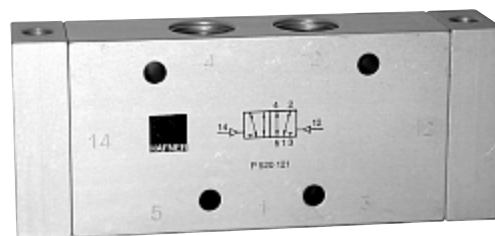
P 520 101



P 520 121/P 520 121 NPT



P 520 181



Pneumatically actuated 5/2-way spool valve actuated by impulse.

If signal is applied to 14 the valve is open from 1 to 4 and 2 to 3, 5 is closed.

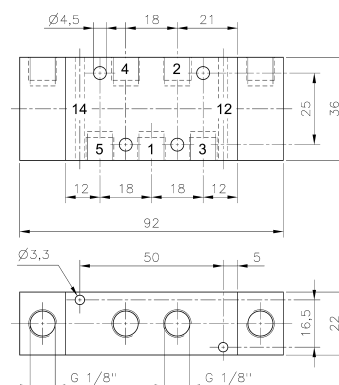
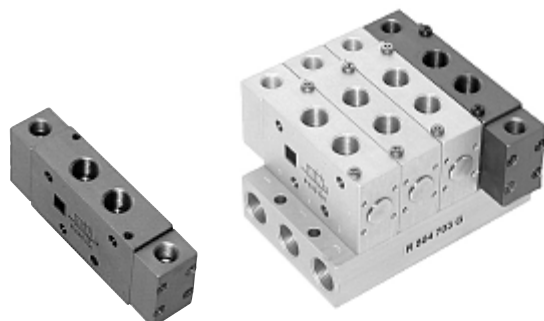
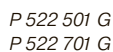
If signal is applied to 12 the valve is open from 1 to 2 and 4 to 5.

Position is kept until next pneumatic signal is applied.

Exhaust can be throttled.

Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 520 101	G 3/8"	2250 l/min	1 - 10 bar	2,5 - 10 bar	0,48 kg 
P 520 121	G 1/2"	3000 l/min	1 - 10 bar	2,5 - 10 bar	0,67 kg 
P 520 181	G 3/4"	6000 l/min	1 - 10 bar	2 - 10 bar	1,22 kg
P 520 121 NPT	1/2" NPT	3000 l/min	1 - 10 bar	2,5 - 10 bar	0,67 kg 

P 520 501 G/P 520 701 G/P 520 121 G
P 522 501 G/P 522 701 G



P 520 501 G/P 522 501 G

Pneumatically actuated 5/2-way spool valve.

Type P 520 double pilot

Type P 522 double pilot dominating at port 14

If signal is applied to 14 the valve is open from 1 to 4 and 2 to 3. 5 is closed.

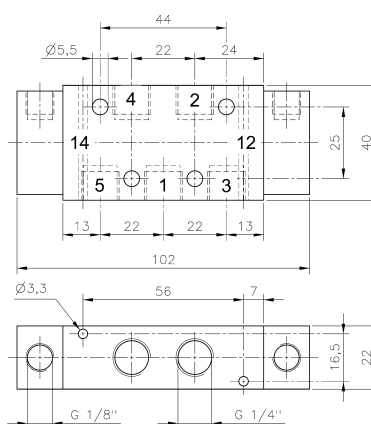
If signal is applied to 12 the valve is open from 1 to 2 and 4 to 5.

Position is kept until next pneumatic signal is applied.

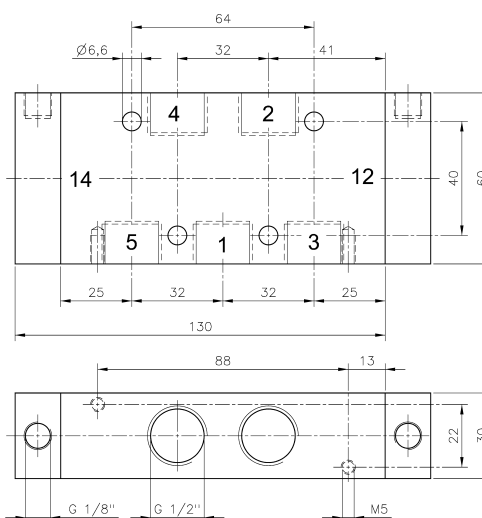
Valves can either be used in-line or on a manifold plate. Manifolds for valves type 501 G are displayed on page 2.7.2.2, manifolds for valves type 701 G are displayed on page 2.7.2.3, manifolds for valves type 121 G are displayed on page 2.7.2.5.

Take into consideration, that G 1/2" valves have to be assembled onto the plate by fixing screws from the bottom through the plate into the valve.

Exhaust can be throttled.

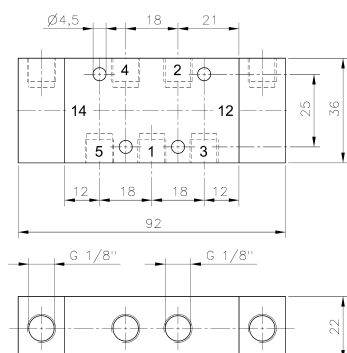
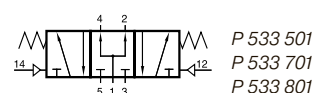
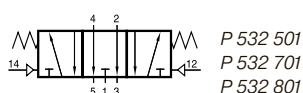
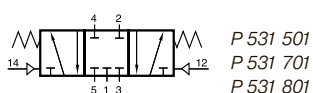


P 520 701 G/P 522 701 G
P 520 701 G NPT



P 520 121 G

Type	Port size	Air flow	Operating press.	Actuating press.	Weight	
P 520 501 G	G 1/8"	650 l/min	1 - 10 bar	2,5 - 10 bar	0,20 kg	❄
P 522 501 G	G 1/8"	650 l/min	1 - 10 bar	2,5 - 10 bar	0,20 kg	
P 520 701 G	G 1/4"	1250 l/min	1 - 10 bar	2,5 - 10 bar	0,22 kg	❄
P 522 701 G	G 1/4"	1250 l/min	1 - 10 bar	2,5 - 10 bar	0,22 kg	
P 520 121 G	G 1/2"	3000 l/min	1 - 10 bar	2,5 - 10 bar	0,67 kg	
P 520 701 G NPT	1/4" NPT	1250 l/min	1 - 10 bar	2,5 - 10 bar	0,22 kg	



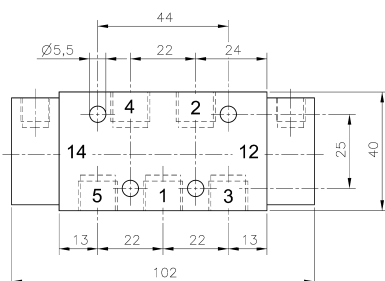
P 53_ 501

Pneumatically actuated 5/3-way spool valve with spring return to middle position.

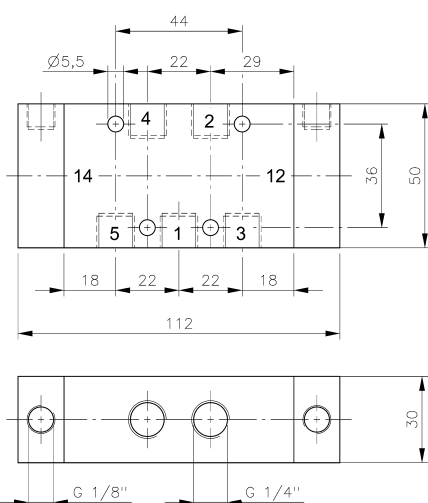
Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurised

When ordering please complete the type number by 1, 2 or 3 according to the type required.




Exhaust can be throttled.



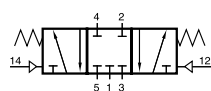
P 53_ 701



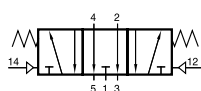
P 53_ 801

Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 53_ 501	G 1/8"	650 l/min	1 - 10 bar	3 - 10 bar	0,20 kg 
P 53_ 701	G 1/4"	1250 l/min	1 - 10 bar	3 - 10 bar	0,22 kg 
P 53_ 801	G 1/4"	1450 l/min	1 - 10 bar	3 - 10 bar	0,44 kg 

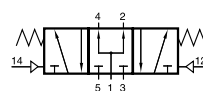
P 53_ 101/P 53_ 121/P 53_ 181



P 531 101
P 531 121
P 531 181
P 531 121 NPT



P 532 101
P 532 121
P 532 181
P 532 121 NPT



P 533 101
P 533 121
P 533 181
P 533 121 NPT

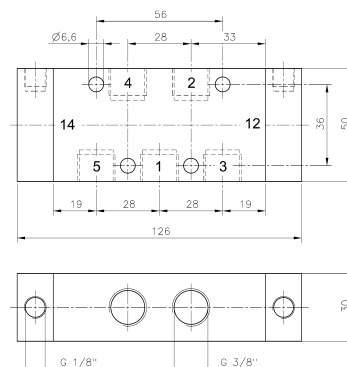


Pneumatically actuated 5/3-way spool valve with spring return to middle position.

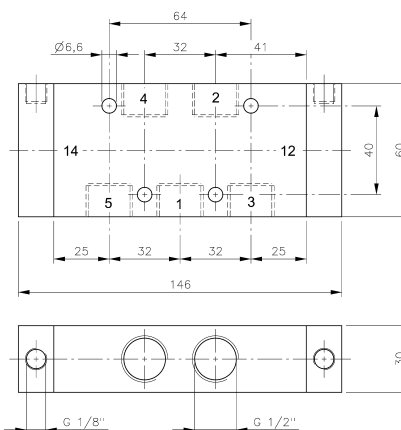
Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurised

When ordering please complete the type number by 1, 2 or 3 according to the type required.

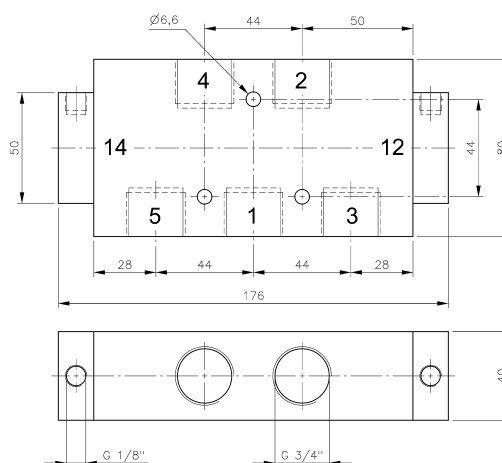
Exhaust can be throttled.






P 53_ 101

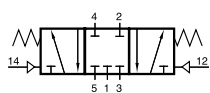


P 53_ 121/P 53_ 121 NPT

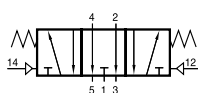


P 53_ 181

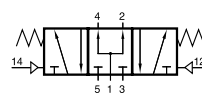
Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 53_ 101	G 3/8"	2250 l/min	1 - 10 bar	3 - 10 bar	0,49 kg 
P 53_ 121	G 1/2"	3000 l/min	1 - 10 bar	3 - 10 bar	0,69 kg 
P 53_ 181	G 3/4"	6000 l/min	1 - 10 bar	3 - 10 bar	1,22 kg
P 53_ 121 NPT	1/2" NPT	3000 l/min	1 - 10 bar	3 - 10 bar	0,69 kg 



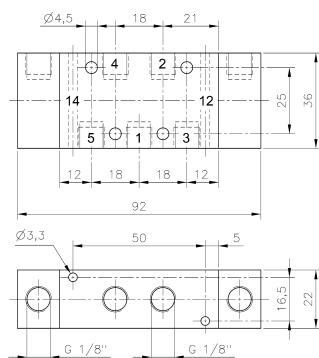
P 531 501 G
P 531 701 G
P 531 121 G
P 531 701 G NPT



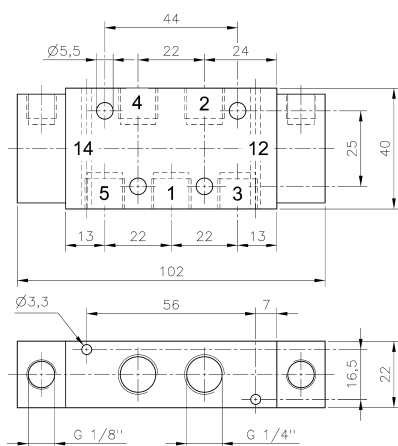
P 532 501 G
P 532 701 G
P 532 121 G
P 532 701 G NPT



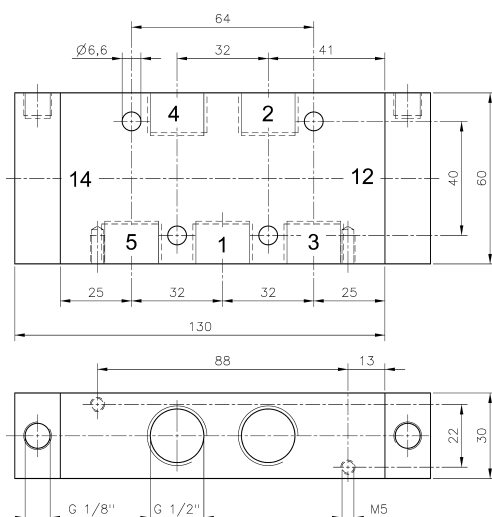
P 533 501 G
P 533 701 G
P 533 121 G
P 533 701 G NPT



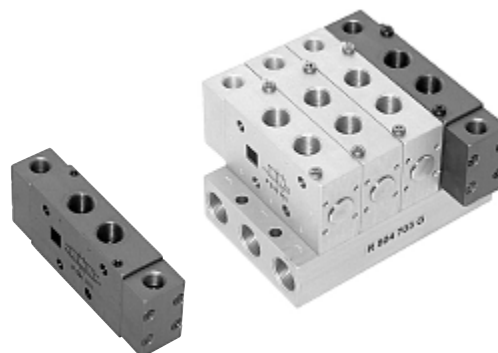
P 53_ 501 G



P 53_ 701 G/P 53_ 701 G NPT



P 53_ 121 G



Pneumatically actuated 5/3-way spool valve with spring return to middle position.

Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurised

When ordering please complete the type number by 1, 2 or 3 according to the type in need.

Valves can either be used in-line or on a manifold plate. Manifolds for valves type 501 G are displayed on page 2.7.2.2, manifolds for valves type 701 G are displayed on page 2.7.2.3, manifolds for valves type 121 G are displayed on page 2.7.2.5.

Take into consideration, that G 1/2" valves have to be assembled onto the plate by fixing screws from the bottom through the plate into the valve.

Exhaust can be throttled.

Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 53_ 501 G	G 1/8"	650 l/min	1 - 10 bar	3 - 10 bar	0,20 kg
P 53_ 701 G	G 1/4"	1250 l/min	1 - 10 bar	3 - 10 bar	0,22 kg
P 53_ 121 G	G 1/2"	3000 l/min	1 - 10 bar	3 - 10 bar	0,69 kg
P 53_ 701 G NPT	1/4" NPT	1250 l/min	1 - 10 bar	3 - 10 bar	0,22 kg



VA 341/VA 401 ES 341/ES 401



VA 341/VA 401: OR-gate

The OR-gate has two inputs 1 and one output 2.

The shuttle valve is used when only one of two possible signals is required to pass on a signal.

Function: If one of two signal inputs are activated, an output signal on port 2 is present and the other input is blocked.

In case of pressurising both inputs at different pressure levels, the higher pressure is fed to port 2.

ES 341/ES 401: AND-gate

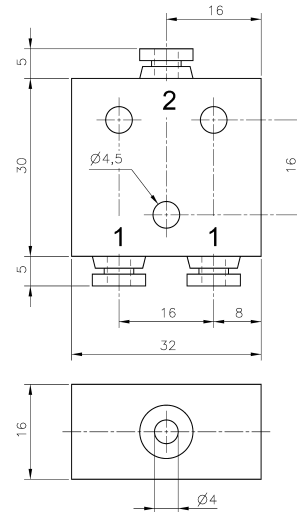
The AND-gate has two inputs 1 and one output 2.

The dual-pressure valve is used when at least 2 signals are required before a signal is passed on.

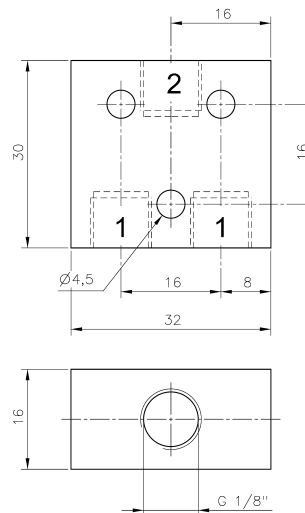
Function: Only when both inputs are pressurised output 2 is pressurised.

If two different pressures are applied the lower pressure is fed to output 2.

In case of only one signal at one of the two ports 1, the output 2 is blocked.

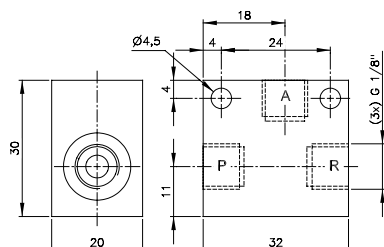
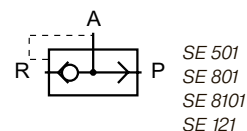


VA 341/ES 341



VA 401/ES 401

Type	Function	Port size	Air flow	Operating press.	Weight
VA 341	OR	pif 4 mm	280 l/min	1 - 10 bar	0,04 kg
VA 401	OR	G 1/8"	280 l/min	1 - 10 bar	0,04 kg
ES 341	AND	pif 4 mm	280 l/min	1 - 10 bar	0,04 kg
ES 401	AND	G 1/8"	280 l/min	1 - 10 bar	0,04 kg



SE 501



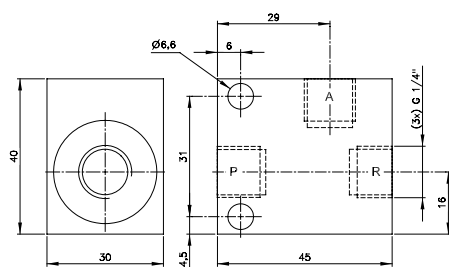
Quick-exhaust valve which can also be used as non-return valve as well as or-gate.

If used as a non-return valve please plug port R. Open from P to A, closed from A to P.

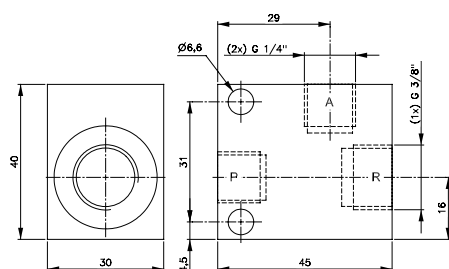
If used as an or-gate connect pressure to P and R. Port A is outlet.

Temperature range: -20° C to +80° C

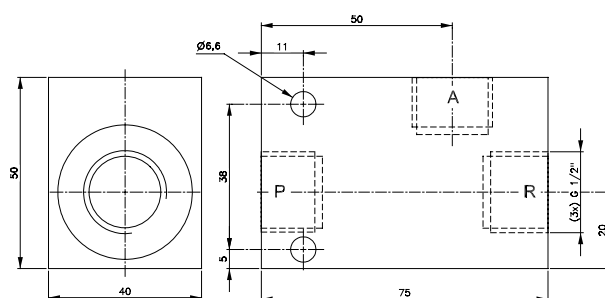
Stainless steel version as well as low temperature version (-40° C) available on request.



SE 801



SE 8101

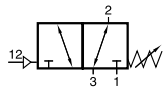


SE 121

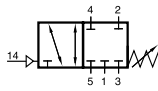
Type	Port size A + P	Port size R	Air flow from A to R	Operating press.	Weight
SE 501	G 1/8"	G 1/8"	564 l/min	0,3 - 10 bar	0,06 kg
SE 801	G 1/4"	G 1/4"	1188 l/min	0,2 - 10 bar	0,18 kg
SE 8101	G 1/4"	G 3/8"	1188 l/min	0,2 - 10 bar	0,18 kg
SE 121	G 1/2"	G 1/2"	3600 l/min	0,5 - 10 bar	0,26 kg



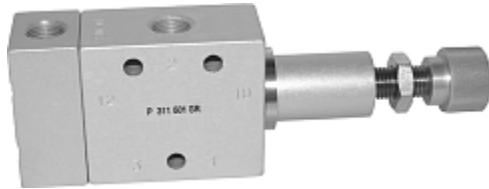
P 311 501 SR/P 411 701 SR
P 411 701 SR NPT



P311 501 SR



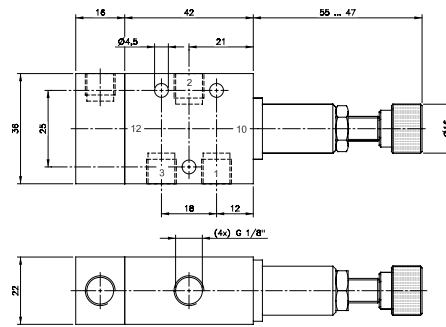
P 411 701 SR
P 411 701 SR NPT



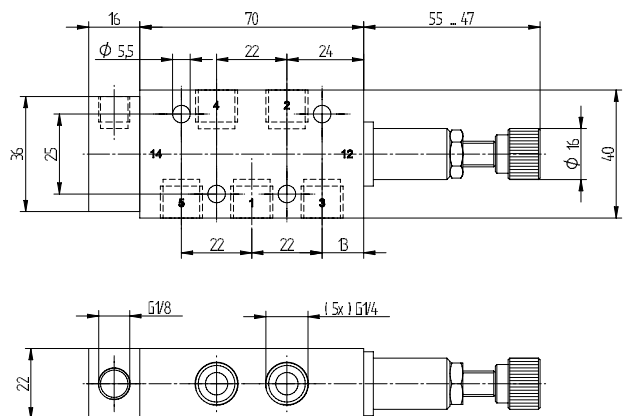
P 311 501 SR pneumatically actuated 3/2-way valve with mechanical spring return.
Valve can be used normally closed (pressure at port 1) and normally open (pressure at port 3).
Can also be used as 2/2-way valve.
Unused port to be closed with a silencer or plug.

P 411 701 SR pneumatically actuated 4/2-way valve with mechanical spring return.
Valve either blocks all ports or is open from 1 to 4 and from 3 to 2.
Port 5 is a vent port and should have a silencer installed, do not plug.



Valve can be used as an **adjustable pneumatic pressure switch**. By turning the hand-wheel the required minimum actuation pressure can be set between 3 and 6 bar. Adjustment is not independent from operation pressure.



P 311 501 SR

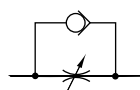


P 411 701 SR/P 411 701 SR NPT

Type	Port size	Air flow	Operating press.	Regulating range act. press.	Max. act. press.	Weight	
P 311 501 SR	G 1/8"	650 l/min	2 - 10 bar	3 - 6 bar	10 bar	0,16 kg	
P 411 701 SR	G 1/4"	1250 l/min	2 - 10 bar	3 - 6 bar	10 bar	0,21 kg	
P 411 701 SR NPT	1/4" NPT	1250 l/min	2 - 10 bar	3 - 6 bar	10 bar	0,21 kg	

DR 501/DR 801/DR 101 D 501/D 801/D 101

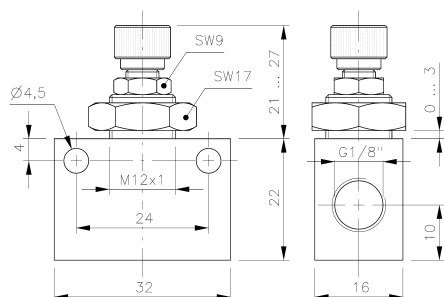
2.4.4.4
page 71



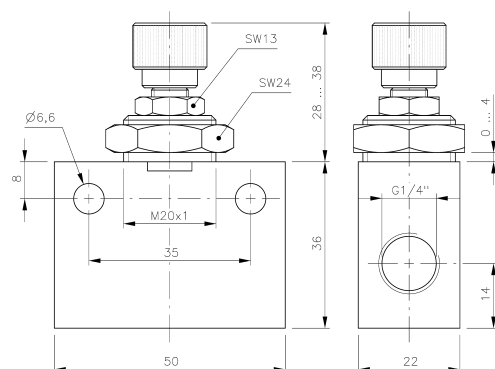
DR 501
DR 801
DR 101



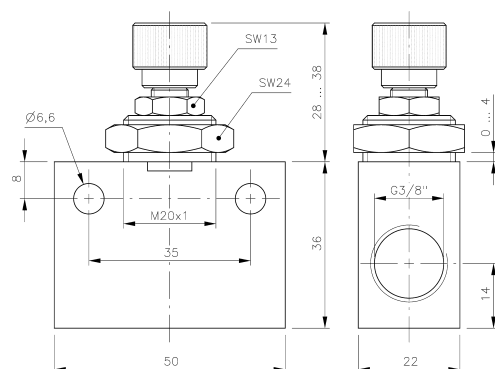
D 501
D 801
D 101



DR 501/D 501



DR 801/D 801



DR 101/D 101



Block form flow regulator.

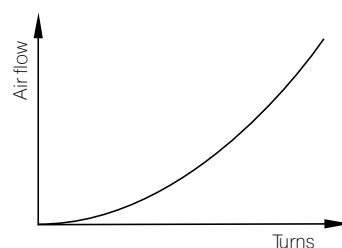
Type DR
uni-directional block form flow regulator.
Air streaming in the direction of the throttle can be regulated by turning the spindle. In the opposite direction air streams unthrottled.

Type D
bi-directional flow regulator. Air is regulated in both directions.

The throttle can be adjusted very precisely along the entire regulation range.

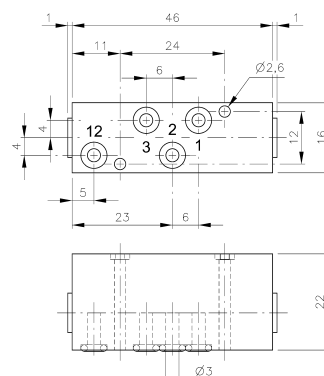
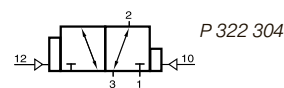
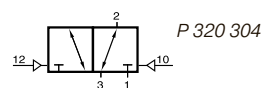
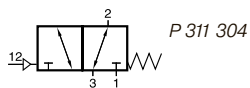
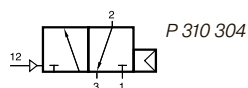
Adjustment can be locked.

Suitable for wall and panel mounting.
Nut is included.

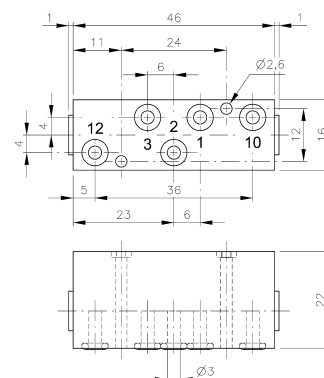


Type	Port size	Air flow	Airflow in opposite direction	Operating press.	Weight
D 501	G 1/8"	450 l/min	450 l/min	0,5 - 10 bar	0,04 kg
D 801	G 1/4"	1150 l/min	1150 l/min	0,5 - 10 bar	0,13 kg
D 101	G 3/8"	1450 l/min	1450 l/min	0,5 - 10 bar	0,13 kg
DR 501	G 1/8"	450 l/min	450 l/min	2 - 10 bar	0,04 kg
DR 801	G 1/4"	1150 l/min	1150 l/min	2 - 10 bar	0,13 kg
DR 101	G 3/8"	1450 l/min	1450 l/min	2 - 10 bar	0,13 kg

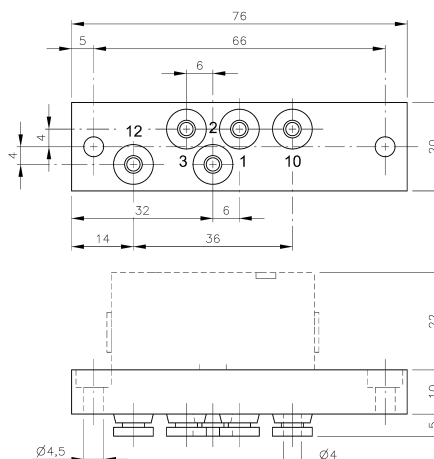
P 310 304/P 311 304 P 320 304/P 322 304/RP 3 344



P 310 304/P 311 304



P 320 304/P 322 304



RP 3 344

Pneumatically actuated 3/2-way spool valves.
To be assembled to plate RP 3 344.

Four different versions are offered:

- P 310 304 valve with air-spring return.
- P 311 304 valve with mechanical spring return.
- P 320 304 double pilot valve
- P 322 304 double pilot valve dominating at port 12.

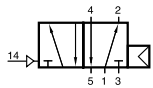
For P 310 304 the operating and actuating pressure should be at the same level.

RP 3 344 is designed for carrying one 3/2-way valve type P 310 304, P 311 304, P 320 304 or P 322 304. The plate is equipped with 5 push-in fittings for 4 mm tube.

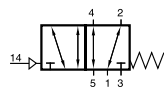
Type	Port size	Air flow	Operating press.	Actuating press	Weight
P 310 304	Ø 3 mm	280 l/min	2 - 10 bar	the same	0,04 kg
P 311 304	Ø 3 mm	280 l/min	2 - 10 bar	3 - 10 bar	0,04 kg
P 320 304	Ø 3 mm	280 l/min	2 - 10 bar	2,5 - 10 bar	0,04 kg
P 322 304	Ø 3 mm	280 l/min	2 - 10 bar	2,5 - 10 bar	0,04 kg
RP 3 344	pif 4 mm				0,04 kg

P 510 304/P 511 304 P 520 304/P 522 304/RP 5 344

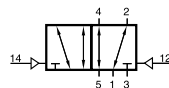
2.4.5.2
page 73



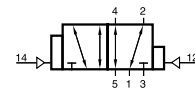
P 510 304



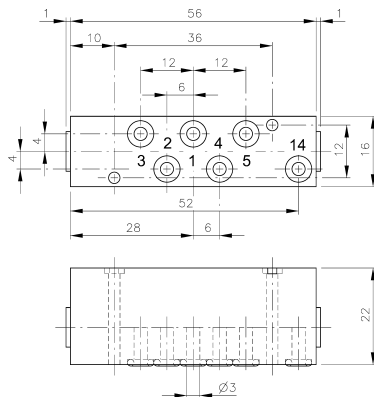
P 511 304



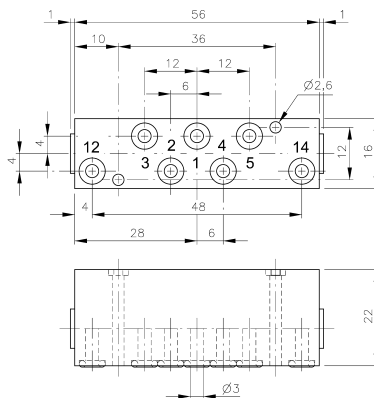
P 520 304



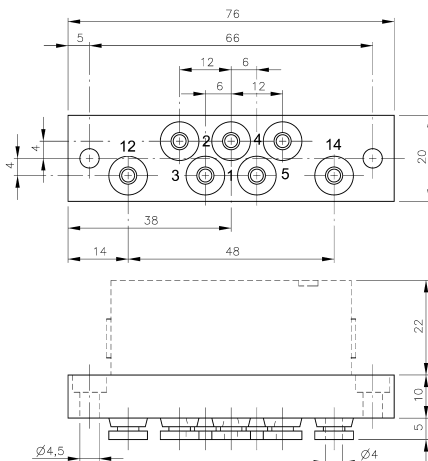
P 522 304



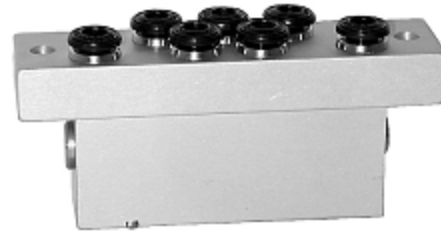
P 510 304/P 511 304



P 520 304/P 522 304



RP 5 344



Pneumatically actuated 5/2-way spool valves.
To be assembled to plate RP 5 344.

Four different versions are offered:

- P 510 304 valve with air-spring return.
- P 511 304 valve with mechanical spring return.
- P 520 304 double pilot valve
- P 522 304 double pilot valve dominating at port 14.

5/3-way valves are available on request.

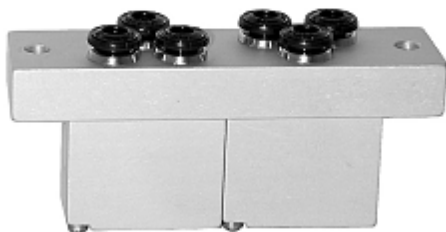
For P 510 304 the operating and actuating pressure should be at the same level.

RP 5 344 is designed for carrying one piece 5-way valve type P 510 304, P 511 304, P 520 304 or P 522 304.

3/2-way valves can also be assembled to that plate.
The plate is equipped with 7 push-in fittings for 4 mm tube.

Type	Port size	Air flow	Operating press.	Actuating press	Weight
P 510 304	Ø 3 mm	280 l/min	2 - 10 bar	the same	0,06 kg
P 511 304	Ø 3 mm	280 l/min	2 - 10 bar	3 - 10 bar	0,06 kg
P 520 304	Ø 3 mm	280 l/min	2 - 10 bar	2,5 - 10 bar	0,06 kg
P 522 304	Ø 3 mm	280 l/min	2 - 10 bar	2,5 - 10 bar	0,06 kg
RP 5 344	pif 4 mm				0,04 kg

VA 304/ES 304/RP 2 344



VA 304: OR-gate

The OR-gate has two inputs 1 and one output 2.

The shuttle valve is used when only one of two possible signals is required to pass on a signal.

Function: If one of two signal inputs are activated, an output signal on port 2 is present and the other input is blocked.

In case of pressurising both inputs at different pressure levels, the higher pressure is fed to port 2.

ES 304: AND-gate

The AND-gate has two inputs 1 and one output 2.

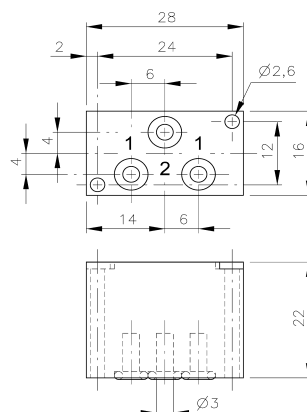
The dual-pressure valve is used when at least 2 signals are required before a signal is passed on.

Function: Only when both inputs are pressurised output 2 is pressurised.

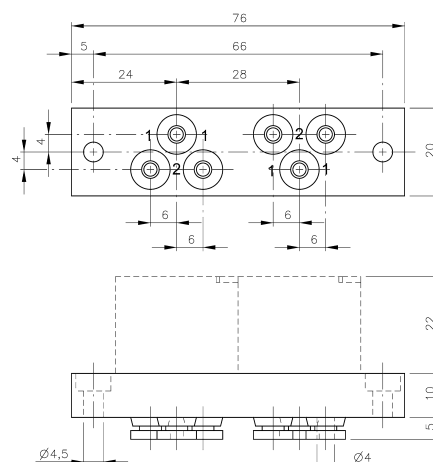
If two different pressures are applied the lower pressure is fed to output 2.

In case of only one signal at one of the two ports 1, the output 2 is blocked.

Both elements can be assembled to RP 2 344.
Plate can carry 2 pieces AND- or OR-gates.
Both types can be mixed on the plate. The plate is equipped with 6 push-in fittings for 4 mm tube.

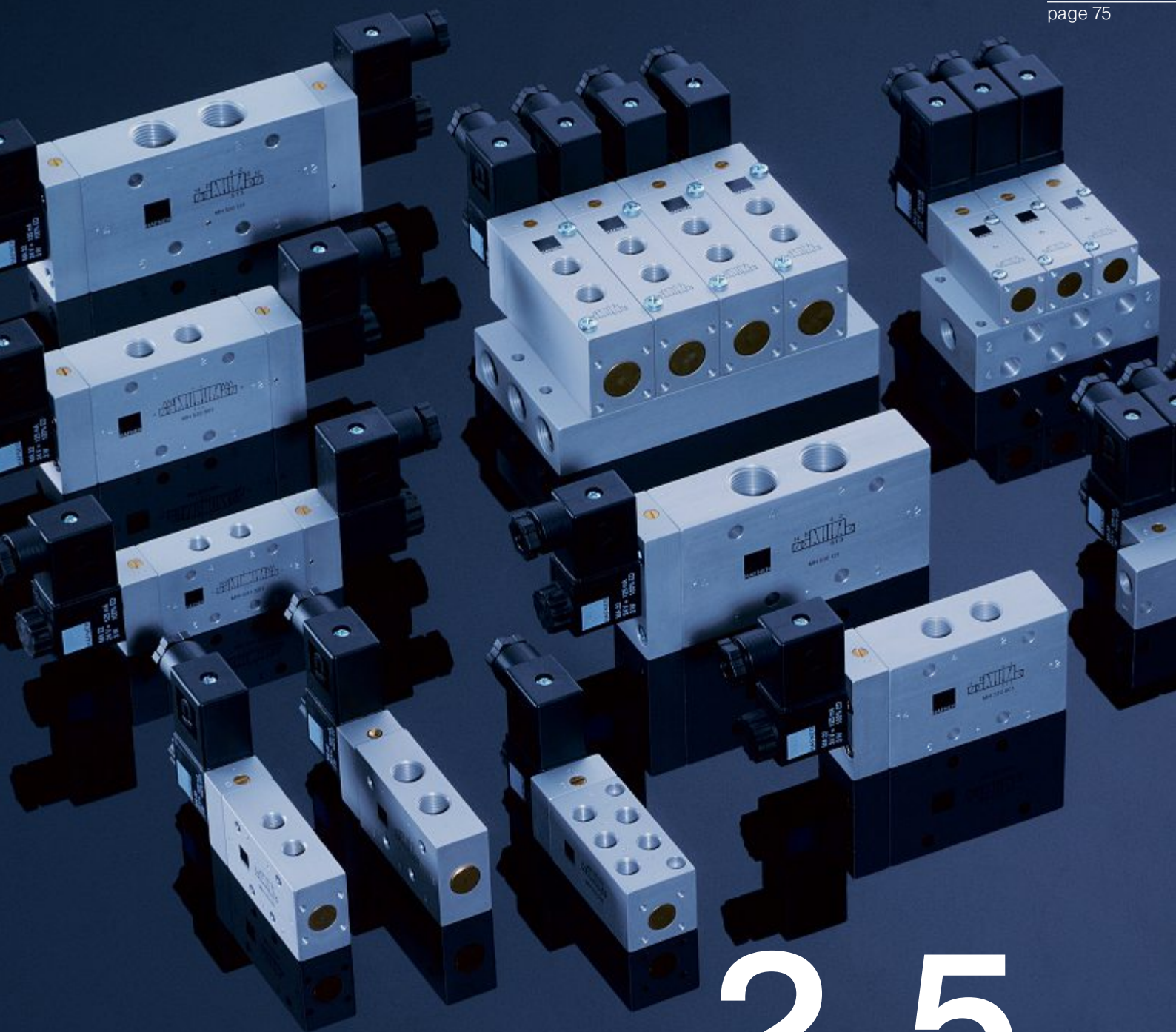


VA 304/ES 304



RP 2 344

Type	Function	Port size	Air flow	Operating press.	Weight
VA 304	OR	Ø 3 mm	280 l/min	1 - 10 bar	0,03 kg
ES 304	AND	Ø 3 mm	280 l/min	1 - 10 bar	0,03 kg
RP 2 344	plate	pif 4 mm			0,04 kg



2.5

Solenoid Valves



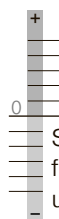
Selected models are available for low temperature application.
Temperature-range: - 50° C to + 50° C.
For detailed information refer to chapter 2.11.



Selected models are available with high flow and low power consumption. For detailed information refer to page 100.



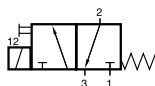
Selected models are available in stainless steel.
For detailed information refer to chapter 2.12.



Selected models can be equipped for high temperature environments up to 80 °C, DC only!

Selected models are available for explosion hazardous environment. They are ATEX-Ex certified.
For detailed information refer to chapter 2.14.





MD 311 010



Direct acting 3/2-way solenoid, valve normally closed (n.c.), equipped with mechanical spring return.

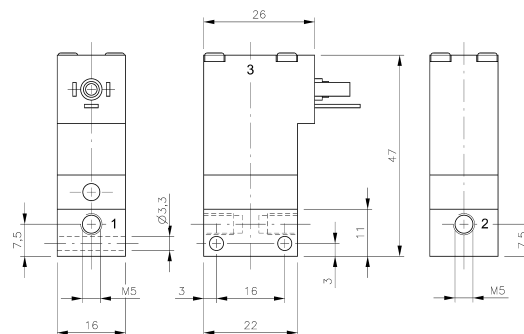
By closing port 3 valve can be converted into a 2/2-way valve.

Available with solenoid operators:
230/50Hz, 110V/50Hz, 24V/50Hz, 24V=,
12V=, 6V= either for connector form C ISO 15217 or
with flying leads, standard cable length 500 mm.

For details about solenoid system, please refer to page 2.13.1.

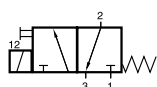
Valves are generally equipped with manual override to push.

Valves can be used for technical vacuum too.

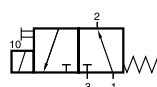


MD 311 010

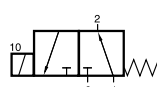
Type	Funktion	Port size	Air flow	Operating press.	Power consumption	Weight
MD 311 010	n.c.	M5	30 l/min	-0,9 - 10 bar	1,8 W = / 3 VA ~	0,05 kg



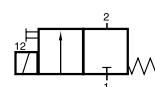
MH 311 012
MH 311 015



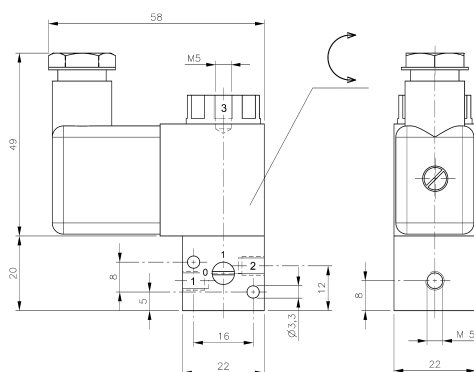
MOH 311 012
MOH 311 015



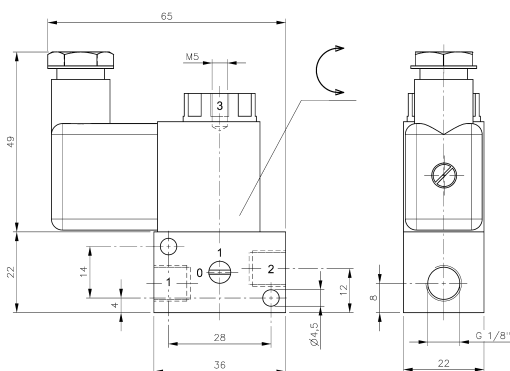
MX 311 012
MX 311 015



MH 211 012
MH 211 015



**MH 311 012/MOH 311 012/MX 311 012/
MH 211 012**



**MH 311 015/MOH 311 015/ MX 311 015
MH 211 015**



Direct acting 3/2-way and 2/2-way solenoid valve equipped with mechanical spring return.

Type MH 311 _ _ _

Normally closed, port 1 and 2 in the valve, port 3 at the top of the solenoid with manual override.

Type MOH 311 _ _ _

Normally open, port 2 and 3 in the valve, port 1 at the top of the solenoid with manual override.

Type MX 311 _ _ _

Normally open, port 1 and 2 in the valve, port 3 at the top of the solenoid, no manual override.

Type MH 211 _ _ _

2/2-way valve n.c. with manual override.

By closing port 3 3/2-way valves can be converted into 2/2-way version, not possible for MX.

Please notice: Drawings are for MH 311 _ _ _-valves.

For MOH-valves ports 1 and 3 are swapped, for MH 211 port 3 is not existing. Operator system of MX-valve is 8 mm longer. MOH 311 and MH 211-valves are equipped with a flat plastic nut.

Available with solenoid operators:

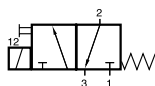
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

Valves can be used for technical vacuum too.

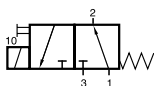
Type	Ways	Function	Port size			Air flow	Operating pressure	Power-consumption	Weight
			1	2	3				
MH 311 012	3/2	n.c.	M5	M5	M5	40 l/min	-0,9 - 10 bar	3 W = / 5 VA ~	0,12 kg
MH 311 015	3/2	n.c.	G 1/8"	G 1/8"	M5	50 l/min	-0,9 - 10 bar	3 W = / 5 VA ~	0,14 kg
MOH 311 012	3/2	n.o.	M5	M5	M5	40 l/min	-0,9 - 10 bar	3 W = / 5 VA ~	0,12 kg
MOH 311 015	3/2	n.o.	M5	G 1/8"	G 1/8"	50 l/min	-0,9 - 10 bar	3 W = / 5 VA ~	0,14 kg
MX 311 012	3/2	n.o.	M5	M5	hole	40 l/min	-0,9 - 8 bar	3 W = / 5 VA ~	0,13 kg
MX 311 015	3/2	n.o.	G 1/8"	G 1/8"	hole	50 l/min	-0,9 - 8 bar	3 W = / 5 VA ~	0,15 kg
MH 211 012	2/2	n.c.	M5	M5		40 l/min	-0,9 - 10 bar	3 W = / 5 VA ~	0,12 kg
MH 211 015	2/2	n.c.	G 1/8"	G 1/8"		50 l/min	-0,9 - 10 bar	3 W = / 5 VA ~	0,14 kg



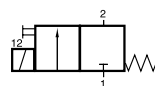
MH 311 305/MH 311 309/MOH 311 305
MOH 311 309/MH 211 305/MH 211 309



MH 311 305
MH 311 309



MOH 311 305
MOH 311 309



MH 211.305
MH 211.309



Direct acting 3/2-way and 2/2-way solenoid valve
equipped with mechanical spring return.
Orifice size: 3 mm, max. pressure: 7 bar.

Type MH 311 ____

Normally closed, port 1 and 2 in the valve, port 3 at the top of the solenoid

Type MOH 311 ____

Normally open, port 2 and 3 in the valve, port 1 at the top of the solenoid

Type MH 211 _ _ _

2/2-way valve n.c.

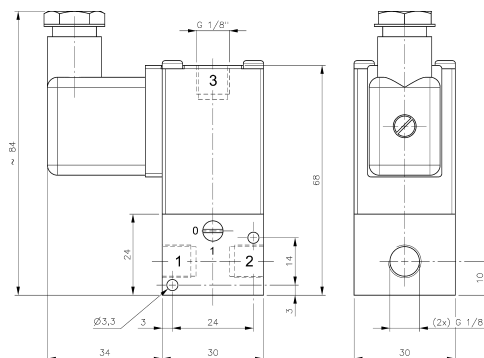
Please notice:

Drawings are for MH 311 ___-valves. For MOH-valves ports 1 and 3 are swapped, for MH 211 port 3 is not existing.

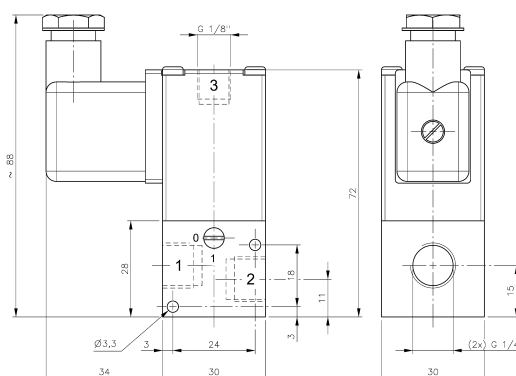
Available with solenoid operators:
230V/50Hz, 24V/50Hz, 24V=.

Valves are generally equipped with manual override.

Connector Industry B (22 mm). Flying leads on request.

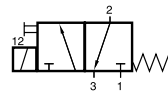


MH 311 305/MOH 311 305/MH 211 305

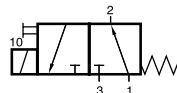


MH 311 309/MOH 311 309/MH 211 309

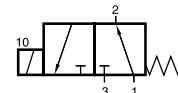
Type	Ways	Function	Port size			Air flow	Operating Power		Weight
			1	2	3		pressure	consumption	
MH 311 305	3/2	n.c.	G 1/8"	G 1/8"	G 1/8"	200 l/min	0 - 7 bar	7,5 W = /8,5 VA ~ 0,17 kg	
MH 311 309	3/2	n.c.	G 1/4"	G 1/4"	G 1/8"	200 l/min	0 - 7 bar	7,5 W = /8,5 VA ~ 0,18 kg	
MOH 311 305	3/2	n.o.	G 1/8"	G 1/8"	G 1/8"	200 l/min	0 - 7 bar	7,5 W = /8,5 VA ~ 0,17 kg	
MOH 311 309	3/2	n.o.	G 1/4"	G 1/4"	G 1/8"	200 l/min	0 - 7 bar	7,5 W = /8,5 VA ~ 0,18 kg	
MH 211 305	2/2	n.c.	G 1/8"	G 1/8"		200 l/min	0 - 7 bar	7,5 W = /8,5 VA ~ 0,17 kg	
MH 211 309	2/2	n.c.	G 1/4"	G 1/4"		200 l/min	0 - 7 bar	7,5 W = /8,5 VA ~ 0,18 kg	



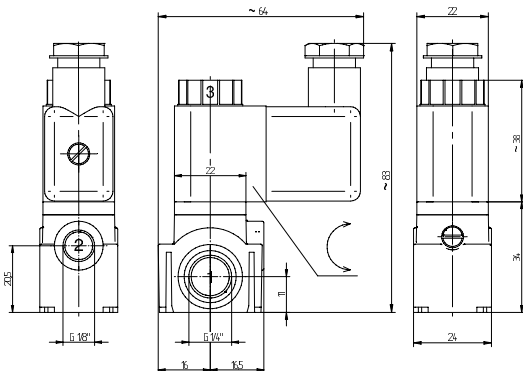
MH 311 105



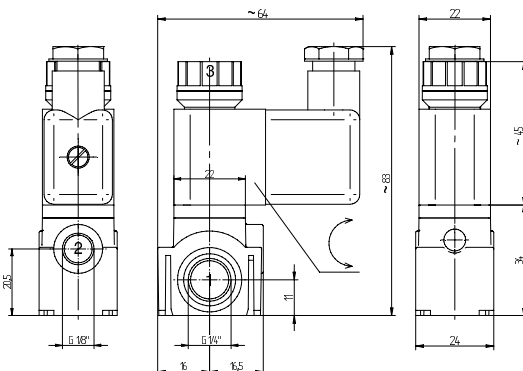
MOH 311 105



MX 311 105



MH 311 105/MOH 311 105



MX 311 105



Direct acting 3/2-way solenoid valve, equipped with mechanical spring return, body made from polyamide.

Type MH 311 105

Normally closed, port 1 in the body, including manual override

Type MOH 311 105

Normally open, port 1 at the top of the solenoid, including manual override

Type MX 311 105

Normally open, port 1 in the body, no manual override

Individual valves can easily be combined to manifold systems just by putting 2 brass brackets (type VBM 105) into the bodies from the bottom. MH and MX valves can be combined in the same manifold system.

By closing port 3 valves can be turned into 2/2-way valves.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

Valves can be used for technical vacuum too.

Available and useful accessories:

KV SET 01

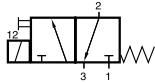
Set to connect two valves consisting of two brass clamping brackets and a NBR O-ring.

3015 – 1/4

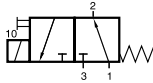
Plug to close one side of the two supply ports in the valve, brass, nickel plated G1/4" with O-ring seal.

Type	Function	Port size			Air flow	Operating pressure	Power consumption	Weight
		1	2	3				
MH 311 105	n.c.	G 1/4"	G 1/8"	M5	60 l/min	-0,9 - 10 bar	3 W= / 5 VA	0,09 kg
MOH 311 105	n.o.	M5	G 1/8"	G 1/4"	60 l/min	-0,9 - 10 bar	3 W= / 5 VA	0,09 kg
MX 311 105	n.o.	G 1/4"	G 1/8"	hole	60 l/min	-0,9 - 8 bar	3 W= / 5 VA	0,09 kg

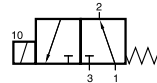
MH 311 014/MOH 311 014 MH 311 019/MX 311 019



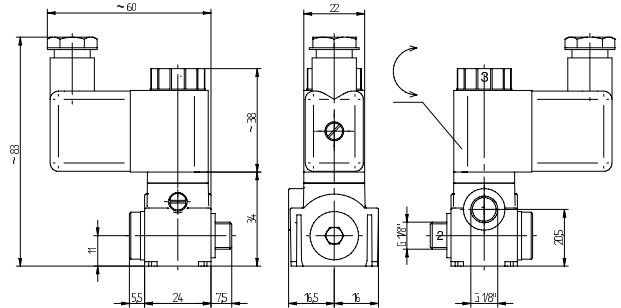
MH 311 014
MH 311 019



MOH 311 014



MX 311 019



MH 311 014/MOH 311 014

Direct acting 3/2-way solenoid valve equipped with spring return. Orifice size 1.3 mm.

Type MH 311 014:

Normally closed, port 1 in the valve, port 2 as banjo screw, exhaust through operator system with manual override.

Type MH 311 019 __:

Normally closed, port 1 swivel either 1/8" or 6 mm pif, port 2 as banjo screw, exhaust through operator system with manual override.

Type MOH 311 014:

Normally open, port 1 at the top of the operator system, port 2 as banjo screw, exhaust at the body, manual override included, delivery with flat nut. Drawing displays MH-valve, for MOH ports 1 and 3 swapped.

Type MX 311 019 __:

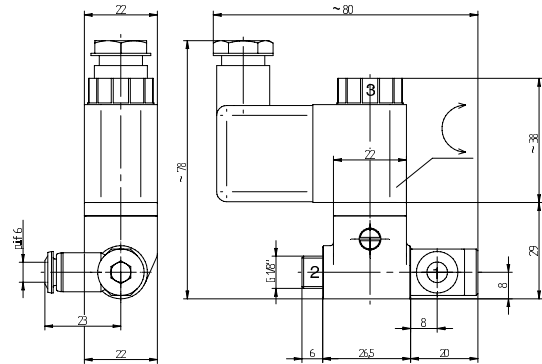
Normally open, port 1 swivel either 1/8" or 6 mm pif, port 2 as banjo screw, exhaust through operator system no manual override. Operator system is 8 mm longer than in drawing.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

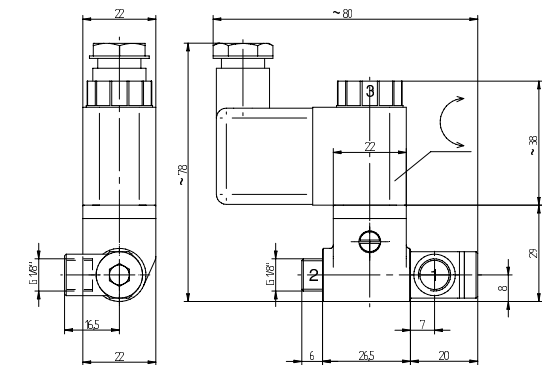
Available and useful accessory:

KV SET 02

Reducer fitting for banjo-screw to change from 1/8" to 1/4", with captive seal.

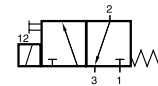


MH 311 019 6/MX 311 109 6

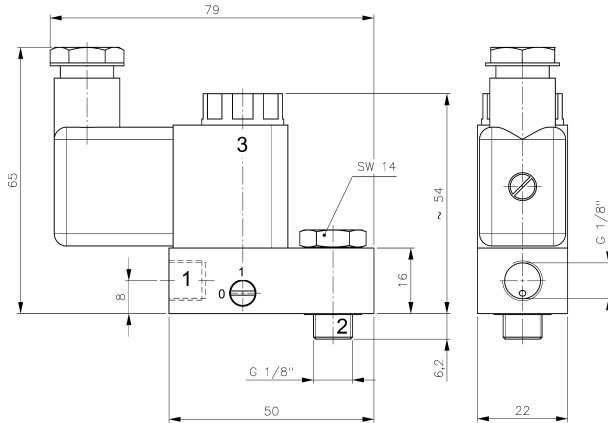


MH 311 019 1/8 / MX 311 019 1/8

Type	Funct.	Port 1	Port 2 banjo	Port 3	Air flow	Operating pressure	Power cons.	Weight
MH 311 014	n.c.	G 1/8"	G 1/8"	M5	60 l/min	-0,9 - 10 bar	3 W= / 5 VA	0,13 kg
MOH 311 014	n.o.	M5	G 1/8"	G 1/8"	60 l/min	-0,9 - 10 bar	3 W= / 5 VA	0,13 kg
MH 311 019 6	n.c.	Swivel 6 mm pif	G 1/8"	M5	50 l/min	-0,9 - 10 bar	3 W= / 5 VA	0,16 kg
MX 311 019 6	n.o.	Swivel 6 mm pif	G 1/8"	M5	50 l/min	-0,9 - 8 bar	3 W= / 5 VA	0,16 kg
MH 311 019 1/8	n.c.	Swivel G 1/8"	G 1/8"	hole	50 l/min	-0,9 - 10 bar	3 W= / 5 VA	0,16 kg
MX 311 019 1/8	n.o.	Swivel G 1/8"	G 1/8"	hole	50 l/min	-0,9 - 8 bar	3 W= / 5 VA	0,16 kg



MH 311 013
MH 311 017



MH 311 013



Direct acting 3/2-way solenoid valve equipped with mechanical spring return, normally closed.

Port 2 is a banjo that can be screwed directly into the actuator that is to be controlled.

Products with port 1 in NPT on request.

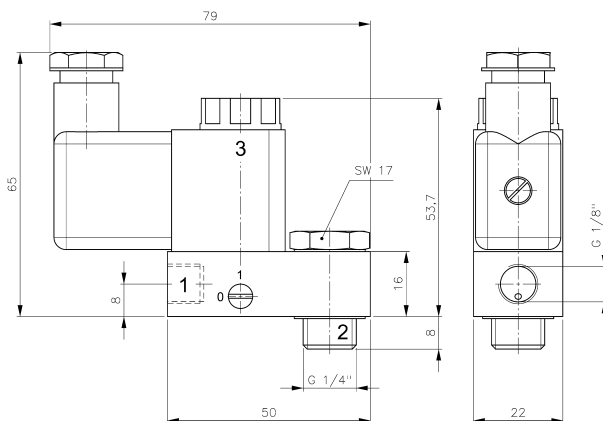
Products normally open on request.

2/2-way version on request.

Available with solenoid operators:

230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

Valves are generally equipped with manual override.



MH 311 017



MH 311 013 and MH 311 017 are designed for piloting angle seat valves or small spring-return actuators.

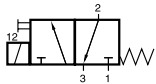
When assembling this type of valve to a spring-return actuator, please take into consideration that there is no exhaust air recirculation ("purge").

Instead of the standard banjo-screw, the valve can also be equipped with a flow-regulating banjo-screw.

Three different versions are available on request: Banjo-screw to regulate the opening speed, the closing speed as well as the opening and closing speed (not independent).

Type	Function	Port			Air flow	Operating pressure	Power consumption	Weight
		1	2 banjo	3				
MH 311 013	n.c.	G 1/8"	G 1/8"	M5	50 l/min	0 - 10 bar	3 W = / 5 VA ~	0,14 kg ❄
MH 311 017	n.c.	G 1/8"	G 1/4"	M5	50 l/min	0 - 10 bar	3 W = / 5 VA ~	0,16 kg ❄

MH 311 313/MH 311 317



MH 311 313
MH 311 317



Direct acting 3/2-way solenoid valve equipped with mechanical spring return, normally closed. Orifice size: 3 mm, max. pressure: 7 bar.

Port 2 is a banjo that can be screwed directly into the actuator that is to be controlled.

Products with port 1 in NPT on request.
Products normally open on request.
2/2-way version on request.

Available with solenoid operators:
230V/50Hz, 24V/50Hz, 24V=.

Valves are generally equipped with manual override.

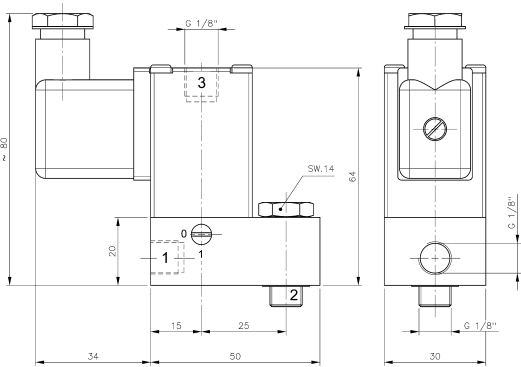
Connector Industry B (22 mm). Flying leads on request.

MH 311 313 and MH 311 317 are designed for pilot-
ing angle seat valves or small spring-return actua-
tors.

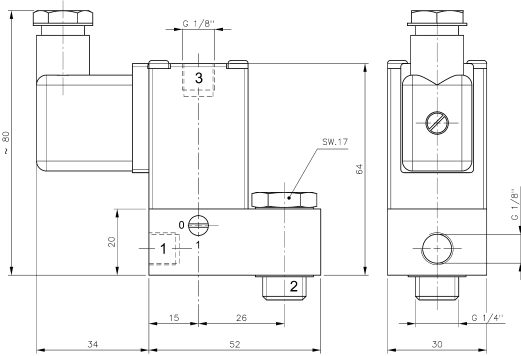
When assembling this type of valve to a spring-
return actuator, please take into consideration that
there is no exhaust air recirculation ("purge").

Instead of the standard banjo-screw, the valve can
also be equipped with a flow-regulating banjo-
screw.

Three different versions are available on request:
Banjo-screw to regulate the opening speed, the
closing speed as well as the opening and closing
speed (not independent).



MH 311 313

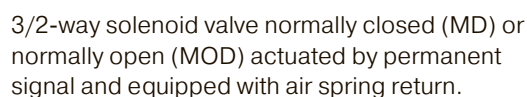
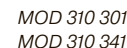
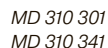


MH 311 317



Type	Function	Port			Air flow	Operating pressure	Power consumption	Weight
		1	2 banjo	3				
MH 311 313	n.c.	G 1/8"	G 1/8"	G 1/8"	150 l/min	0 - 7 bar	7,5 W = /8,5 VA ~	0,21 kg
MH 311 317	n.c.	G 1/8"	G 1/4"	G 1/8"	150 l/min	0 - 7 bar	7,5 W = /8,5 VA ~	0,22 kg

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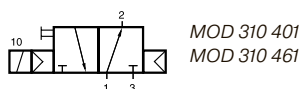
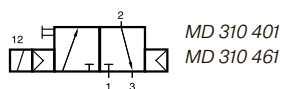


Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=,
12V=, 6V= either for connector form C ISO 15217
or with flying leads, standard cable length 500 mm.
For details about solenoid system, please refer to
page 2.13.1.

Valves are generally equipped with manual override to push.

HAFNER

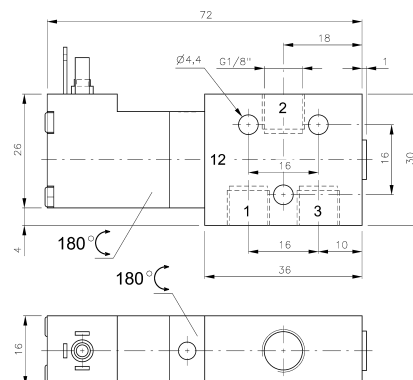
MD 310 401/MD 310 461
MOD 310 401/MOD 310 461



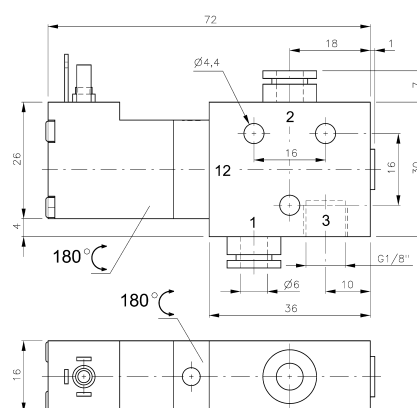
3/2-way solenoid valve normally closed (MD) or normally open (MOD) actuated by permanent signal and equipped with air spring return.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=,
12V=, 6V= either for connector form C ISO 15217
or with flying leads, standard cable length 500 mm.
For details about solenoid system, please refer to
page 2.13.1.

Valves are generally equipped with manual override to push.



MD 310 401/MOD 310 401

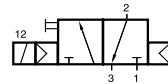


MD 310 461/MOD 310 461

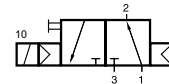
Type	Function	Port size 1 and 2	Air flow	Operating pressure	Power consumption	Weight
MD 310 401	n.c.	G 1/8"	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,09 kg
MD 310 461	n.c.	pif 6 mm	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,10 kg
MOD 310 401	n.o.	G 1/8"	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,09 kg
MOD 310 461	n.o.	pif 6 mm	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,10 kg

MH 310 302/MH 310 502 MOH 310 302/MOH 310 502

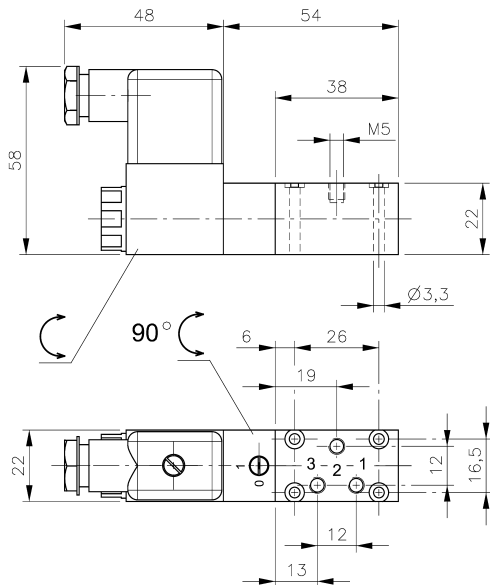
2.5.1.1.10
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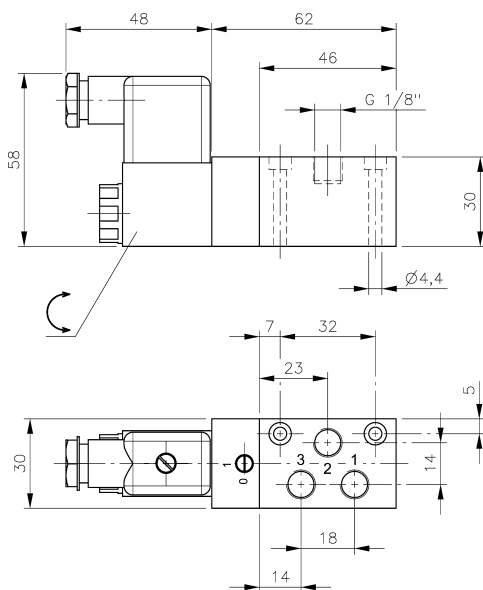
MH 310 302
MH 310 502



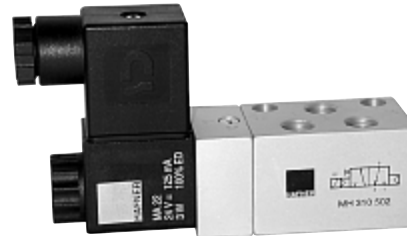
MOH 310 302
MOH 310 502



MH 310 302/MOH 310 302



MH 310 502/MOH 310 502



3/2-way solenoid valve normally closed (MH) or normally open (MOH) actuated by permanent signal and equipped with air spring return.

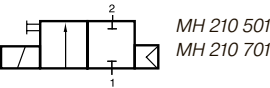
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override.
If requested without manual override please order
M 310 ____ / MO 310 ____.

Please notice:
Do not close port 3 to convert into a 2-way valve.

Type	Function	Port size 1 and 2	Air flow	Operating pressure	Power consumption	Weight
MH 310 302	n.c.	M5	180 l/min	2 - 10 bar	3 W = / 5 VA ~	0,18 kg
MH 310 502	n.c.	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,25 kg
MOH 310 302	n.o.	M5	180 l/min	2 - 10 bar	3 W = / 5 VA ~	0,18 kg
MOH 310 502	n.o.	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,25 kg

MH 210 501/MH 210 701

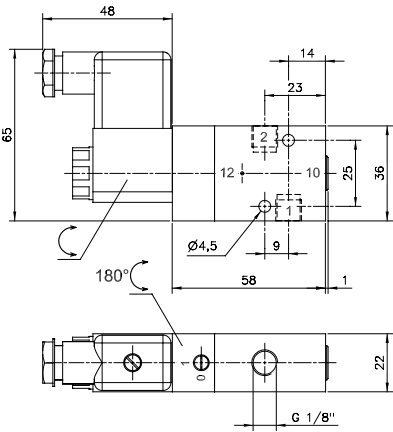


2/2-way solenoid valve, normally closed, actuated by permanent signal and equipped with air spring return.

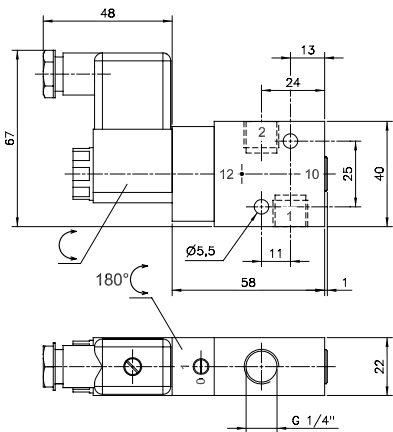
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

Valves are generally equipped with manual override.

Normally open version (MOH) on request.



MH 210 501

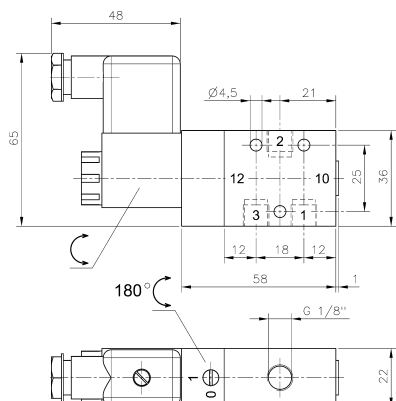
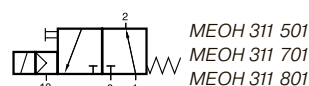
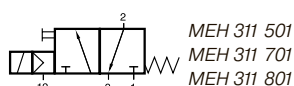
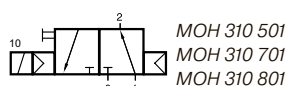
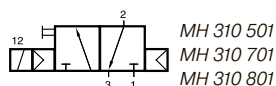


MH 210 701

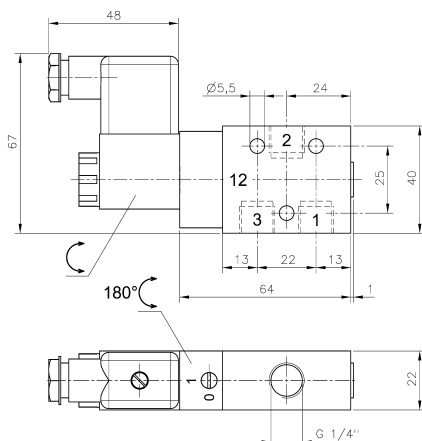
Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 210 501	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,19 kg
MH 210 701	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,19 kg

MH 310 501/MH 310 701/MH 310 801 MOH 310 501/MOH 310 701/MOH 310 801

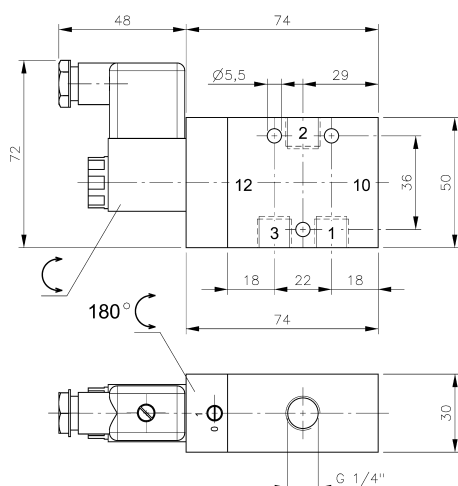
2.5.1.1.12
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MH 310 501/MOH 310 501



MH 310 701/MOH 310 701



MH 310 801/MOH 310 801











3/2-way solenoid valve normally closed (MH) or normally open (MOH) actuated by permanent signal and equipped with air spring return.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

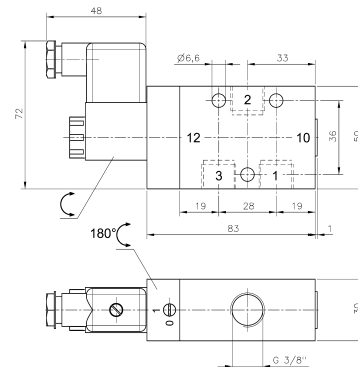
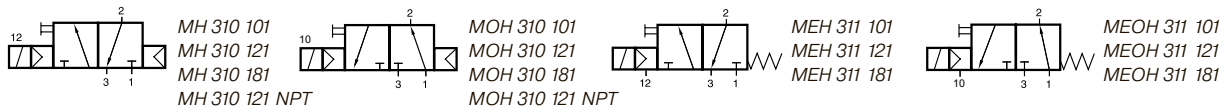
Valves are generally equipped with manual override. If requested without manual override please order M 310 ___ / MO 310 ___

Valves are also available with external pilot feed. Type: MEH 311 ___ (n.c.) or MEOH 311 ___ (n.o.). Port 12 series 501 and 701 M5, series 801 G 1/8". Minimum actuation pressure: 3 bar. Operating pressure: 0 - 10 bar. Version for vacuum on request.

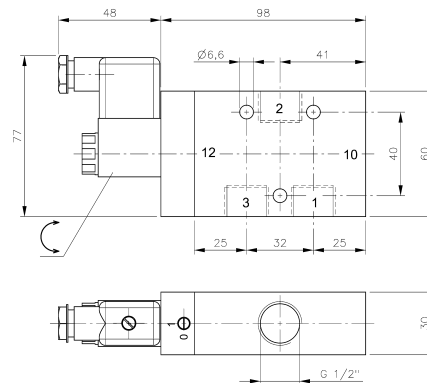
Please notice:
Do not close port 3 to convert into a 2-way valve.

Type	Function	Port size	Air flow	Operating press.	Power consumption	Weight
MH 310 501	n.c.	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,19 kg 
MH 310 701	n.c.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,21 kg  MK 
MH 310 801	n.c.	G 1/4"	1450 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,39 kg 
MOH 310 501	n.o.	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,19 kg 
MOH 310 701	n.o.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,21 kg  MK 
MOH 310 801	n.o.	G 1/4"	1450 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,39 kg 

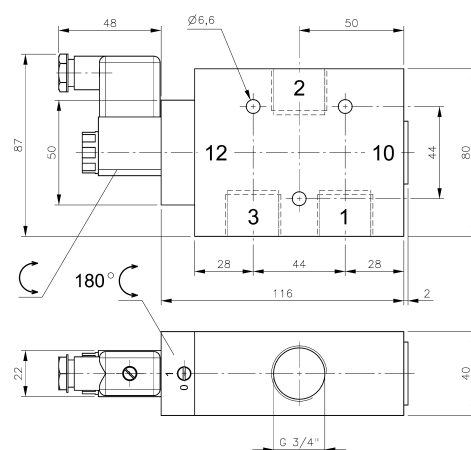
MH 310 101/MH 310 121/MH 310 181 MOH 310 101/MOH 310 121/MOH 310 181



MH 310 101/MOH 310 101



**MH 310 121/MOH 310 121
MH 310 121 NPT/MOH 310 121 NPT**



MH 310 181/MOH 310 181

3/2-way solenoid valve normally closed (MH) or normally open (MOH) actuated by permanent signal and equipped with air spring return.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override. If requested without manual override please order M 310 ___ / MO 310 ___.

Valves are also available with external pilot feed.
Type: MEH 311 ___ (n.c.) or MEOH 311 ___ (n.o.).
Port 12: G 1/8\".

Minimum actuation pressure: 3 bar.

Operating pressure: 0 - 10 bar.

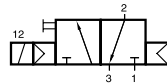
Version for vacuum on request.

Please notice:
Do not close port 3 to convert into a 2-way valve.

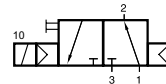
Type	Function	Port size	Air flow	Operating press.	Power cons.	Weight
MH 310 101	n.c.	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,41 kg
MH 310 121	n.c.	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,53 kg
MH 310 181	n.c.	G 3/4"	6000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,88 kg
MOH 310 101	n.o.	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,41 kg
MOH 310 121	n.o.	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,53 kg
MOH 310 181	n.o.	G 3/4"	6000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,88 kg
MH 310 121 NPT	n.o.	1/2" NPT	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,53 kg
MOH 310 121 NPT	n.o.	1/2" NPT	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,53 kg

MH 310 501 G/MH 310 701 G MOH 310 501 G/MOH 310 701 G

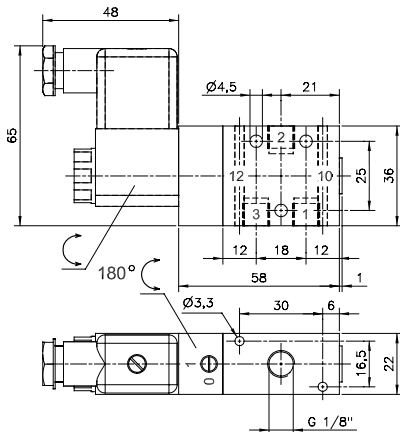
2.5.1.1.14
page 89



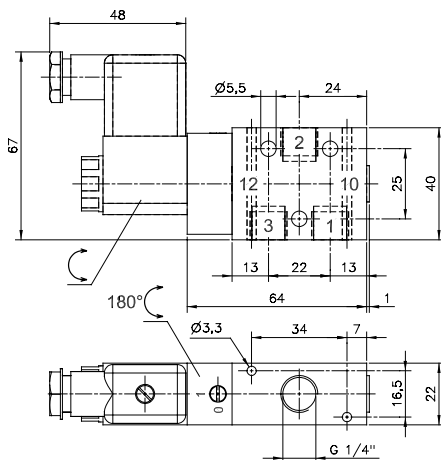
MH 310 501 G
MH 310 701 G
MH 310 701 G NPT



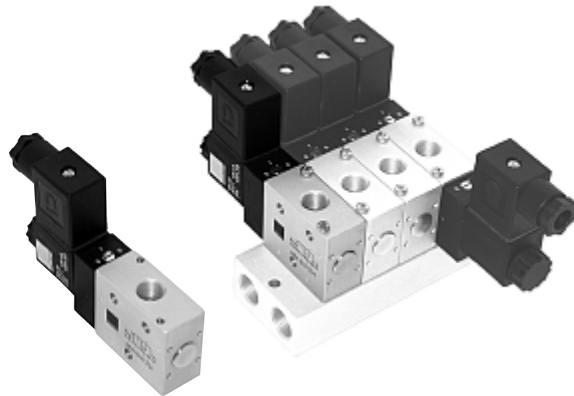
MOH 310 501 G
MOH 310 701 G
MOH 310 701 G NPT



MH 310 501 G/MOH 310 501 G



**MH 310 701 G/MOH 310 701 G
MH 310 701 G NPT/ MOH 310 701 G NPT**



3/2-way solenoid valve normally closed (MH) or normally open (MOH) actuated by permanent signal and equipped with air spring return.

Valves can either be used in-line or to be assembled onto a manifold plate. Manifolds are displayed on page 2.7.1.4.

Normally open and normally closed products can be mixed on one plate.

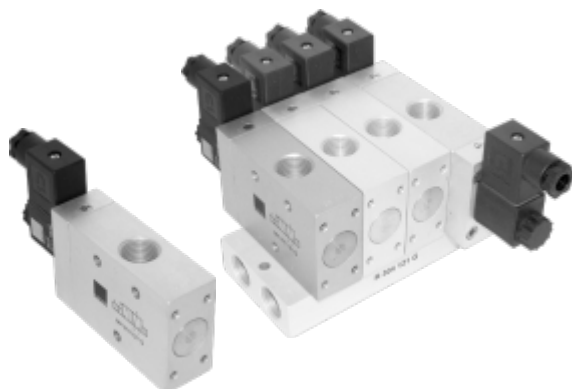
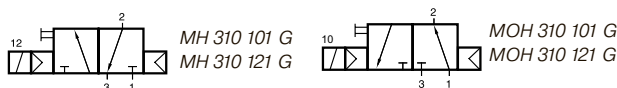
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override.
If requested without manual override please order
M 310 ____ / MO 310 ____.

Please notice:
Do not close port 3 to convert into a 2-way valve.

Type	Function	Port size	Air flow	Operating press.	Power cons.	Weight
MH 310 501 G	n.c.	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,20 kg
MH 310 701 G	n.c.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,21 kg MK
MOH 310 501 G	n.o.	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,20 kg
MOH 310 701 G	n.o.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,21 kg MK
MH 310 701 G NPT	n.c.	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,21 kg
MOH 310 701 G NPT	n.o.	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,21 kg

MH 310 101 G/MH 310 121 G MOH 310 101 G/MOH 310 121 G



3/2-way solenoid valve normally closed (MH) or normally open (MOH) actuated by permanent signal and equipped with air spring return.

Valves can either be used in-line or to be assembled onto a manifold plate. Manifolds are displayed on page 2.7.1.5.

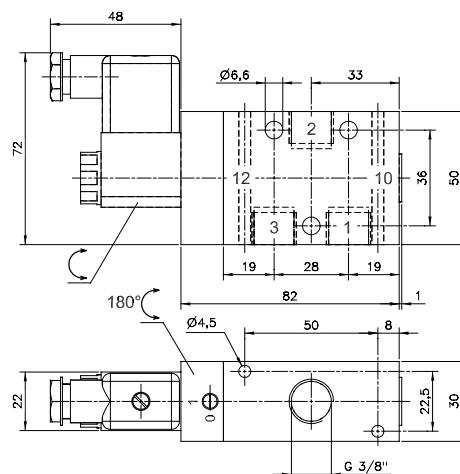
Normally open and normally closed products can be mixed on one plate.

Valves G1/2" have to be assembled onto the plate by fixing screws from the bottom through the plate into the valve.

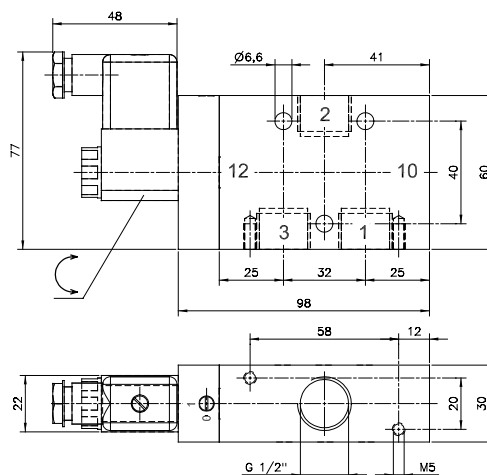
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

Valves are generally equipped with manual override. If requested without manual override please order M 310 ___ / MO 310 ___.

Please notice:
Do not close port 3 to convert into a 2-way valve.

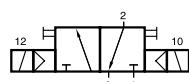


MH 310 101 G/MOH 310 101 G

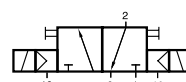


MH 310 121 G/MOH 310 121 G

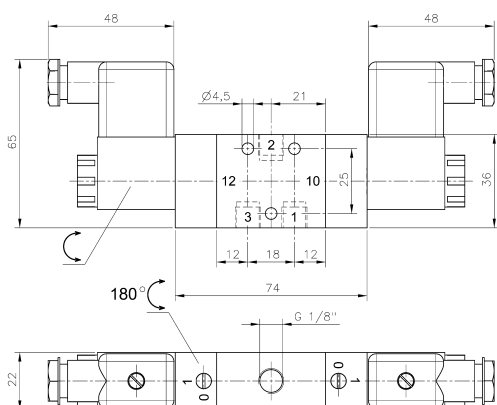
Type	Function	Port size	Air flow	Operating press.	Power consumption	Weight
MH 310 101 G	n.c.	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,41 kg
MH 310 121 G	n.c.	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,53 kg
MOH 310 101 G	n.o.	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,41 kg
MOH 310 121 G	n.o.	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,53 kg



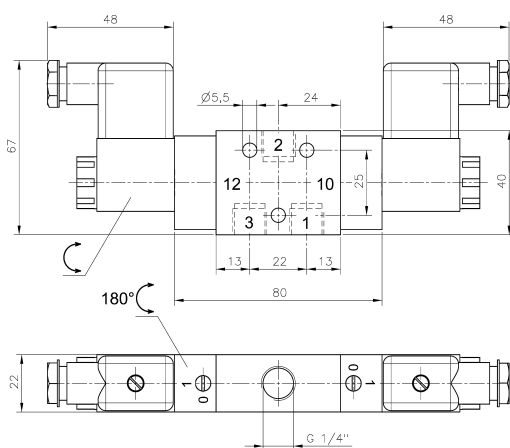
MH 320 501
MH 320 701
MH 320 801



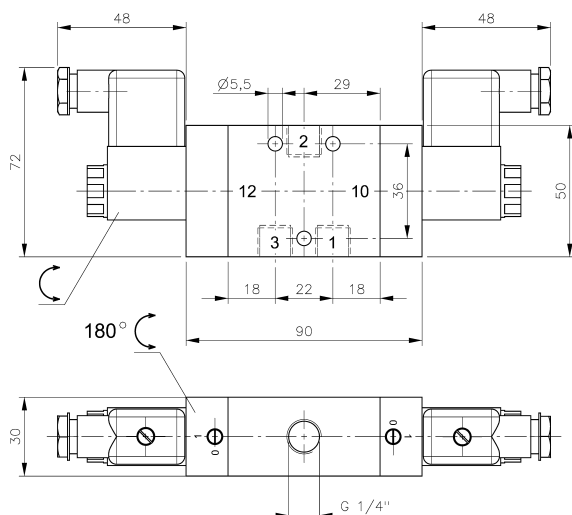
MEH 320 501
MEH 320 701
MEH 320 801



MH 320 501



MH 320 701



MH 320 801



3/2-way double solenoid valve actuated by impulse. Position is kept until an electrical signal is applied to the opposite side even when not attached to an electrical source.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

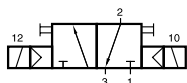
Valves are generally equipped with manual override. If requested without manual override please order type no. M 320 ____.

Valves are also available with external pilot feed.
Type: MEH 320 ____.
Port 12 series 501 and 701 M5, series 801 G 1/8".
Minimum actuation pressure: 2,5 bar.
Operating pressure: 0 - 10 bar.
Version for vacuum on request.

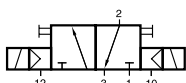
Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 320 501	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,29 kg
MH 320 701	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,31 kg
MH 320 801	G 1/4"	1450 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,54 kg



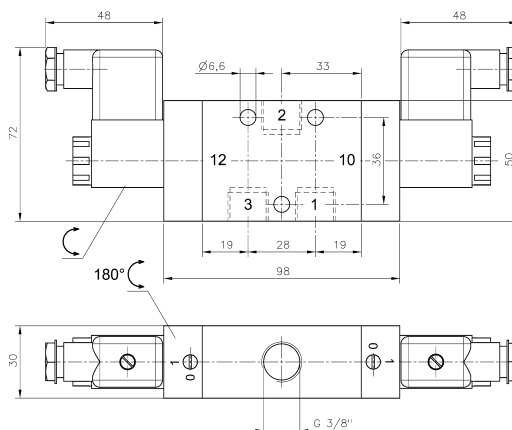
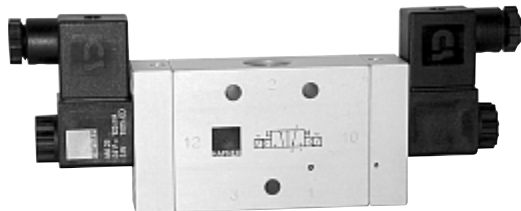
MH 320 101/MH 320 121/MH 320 181



MH 320 101
MH 320 121
MH 320 181



MEH 320 101
MEH 320 121
MEH 320 181



MH 320 101

3/2-way double solenoid valve actuated by impulse. Position is kept until an electrical signal is applied to the opposite side even when not attached to an electrical source.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override. If requested without manual override please order type no. M 320 ____.

Valves are also available with external pilot feed.

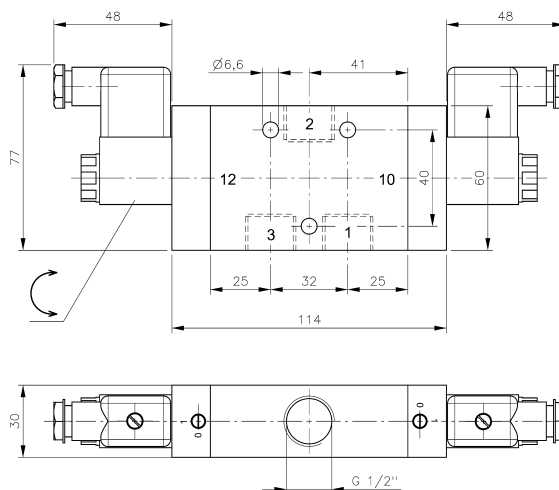
Type: MEH 320 ____.

Port 12: G 1/8".

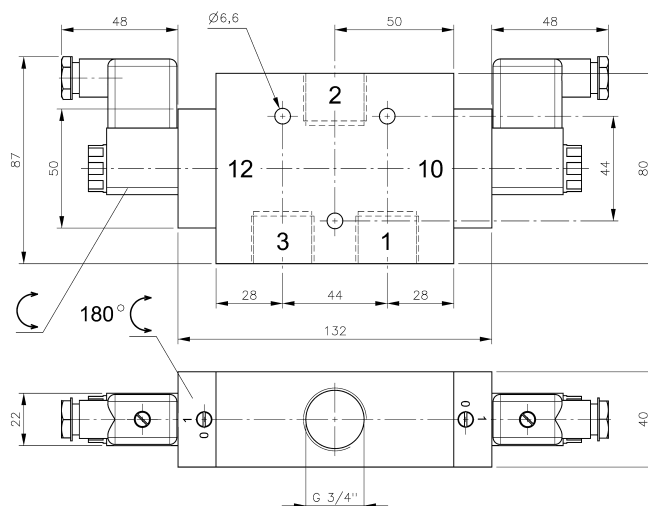
Minimum actuation pressure: 2,5 bar.

Operating pressure: 0 - 10 bar.

Version for vacuum on request.



MH 320 121

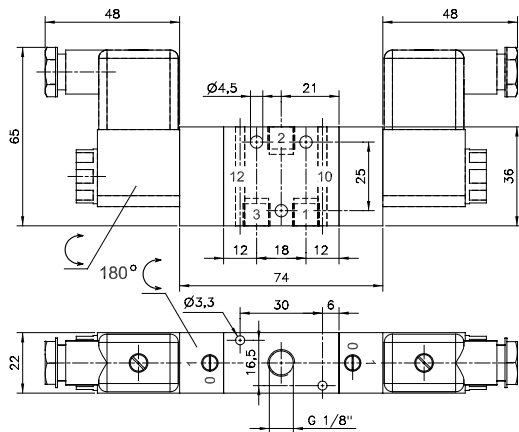


MH 320 181

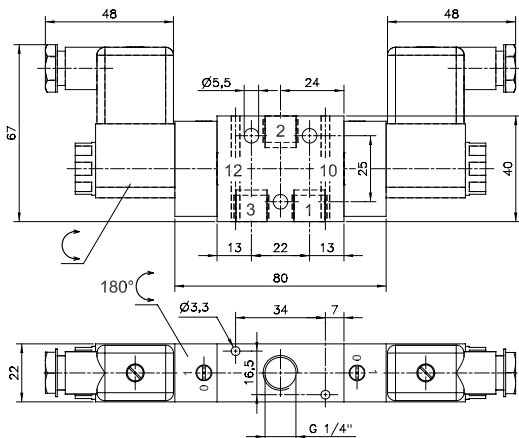
Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 320 101	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,58 kg
MH 320 121	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,70 kg
MH 320 181	G 3/4"	6000 l/min	1 - 10 bar	3 W = / 5 VA ~	1,08 kg

MH 320 501 G/MH 320 701 G MH 320 101 G/MH 320 121 G

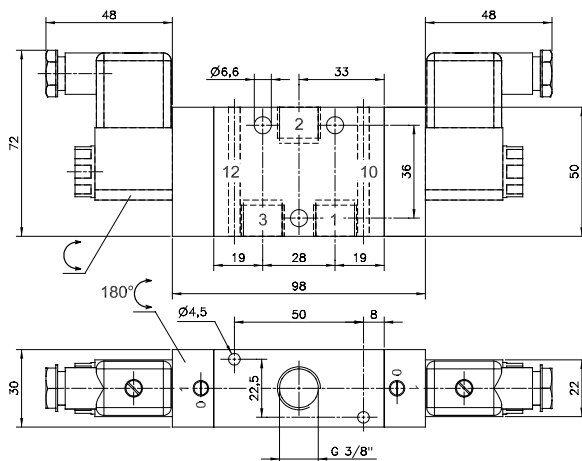
2.5.1.1.18
page 93



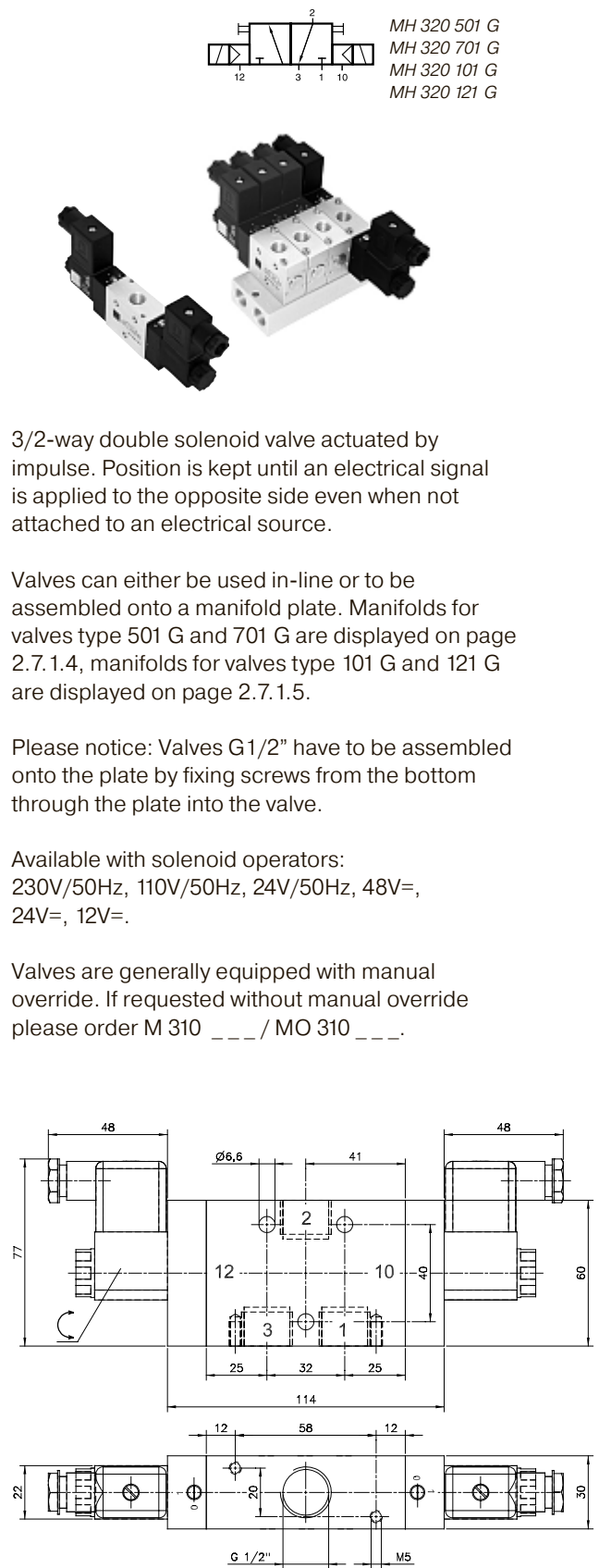
MH 320 501 G



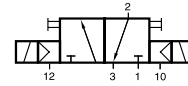
MH 320 701 G



MH 320 101 G



MH 320 121 G



MH 320 501 G
MH 320 701 G
MH 320 101 G
MH 320 121 G

3/2-way double solenoid valve actuated by impulse. Position is kept until an electrical signal is applied to the opposite side even when not attached to an electrical source.

Valves can either be used in-line or to be assembled onto a manifold plate. Manifolds for valves type 501 G and 701 G are displayed on page 2.7.1.4, manifolds for valves type 101 G and 121 G are displayed on page 2.7.1.5.

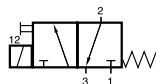
Please notice: Valves G 1/2" have to be assembled onto the plate by fixing screws from the bottom through the plate into the valve.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override. If requested without manual override please order M 310 ___ / MO 310 ___.

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 320 501 G	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,29 kg
MH 320 701 G	G 1/4"	250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,31 kg
MH 320 101 G	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,58 kg
MH 320 121 G	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,70 kg

HAFNER



MD.311 104



System consisting of direct acting 3/2-way solenoid valves, normally closed, actuated by permanent signal and manifold plates for common pressure supply (1). Port 2 is in the plate, either threaded M5 or with 4 mm push-in fitting, exhaust through the operator tube, thread M3.

Valves

Type MD 311 104:

with electrical connection C ISO 15217, pins are 8 mm apart

Type MD 311 104 L:

with flying leads standard length 500 mm

Available with solenoid operators:

230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=, 12V=, 6V=.

For details about solenoid system, please refer to page 2.13.1.

Valves are generally equipped with manual override to push.

Plates

RD 3 104:

with M5 at port 2 (add 2 digits for number of positions required)

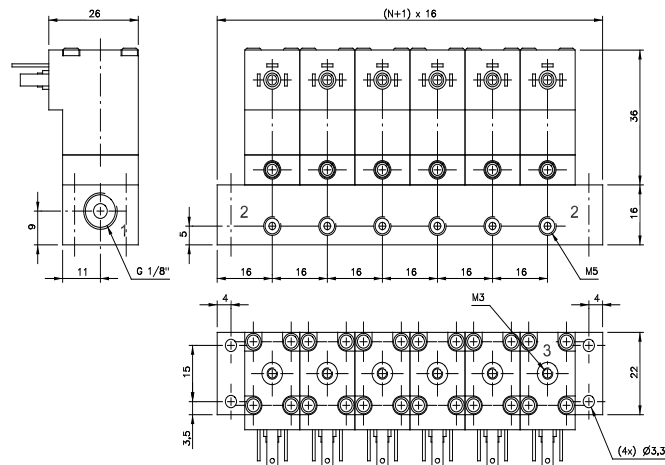
RD 3 144:

with pif 4 mm at port 2 (add 2 digits for number of positions required)

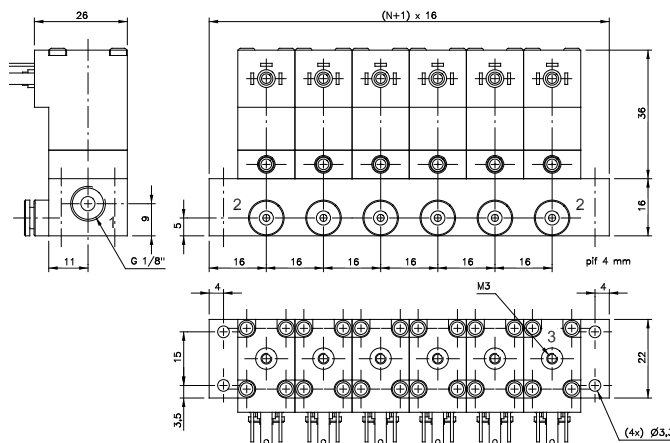
Plates are available with 2, 3, 4, 5, 6, 8, 10 and 12 positions, others on request.

Products are to be ordered individually but system will be delivered fully assembled.

Versions with common electrical connection (terminals) are displayed on page 2.8.2.1



MD 311 104/RD 3__104

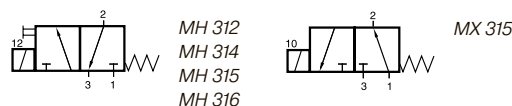


MD 311 104/RD 3__144

Valves can be used for technical vacuum too.

Type	Electric interface	Air flow	Operating press.	Power consumption	Weight
MD 311 104	form C, 8 mm pin	30 l/min	-0,9 - 10 bar	1,8 W = / 3,0 VA ~	0,06 kg
MD 311 104 L	flying leads	30 l/min	-0,9 - 10 bar	1,8 W = / 3,0 VA ~	0,07 kg

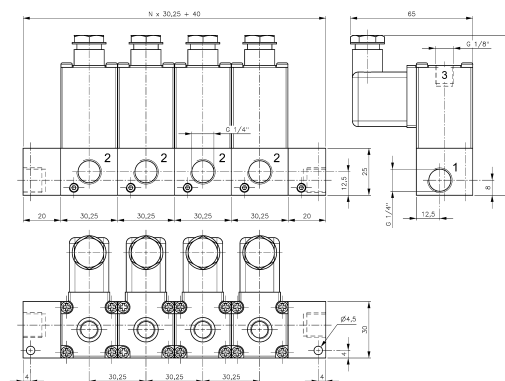
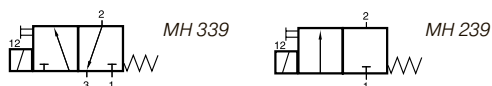
2.5.1.2.2
page 95

[illegible]

MH 316

Valves can be used for technical vacuum too.

Type	Function	Port 2	Air flow	Operating press.	Power consumption	Weight	
MH 312	n.c.	M5	40 l/min	-0,9 - 10 bar	3 W = / 5 VA ~	0,13 kg	Ex
MH 314	n.c.	pif 4 mm	40 l/min	-0,9 - 10 bar	3 W = / 5 VA ~	0,13 kg	
MH 315	n.c.	G 1/8"	50 l/min	-0,9 - 10 bar	3 W = / 5 VA ~	0,13 kg	Ex
MH 316	n.c.	pif 6 mm	50 l/min	-0,9 - 10 bar	3 W = / 5 VA ~	0,13 kg	
MX 315	n.o.	G 1/8"	50 l/min	-0,9 - 10 bar	3 W = / 5 VA ~	0,14 kg	



Modular system MH 339/MH 239

Modular system consisting of direct acting 3/2-way or 2/2-way solenoid valves normally closed, actuated by permanent signal and endplates for common pressure supply (1). Port 2 is in the valve, G 1/4", exhaust through the operator tube, thread G 1/8".

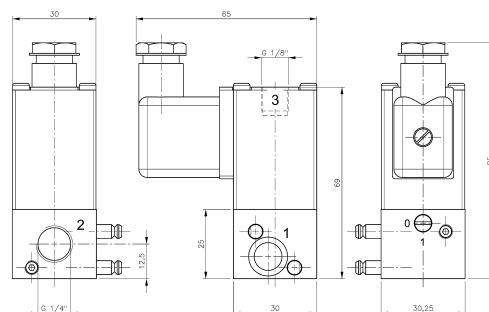
By opening 2 hexagonsocket screws at the bodies the system can be taken apart at any point and valves can be added or taken away.

Valves:

Type MH 339: 3/2-way – drawings show 3/2-way valves

Type MH 229: 2/2-way – 2/2-way without port 3

Orifice size: 3 mm, max. pressure: 7 bar.



Individual valve MH 339/MH 239

Available with solenoid operators:

230V/50Hz, 24V/50Hz, 24V=

Connector Industry B (22 mm). Flying leads on request.

Valves are generally equipped with manual override.

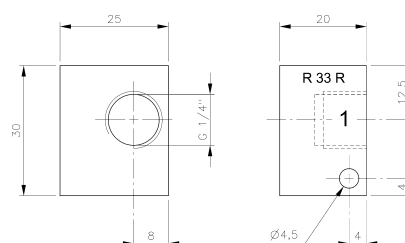
The system consists of:

End-plate right type R 33 R

End-plate left type R 33 L

Individual valve 3/2-way type MH 339

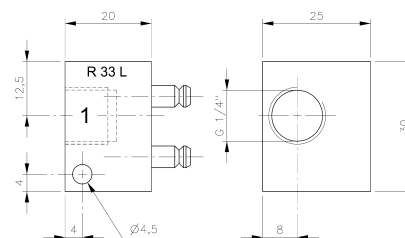
Individual valve 2/2-way type MH 229



End-plate right R 33 R

The end-plates can be equipped with DIN-rail mounting clips. For details, please refer to page 2.7.3.

Products are to be ordered individually but system can be delivered fully assembled.

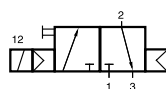


End-plate left R 33 L

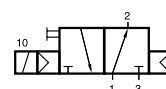
Type	Ways	Function	Port size			Air flow	Operating Power		Weight
			1	2	3		pressure	consumption	
MH 339	3/2	n.c.	G 1/4"	G 1/8"	200 l/min	0 - 7 bar	7,5 W =	/8,5 VA ~ 0,18 kg	
MH 239	2/2	n.c.	G 1/4"		200 l/min	0 - 7 bar	7,5 W =	/8,5 VA ~ 0,18 kg	
R 33	R	end-plate right	G 1/4"					0,04 kg	
R 33	L	end-plate left	G 1/4"					0,04 kg	

MD 310 343/MD 310 403/MD 310 463 MOD 310 343/MOD 310 403/MOD 310 463

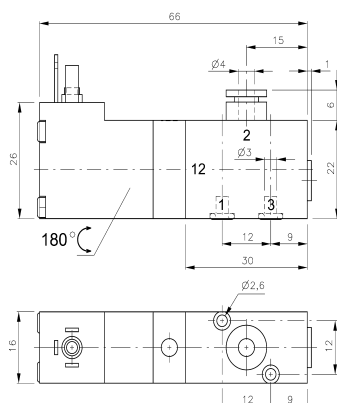
2.5.1.2.4
page 97



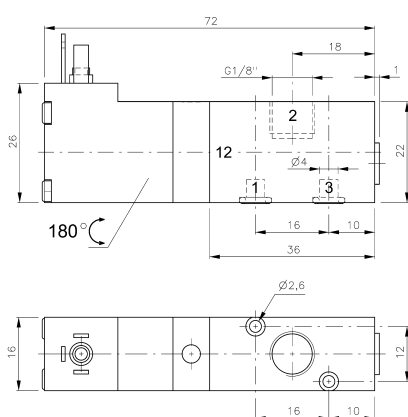
MD 310 343
MD 310 403
MD 310 463



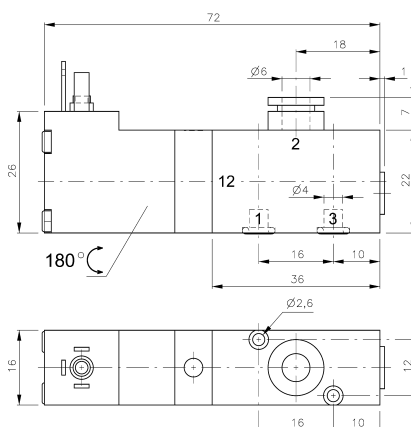
MOD 310 343
MOD 310 403
MOD 310 463



MD 310 343/MOD 310 343



MD 310 403/MOD 310 403



MD 310 463/MOD 310 463



3/2-way solenoid valve normally closed (MD) or normally open (MOD) for assembling on a manifold plate. Port 2 in the valve.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=, 12V=, 6V= either for connector form C ISO 15217 or with flying leads, standard cable length 500 mm. For details about solenoid system, please refer to page 2.13.1.

Valves are generally equipped with manual override to push.

Manifolds are displayed on page 2.7.1.2.

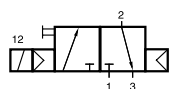
Valves normally open and normally closed can be mixed on one manifold plate!

Blanking plates are also available type BP 3 303 or BP 3 403.

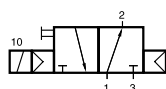
Mounting screws and seals are included.

Type	Function	Port size	Air flow	Operating press.	Power consumption	Weight
MD 310 343	n.c.	pif 4 mm	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,08 kg
MD 310 403	n.c.	G 1/8"	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,09 kg
MD 310 463	n.c.	pif 6 mm	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,09 kg
MOD 310 343	n.o.	pif 4 mm	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,08 kg
MOD 310 403	n.o.	G 1/8"	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,09 kg
MOD 310 463	n.o.	pif 6 mm	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,09 kg

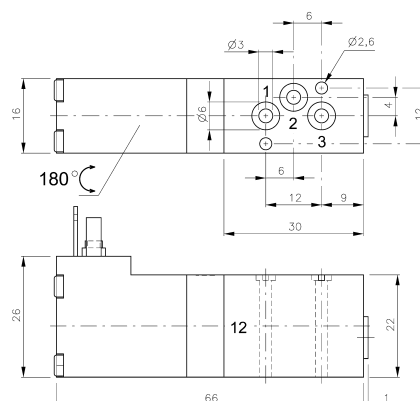
MD 310 304/MD 310 404 MOD 310 304/MOD 310 404



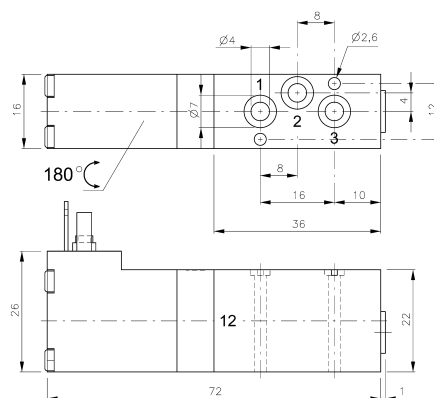
MD 310 304
MD 310 404



MOD 310 304
MOD 310 404



MD 310 304/MOD 310 304



MD 310 404/MOD 310 404

3/2-way solenoid valve normally closed (MD) or normally open (MOD) for assembling on a manifold plate. All the ports are in the plate.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=, 6V= either for connector form C ISO 15217 or with flying leads, standard cable length 500 mm. For details about solenoid system, please refer to page 2.13.1.

Valves are generally equipped with manual override to push.

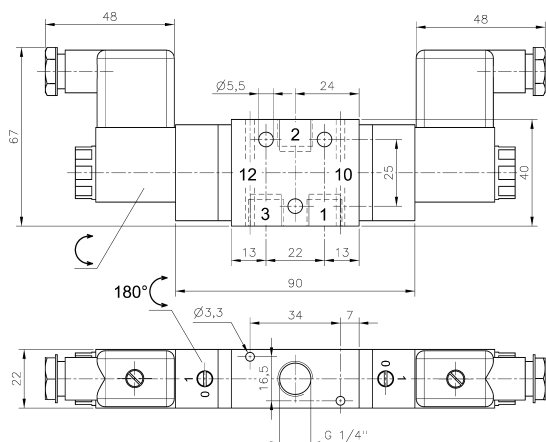
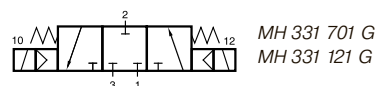
Manifolds are displayed on page 2.7.1.3.

Valves normally open and normally closed can be mixed on one manifold plate!

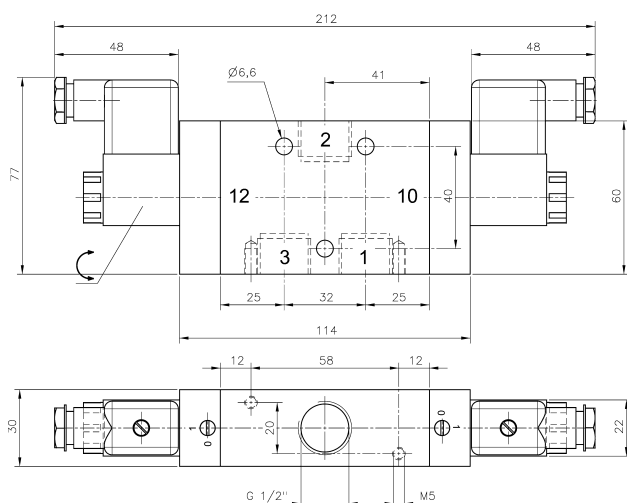
Blanking plates are also available type BP 3 304 or BP 3 404.

Mounting screws and seals are included.

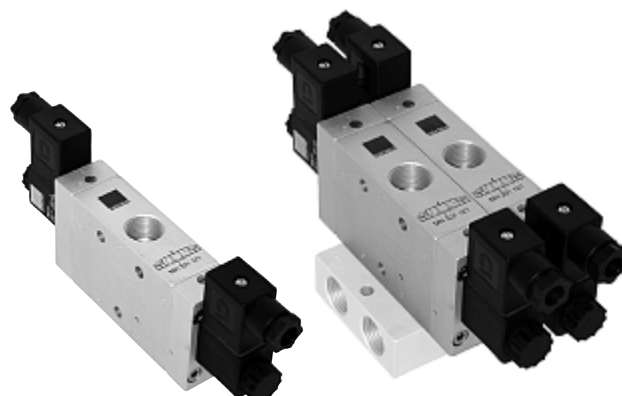
Type	Function	Air flow	Operating press.	Power consumption	Weight
MD 310 304	n.c.	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,08 kg
MD 310 404	n.c.	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,09 kg
MOD 310 304	n.o.	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,08 kg
MOD 310 404	n.o.	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,09 kg



MH 331 701 G



MH 331 121 G



3/3-way solenoid valve with spring return to middle position, actuated by permanent signal. Valve is to be used when a single acting cylinder or any other single acting actuator such as a lifting bag or car-suspension needs to be held in an intermediate position.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves can be used in-line or on manifold plate, plates are displayed on page 2.7.1.5.

Please notice:
Valves G 1/2" have to be assembled onto the plate by fixing screws from the bottom through the plate into the valve.

Valves are generally equipped with manual override to turn.

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 331 701 G	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,32 kg
MH 331 121 G	G 1/2"	3000 l/min	3 - 10 bar	3 W = / 5 VA ~	0,72 kg

MK

The MK- series is a combination of the 1.8 Watt / 3.0 VA solenoid-system MD 401 (detailed information on page 2.13.1) and the G 1/4" valves of the 700-series with a flow of 1.250 NL/min. The following valves are available:



MK 310 701	3/2-way single solenoid, n.c.	in-line	description on page 2.5.1.1.12
MOK 310 701	3/2-way single solenoid, n.o.	in-line	page 2.5.1.1.12
MK 310 701 G	3/2-way single solenoid, n.c.	dual use	page 2.5.1.1.14
MOK 310 701 G	3/2-way single solenoid, n.o.	dual use	page 2.5.1.1.14
MK 320 701	3/2-way single solenoid	in-line	page 2.5.1.1.16
MK 320 701 G	3/2-way single solenoid	dual use	page 2.5.1.1.18
MK 510 701	5/2-way single solenoid	in-line	page 2.5.2.1.3
MK 520 701	5/2-way double solenoid	in-line	page 2.5.2.1.9
MK 531 701	5/3-way centre closed	in-line	page 2.5.3.1.2
MK 532 701	5/3-way centre exhausted	in-line	page 2.5.3.1.2
MK 533 701	5/3-way centre pressurized	in-line	page 2.5.3.1.2
MK 510 701 G	5/2-way single solenoid	dual use	page 2.5.2.1.5
MK 520 701 G	5/2-way double solenoid	dual use	page 2.5.2.1.11
MK 531 701 G	5/3-way centre closed	dual use	page 2.5.3.1.4
MK 532 701 G	5/3-way centre exhausted	dual use	page 2.5.3.1.4
MK 533 701 G	5/3-way centre pressurized	dual use	page 2.5.3.1.4
MK 510 703	5/2-way single solenoid	manifold	page 2.5.2.2.2
MK 520 703	5/2-way double solenoid	manifold	page 2.5.2.2.6
MK 531 703	5/3-way centre closed	manifold	page 2.5.3.2.2
MK 532 703	5/3-way centre exhausted	manifold	page 2.5.3.2.2
MK 533 703	5/3-way centre pressurized	manifold	page 2.5.3.2.2
MK 510 704	5/2-way single solenoid	manifold	page 2.5.2.2.4
MK 520 704	5/2-way double solenoid	manifold	page 2.5.2.2.8
MK 531 704	5/3-way centre closed	manifold	page 2.5.3.2.4
MK 532 704	5/3-way centre exhausted	manifold	page 2.5.3.2.4
MK 533 704	5/3-way centre pressurized	manifold	page 2.5.3.2.4

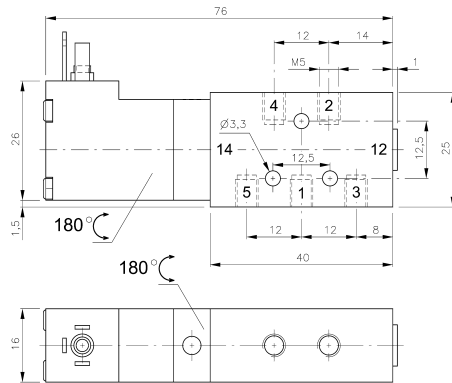
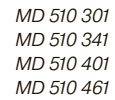
as well as valves with Namur interface, please refer to chapter 2.9.

- ## Advantages
- **High flow**
 - **Compact design**
 - **Low power consumption**

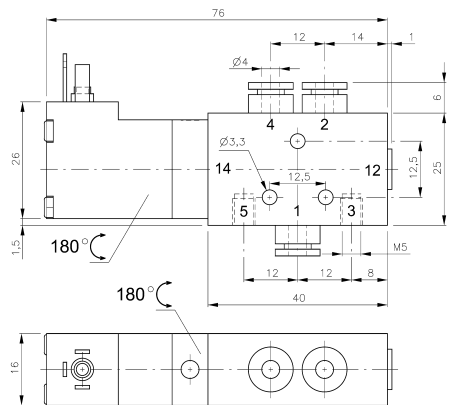


The valves are also used for the **22 mm terminals**, described in chapter 2.8.

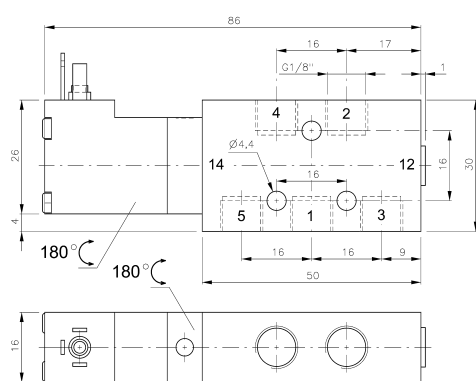
2.5.2.1.1
page 101



MD 510 301



MD 510 341



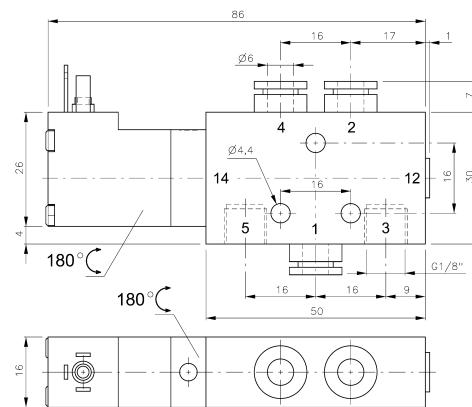
MD 510 401



5/2-way solenoid valve actuated by permanent signal and equipped with air spring return.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=,
12V=, 6V= either for connector form C ISO 15217
or with flying leads, standard cable length 500 mm.
For details about solenoid system, please refer to
page 2.13.1.

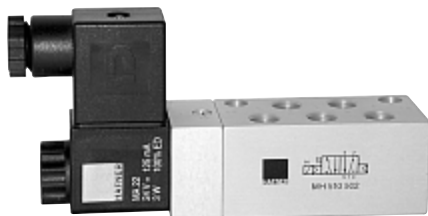
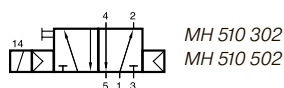
Valves are generally equipped with manual override to push.



MD 510 461

Type	Ports 1, 2, 4	Air flow	Operating press.	Powerconsumption	Weight
MD 510 301	M5	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,09 kg
MD 510 341	pif 4 mm	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,10 kg
MD 510 401	G 1/8"	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,10 kg
MD 510 461	pif 6 mm	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,12 kg

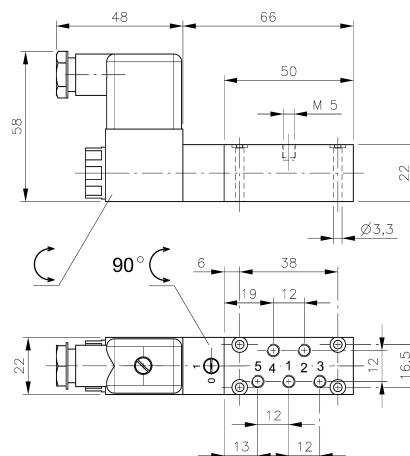
MH 510 302/MH 510 502



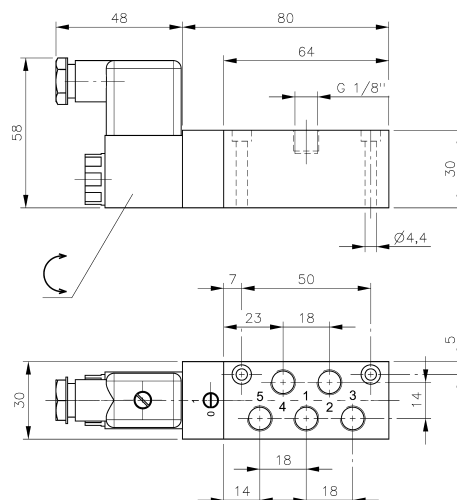
5/2-way solenoid valve actuated by permanent signal and equipped with air spring return.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override.
If requested without manual override please order
M 510 ____.



MH 510 302



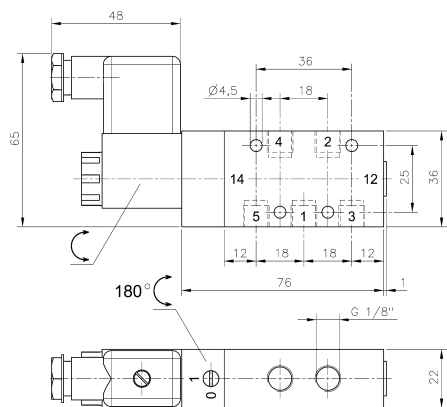
MH 510 502

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 510 302	M5	180 l/min	2 - 10 bar	3 W = / 5 VA ~	0,19 kg
MH 510 502	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,30 kg

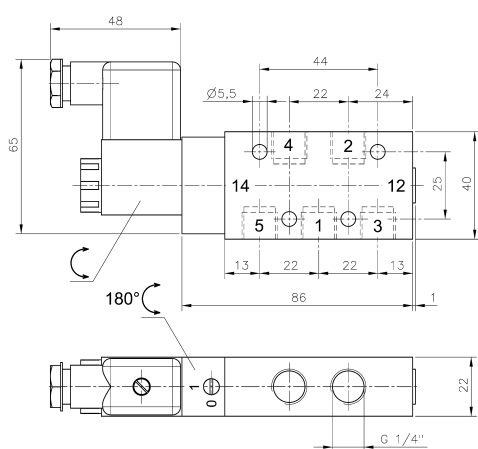
MH 510 501/MH 510 701/MH 510 801

2.5.2.1.3

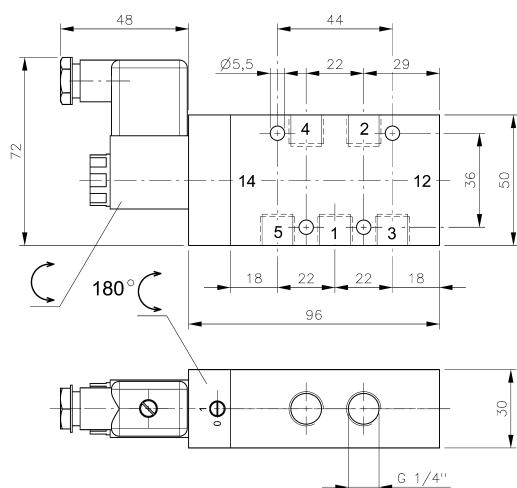
page 103



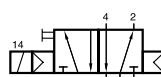
MH 510 501



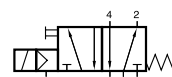
MH 510 701



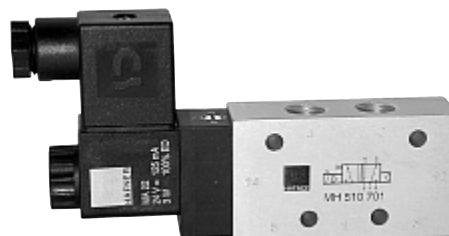
MH 510 801



MH 510 501
MH 510 701
MH 510 801



MEH 511 501
MEH 511 701
MEH 511 801



5/2-way solenoid valve actuated by permanent signal and equipped with air spring return.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

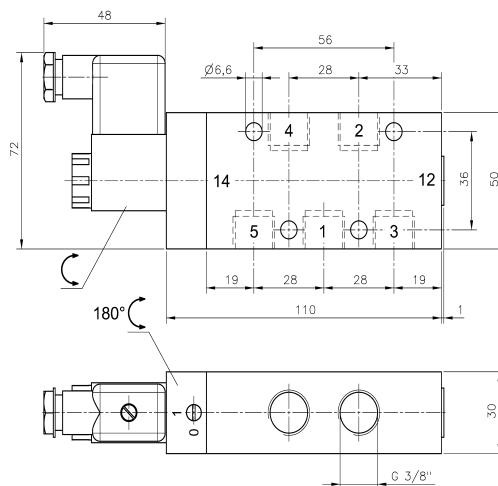
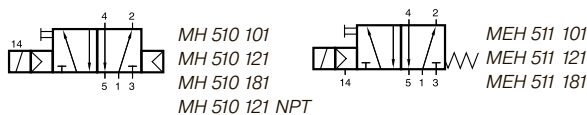
Valves are generally equipped with manual override.
If requested without manual override please order
M 510 ____.

Valves are also available with external pilot feed.
Type: MEH 511 ____.
Port 14 series 501 and 701 M5, series 801 G 1/8".
Minimum actuation pressure: 3 bar.
Operating pressure: 0 - 10 bar.

Version for vacuum on request.

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 510 501	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,23 kg
MH 510 701	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,25 kg MK
MH 510 801	G 1/4"	1450 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,48 kg

MH 510 101/MH 510 121/MH 510 181



MH 510 101

5/2-way solenoid valve actuated by permanent signal and equipped with air spring return.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

Valves are generally equipped with manual override. If requested without manual override please order M 510 ____.

Valves are also available with external pilot feed.

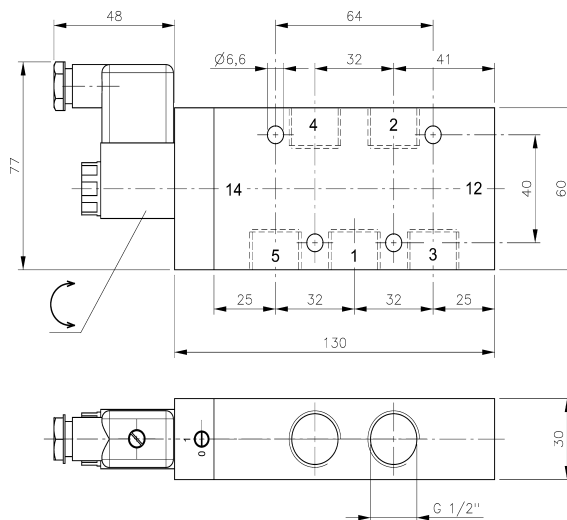
Type: MEH 511 ____.

Port 14: G 1/8".

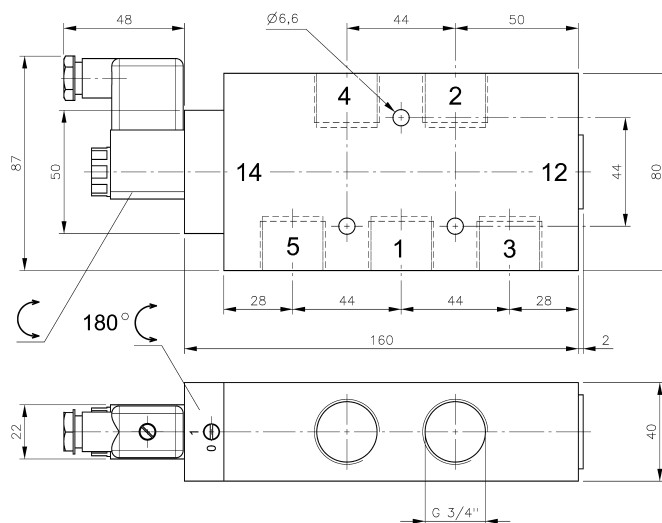
Minimum actuation pressure: 3 bar.

Operating pressure: 0 - 10 bar.

Version for vacuum on request.

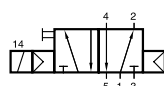


MH 510 121/MH 510 121 NPT

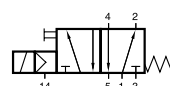


MH 510 181

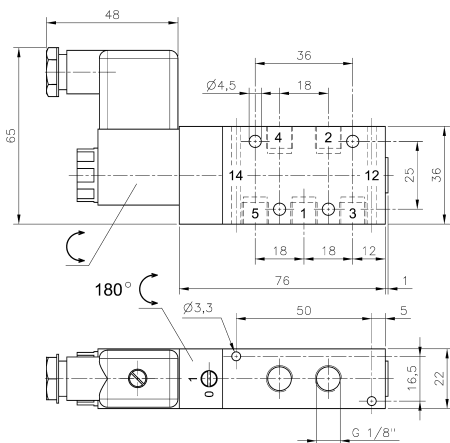
Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 510 101	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,50 kg
MH 510 121	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,67 kg
MH 510 181	G 3/4"	6000 l/min	1 - 10 bar	3 W = / 5 VA ~	1,29 kg
MH 510 121 NPT	1/2" NPT	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,67 kg



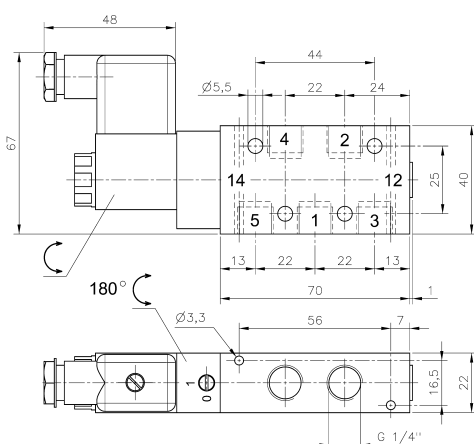
MH 510 501 G
MH 510 701 G
MH 510 701 G NPT



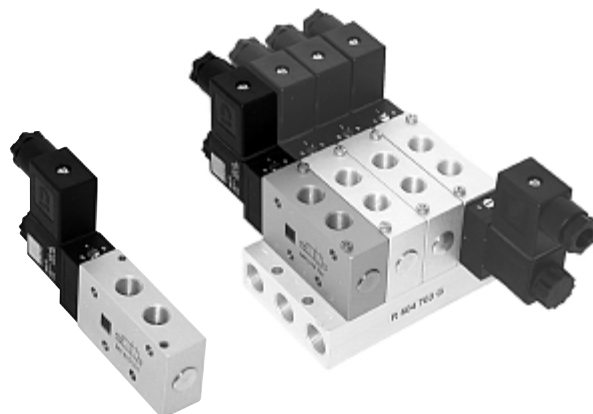
MEH 511 501 G
MEH 511 701 G



MH 510 501 G



MH 510 701 G/MH 510 701 G NPT



5/2-way solenoid valve actuated by permanent signal and equipped with air spring return.

Valves can either be used in-line or on a manifold plate. Manifolds for valves type 501 G are displayed on page 2.7.2.2, manifolds for valves type 701 G are displayed on page 2.7.2.3.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override.
If requested without manual override please order
M 510 _ _ _.

Valves are also available with external pilot feed.

Type: MEH 511 _ _ _ G.

Port 14: M5.

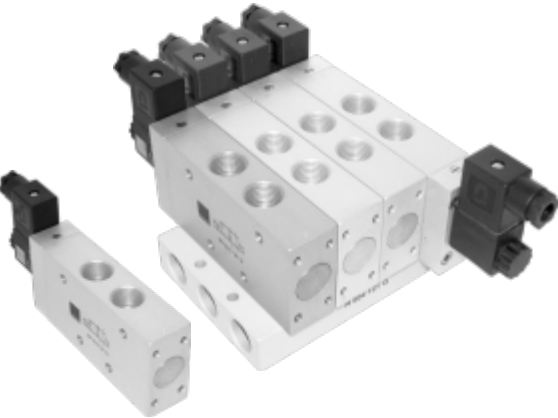
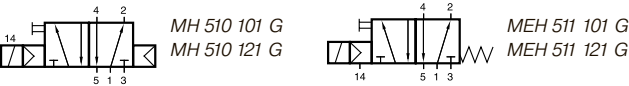
Minimum actuation pressure: 3 bar.

Operating pressure: 0 - 10 bar.

Version for vacuum on request.

Type	Port size	Air flow	Operating press.	Power cons.	Weight
MH 510 501 G	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,23 kg
MH 510 701 G	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,25 kg
MH 510 701 G NPT	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,25 kg

MH 510 101 G/MH 510 121 G



5/2-way solenoid valve actuated by permanent signal and equipped with air spring return.

Valves can either be used in-line or to be assembled onto a manifold plate. Manifolds for valves type 101 G are displayed on page 2.7.2.4, manifolds for valves type 121 G are displayed on page 2.7.2.5.

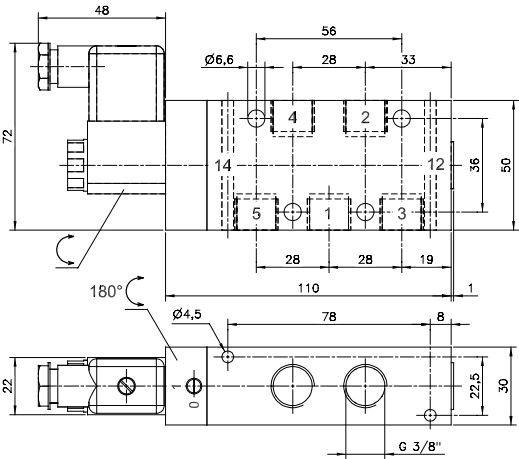
Please notice:
Valves G 1/2" have to be assembled onto the plate by fixing screws from the bottom through the plate into the valve.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

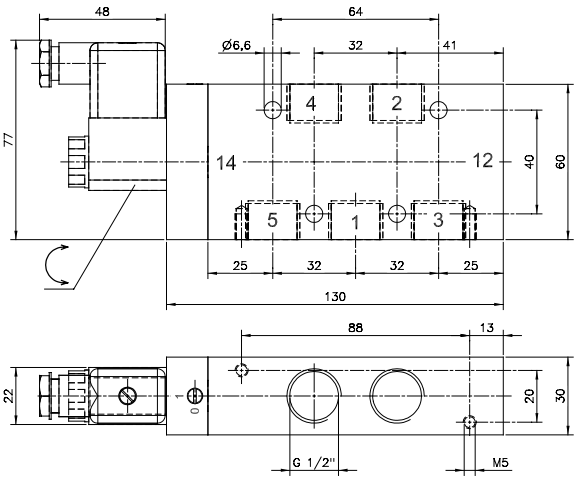
Valves are generally equipped with manual override. If requested without manual override please order M 510 ___ G

Valves are also available with external pilot feed.
Type: MEH 511 ___ G.
Port 14: G 1/8".
Minimum actuation pressure: 3 bar.
Operating pressure: 0 - 10 bar.

Version for vacuum on request.



MH 510 101 G

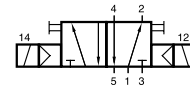


MH 510 121 G

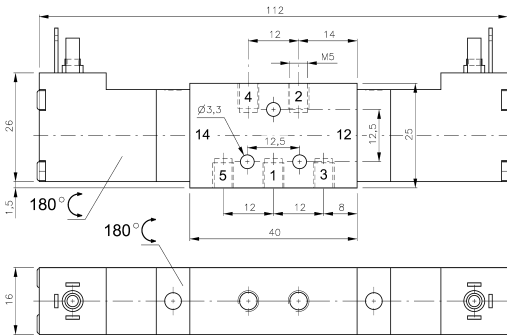
Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 510 101 G	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,52 kg
MH 510 121 G	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,70 kg

MD 520 301/MD 520 341 MD 520 401/MD 520 461

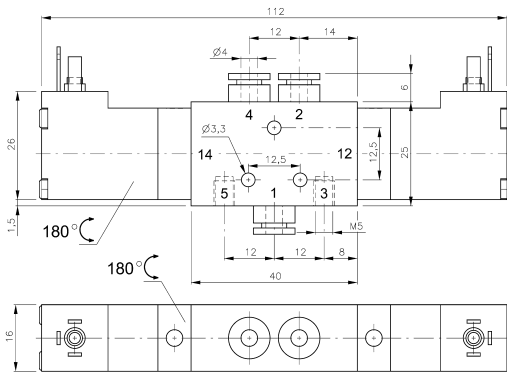
2.5.2.1.7
page 107



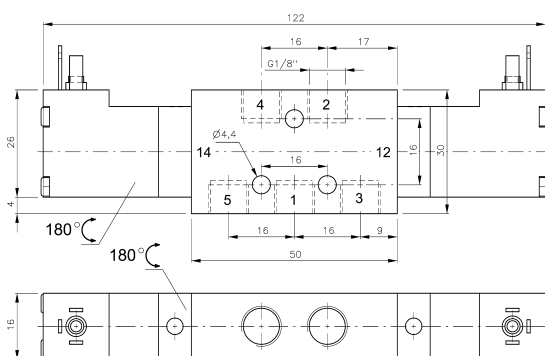
MD 520 301
MD 520 341
MD 520 401
MD 520 461



MD 520 301



MD 520 341



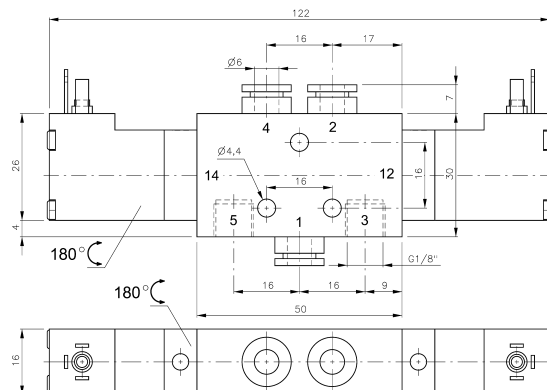
MD 520 401



5/2-way double solenoid valve actuated by impulse.
Position is kept until an electrical signal is applied to the opposite side even when not attached to electrical source.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=,
12V=, 6V= either for connector form C ISO 15217
or with flying leads, standard cable length 500 mm.
For details about solenoid system, please refer to
page 2.13.1.

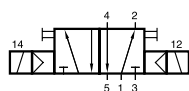
Valves are generally equipped with manual override
to push.



MD 520 461

Type	Ports 1, 2, 4	Air flow	Operating press.	Power consumption	Weight
MD 520 301	M5	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,13 kg
MD 520 341	pif 4 mm	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,14 kg
MD 520 401	G 1/8"	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,15 kg
MD 520 461	pif 6 mm	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,16 kg

MH 520 302/MH 520 502



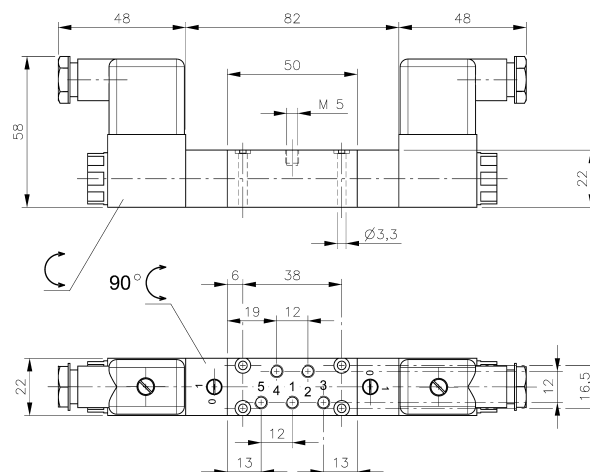
MH 520 302
MH 520 502



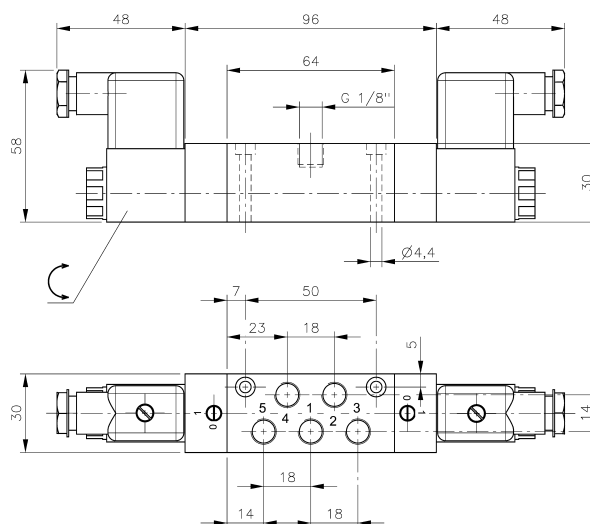
5/2-way double solenoid valve actuated by impulse. Position is kept until an electrical signal is applied to the opposite side even when not attached to electrical source.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override. If requested without manual override please order M 520 _ _ _.

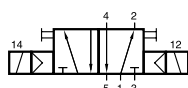


MH 520 302

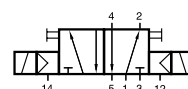


MH 520 502

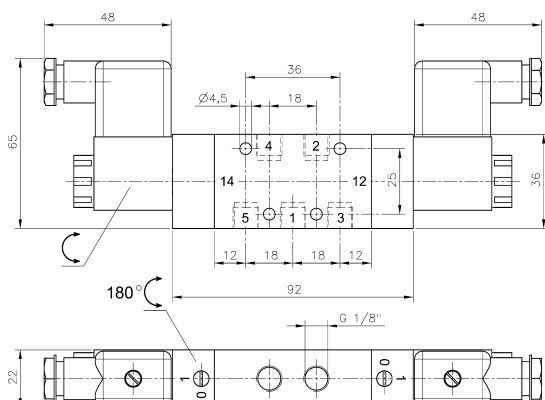
Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 520 302	M5	180 l/min	2 - 10 bar	3 W = / 5 VA ~	0,30 kg
MH 520 502	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,43 kg



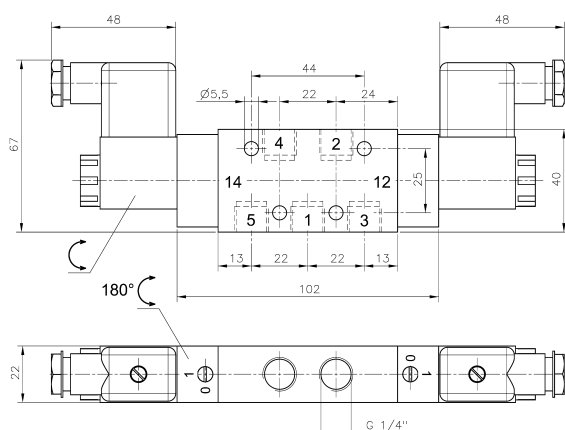
MH 520 501
MH 520 701
MH 520 801



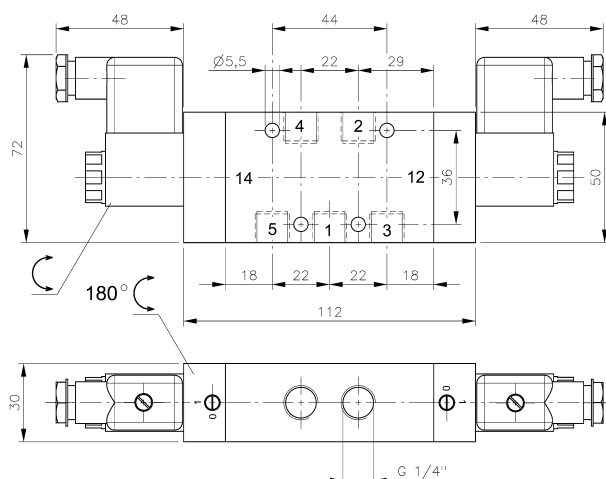
MEH 520 501
MEH 520 701
MEH 520 801



MH 520 501



MH 520 701



MH 520 801



5/2-way double solenoid valve actuated by impulse. Position is kept until an electrical signal is applied to the opposite side even when not attached to electrical source.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override. If requested without manual override please order M 520 _ _ _.

Valves are also available with external pilot feed.

Type: MEH 520 _ _ _.

Ports 12 and 14 series 501 and 701: M5,
series 801: G 1/8\".

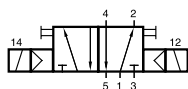
Minimum actuation pressure: 2,5 bar.

Operating pressure: 0 - 10 bar.

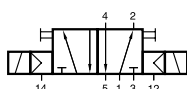
Version for vacuum on request.

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 520 501	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,33 kg
MH 520 701	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,35 kg MK
MH 520 801	G 1/4"	1450 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,62 kg

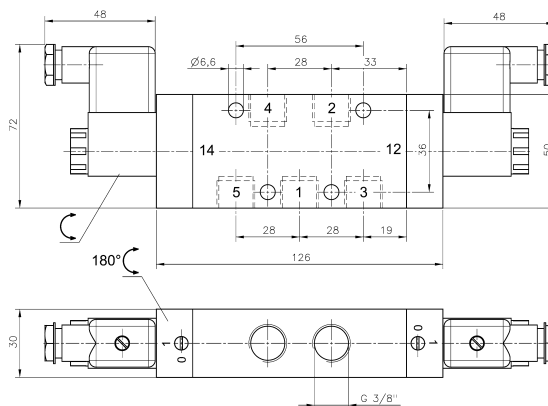
MH 520 101/MH 520 121/MH 520 181



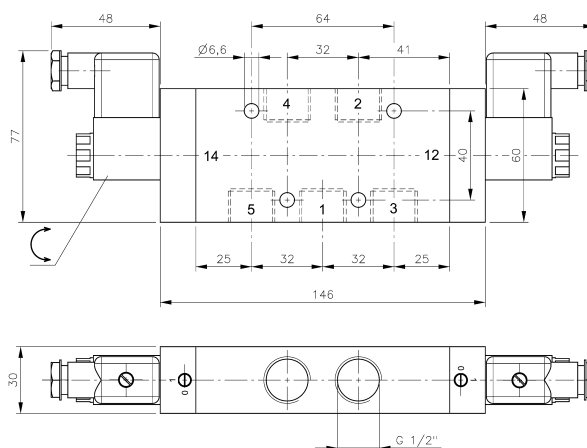
MH 520 101
MH 520 121
MH 520 181
MH 520 121 NPT



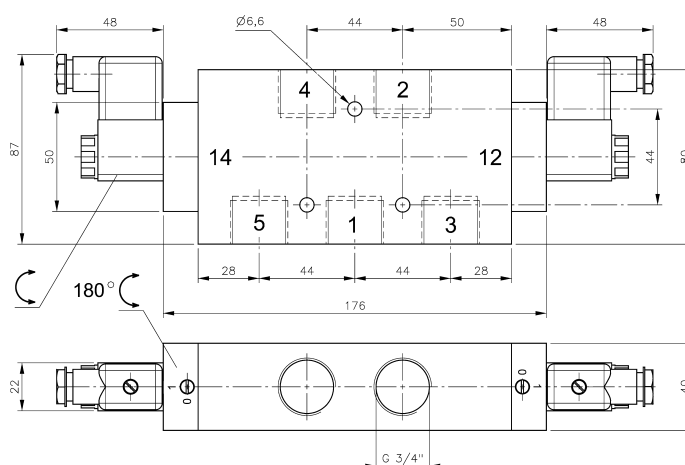
MEH 520 101
MEH 520 121
MEH 520 181



MH 520 101



MH 520 121/ MH 520 121 NPT



MH 520 181

5/2-way double solenoid valve actuated by impulse.
Position is kept until an electrical signal is applied
to the opposite side even when not attached to
electrical source.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

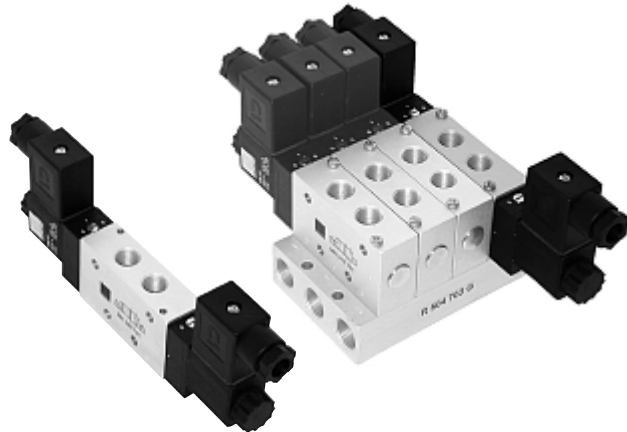
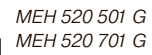
Valves are generally equipped with manual override.
If requested without manual override please order
M 520 _ _ _.

Valves are also available with external pilot feed.
Type: MEH 520 _ _ _.
Ports 12 and 14: G 1/8\".






Version for vacuum on request.

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 520 101	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,66 kg
MH 520 121	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,84 kg
MH 520 181	G 3/4"	6000 l/min	1 - 10 bar	3 W = / 5 VA ~	1,45 kg
MH 520 121 NPT	1/2" NPT	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,84 kg

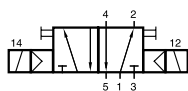
page 111



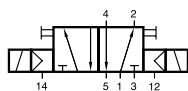
Technical drawing of the 102mm long version of the 1000 Series. The drawing includes a side view and a front view. The side view shows a central body with a total length of 102mm, with mounting flanges on both ends. Dimensions include 48mm for the flange width, 67mm for the flange height, 44mm for the central body length, and 25mm for the central body height. There are 12 mounting holes in total, arranged in two rows of six. The front view shows a total length of 102mm, with a central body length of 56mm and a flange width of 7mm. It shows 12 mounting holes in total, arranged in two rows of six. The front view also shows a 180-degree rotation arrow and a 1/4 inch G thread specification.

Type	Port size	Air flow	Operating press.	Power consumption	Weight	
MH 520 501 G	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,33 kg	 
MH 520 701 G	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,35 kg	  MK
MH 520 701 G NPT	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,35 kg	

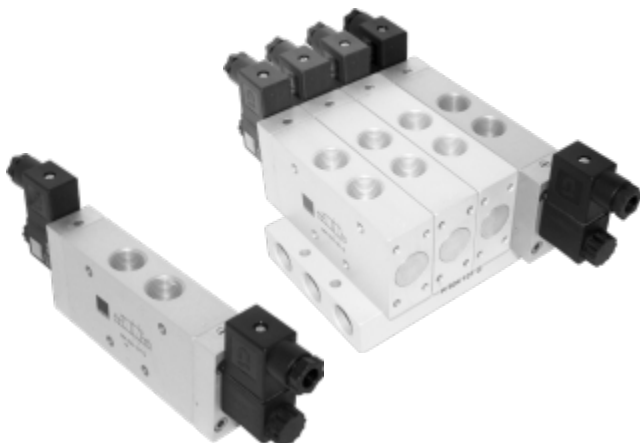
MH 520 101 G/MH 520 121 G



MH 520 101 G
MH 520 121 G



MEH 520 101 G
MEH 520 121 G



5/2-way double solenoid valve actuated by impulse. Position is kept until an electrical signal is applied to the opposite side even when not attached to electrical source.

Valves can either be used in-line or to be assembled onto a manifold plate. Manifolds for valves type 101 G are displayed on page 2.7.2.4, manifolds for valves type 121 G are displayed on page 2.7.2.5.

Please notice: Valves G1/2" have to be assembled onto the plate by fixing screws from the bottom through the plate into the valve.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

Valves are generally equipped with manual override. If requested without manual override please order M 520 ___ G

Valves are also available with external pilot feed.

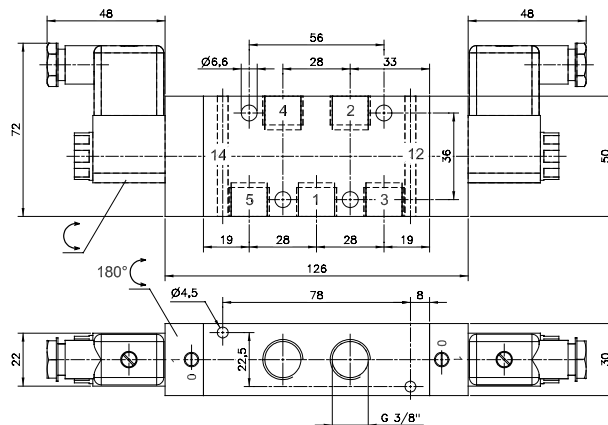
Type: MEH 520 ___ G.

Ports 12 and 14: G 1/8".

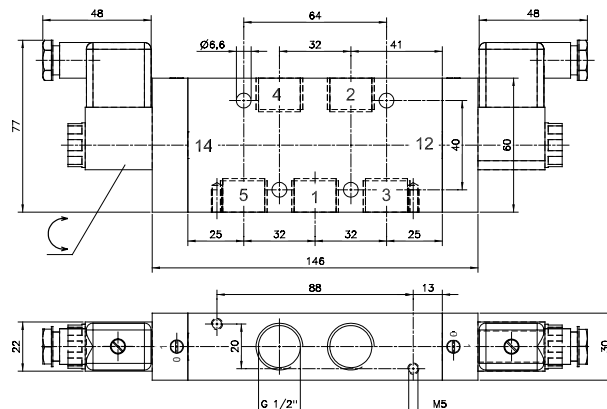
Minimum actuation pressure: 2,5 bar.

Operating pressure: 0 - 10 bar.

Version for vacuum on request.



MH 520 101 G

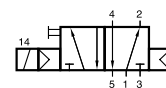


MH 520 121 G

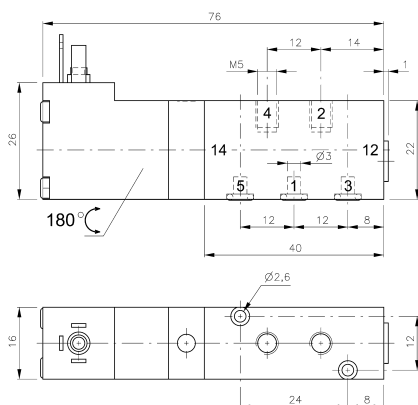
Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 520 101 G	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,66 kg
MH 520 121 G	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,84 kg

MD 510 303/MD 510 343 MD 510 403/MD 510 463

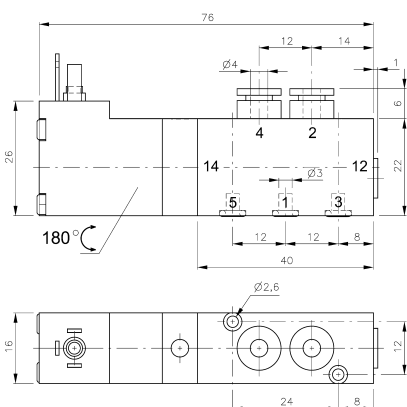
2.5.2.2.1
page 113



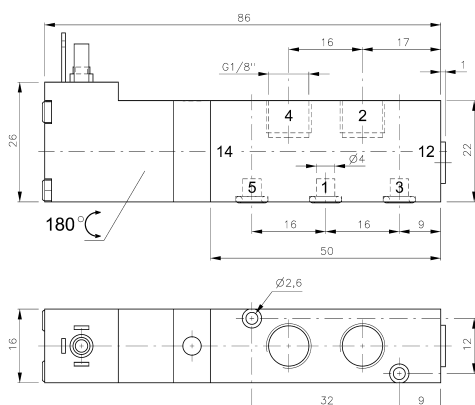
MD 510 303
MD 510 343
MD 510 403
MD 510 463



MD 510 303



MD 510 343



MD 510 403



5/2-way solenoid valve actuated by permanent signal and equipped with air spring return. Ports 2 and 4 are in the valve, ports 1, 3 and 5 in the manifold plate.

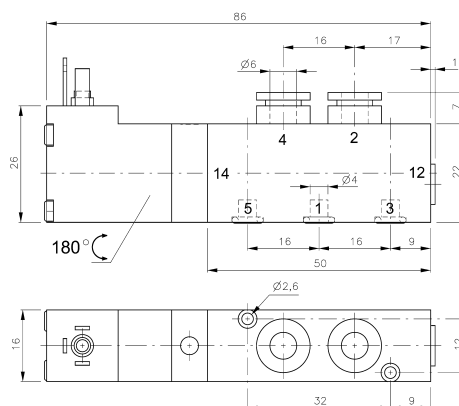
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=, 12V=, 6V= either for connector form C ISO 15217 or with flying leads, standard cable length 500 mm. For details about solenoid system, please refer to page 2.13.1.

Valves are generally equipped with manual override to push.

Manifolds are displayed on page 2.7.2.1.

Blanking plates are also available type BP 5 303 or BP 5 403.

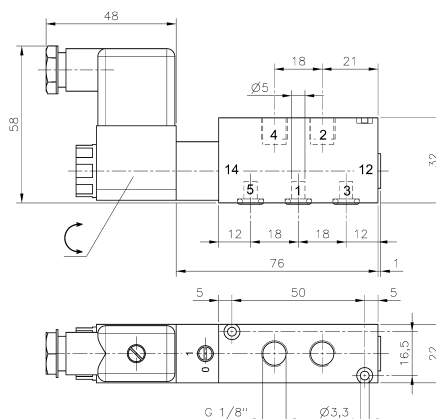
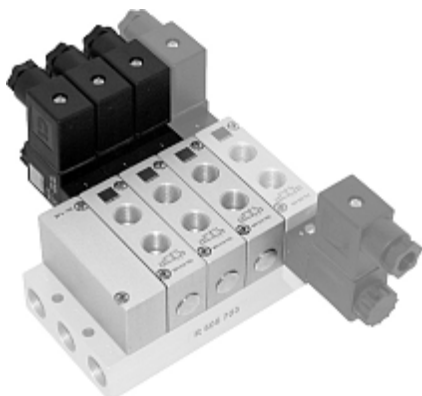
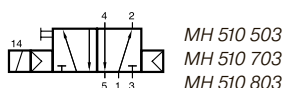
Mounting screws and seals are included.



MD 510 463

Type	Ports 1, 2, 4	Air flow	Operating press.	Powerconsumption	Weight
MD 510 303	M5	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,09 kg
MD 510 343	pif 4 mm	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,10 kg
MD 510 403	G 1/8"	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,10 kg
MD 510 463	pif 6 mm	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,12 kg

MH 510 503/MH 510 703/MH 510 803



MH 510 503

5/2-way solenoid valve actuated by permanent signal and equipped with air spring return. Ports 2 and 4 are in the valve, ports 1, 3 and 5 in the manifold plate.

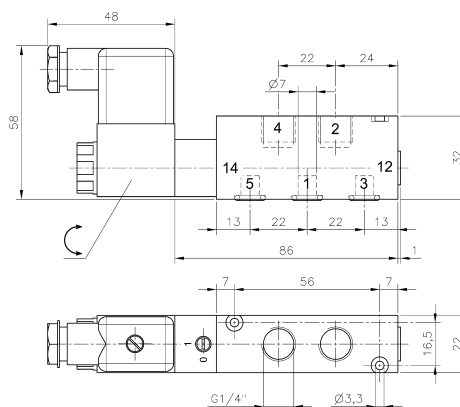
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=
24V=, 12V=.

Valves are generally equipped with manual override.
If requested without manual override please order
M 510 _ _ _.

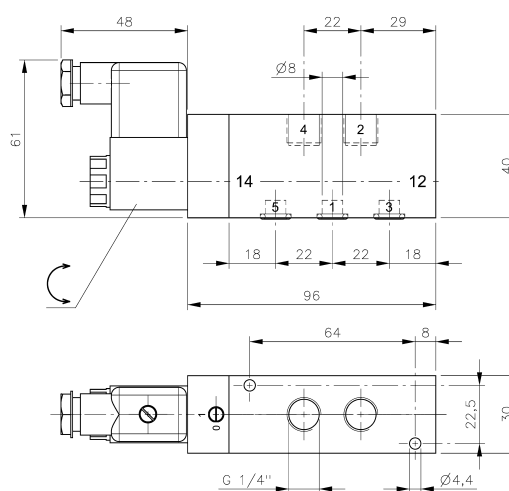
Manifolds for valves type 503 are displayed on
page 2.7.2.2, manifolds for valves type 703 are
displayed on page 2.7.2.3, manifolds for valves
type 803 are displayed on page 2.7.2.5.

Blanking plates are also available type BP 5 503,
BP 5 703 or BP 5 803.

Mounting screws and seals are included.



MH 510 703



MH 510 803

Type	Ports 2, 4	Air flow	Operating press.	Power consumption	Weight
MH 510 503	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,22 kg MK
MH 510 703	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,23 kg MK
MH 510 803	G 1/4"	1450 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,42 kg

2.5.2.2.3
page 115

MH 510 304/MH 510 504 MH 510 704/MH 510 104



MH 510 304 MH 510 704
MH 510 504 MH 510 104



5/2-way solenoid valve actuated by permanent signal and equipped with air spring return. All the ports are in the plate.

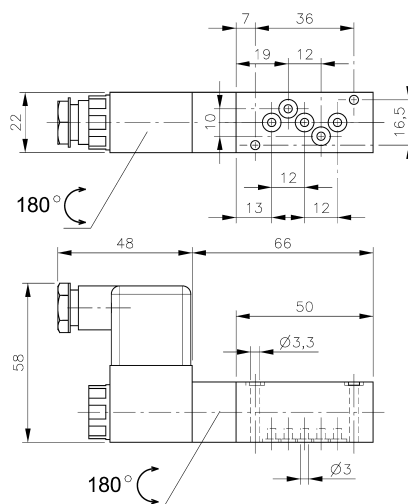
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override.
If requested without manual override please order
M 510 ____.

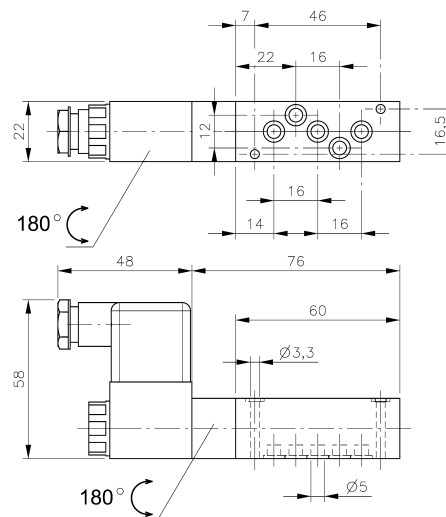
Manifolds for valves type 304 and 504 are displayed
on page 2.7.2.7. Manifolds for valves type 704 are
displayed on page 2.7.2.8 and 2.7.2.9. Manifolds for
valves type 104 are displayed on page 2.7.2.10.

Blanking plates are also available type BP 5 304,
BP 5 504 or BP 5 704.

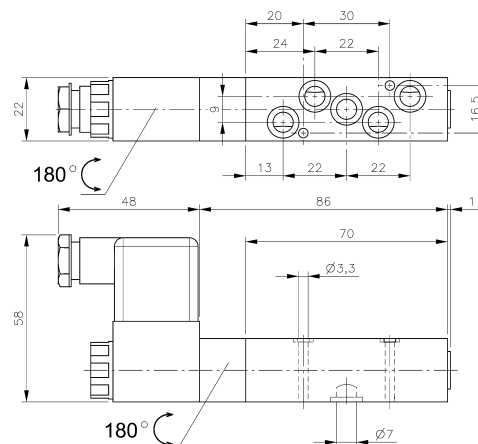
Mounting screws and seals are included.



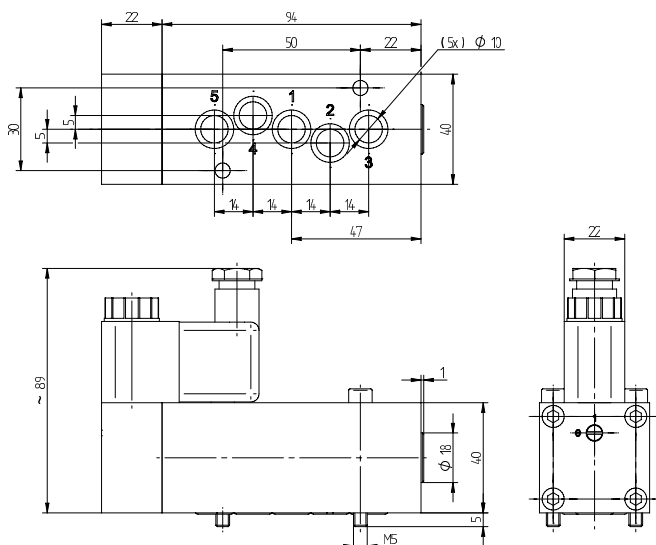
MH 510 304



MH 510 504



MH 510 704



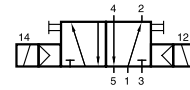
MH 510 104

Type	Port size	Air flow	Operating press.	Power cons.	Weight
MH 510 304	Ø 3 mm	220 l/min	2 - 10 bar	3 W = / 5 VA ~	0,18 kg
MH 510 504	Ø 5 mm	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,19 kg
MH 510 704	Ø 7 mm	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,20 kg
MH 510 104	Ø 10 mm	2250 l/min	1 - 10 bar	3 W = / 5 VA ~	0,61 kg

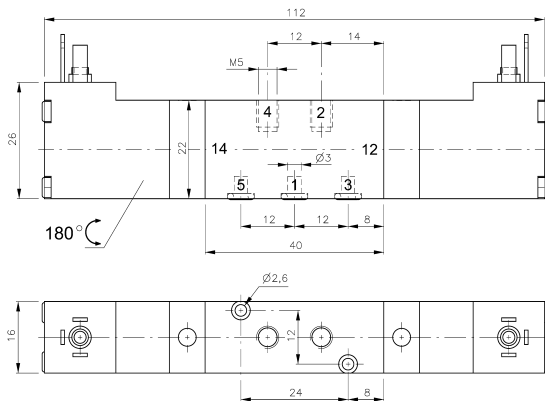


MD 520 303/MD 520 343 MD 520 403/MD 520 463

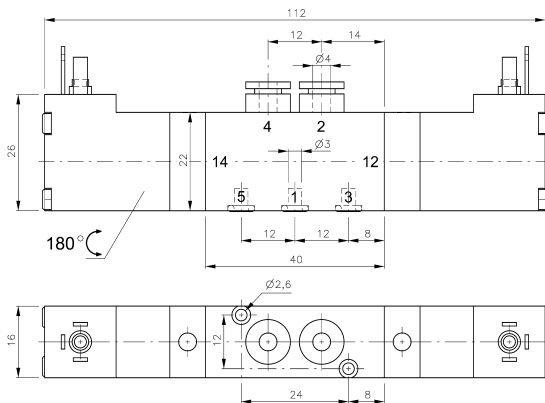
2.5.2.2.5
page 117



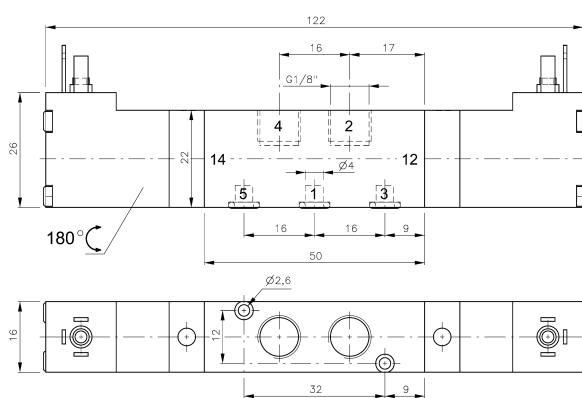
MD 520 303
MD 520 343
MD 520 403
MD 520 463



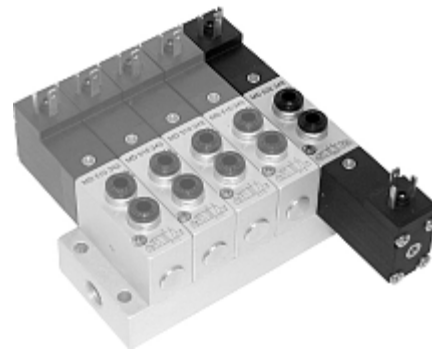
MD 520 303



MD 520 343



MD 520 403



5/2-way double solenoid valve actuated by impulse. Position is kept until an electrical signal is applied to the opposite side even when not attached to electrical source. Ports 2 and 4 are in the valve, ports 1, 3 and 5 in the manifold plate.

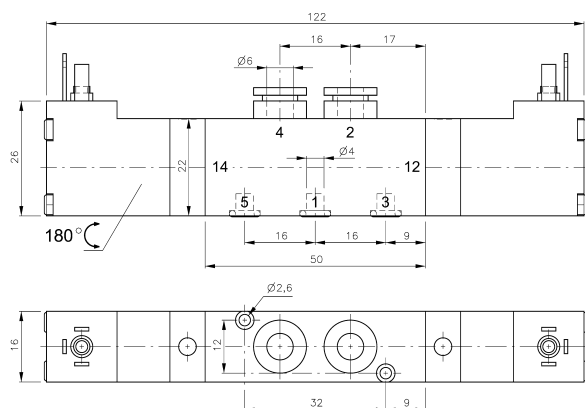
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=, 12V=, 6V= either for connector form C ISO 15217 or with flying leads, standard cable length 500 mm. For details about solenoid system, please refer to page 2.13.1.

Valves are generally equipped with manual override to push.

Manifolds are displayed on page 2.7.2.1.

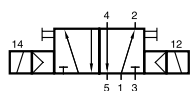
Blanking plates are also available type BP 5 303 or BP 5 403.

Mounting screws and seals are included.

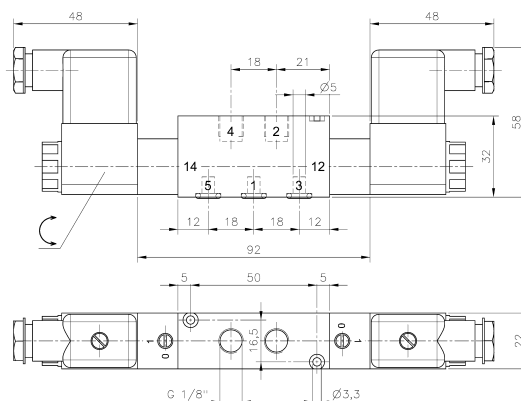
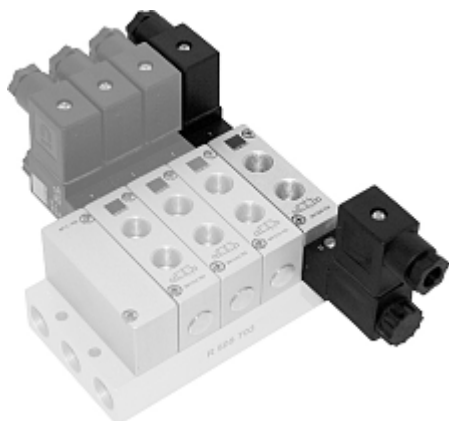


MD 520 463

Type	Ports 1, 2, 4	Air flow	Operating press.	Power consumption	Weight
MD 520 303	M5	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,13 kg
MD 520 343	pif 4 mm	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,14 kg
MD 520 403	G 1/8"	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,14 kg
MD 520 463	pif 6 mm	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,15 kg



MH 520 503
MH 520 703
MH 520 803



MH 520 503

5/2-way double solenoid valve actuated by impulse. Position is kept until an electrical signal is applied to the opposite side even when not attached to electrical source. Ports 2 and 4 are in the valve, ports 1, 3 and 5 in the manifold plate.

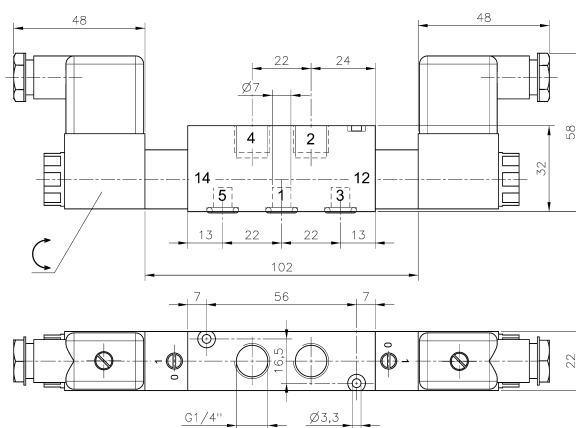
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override.
If requested without manual override please order
M 520 .

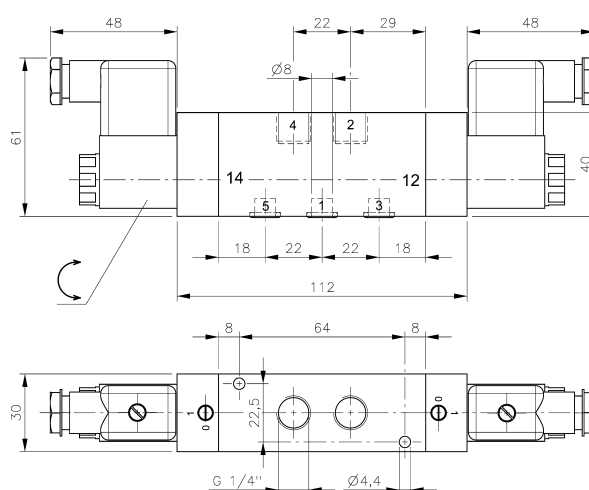
Manifolds for valves type 503 are displayed on page 2.7.2.2, manifolds for valves type 703 are displayed on page 2.7.2.3, manifolds for valves type 803 are displayed on page 2.7.2.5.

Blanking plates are also available type BP 5 503, BP 5 703 or BP 5 803.

Mounting screws and seals are included.



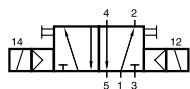
MH 520 703



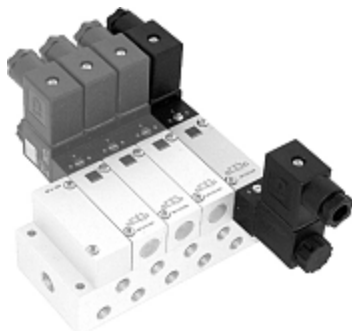
MH 520 803

Type	Ports 2, 4	Air flow	Operating press.	Power consumption	Weight
MH 520 503	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,31 kg
MH 520 703	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,33 kg
MH 520 803	G 1/4"	1450 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,56 kg

MH 520 304/MH 520 504 MH 520 704/MH 520 104



MH 520 304 MH 520 704
MH 520 504 MH 520 104



5/2-way double solenoid valve actuated by impulse. Position is kept until an electrical signal is applied to the opposite side even when not attached to electrical source. All the ports are in the plate.

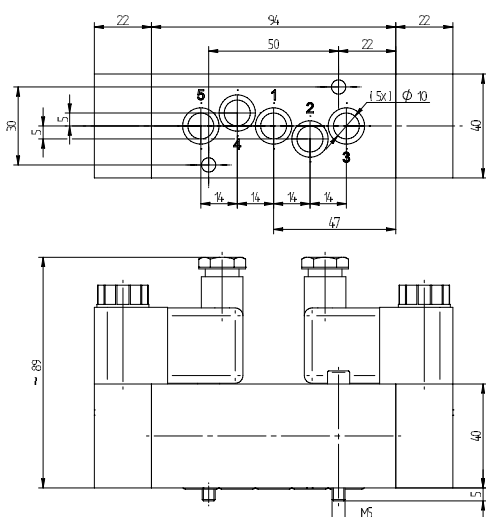
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override. If requested without manual override please order M 520 _ _ _.

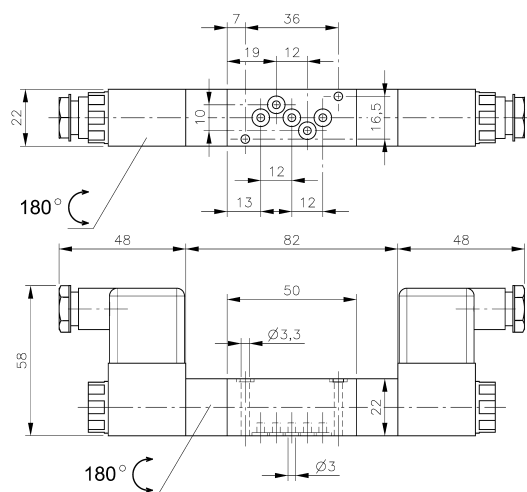
Manifolds for valves type 304 and 504 are displayed on page 2.7.2.7. Manifolds for valves type 704 are displayed on page 2.7.2.8 and 2.7.2.9. Manifolds for valves type 104 are displayed on page 2.7.2.10.

Blanking plates are also available type BP 5 304, BP 5 504 or BP 5 704.

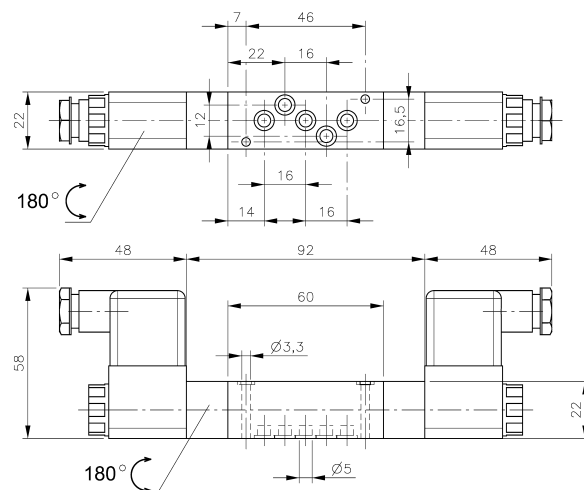
Mounting screws and seals are included.



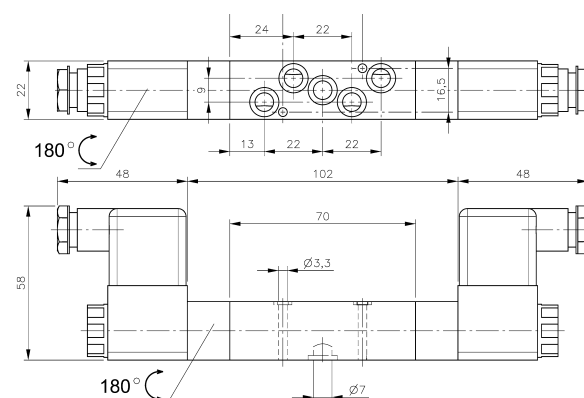
MH 520 104



MH 520 304

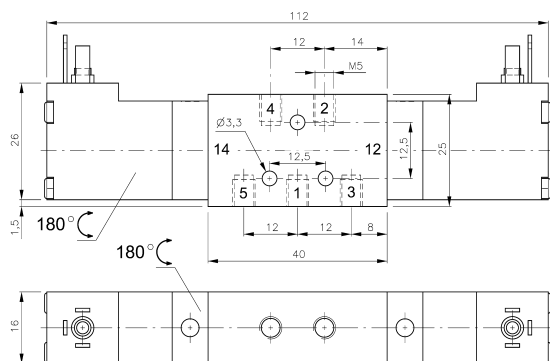
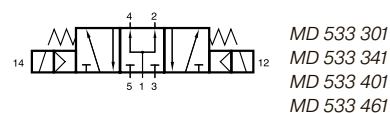
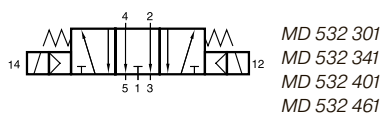
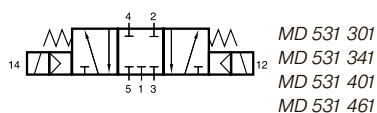


MH 520 504

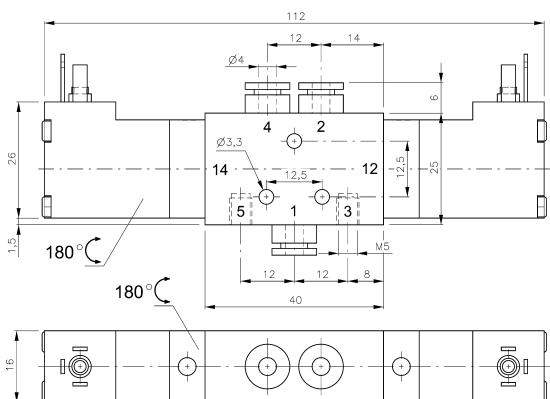


MH 520 704

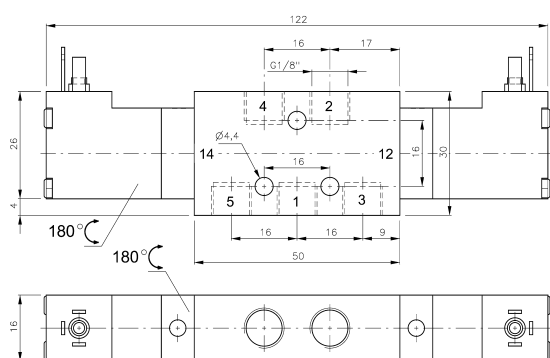
Type	Port size	Air flow	Operating press.	Power cons.	Weight
MH 520 304	Ø 3 mm	220 l/min	2 - 10 bar	3 W = / 5 VA ~	0,25 kg ❄
MH 520 504	Ø 5 mm	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,27 kg ❄❄MK
MH 520 704	Ø 7 mm	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,29 kg ❄❄MK
MH 520 104	Ø 10 mm	2250 l/min	1 - 10 bar	3 W = / 5 VA ~	0,80 kg



MD 53_301



MD 53_341



MD 53_401



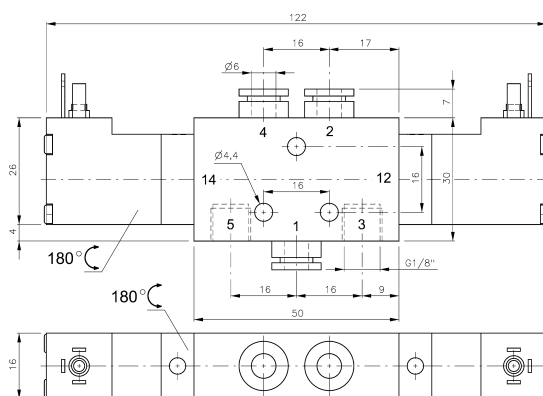
5/3-way solenoid valve with spring return to middle position, actuated by permanent signal.

Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurised

When ordering please complete the type number by 1, 2 or 3 according to the type required.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=, 6V=
either for connector form C ISO 15217 or with flying leads, standard cable length 500 mm. For details about solenoid system, please refer to page 2.13.1.

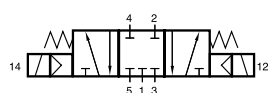
Valves are generally equipped with manual override to push.



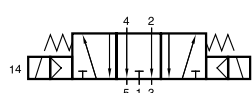
MD 53_461

Type	Ports 1, 2, 4	Air flow	Operating press.	Powerconsumption	Weight
MD 53_301	M5	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,13 kg
MD 53_341	pif 4 mm	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,14 kg
MD 53_401	G 1/8"	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,15 kg
MD 53_461	pif 6 mm	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,16 kg

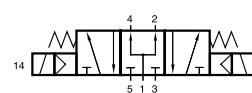
MH 53_ 501/MH 53_ 701/MH 53_ 801



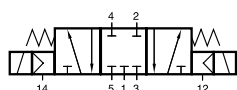
MH 531 501
MH 531 701
MH 531 801



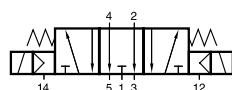
MH 532 501
MH 532 701
MH 532 801



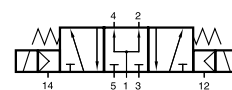
MH 533 501
MH 533 701
MH 533 801



MEH 531 501
MEH 531 701
MEH 531 801



MEH 532 501
MEH 532 701
MEH 532 801



MEH 533 501
MEH 533 701
MEH 533 801



5/3-way solenoid valve with spring return to middle position, actuated by permanent signal.

Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurised

When ordering please complete the type number by 1, 2 or 3 according to the type required.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V =, 12V=.

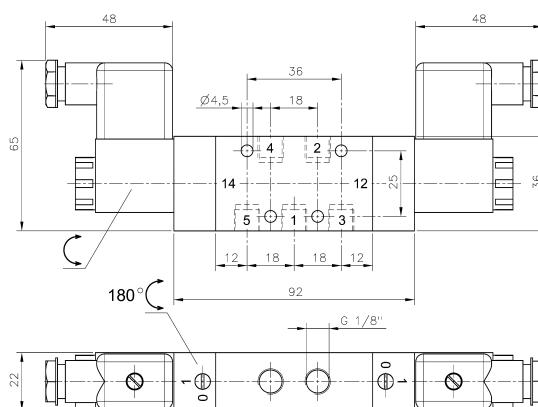
Valves are generally equipped with manual override.
If requested without manual override please order M 53_ _ _ _.

Valves are also available with external pilot feed.
Type: MEH 53_ _ _ _ (please add 1 digit for type and 3 digits for size).

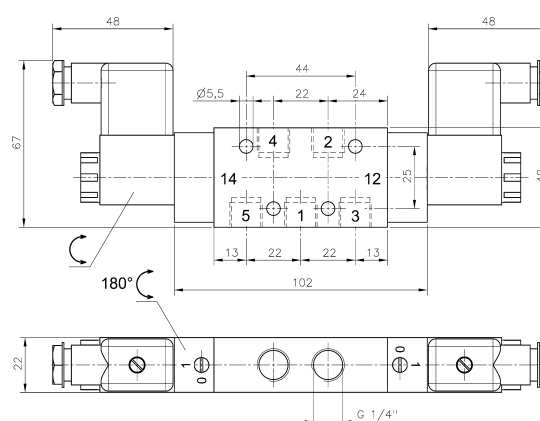
Ports 12 and 14 series 501 and 701: M5,
series 801: G 1/8".

Minimum actuation pressure: 3 bar.
Operating pressure: 0-10 bar.

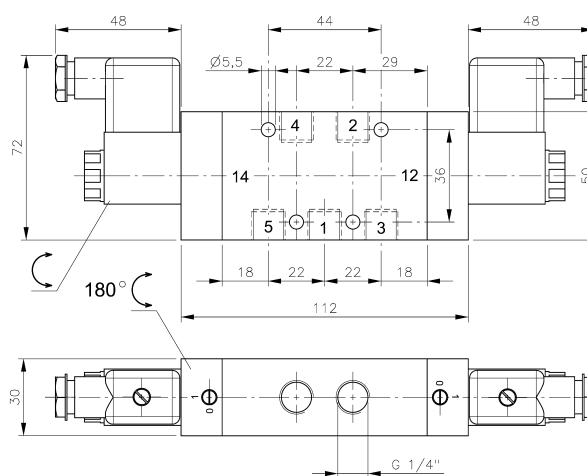
Version for vacuum on request.



MH 53_ 501

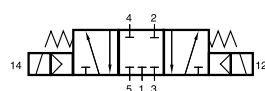


MH 53_ 701

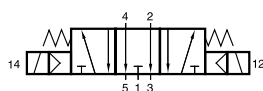


MH 53_ 801

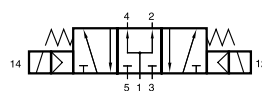
Type	Port size	Air flow	Operating press.	Power cons.	Weight
MH 53_ 501	G 1/8"	650 l/min	3 - 10 bar	3 W = / 5 VA ~	0,33 kg
MH 53_ 701	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,35 kg MK
MH 53_ 801	G 1/4"	1450 l/min	3 - 10 bar	3 W = / 5 VA ~	0,62 kg



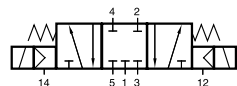
MH 531 101
MH 531 121
MH 531 181
MH 531 121 NPT



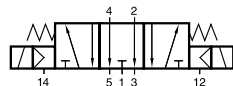
MH 532 101
MH 532 121
MH 532 181
MH 532 121 NPT



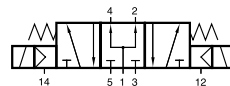
MH 533 101
MH 533 121
MH 533 181
MH 533 121 NPT



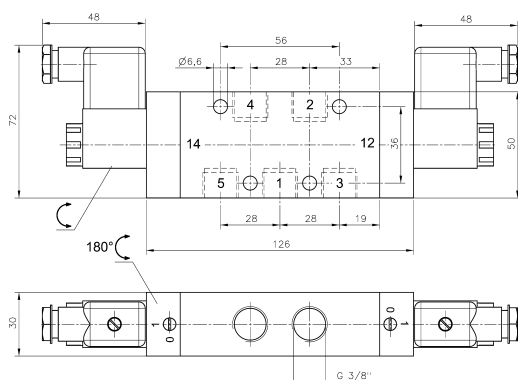
MEH 531 101
MEH 531 121
MEH 531 181



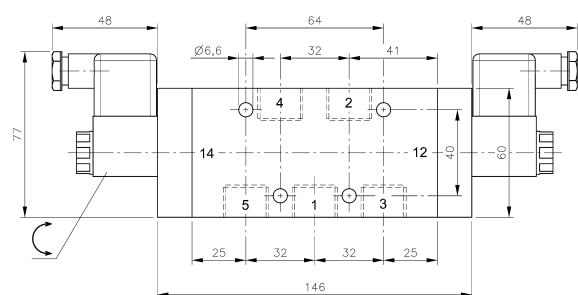
MEH 532 101
MEH 532 121
MEH 532 181



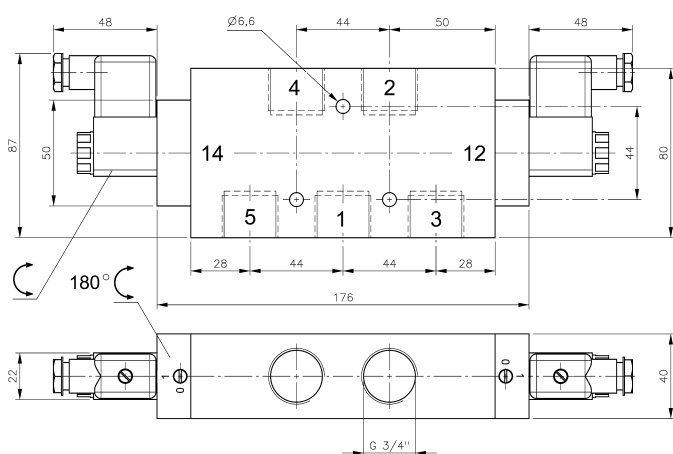
MEH 533 101
MEH 533 121
MEH 533 181



MH 53_101



MH 53_121/MH 53_121 NPT



MH 53_181



5/3-way solenoid valve with spring return to middle position, actuated by permanent signal.

Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurised

When ordering please complete the type number by 1, 2 or 3 according to the type required.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V =, 12V=.

Valves are generally equipped with manual override.
If requested without manual override please order
M 53_ _ _ _.

Valves are also available with external pilot feed.
Type: MEH 53_ _ _ _ (please add 1 digit for type
and 3 digits for size).

Ports 12 and 14: G 1/8".

Minimum actuation pressure: 3 bar.

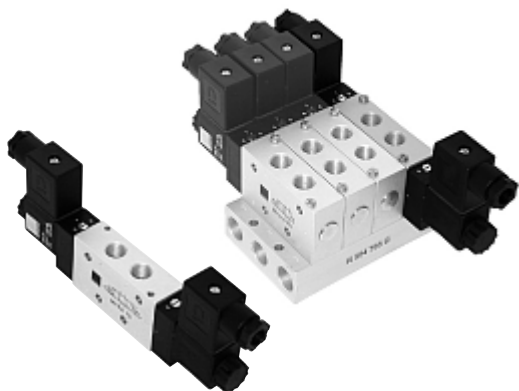
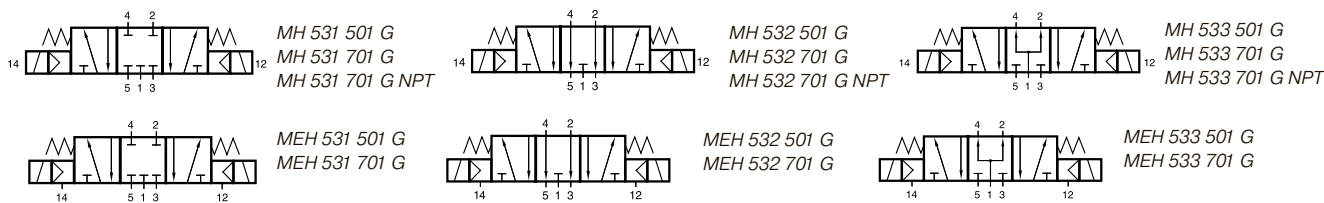
Operating pressure: 0-10 bar.

Version for vacuum on request.

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 53_ 101	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,66 kg
MH 53_ 121	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,84 kg
MH 53_ 181	G 3/4"	6000 l/min	1 - 10 bar	3 W = / 5 VA ~	1,45 kg
MH 53_ 121 NPT	1/2" NPT	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,84 kg



MH 53_ 501 G/MH 53_ 701 G



5/3-way solenoid valve with spring return to middle position, actuated by permanent signal.

- Type 531 centre closed
- Type 532 centre exhausted
- Type 533 centre pressurised

When ordering please complete the type number by 1, 2 or 3 according to the type required.

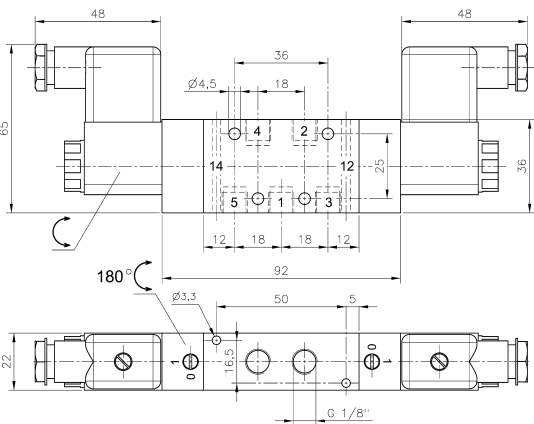
Valves can either be used in-line or on a manifold plate. Manifolds for valves type 501 G are displayed on page 2.7.2.2, manifolds for valves type 701 G are displayed on page 2.7.2.3.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

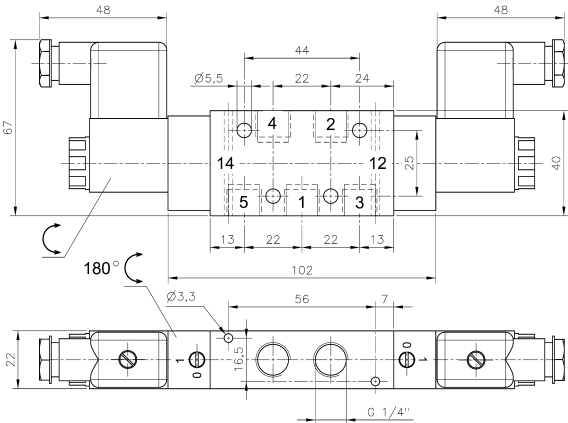
Valves are generally equipped with manual override. If requested without manual override please order M 53_ _ _ _ G.

Valves are also available with external pilot feed.
Type: MEH 53_ _ _ _ G (please add 1 digit for type and 3 digits for size).
Ports 12 and 14: M5.
Minimum actuation pressure: 3 bar.
Operating pressure: 0- 10 bar.

Version for vacuum on request.



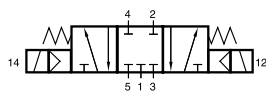
MH 53_ 501 G



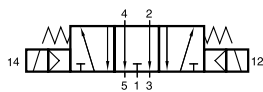
MH 53_ 701 G/MH 53_ 701 G NPT

Type	Port size	Air flow	Operating press.	Power cons.	Weight
MH 53_ 501 G	G 1/8"	650 l/min	3 - 10 bar	3 W = / 5 VA ~	0,33 kg
MH 53_ 701 G	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,35 kg MK
MH 53_ 701 G NPT	1/4" NPT	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,35 kg

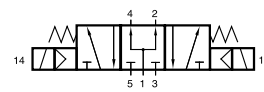
MD 53_ 303/MD 53_ 343 MD 53_ 403/MD 53_ 463



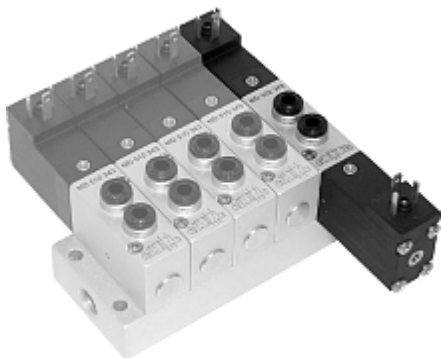
MD 531 303
MD 531 343
MD 531 403
MD 531 463



MD 532 303
MD 532 343
MD 532 403
MD 532 463



MD 533 303
MD 533 343
MD 533 403
MD 533 463



5/3-way solenoid valve with spring return to middle position, actuated by permanent signal. Ports 2 and 4 are in the valve, ports 1, 3 and 5 in the manifold plate.

Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurised

When ordering please complete the type number by 1, 2 or 3 according to the type required.

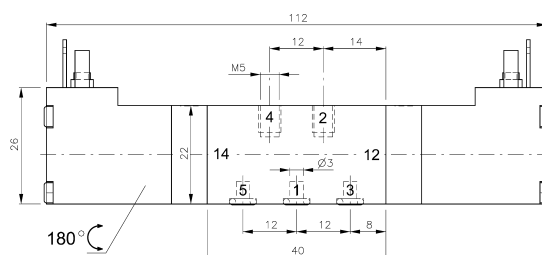
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=,
12V=, 6V= either for connector form C ISO 15217
or with flying leads, standard cable length 500 mm.
For details about solenoid system, please refer to
page 2.13.1.

Valves are generally equipped with manual override to push.

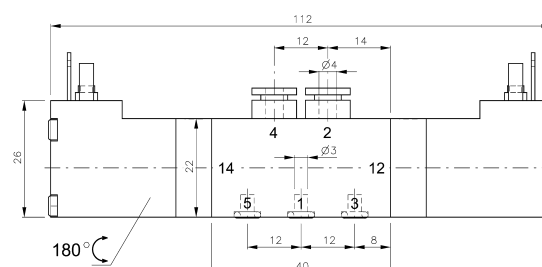
Manifolds are described on page 2.7.2.1.

Blanking plates are also available type BP 5 303
or BP 5 403.

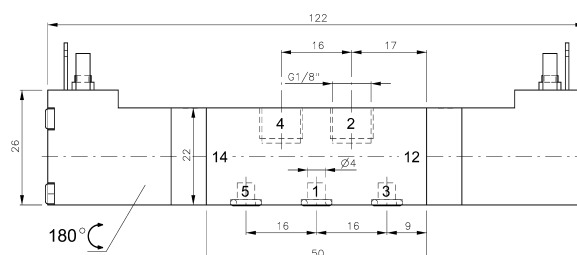
Mounting screws and seals are included.



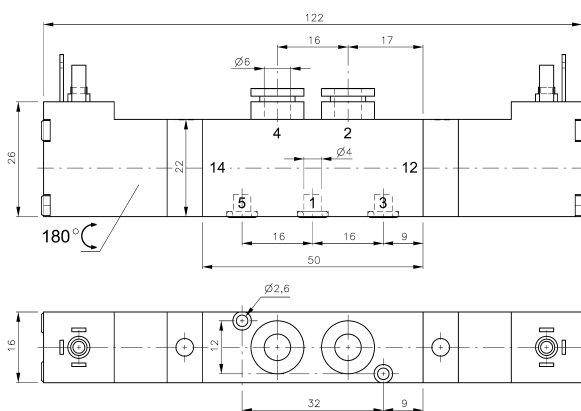
MD 53_303



MD 53_343



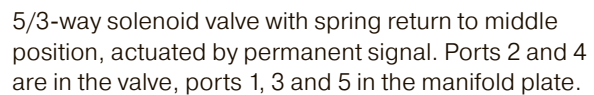
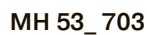
MD 53_403



MD 53_463

Type	Ports 1, 2, 4	Air flow	Operating press.	Power consumption	Weight
MD 53_303	M5	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,13 kg
MD 53_343	pif 4 mm	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,14 kg
MD 53_403	G 1/8"	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,14 kg
MD 53_463	pif 6 mm	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,15 kg

2.5.3.2.2
page 127



Type 531	centre closed
Type 532	centre exhausted
Type 533	centre pressurised

When ordering please complete the type number by 1, 2 or 3 according to the type required.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are generally equipped with manual override.
If requested without manual override please order
M 53 ____ (please add 1 digit for type and 3 for size).

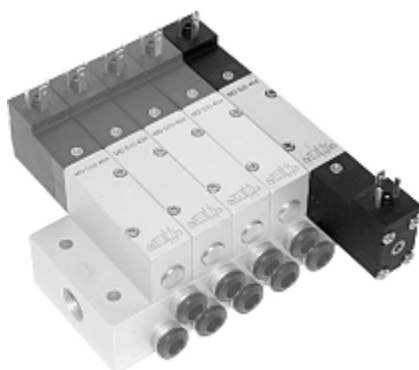
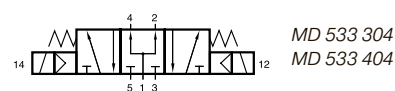
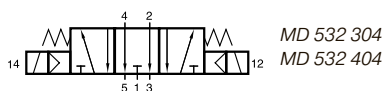
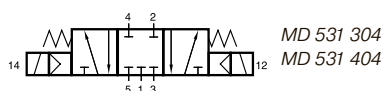
Manifolds for valves type 503 are displayed on page 2.7.2.2, manifolds for valves type 703 are displayed on page 2.7.2.3, manifolds for valves type 803 are displayed on page 2.7.2.5.

Blanking plates are also available type BP 5 503, BP 5 703 or BP 5 803.

Mounting screws and seals are included.

Type	Ports 2, 4	Air flow	Operating press.	Power consumption	Weight
MH 53_ 503	G 1/8"	650 l/min	3 - 10 bar	3 W = / 5 VA ~	0,31 kg MK
MH 53_ 703	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,33 kg MK
MH 53_ 803	G 1/4"	1450 l/min	3 - 10 bar	3 W = / 5 VA ~	0,56 kg

MD 53_304/MD 53_404



5/3-way solenoid valve with spring return to middle position, actuated by permanent signal. All the ports are in the plate.

Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurised

When ordering please complete the type number by 1, 2 or 3 according to the type required.

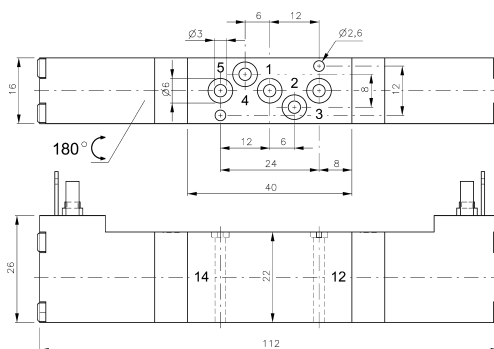
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=,
12V=, 6V= either for connector form C ISO 15217
or with flying leads, standard cable length 500 mm.
For details about solenoid system, please refer to
page 2.13.1.

Valves are generally equipped with manual override to push.

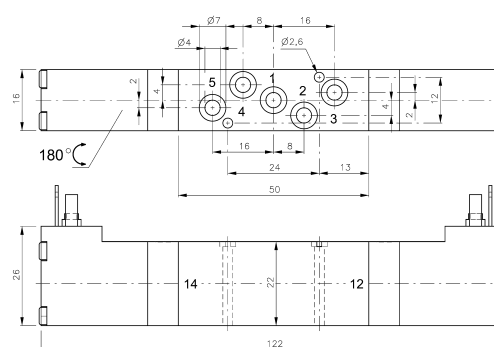
Manifolds are described on page 2.7.2.6.

Blanking plates are also available type BP 5 344
or BP 5 464.

Mounting screws and seals are included.



MD 53_304



MD 53_404

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MD 53_304	Ø 3 mm	280 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,13 kg
MD 53_404	Ø 4 mm	450 l/min	3 - 10 bar	1,8 W = / 3,0 VA ~	0,14 kg

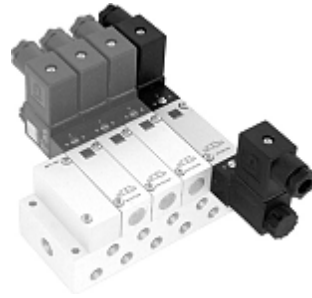
2.5.3.2.4
page 129



MH 53_304

MH 53_ 504

MH 53_704



5/3-way solenoid valve with spring return to middle position, actuated by permanent signal. All the ports are in the plate.

Type 531	centre closed
Type 532	centre exhausted
Type 533	centre pressurised

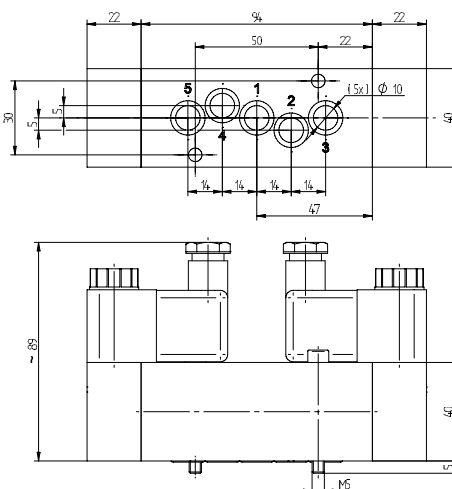
When ordering please complete the type number by 1, 2 or 3 according to the type required.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

Valves are generally equipped with manual override.
If requested without manual override please order
M 53 ____ (please add 1 digit for type and 3 for size).

Manifolds for valves type 304 and 504 are displayed on page 2.7.2.7. Manifolds for valves type 704 are displayed on page 2.7.2.8 and 2.7.2.9. Manifolds for valves type 104 are displayed on page 2.7.2.10.

Blanking plates are also available:
Type no. BP 5 304, BP 5 504 or BP 5 704.
Mounting screws and seals are included.



MH 53_ 104

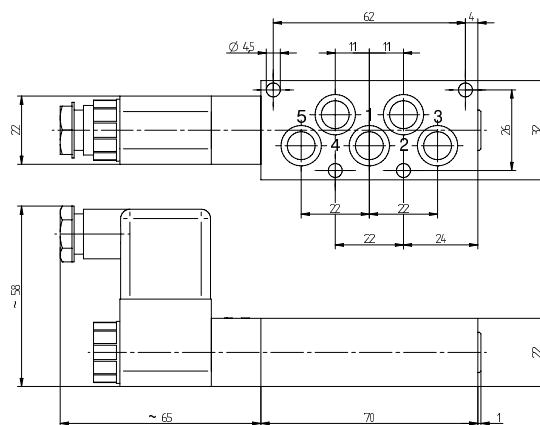
Type	Port size	Air flow	Operating press.	Power cons.	Weight	
MH 53_ 304	Ø 3 mm	220 l/min	3 - 10 bar	3 W = / 5 VA ~	0,25 kg	❄
MH 53_ 504	Ø 5 mm	650 l/min	3 - 10 bar	3 W = / 5 VA ~	0,27 kg	❄❄MK
MH 53_ 704	Ø 7 mm	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,29 kg	❄❄MK
MH 53_ 104	Ø 10 mm	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,80 kg	

Examples for the Cement Industry

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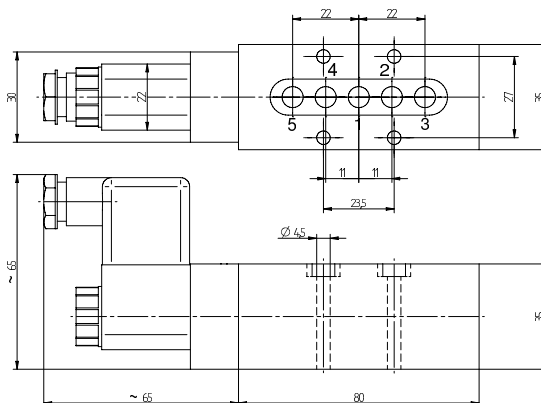
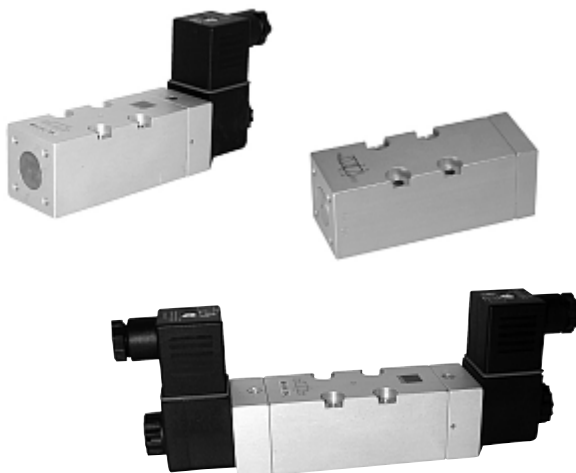
Hafner is offering a series of valves and cylinders to cover the replacement business in the cement industry.

Valves Series 714 B For manifold plates
Valves Series 714 BT For valve terminals



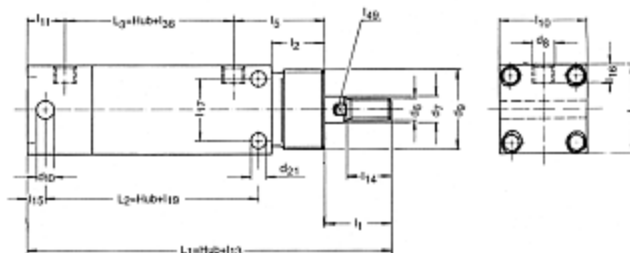
MH 510 714 B

Valve Series 704 J – SIVG – SIMPG

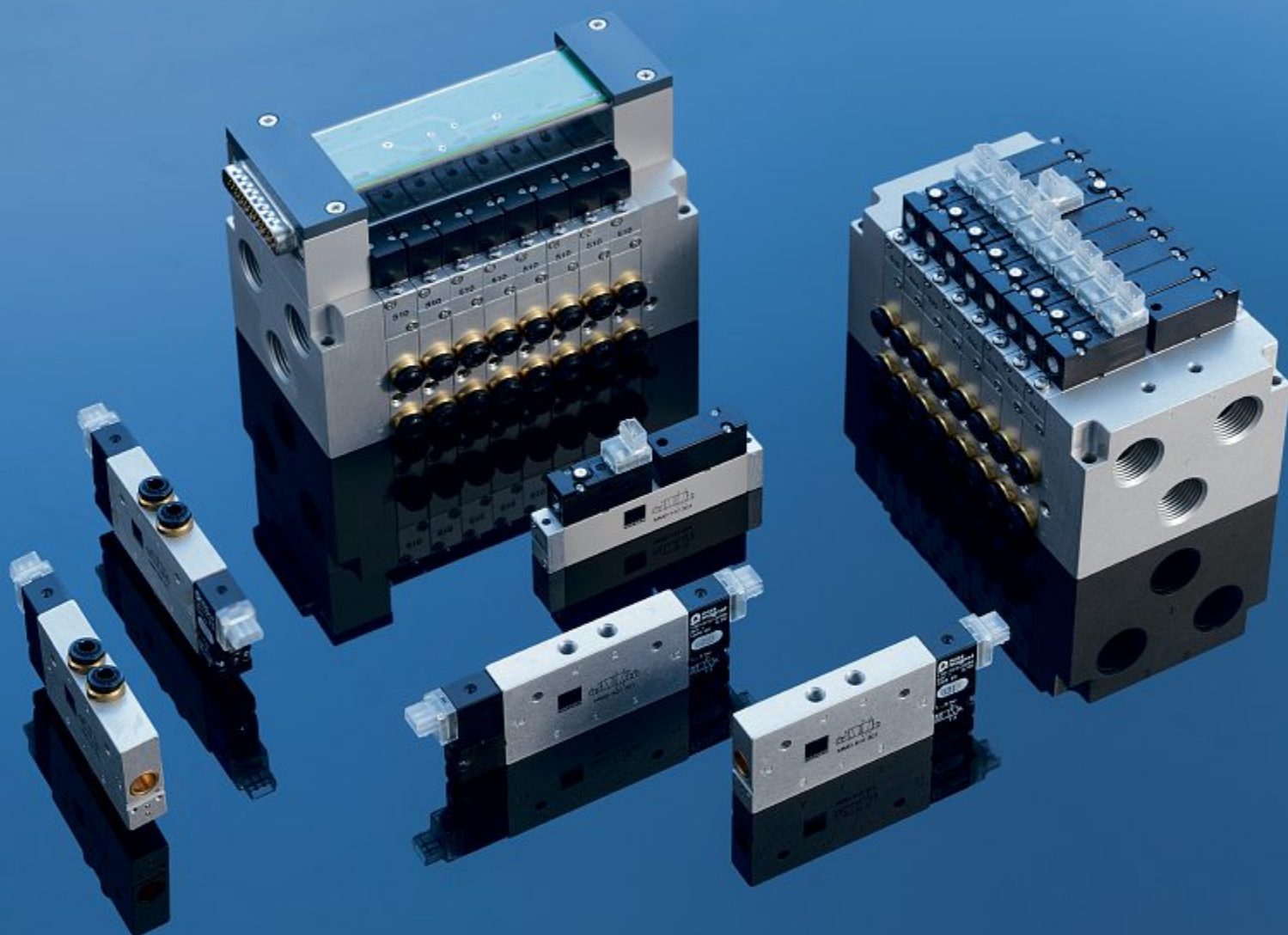


MH 510 704 J

SEJ Single-acting clamping cylinders
SDJ Double-acting clamping cylinders



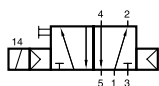
SEJ/SDJ



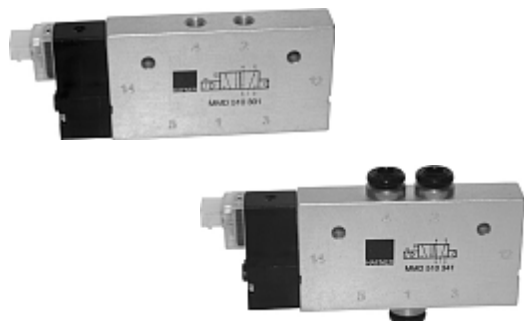
2.6

10 mm Solenoid Valves

MMD 510 301 24DC/MMD 510 341 24DC



MMD 510 301 24DC
MMD 510 341 24DC



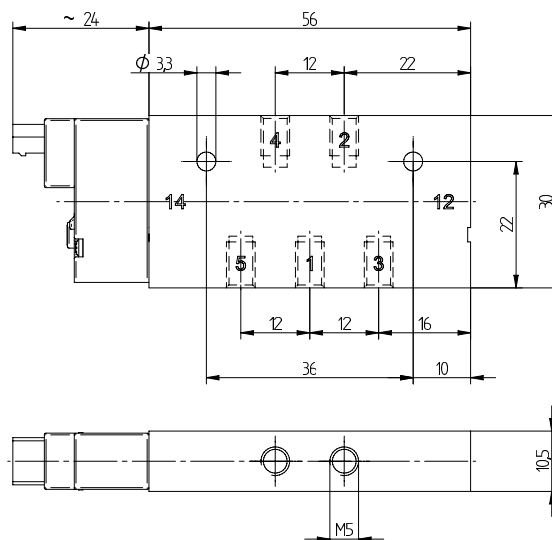
5/2-way solenoid valve actuated by permanent signal and equipped with air spring return.

Available with 24V= solenoid system for connector according to JPC standard.
12V= available on request.

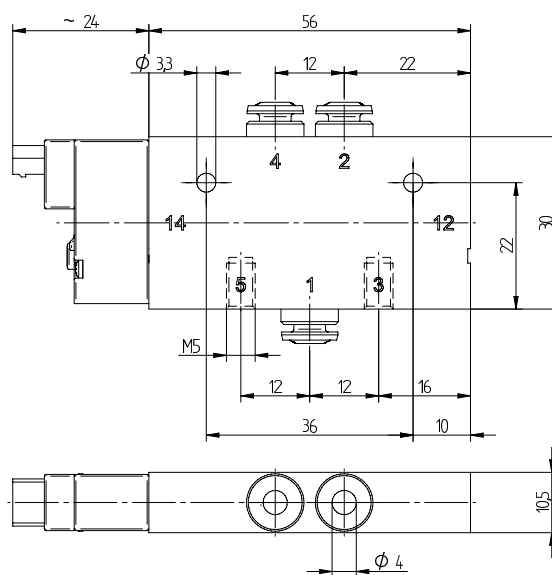
Solenoid with integrated LED and varistor.
Protection class IP 40.

Valves are generally equipped with manual override to push.

Connector according to JPC standard with a cable length of 300 mm is included.



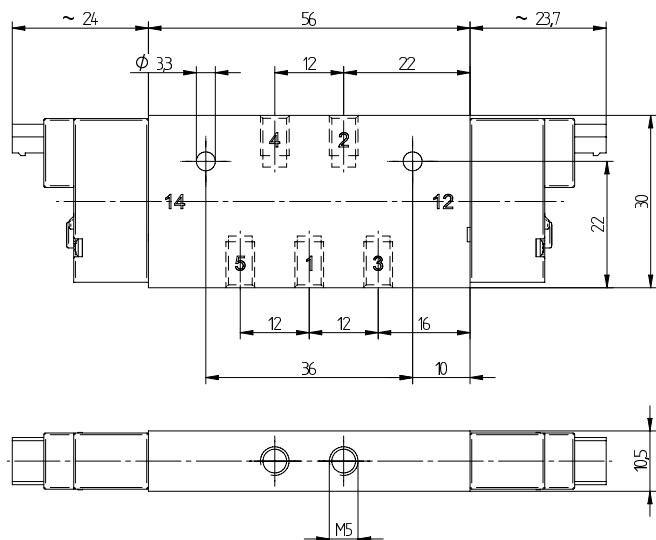
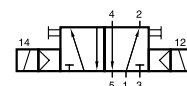
MMD 510 301 24DC



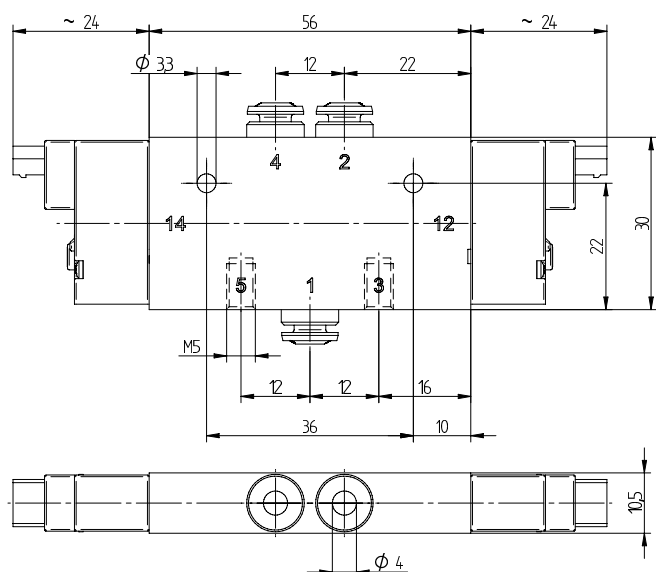
MMD 510 341 24DC

Type	Ports 1,2,3	Air flow	Operating press.	Power cons.	Weight
MMD 510 301 24DC	M5	230 l/min	3 - 8 bar	0,6 W	0,058 kg
MMD 510 341 24DC	pif 4 mm	230 l/min	3 - 8 bar	0,6 W	0,064 kg

MMD 520 301 24DC
MMD 520 341 24DC



MMD 520 301 24DC



MMD 520 341 24DC



5/2-way double solenoid valve actuated by impulse. Position is kept until an electrical signal is applied to the opposite side even when not attached to electrical signal.

Available with 24V= solenoid system for connector according to JPC standard.
12V= available on request.

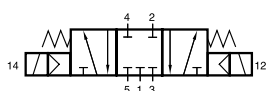
Solenoid with integrated LED and varistor.
Protection class IP 40.

Valves are generally equipped with manual override to push.

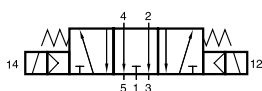
Connectors according to JPC standard with a cable length of 300 mm are included.

Type	Ports 1,2,3	Air flow	Operating press.	Power cons.	Weight
MMD 520 301 24DC	M5	230 l/min	3 - 8 bar	0,6 W	0,058 kg
MMD 520 341 24DC	pif 4 mm	230 l/min	3 - 8 bar	0,6 W	0,064 kg

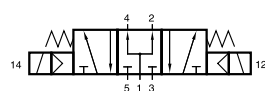
MMD 53_ 301 24DC/MMD 53_ 341 24DC



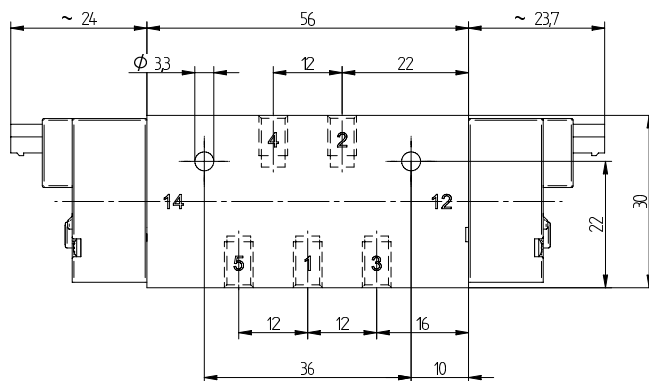
MMD 531 301 24DC
MMD 531 341 24DC



MMD 532 301 24DC
MMD 532 341 24DC



MMD 533 301 24DC
MMD 533 341 24DC



MMD 510 301 24DC

5/3-way solenoid valve with spring return to middle position, actuated by permanent signal.

Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurized

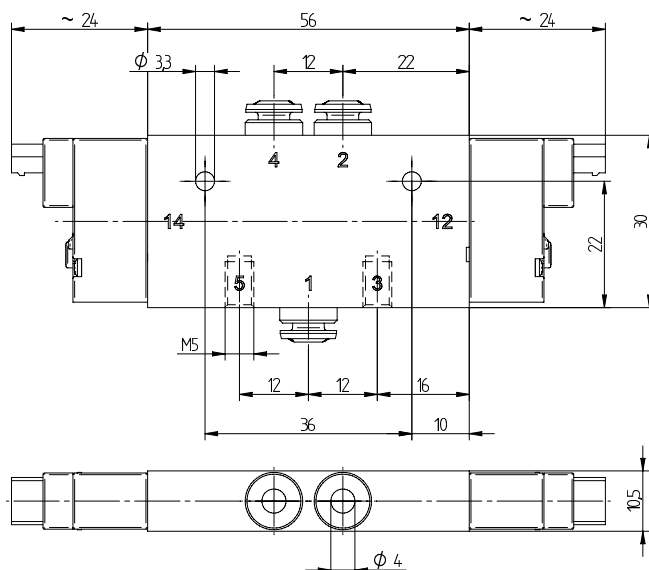
When ordering please complete the type number by 1, 2 or 3 according to the type required.

Available with 24V= solenoid system for connector according to JPC standard.
12V= available on request.

Solenoid with integrated LED and varistor.
Protection class IP 40.

Valves are generally equipped with manual override to push.

Connectors according to JPC standard with a cable length of 300 mm are included.

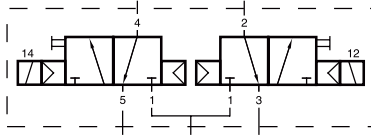


MMD 510 341 24DC

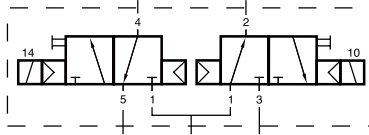
Type	Ports 1,2,3	Air flow	Operating press.	Power cons.	Weight
MMD 53_ 301 24DC	M5	230 l/min	3 - 8 bar	0,6 W	0,068 kg
MMD 53_ 341 24DC	pif 4 mm	230 l/min	3 - 8 bar	0,6 W	0,074 kg

MMD 231 304 24DC/MMD 232 304 24DC MMD 233 304 24DC

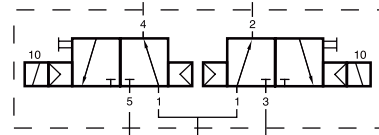
2.6.2.1
page 135



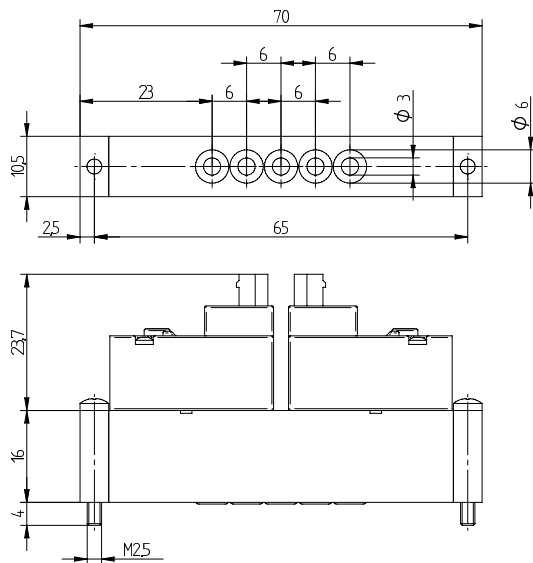
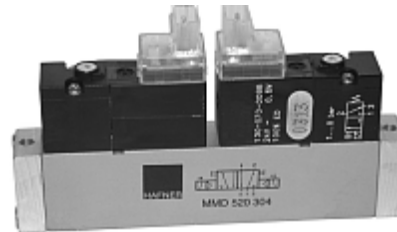
MMD 231 304 24DC



MMD 232 304 24DC



MMD 233 304 24DC



MMD 23_304 24DC

Double 3/2-way solenoid valve actuated by permanent signal and equipped with air spring return.

Type 231	NC & NC
Type 232	NC & NO
Type 233	NO & NO

When ordering please complete the type number by 1, 2 or 3 according to the type required.

Available with 24V= solenoid system for connector according to JPC standard.
12V= available on request.

Solenoid with integrated LED and varistor.
Protection class IP 40.

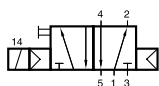
Valves are generally equipped with manual override to push.

Connectors according to JPC standard with a cable length of 300 mm are included.

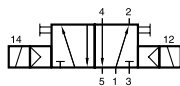
Modular manifold system type RM 5 304 on page 2.6.2.4, valve terminals on page 2.6.2.5.

Type	Ports 1,2,3	Air flow	Operating press.	Power cons.	Weight
MMD 23_304 24DC	Ø 3 mm	230 l/min	3 - 8 bar	0,6 W	0,054 kg

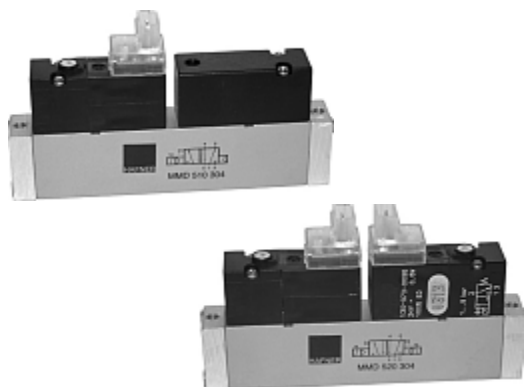
MMD 510 304 24DC/MMD 520 304 24DC



MMD 510 304 24DC



MMD 520 304 24DC



MMD 510 304

5/2-way solenoid valve actuated by permanent signal and equipped with air spring return. All the ports are in the plate.

MMD 520 304

5/2-way double solenoid valve actuated by impulse. Position is kept until an electrical signal is applied to the opposite side even when not attached to electrical signal. All the ports are in the plate.

Available with 24V= solenoid system for connector according to JPC standard.
12V= available on request.

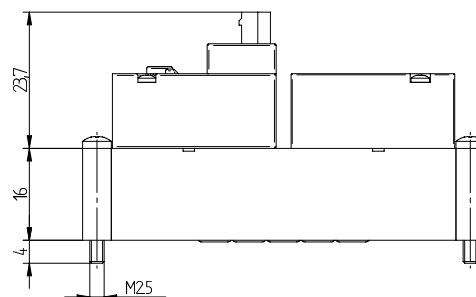
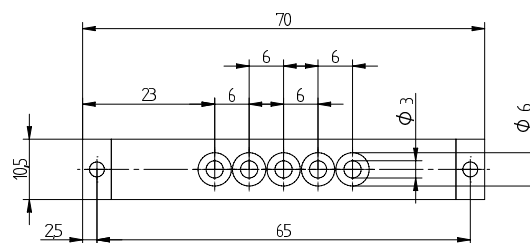
Solenoid with integrated LED and varistor.
Protection class IP 40.

Valves are generally equipped with manual override to push.

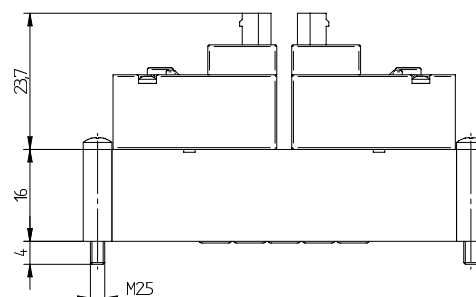
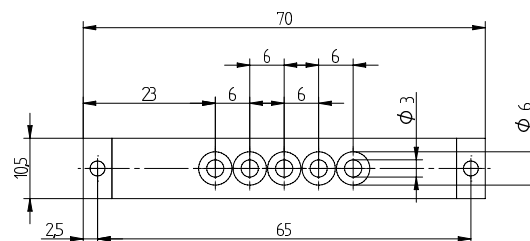
Connector according to JPC standard with a cable length of 300 mm is included.

MMD 520 304 24DC equipped with two connectors.

Modular manifold system type RM 5 304 on page 2.6.2.4, valve terminals on page 2.6.2.5.

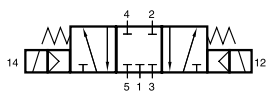


MMD 510 304 24DC

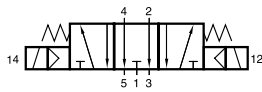


MMD 520 304 24DC

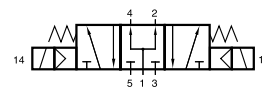
Type	Ports 1,2,3	Air flow	Operating press.	Power cons.	Weight
MMD 510 304 24DC	Ø 3 mm	230 l/min	3 - 8 bar	0,6 W	0,054 kg
MMD 520 304 24DC	Ø 3 mm	230 l/min	3 - 8 bar	0,6 W	0,054 kg



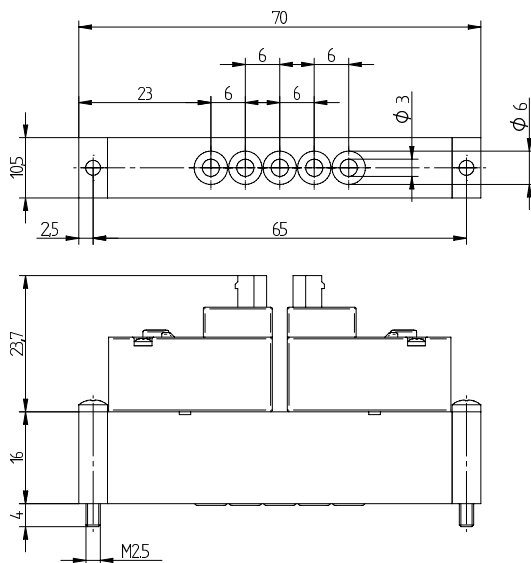
MMD 531 304 24DC



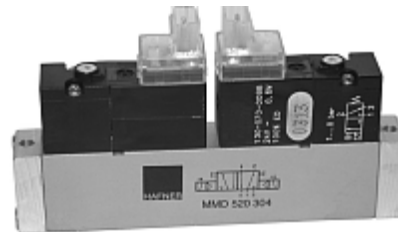
MMD 532 304 24DC



MMD 533 304 24DC



MMD 53_ 304 24DC



5/3-way solenoid valve with spring return to middle position, actuated by permanent signal. All the ports are in the plate.

Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurized

When ordering please complete the type number by 1, 2 or 3 according to the type required.

Available with 24V= solenoid system for connector according to JPC standard.
12V= available on request.

Solenoid with integrated LED and varistor.
Protection class IP 40.

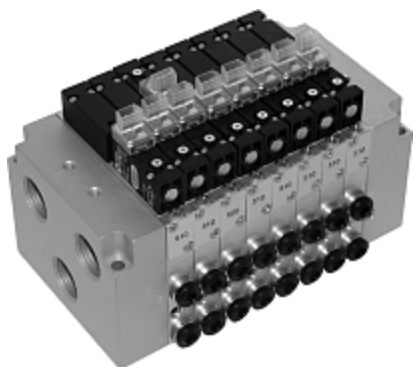
Valves are generally equipped with manual override to push.

Connectors according to JPC standard with a cable length of 300 mm are included.

Modular manifold system type RM 5 304 on page 2.6.2.4, valve terminals on page 2.6.2.5.

Type	Ports 1,2,3	Air flow	Operating press.	Power cons.	Weight
MMD 53_ 304 24DC	Ø 3 mm	230 l/min	3 - 8 bar	0,6 W	0,054 kg

RM 5_ _ 344



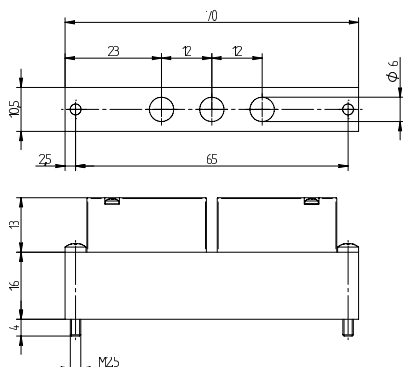
Modular manifold system for common connection to ports 1 (pressure), 3 and 5 (exhaust). Ports 2 and 4 of the individual valves are also located in the manifold plate and equipped with 4 mm push-in fittings.

The system can be build and taken apart just by operating two hexagon socket screws. Additional stations can be added at any position and any time.

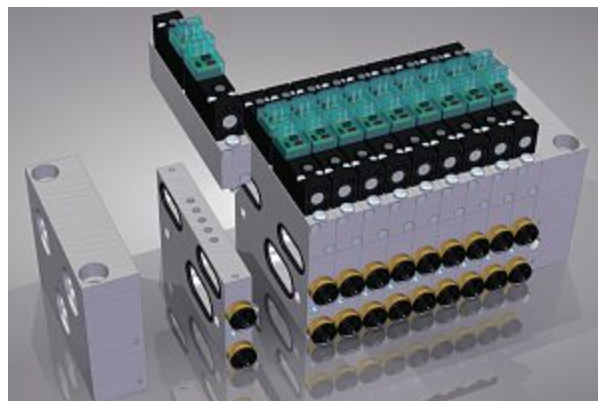
Valves to be screwed from the top onto the modular manifold plate.

Blanking plates are also available type BPM 5 304. The plates can also be ordered assembled by the manufacturer. In this case order RM 5_ _ 344. Please add two digits for the number of positions required.

End-plates do not offer a valve-position.

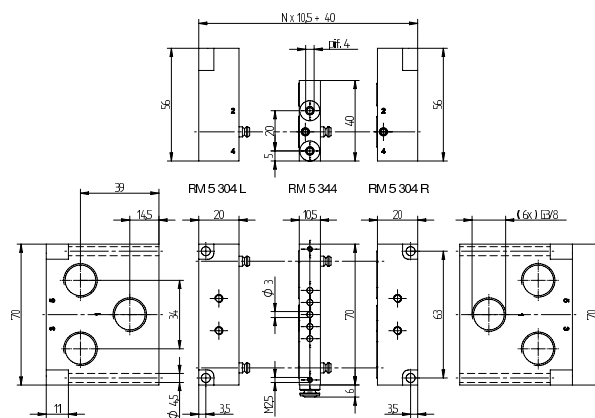


BPM 5 304



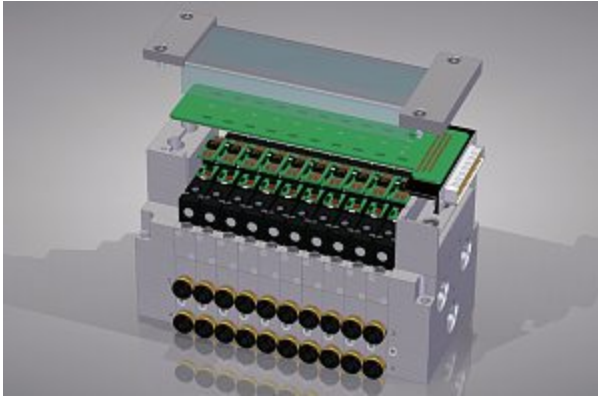
The following valves can be assembled to the manifold plate RM 5_ _ 304:

Type	Function	Page
MMD 231 304 24DC	Double 3/2-way (NC&NC)	2.6.2.1
MMD 232 304 24DC	Double 3/2-way (NC&NO)	2.6.2.1
MMD 233 304 24DC	Double 3/2-way (NO&NO)	2.6.2.1
MMD 510 304 24DC	5/2 single sol.	2.6.2.2
MMD 520 304 24DC	5/2 double sol.	2.6.2.2
MMD 531 304 24DC	5/3 solenoid, closed	2.6.2.3
MMD 532 304 24DC	5/3 solenoid, exhausted	2.6.2.3
MMD 533 304 24DC	5/3 solenoid, pressurized	2.6.2.3



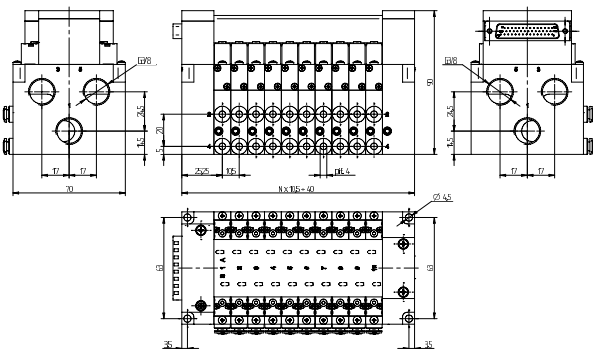
RM 5 304 L / RM 5 344 / RM 5 304 R

Type	Function	Ports	Weight
RM 5 304 L	End-plate left	G 3/8"	0,176 kg
RM 5 304 R	End-plate right	G 3/8"	0,176 kg
RM 5 344	Individual position	pif 4 mm	0,064 kg
BPM 5 304	Blanking plate	—	0,054 kg

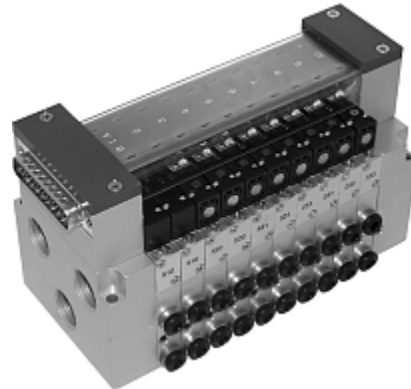


The following valves can be assembled to the valve terminal T_ 10 5_ _ 344:

Type	Function	Page
MMD 231 304 24DC	Double 3/2-way (NC&NC)	2.6.2.1
MMD 232 304 24DC	Double 3/2-way (NC&NO)	2.6.2.1
MMD 233 304 24DC	Double 3/2-way (NO&NO)	2.6.2.1
MMD 510 304 24DC	5/2 single sol.	2.6.2.2
MMD 520 304 24DC	5/2 double sol.	2.6.2.2
MMD 531 304 24DC	5/3 solenoid, closed	2.6.2.3
MMD 532 304 24DC	5/3 solenoid, exhausted	2.6.2.3
MMD 533 304 24DC	5/3 solenoid, pressurized	2.6.2.3



T_ 10 5_ _ 344



Valve terminal with 2 to 20 valve positions for valves with one or two solenoids. Common connection to ports 1 (pressure), 3 and 5 (exhaust). Ports 2 and 4 of the individual valves are also located in the manifold plate and equipped with 4 mm push-in fittings.

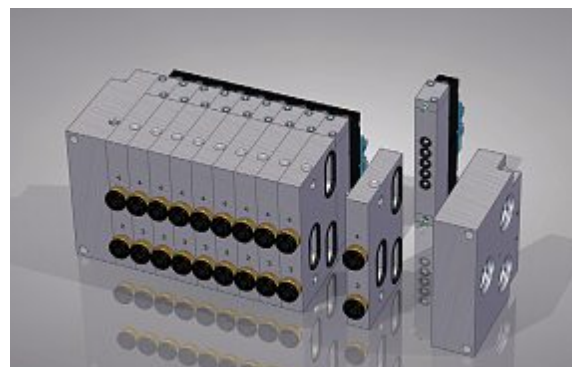
Valves are screwed from the top onto the modular manifold plate. Electric part is added afterwards. The electric part has a defined number of positions and can be chosen with cable connection either on the left or on the right side. The following illustration shows a TR 10 510 344.

The TL 10 has the connector on the opposite side.

Blanking plates are also available type BPM 5 304, displayed on page 2.6.2.4.

The valve terminal will be equipped and tested by the manufacturer. Please advise configuration.

End-plates do not offer a valve-position.



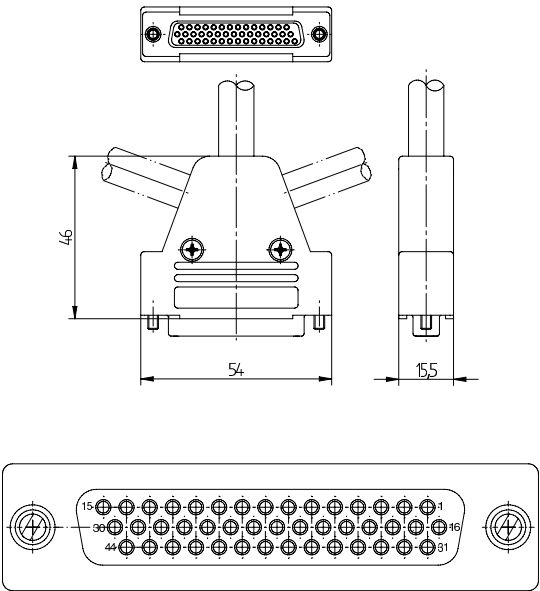
Element with ports 2+4 on the bottom:
RM 5 344 K1

Type	Connector	Ports	Comment
TR 10 5_ _ 344	On the right side	front side	Please amend the type nr. by the required positions
TL 10 5_ _ 344	On the left side	front side	Please amend the type nr. by the required positions
TR 10 5_ _ 344 K1	On the right side	bottom	Please amend the type nr. by the required positions
TL 10 5_ _ 344 K1	On the left side	bottom	Please amend the type nr. by the required positions

ST 54 20 L3000/ST 54 40 L3000



Straight electrical connector fo 10 mm valve terminals.
Cable can be offset by 2 x 90°.
Standard cable length 3000 mm, others on request.

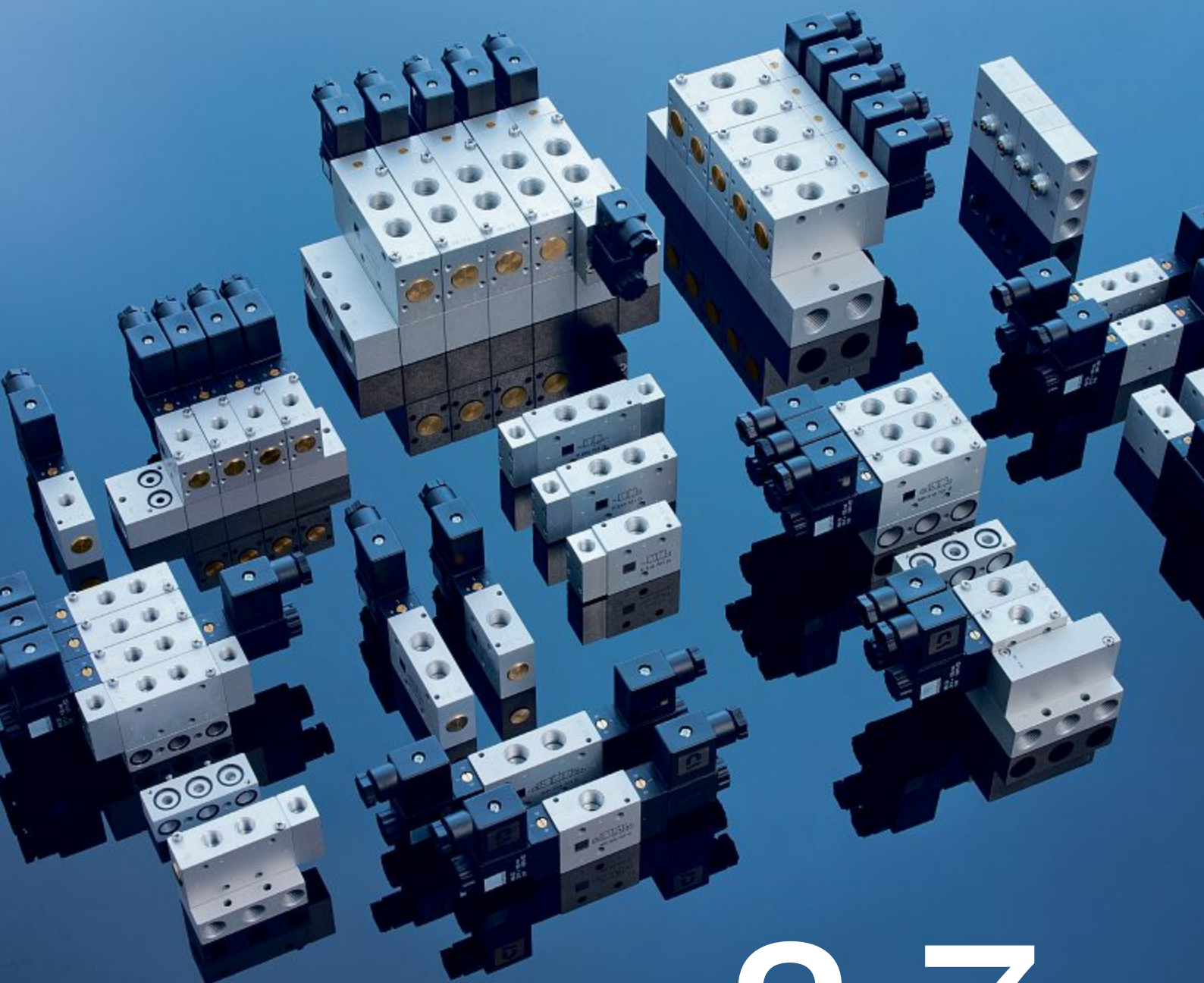


PIN-numbering

Valve	Solenoid	Colour	PIN
1	A	brown	23
	B	yellow	37
2	A	green	38
	B	red	22
3	A	blue	9
	B	pink	7
4	A	grey	24
	B	violet	36
5	A	black	39
	B	brown-green	21
6	A	white-green	10
	B	red-blue	6
7	A	grey-pink	25
	B	yellow-brown	35
8	A	white-yellow	40
	B	pink-brown	20
9	A	white-pink	11
	B	grey-brown	5
10	A	white-grey	26
	B	white-red	34
11	A	white-blue	41
	B	grey-green	19
12	A	brown-black	12
	B	white-black	4
13	A	brown-red	27
	B	pink-green	33
14	A	yellow-grey	42
	B	green-red	18
15	A	yellow-blue	13
	B	green-blue	3
16	A	yellow-pink	28
	B	grey-blue	32
17	A	yellow-black	29
	B	green-black	17
18	A	yellow-red	43
	B	grey-red	2
19	A	pink-blue	14
	B	grey-black	31
20	A	pink-red	44
	B	blue-black	16
common +/- up to 10 valves		white	8
2. common +/- for 10 to 20 valves		brown-blue	8
Without function		pink-black	
		red-black	

Solenoid A and B are marked on the terminal.
For TR10 solenoids A are on valve-side 12,
the B solenoids are on valve-side 14.
For TL10 solenoids A re on valve-side 14,
the B solenoids are on valve-side 12.

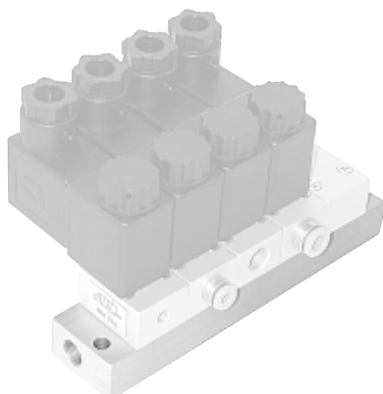
Type	Comment
ST 54 20 L3000	Connector for up to 10 valves
ST 54 40 L3000	Connector for up to 20 valves



2.7

Manifold Plates

R _ _



Common connection to port 1 (pressure).

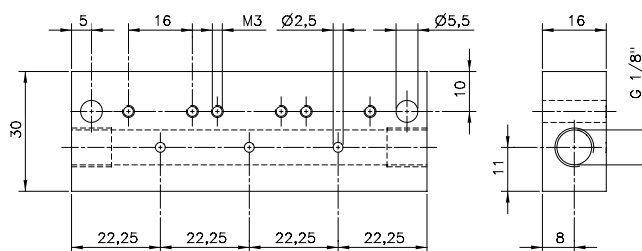
The following valves can be assembled to the manifold plate type **R _ _**:

- MH 312 port 2: M5
- MH 314 port 2: pif 4 mm
- MH 315 port 2: G 1/8"
- MH 316 port 2: pif 6 mm

All the valves are displayed on page 2.5.1.2.2.

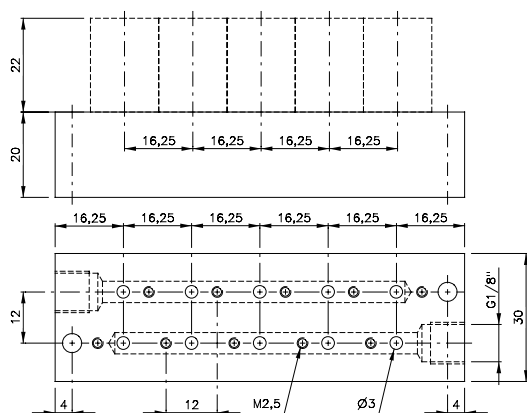
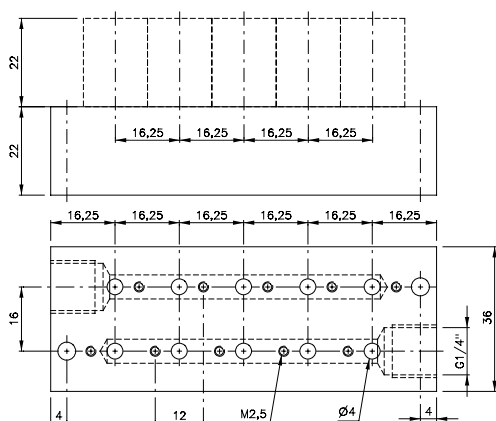
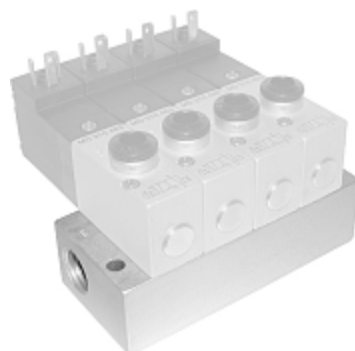
Blanking plates are also available type BP 3.

All the manifold plates offered by Hafner-Pneumatik can be equipped with the DIN-rail mounting clips.



R _ _ Orifice size: 8,5 mm

Stations	Type	Weight	Available
1	R 01	0,05 kg	from stock
2	R 02	0,08 kg	from stock
3	R 03	0,11 kg	from stock
4	R 04	0,13 kg	from stock
5	R 05	0,16 kg	from stock
6	R 06	0,19 kg	from stock
7	R 07	0,21 kg	from stock
8	R 08	0,24 kg	from stock
9	R 09	0,27 kg	from stock
10	R 10	0,30 kg	from stock
11	R 11	0,32 kg	from stock
12	R 12	0,35 kg	from stock
13	R 13	0,38 kg	from stock
14	R 14	0,41 kg	from stock
15	R 15	0,44 kg	from stock
16	R 16	0,47 kg	from stock

**RD 3__ 303** Orifice size: 5 mm**RD 3__ 403** Orifice size: 6 mm

Common connection to port 1 (pressure) and 3 (exhaust).

The following valves can be assembled to the manifold plate type **RD 3__ 303**:

3/2-way n.c.	pif 4 mm	MD 310 343	page 2.5.1.2.4
3/2-way n.o.	pif 4 mm	MOD 310 343	page 2.5.1.2.4

Blanking plates are also available type BP 3 303.

The following valves can be assembled to the manifold plate type **RD 3__ 403**:

3/2-way n.c.	G 1/8"	MD 310 403	page 2.5.1.2.4
3/2-way n.o.	G 1/8"	MOD 310 403	page 2.5.1.2.4
3/2-way n.c.	pif 6 mm	MD 310 463	page 2.5.1.2.4
3/2-way n.o.	pif 6 mm	MOD 310 463	page 2.5.1.2.4

Blanking plates are also available type BP 3 403.

Please notice:

Due to the compact design of the plate if a larger number of valves are to switch at the same time please do not select plates with more than 6 stations.

Stations	Type	Weight	Available	Type	Weight	Available
2	RD 302 303	0,07 kg	from stock	RD 302 403	0,09 kg	from stock
3	RD 303 303	0,10 kg	from stock	RD 303 403	0,13 kg	from stock
4	RD 304 303	0,13 kg	from stock	RD 304 403	0,16 kg	from stock
5	RD 305 303	0,15 kg	from stock	RD 305 403	0,19 kg	from stock
6	RD 306 303	0,18 kg	from stock	RD 306 403	0,23 kg	from stock
7	RD 307 303	0,21 kg	on request	RD 307 403	0,27 kg	on request
8	RD 308 303	0,23 kg	from stock	RD 308 403	0,30 kg	from stock
9	RD 309 303	0,26 kg	on request	RD 309 403	0,33 kg	on request
10	RD 310 303	0,28 kg	from stock	RD 310 403	0,36 kg	from stock
12	RD 312 303	0,33 kg	from stock	RD 312 403	0,43 kg	from stock
14	RD 314 303	0,38 kg	on request	RD 314 403	0,49 kg	on request
16	RD 316 303	0,43 kg	on request	RD 316 403	0,55 kg	on request

RD 3__ 344/RD 3__ 464



Common connection to port 1 (pressure) and 3 (exhaust). The individual ports 2 are also in the manifold plate equipped with push-in fittings.

The following valves can be assembled to the manifold plate type **RD 3__ 344** (pif 4 mm):

3/2-way n.c. MD 310 304 page 2.5.1.2.5
3/2-way n.o. MOD 310 304 page 2.5.1.2.5

Blanking plates are also available type BP 3 344.

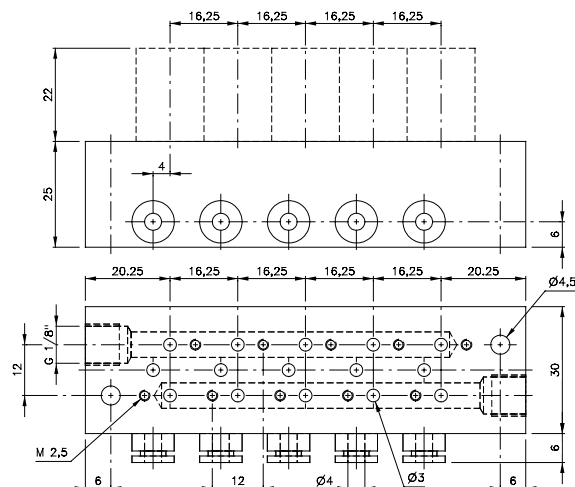
The following valves can be assembled to the manifold plate type **RD 3__ 464** (pif 6 mm):

3/2-way n.c. MD 310 404 page 2.5.1.2.5
3/2-way n.o. MOD 310 404 page 2.5.1.2.5

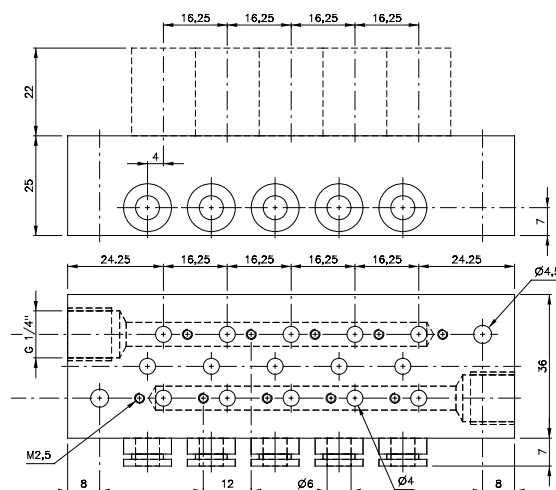
Blanking plates are also available type BP 3 464.

Please notice:

Due to the compact design of the plate if a larger number of valves are to switch at the same time please do not select plates with more than 6 stations.



RD 3__ 344 Orifice size: 5 mm



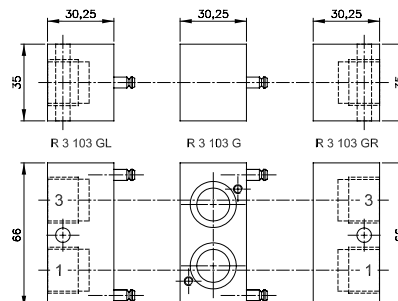
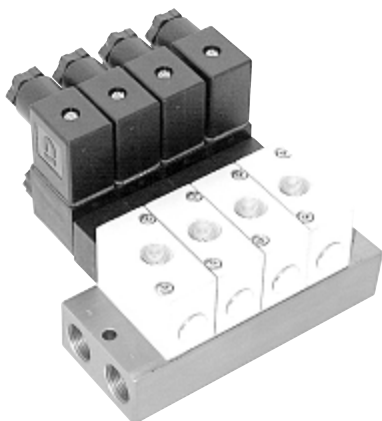
RD 3__ 464 Orifice size: 6 mm

Stations	Type	Weight	Available	Type	Weight	Available
2	RD 302 344	0,13 kg	from stock	RD 302 464	0,15 kg	from stock
3	RD 303 344	0,16 kg	from stock	RD 303 464	0,19 kg	from stock
4	RD 304 344	0,19 kg	from stock	RD 304 464	0,23 kg	from stock
5	RD 305 344	0,22 kg	from stock	RD 305 464	0,26 kg	from stock
6	RD 306 344	0,25 kg	from stock	RD 306 464	0,30 kg	from stock
7	RD 307 344	0,28 kg	on request	RD 307 464	0,34 kg	on request
8	RD 308 344	0,31 kg	from stock	RD 308 464	0,38 kg	from stock
9	RD 309 344	0,34 kg	on request	RD 309 464	0,41 kg	on request
10	RD 310 344	0,38 kg	from stock	RD 310 464	0,49 kg	from stock
12	RD 312 344	0,44 kg	from stock	RD 312 464	0,53 kg	from stock
14	RD 314 344	0,50 kg	on request	RD 314 464	0,60 kg	from stock
16	RD 316 344	0,56 kg	on request	RD 316 464	0,68 kg	on request



Type	Function	Weight
R 3 703 GR	End-plate right	0,11 kg
R 3 703 GL	End-plate left	0,11 kg
R 3 703 G	Individual position	0,07 kg
R 3 703 G D1	Individual position, with individual valve isolation	0,08 kg

RB 3__ 103 G/R 3__ 121 G



Parts of modular manifold **RB 3__ 103 G**

Series 103 G modular manifold system for common connections to ports 1 (pressure) and 3 (exhaust). The system can be build and taken apart just by operating two hexagon socket screws. Additional stations can be added at any position and any time. End-plates are equipped with threads for adding DIN-rail mounting clips.

The following valves can be assembled to the system

RB 3__ 103 G:

3/2 single sol. n.c.	G 3/8" MH 310 101 G	page 2.5.1.1.15
3/2 single sol. n.o.	G 3/8" MOH 310 101 G	page 2.5.1.1.15
3/2 double sol.	G 3/8" MH 320 101 G	page 2.5.1.1.18

The system consists of:

End-plate right type R 3 103 GR

End-plate left type R 3 103 GL

Individual position type R 3 103 G

Blanking plates are also available type BP 3 103.

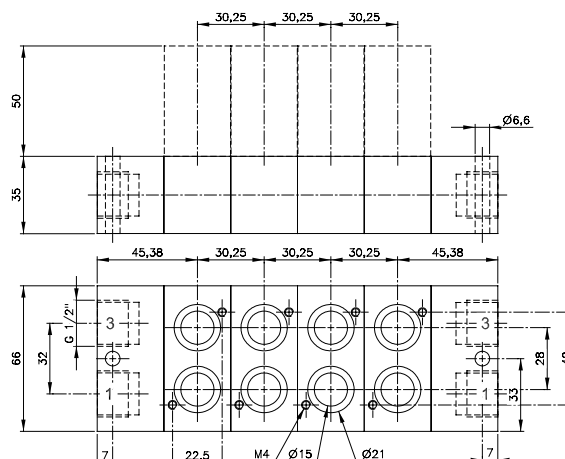
Please notice:

End-plates of series 103 G are not offering an individual valve position.

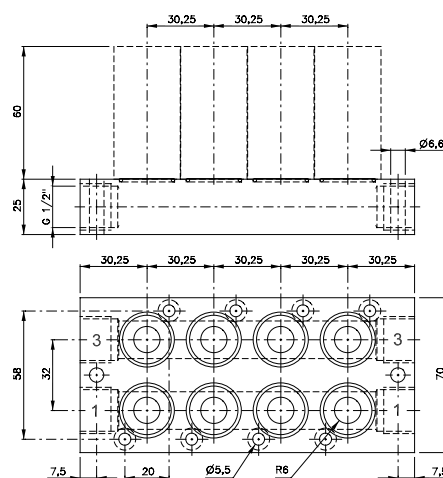
The plates can also be ordered assembled by the manufacturer.

In this case order RB 3__ 103 G (3/8").

Please add two digits for the number of positions required.



RB 3__ 103 G Orifice size: 19 mm



R 3__ 121 G Orifice size: 12 mm

Series 121 G solid manifold system for common connections to ports 1 (pressure) and 3 (exhaust).

The following valves can be assembled to the manifold plate type **R 3__ 121 G**:

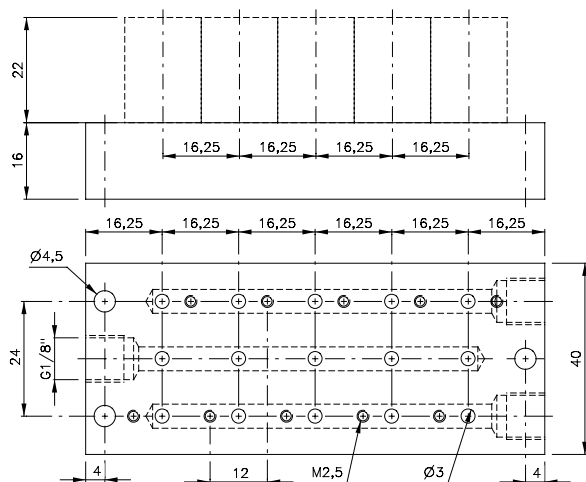
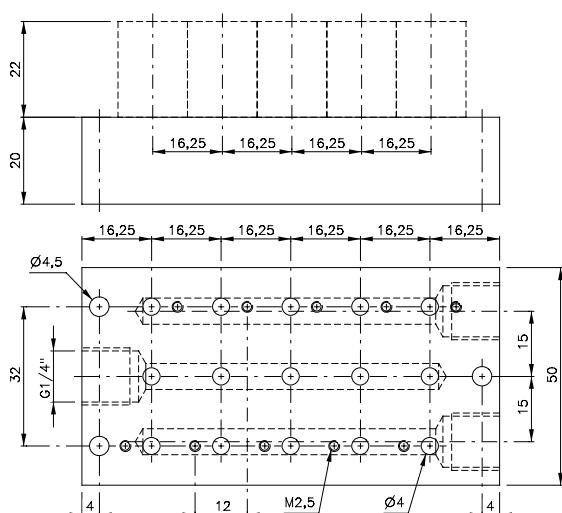
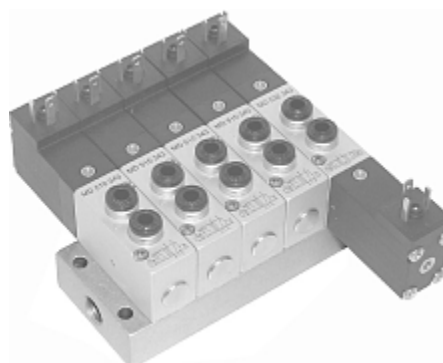
Solenoid valves:

3/2 single sol. n.c.	G 1/2" MH 310 121 G	page 2.5.1.1.15
3/2 single sol. n.o.	G 1/2" MOH 310 121 G	page 2.5.1.1.15
3/2 double sol.	G 1/2" MH 320 121 G	page 2.5.1.1.18
3/3-way centre closed	G 1/2" MH 331 121 G	page 2.5.1.3

Pneumatically actuated 3/2-way valves:

air spring	G 1/2" P 310 121 G	page 2.4.1.4
mech. spring	G 1/2" P 311 121 G	page 2.4.1.4

Type	Function	Weight	Type	Weight	Available
R 3 103 GR	End-plate right	0,14 kg	R 302 121 G	0,28 kg	from stock
R 3 103 GL	End-plate left	0,15 kg			
R 3 103 G	Individual position	0,12 kg	R 304 121 G	0,48 kg	from stock

**RD 5_ _ 303** Orifice size: 8 mm**RD 5_ _ 403** Orifice size: 10 mm

Common connection to port 1 (pressure), 3 and 5 (exhaust).

The following solenoid valves can be assembled to the manifold plate type **RD 5_ _ 303**:

5/2 single sol.	M5	MD 510 303	page 2.5.2.2.1
5/2 single sol.	pif 4 mm	MD 510 343	page 2.5.2.2.1
5/2 double sol.	M5	MD 520 303	page 2.5.2.2.5
5/2 double sol.	pif 4 mm	MD 520 343	page 2.5.2.2.5
5/3-way	M5	MD 53_ 303	page 2.5.3.2.1
5/3-way	pif 4 mm	MD 53_ 343	page 2.5.3.2.1

Blanking plates are also available type BP 5 303.

The following solenoid valves can be assembled to the manifold plate type **RD 5_ _ 403**:

5/2 single sol.	G 1/8"	MD 510 403	page 2.5.2.2.1
5/2 single sol.	pif 6 mm	MD 510 463	page 2.5.2.2.1
5/2 double sol.	G 1/8"	MD 520 403	page 2.5.2.2.5
5/2 double sol.	pif 6 mm	MD 520 463	page 2.5.2.2.5
5/3-way	G 1/8"	MD 53_ 403	page 2.5.3.2.1
5/3-way	pif 6 mm	MD 53_ 463	page 2.5.3.2.1

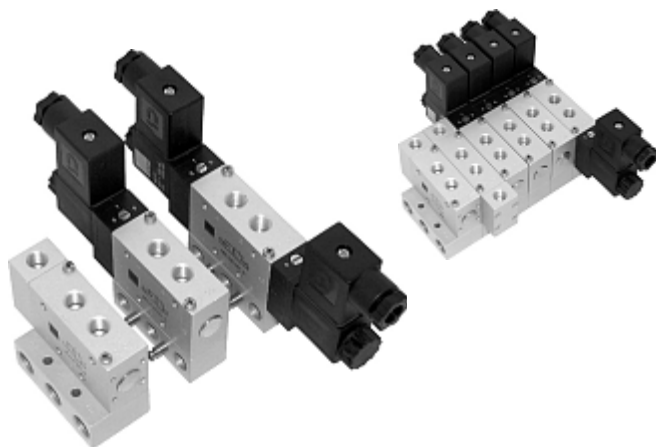
Blanking plates are also available type BP 5 403.

Please notice:

Due to the compact design of the plate if a larger number of valves are to switch at the same time please do not select plates with more than 6 stations.

Stations	Type	Weight	Available	Type	Weight	Available
2	RD 502 303	0,08 kg	from stock	RD 502 403	0,12 kg	from stock
3	RD 503 303	0,10 kg	from stock	RD 503 403	0,16 kg	from stock
4	RD 504 303	0,13 kg	from stock	RD 504 403	0,20 kg	from stock
5	RD 505 303	0,16 kg	from stock	RD 505 403	0,24 kg	from stock
6	RD 506 303	0,18 kg	from stock	RD 506 403	0,28 kg	from stock
7	RD 507 303	0,21 kg	on request	RD 507 403	0,32 kg	on request
8	RD 508 303	0,24 kg	from stock	RD 508 403	0,37 kg	from stock
9	RD 509 303	0,26 kg	on request	RD 509 403	0,41 kg	on request
10	RD 510 303	0,29 kg	from stock	RD 510 403	0,45 kg	from stock
12	RD 512 303	0,34 kg	from stock	RD 512 403	0,53 kg	from stock
14	RD 514 303	0,39 kg	on request	RD 514 403	0,62 kg	from stock
16	RD 516 303	0,44 kg	on request	RD 516 403	0,69 kg	from stock

RB 5 _ _ 503 G



Modular manifold system for common connections to ports 1 (pressure), 3 and 5 (exhaust). The system can be build and taken apart just by operating two hexagon socket screws. Additional stations can be added at any position and any time. End-plates are equipped with threads for adding DIN-rail mounting clips.

The following valves can be assembled to the system **RB 5 _ _ 503 G**:

Solenoid valves:

5/2 single sol.	G 1/8"	MH 510 501 G	page 2.5.2.1.5
5/2 single sol.	G 1/8"	MH 510 503	page 2.5.2.2.2
5/2 double sol.	G 1/8"	MH 520 501 G	page 2.5.2.1.11
5/2 double sol.	G 1/8"	MH 520 503	page 2.5.2.2.6
5/3 solenoid	G 1/8"	MH 53_ 501 G	page 2.5.3.1.4
5/3 solenoid	G 1/8"	MH 53_ 503	page 2.5.3.2.2

Pneumatically actuated valves:

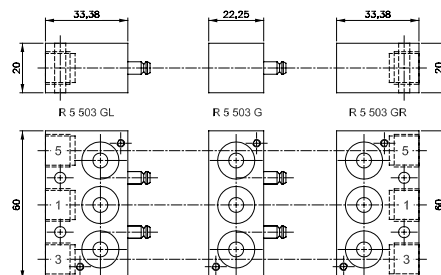
5/2 air spring	G 1/8"	P 510 501 G	page 2.4.2.4
5/2 mech. spring	G 1/8"	P 511 501 G	page 2.4.2.4
5/2 double pilot	G 1/8"	P 52_ 501 G	page 2.4.2.8
5/3	G 1/8"	P 53_ 501 G	page 2.4.3.3

The system consists of:

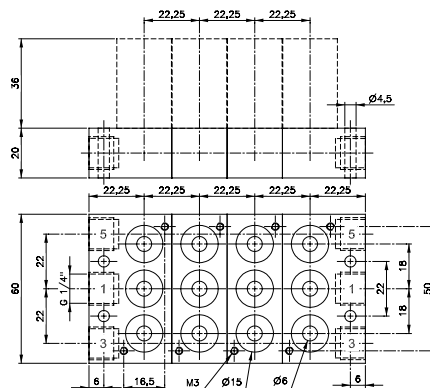
End-plate right	type R 5 503 GR
End-plate left	type R 5 503 GL
Individual position	type R 5 503 G

Blanking plates are also available type BP 5 503.

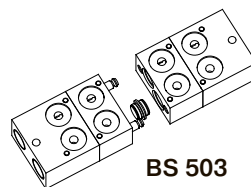
The plates can also be ordered assembled by the manufacturer. In this case order RB 5 _ _ 503 G. Please add two digits for the number of positions required.



Parts of modular manifold RB 5 _ _ 503 G



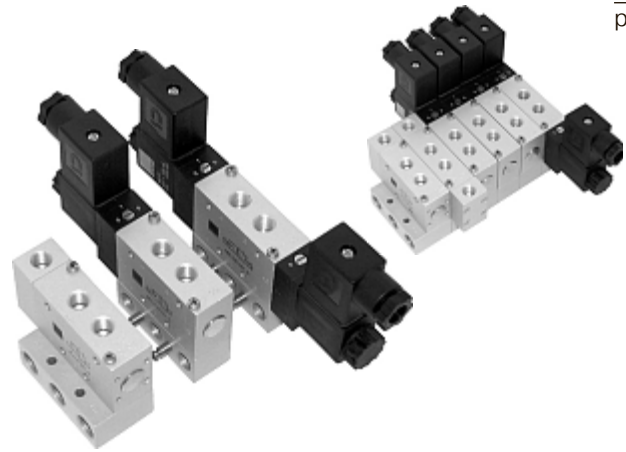
RB 5 _ _ 503 G Orifice size: 10 mm



BS 503

By adding a special plug (type BS 503), two different pressures can be attached at the same manifold plate. The plug is intercepting the air-supply in the manifold plate wherever the customer likes to.

Type	Function	Weight
R 5 503 GR	End-plate right	0,08 kg
R 5 503 GL	End-plate left	0,08 kg
R 5 503 G	Individual position	0,06 kg

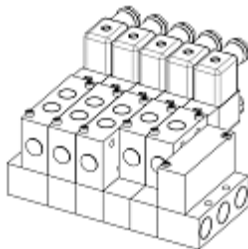


Modular manifold system for common connections to ports 1 (pressure), 3 and 5 (exhaust). The system can be build and taken apart just by operating two hexagon socket screws. Additional stations can be added at any position and any time. End-plates are equipped with threads for adding DIN-rail mounting clips.

[illegible]

Solenoid valves:			
5/2 single sol.	G 1/4"	MH 510 701 G	page 2.5.2.1.5
5/2 single sol.	G 1/4"	MH 510 703	page 2.5.2.2.2
5/2 double sol.	G 1/4"	MH 520 701 G	page 2.5.2.1.11
5/2 double sol.	G 1/4"	MH 520 703	page 2.5.2.2.6
5/3 solenoid	G 1/4"	MH 53_ 701 G	page 2.5.3.1.4
5/3 solenoid	G 1/4"	MH 53_ 703	page 2.5.3.2.2

Pneumatically actuated valves:			
5/2 air spring	G 1/4"	P 510 701 G	page 2.4.2.4
5/2 mech. spring	G 1/4"	P 511 701 G	page 2.4.2.4
5/2 double pilot	G 1/4"	P 52_ 701 G	page 2.4.2.8
5/3 pneum.	G 1/4"	P 53_ 701 G	page 2.4.3.3



The system consists of:

End-plate right	type R 5 703 GR
End-plate left	type R 5 703 GL
Individual position	type R 5 703 G

Blanking plates are also available type BP 5 703.

NPT-ported end-plates available on request.

The plates can also be ordered assembled by the manufacturer. In this case order RB 5 __ 703 G. Please add two digits for the number of positions required.

Additional:

1.) Combine 3-way and 5-way valves on the same plate. By adding R 53 703 G elements to the standard R 5 703 G elements, 3-way as well as 5-way valves can be mixed on the same plate (e.g. MH 510 701 G and MH 310 701 G).

2.) Individual valve isolation.

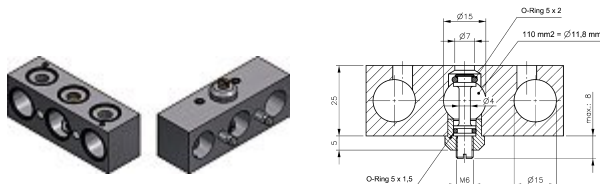
In certain industries the user appreciates, if he can take away air pressure at any valve on the plate individually. Valves can easily be exchanged by closing port 1 on the reverse side of the plate without interruption of the air-supply of the other valves.

The system consists of:

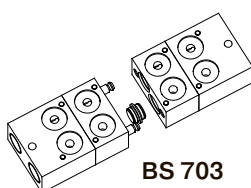
The system consists of:

End-plate right	type R 5 703 GR D1
End-plate left	type R 5 703 GL D1
Individual position	type R 5 703 G D1

Type	Function	Weight
R 5 703 GR	End-plate right	0,13 kg
R 5 703 GL	End-plate left	0,12 kg
R 5 703 G	Individual position	0,09 kg
R 5 703 G D1	Individual position with individual valve isolation	0,09 kg

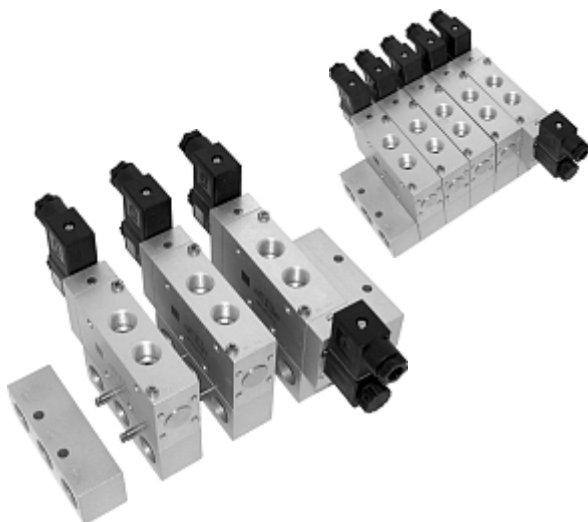


2.) Individual valve isolation (R 5 703 G D1)



By adding a special plug (type BS 703), two different pressures can be attached at the same manifold plate. The plug is intercepting the air-supply in the manifold plate wherever the customer likes to.

RB 5 __ 103 G



Modular manifold system for common connections to ports 1 (pressure), 3 and 5 (exhaust). The system can be build and taken apart just by operating two hexagon socket screws. Additional stations can be added at any position and any time. End-plates are equipped with threads for adding DIN-rail mounting clips.

The following valves can be assembled to the system

RB 5 __ 103 G:

5/2 single solenoid	G 3/8"	MH 510 101 G	page 2.5.2.1.6
5/2 double solenoid	G 3/8"	MH 520 101 G	page 2.5.2.1.12
5/3 solenoid	G 3/8"	MH 53_ 101 G	page 2.5.3.1.5

The system consists of:

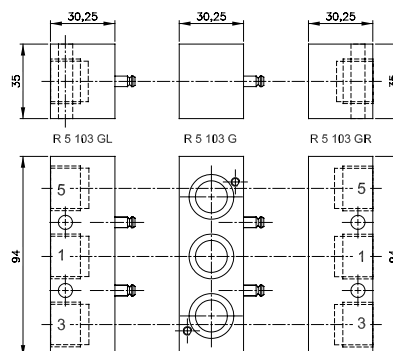
End-plate right	type R 5 103 GR
End-plate left	type R 5 103 GL
Individual position	type R 5 103 G

Blanking plates are also available type BP 5 103.

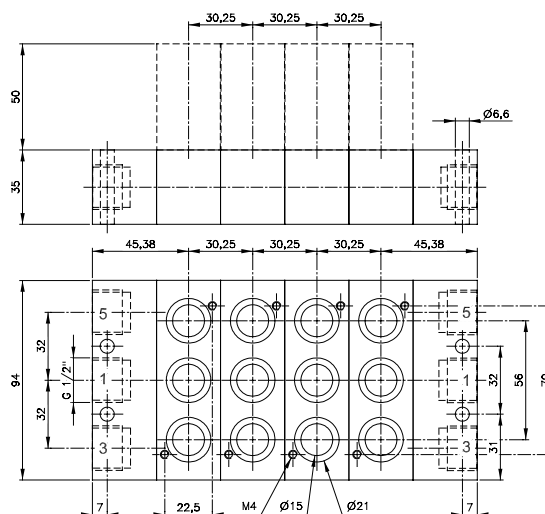
Please notice:

End-plates are not offering an individual valve-position.

The plates can also be ordered assembled by the manufacturer. In this case order RB 5 __ 103 G. Please add two digits for the number of positions required.

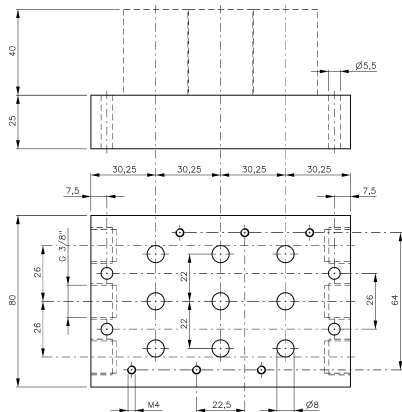


Parts of modular manifold RB 5 __ 103 G

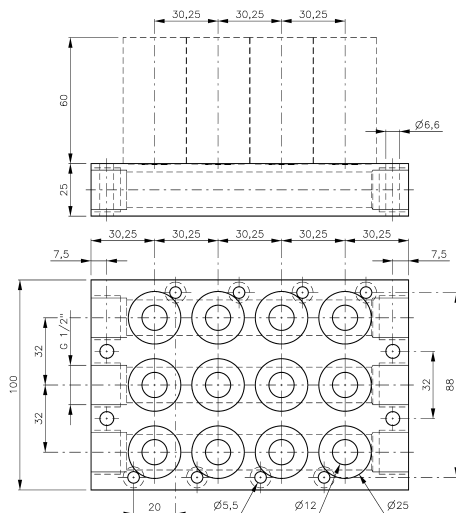


R 5 __ 103 G Orifice size: 19 mm

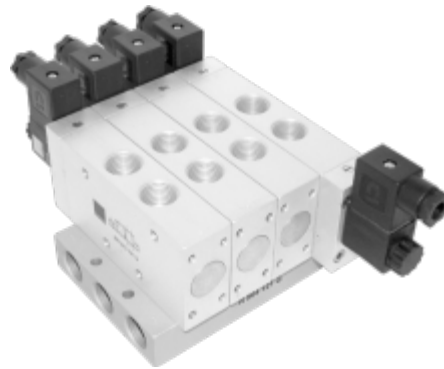
Type	Function	Weight
R 5 103 GR	End-plate right	0,20 kg
R 5 103 GL	End-plate left	0,21 kg
R 5 103 G	Individual position	0,18 kg



R 5 __ 803 Orifice size: 15 mm



R 5 __ 121 G Orifice size: 17 mm



Common connection to port 1 (pressure), 3 and 5 (exhaust).

R 5 __ 803 for valves for manifold-plates only.

The following solenoid valves can be assembled to **R __ 803**:

5/2 single sol.	G 1/4"	MH 510 803	page 2.5.2.2.2
5/2 double sol.	G 1/4"	MH 520 803	page 2.5.2.2.6
5/3- way	G 1/4"	MH 53_ 803	page 2.5.3.2.2

Blanking plates are also available type BP 5 803.

R 5 __ 121 G for dual use valves.

The following valves can be assembled to **R 5 __ 121 G**:

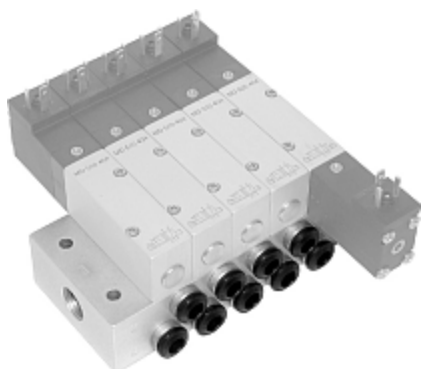
5/2 single sol.	G 1/2"	MH 510 121 G	page 2.5.2.1.6
5/2 double sol.	G 1/2"	MH 520 121 G	page 2.5.2.1.12
5/3 solenoid	G 1/2"	MH 53_ 121 G	page 2.5.3.1.5

5/2 single pilot	G 1/2"	P 510 121 G	page 2.4.2.4
5/2 double pilot	G 1/2"	P 520 121 G	page 2.4.2.8
5/3 pneumatic	G 1/2"	P 53_ 121 G	page 2.4.3.3

Blanking plates are also available type BP 5 121 G.

Plates can be equipped with DIN-rail mounting clips.

Stations	Type	Weight	Type	Weight
2	R 502 803	0,41 kg	R 502 121 G	0,41 kg
3	R 503 803	0,54 kg	R 503 121 G	0,56 kg
4	R 504 803	0,71 kg	R 504 121 G	0,70 kg
5	R 505 803	0,86 kg	R 505 121 G	0,85 kg
6	R 506 803	1,00 kg	R 506 121 G	0,99 kg
8	R 508 803	1,30 kg	n.a.	
10	R 510 803	1,61 kg	n.a.	
12	R 512 803	1,90 kg	n.a.	



Common connection to port 1 (pressure), 3 and 5 (exhaust).
The individual ports 2 and 4 are also in the manifold plate
equipped with push-in fittings.

The following solenoid valves can be assembled to the manifold plate type **RD 5_344** (pif 4 mm):

5/2 single sol.	MD 510 304	page 2.5.2.2.3
5/2 double sol.	MD 520 304	page 2.5.2.2.7
5/3-way	MD 53 304	page 2.5.3.2.3

Blanking plates are also available type BP 5 344.

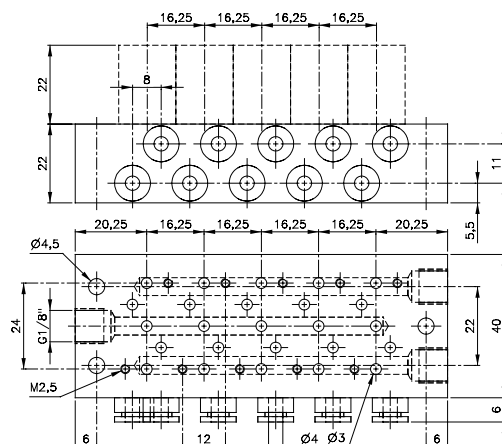
The following solenoid valves can be assembled to the manifold plate type **RD 5_464** (pif 6 mm):

5/2 single sol.	MD 510 404	page 2.5.2.2.3
5/2 double sol.	MD 520 404	page 2.5.2.2.7
5/3-way	MD 53 404	page 2.5.3.2.3

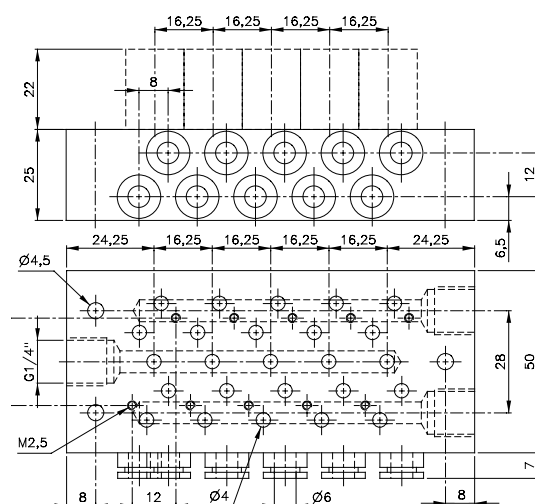
Blanking plates are also available type BP 5 464.

Please notice:

Due to the compact design of the plate if a larger number of valves are to switch at the same time please do not select plates with more than 6 stations.

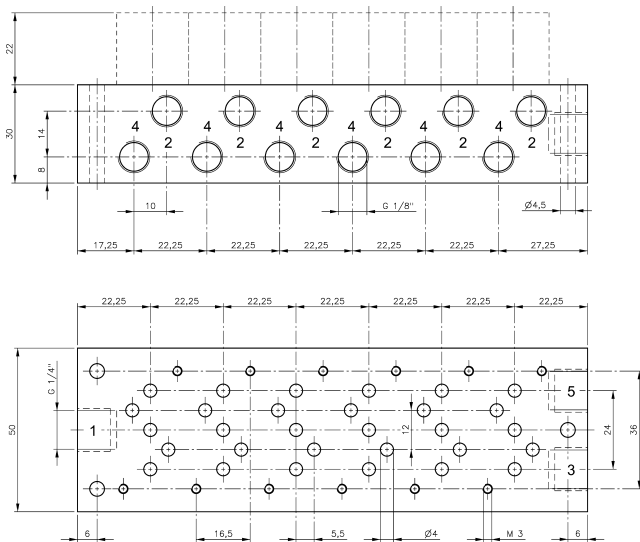


RD 5_344 Orifice size: 5 mm

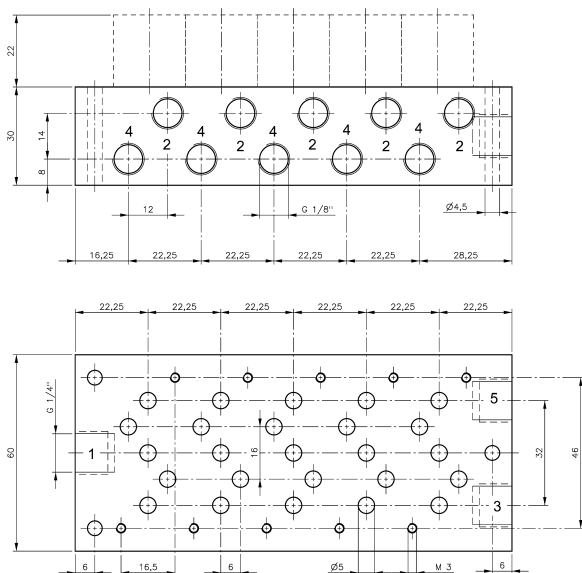


RD 5 464 Orifice size: 6 mm

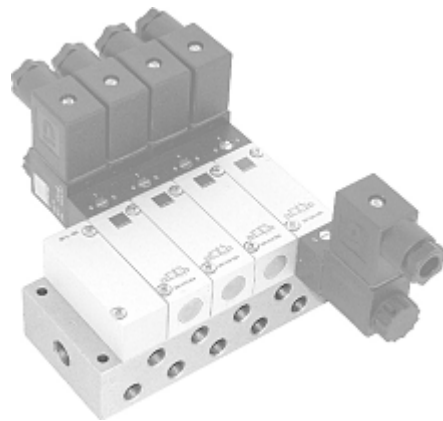
Stations	Type	Weight	Available	Type	Weight	Available
2	RD 502 344	0,14 kg	from stock	RD 502 464	0,21 kg	from stock
3	RD 503 344	0,18 kg	from stock	RD 503 464	0,27 kg	from stock
4	RD 504 344	0,22 kg	from stock	RD 504 464	0,33 kg	from stock
5	RD 505 344	0,26 kg	from stock	RD 505 464	0,38 kg	from stock
6	RD 506 344	0,30 kg	from stock	RD 506 464	0,44 kg	from stock
7	RD 507 344	0,34 kg	on request	RD 507 464	0,50 kg	from stock
8	RD 508 344	0,38 kg	from stock	RD 508 464	0,55 kg	from stock
9	RD 509 344	0,42 kg	on request	RD 509 464	0,60 kg	from stock
10	RD 510 344	0,46 kg	from stock	RD 510 464	0,66 kg	from stock
12	RD 512 344	0,54 kg	from stock	RD 512 464	0,77 kg	from stock
14	RD 514 344	0,62 kg	on request	RD 514 464	0,88 kg	on request
16	RD 516 344	0,70 kg	on request	RD 516 464	0,99 kg	on request



R 5__ 304 Orifice size: 6 mm



R 5__ 504 Orifice size: 6,6 mm



Common connection to port 1 (pressure), 3 (exhaust) and 5 (exhaust). The ports 2 and 4 of the individual valves are also located in the manifold plate.

The following solenoid valves can be assembled to the manifold plate type **R 5__ 304** (G 1/8" orifice 3 mm):

5/2 single sol.	MH 510 304	page 2.5.2.2.4
5/2 double sol.	MH 520 304	page 2.5.2.2.8
5/3-way	MH 53_ 304	page 2.5.3.2.4

Blanking plates are also available type BP 5 304.

The following solenoid valves can be assembled to the manifold plate type **R 5__ 504** (G 1/8" orifice 5 mm):

5/2 single sol.	MH 510 504	page 2.5.2.2.4
5/2 double sol.	MH 520 504	page 2.5.2.2.8
5/3-way	MH 53_ 504	page 2.5.3.2.4

Blanking plates are also available type BP 5 504.

Stations	Type	Weight	Type	Weight
2	R 502 304	0,26 kg	R 502 504	0,30 kg
3	R 503 304	0,34 kg	R 503 504	0,40 kg
4	R 504 304	0,42 kg	R 504 504	0,50 kg
5	R 505 304	0,51 kg	R 505 504	0,60 kg
6	R 506 304	0,59 kg	R 506 504	0,70 kg
8	R 508 304	0,76 kg	R 508 504	0,89 kg
10	R 510 304	0,93 kg	R 510 504	1,08 kg
12	R 512 304	1,11 kg	R 512 504	1,29 kg

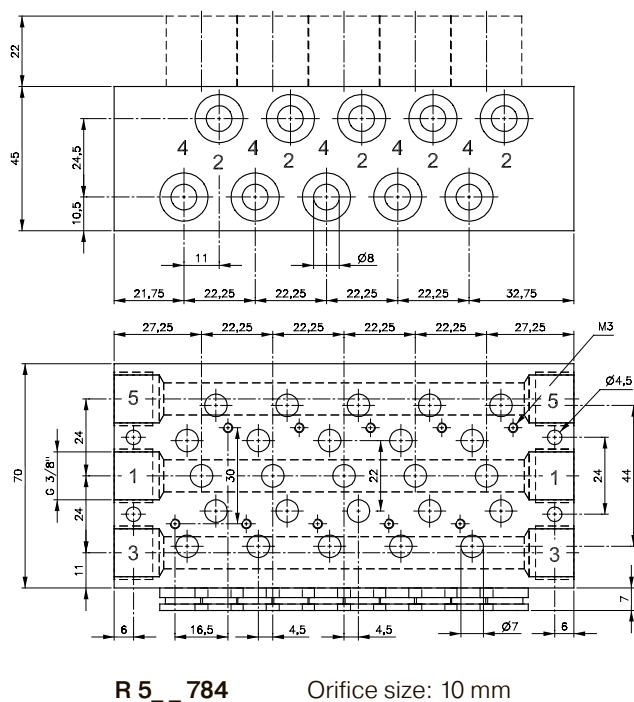
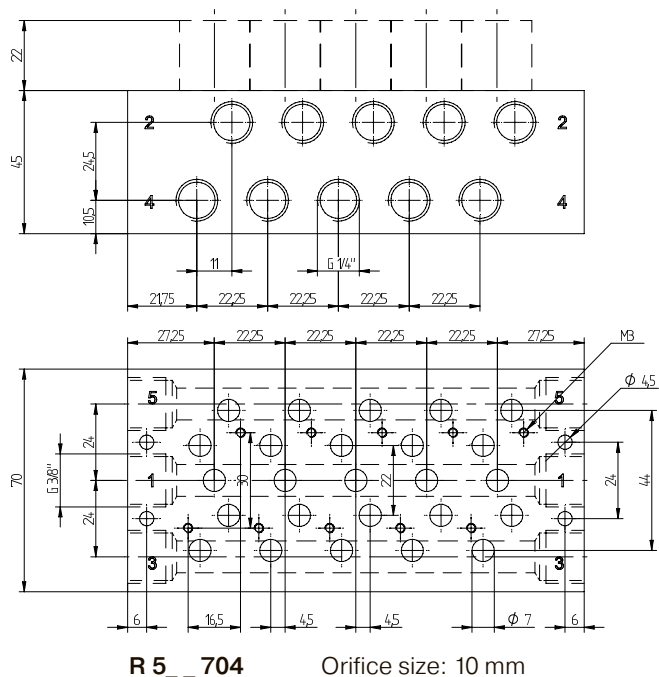


Common connection to port 1 (pressure), 3 (exhaust) and 5 (exhaust). The ports 2 and 4 of the individual valves are also located in the manifold plate.

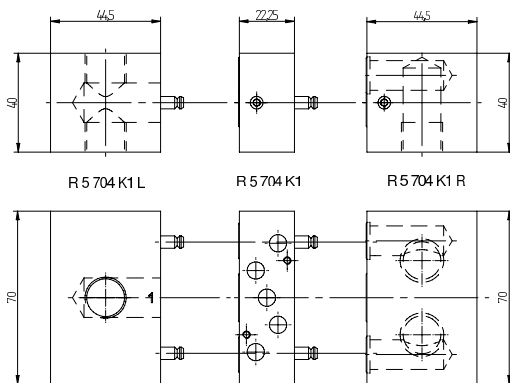
The following valves can be assembled to the manifold plate type **R 5__704** (G 1/4") and **R 5__784** (pif 8 mm):

5/2-way	MH 510 704	page 2.5.2.2.4
5/2-way	MH 520 704	page 2.5.2.2.8
5/3-way	MH 53_704	page 2.5.3.2.4

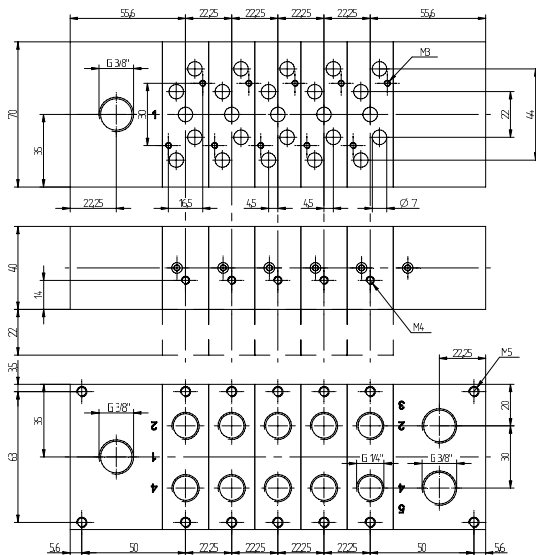
Blanking plates are also available type BP 5 704.



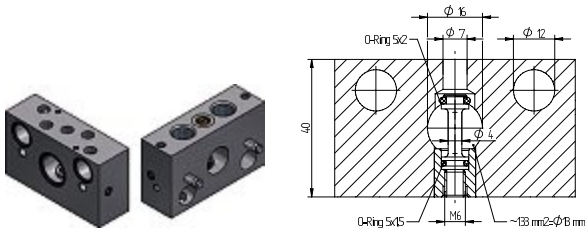
Stations	Type	Weight	Type	Weight
2	R 502 704	0,54 kg	R 502 784	0,54 kg
3	R 503 704	0,72 kg	R 503 784	0,72 kg
4	R 504 704	0,90 kg	R 504 784	0,90 kg
5	R 505 704	1,10 kg	R 505 784	1,10 kg
6	R 506 704	1,25 kg	R 506 784	1,25 kg
8	R 508 704	1,60 kg	R 508 784	1,60 kg
10	R 510 704	1,95 kg	R 510 784	1,95 kg
12	R 512 704	2,32 kg	R 512 784	2,32 kg



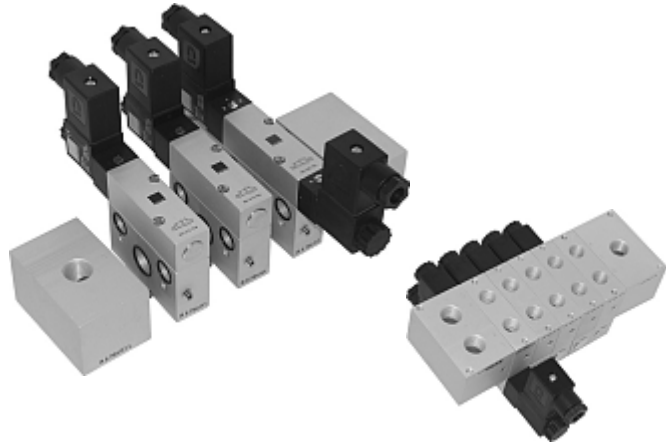
Parts of modular manifold RB 5__704 K1



RB 5__704 K1



Individual valve isolation (R 5 704 K1 D1)



Modular manifold system with all ports on the bottom. Plates are designed for assemblage in control cabinets.

Common connection to port 1 (pressure), 3 (exhaust) and 5 (exhaust). The ports 2 and 4 of the individual valves are also located in the manifold plate. The system can be build up and taken apart by just operating two hexagon socket screws.

Additional stations can be added at any position and any time.

The following valves can be assembled to the system

RB 5__704 K1:

5/2 single solenoid	MH 510 704	page 2.5.2.2.4
5/2 double solenoid	MH 520 704	page 2.5.2.2.8
5/3 solenoid	MH 53_ 704	page 2.5.3.2.4

3/2-way functions by closing either port 2 or 4.

The system consists of:

End-plate right	type R 5 704 K1 R
End-plate left	type R 5 704 K1 L
Individual position	type R 5 704 K1

Blanking plates are also available type BP 5 704.

Please notice:

End-plates are not offering an individual valve-position.

The plates can also be ordered assembled by the manufacturer. In this case order **RB 5 __ 704 K1**. Please add two digits for the number of positions required.

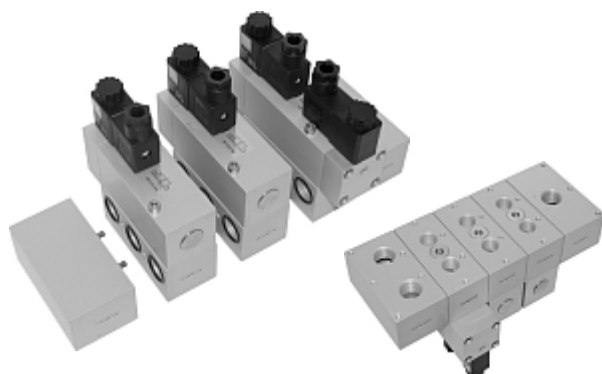
In case the customer wants to have the FRL inside the box, the endplate left offers as second supply port that faces inside the box. One of the two has to be closed with a G 3/8" plug.

The individual plates are also available with individual valve isolation type R 5 704 K1 D1. In certain industries the user appreciates, if he can take away air pressure at any valve on the plate individually. Valves can easily be exchanged by closing the plug in port 1 without interruption of the air-supply of the other valves.

Wider elements for usage with wider coils (e.g. ATEX-approved versions) are available on request.

Type	Function	Weight
R 5 704 K1 R	End-plate right	0,13 kg
R 5 704 K1 L	End-plate left	0,12 kg
R 5 704 K1	Individual position	0,09 kg
R 5 704 K1 D1	Individual position, with individual valve isolation	0,09 kg

RB 5__ 104 K1



Modular manifold system with all ports on the bottom. Plates are designed for assemblage in control cabinets.

Common connection to port 1 (pressure), 3 (exhaust) and 5 (exhaust). The ports 2 and 4 of the individual valves are also located in the manifold plate. The system can be build up and taken apart by just operating two hexagon socket screws.

Additional stations can be added at any position and any time.

The following valves can be assembled to the system

RB 5__ 104 K1:

5/2 single solenoid	MH 510 104	page 2.5.2.2.4
5/2 double solenoid	MH 520 104	page 2.5.2.2.8
5/3 solenoid	MH 53_ 104	page 2.5.3.2.4

The system consists of:

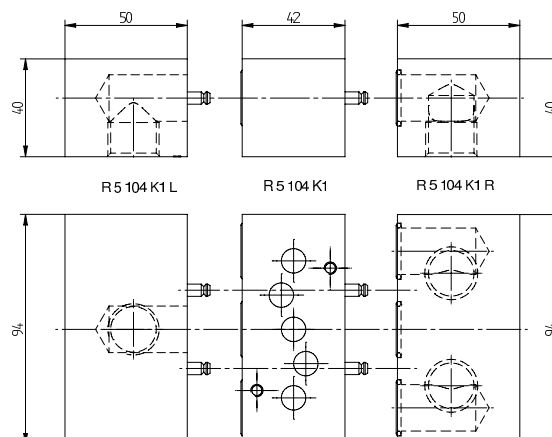
End-plate right	type R 5 104 K1 R
End-plate left	type R 5 104 K1 L
Individual position	type R 5 104 K1

Please notice:

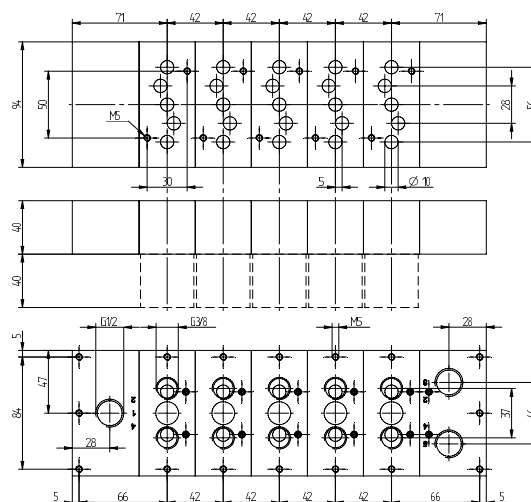
End-plates are not offering an individual valve-position.

The plates can also be ordered assembled by the manufacturer. In this case order **RB 5__ 104 K1**. Please add two digits for the number of positions required.

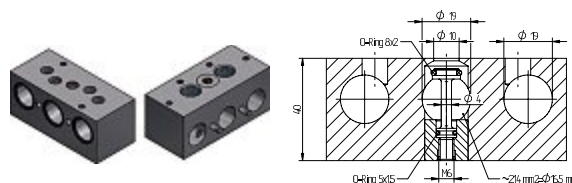
The individual plates are also available with individual valve isolation type R 5 104 K1 D1. In certain industries the user appreciates, if he can take away air pressure at any valve on the plate individually. Valves can easily be exchanged by closing the plug in port 1 without interruption of the air-supply of the other valves.



Parts of modular manifold RB 5__ 104 K1

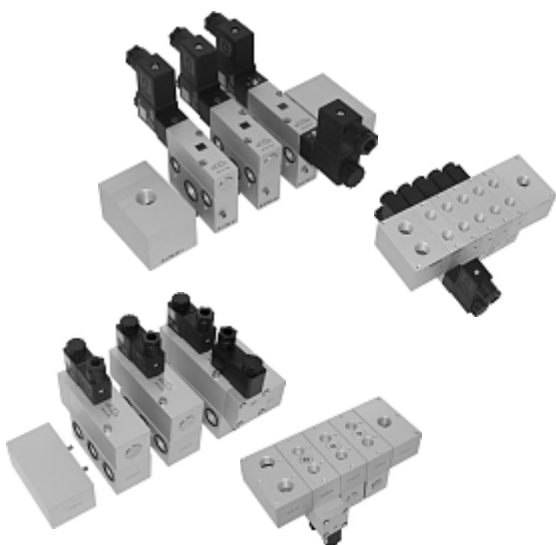


RB 5__ 104 K1



Individual valve isolation (R 5 104 K1 D1)

Type	Function	Weight
R 5 104 K1 R	End-plate right	0,45 kg
R 5 104 K1 L	End-plate left	0,50 kg
R 5 104 K1	Individual position	0,32 kg
R 5 104 K1 D1	Individual position, with individual valve isolation	0,32 kg



Hafner is offering a range of products designed to make the assemblage of manifolds and valve terminals inside a control cabinet as easy as possible. No tubing needs to stay inside the box!

- **Series 704 K1** with a maximum air-flow of 1.250 l/min
Further information on page 2.7.2.9 and 2.8.3.8
- **Series 104 K1** with a maximum air-flow of 2.250 l/min
Further information on page 2.7.2.10

The Hafner system offers distinct advantages:

- Less effort to assemble = significant time-savings
- No bulk-head fittings required
- Less installation material = significant material savings
- No hoses inside the box
- Less risk of leakage inside the box, significant air savings



Available as a special feature:

Manifolds with **individual valve isolation screw** (suffix D1 to type-number).

Valves can easily be exchanged by closing the plug in port 1 without interruption of the air-supply of the other valves.

Application examples:

Control cabinet with 8 x 5/2-way single solenoid valves with 7 mm orifice, assembled on a valve terminal. Manifold is having the individual valve isolation feature.

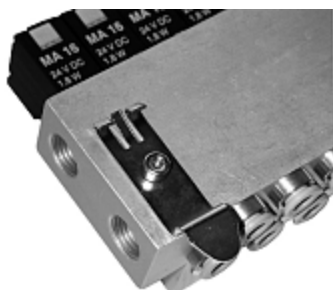


Same cabinet as above but with hand-lever valves.



DIN-rail mounting clips

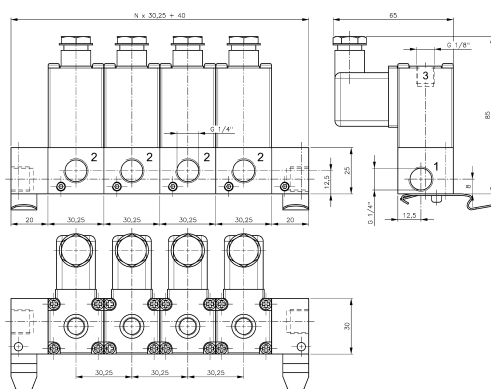
For assembling valve-terminals,
please send us your inquiry.



Mounting accessory to assemble and dismantle manifold plates to and from 35 mm wide DIN-rails. The mounting accessory is generally to be assembled on the back of the manifold plate by the manufacturer. Self-assembly is also possible, assembly drawings can be made available.

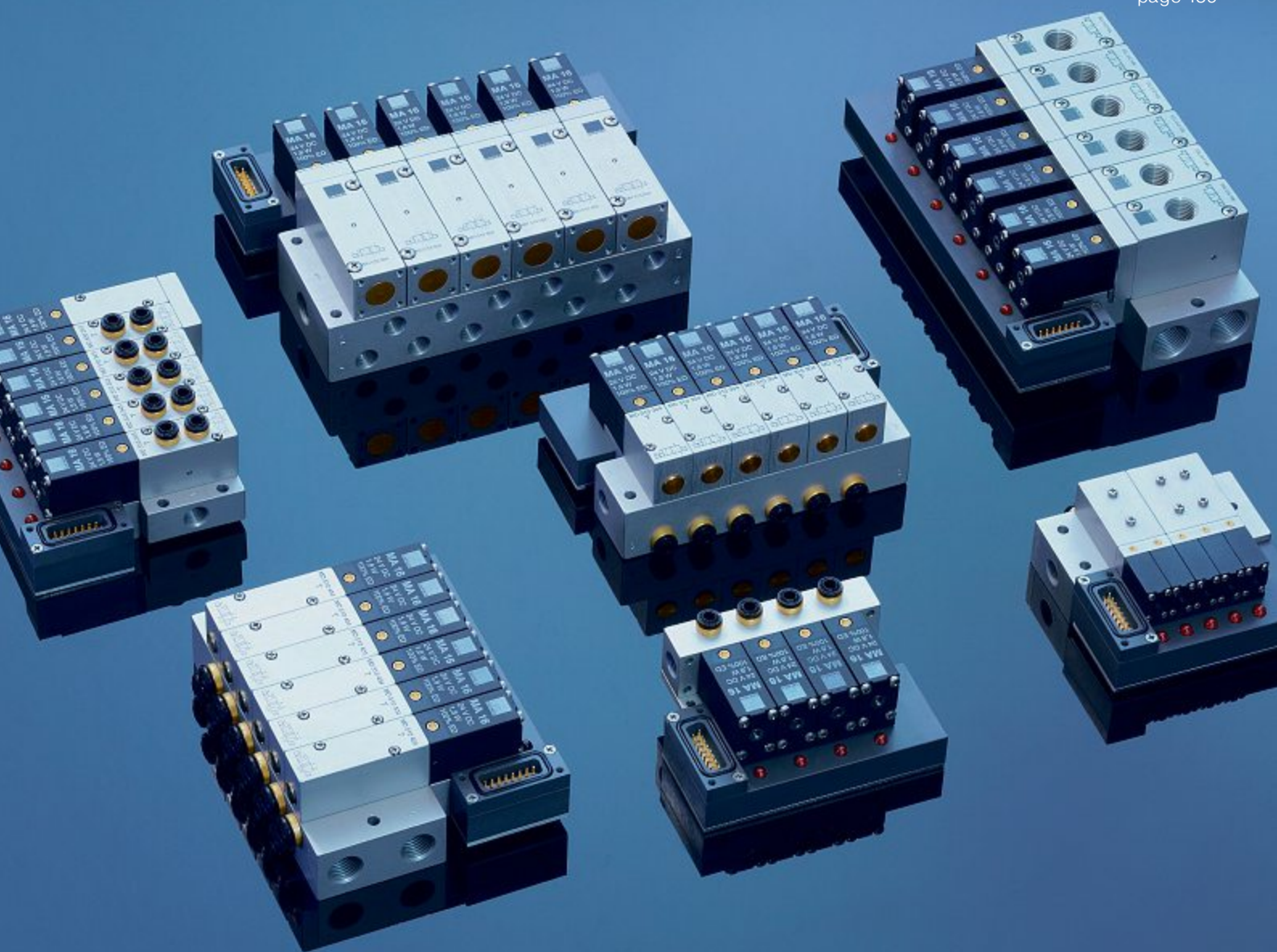
All the manifold plates offered by Hafner-Pneumatik can be equipped with the DIN-rail mounting clips.

Modular manifolds are generally equipped with threads for assembling DIN-rails.



Also individual valves such as the **MH 311 015 DIN** can be equipped with DIN-rail mounting clips.





2.8

Valve Terminals

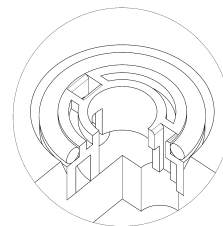
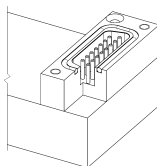
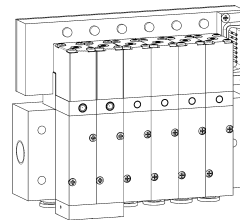
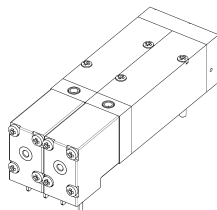
General Information on Valve Terminals

Valve terminal for valves 24 V= and 24 V~.

2 - 14 stations available, equipped with varistor and red LED. Common Minus or Plus on white cable.

Double solenoid valves (5/2-way and 5/3-way) occupy 2 spaces.

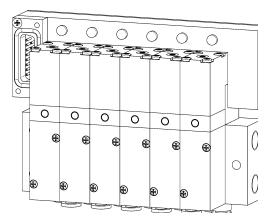
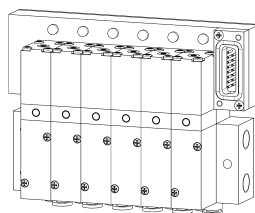
The system is highly water resistant. D-sub-multipin connector and individual valve positions are sealed with NBR O-rings against water and humidity offering IP 65.



Seal at connector

Seal at valve

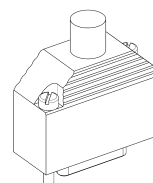
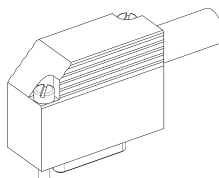
Position of the connector can be chosen at the right or at the left hand side of the terminal.



Connector right = TR16

Connector left = TL16

Cable can be supplied with an elbow or a straight electrical connector. Standard cable length is 3 m others are available on request. For details please refer to page 2.8.4.



ST40 W__

ST40 G__

General order information:

When ordering a Hafner valve terminal please proceed as follows:

The electrical and pneumatical manifold has the type-number:

For ordering the required valves add a T to the order code, e.g. MD 510 404 T.

The cable with the connector as displayed on page 2.7.4.

All items to be ordered separately but assembled by manufacturer.

T _ _ _ _ _
1 2 3 4 5 6 7 8

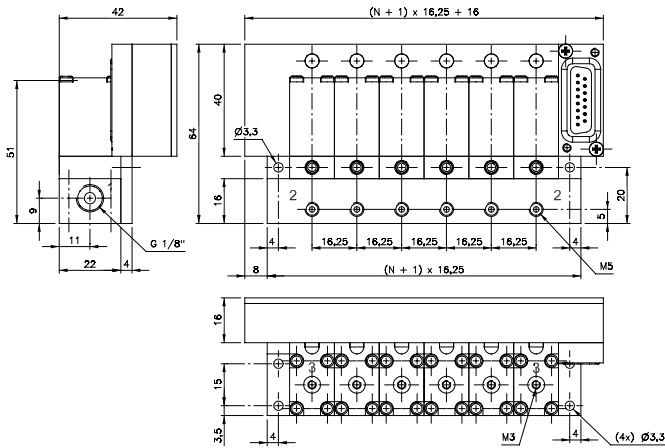
1
R or L: Defining the side of the connector
R = right, L = left

2
16 for valves 16 mm wide
22 for valves 22 mm wide

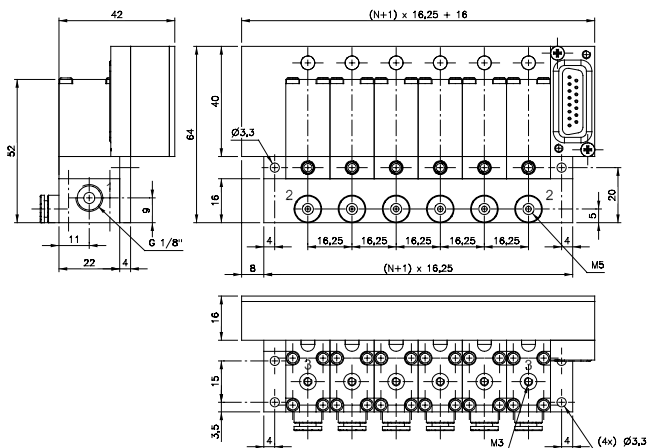
3
3 or 5: Defining if the plate is for 3- or 5-way valves

4, 5
number of positions, 02 to 14

6, 7, 8
defining size and position of the ports, please refer to page 2.7.1.2 to 2.7.3.9



T_163__104



T_163__144



Valve terminal with direct actuated 3-way valves, orifice size 1 mm, port 2 is in the plate. Port 2 is either equipped with push-in fitting for 4 mm tube or thread M5.

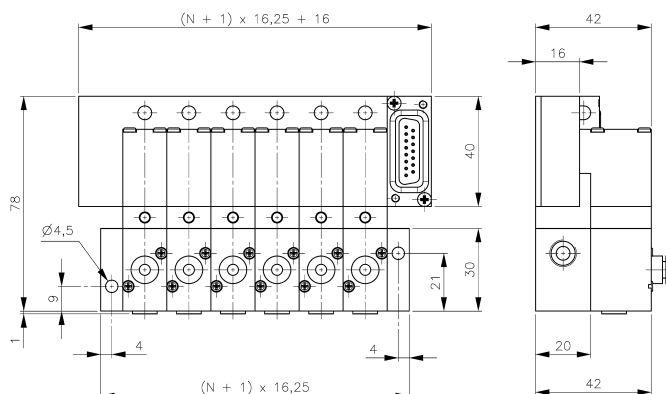
The terminal is available from 2 to 14 stations (4 to 12 preferred stock item). Every station is equipped with a varistor and a red LED for coils 24 V= or 24 V~.

The pneumatic system (valve and manifold) is displayed and described on page 2.5.1.2.1, type RD 3__104 or RD 3__144.

Valves for terminal use offer a solenoid turned by 180° and no 3rd pin (ground). For ordering add a T to the regular type-number (e.g. MD 311 104 T 24DC or MD 311 104 T 24AC).

Blanking plates are also available type BP 3 104 T.

T_ 16 3 _ _ 303



T_ 16 3 _ _ 303
equipped with valves type 343 T

Valve terminal with 3-way valves, orifice size 3 mm, port 2 is in the valve. Port 2 is equipped with push-in fitting for 4 mm tube.

The terminal is available from 2 to 14 stations (4 to 12 preferred stock item). Every station is equipped with a varistor and a red LED for coils 24 V= or 24 V~.

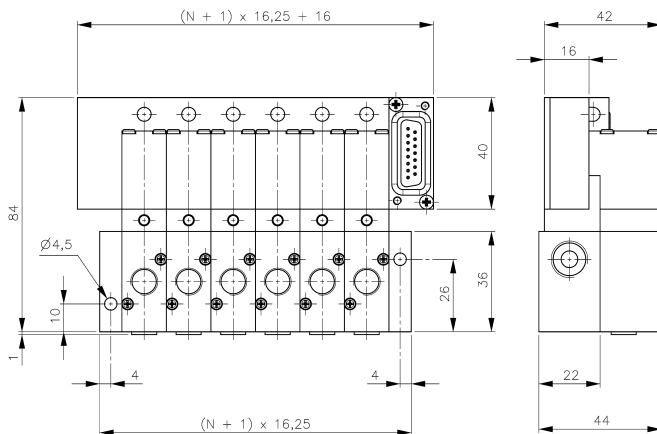
The pneumatic manifold is displayed and described on page 2.7.1.2, type RD 3 _ _ 303.

Valves for terminal use offer a solenoid turned by 180° and no 3rd pin (ground). For ordering please add a T to the regular type-number (e.g. MD 310 343 T 24DC or MD 310 343 T 24AC).

Blanking plates are also available type BP 3 303 T.

The following valves can be used on that type of valve-terminal:

Type	Function	Page	Comment
MD 310 343 T	n.c.	2.5.1.2.4	both types can be mixed on the plate
MOD 310 343 T	n.o.	2.5.1.2.4	both types can be mixed on the plate



T_16 3__403
equipped with valves type 403 T



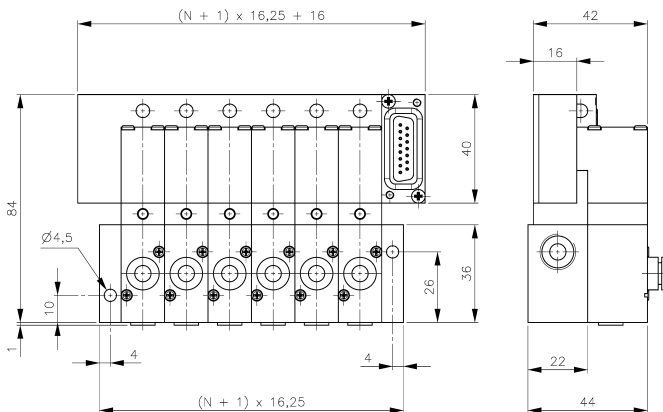
Valve terminal with 3-way valves, orifice size 4 mm, port 2 is in the valve. Port 2 is either equipped with thread G 1/8" or with push-in fitting for 6 mm tube.

The terminal is available from 2 to 14 stations (4 to 12 preferred stock item). Every station is equipped with a varistor and a red LED for coils 24 V= or 24 V~.

The pneumatic manifold is displayed and described on page 2.7.1.2, type RD 3__403.

Valves for terminal use offer a solenoid turned by 180° and no 3rd pin (ground). For ordering please add a T to the regular type-number (e.g. MD 310 463 T 24DC or MD 310 463 T 24AC).

Blanking plates are also available type BP 3 403 T.



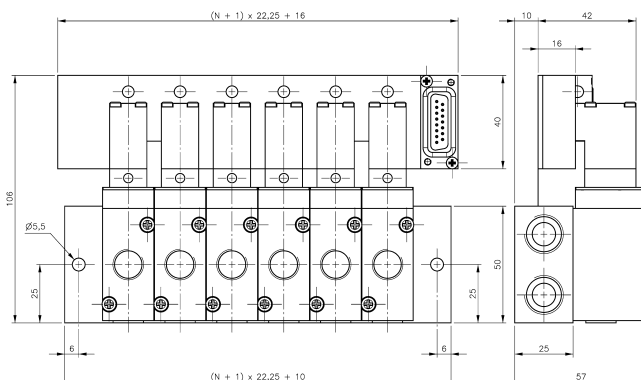
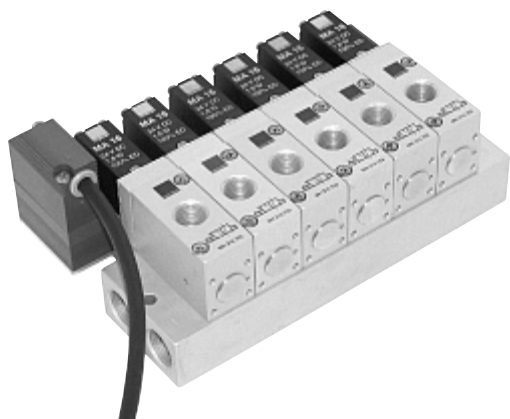
T_16 3__403
equipped with valves type 463 T

The following valves can be used on that type of valve-terminal:

Type	Function	Page	Comment
MD 310 403 T	n.c.	2.5.1.2.4	all four types of valves can be mixed on one plate
MD 310 463 T	n.c.	2.5.1.2.4	all four types of valves can be mixed on one plate
MOD 310 403 T	n.o.	2.5.1.2.4	all four types of valves can be mixed on one plate
MOD 310 463 T	n.o.	2.5.1.2.4	all four types of valves can be mixed on one plate

For additional order information please refer to page 2.8.1.

T_22 3__703



T_22 3__703
equipped with valves type 703 T

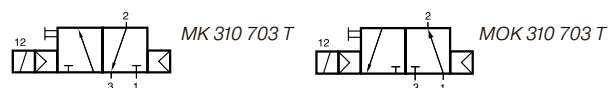
Valve terminal with 3-way valves, orifice size 7 mm, port 2 is in the valve, G 1/4".

The terminal is available with 2, 3, 4, 5, 6, 8, 10, 12 positions, others on request. Every station is equipped with a varistor and a red LED for coils 24 V= or 24 V~.

The pneumatic manifold is displayed and described on page 2.7.1.4, type R 3__703.

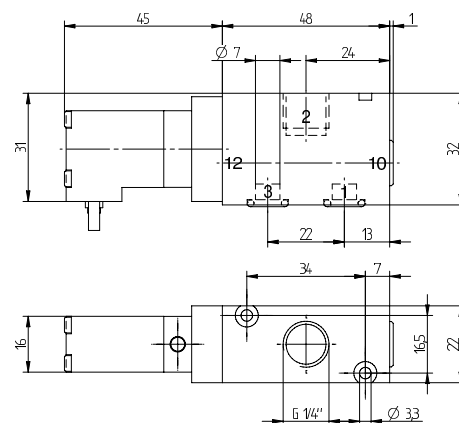
Blanking plates are also available type BP 3 703 T.

Normally closed (MK 310 703 T) and normally open (MOK 310 703 T) valves can be mixed on the same terminal.



Valves offer a manual override to be pushed.

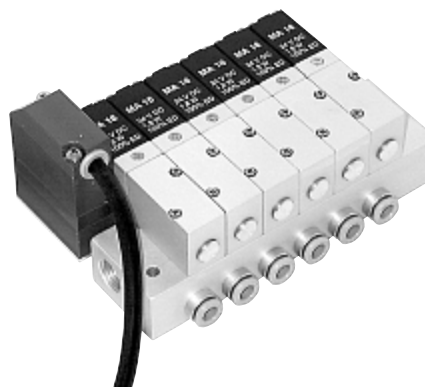
Valves 24 DC as well as 24 AC can be used on the terminals.



MK 310 703 T/MOK 310 703 T

Type	Function	Air flow	Operating press.	Power consumption	Weight
MK 310 703 T	n.c.	1250 l/min	2 - 10 bar	1,8 W = / 3 VA ~	0,19 kg
MOK 310 703 T	n.o.	1250 l/min	2 - 10 bar	1,8 W = / 3 VA ~	0,19 kg

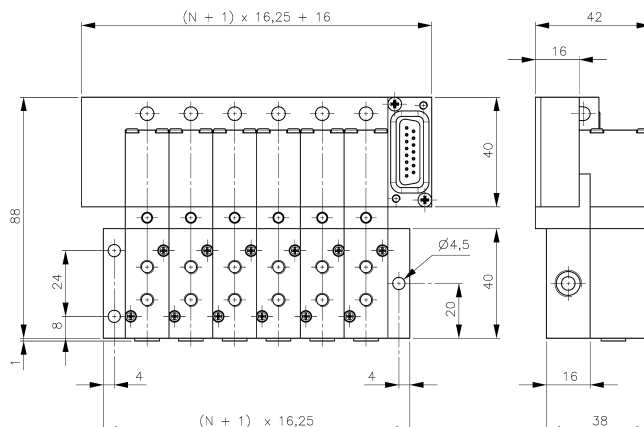
For additional order information please refer to page 2.8.1.



The technical drawing illustrates the DSI-06 connector from three perspectives:

- Front View (Top):** Shows a rectangular connector with a total width of $(N + 1) \times 16,25 + 16$. The height is 84. It features two rows of pins, each with a pitch of 16.25 mm. A central pin diameter of $\varnothing 4,5$ is indicated.
- Side View (Middle):** Shows the profile of the connector with a total height of 42. The mounting flange has a thickness of 16. The main body has a height of 40. The bottom flange has a height of 26.
- Top View (Bottom):** Shows the connector from above with a total width of $(N + 1) \times 16,25 + 16$. The distance between the centerlines of the two rows of pins is 36. The mounting flange has a width of 8. The overall length of the connector is 47.

T_ 16 5_ _ 303



T_ 16 5_ _ 303
equipped with valves type 303 T

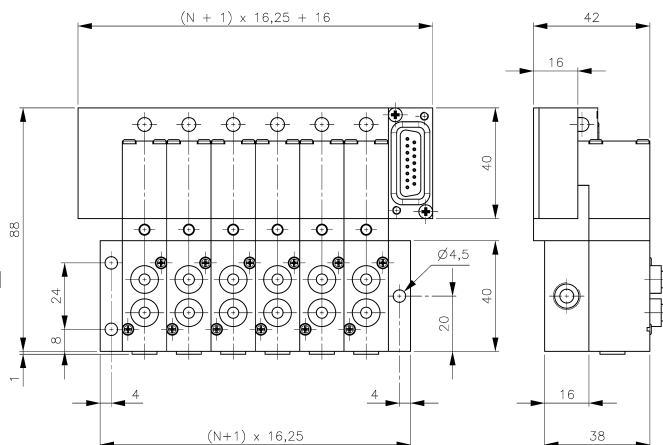
Valve terminal with 5-way valves, orifice size 3 mm, ports 2 and 4 are in the valve. Ports 2 and 4 are either equipped with thread M5 or with push-in fittings for 4 mm tube.

The terminal is available from 2 to 14 stations (4 to 12 preferred stock item). Every station is equipped with a varistor and a red LED for coils 24 V= or 24 V~.

The pneumatic manifold is displayed and described on page 2.7.2. 1, type RD 5_ _ 303.

Valves for terminal use offer a solenoid turned by 180° and no 3rd pin (ground). For ordering please add a T to the regular type-number (e.g. MD 510 303 T 24DC or MD 510 303 T 24AC). "Double body valves" (5/2-way impulse and 5/3-way-valves) occupy 2 spaces as described on page 2.8. 1.

Blanking plates are also available type BP 5 303 T.

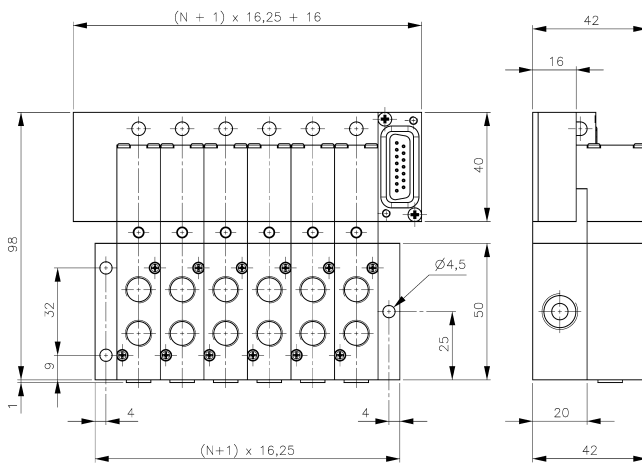


T_ 16 5_ _ 303
equipped with valves type 343 T

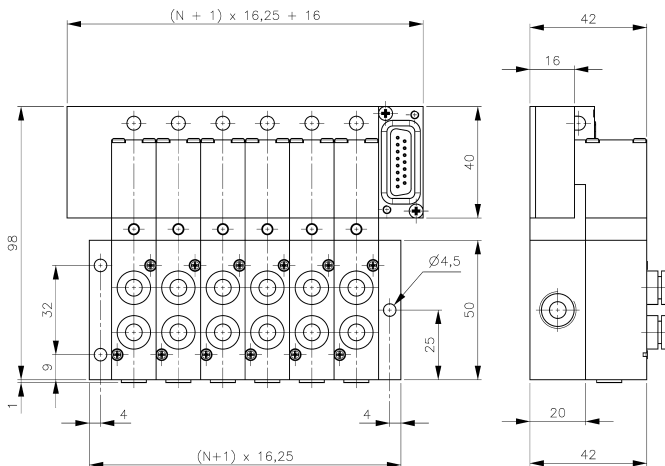
The following valves can be used on that type of valve terminal:

Type	Function	Page	Comment
MD 510 303 T	single sol.	2.5.2.2.1	
MD 510 343 T	single sol.	2.5.2.2.1	
MD 520 303 T	double sol.	2.5.2.2.5	double body
MD 520 343 T	double sol.	2.5.2.2.5	double body
MD 53_ 303 T	5/3-way	2.5.3.2.1	double body, 3 versions available, refer to description
MD 53_ 343 T	5/3-way	2.5.3.2.1	double body, 3 versions available, refer to description

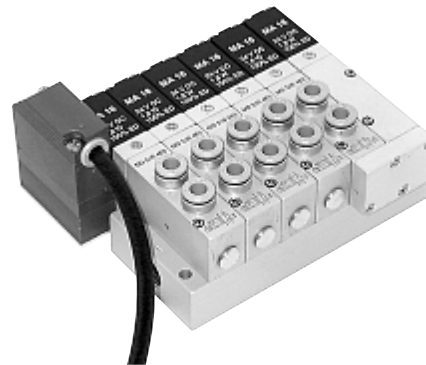
For additional order information please refer to page 2.8. 1.



T_16 5__403
equipped with valves type 403 T



T_16 5__403
equipped with valves type 463 T



Valve terminal with 5-way valves, orifice size 4 mm, ports 2 and 4 are in the valve. Ports 2 and 4 are either equipped with thread G 1/8" or with push-in fittings for 6 mm tube.

The terminal is available from 2 to 14 stations (4 to 12 preferred stock item). Every station is equipped with a varistor and a red LED for coils 24 V= or 24 V~.

The pneumatic manifold is displayed and described on page 2.7.2.1, type RD 5__403.

Valves for terminal use offer a solenoid turned by 180° and no 3rd pin (ground). For ordering please add a T to the regular type-number (e.g. MD 510 403 T 24DC or MD 510 403 T 24AC). "Double body valves" (5/2-way impulse and 5/3-way-valves) occupy 2 spaces as described on page 2.8.1.

Blanking plates are also available type BP 5 403 T.

The following valves can be used on that type of valve terminal:

Type	Function	Page	Comment
MD 510 403 T	single sol.	2.5.2.2.1	
MD 510 463 T	single sol.	2.5.2.2.1	
MD 520 403 T	double sol.	2.5.2.2.5	double body
MD 520 463 T	double sol.	2.5.2.2.5	double body
MD 53__403 T	5/3-way	2.5.3.2.1	double body, 3 versions available, refer to description
MD 53__463 T	5/3-way	2.5.3.2.1	double body, 3 versions available, refer to description

For additional order information please refer to page 2.8.1.

T_22 5__ 503/T_22 5__ 703



Valve terminal with 5-way valves, ports 2 and 4 are in the valve.

Type 503 orifice size 5 mm, G 1/8"

Type 703 orifice size 7 mm, G 1/4"

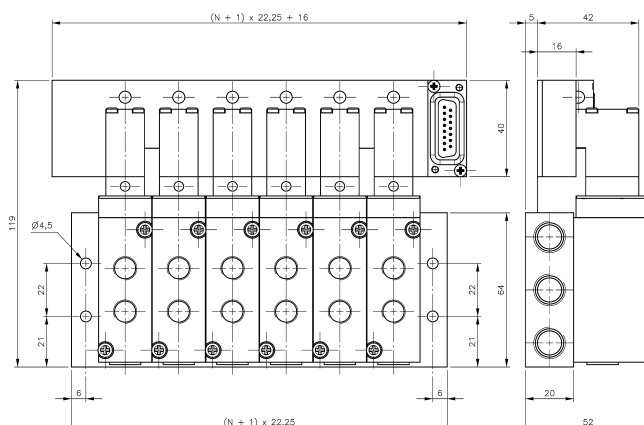
The terminal is available with 2, 3, 4, 5, 6, 8, 10, 12 positions, others on request. Every station is equipped with a varistor and a red LED for coils 24 V= or 24 V~.

The pneumatic manifolds are displayed and described on page 2.7.2.2 type R 5__ 503, on page 2.7.2.3 type R 5__ 703.

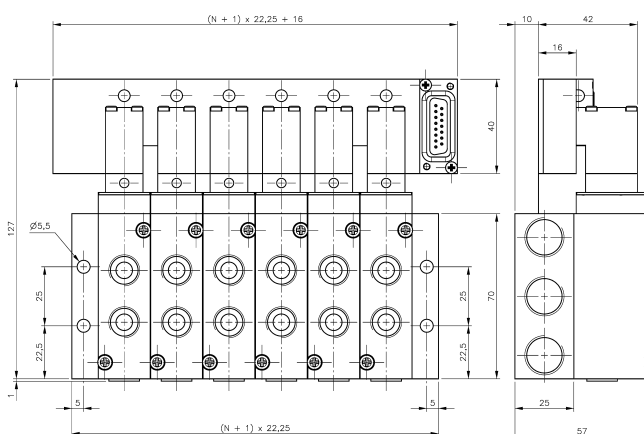
Valves for terminal use offer a 1.8 Watt / 3 VA solenoid, turned by 180° and no 3rd pin (ground). Order-number values:

MK 5__ _03 T 24DC or MK 5__ _03 T 24AC.

Blanking plates are also available type BP 5 503 T or type BP 5 703 T.



T_22 5__ 503
equipped with valves type 503 T



T_22 5__ 703
equipped with valves type 703 T

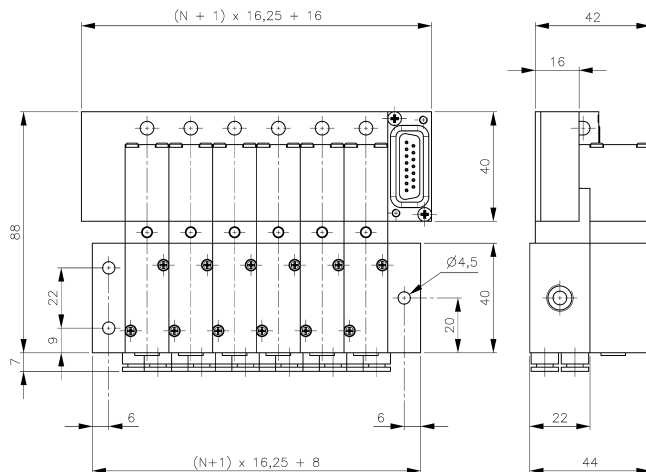
The following valves can be used on T_22 5__ 503:

Type	Function	Page	Comment
MK 510 503 T	single sol.	2.5.2.2.2	
MK 520 503 T	double sol.	2.5.2.2.6	double body
MK 53_ 503 T	5/3-way	2.5.3.2.2	double body, 3 versions available, refer to description

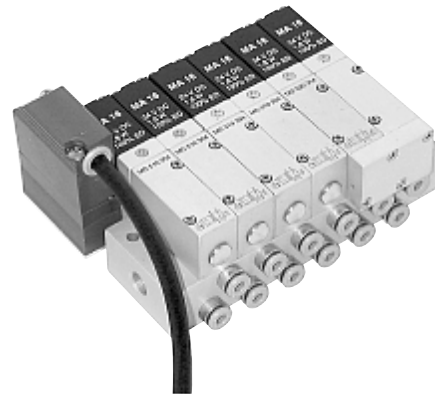
The following valves can be used on T_22 5__ 703:

Type	Function	Page	Comment
MK 510 703 T	single sol.	2.5.2.2.2	
MK 520 703 T	double sol.	2.5.2.2.6	double body
MK 53_ 703 T	5/3-way	2.5.3.2.2	double body, 3 versions available, refer to description

For additional order information please refer to page 2.8.1.



T_16 5__344
equipped with valves type 304 T



Valve terminal with 5-way valves, orifice size 3 mm, all the ports are in the plate. Ports 2 and 4 are equipped with push-in fittings for 4 mm tube.

The terminal is available from 2 to 14 stations (4 to 12 preferred stock item). Every station is equipped with a varistor and a red LED for coils 24 V= or 24 V~.

The pneumatic manifold is displayed and described on page 2.7.2.6, type RD 5__344.

Valves for terminal use offer a solenoid turned by 180° and no 3rd pin (ground). For ordering please add a T to the regular type-number (e.g. MD 510 304 T 24DC or MD 510 304 T 24AC). "Double body valves" (5/2-way impulse and 5/3-way-valves) occupy 2 spaces as described on page 2.8.1.

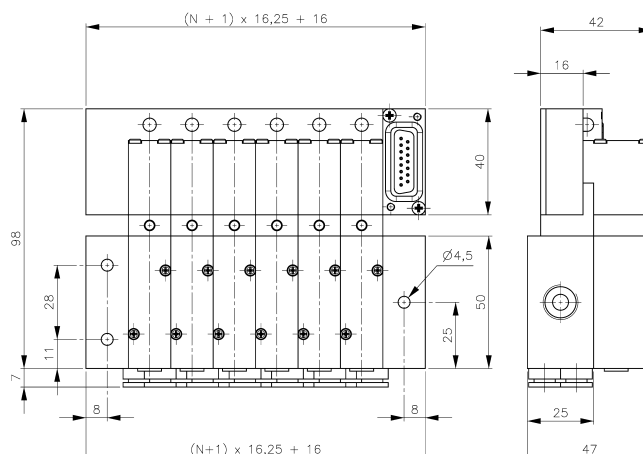
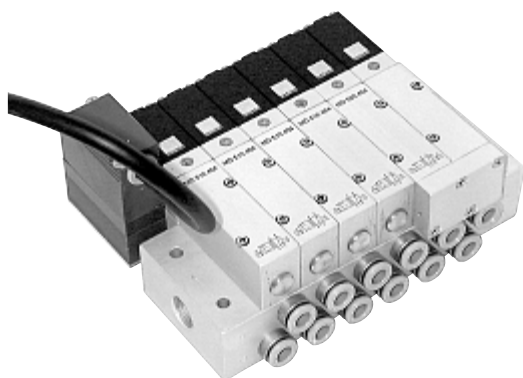
Blanking plates are also available type BP 5 344 T.

The following valves can be used on that type of valve terminal:

Type	Function	Page	Comment
MD 510 304 T	single sol.	2.5.2.2.3	
MD 520 304 T	double sol.	2.5.2.2.7	double body
MD 53__304 T	5/3-way	2.5.3.2.3	double body, 3 versions available, refer to description

For additional order information please refer to page 2.8.1.

T_ 16 5_ _ 464



T_ 16 5_ _ 464
equipped with valves type 404 T

Valve terminal with 5-way valves, orifice size 4 mm, all the ports are in the plate. Ports 2 and 4 are equipped with push-in fittings for 6 mm tube.

The terminal is available from 2 to 14 stations (4 to 12 preferred stock item). Every station is equipped with a varistor and a red LED for coils 24 V= or 24 V~.

The pneumatic manifold is displayed and described on page 2.7.2.6, type RD 5_ _ 464.

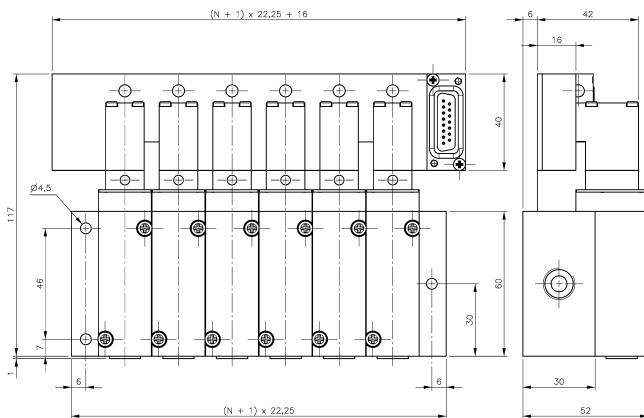
Valves for terminal use offer a solenoid turned by 180° and no 3rd pin (ground). For ordering please add a T to the regular type-number (e.g. MD 510 404 T 24DC or MD 510 404 T 24AC). "Double body valves" (5/2-way impulse and 5/3-way-valves) occupy 2 spaces as described on page 2.8.1.

Blanking plates are also available type BP 5 464 T.

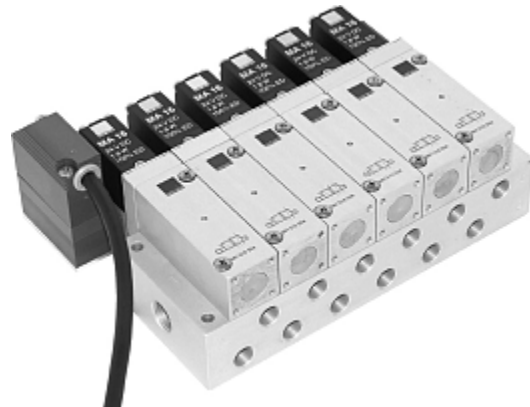
The following valves can be used on that type of valve terminal:

Type	Function	Page	Comment
MD 510 404 T	single sol.	2.5.2.2.3	
MD 520 404 T	double sol.	2.5.2.2.7	double body
MD 53_ 404 T	5/3-way	2.5.3.2.3	double body, 3 versions available, refer to description

For additional order information please refer to page 2.8.1.



T_22 5__ 504
equipped with valves type 504 T



Valve terminal with 5-way valves, orifice 5 mm, all the ports are in the plate. Port 2 and 4: G 1/8".

The terminal is available with 2, 3, 4, 5, 6, 8, 10, 12 positions, others on request. Every station is equipped with a varistor and a red LED for coils 24 V= or 24 V~.

The pneumatic manifolds are displayed and described on page 2.7.2.7, type R 5__ 504.

Valves for terminal use offer a 1.8 Watt / 3 VA solenoid, turned by 180° and no 3rd pin (ground).
Order-number valves:
MK 5__ 504 T 24DC or MK 5__ 504 T 24AC.

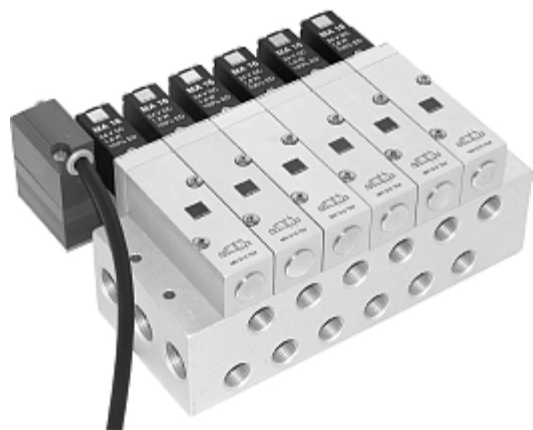
Blanking plates are also available type BP 5 504 T.

The following valves can be used on that type of valve terminal:

Type	Function	Page	Comment
MK 510 504 T	single sol.	2.5.2.2.4	
MK 520 504 T	double sol.	2.5.2.2.8	double body
MK 53_ 504 T	5/3-way	2.5.3.2.4	double body, 3 versions available, refer to description

For additional order information please refer to page 2.8.1.

T_22 5__704/T_22 5__784



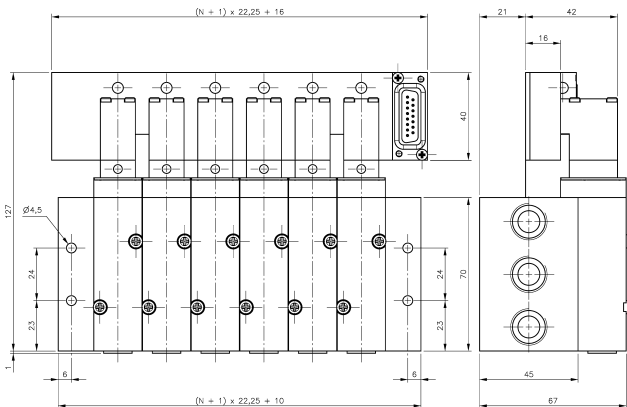
Valve terminal with 5-way valves, orifice 7 mm, all the ports are in the plate. Port 2 and 4 either G 1/4" (terminal 704) or push-in fittings for 8 mm tube (terminal 784).

The terminal is available with 2, 3, 4, 5, 6, 8, 10, 12 positions, others on request. Every station is equipped with a varistor and a red LED for coils 24 V= or 24 V~.

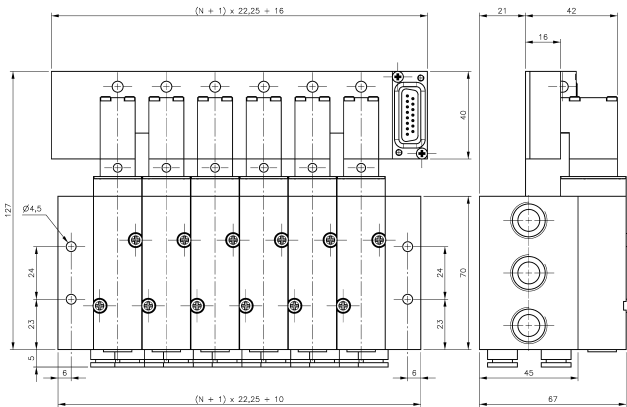
The pneumatic manifolds are displayed and described on page 2.7.2.8, type R 5__704 / 784.

Valves for terminal use offer a 1.8 Watt / 3 VA solenoid, turned by 180° and no 3rd pin (ground).
Order-number valves:
MK 5__704 T 24DC or MK 5__704 T 24AC.

Blanking plates are also available type BP 5 704 T.



T_22 5__704
equipped with valves type 704 T

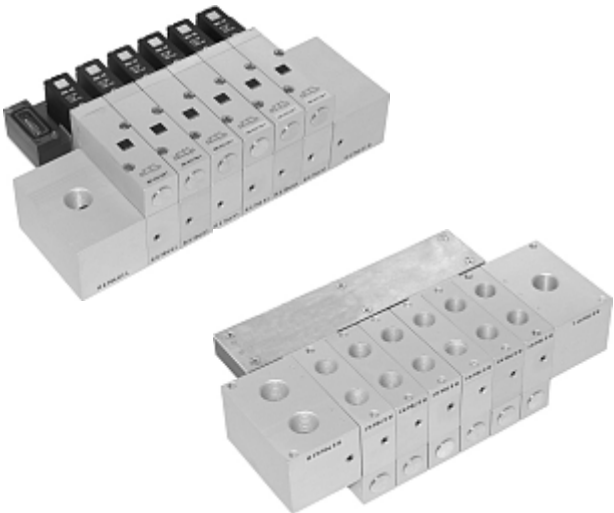


T_22 5__784
equipped with valves type 704 T

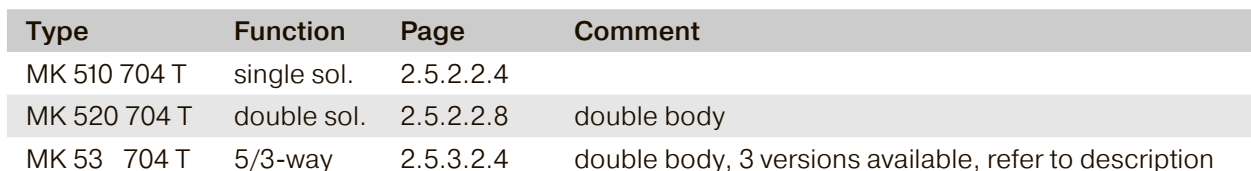
The following valves can be used on that type of valve terminal:

Type	Function	Page	Comment
MK 510 704 T	single sol.	2.5.2.2.4	
MK 520 704 T	double sol.	2.5.2.2.8	double body
MK 53_ 704 T	5/3-way	2.5.3.2.4	double body, 3 versions available, refer to description

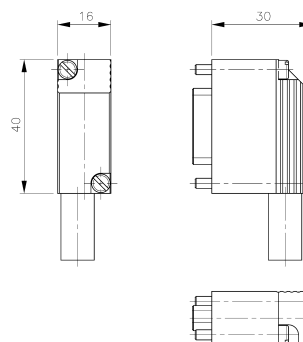
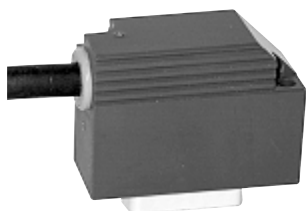
For additional order information please refer to page 2.8.1.



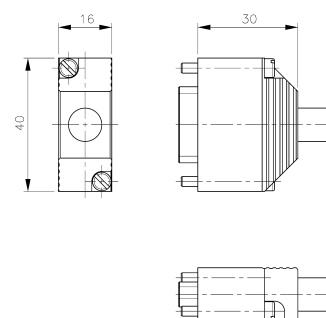
The valve terminals are also available with individual valve isolation. In certain industries the user appreciates, if he can take away air pressure at any valve on the plate individually. Valves can easily be exchanged by closing the plug in port 1 without interruption of the air-supply of the other valves. If requested, please order T 5 704 K1D1.


HAFNER

Connectors and Cable ST40 W__ /ST40 G__



ST40 W__



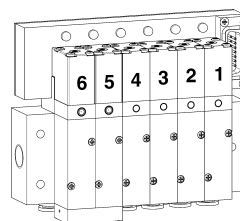
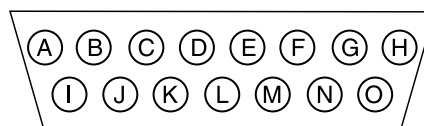
ST40 G__

Connector and cables for Hafner valve-terminals. O-ring seal assures best protection against water and humidity. Standard cable length is 3 m, others are available on request.

2 screws are included.

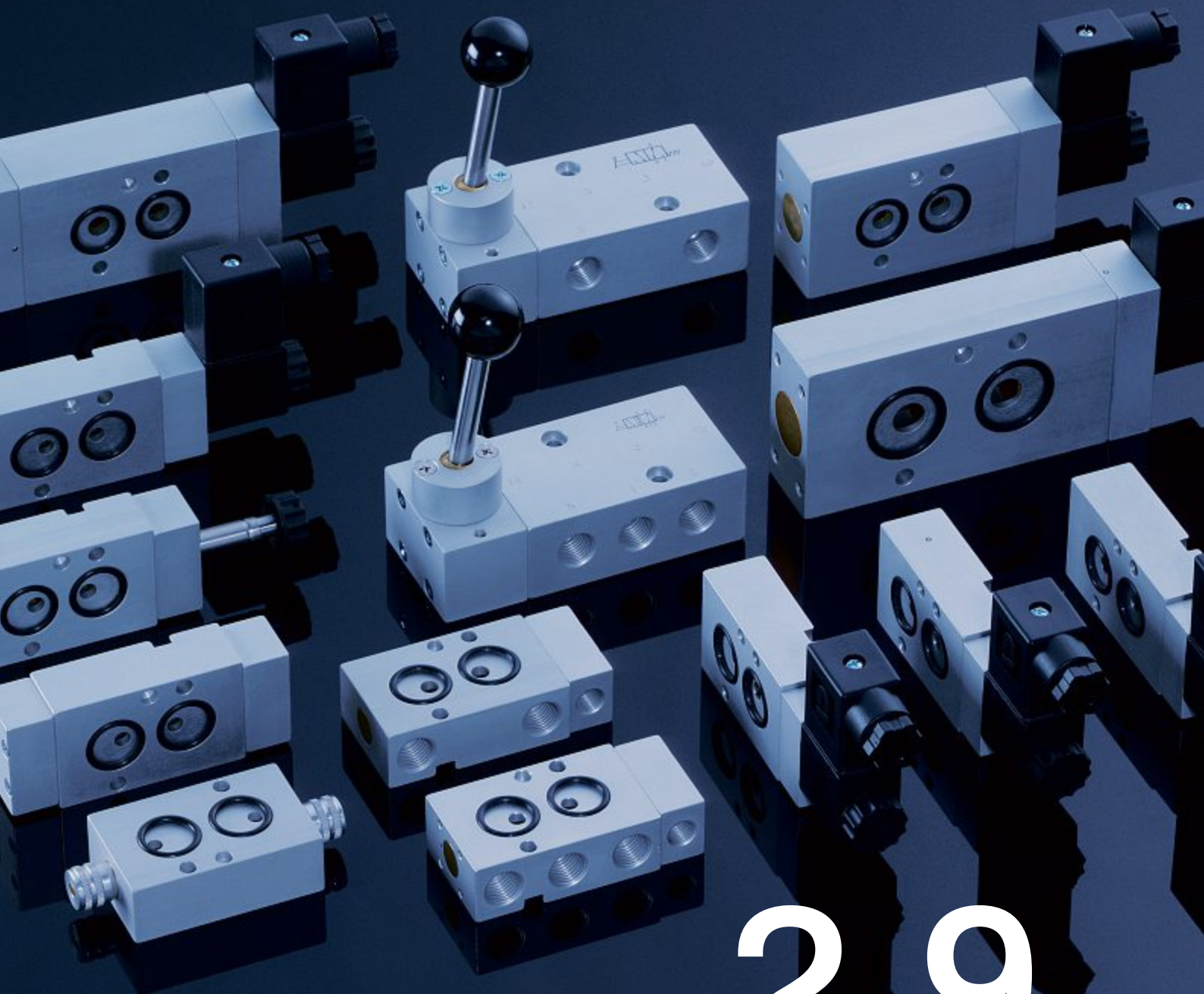
Relationship of valve-position, cable-colour and PINS in the connector

Position of solenoid	Colour of cable	PIN
1	brown	K
2	green	M
3	yellow	C
4	grey	F
5	pink	J
6	blue	N
7	red	B
8	black	G
9	violet	I
10	grey-pink	O
11	blue-red	A
12	white-green	H
13	brown-green	D
14	white-yellow	E
common – or + white		L



Please be aware: Always count position of solenoid from the connector !

Type	Exit of cable	Number of laces
ST40 W06	at the side	7, 6 positions and common Plus or Minus
ST40 W14	at the side	15, 14 positions and common Plus or Minus
ST40 G06	at the back	7, 6 positions and common Plus or Minus
ST40 G14	at the back	15, 14 positions and common Plus or Minus



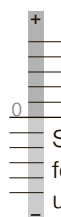
2.9

Namur Valves

Namur 1/4" also called "Namur 1" in accordance to VDI/VDE 3845. Namur 1/2" also called "Namur 2".



Selected models are available for low temperature application.
Temperature-range: - 50° C to + 50° C.
For detailed information refer to chapter 2.11.



Selected models can be equipped for high temperature environments up to 80 °C, DC only!



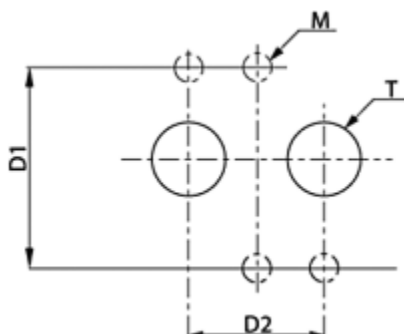
316 Selected models are available in stainless steel.
For detailed information refer to chapter 2.12.

Selected models are available for explosion hazardous environment. They are ATEX-Ex certified.
For detailed information refer to chapter 2.14.



General information: Valves with the 1/4" and 1/2" NAMUR-interface and different flow rates

The Hafner NAMUR-valves are available with the 1/4" standard in accordance to VDI / VDE 3845 also called NAMUR 1 – as well as with the 1/2" standard – also called NAMUR 2.



NAMUR-standard: Drawing of the actuator flange



Notice: Difference between 1/4" – 1/8" and 1/2" – 3/8" is port-size and position as well as the size, position and depth of the fixing screws in the actuator. On actuators NAMUR 1 (G 1/8" and **G 1/4"**) the same NAMUR-valves can be used. The same is true on NAMUR 2 (G 3/8" and **G 1/2"**) where also the same NAMUR-valves fit.

Type	D1 (mm)	D2 (mm)	M (mm)
1/4" (1/8")	32	24	M5
1/2" (3/8")	45	40	M6

Hafner's target to offer valves with maximum flow leads to offer 3 sizes of NAMUR-valves.



Series 701 / 711 Orifice size 7
NAMUR-interface 1/4"
Port size G 1/4" or 1/4" NPT



Series 101 Orifice size 10
NAMUR-interface 1/4"
Port size G 3/8"



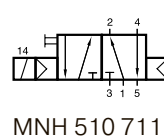
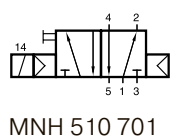
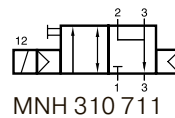
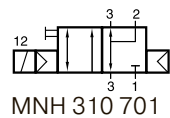
Series 121 Orifice size 12
NAMUR-interface 1/2"
Port size G 1/2" or 1/2" NPT

For single solenoid valves we offer two different port-schemes. Use depends on actuator interface.

2 port-schemes for 1/4" NAMUR-valves

standard port-scheme

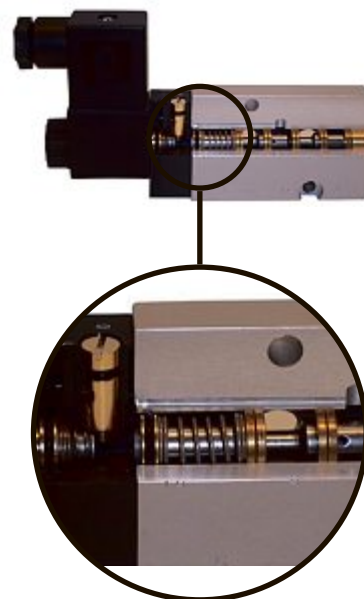
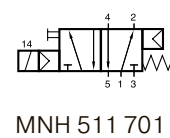
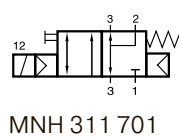
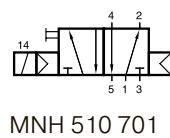
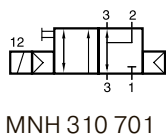
alternative port-scheme



Single solenoid and single pilot valves are available with air spring or combined (air and mechanical spring) return.

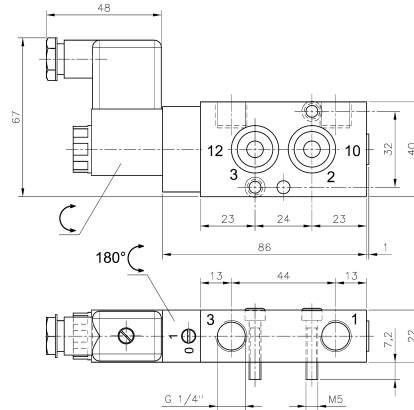
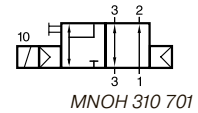
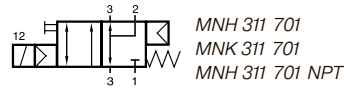
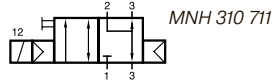
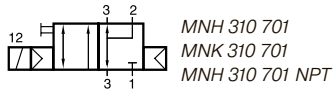
Valves with air spring return

Valves with combined spring return

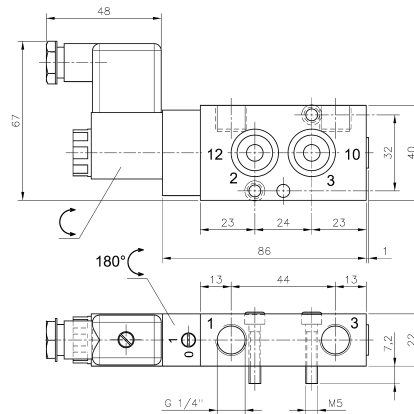


Combined spring assures a **fail-safe function** in case of loss of air pressure. Also available in 1/2"-valves.

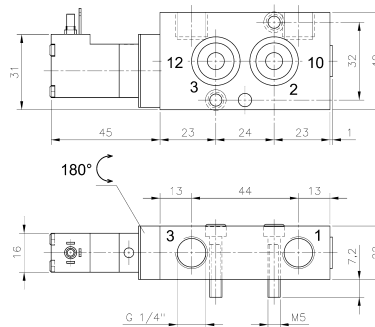
MNH 310 701/MNH 310 711/MNH 311 701 MNOH 310 701/MNK 310 701/MNK 311 701



**MNH 310 701/MNH 311 701/MNOH 310 701
MNH 310 701 NPT/MNH 311 701 NPT**



MNH 310 711 ports 1 and 3 are swapped!



MNK 310 701/MNK 311 701

3/2-way solenoid valve, actuated by permanent signal. Interface according to 1/4" NAMUR-standard, with exhaust air recirculation ("purge").

Type MNH 31_7_1 normally closed
Type MNOH 31_701 normally open
Type MNK 31_701 n.c. low power

MNH 310 701, MNH 310 711, MNOH 310 701 and MNK 310 701 with pneumatic spring return, MNH 311 701 and MNK 311 701 with combined spring assuring a fail-safe function.

MNH generally with manual override to turn with solenoid operators 230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

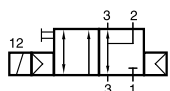
MNK with manual override to push with solenoid operators 230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=, 12V=, 6V=

Delivery includes 1 pin, 2 screws and 2 O-rings.

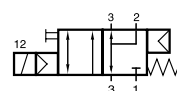
Type	Function	Port size	Air flow	Operating press.	Power cons.	Weight	
MNH 310 701	n.c.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,26 kg	Ex
MNOH 310 701	n.o.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,26 kg	
MNH 310 711	n.c.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,26 kg	Ex
MNH 311 701	n.c.	G 1/4"	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,26 kg	
MNK 310 701	n.c.	G 1/4"	1250 l/min	2 - 10 bar	1,8 W = / 3 VA ~	0,21 kg	
MNK 311 701	n.c.	G 1/4"	1250 l/min	2,5 - 10 bar	1,8 W = / 3 VA ~	0,21 kg	
MNH 310 701 NPT	n.c.	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,26 kg	Ex
MNH 311 701 NPT	n.c.	1/4" NPT	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,26 kg	

MNH 310 101/MNH 311 101 MNH 310 121/MNH 311 121

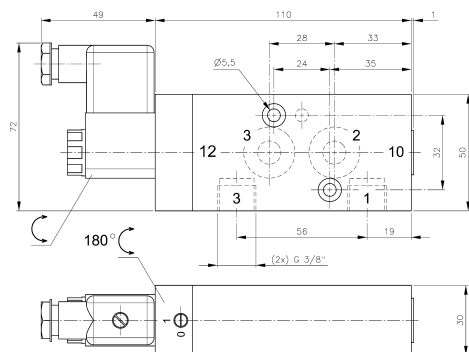
2.9.1.1.2
page 179



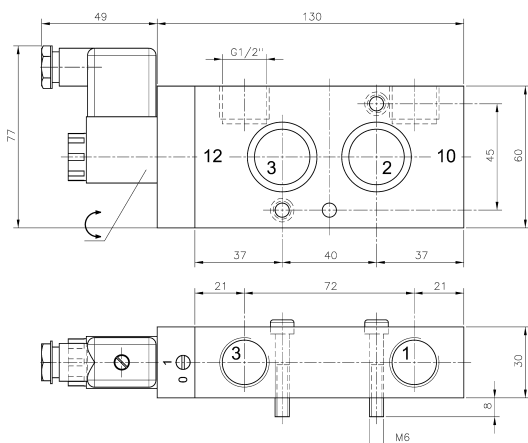
MNH 310 101
MNH 310 121
MNH 310 121 NPT



MNH 311 101
MNH 311 121
MNH 311 121 NPT



MNH 310 101/MNH 311 101



**MNH 310 121/MNH 311 121
MNH 310 121 NPT/MNH 311 121 NPT**



3/2-way solenoid valve, actuated by permanent signal. Interface according to NAMUR-standard, with exhaust air recirculation ("purge").

Type 101 according to 1/4" NAMUR-standard
Type 121 according to 1/2" NAMUR-standard

MNH 310 101, MNH 310 121 with pneumatic spring return, MNH 311 101 and MNH 311 121 with combined spring assuring a fail-safe function.

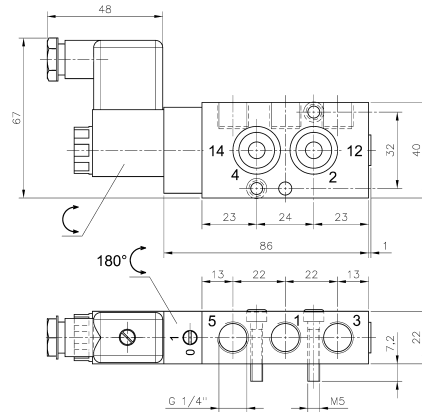
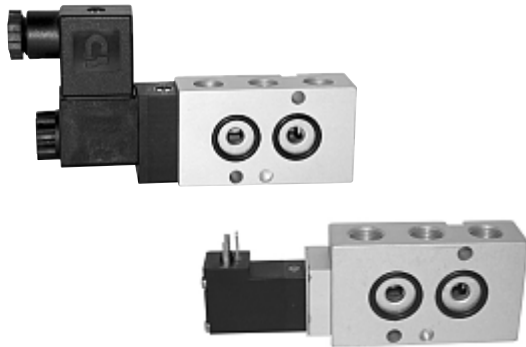
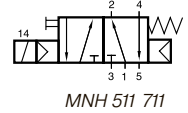
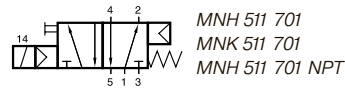
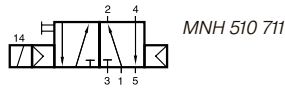
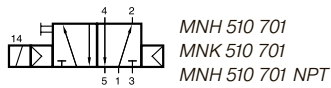
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

The valves are generally equipped with manual override to turn.

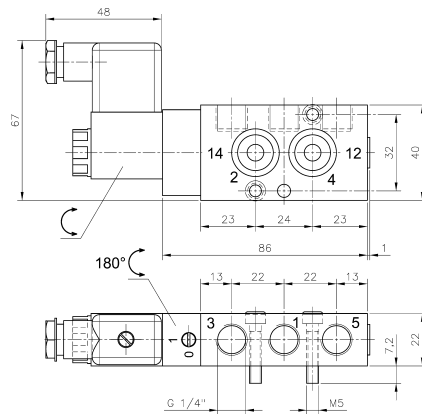
Delivery includes 1 pin, 2 screws, 2 O-rings.

Type	NAMUR Port size	Air flow	Operating press.	Power cons.	Weight
MNH 310 101	1/4" G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,55 kg
MNH 311 101	1/4" G 3/8"	2250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,55 kg
MNH 310 121	1/2" G 1/2"	3000 l/min	1,0 - 10 bar	3 W = / 5 VA ~	0,70 kg
MNH 311 121	1/2" G 1/2"	3000 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,70 kg
MNH 310 121 NPT	1/2" 1/2" NPT	3000 l/min	1,0 - 10 bar	3 W = / 5 VA ~	0,70 kg
MNH 311 121 NPT	1/2" 1/2" NPT	3000 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,70 kg

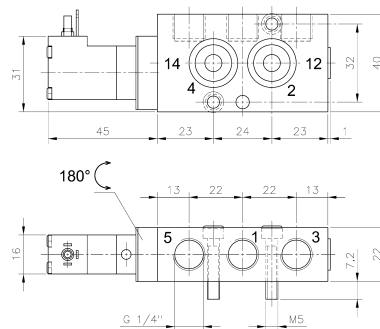
MNH 510 701/MNH 510 711/MNH 511 701 MNH 511 711/MNK 510 701/MNK 511 701



**MNH 510 701/MNH 511 701
MNH 510 701 NPT/MNH 511 701 NPT**



**MNH 510 711/MNH 511 711
ports 2,4,3,5 are swapped!**



MNK 510 701/MNK 511 701

5/2-way solenoid valve, actuated by permanent signal. Interface according to 1/4" NAMUR-standard.

MNH 510 701, MNH 510 711 and MNK 510 701 with pneumatic spring return, MNH 511 701, MNH 511 711 and MNK 511 701 with combined spring.

MNH generally with manual override to turn with solenoid operators 230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

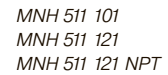
MNK with manual override to push with solenoid operators 230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=, 12V=, 6V=.

Delivery includes 1 pin, 2 screws, 2 O-rings.

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MNH 510 701	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,26 kg
MNH 510 711	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,26 kg
MNH 511 701	G 1/4"	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,26 kg
MNH 511 711	G 1/4"	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,26 kg
MNK 510 701	G 1/4"	1250 l/min	2 - 10 bar	1,8 W = / 3 VA ~	0,21 kg
MNK 511 701	G 1/4"	1250 l/min	2,5 - 10 bar	1,8 W = / 3 VA ~	0,21 kg
MNH 510 701 NPT	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,26 kg
MNH 511 701 NPT	1/4" NPT	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,26 kg



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MNH 510 101/MNH 511 101

MNH 510 121/MNH 511 121
MNH 510 121 NPT/MNH 511 121 NPT



5/2-way solenoid valve, actuated by permanent signal. Interface according to NAMUR-standard.



Type 101 according to 1/4" NAMUR-standard
Type 121 according to 1/2" NAMUR-standard

MNH 510 101, MNH 510 121 with pneumatic spring return, MNH 511 101 and MNH 511 121 with combined spring.

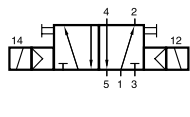
Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

The valves are generally equipped with manual override to turn.

Delivery includes 1 pin, 2 screws, 2 O-rings.

Type	NAMUR Port size		Air flow	Operating press.	Power cons.	Weight
MNH 510 101	1/4"	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,55 kg
MNH 511 101	1/4"	G 3/8"	2250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,55 kg
MNH 510 121	1/2"	G 1/2"	3000 l/min	1,0 - 10 bar	3 W = / 5 VA ~	0,70 kg 
MNH 511 121	1/2"	G 1/2"	3000 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,70 kg
MNH 510 121 NPT	1/2"	1/2" NPT	3000 l/min	1,0 - 10 bar	3 W = / 5 VA ~	0,70 kg 
MNH 511 121 NPT	1/2"	1/2" NPT	3000 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,70 kg

MNH 520 701/MNH 520 101/MNH 520 121 MNK 520 701



MNH 520 701
MNH 520 101
MNH 520 121
MNK 520 701
MNH 520 701 NPT
MNH 520 121 NPT

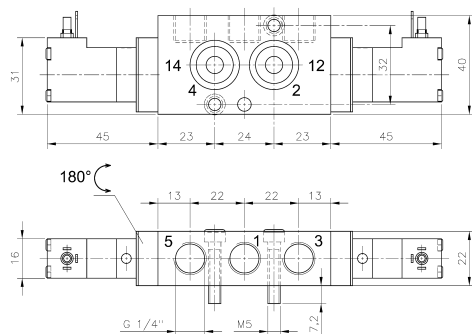


5/2-way solenoid valve actuated by impulse.
Position is kept until next electrical signal even
when not attached to electrical source. Interface
according to NAMUR-standard.

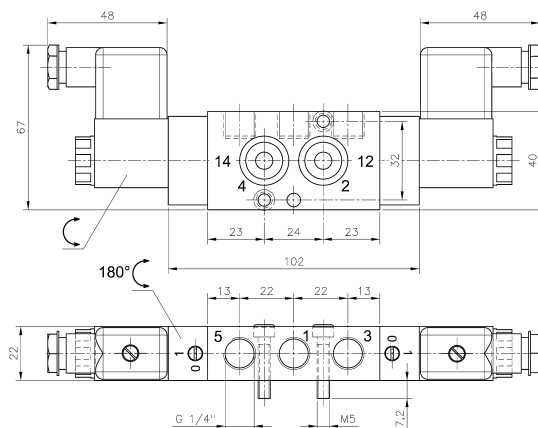
MNH generally with manual override to turn
with solenoid operators 230V/50Hz, 110V/50Hz,
24V/50Hz, 48V=, 24V=, 12V=.

MNK with manual override to push with solenoid
operators 230V/50Hz, 110V/50Hz, 24V/50Hz,
24V=, 12V=, 6V=.

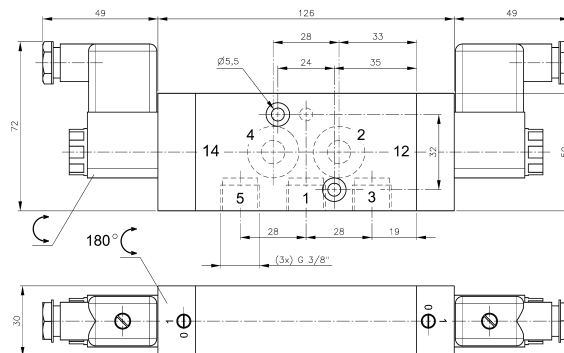
Delivery includes 1 pin, 2 screws, 2 O-rings.



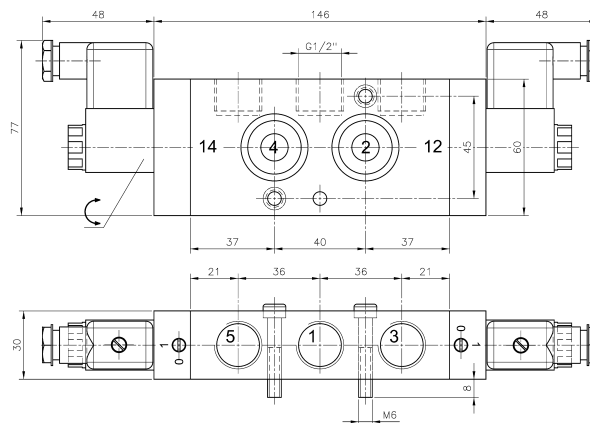
MNK 520 701



MNH 520 701/MNH 520 701 NPT



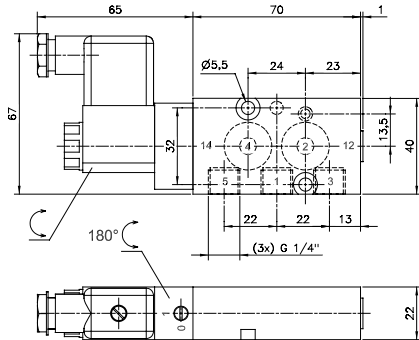
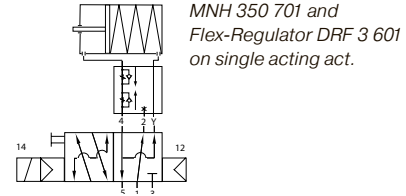
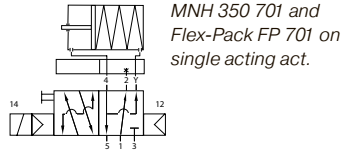
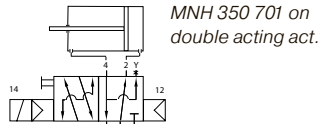
MNH 520 101



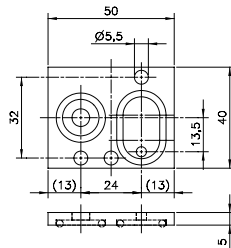
MNH 520 121/MNH 520 121 NPT

Type	NAMUR Port size		Air flow	Operating press.	Power cons.	Weight
MNH 520 701	1/4"	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,35 kg
MNH 520 101	1/4"	G 3/8"	2250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,84 kg
MNH 520 121	1/2"	G 1/2"	3000 l/min	1,0 - 10 bar	3 W = / 5 VA ~	0,87 kg
MNK 520 701	1/4"	G 1/4"	1250 l/min	2 - 10 bar	1,8 W = / 3 VA ~	0,31 kg
MNH 520 701 NPT	1/4"	1/4" NPT	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,35 kg
MNH 520 121 NPT	1/2"	1/2" NPT	3000 l/min	1,0 - 10 bar	3 W = / 5 VA ~	0,87 kg

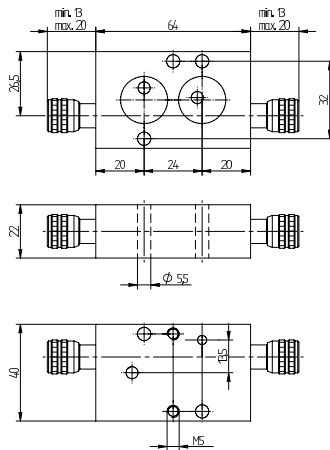




MNH 350 701/MNH 351 701
MNH 350 701 NPT/MNH 351 701 NPT



FP 701 K/FP 701 A



DRF 3 601



5/2-way solenoid valve, actuated by permanent signal. Interface according to 1/4" NAMUR-standard. Adding the „**Flex-Pack**“, converts the valve into a 3/2-way NAMUR-valve with exhaust-air recirculation ("purge").

MNH 350 701 with pneumatic spring return, MNH 351 701 with combined spring.

Valves are available with solenoid operators: 230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=

Valves are generally equipped with manual override.

Delivery of valve includes 1 pin, 2 screws, 2 O-rings.

Instead of the Flex-Pack the „**Flex-regulator**“ Type DRF 601 converts the function of the valve and offers the possibility to control opening- and closing-speed of a spring-return actuator independently.

Delivery of FP 701 and DRF 3 601 includes longer screws, seals as well as a plug to close port 3 of the valve.

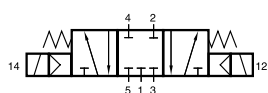
Type	Material	Orifice 4	Orifice 2-3	Weight
FP 701 K	PA	7 mm	4 mm	0,012 kg
FP 701 A	alu	7 mm	4 mm	0,016 kg
DRF 3 601	alu + brass	0,5 - 6 mm	4 mm	0,18 kg



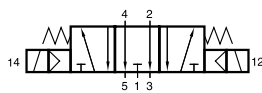
Type	Port size	Air flow	Operating press.	Power Cons.	Weight
MNH 350 701	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,24 kg
MNH 351 701	G 1/4"	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,24 kg
MNH 350 701 NPT	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,24 kg
MNH 351 701 NPT	1/4" NPT	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,24 kg



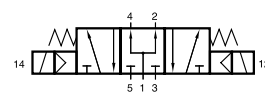
MNH 531 701/MNH 532 701/MNH 533 701 MNH 531 101/MNH 531 121/MNK 531 701



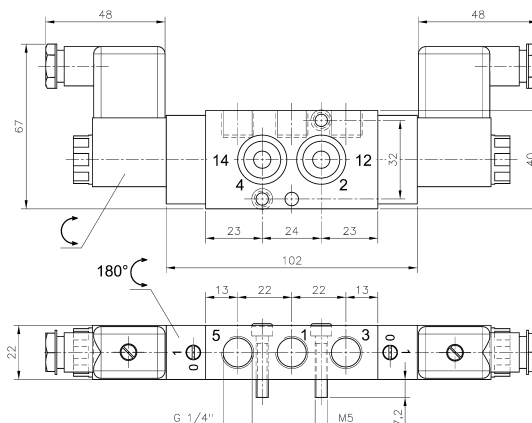
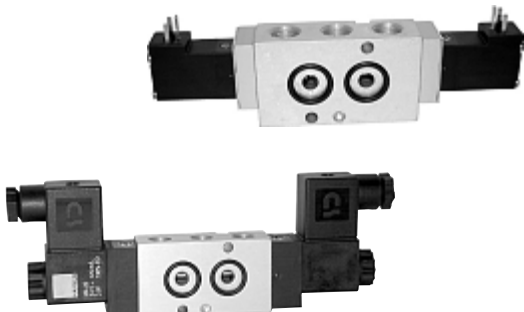
MNH 531 701
MNH 531 101
MNH 531 121
MNK 531 701
MNH 531 701 NPT
MNH 531 121 NPT



MNH 532 701



MNH 533 701



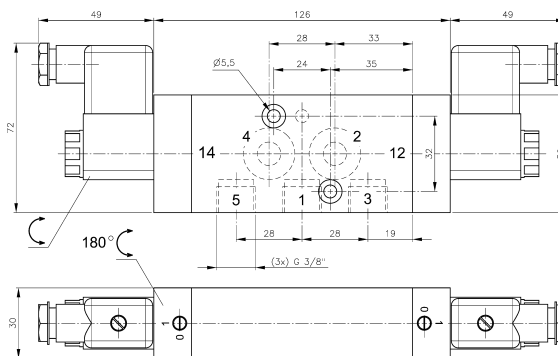
MNH 53_701/MNH 531 701 NPT

5/3-way solenoid valve with spring return to middle position. Interface according to NAMUR-standard.

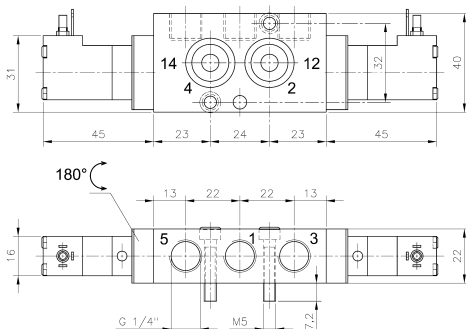
Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurised

MNH generally with manual override to turn with solenoid operators 230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

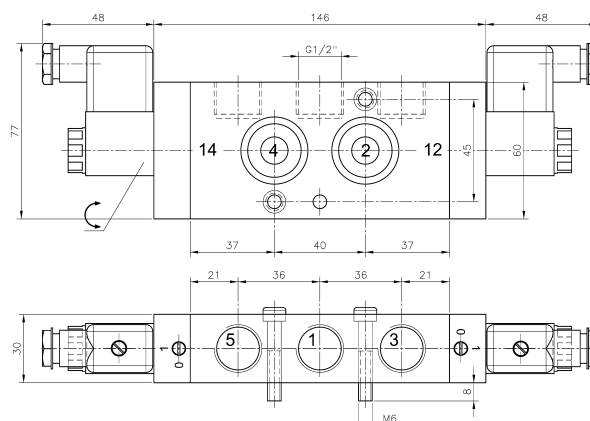
MNK with manual override to push with solenoid operators 230V/50Hz, 110V/50Hz, 24V/50Hz, 24V=, 12V=, 6V=.



MNH 531 101

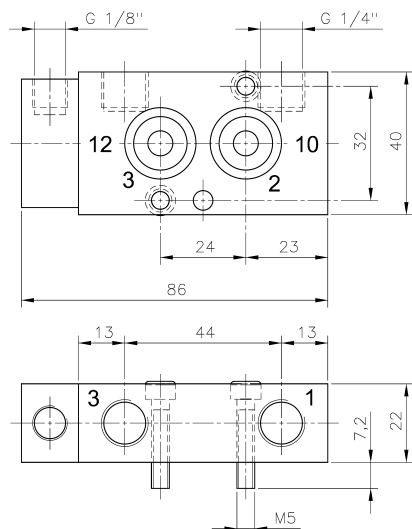


MNK 531 701

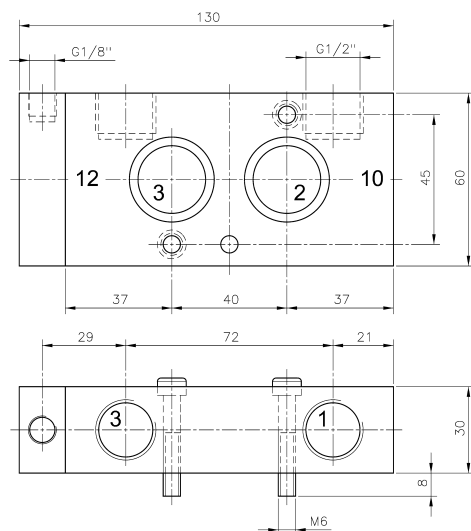


MNH 531 121/MNH 531 121 NPT

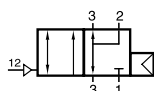
Type	NAMUR Port size	Air flow	Operating press.	Power cons.	Weight
MNH 53_701	1/4"	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~ 0,36 kg
MNH 531 101	1/4"	G 3/8"	2250 l/min	3 - 10 bar	3 W = / 5 VA ~ 0,84 kg
MNH 531 121	1/2"	G 1/2"	3000 l/min	3 - 10 bar	3 W = / 5 VA ~ 0,87 kg
MNK 531 701	1/4"	G 1/4"	1250 l/min	3 - 10 bar	1,8 W = / 3 VA ~ 0,32 kg
MNH 531 701 NPT	1/4"	1/4" NPT	1250 l/min	3 - 10 bar	3 W = / 5 VA ~ 0,36 kg
MNH 531 121 NPT	1/2"	1/2" NPT	3000 l/min	3 - 10 bar	3 W = / 5 VA ~ 0,87 kg



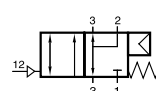
PN 310 701/PN 311 701



PN 310 121



PN 310 701
PN 310 121



PN 311 701



Pneumatically actuated 3/2-way spool valve. Interface according to NAMUR-standard with exhaust recirculation („purge”).

PN 310 701 and PN 310 121 with pneumatic spring. For valves with pure pneumatic spring operating and actuation pressure should be at the same level. PN 311 701 with combined mechanical and pneumatic spring return.

Port sizes type 701: 1 and 3: G 1/4"
12: G 1/8"

Port sizes type 121: 1 and 3: G 1/2"
12: G 1/8"

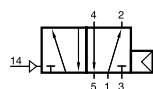
Delivery includes 1 pin, 2 screws, 2 O-rings.

NPT ported valves are available on request.

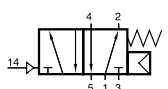
Type	NAMUR Port size		Air flow	Operating press.	Actuation press.	Weight
PN 310 701	1/4"	G 1/4" - G 1/8"	1250 l/min	2 - 10 bar	the same	0,20 kg
PN 311 701	1/4"	G 1/4" - G 1/8"	1250 l/min	3 - 10 bar	3 - 10 bar	0,20 kg
PN 310 121	1/2"	G 1/2" - G 1/8"	3000 l/min	1 - 10 bar	the same	0,62 kg



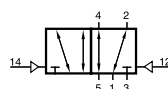
PN 510 701/PN 511 701/PN 510 121 PN 520 701/PN 520 121



PN 510 701
PN 510 121



PN 511 701



PN 520 701
PN 520 121



Pneumatically actuated 5/2-way spool valve. Interface according to NAMUR-standard.

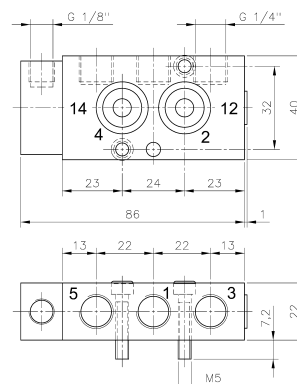
PN 510 701 and PN 510 121 with pneumatic spring. For valves with pure pneumatic spring operating and actuation pressure should be at the same level. PN 511 701 with combined mechanical and pneumatic spring return. PN 520 with double pilot.

Port sizes type 701: 1, 3 and 5: G 1/4"
12 and 14: G 1/8"

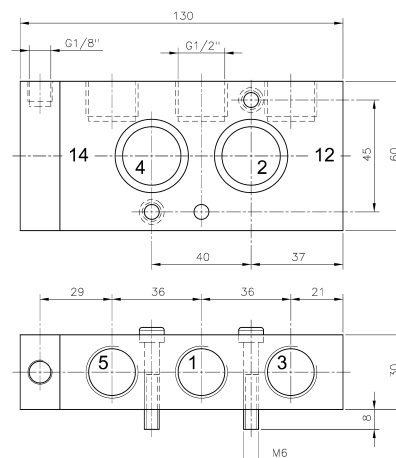
Port sizes type 121: 1, 3 and 5: G 1/2"
12 and 14: G 1/8"

Delivery includes 1 pin, 2 screws, 2 O-rings.

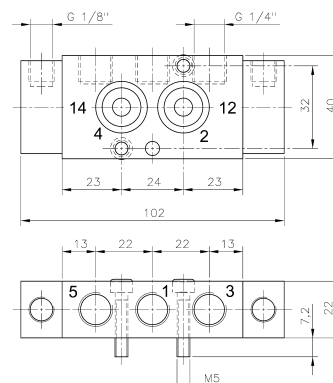
NPT ported valves are available on request.



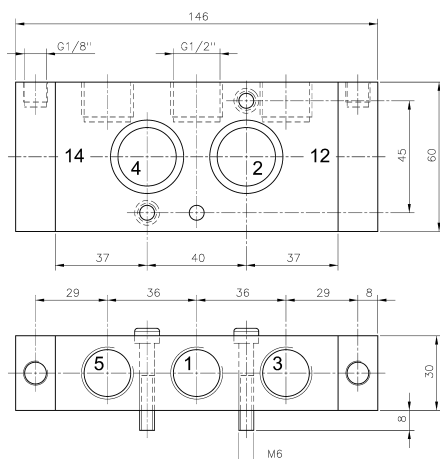
PN 510 701/PN 511 701



PN 510 121

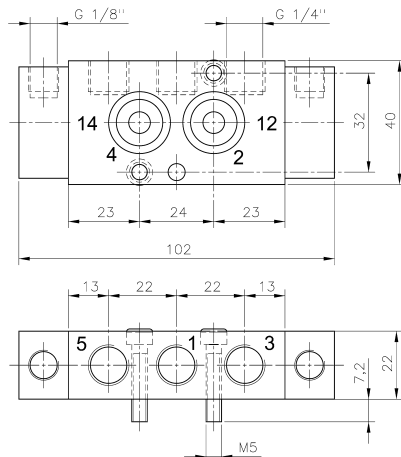
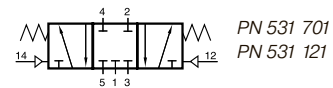


PN 520 701

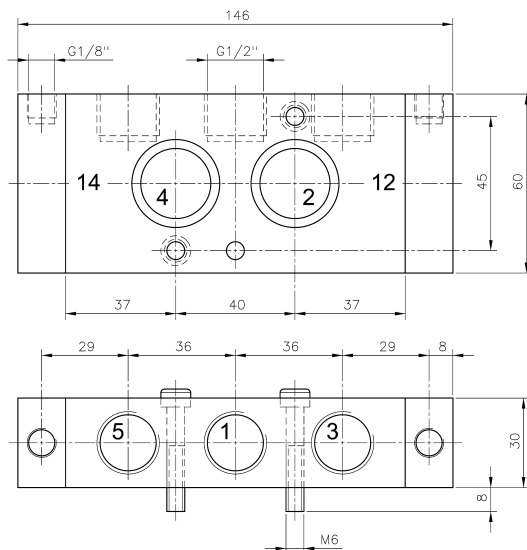


PN 520 121

Type	NAMUR Port size		Air flow	Operating press.	Actuating press.	Weight
PN 510 701	1/4"	G 1/4" - G 1/8"	1250 l/min	2 - 10 bar	the same	0,19 kg
PN 511 701	1/4"	G 1/4" - G 1/8"	1250 l/min	3 - 10 bar	3 - 10 bar	0,19 kg
PN 510 121	1/2"	G 1/2" - G 1/8"	3000 l/min	1 - 10 bar	the same	0,60 kg
PN 520 701	1/4"	G 1/4" - G 1/8"	1250 l/min	2 - 10 bar	2,5 - 10 bar	0,22 kg
PN 520 121	1/2"	G 1/2" - G 1/8"	3000 l/min	1 - 10 bar	2,5 - 10 bar	0,67 kg



PN 531 701



PN 531 121



Pneumatically actuated 5/3-way spool valve with spring return to middle position, centre closed. Interface according to NAMUR-standard.

Port sizes type 701: 1, 3 and 5: G 1/4"
12 and 14: G 1/8"

Port sizes type 121: 1, 3 and 5: G 1/2"
12 and 14: G 1/8"

Other 5/3-way versions (centre exhausted or pressurised) are available on request.

Delivery includes 1 pin, 2 screws, 2 O-rings.

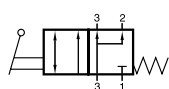
NPT ported valves are available on request.

Type	NAMUR Port size		Air flow	Operating press.	Actuation press.	Weight
PN 531 701	1/4"	G 1/4" - G 1/8"	1250 l/min	1 - 10 bar	3 - 10 bar	0,22 kg
PN 531 121	1/2"	G 1/2" - G 1/8"	3000 l/min	1 - 10 bar	3 - 10 bar	0,67 kg

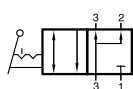


HVN 311 701/HVRN 320 701

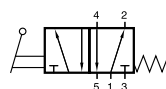
HVN 511 701/HVRN 520 701



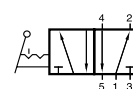
HVN 311 701



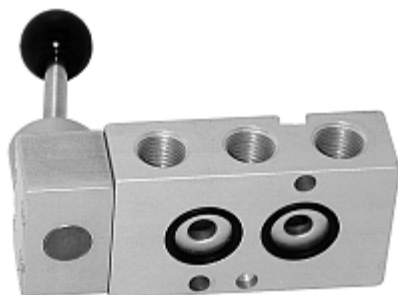
HVRN 320 701



HVN 511 701



HVRN 520 701



Lever actuated spool valves with interface according to 1/4" NAMUR- standard.
4 versions are offered:

HVN 311 701 3/2-way, normally closed with spring return

HVRN 320 701 3/2-way, indexed

HVN 511 701 5/2-way with spring return

HVRN 520 701 5/2-way indexed

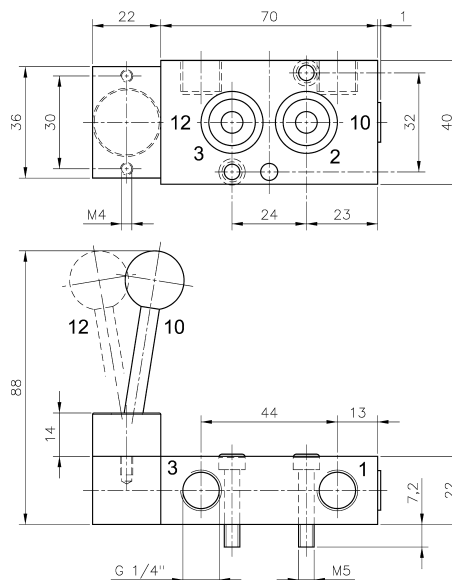
3/2-way valves offer exhaust air recirculation („purge”).

The lever is sealed by using a metal ball.

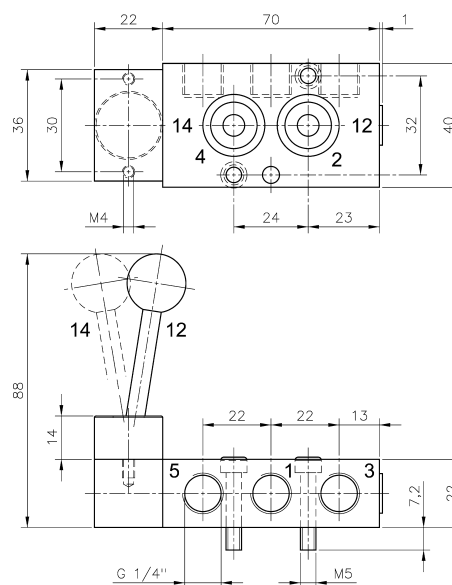
Exhaust can be throttled.

Delivery includes 1 pin, 2 screws, 2 O-rings.

NPT ported versions and 5/3-way valves are available on request.

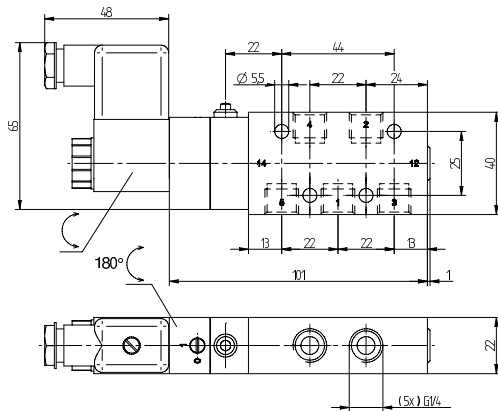


HVN 311 701/HVRN 320 701



HVN 511 701/HVRN 520 701

Type	Function	Port size	Air flow	Operating press.	Actuating force	Weight
HVN 311 701	3/2-way spring	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg
HVRN 320 701	3/2-way indexed	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg
HVN 511 701	5/2-way spring	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg
HVRN 520 701	5/2-way indexed	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg



MHLL 510 701 ALU



Valves with manual reset function for monitored reactivation by maintenance staff.
When the solenoid valve is de-energized it will move to its default position.

A regular solenoid valves will be switched on just by energizing the solenoid.

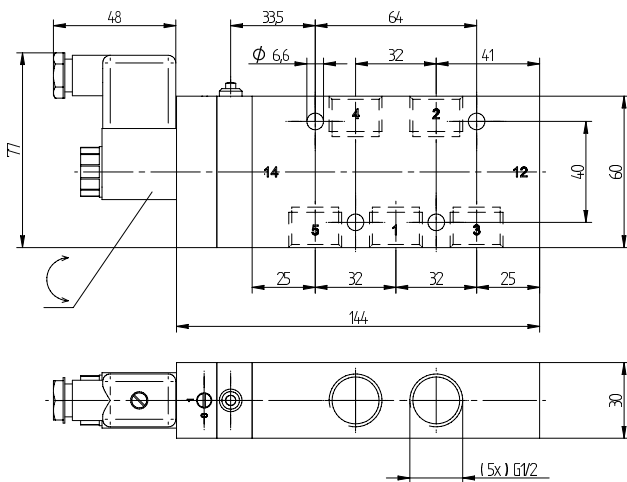
Unlike a valve with a manual reset function:
In order to switch-on the valve the solenoid has to be actuated and initially a knob on the valve has to be pushed.

The requirement that an operator has to be physically present when an especially important or critical piece of equipment is activated is fulfilled by this product.

The manual reset system is available for our G 1/8", G 1/4" as well as G 1/2" valves.

On request:

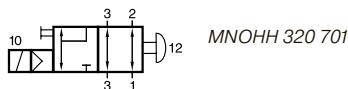
- *Stainless steel version*
- *ATEX-approved*
- *Pneumatically actuated valves*



MHLL 510 121

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MHLL 510 701 ALU	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,30 kg
MHLL 510 121	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	0,72 kg

Valves with latch-lock function



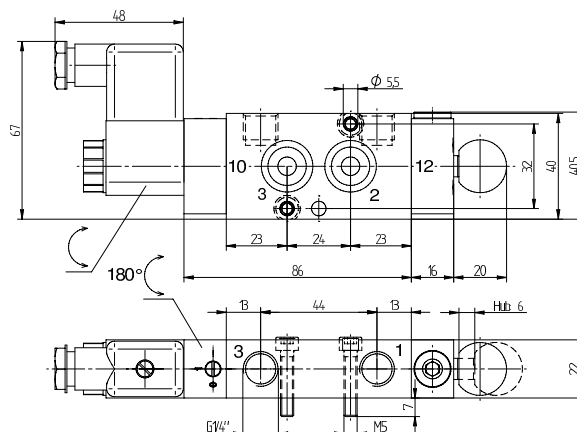
The MNOHH 320 701 is a 2-position valve, actuated from one side by solenoid, from the other side manually.

Interface according to 1/4" NAMUR- standard.

As long as there is no electric signal applied, the valve is open from 1 to 2 and port 3 can exhaust.

When an electric signal is applied to the solenoid, the valve moves to the closed position. The valve will stay in this position no matter if the electric signal cuts-off.

It can only be switched into the other position by manually pushing the knob.



MNOHH 320 701

Typical application:

Valve is mounted on a single acting actuator.

Another 3/2-way control valve is connected to port 1 of the MNOHH 320 701.

In normal operation, no electric signal is applied to the solenoid and the actuator can be opened and closed by the 3/2-way control valve. When there is an emergency, an electric signal is applied to the solenoid and the valve moves to the closed position. The air supply to the actuator is now cut-off and the actuator will close by the force of the spring.

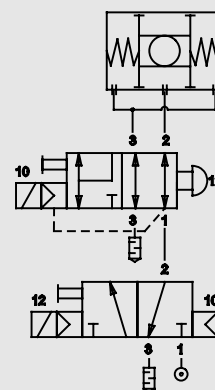
As a result the process valve stays in this position until maintenance personnel is present and resets the valve.

Function:

Actuator

MNOHH 320 701

3/2-way valve



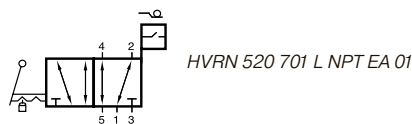
On request:

- Other functions
- ATEX-approved
- Stainless steel version

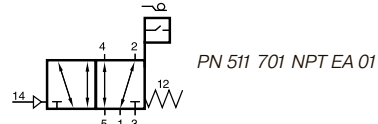
Type	Port size	Air flow	Operating press.	Power consumption	Weight
MNOHH 320 701	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,30 kg

Valves with position feedback function

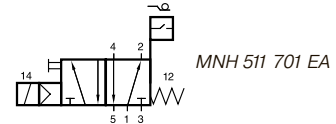
2.9.4.3
page 191



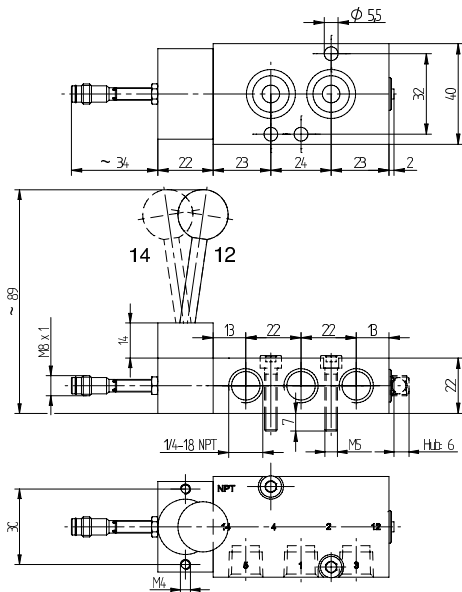
HVRN 520 701 L NPT EA 01



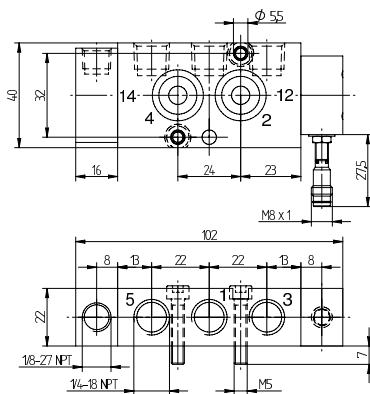
PN 511 701 NPT EA 01



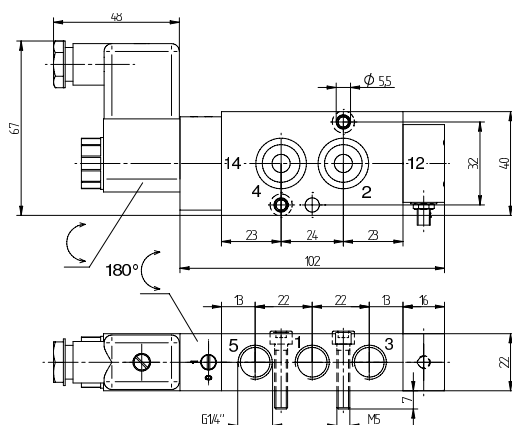
MNH 511 701 EA



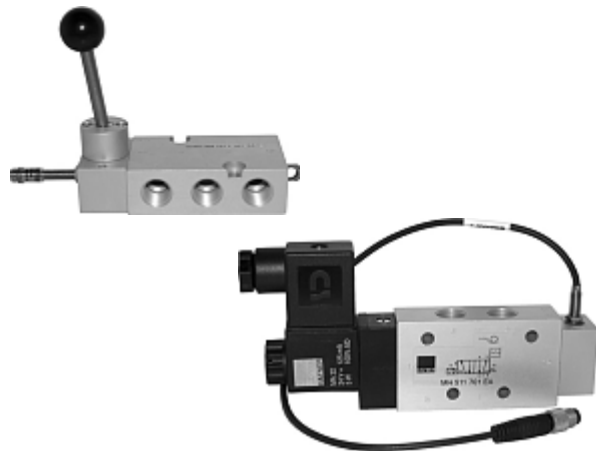
HVRN 520 701 L NPT EA 01



PN 511 701 NPT EA 01



MNH 511 701 EA



The Machinery Directive DIN EN ISO 13849 is challenging machine manufacturers. The security level of control system has to be assessed, redundant systems or components with feedback-functions have to be installed.

Solution from Hafner:

Valves with position feedback function. The sensors give a signal assuring that the valve has fully switched through.

HVRN 520 701 L NPT EA 01:

Lever actuated 5/2-way spool valve, indexed. Interface according to 1/4" NAMUR-standard. Additionally the user can put a padlock in the drilling of the extended spool and thereby lock the valve. Equipped with an inductive sensor from Contrinex according to NAMUR (DIN 19234).

PN 511 701 NPT EA 01:

Pneumatically actuated 5/2-way spool valve. Interface according to 1/4" NAMUR-standard. Equipped with an inductive sensor from Contrinex according to NAMUR (DIN 19234).

MNH 511 701 EA:

5/2-way solenoid valve, actuated by permanent signal. Interface according to 1/4" NAMUR-standard. Equipped with an inductive sensor from Balluff with 0.30 m cable.

Other valves and sensors available on request.

Type	Port size	Air flow	Operating press.	Actuation press.	Power consumption	Weight
HVRN 520 701 L NPT EA 01	1/4" NPT	1250 l/min	1 - 10 bar	–	–	0,24 kg
PN 511 701 NPT EA 01	1/4" NPT	1250 l/min	1 - 10 bar	3 - 6 bar	–	0,19 kg
MNH 511 701 EA	G 1/4"	1250 l/min	2 - 10 bar	–	3 W = / 5 VA ~	0,25 kg

Valves for high temperature applications

page 192

Hafner is offering selected products to be used in **high temperature environment**.

All valves of the series 500 (G 1/8") as well as 700 (G 1/4") can be delivered like that.
Other sizes available on request.

Temperature range solenoid valves
(DC-coils only):
-10°C to +80° (100% ED)

The solenoid valves are available with coils 24V=.

For a better heat resistance, we equip the valves with the Epoxy coil (MA 22 D).



Sample Product: MNH 310 701 HT

3/2-way solenoid valve, interface according to 1/4" NAMUR-standard.

Equipped with aluminum pilot-head, aluminum fixing nut and Epoxy coil.

Inner seals are made from FKM.

Temperature range manually, mechanically and pneumatically actuated valves: **-10°C to +120°C**.



Sample Product: P 310 701 VIT

Pneumatically actuated 3/2-way valve with FKM seals.



Sample Product: HVR 520 701 L

Lever actuated 5/2-way spool valve, indexed, with FKM seals.

Added value: The user can put a padlock in the drilling of the extended spool and thereby lock the valve.



Sample Product: D 181 G

Block form flow regulator, bi-directional.

Port-size G 3/4", 6000 l/min air-flow.

*Other products can be made available for high temperature applications as well.
Please send us your inquiry!*

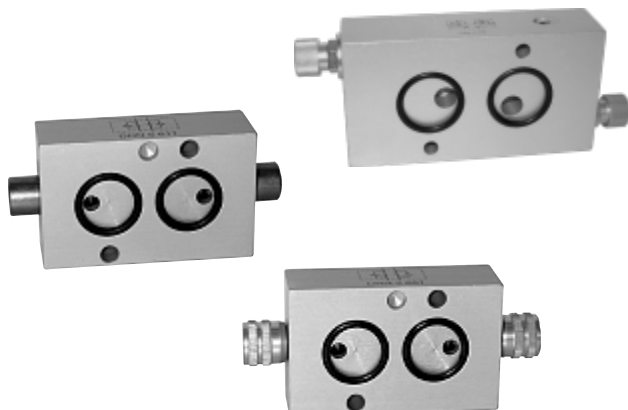
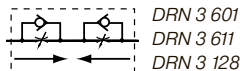


2.10

**Accessories for smart
valve automation**

DRN 3 601/DRN 3 611/DRN 3 128

Flow regulator plate

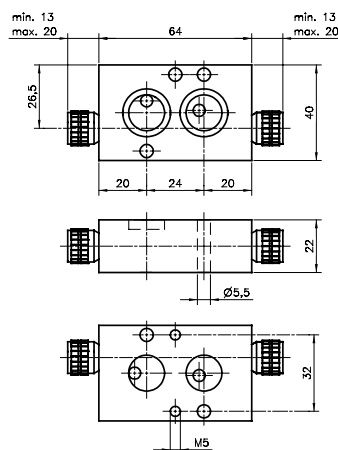


Block form flow regulator as intermediate plate, interface according to NAMUR-standard, for 3/2-way valves with exhaust air recirculation.

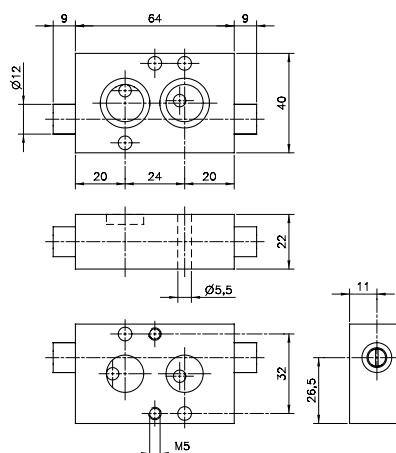
To regulate the forward stroke of a single acting pneumatic actuator and to regulate the exhaust air going into the spring return unit. DRN 3 601 and DRN 3 128 to be operated manually, DRN 3 611 with a screw-driver.

If flow regulator is required with G 1/4" ports, plate GPN 1/4 can be added. For details please refer to page 2.10.14.

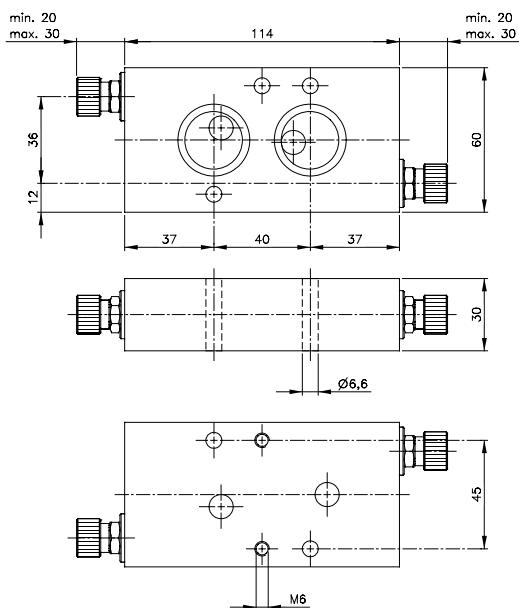
Delivery includes 1 pin, 2 screws, 2 O-rings.



DRN 3 601

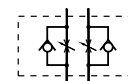


DRN 3 611

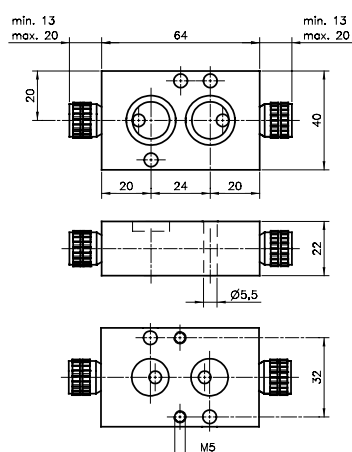


DRN 3 128

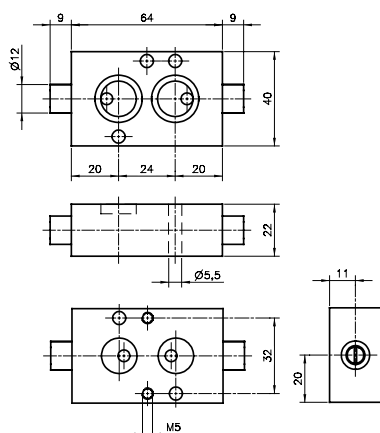
Type	Function	NAMUR	Port size	Max. air flow	Operating pressure	Weight
DRN 3 601	3-way	1/4"	Ø 5 mm	650 l/min	0,5 - 10 bar	0,18 kg
DRN 3 611	3-way	1/4"	Ø 5 mm	650 l/min	0,5 - 10 bar	0,18 kg
DRN 3 128	3-way	1/2"	Ø 8 mm	1.500 l/min	0,5 - 10 bar	0,60 kg



DRN 5 601
DRN 5 611



DRN 5 601



DRN 5 611

Block form flow regulator as intermediate plate, interface according to 1/4" NAMUR-standard, for 5-way valves only.

To regulate the forward- and backward-stroke of a double acting pneumatic actuator. DRN 5 601 and DRN 5 501 to be operated manually, DRN 5 611 with a screw-driver.

If flow regulator is required with G 1/4" ports, plate GPN 1/4 can be added. For details please refer to page 2.10.14.

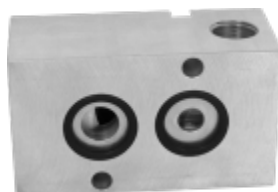
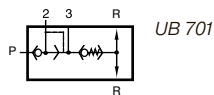
Delivery includes 1 pin, 2 screws, 2 O-rings.

Type	Function	Port size	Max. air flow	Operating pressure	Weight
DRN 5 601	5-way	Ø 5 mm	650 l/min	0,5 - 10 bar	0,18 kg
DRN 5 611	5-way	Ø 5 mm	650 l/min	0,5 - 10 bar	0,18 kg



UB 701

Air-recirculation block for single acting actuators



The air-recirculation block guarantees, that only exhausting air from the actuation chamber is going into the spring chamber, no ambient atmosphere is sucked-in.

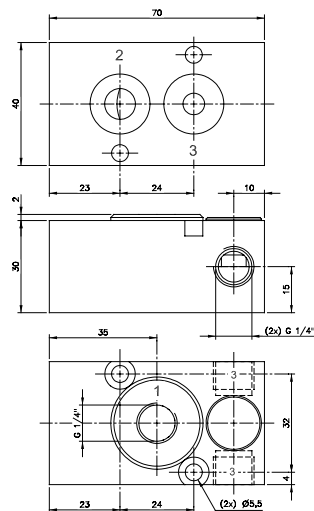
Valve is designed for spring return pneumatic actuators with 1/4" NAMUR-interface to be controlled by a remote piloted 3/2-way valve.

Standard with G 1/4" pilot port. Materials being used:

Body: aluminum
Diaphragm: NBR
Other inner parts: brass

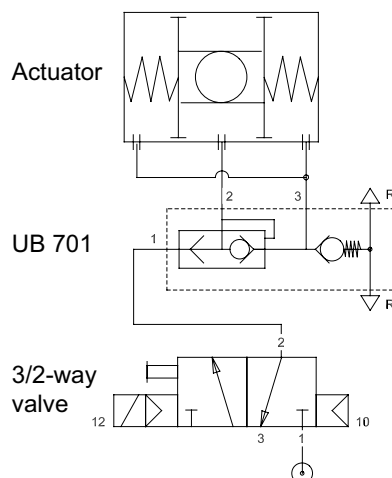
One of the two exhaust ports 3 to be closed by a plug.

Delivery includes 2 screws, 2 O-rings, 1/4" plug for port 3.



UB 701

Function:

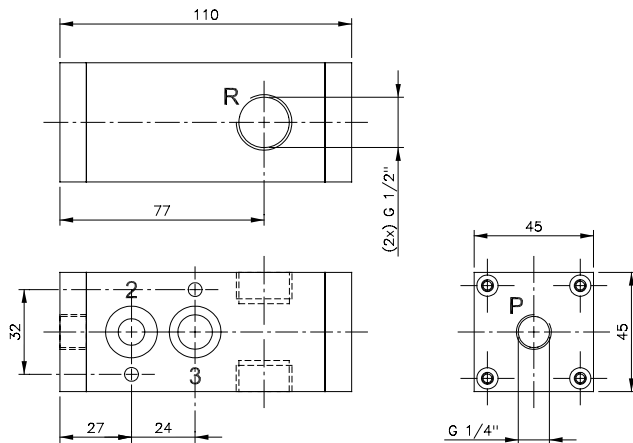


Type	NAMUR	Port size	Air flow	Operating pressure	Weight
UB 701	1/4"	G 1/4"	1250 l/min	1 - 10 bar	0,22 kg

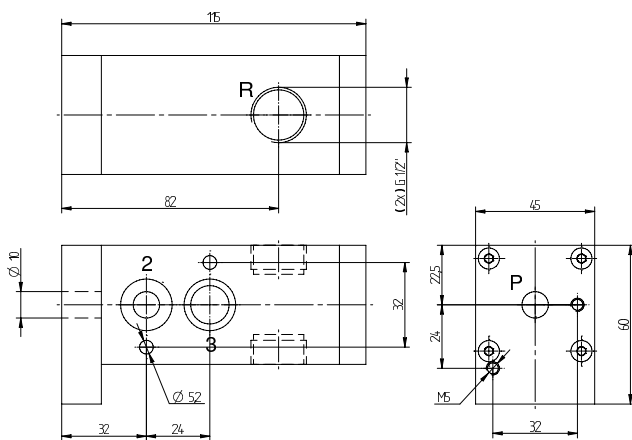
SENR 20/SENR 207/SENR 207 01

Quick-exhaust-block with non-return valve

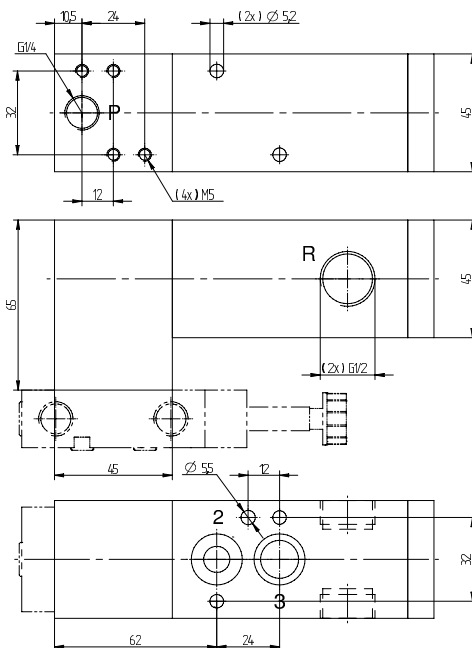
2.10.4
page 197



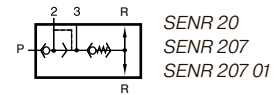
SENR 20



SENR 207



SENR 207 01



The valve is designed for fast closing of spring-return actuators with 1/4" NAMUR-interface.

Any 3/2-way valve can be used as pilot valve. The connection towards the pilot valve is either G 1/4" ported (type SENR 20) or for NAMUR-valves with the 1/4" NAMUR-interface (SENR 207/ SENR 207 01).

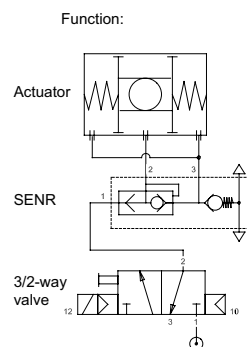
The block assures that only compressed air that has been used to open the actuator is used in the spring-chamber (non-return-function). Excess air is released very fast by the quick-exhaust valve, exhaust-port G 1/2", orifice 10 mm. The non-return valve makes absolutely sure that no ambient atmosphere can be sucked into the actuator.

Two exhaust-ports R allow that the product can always be assembled so the silencer faces downwards.

Delivery includes 2 screws, 2 O-rings, 1/2" plug for port R.

Special solution (SENR 207 01):

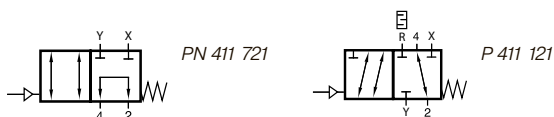
Quick-exhaust block for external piping and universal NAMUR-valve mounting.



Type	NAMUR	Port P	Port R	Air flow P to 2	Air flow exhaust	Operating press.	Weight
SENR 20	1/4"	G 1/4"	G 1/2"	1250 l/min	2500 l/min	2 - 10 bar	0,54 kg
SENR 207	1/4"	1/4" NAMUR	G 1/2"	1250 l/min	2500 l/min	2 - 10 bar	0,56 kg
SENR 207 01	1/4"	G 1/4" - 1/4" NAMUR	G 1/2"	1250 l/min	2500 l/min	2 - 10 bar	0,85 kg

PN 411 721/P 411 121

Short-cut valve when using manual gearbox



The **PN 411 721** is made for direct assemblage to an actuator with 1/4" NAMUR-interface. It offers a 1/4" NAMUR-interface towards the pilot-valve (use as sandwich plate) as well as ports G 1/4" for piped application. Delivery includes 2 screws, 2 O-rings.

The **P 411 121** is an in-line-version for high-flow-application, ported G 1/2".

Function:

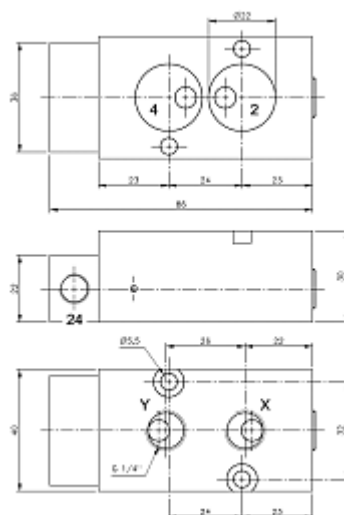
As long as a pneumatic signal is applied, the valve forwards the signals applied to 2 and 4 through to X and Y. When no pneumatic signal is applied the ports 2 and 4 are shortcut.

Typical application:

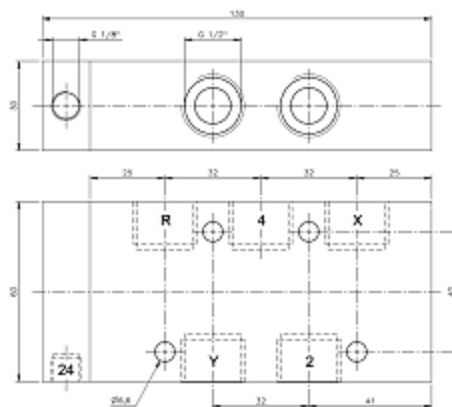
On automated process-valve equipped with a gear-box for manual actuation in case of emergency. When failure occurs, compressed air might get trapped in the actuator. Manual operation might damage the actuator. Valve assures, that the user doesn't have to close the process valve against the force of the air.

On request:

Valve that is normally blocked, type PN 411 711.



PN 411 721



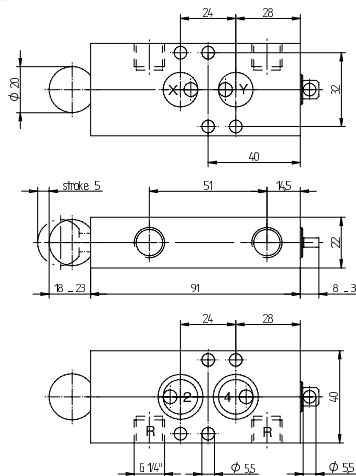
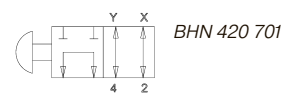
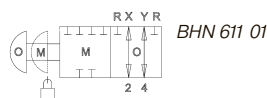
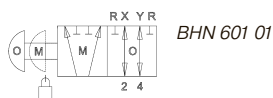
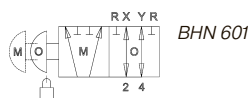
P 411 121

Type	Port size	Air flow	Operating press.	Actuating press.	Weight
PN 411 721	G 1/4"	1250 l/min	1,5 - 10 bar	3 - 10 bar	0,20 kg
P 411 121	G 1/2"	3000 l/min	1 - 10 bar	3 - 10 bar	0,63 kg

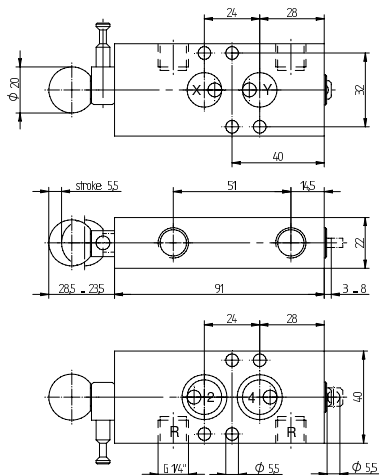
BHN 601/BHN 601 01/BHN 611 01 BHN 420 701

2.10.6
page 199

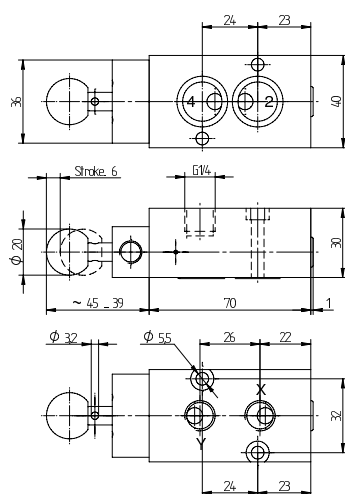
Manual actuated block and vent/block and block/short-cut valve



BHN 601



BHN 601 01/ BHN 611 01



BHN 420 701



Intermediate valve for assemblage onto the actuator with 1/4" NAMUR-interface. Blocks signals from pilot-valve.

BHN 601 exhausts actuator when knob is pulled. Lockable in standard operation mode (O-position).

BHN 601 01 exhaust actuator when knob is pushed. Lockable in manual mode (M-position). Protection against unintended use with pin. Typical application: to avoid injuries of maintenance personal when working on installed process equipment.

BHN 611 01 blocks actuator when knob is pushed. Lockable in manual mode (M-position). Protection against unintended use with pin. Typical application: For process valves on tanks where maintenance people have to go into the tank.

BHN 420 701 compressed air in the actuator is free to float between the two chambers.

Typical application: For process valves with manual gear-box to avoid damage caused by potentially trapped compressed air in the actuator.

If BHN 6__ are required with G 1/4" ports, plate GPN 1/4 can be added. For details please refer to page 2.10.14.

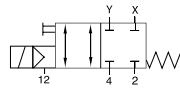
Delivery includes 1 pin, 2 screws, 2 O-rings.

Type	Function	lockable	Air flow	Operating press.	Actuation force	Weight
BHN 601	vents actuator	O-position	900 l/min	1 - 10 bar	18 N	0,23 kg
BHN 601 01	vents actuator	M-position	900 l/min	1 - 10 bar	18 N	0,24 kg
BHN 611 01	blocks actuator	M-position	900 l/min	1 - 10 bar	18 N	0,24 kg
BHN 420 701	shortcuts actuator	–	1250 l/min	1 - 10 bar	18 N	0,22 kg

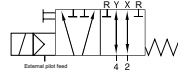


MNEH 411 711/MNEH 611 601

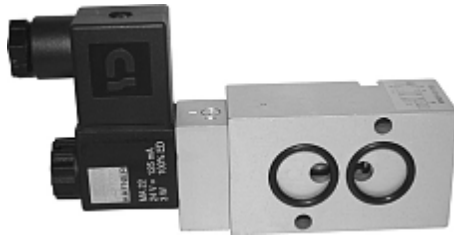
Electrically actuated block and block/block and vent valve



MNEH 411 711



MNEH 611 601



The **MNEH 411 711** is made for blocking the air supply from the pilot valve to the actuator and holding the actuator in the current position. It offers a so-called "stay-put" or "fail-in-place" function.

It is designed for direct assemblage to an actuator with 1/4" NAMUR-interface.

It offers a 1/4" NAMUR-interface towards the pilot-valve (use as sandwich) as well as G 1/4" ports (piped application). Delivery includes 2 screws, 2 O-rings.

Function:

As long as an electric signal is applied to the solenoid as well as air pressure is applied to the external pilot port, the valve forwards the signals from the pilot valve which are applied to X and Y through to 2 and 4.

All ports are blocked when the electric signal or air pressure at the external pilot port cuts off.

On request: Valve where port 2 and 4 is shortcut in basic position, type MNEH 411 721.

The **MNEH 611 601** is made for blocking the air supply from the pilot valve to the actuator and venting the actuator at the same time. It is designed for direct assemblage to an actuator with 1/4" NAMUR-interface. It offers a 1/4" NAMUR-interface towards the pilot-valve (use as sandwich).

Delivery includes 1 pin, 2 screws, 2 O-rings.

Function:

As long as an electric signal is applied to the solenoid as well as air pressure is applied to the external pilot port, the valve forwards the signals from the pilot valve which are applied to X and Y through to 2 and 4.

Pilot ports are blocked and actuator chamber is vented when the electric signal or air pressure at the external pilot port cuts off.

Available with solenoid operators:

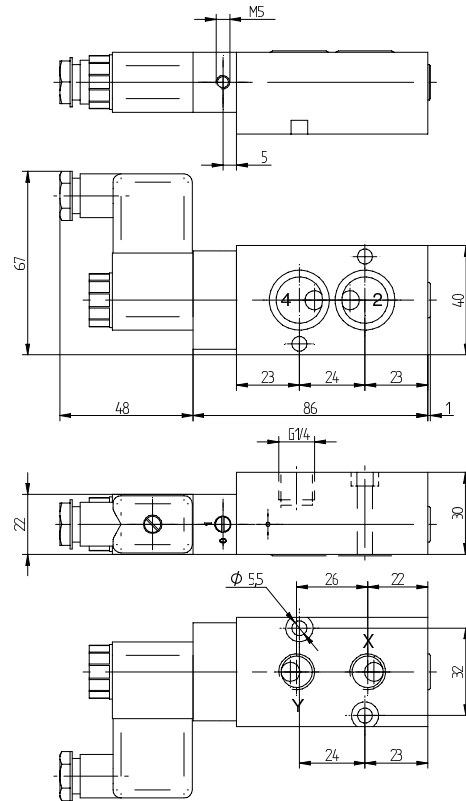
230V/50Hz, 100V/50Hz, 24V/50Hz, 48V=. 24V=, 12V=.

The valves are equipped with manual override to turn.

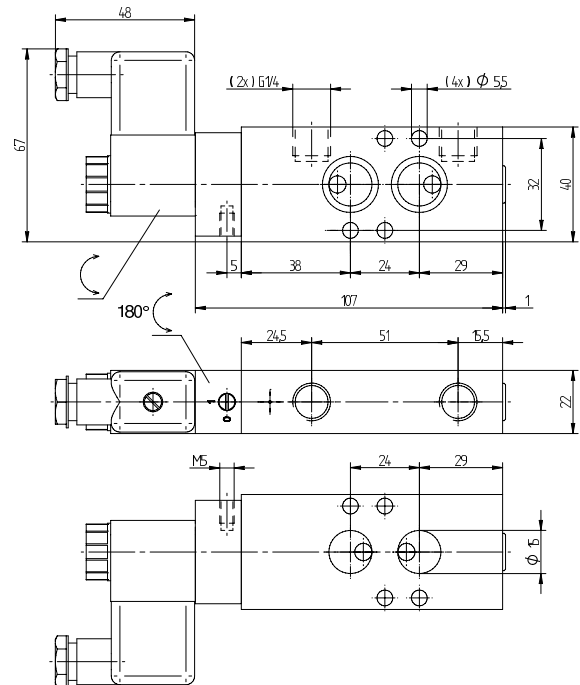
Valves can be used in combination with a positioner.

External pilot-feed is required.

Delivery includes 1 pin, 2 screws, 2 O-rings.

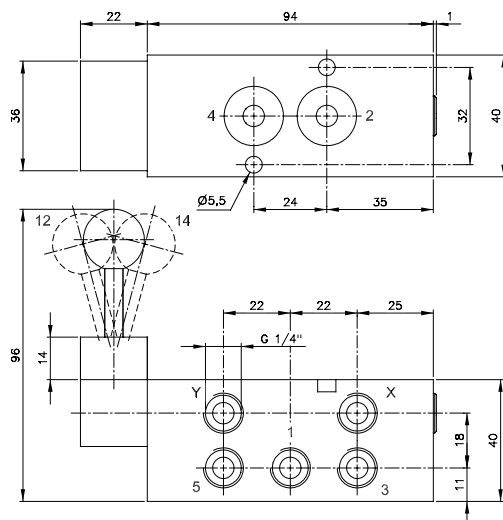
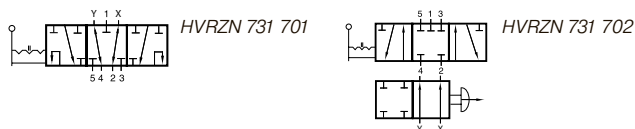


MNEH 411 711

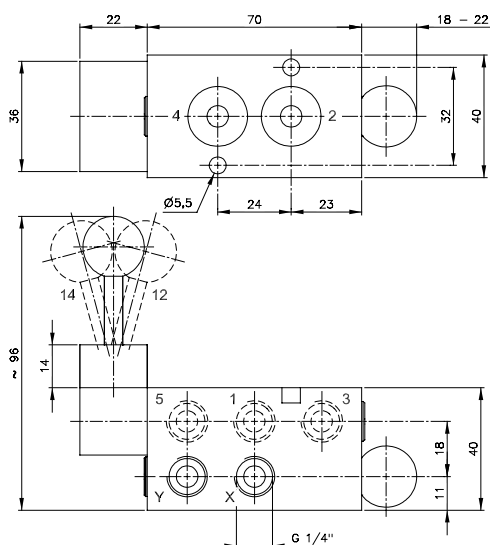


MNEH 611 601

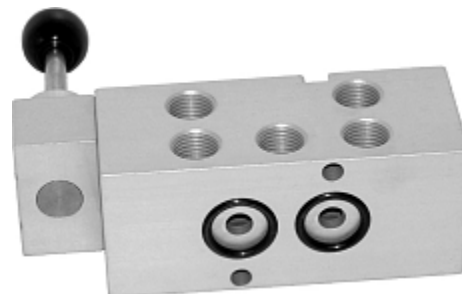
Type	Port size	Air flow	Operating press.	Actuation press.	Power consumption	Weight
MNEH 411 711	G 1/4" - 1/4" NAMUR	1250 l/min	1 - 10 bar	3 - 6 bar	3 W = / 5 VA ~	0,20 kg
MNEH 611 601	1/4" NAMUR	900 l/min	1 - 10 bar	3 - 6 bar	3 W = / 5 VA ~	0,28 kg



HVRZN 731 701



HVRZN 731 702



Lever valve for direct assemblage to an actuator with 1/4" NAMUR-interface.

Valves offer the possibility to override a positioner.

Version 731 701:

Normally the lever is in the middle position and the actuator is piloted by the positioner. In this position the valve just feeds the signals from the positioner through to the actuator.

In case of electric / electronic problems the actuator can be opened or closed manually.

Advantages of version 701:

Only one lever to manipulate (no second actuation elements).

Overrides in manual mode the positioner, manual mode and automatic mode truly independent.

Version 731 702:

If the knob is pushed, air flows from the positioner from Y to 4 and from X to 2.

If the knob is pulled valve is in manual mode.

The lever valve is to be used as a centre closed 5/3-way valve, actuator can be fully opened, fully closed or put into intermediate position.

Advantage of version 702:

Offers in manual mode a centre closed 5/3-way-valve. Version 701 is in manual mode a 5/2-way-valve.

Safety lever:

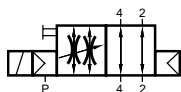
In order to avoid unintended manual actuation the lever of both versions has to be pulled thoroughly for being manipulated out of central position.

Delivery includes 2 screws, 2 O-rings.

Type	Function	Port size	Air flow	Operating press.	Actuating force	Weight
HVRZN 731 701	5/2-way indexed	G 1/4"	1250 l/min	1 - 10 bar	~ 25 N	0,53 kg
HVRZN 731 702	5/3-way indexed	G 1/4"	1250 l/min	1 - 10 bar	~ 25 N	0,45 kg

SGV 700

Two-speed valve



SGV 700



Two-speed valve to operate a pneumatic actuator at two different speeds.

This ensures a smooth closing and, if requested, a smooth opening of the process valve and helps to avoid water hammers.

Function:

When the valve is switched-off the air streams through the valve without any restriction.

When the actuator reaches a defined angle e.g. 5° the solenoid receives a signal from the switch-box (additional electric switch required) to actuate it. This restricts the air-flow. The flow can be regulated by turning the spindle at the end of the valve.

To open you have the choice whether to keep the restrictor active = solenoid energized until actuator reaches a certain angle (again) or if you want to open at full speed = switch-off the valve.

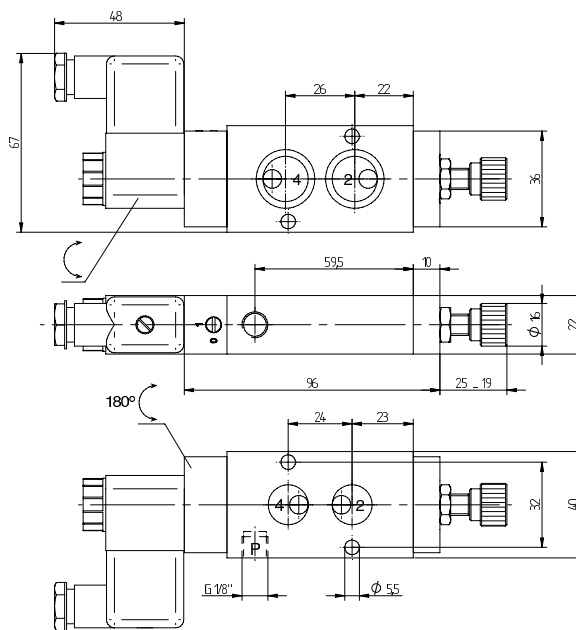
The valve is designed to go as a sandwich between actuator and NAMUR-pilot-valve.

If the valve is required with G 1/4" ports, plate GPN 1/4 can be added.

For details please refer to page 2.10.14.

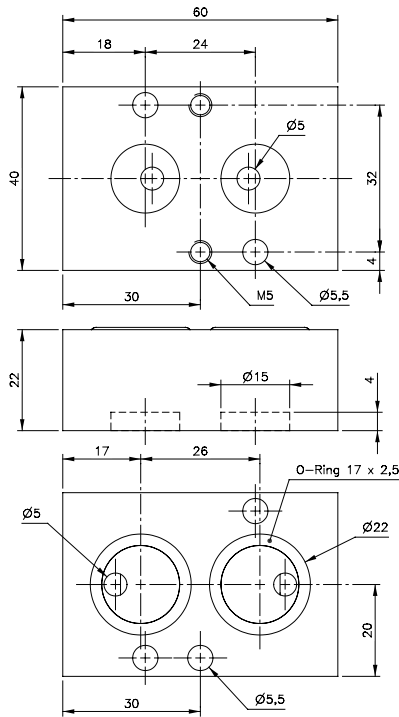
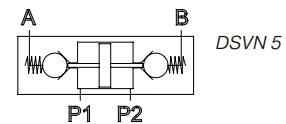
The valve needs an external air supply, port P (G 1/8").

Delivery includes 2 screws, 2 O-rings.



SGV 700

Type	NAMUR	Air flow	Operating press.	Power consumption	Weight
SGV 700	1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,28 kg



DSVN 5



Pressure applied safety valve to hold a double acting actuator at the current position in case of cut-off of pressure supply.

The valve is consisting of two non-return valves which will be unlocked by pressurising port P1 or P2.

Installation between pilot valve and actuator.

Inner parts are made from brass and POM, seals are made from NBR.

If the valve is required with G 1/4" ports, plate GPN 1/4 can be added.

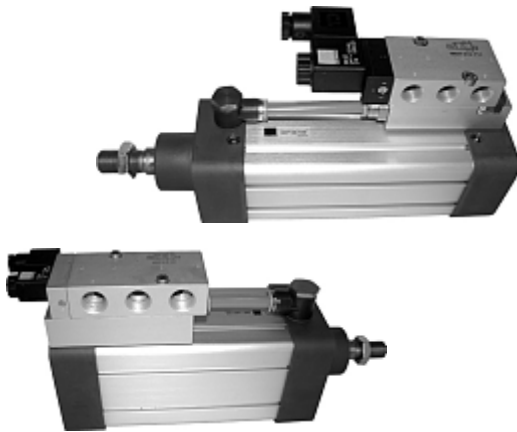
For details please refer to page 2.10.14.

Delivery includes 1 pin, 2 screws, 2 O-rings.

Type	NAMUR	Air flow P to A/B	Air flow A/B to P	Operating press.	Weight
DSVN 5	1/4"	230 l/min	360 l/min	1 - 10 bar	0,10 kg

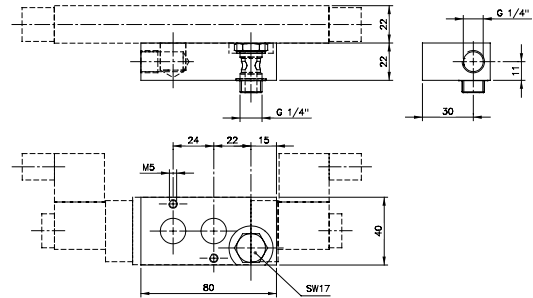
ZVP 701/ZVP 101/ZVP 121/ZVP 121-701

Plates for cylinder-valve combinations – 1. for standard pneumatic cylinders

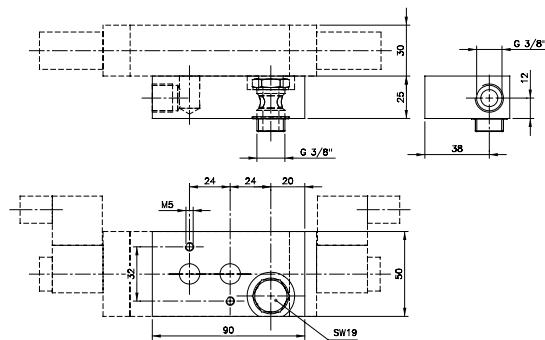


Plates to combine a NAMUR-valve with a double acting cylinder / the actuation-element of a knife-gate-valve.

ZVP 701 to be assembled onto a cylinder with G 1/4" ports (diameter 32, 40, 50 mm according to ISO 6431/ISO 15552). Designed for an orifice size 7 mm in combination with e.g. MNH 510 711.

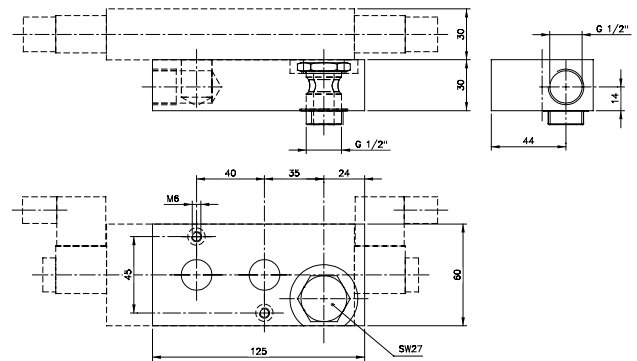


ZVP 701



ZVP 101

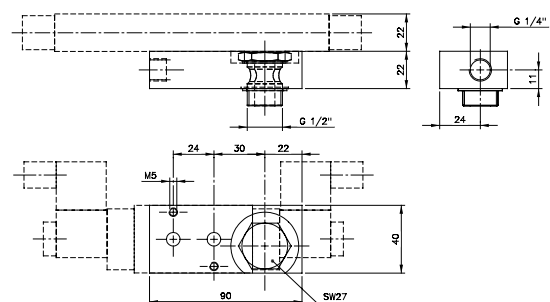
ZVP 101 to be assembled onto a cylinder with G 3/8" ports (diameter 63, 80 mm according to ISO 6431/ISO 15552). Designed for an orifice size 10 mm in combination with e.g. MNH 510 101.



ZVP 121

ZVP 121 to be assembled onto a cylinder with G 1/2" ports (diameter 100, 125 mm according to ISO 6431/ISO 15552). Designed for an orifice size 12 mm in combination with e.g. MNH 510 121.

ZVP 121 - 701 to be assembled onto a cylinder with G 1/2" ports and equipped with a NAMUR-valve of 1/4" standard.



ZVP 121-701

Plate can be equipped with different kinds of NAMUR-valves.

Delivery contains the plate and the banjo for one port.

Straight male fittings and rotating elbow fittings to make the other connection can be supplied on request.

Type	Port A	Port B	NAMUR	Orifice	Weight
ZVP 701	Banjo G 1/4"	G 1/4"	1/4"	7 mm	0,35 kg
ZVP 101	Banjo G 3/8"	G 3/8"	1/4"	10 mm	0,40 kg
ZVP 121	Banjo G 1/2"	G 1/2"	1/2"	12 mm	0,45 kg
ZVP 121-701	Banjo G 1/2"	G 1/4"	1/4"	7 mm	0,35 kg

ZVPS 701/ZVPS 101/ZVPS 121

Plates for cylinder-valve combinations – 2. for scotch-yoke actuators

2.10.12
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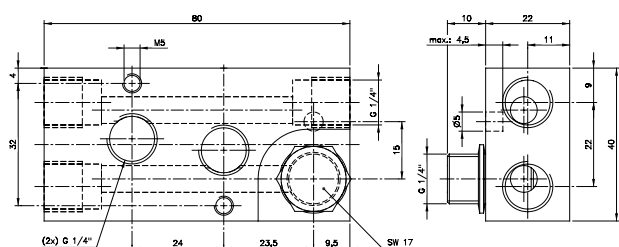
Double cylinder actuator



Single cylinder actuator, piped



Single cylinder actuator, NAMUR



ZVPS 701

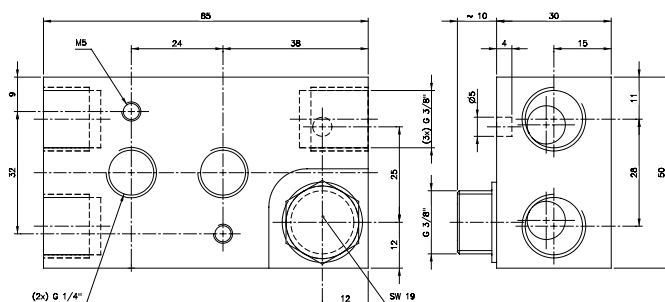
Hafner is offering an innovative system to generate a NAMUR-interface on scotch-yoke actuators.

The plates can be attached to different cylinders, independent of their stroke.

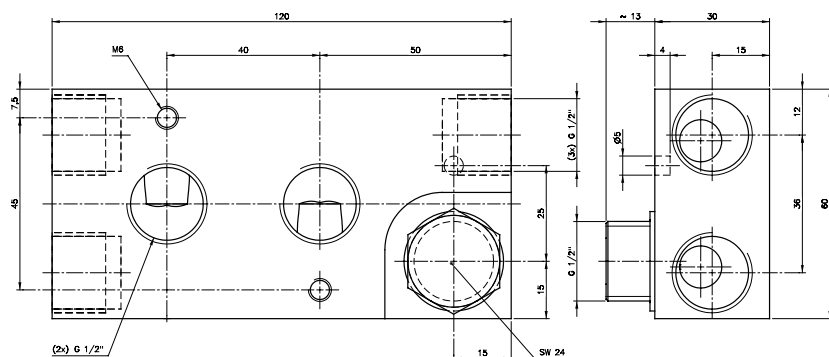
Plates are available with 1/4" as well as with 1/2" NAMUR-interface.

Banjo-joint to fix plate on actuator in G 1/4", G 3/8" and G 1/2".

Delivery contains the plate and the banjo for one port.
Straight male fittings and rotating elbow fittings to make the other connection can be supplied on request.



ZVPS 101

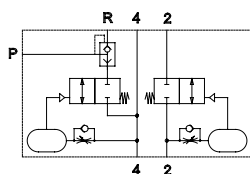


ZVPS 121

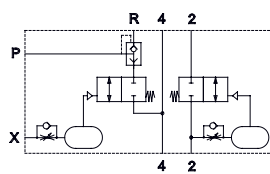
Type	Port A	Port B	Port C + O	NAMUR	Orifice	Weight
ZVPS 701	Banjo G 1/4"	G 1/4"	G 1/4"	1/4"	7 mm	0,35 kg
ZVPS 101	Banjo G 3/8"	G 3/8"	G 1/4"	1/4"	10 mm	0,40 kg
ZVPS 121	Banjo G 1/2"	G 1/2"	G 1/2"	1/2"	12 mm	0,45 kg

CBN 700 K/CBN 700 K EB

Controlblock for butterfly valves with inflatable valve-seat



CBN 700 K



CBN 700 K EB



Control block for double acting actuators with interface according to 1/4" NAMUR-standard, to be used on process-valves with inflatable valve seat.

The control-block receives it's signals to open and close from a standard 5/2-way NAMUR-valve. The block is to be put between the actuator and the NAMUR-valve (flange-version). The closing-signal is fed through to the actuator, the seal is inflated with time-delay.

When the process-valves is to be closed first the seal is deflated, with time-delay the actuator opens the process-valve.

Opening- and closing-time-delay can be adjusted independently but they are related to the operating pressure.

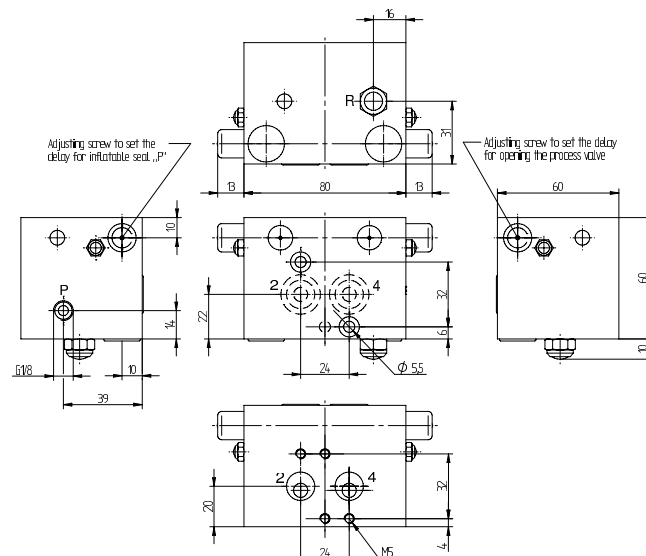
At 6 bar time-delay can be adjusted between 0 and 2 seconds.

Type **CBN 700 K EB** with additional port X: pressurizing of the inflatable seal does not start before a pneumatic signal is received.

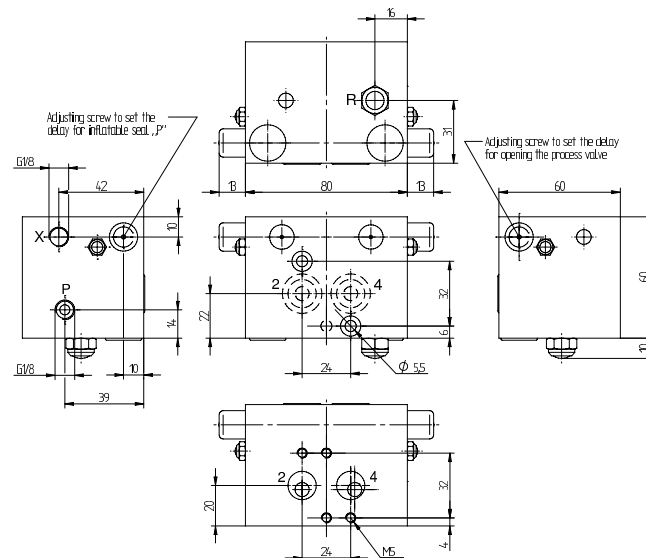
If the valve is required with G 1/4" ports, plate GPN 1/4 can be added. For details please refer to page 2.10.14.

Delivery includes 2 screws, 2 O-rings, 2 protection caps.

Also available for explosion hazardous environment zone 22 (cat. III D), please refer to page 2.14.4.1.

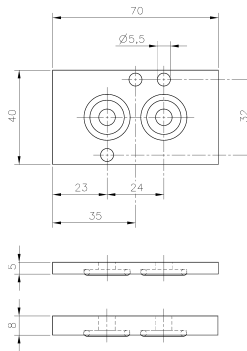


CBN 700 K

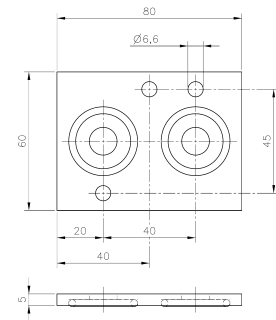


CBN 700 K EB

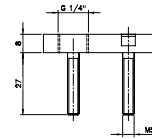
Type	NAMUR	Port P	Port X	Air flow act.	Operating press.	Air flow seal	Weight	
CBN 700 K	1/4"	G 1/8"		900 l/min	3 - 10 bar	400 l/min	0,80 kg	Ex
CBN 700 K EB	1/4"	G 1/8"	G 1/8"	900 l/min	3 - 10 bar	400 l/min	0,80 kg	Ex



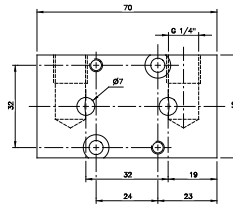
ZPN 5/ZPN 8



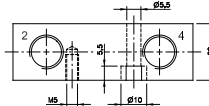
ZPN 6-5



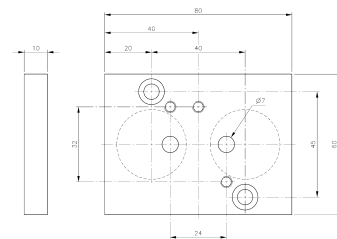
GPN 1/4



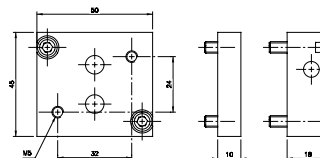
FPNW 22-1/4



ZPN 701-90



ZPN 6-10



Mounting accessories for NAMUR products when assembling them to an actuator.

O-ring seals are made from NBR 70° shore, fasteners such as screws and pins are made from stainless steel (A2) only.

GPN 1/4

Plate to convert a 1/4" NAMUR-interface into 2 x G 1/4" threaded ports for remote piloting.

FPNW 22-1/4:

Plate to convert a 5-way NAMUR-valve into an inline valve. The NAMUR ports 2 and 4 are transferred into the plate and offer G 1/4" BSP thread. Mounting plate can be assembled independently and the valve is attached later-on.

ZPN 6-10:

Adapter plate to be assembled onto an actuator with 1/2" interface. A 1/4" NAMUR-valve can be assembled to the plate. Saves money whenever the actuator does not have to be operated fast.

ZPN 701-90:

Plate to rotate a NAMUR-valve on the actuator by 90°. Orifice 7 mm assures full flow!

Type	Use and Content
ZPN 5	Intermediate plate, made from anodised aluminium 5 mm thick to be used in case a 30 mm wide coil is to be assembled to a 22 mm wide 1/4" NAMUR-valve
ZPN 5K	Intermediate plate, made from Polyamid 5 mm thick to be used in case a 30 mm wide coil is to be assembled to a 22 mm wide 1/4" NAMUR-valve
ZPN 8	Intermediate plate, made from anodised aluminium 8 mm thick to be used in case a 36 mm wide coil is to be assembled to a 22 mm wide 1/4" NAMUR-valve
ZPN 6-5	Intermediate plate, made from anodised aluminium 5 mm thick to be used in case a 36 mm wide coil is to be assembled to a 30 mm wide 1/2" NAMUR-valve
FPNW 22-1/4	Plate to convert a NAMUR-valve into an inline valve
ZPN 6-10	Adapter-plate G 1/2" actuator to G 1/4" valve
ZPN 701-90	Plate to turn a NAMUR-valve by 90° on the actuator
GPN 1/4	Plate to convert a 1/4" NAMUR-interface into G 1/4" threaded ports

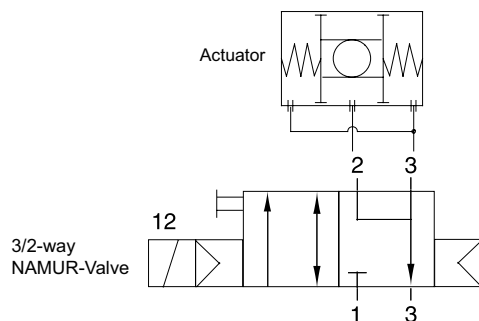
The air-recirculation in single-acting actuators

Air-recirculation into the spring chamber or “purge” is a central demand in process-automation. On standard Rack and Pinion actuators as well as on smaller Scotch Yoke actuators with spring return the spring chamber has an air-port. Therefore the pilot valve should support the desire of the user to supply the spring chamber with process air and not just suck ambient atmosphere into it.

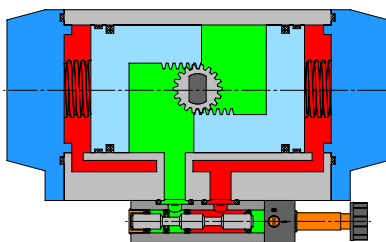
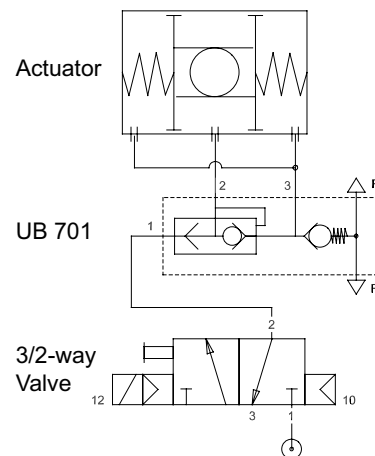
This function is called **exhaust air-recirculation** or **“purge”**.

How it works: When the actuator “closes” (pressurized chamber exhausts), a part of the instrument air is directed from the actuation side into the spring chamber. The rest exhausts out of port 3.

Function if actuator is piloted by a NAMUR-valve:

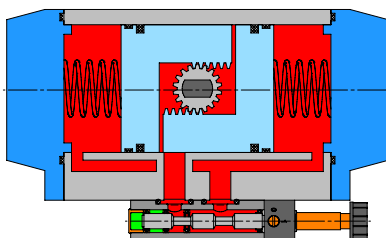
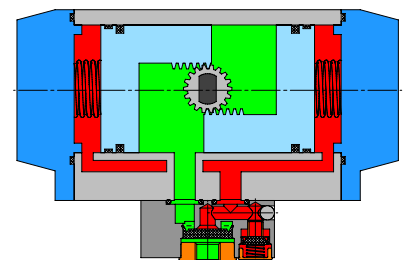


Function if actuator is remote piloted:



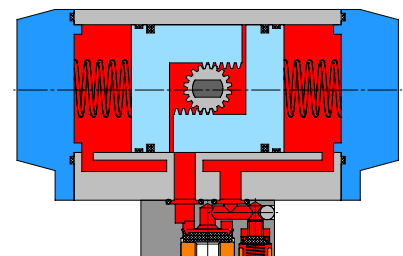
Step 1 - Opening:

1. Pilot valve opens
2. Air flows into actuation chamber
3. Actuator opens



Step 2 - Closing:

1. Pilot valve closes
2. Actuator closes through the force of the springs
3. Air is directed from the actuation chamber into the spring chamber



All 3-way Hafner NAMUR-valves ensure the exhaust air-recirculation! That applies also to our Hafner NAMUR-Flex valve (page 2.9.1.3).

If single-acting actuators are remote controlled, we strongly recommend to use our air-recirculation block type UB 701 which you can find on page 2.10.3.

Only by using the UB 701 you can avoid that ambient atmosphere can suck into the actuator.



2.11

„Hafner on the Rocks“ Low Temperature Valves

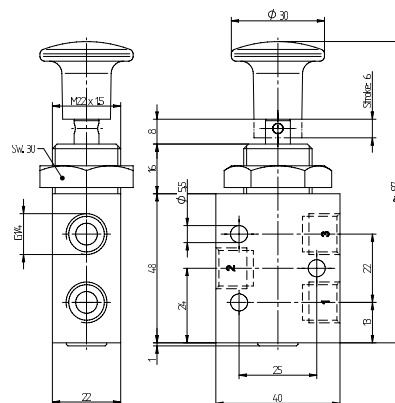
Selected models are available for
explosion hazardous environment.
They are ATEX-Ex certified.
For detailed information refer to
chapter 2.14.



Temperature range: - 50° C to + 50° C

Please notice:
Below -40°C minimum operating
pressure generally increases to 3 bar.

BH 311 701 TT/BH 320 701 TT
BH 511 701 TT/BH 520 701 TT



BH 311 701 TT/BH 320 701 TT

BH 511 701 TT/ BH 520 701 TT

When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!

Use unlubricated air only.

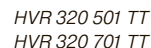
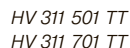
Suitable for wall or panel mounting. Nut for panel mounting M22 x 1,5 is included.

Mechanically actuated 3/2-way valve, body as well as technical specifications similar to BH 311 701.
Modified stem actuator.



HAFNER

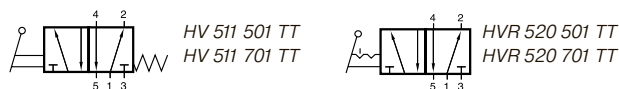
2.11.2.1
page 211



Exhaust can be throttled.

HAFNER

HV 511 501 TT/HV 511 701 TT HVR 520 501 TT/HVR 520 701 TT



Lever actuated 5/2-way spool valve for low temperature environment - 50° C to + 50° C.

Type HV 511 spring return
Type HVR 520 indexed

The lever is sealed by using a metal ball.

Due to the specific design of the low temperature seals pressure has to be applied to port 1. If other function is required please get in touch with the manufacturer.

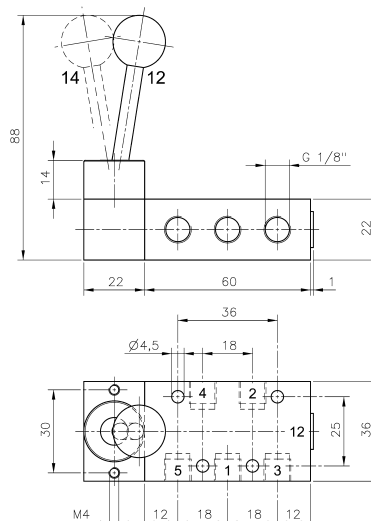
Please notice:

When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!

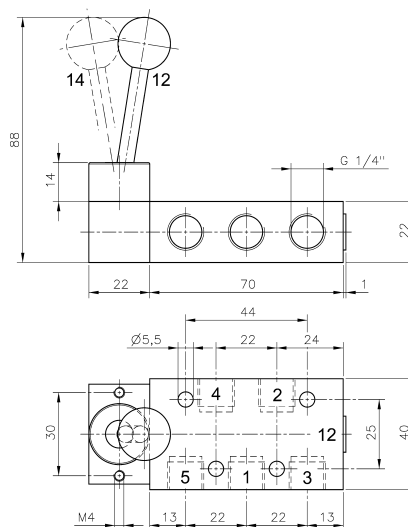
Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min.

Use unlubricated air only.

Exhaust can be throttled.



HV 511 501 TT/HVR 520 501 TT

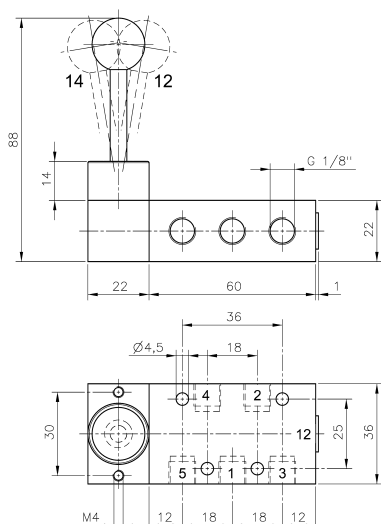
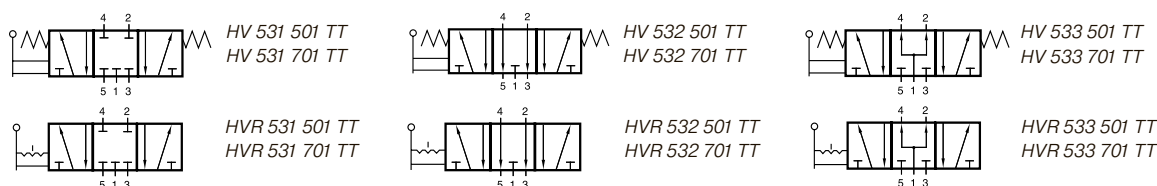


HV 511 701 TT/HVR 520 701 TT

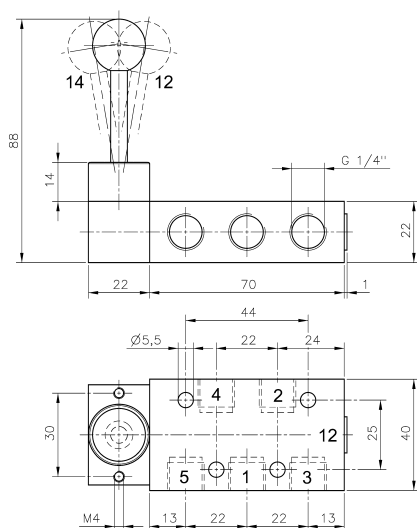
Type	Function	Port size	Air flow	Operating press.	Actuating force	Weight
HV 511 501 TT	5/2-way spring ret.	G 1/8"	650 l/min	1 - 10 bar	20 N	0,22 kg
HV 511 701 TT	5/2-way spring ret.	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg
HVR 520 501 TT	5/2-way indexed	G 1/8"	650 l/min	1 - 10 bar	20 N	0,22 kg
HVR 520 701 TT	5/2-way indexed	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg

HV 53_ 501 TT/HV 53_ 701 TT HVR 53_ 501 TT/HVR 53_ 701 TT

2.11.2.3
page 213



HV 53_ 501 TT/HVR 53_ 501 TT



HV 53_ 701 TT/HVR 53_ 701 TT



Lever actuated 5/3-way spool valve for low temperature environment - 50° C to + 50° C.

Type HV	spring return to middle position
Type HVR	indexed
Type 531	centre closed
Type 532	centre exhausted
Type 533	centre pressurized

When ordering please complete the type number by 1, 2 or 3 according to the type required.

The lever is sealed by using a metal ball.

Exhaust can be throttled.

Due to the specific design of the low temperature seals pressure has to be applied to port 1. If other function is required please get in touch with the manufacturer.

Please notice:

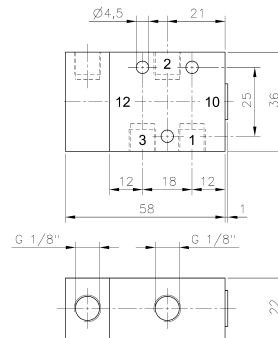
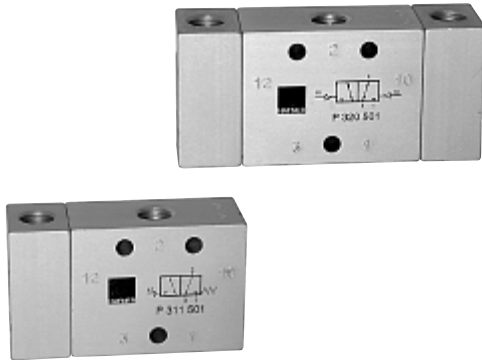
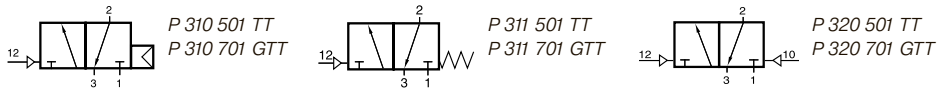
When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!

Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min. Use unlubricated air only.

For type 531: pressure at port 1 has to be ≥ pressure at 2 and 4. If pressure supply is lost, 2 or 4 can exhaust and actuator might move.

Type	Function	Port size	Air flow	Operating press.	Actuating force	Weight
HV 53_ 501 TT	spring ret.	G 1/8"	650 l/min	1 - 10 bar	20 N	0,22 kg
HV 53_ 701 TT	spring ret.	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg
HVR 53_ 501 TT	indexed	G 1/8"	650 l/min	1 - 10 bar	20 N	0,22 kg
HVR 53_ 701 TT	indexed	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,24 kg

P 310 501 TT/P 310 701 GTT/P 311 501 TT P 311 701 GTT/P 320 501 TT/P 320 701 GTT



P 310 501 TT/P 311 501 TT

Pneumatically actuated 3/2-way spool valve for low temperature environment - 50° C to + 50° C.

- Type 310 single pilot n.c. air-spring return
operating and actuating pressure
should be at the same level.
- Type 311 single pilot n.c. mechanical
spring return
- Type 320 double pilot

GTT: dual use, valves can be used in-line as well as on manifold plates. Manifolds for valves type 701 G are displayed on page 2.7.1.4.

Due to the specific design of the low temperature seals pressure has to be applied to port 1.
For other versions (e.g. normally open) please get in touch with the manufacturer.

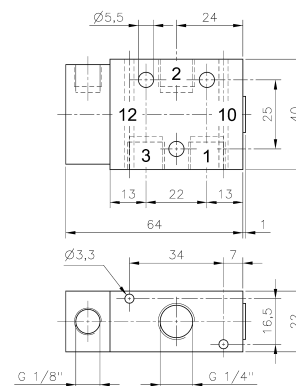
Please notice:

When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!

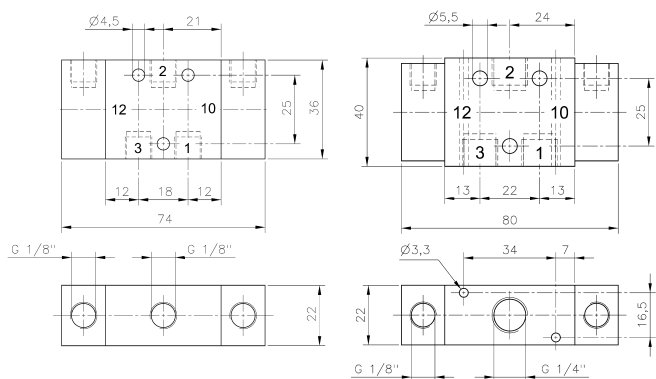
Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min, actuation pressure minimum 3 bar.

Use unlubricated air only.

Exhaust can be throttled.



P 310 701 GTT/P 311 701 GTT



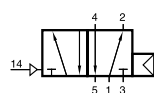
P 320 501 TT

P 320 701 GTT

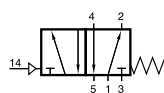
Type	Function	Port size	Air flow	Operating pressure	Actuating pressure	Weight	
P 310 501 TT	n.c. air return	G 1/8"	650 l/min	2 - 10 bar	the same	0,13 kg	⊗
P 310 701 GTT	n.c. air return	G 1/4"	1250 l/min	2 - 10 bar	the same	0,14 kg	⊗
P 311 501 TT	n.c. mech. spring	G 1/8"	650 l/min	2 - 10 bar	3 - 10 bar	0,13 kg	
P 311 701 GTT	n.c. mech. spring	G 1/4"	1250 l/min	2 - 10 bar	3 - 10 bar	0,14 kg	
P 320 501 TT	double pilot	G 1/8"	650 l/min	2 - 10 bar	≤ operating press.	0,16 kg	⊗
P 320 701 GTT	double pilot	G 1/4"	1250 l/min	2 - 10 bar	≤ operating press.	0,17 kg	⊗

P 510 501 GTT/P 510 701 GTT/P 511 501 GTT P 511 701 GTT/P 520 501 GTT/P 520 701 GTT

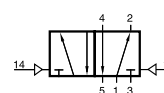
2.11.3.2
page 215



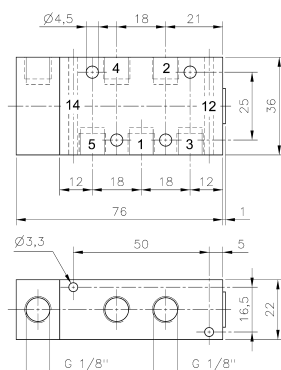
P 510 501 TT
P 510 701 GTT



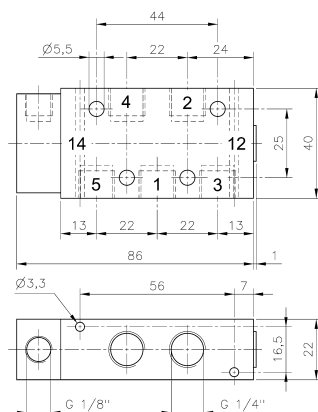
P 511 501 TT
P 511 701 GTT



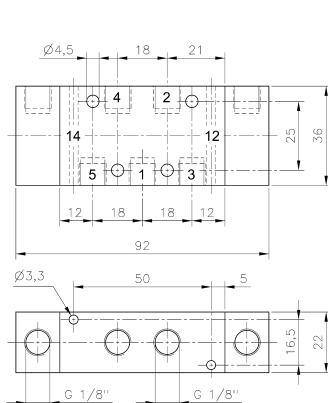
P 520 501 TT
P 520 701 GTT



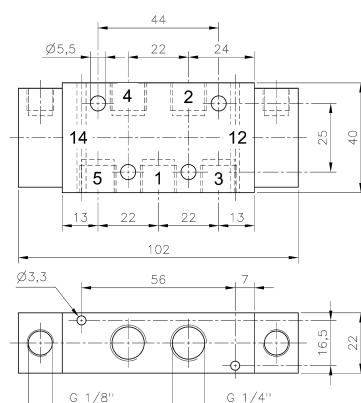
P 510 501 GTT/P 511 501 GTT



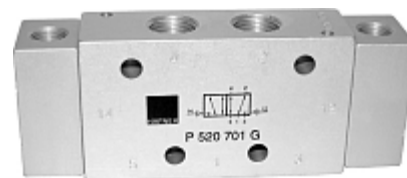
P 510 701 GTT/P 511 701 GTT



P 520 501 GTT



P 520 701 GTT



Pneumatically actuated 5/2-way spool valve for low temperature environment - 50° C to + 50° C.

- | | |
|----------|--|
| Type 510 | single pilot air-spring return
operating and actuating pressure
should be at the same level. |
| Type 511 | single pilot mechanical
spring return |
| Type 520 | double pilot |

GTT: dual use, valves can be used in-line as well as on manifold plates. Manifolds for valves type 501 G are displayed on page 2.7.2.2, manifold for valves type 701 G are displayed on page 2.7.2.3.

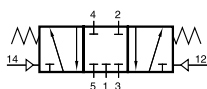
Due to the specific design of the low temperature seals pressure has to be applied to port 1. For other versions please get in touch with the manufacturer.

Please notice:
When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!
Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min, actuation pressure minimum 3 bar.
Use unlubricated air only.

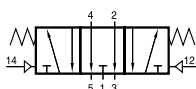
Exhaust can be throttled.

Type	Function	Port size	Air flow	Operating pressure	Actuating pressure	Weight	
P 510 501 GTT	air return	G 1/8"	650 l/min	2 - 10 bar	the same	0,16 kg	Ex
P 510 701 GTT	air return	G 1/4"	1250 l/min	2 - 10 bar	the same	0,18 kg	Ex
P 511 501 GTT	mech. spring	G 1/8"	650 l/min	2 - 10 bar	3 - 10 bar	0,16 kg	
P 511 701 GTT	mech. spring	G 1/4"	1250 l/min	2 - 10 bar	3 - 10 bar	0,18 kg	
P 520 501 GTT	double pilot	G 1/8"	650 l/min	2 - 10 bar	≤ operating press.	0,20 kg	Ex
P 520 701 GTT	double pilot	G 1/4"	1250 l/min	2 - 10 bar	≤ operating press.	0,22 kg	Ex

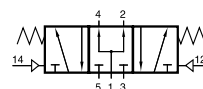
P 53_ 501 GTT/P 53_ 701 GTT



P 531 501 GTT
P 531 701 GTT
P 531 121 GTT



P 532 501 GTT
P 532 701 GTT
P 532 121 GTT



P 533 501 GTT
P 533 701 GTT
P 533 121 GTT



Pneumatically actuated 5/3-way spool valve for low temperature environment - 50° C to + 50° C.

Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurized

When ordering please complete the type number by 1, 2 or 3 according to the type required.

GTT: dual use, valves can be used in-line as well as on manifold plates. Manifolds for valves type 501 G are displayed on page 2.7.2.2, manifold for valves type 701 G are displayed on page 2.7.2.3.

Due to the specific design of the low temperature seals pressure has to be applied to port 1.
For other versions please get in touch with the manufacturer.

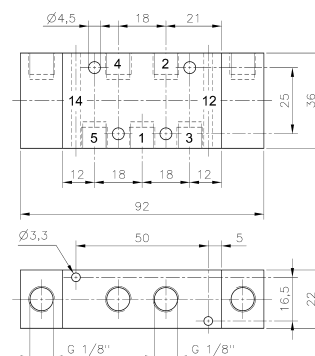
Please notice:

When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!

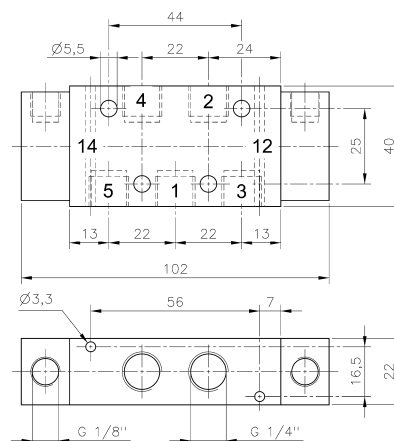
Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min.

Use unlubricated air only.

For type 531: pressure at port 1 has to be ≥ pressure at 2 and 4. If pressure supply is lost, 2 or 4 can exhaust and actuator might move.



P 53_ 501 GTT

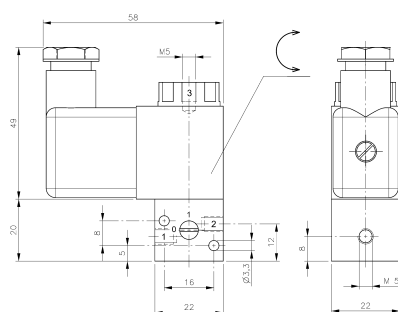


P 53_ 701 GTT

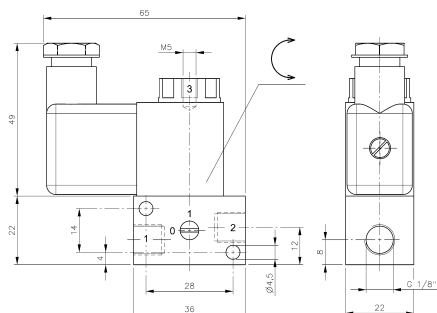
Type	Port size	Air flow	Operating pressure	Actuating pressure	Weight
P 53_ 501 GTT	G 1/8"	650 l/min	2 - 10 bar	3 - 10 bar	0,20 kg
P 53_ 701 GTT	G 1/4"	1250 l/min	2 - 10 bar	3 - 10 bar	0,22 kg

MH 311 012 TT/MH 311 015 TT MH 311 013 TT/MH 311 017 TT

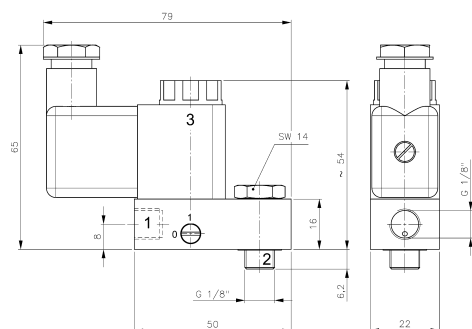
2.11.4.1.1
page 217



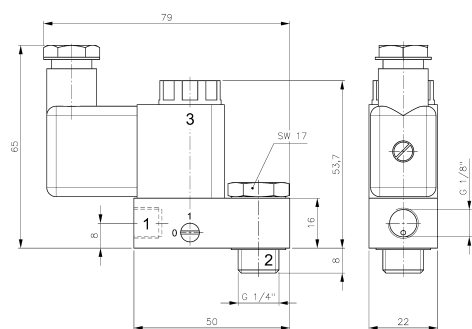
MH 311 012 TT



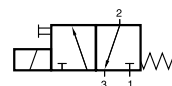
MH 311 015 TT



MH 311 013 TT



MH 311 017 TT



MH 311 012 TT
MH 311 015 TT
MH 311 013 TT
MH 311 017 TT



Direct acting 3/2-way solenoid valve equipped with mechanical spring return for low temperature environment - 50° C to + 50° C.

By closing port 3 the valves can be converted into 2/2-way version.

MH 311 013 TT and MH 311 017 TT are designed for piloting angle seat valves or small spring-return actuators.

When assembling this type of valve to a spring-return actuator, please take into consideration that there is no exhaust air recirculation ("purge").

Please notice:

When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!

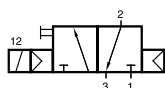
Use unlubricated air only.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

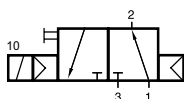
Valves are equipped with manual override to turn.

Type	Port size			Air flow	Operating pressure	Power consumption	Weight	
	1	2	3					
MH 311 012 TT	M5	M5	M5	40 l/min	0 - 10 bar	3 W = / 5 VA ~	0,12 kg	Ex
MH 311 015 TT	G 1/8"	G 1/8"	M5	50 l/min	0 - 10 bar	3 W = / 5 VA ~	0,14 kg	Ex
MH 311 013 TT	G 1/8"	G 1/8" Banjo	M5	50 l/min	0 - 10 bar	3 W = / 5 VA ~	0,14 kg	Ex
MH 311 017 TT	G 1/8"	G 1/4" Banjo	M5	50 l/min	0 - 10 bar	3 W = / 5 VA ~	0,16 kg	Ex

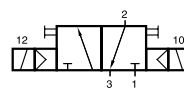
M(O)H 310 501 TT/M(O)H 310 701 GTT MH 320 501 TT/MH 320 701 GTT



MH 310 501 TT
MH 310 701 GTT



MOH 310 501 TT
MOH 310 701 GTT



MH 320 501 TT
MH 320 701 GTT



3/2-way solenoid valve for low temperature environment - 50° C to + 50° C.

Type MH 310 single solenoid n.c. air-spring return
Type MOH 310 single solenoid n.o. air-spring return
Type MH 320 double solenoid

G 1/4"-valves are dual use, they can be used in-line as well as on manifold plates. Manifolds for valves type 701 G are displayed on page 2.7.1.4.

Available with solenoid operators
230V/50 Hz, 110V/50 Hz, 24V/50 Hz, 48V=,
24V=, 12V=.

Valves are equipped with manual override to turn.

Please notice:

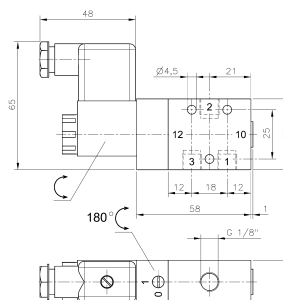
When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!

Below - 40° C the leakage-rate of the valve can increase to 10 cm³/min.

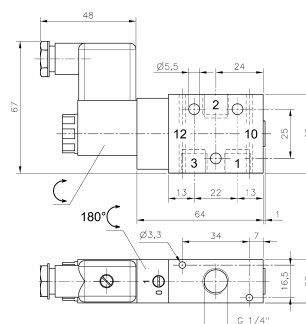
Use unlubricated air only.

Valves are also available with external pilot feed.

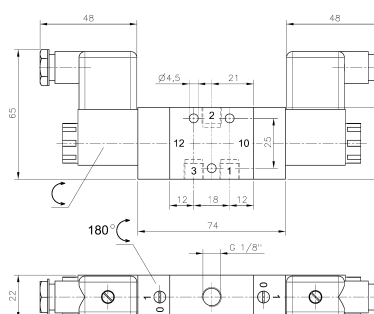
NPT ported valves are available on request.



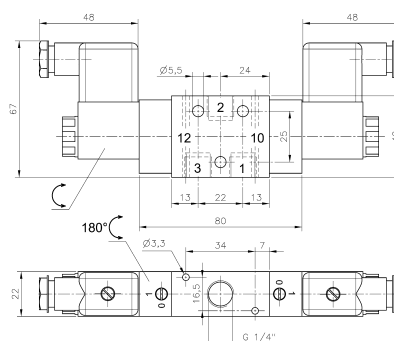
MH 310 501 TT/MOH 310 501 TT



MH 310 701 GTT/MOH 310 701 GTT

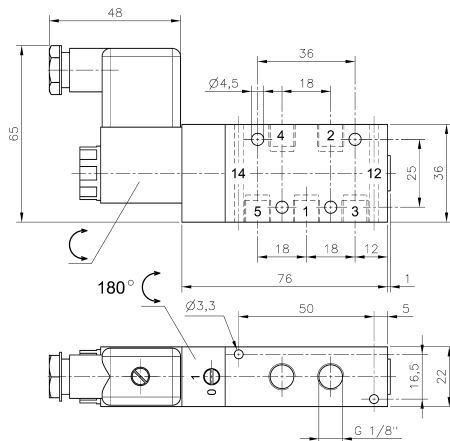
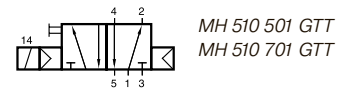


MH 320 501 TT

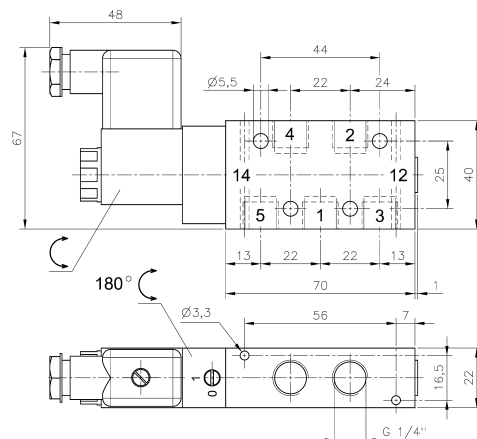


MH 320 701 GTT

Type	Function	Port size	Air flow	Operating press.	Power cons.	Weight
MH 310 501 TT	n.c.	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,21 kg
MH 310 701 GTT	n.c.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,23 kg
MOH 310 501 TT	n.o.	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,21 kg
MOH 310 701 GTT	n.o.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,23 kg
MH 320 501 TT	double sol.	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,34 kg
MH 320 701 GTT	double sol.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,36 kg



MH 510 501 GTT



MH 510 701 GTT



5/2-way single solenoid valve equipped with air spring return for low temperature environment - 50° C to + 50° C.

Valves are dual use, they can be used in-line as well as on manifold plates. Manifolds for valves type 501 G are displayed on page 2.7.2.2, manifold for valves type 701 G are displayed on page 2.7.2.3.



Available with solenoid operators
230V/50 Hz, 110V/50 Hz, 24V/50 Hz, 48V=,
24V=, 12V=.

Valves are equipped with manual override to turn.

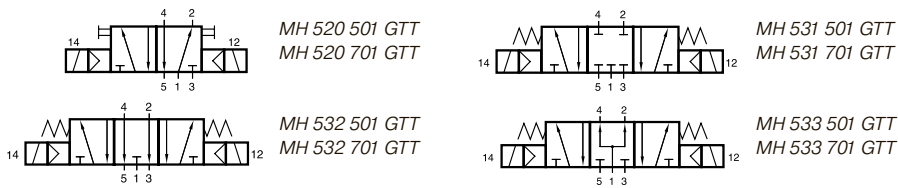
Please notice:
When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!
Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min.
Use unlubricated air only.

Valves are also available with external pilot feed.

NPT ported valves are available on request.

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 510 501 GTT	G 1/8"	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,25 kg 
MH 510 701 GTT	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,27 kg 

MH 520 501 GTT/MH 520 701 GTT
MH 53_ 501 GTT/MH 53_ 701 GTT



5-way solenoid valve for low temperature environment - 50° C to + 50° C.

Type 520	5/2-way double solenoid, actuated by impulse
Type 531	5/3-way centre closed
Type 532	5/3-way centre exhausted
Type 533	5/3-way centre pressurized

Valves are dual use, they can be used in-line as well as on manifold plates. Manifolds for valves type 501 G are displayed on page 2.7.2.2, manifold for valves type 701 G are displayed on page 2.7.2.3

Available with solenoid operators
230V/50 Hz, 110V/50 Hz, 24V/50 Hz, 48V=,
24V=, 12V=.

Valves are equipped with manual override to turn.

Please notice:

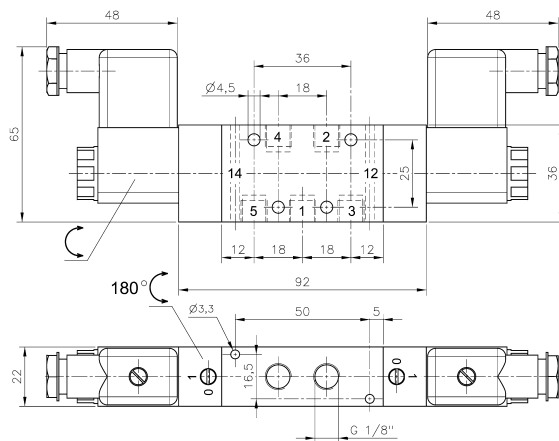
When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!

Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min.
Use unlubricated air only.

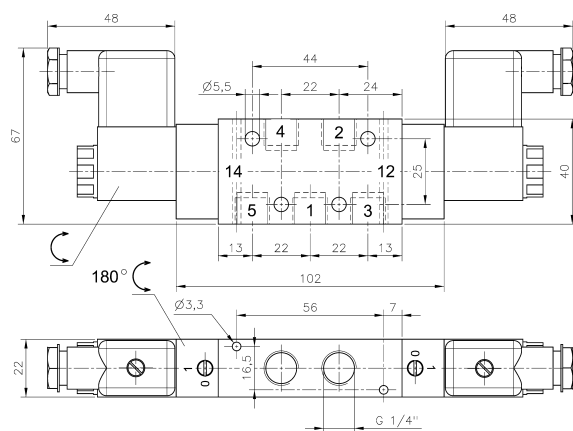
For type 531: pressure at port 1 has to be \geq pressure at 2 and 4. If pressure supply is lost, 2 or 4 can exhaust and actuator might move.

Valves are also available with external pilot feed.





NPT ported valves are available on request.



MH 520 501 GTT/MH 53 501 GTT

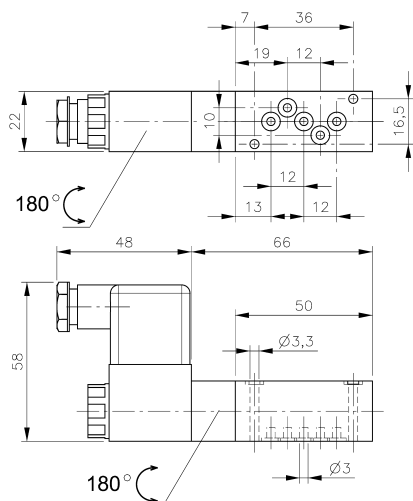


MH 520 701 GTT/MH 53_ 701 GTT

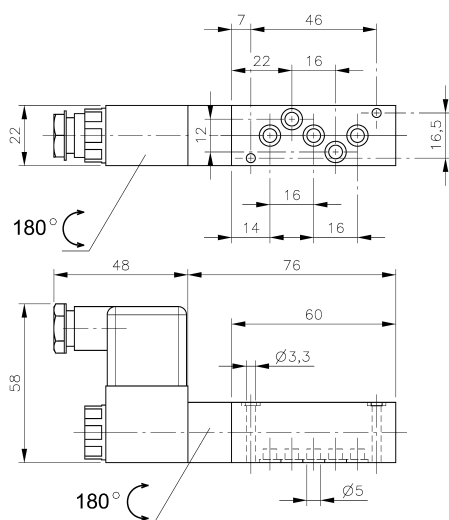
Type	Port size	Air flow	Operating press.	Power consumption	Weight	
MH 520 501 GTT	G 1/8"	650 l/min	1 - 10 bar	3 W = / 5 VA ~	0,38 kg	
MH 520 701 GTT	G 1/4"	1250 l/min	1 - 10 bar	3 W = / 5 VA ~	0,40 kg	
MH 53_ 501 GTT	G 1/8"	650 l/min	3 - 10 bar	3 W = / 5 VA ~	0,38 kg	
MH 53_ 701 GTT	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,40 kg	

MH 510 304 TT/MH 510 504 TT MH 510 704 TT

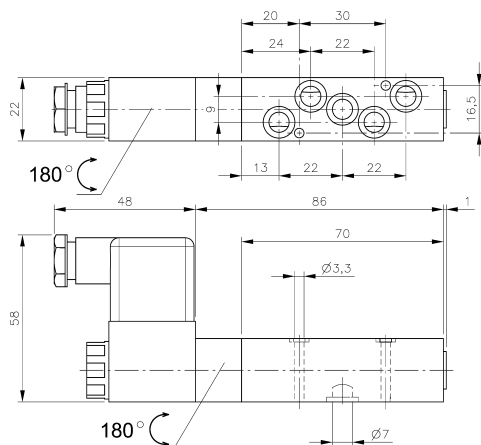
2.11.4.3.1
page 221



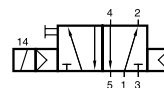
MH 510 304 TT



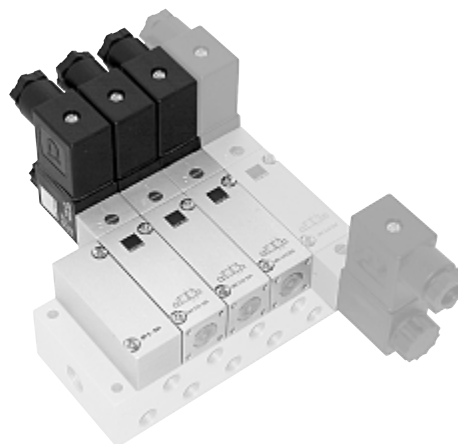
MH 510 504 TT



MH 510 704 TT



MH 510 304 TT
MH 510 504 TT
MH 510 704 TT



5/2-way single solenoid valve equipped with air spring return for low temperature environment - 50° C to + 50° C.

All the ports are in the plate, plates are displayed on page 2.7.2.7 and 2.7.2.8.

Available with solenoid operators
230V/50 Hz, 110V/50 Hz, 24V/50 Hz, 48V=, 24V=, 12V=.

Valves are equipped with manual override to turn.

Please notice:

When operated below 0°C the pressure condensation point has to be at least 15°C below the temperature of environment and media. Air has to be dried!

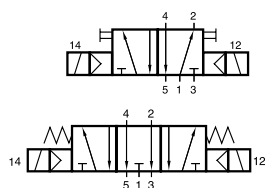
Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min.

Use unlubricated air only.

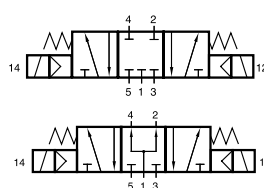
Mounting screws and seals are included.

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 510 304 TT	Ø 3 mm	220 l/min	2 - 10 bar	3 W = / 5 VA ~	0,20 kg
MH 510 504 TT	Ø 5 mm	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,21 kg
MH 510 704 TT	Ø 7 mm	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,22 kg

MH 520 304 TT/MH 520 504 TT/MH 520 704 TT MH 53_ 304 TT/MH 53_ 504 TT/MH 53_ 704 TT



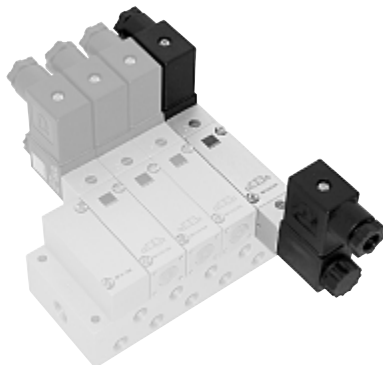
MH 520 304 TT
MH 520 504 TT
MH 520 704 TT



MH 531 304 TT
MH 531 504 TT
MH 531 704 TT

MH 532 304 TT
MH 532 504 TT
MH 532 704 TT

MH 533 304 TT
MH 533 504 TT
MH 533 704 TT



5-way solenoid valve for low temperature environment - 50° C to + 50° C.

- Type 520 5/2-way double solenoid, actuated by impulse
Type 531 5/3-way centre closed
Type 532 5/3-way centre exhausted
Type 533 5/3-way centre pressurized

All the ports are in the plate, plates are displayed on page 2.7.2.7 and 2.7.2.8.

Available with solenoid operators
230V/50 Hz, 110V/50 Hz, 24V/50 Hz, 48V=, 24V=, 12V=.

Valves are equipped with manual override to turn.

Please notice:

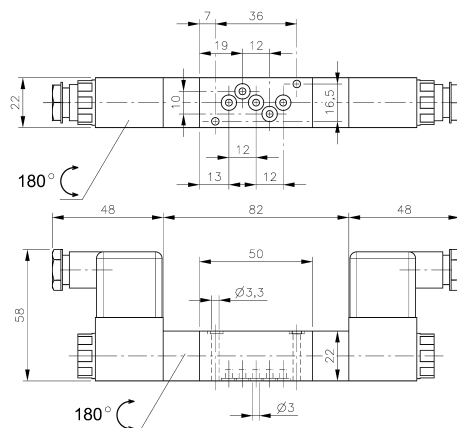
When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!

Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min.

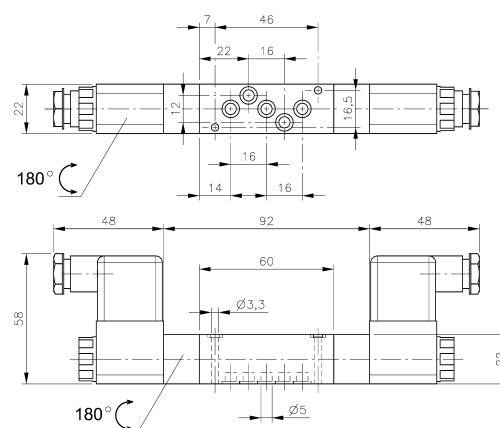
Use unlubricated air only.

For type 531: pressure at port 1 has to be ≥ pressure at 2 and 4. If pressure supply is lost, 2 or 4 can exhaust and actuator might move.

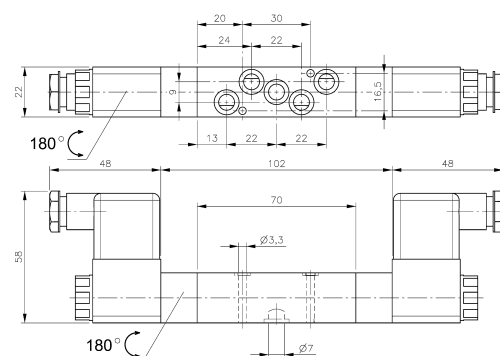
Mounting screws and seals are included.



MH 520 304 TT/MH 53_ 304 TT

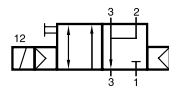


MH 520 504 TT/MH 53_ 504 TT

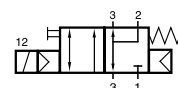


MH 520 704 TT/MH 53_ 704 TT

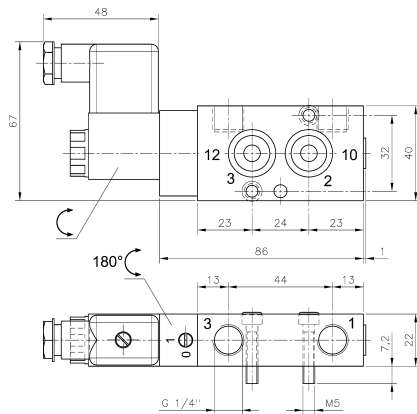
Type	Port size	Air flow	Operating press.	Power consumption	Weight
MH 520 304 TT	Ø 3 mm	220 l/min	2 - 10 bar	3 W = / 5 VA ~	0,30 kg
MH 520 504 TT	Ø 5 mm	650 l/min	2 - 10 bar	3 W = / 5 VA ~	0,32 kg
MH 520 704 TT	Ø 7 mm	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,34 kg
MH 53_ 304 TT	Ø 3 mm	220 l/min	3 - 10 bar	3 W = / 5 VA ~	0,30 kg
MH 53_ 504 TT	Ø 5 mm	650 l/min	3 - 10 bar	3 W = / 5 VA ~	0,32 kg
MH 53_ 704 TT	Ø 7 mm	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,34 kg



MNH 310 701 TT



MNH 311 701 TT



MNH 310 701 TT/MNH 311 701 TT



3/2-way solenoid valve, actuated by permanent signal for low temperature environment - 50° C to + 50° C. Interface according to 1/4" Namur standard, with exhaust air recirculation (purge).

Type MNH 310 701 with pneumatic spring return
Type MNH 311 701 with combined spring assuring a fail-safe function in case of cut-off of pressure supply.

Available with actuators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

The valves are generally equipped with manual override to turn.

Please notice:
When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!
Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min.
Use unlubricated air only.

Delivery includes 1 pin, 2 screws, 2 O-rings.

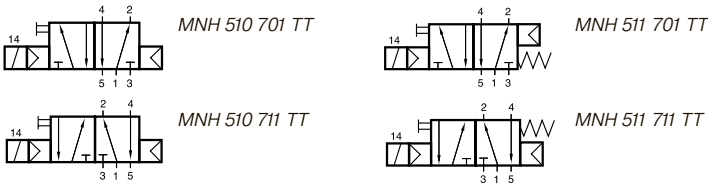
NPT ported valves are available on request.

Type	Port size	Air flow	Operating press.	Power consumption	Weight
MNH 310 701 TT	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,28 kg
MNH 311 701 TT	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,28 kg



MNH 510 701 TT/MNH 511 701 TT

MNH 510 711 TT/MNH 511 711 TT



5/2-way solenoid valve, actuated by permanent signal for low temperature environment - 50° C to + 50° C. Interface according to 1/4" Namur standard.

Type MNH 510 7_1 with pneumatic spring return
Type MNH 511 7_1 with combined spring.

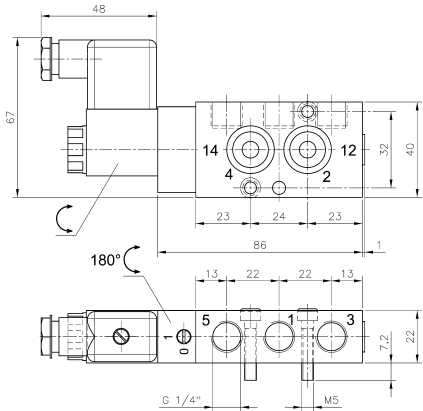
Available with actuators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

The valves are generally equipped with manual override to turn.

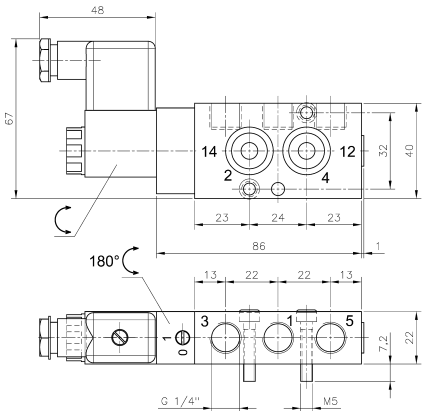
Please notice:
When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!
Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min.
Use unlubricated air only.

Delivery includes 1 pin, 2 screws, 2 O-rings.

NPT ported valves are available on request.

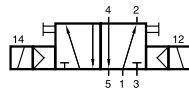


MNH 510 701 TT/MNH 511 701 TT

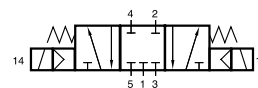


MNH 510 711 TT/MNH 511 711 TT
ports 2 and 4 are swapped!

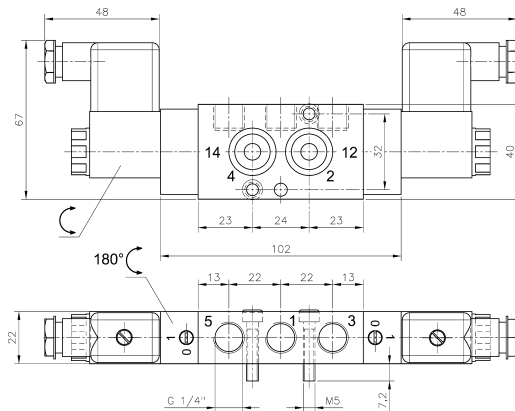
Type	Port size	Air flow	Operating press.	Power consumption	Weight	
MNH 510 701 TT	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,28 kg	Ex
MNH 510 711 TT	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,28 kg	Ex
MNH 511 701 TT	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,28 kg	
MNH 511 711 TT	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,28 kg	



MNH 520 701 TT



MNH 531 701 TT



MNH 520 701 TT/MNH 531 701 TT



5-way solenoid valve for low temperature environment - 50° C to + 50° C. Interface according to 1/4" Namur standard.

Type 520 5/2-way double solenoid, actuated by impulse.
Type 531 5/3-way centre closed. Other 5/3-way versions available on request.

Available with solenoid operators
230V/50 Hz, 110V/50 Hz, 24V/50 Hz, 48V=, 24V=, 12V=.

Valves are equipped with manual override to turn.

Please notice:

When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!

Below - 40° C the leakage-rate of the valve can increase to 10 cm³ /min.

Use unlubricated air only.

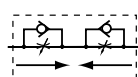
For type 531: pressure at port 1 has to be ≥ pressure at 2 and 4. If pressure supply is lost, 2 or 4 can exhaust and actuator might move.

Delivery includes 1 pin, 2 screws, 2 O-rings.

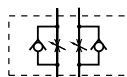
NPT ported valves are available on request.

Type	Function	Port size	Air flow	Operating pressure	Power consumption	Weight
MNH 520 701 TT	5/2 double sol.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,41 kg
MNH 531 701 TT	5/3 centre closed	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,41 kg

DRN 3 611 TT/DRN 5 611 TT



DRN 3 611 TT



DRN 5 611 TT



Block form flow regulator as intermediate plate, interface according to 1/4" Namur standard for low temperature environment - 50° C to + 50° C.

Type DRN 3 611 TT:

for 3/2-way valves with exhaust air recirculation only. To regulate the forward stroke of a single acting pneumatic actuator and to regulate the exhaust air going into the spring return unit independently. To be operated with a screw-driver.

Type DRN 5 611 TT:

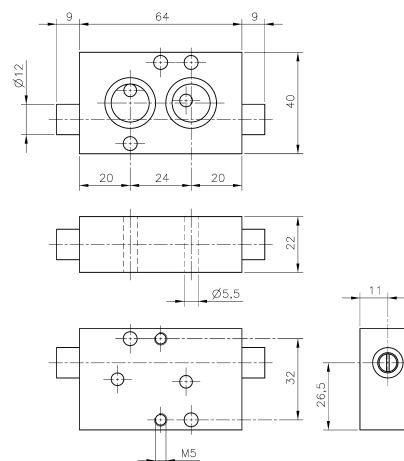
for 5/2 and 5/3 way valves only. To regulate the forward- and backward stroke of a double acting pneumatic actuator. To be operated with a screw-driver.

Please notice:

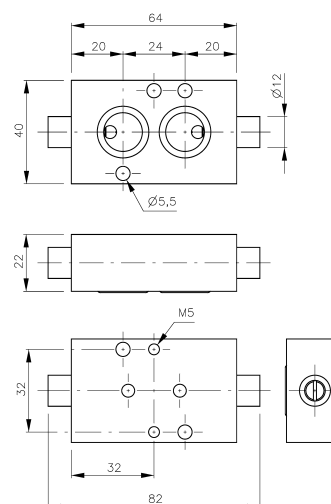
When operated below 0° C the pressure condensation point has to be at least 15° C below the temperature of environment and media. Air has to be dried!

Use unlubricated air only.

Delivery includes 1 pin, 2 screws (50 mm long), 2 O-rings.



DRN 3 611



DRN 5 611

Type	Function	Port size	Max. air flow	Operating pressure	Weight
DRN 3 611 TT	3-way	Ø 5 mm	650 l/min	0,5 - 10 bar	0,18 kg
DRN 5 611 TT	5-way	Ø 5 mm	650 l/min	0,5 - 10 bar	0,18 kg



2.12

„Heavy Metal“ Stainless Steel Valves

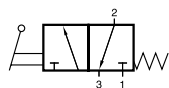
Selected models are available for explosion hazardous environment. They are ATEX-Ex certified. For detailed information refer to chapter 2.14.



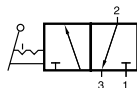
Selected models are available for low temperature application. Temperature-range: - 50° C to + 50° C. For detailed information refer to chapter 2.11.



HV 311 701 VES/HVR 320 701 VES



HV 311 701 VES



HVR 320 701 VES



Lever actuated 3/2-way spool valve.

Body parts are made from stainless steel 316L / 1.4404, seals PUR and FKM.

Type HV spring return
Type HVR indexed

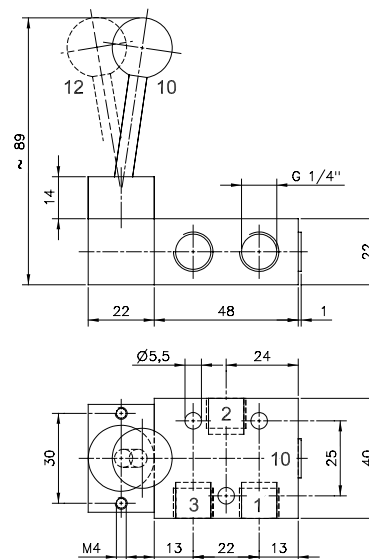
The lever is sealed by using a metal ball.

Exhaust can be throttled.

Versions with G 1/2" ports (3.000 l/min air-flow) are available on request.

NPT ported valves are available on request.

Due to the specific design of the internal parts pressure has to be applied to port 1. For other versions please contact the manufacturer.

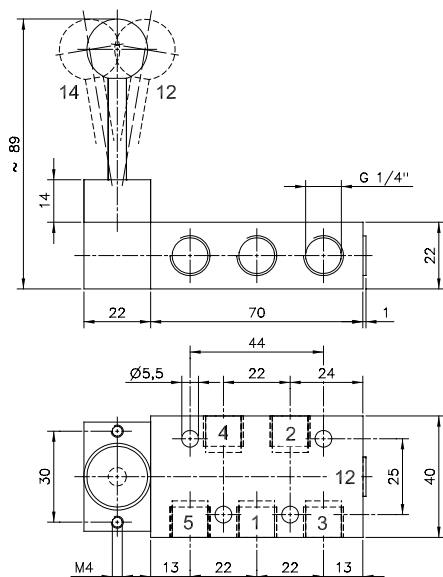
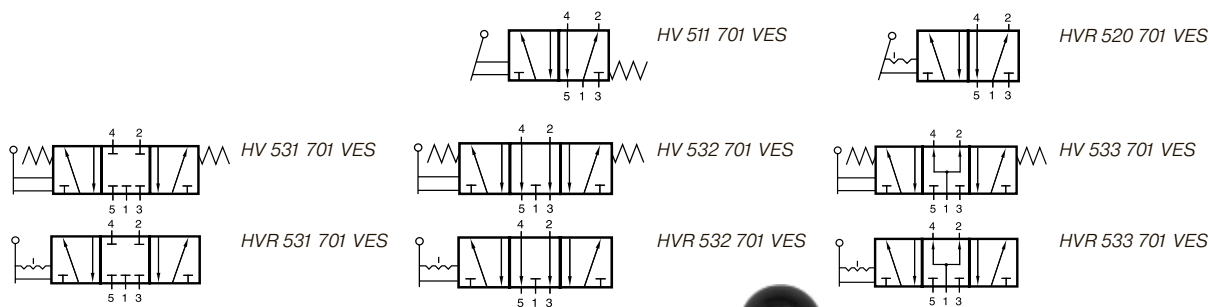


HV 311 701 VES/HVR 320 701 VES

Type	Function	Port size	Air flow	Operating press.	Act. force	Weight
HV 311 701 VES	Spring ret.	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,35 kg
HVR 320 701 VES	Indexed	G 1/4"	1250 l/min	1 - 10 bar	20 N	0,35 kg

HV 511 701 VES/HVR 520 701 VES HV 53_ 701 VES/HVR 53_ 701 VES

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**HV 511 701 VES/HVR 520 701 VES/
HV_ 53_ 701 VES**



Lever actuated 5/2-way and 5/3-way spool valves.

Body parts are made from stainless steel 316L / 1.4404, seals PUR and FKM.

Type HV spring return
Type HVR indexed

Type 511 and 520		5/2-way
Type 531	centre closed	5/3-way
Type 532	centre exhausted	5/3-way
Type 533	centre pressurized	5/3-way

The lever is sealed by using a metal ball.

Exhaust can be throttled.

Versions with G 1/2" ports (3.000 l/min air-flow) are available on request.

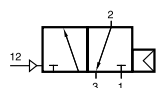
NPT ported valves are available on request.

Due to the specific design of the internal parts pressure has to be applied to port 1. For other versions please contact the manufacturer.

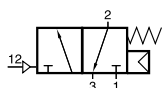
Please notice: for type 531: pressure at port 1 has to be \geq pressure at 2 and 4. If pressure supply is lost, 2 or 4 can exhaust and actuator might move.

Type	Function	Port size	Air flow	Operating press.	Act. force	Weight
HV 511 701 VES	Spring ret.	G 1/4"	1250 l/min	1- 10 bar	20 N	0,50 kg
HVR 520 701 VES	Indexed	G 1/4"	1250 l/min	1- 10 bar	20 N	0,50 kg
HV 53_ 701 VES	Spring ret.	G 1/4"	1250 l/min	1- 10 bar	20 N	0,50 kg
HVR 53_ 701 VES	Indexed	G 1/4"	1250 l/min	1- 10 bar	20 N	0,50 kg

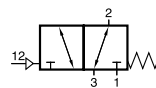
P 310 701 VES/P 311 701 VES P 310 121 VES/P 311 121 VES



P 310 701 VES
P 310 701 NPT VES
P 310 121 VES
P 310 121 NPT VES



P 311 701 VES
P 311 701 NPT VES



P 311 121 VES
P 311 121 NPT VES



Pneumatically actuated 3/2-way spool valve.

Body parts are made from stainless steel 316L / 1.4404, seals in FKM / PUR (series 701).

Type P 310 ___ VES single pilot valve with air-spring-return.

Operating pressure and actuating pressure should be at the same level.

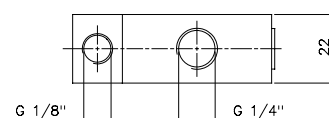
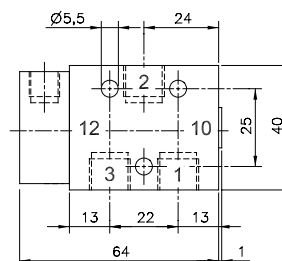
Type P 311 701 VES single pilot valve with combined spring return.

Type P 311 121 VES single pilot valve with mechanic spring return.

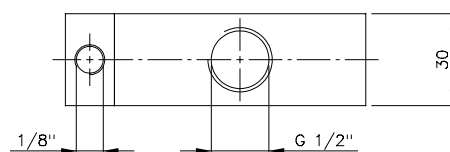
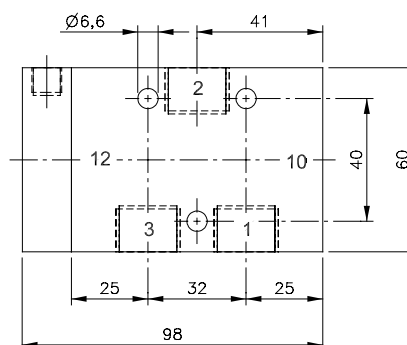
Double pilot valves are available on request.

Exhaust can be throttled.

For 1/4"-size: Due to the specific design of the internal parts pressure has to be applied to port 1. For other versions (e.g. normally open) please contact the manufacturer.



P 310 701 VES/ P 311 701 VES
P 310 701 NPT VES/ P 311 701 NPT VES

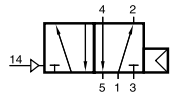


P 310 121 VES/ P 311 121 VES
P 310 121 NPT VES/ P 311 121 NPT VES

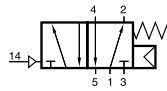
Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 310 701 VES	G 1/4"	1250 l/min	2 - 10 bar	the same	0,35 kg
P 311 701 VES	G 1/4"	1250 l/min	2 - 10 bar	3 - 10 bar	0,35 kg
P 310 701 NPT VES	G 1/4"	1250 l/min	2 - 10 bar	the same	0,35 kg
P 311 701 NPT VES	G 1/4"	1250 l/min	2 - 10 bar	3 - 10 bar	0,35 kg
P 310 121 VES	G 1/2"	3000 l/min	2 - 10 bar	the same	1,20 kg
P 311 121 VES	G 1/2"	3000 l/min	2 - 10 bar	3 - 10 bar	1,20 kg
P 310 121 NPT VES	G 1/2"	3000 l/min	2 - 10 bar	the same	1,20 kg
P 311 121 NPT VES	G 1/2"	3000 l/min	2 - 10 bar	3 - 10 bar	1,20 kg

P 510 701 VES/P 511 701 VES P 510 121 VES/P 511 121 VES

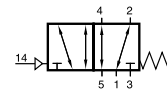
2.12.2.2
page 231



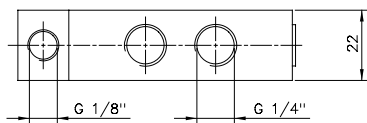
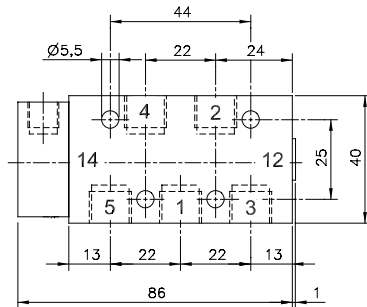
P 510 701 VES
P 510 701 NPT VES



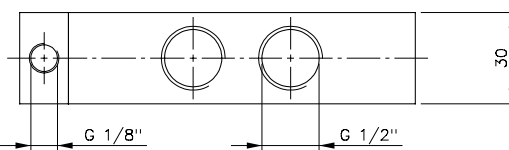
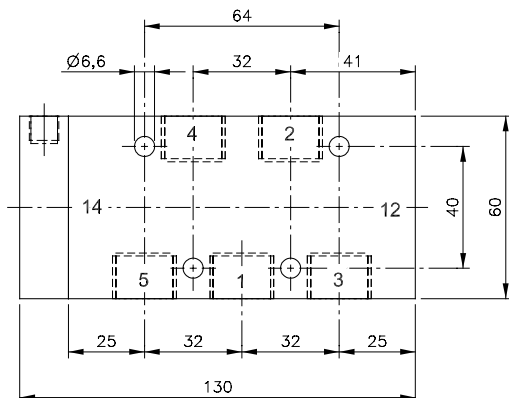
P 511 701 VES
P 511 701 NPT VES



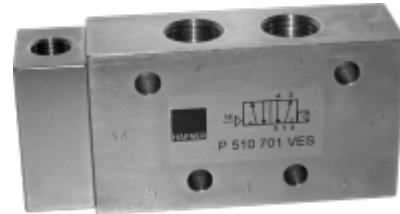
P 511 121 VES
P 511 121 NPT VES



P 510 701 VES/P 511 701 VES
P 510 701 NPT VES/P 511 701 NPT VES



P 510 121 VES/P 511 121 VES
P 510 121 NPT VES/P 511 121 NPT VES



Pneumatically actuated 5/2-way spool valve.

Body parts are made from stainless steel 316L / 1.4404, rubber parts FKM, PUR (series 701).

Type P 510 __ VES single pilot valve with air-spring-return.

Operating pressure and actuating pressure should be at the same level.

Type P 511 701 VES single pilot valve with combined spring return.

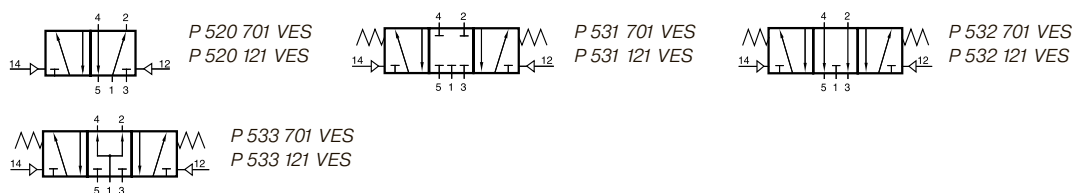
Type P 511 121 VES single pilot valve with mechanic spring return.

Exhaust can be throttled.

For 1/4"-size: Due to the specific design of the internal parts pressure has to be applied to port 1. For other versions (e.g. normally open) please contact the manufacturer.

Type	Port size	Air flow	Operating press.	Actuating press.	Weight
P 510 701 VES	G 1/4"	1250 l/min	2 - 10 bar	the same	0,40 kg ❄️⊠
P 511 701 VES	G 1/4"	1250 l/min	3 - 10 bar	3 - 10 bar	0,40 kg ❄️
P 510 701 NPT VES	1/4" NPT	1250 l/min	2 - 10 bar	the same	0,40 kg ❄️⊠
P 511 701 NPT VES	1/4" NPT	1250 l/min	2 - 10 bar	3 - 10 bar	0,40 kg ❄️
P 510 121 VES	G 1/2"	3000 l/min	3 - 10 bar	the same	1,50 kg ⊠
P 511 121 VES	G 1/2"	3000 l/min	2 - 10 bar	3 - 10 bar	1,50 kg
P 510 121 NPT VES	1/2" NPT	3000 l/min	3 - 10 bar	the same	1,50 kg ⊠
P 511 121 NPT VES	1/2" NPT	3000 l/min	2 - 10 bar	3 - 10 bar	1,50 kg

P 520 701 VES/P 53_ 701 VES
P 520 121 VES/P 53_ 121 VES



Pneumatically actuated 5/2-way and 5/3-way spool valves, actuated by impulse.

Body parts are made from stainless steel 316L / 1.4404, seals FKM / PUR (series 701).

Type P 520 ___ VES
5/2-way double pilot. Position is kept until next
pneumatic signal is applied.
Operating pressure and actuating pressure should
be at the same level.

Type P 53_ 701 and 121 VES
5/3-way valves.

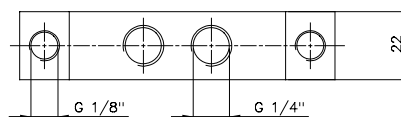
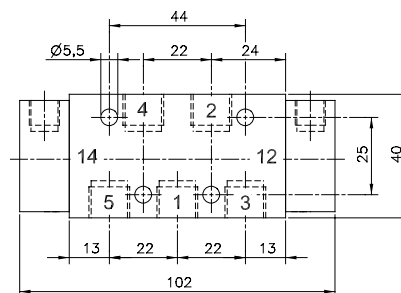
Type 531	centre closed
Type 532	centre exhausted
Type 533	centre pressurized

When ordering please complete the type number by 1, 2 or 3 according to the type required.

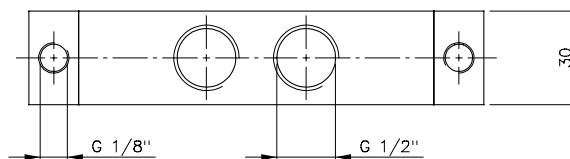
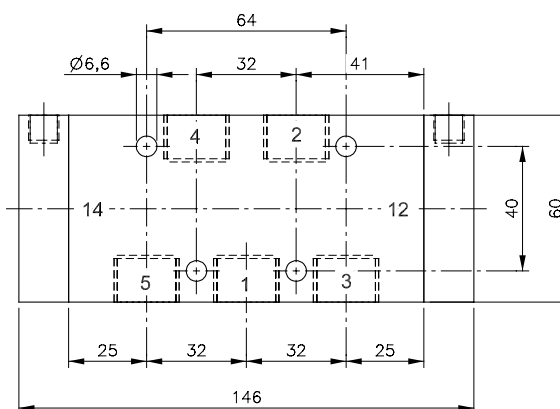
For 1/4"-size: Due to the specific design of the internal parts pressure has to be applied to port 1. For other versions please contact the manufacturer.

For type P 531 701 VES: pressure at port 1 has to be \geq pressure at 2 and 4. If pressure supply is lost, 2 or 4 can exhaust and actuator might move.

1/2" NPT on request.

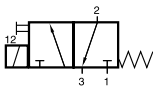


P 520 701 VES/ P 53_ 701 VES
P 520 701 NPT VES/ P 53 701 NPT VES

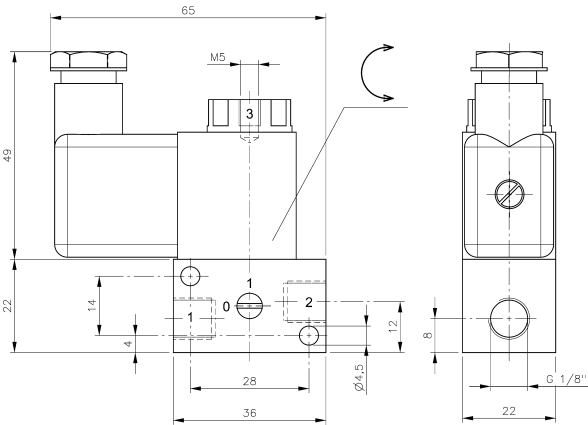


P 520 121 VES/ P 53_ 121 VES

Type	Port size	Function	Air flow	Oper. press.	Act. press.	Weight	
P 520 701 VES	G 1/4"	double pilot	1250 l/min	1,5 - 10 bar	the same	0,50 kg	☃️⊗
P 520 701 NPT VES	1/4" NPT	double pilot	1250 l/min	1,5 - 10 bar	the same	0,50 kg	☃️⊗
P 520 121 VES	G 1/2"	double pilot	3000 l/min	1,5 - 10 bar	the same	1,70 kg	⊗
P 53_ 701 VES	G 1/4"	5/3-way	1250 l/min	1,5 - 10 bar	3,0 - 10 bar	0,50 kg	☃️⊗
P 53_ 701 NPT VES	G 1/4"	5/3-way	1250 l/min	1,5 - 10 bar	3,0 - 10 bar	0,50 kg	☃️⊗
P 53_ 121 VES	G 1/2"	5/3-way	3000 l/min	1,5 - 10 bar	3,0 - 10 bar	1,70 kg	⊗



MH 311 015 VES



MH 311 015 VES



Direct acting 3/2-way solenoid valve equipped with mechanical spring return.

Valve body is made from stainless steel, material: 1.4404.
Plunger-seals are made of FKM.

Normally closed, port 1 and 2 in the valve, port 3 at the top of the solenoid.

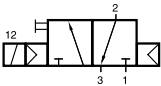
By closing port 3 valve can be converted into a 2/2-way valve.

Available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

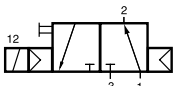
Valves are generally equipped with manual override.

Type	Function	Port size			Air flow	Operating pressure	Power consumption	Weight
		1	2	3				
MH 311 015 VES	n.c.	G 1/8"	G 1/8"	M5	50 l/min	0 - 10 bar	3 W = / 5 VA ~	0,14 kg ❄️⊕

MH 310 701 VES/MH 310 701 KES MOH 310 701 VES/MOH 310 701 KES



MH 310 701 VES
MH 310 701 KES
MH 310 701 NPT VES
MH 310 701 NPT KES



MOH 310 701 VES
MOH 310 701 KES
MOH 310 701 NPT VES
MOH 310 701 NPT KES

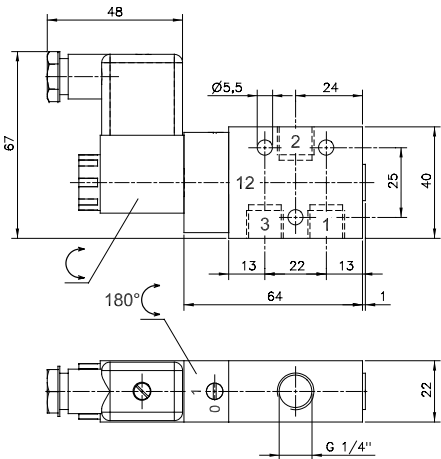


3/2-way solenoid valve normally closed (MH) or normally open (MOH) actuated by permanent signal and equipped with air spring return.

Body parts are made from stainless steel 316L / 1.4404. Customer has the choice between two versions VES and KES, for details refer to the table below.

Available with solenoid operators :
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V~, 12V=.

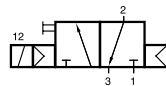
Valves are equipped with manual override to be turned.



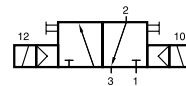
MH 310 701 VES/KES
MOH 310 701 VES/KES
MH 310 701 NPT VES/KES
MOH 310 701 NPT VES/KES

Type	Pilot head	Seals	Other rubber parts
VES	1.4404	PUR	FKM
KES	PA	PUR	FKM

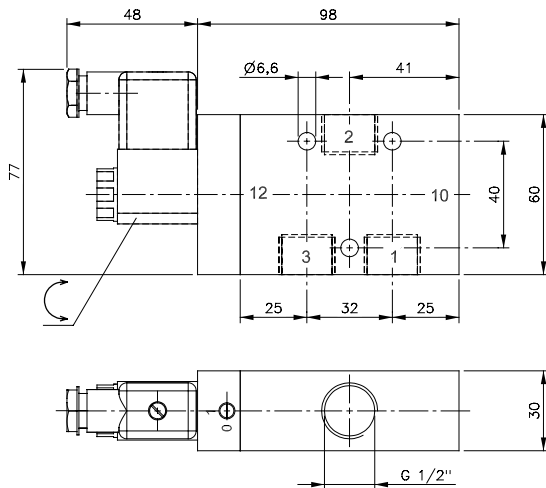
Type	Function	Port size	Air flow	Oper. press.	Power cons.	Weight
MH 310 701 VES	n.c.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,42 kg ❄️ⓧ
MH 310 701 KES	n.c.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,35 kg ❄️ⓧ
MOH 310 701 VES	n.o.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,42 kg ❄️ⓧ
MOH 310 701 KES	n.o.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,35 kg ❄️ⓧ
MH 310 701 NPT VES	n.c.	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,42 kg ❄️ⓧ
MH 310 701 NPT KES	n.c.	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,35 kg ❄️ⓧ
MOH 310 701 NPT VES	n.o.	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,42 kg ❄️ⓧ
MOH 310 701 NPT KES	n.o.	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,35 kg ❄️ⓧ



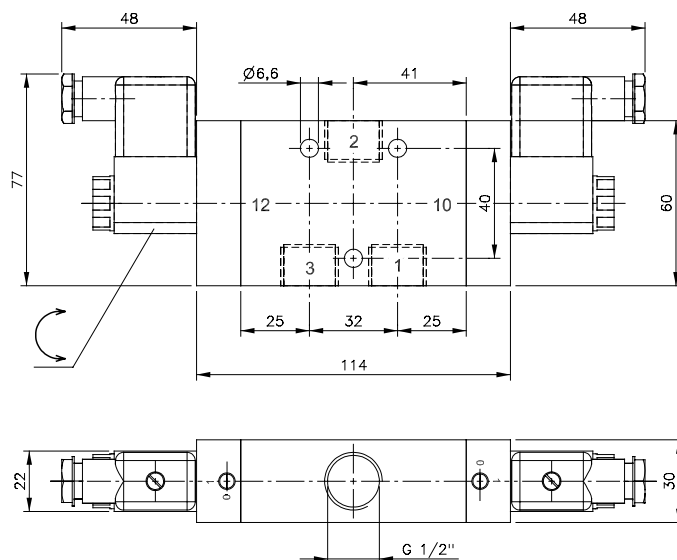
MH 310 121 VES
MH 310 121 NPT VES



MH 320 121 VES



MH 310 121 VES
MH 310 121 NPT VES



MH 320 121 VES



Type MH 310 121 VES 3/2-way solenoid valve normally closed actuated by permanent signal and equipped with air spring return.

Type MH 320 121 VES 3/2-way double solenoid valve. Position is kept until an electrical signal is applied to the opposite side even when not attached to an electrical source.

Body parts are made from stainless steel 316L / 1.4404, rubber parts are made from FKM.

Valves are available with solenoid operators: 230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V-, 12V=.

Valves are equipped with manual override to be turned.

Normally open version on request.

Type	Function	Port size	Air flow	Oper. Press.	Power cons.	Weight
MH 310 121 VES	n.c.	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	1,20 kg
MH 310 121 NPT VES	n.c.	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	1,20 kg
MH 320 121 VES	double coil	G 1/2"	3000 l/min	2 - 10 bar	3 W = / 5 VA ~	1,45 kg

MH 510 701 VES/MH 510 701 KES MH 510 121 VES



MH 510 701 VES/KES
MH 510 701 NPT VES/KES
MH 510 121 VES
MH 510 121 NPT VES



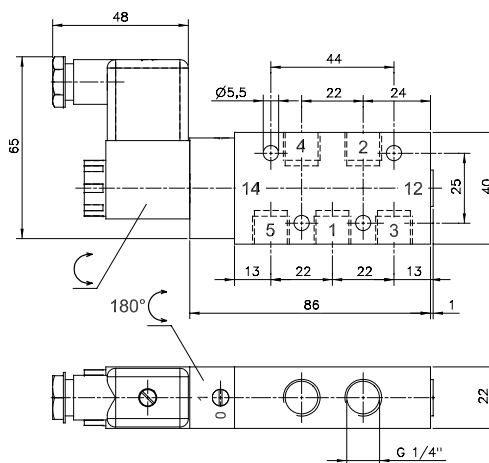
5/2-way solenoid valves actuated by permanent signal and equipped with air spring return.

Body parts are made from stainless steel 316L / 1.4404.

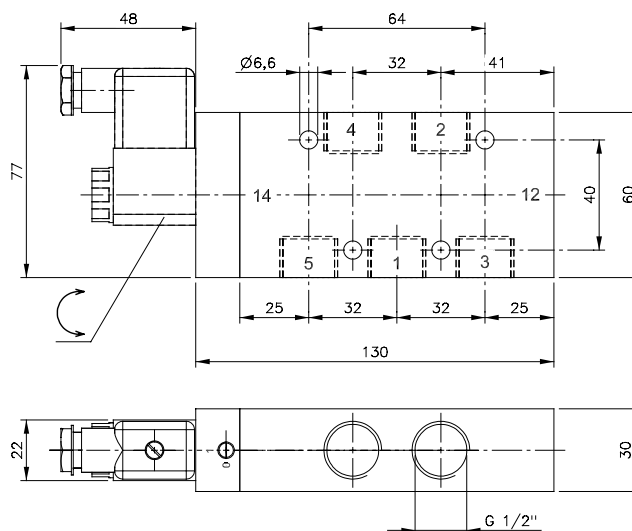
For series 701 the customer has the choice between two versions VES and KES, for details refer to the table below.

Available with solenoid operators :
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are equipped with manual override to be turned.



MH 510 701 VES/KES
MH 510 701 NPT VES/KES



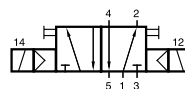
MH 510 121 VES
MH 510 121 NPT VES

Type	Pilot head	Seals	Other rubber parts
701 VES	1.4404	PUR	FKM
701 KES	PA	PUR	FKM
121 VES	1.4404	FKM	FKM

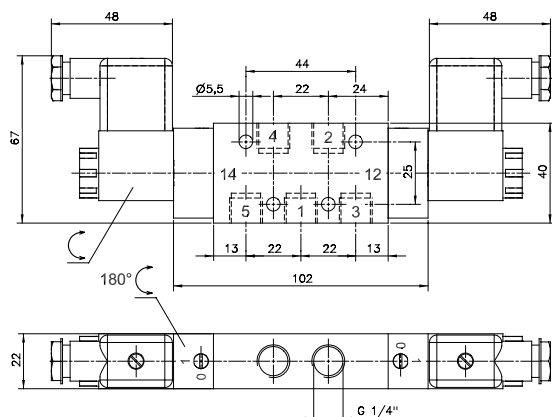
Type	Function	Port size	Air flow	Oper. press.	Power cons.	Weight
MH 510 701 VES	single sol.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,53 kg ❄️⊕
MH 510 701 KES	single sol.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,46 kg
MH 510 701 NPT VES	single sol.	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,53 kg ❄️⊕
MH 510 701 NPT KES	single sol.	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,46 kg
MH 510 121 VES	single sol.	G 1/2"	3000 l/min	2 - 10 bar	3 W = / 5 VA ~	1,50 kg ⊕
MH 510 121 NPT VES	single sol.	1/2" NPT	3000 l/min	2 - 10 bar	3 W = / 5 VA ~	1,50 kg ⊕

MH 520 701 VES/MH 520 701 KES MH 520 121 VES

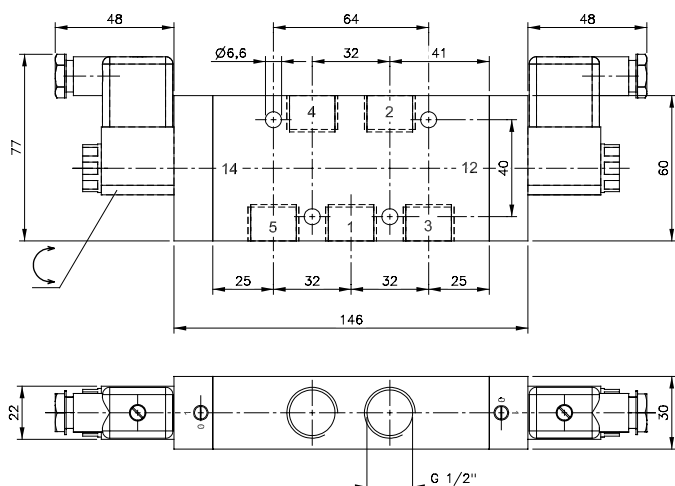
2.12.3.5
page 237



MH 520 701 VES/KES
MH 520 701 NPT VES/KES
MH 520 121 VES
MH 520 121 NPT VES



**MH 520 701 VES/KES
MH 520 701 NPT VES/KES**



**MH 520 121 VES
MH 520 121 NPT VES**



5/2-way double solenoid valve.

Position is kept until an electrical signal is applied to the opposite side even when not attached to an electrical source.

Body parts are made from stainless steel 316L / 1.4404, rubber parts FKM, PUR (series 701). Series 701: Customer has the choice between two versions KES and VES, for details refer to the table below.

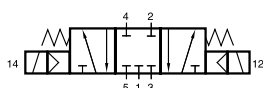
Valves are available with solenoid operators: 230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=, 24V=, 12V=.

Valves are equipped with manual override to be turned.

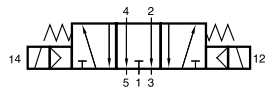
Type	Pilot head	Seals	Other rubber parts
701 VES	1.4404	PUR	FKM
701 KES	PA	PUR	FKM
121 VES	1.4404	FKM	FKM

Type	Port size	Air flow	Oper. Press.	Power cons.	Weight
MH 520 701 VES	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,74 kg
MH 520 701 KES	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,60 kg
MH 520 701 NPT VES	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,74 kg
MH 520 701 NPT KES	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~	0,60 kg
MH 520 121 VES	G 1/2"	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	1,70 kg
MH 520 121 NPT VES	1/2" NPT	3000 l/min	1 - 10 bar	3 W = / 5 VA ~	1,70 kg

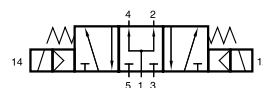
MH 53_ 701 VES/MH 53_ 701 KES MH 53_ 121 VES



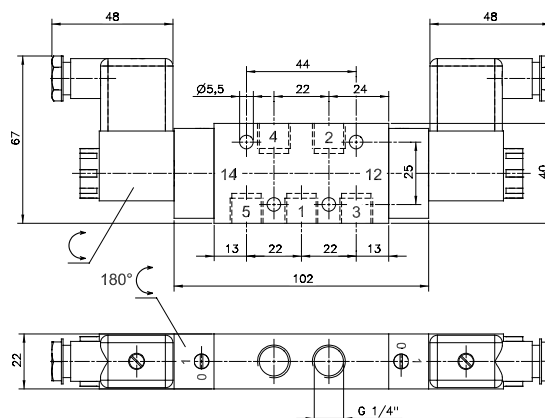
MH 531 701 VES/KES
MH 531 701 NPT VES/KES
MH 531 121 VES
MH 531 121 NPT VES



MH 532 701 VES/KES
MH 532 701 NPT VES/KES
MH 532 121 VES
MH 532 121 NPT VES



MH 533 701 VES/KES
MH 533 701 NPT VES/KES
MH 533 121 VES
MH 533 121 NPT VES



MH 53_ 701 VES/KES
MH 53_ 701 NPT VES/KES

5/3-way valves actuated with spring return to middle position, actuated by permanent signal.

Body parts are made from stainless steel 316L / 1.4404, rubber parts FKM, PUR (series 701). Series 701: Customer has the choice between two versions KES and VES, for details refer to the table below.

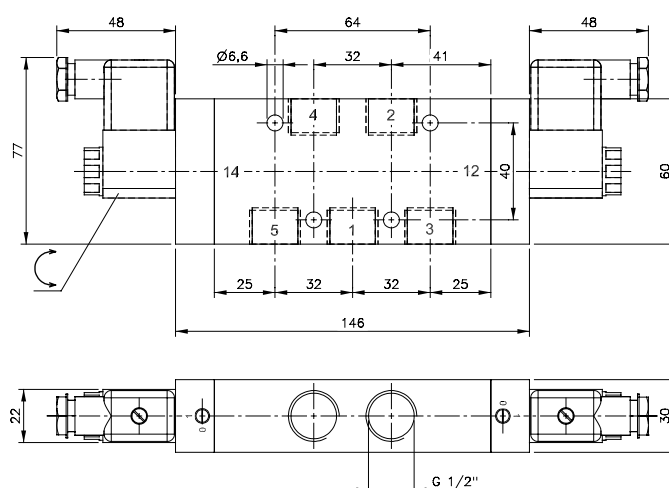
Type 531 centre closed
Type 532 centre exhausted
Type 533 centre pressurized

When ordering please complete the type number by 1, 2 or 3 according to the type required.

Valves are available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are equipped with manual override to be turned.

For type 531 701: pressure at port 1 has to be
>= pressure at 2 and 4. If pressure supply is lost,
2 or 4 can exhaust and actuator might move.



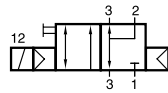
MH 53_ 121 VES
MH 53_ 121 NPT VES

Type	Pilot head	Seals	Other rubber parts
701 VES	1.4404	PUR	FKM
701 KES	PA	PUR	FKM
121 VES	1.4404	FKM	FKM

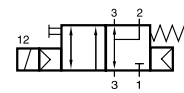
Type	Port size	Air flow	Oper. Press.	Power cons.	Weight
MH 53_ 701 VES	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,74 kg
MH 53_ 701 KES	G 1/4"	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,60 kg
MH 53_ 701 NPT VES	1/4" NPT	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,74 kg
MH 53_ 701 NPT KES	1/4" NPT	1250 l/min	3 - 10 bar	3 W = / 5 VA ~	0,60 kg
MH 53_ 121 VES	G 1/2"	3000 l/min	3 - 10 bar	3 W = / 5 VA ~	1,70 kg
MH 53_ 121 NPT VES	1/2" NPT	3000 l/min	3 - 10 bar	3 W = / 5 VA ~	1,70 kg

MNH 310 701 VES/MNH 310 701 KES MNH 311 701 VES/MNH 311 701 KES

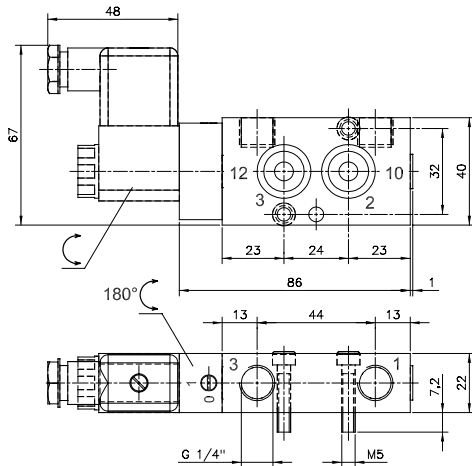
2.12.4.1
page 239



MNH 310 701 VES
MNH 310 701 KES
MNH 310 701 NPT VES
MNH 310 701 NPT KES



MNH 311 701 VES
MNH 311 701 KES
MNH 310 701 NPT VES
MNH 310 701 NPT KES



MNH 310 701 VES/KES
MNH 311 701 VES/KES
MNH 310 701 NPT VES/KES
MNH 311 701 NPT VES/KES



3/2-way solenoid valve, actuated by permanent signal. Interface according to 1/4" Namur standard, with exhaust air recirculation (purge).

Type MNH 310 701 with pneumatic spring return.
Type MNH 311 701 with combined spring assuring a fail-safe function in case of cut-off of pressure supply.

Body parts are made from stainless steel 316L / 1.4404. Customer has the choice between two versions VES and KES, for details refer to the table below.

Available with solenoid operators :
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are equipped with manual override to be turned.

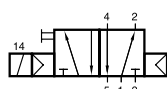
Delivery includes 1 pin, 2 screws, 2 O-rings.

Namur 2 (1/2") on request.

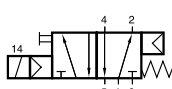
Type	Pilot head	Seals	Other rubber parts
VES	1.4404	PUR	FKM
KES	PA	PUR	FKM

Type	Function	Port size	Air flow	Oper. press.	Power cons.	Weight
MNH 310 701 VES	air-spring	G 1/4"	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,57 kg ❄️☒
MNH 310 701 KES	air-spring	G 1/4"	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,49 kg
MNH 311 701 VES	comb. spring	G 1/4"	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,57 kg ❄️
MNH 311 701 KES	comb. spring	G 1/4"	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,49 kg
MNH 310 701 NPT VES	air-spring	1/4" NPT	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,57 kg ❄️☒
MNH 310 701 NPT KES	air-spring	1/4" NPT	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~	0,49 kg
MNH 311 701 NPT VES	comb. spring	1/4" NPT	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,57 kg ❄️
MNH 311 701 NPT KES	comb. spring	1/4" NPT	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~	0,49 kg

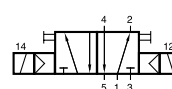
MNH 510 701 VES/MNH 510 701 KES MNH 511 701 VES/MNH 511 701 KES MNH 520 701 VES/MNH 520 701 KES



MNH 510 701 VES
MNH 510 701 KES
MNH 510 701 NPT VES
MNH 510 701 NPT KES



MNH 511 701 VES
MNH 511 701 KES
MNH 511 701 NPT VES
MNH 511 701 NPT KES



MNH 520 701 VES
MNH 520 701 KES
MNH 520 701 NPT VES
MNH 520 701 NPT KES



5/2-way solenoid valve.

Type MNH 510 ___ single solenoid actuated by permanent signal and equipped with air spring return.

Type MNH 520 ___ double solenoid actuated by impulse. Position is kept until an electric signal is applied to the opposite side even when not attached to an electrical source.

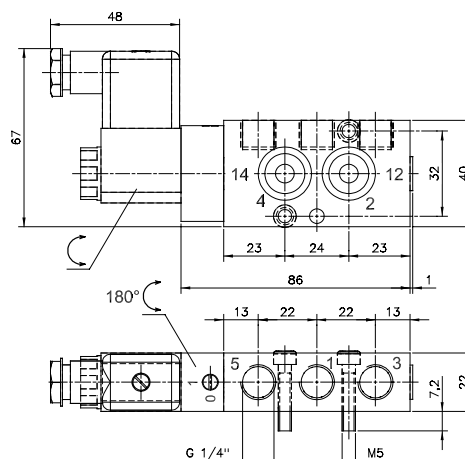
Body parts are made from stainless steel 316L / 1.4404. Customer has the choice between two versions VES and KES, for details refer to the table below.

Available with solenoid operators :
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=.

Valves are equipped with manual override to be turned.

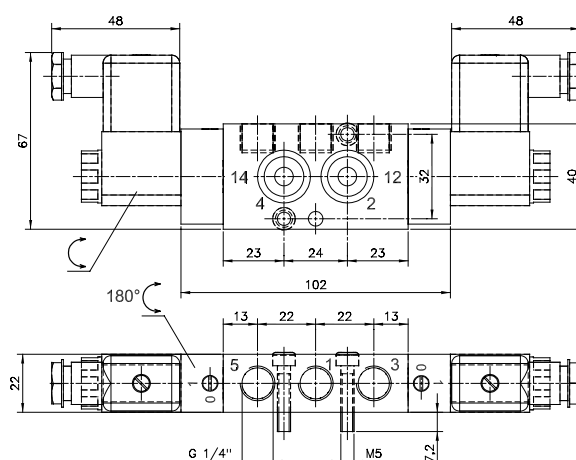
Delivery includes 1 pin, 2 screws, 2 O-rings.

5/3-way valves and Namur 2 (1/2") on request.



**MNH 510 701 VES/KES
MNH 511 701 VES/KES**

**MNH 510 701 NPT VES/KES
MNH 511 701 NPT VES/KES**



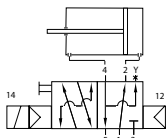
**MNH 520 701 VES/KES
MNH 520 701 NPT VES/KES**

Type	Pilot head	Seals	Other rubber parts
VES	1.4404	PUR	FKM
KES	PA	PUR	FKM

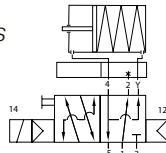
Type	Function	Port size	Air flow	Oper. press.	Power cons.	Weight
MNH 510 701 VES	air-spring	G 1/4"	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~ 0,57 kg	❄️⊗
MNH 510 701 KES	air-spring	G 1/4"	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~ 0,49 kg	
MNH 511 701 VES	comb. spring	G 1/4"	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~ 0,57 kg	❄️
MNH 511 701 KES	comb. spring	G 1/4"	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~ 0,49 kg	
MNH 520 701 VES	double sol.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~ 0,67 kg	❄️⊗
MNH 520 701 KES	double sol.	G 1/4"	1250 l/min	2 - 10 bar	3 W = / 5 VA ~ 0,58 kg	
MNH 510 701 NPT VES	air-spring	1/4" NPT	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~ 0,57 kg	❄️⊗
MNH 510 701 NPT KES	air-spring	1/4" NPT	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~ 0,49 kg	
MNH 511 701 NPT VES	comb. spring	1/4" NPT	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~ 0,57 kg	❄️
MNH 511 701 NPT KES	comb. spring	1/4" NPT	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~ 0,49 kg	
MNH 520 701 NPT VES	double sol.	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~ 0,67 kg	❄️⊗
MNH 520 701 NPT KES	double sol.	1/4" NPT	1250 l/min	2 - 10 bar	3 W = / 5 VA ~ 0,58 kg	

MNH 350 701 VES/MNH 350 701 KES MNH 351 701 VES/MNH 351 701 KES

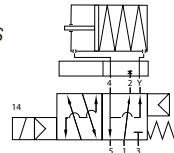
2.12.4.3
page 241



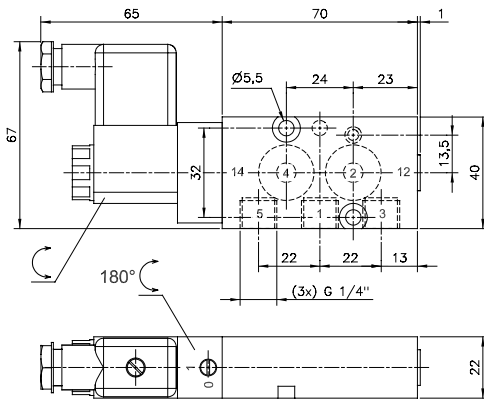
MNH 350 701 VES/KES
MNH 350 701 NPT VES/KES
on double acting act.



MNH 350 701 VES/KES
MNH 350 701 NPT VES/KES
and Flex-Pack
on single acting act.

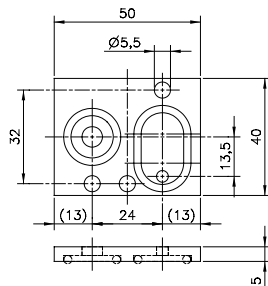


MNH 351 701 VES/KES
MNH 351 701 NPT VES/KES
and Flex-Pack
on single acting act.



MNH 350 701 VES/KES
MNH 351 701 VES/KES

MNH 350 701 NPT VES/KES
MNH 351 701 NPT VES/KES



FP 701 K/FP 701 VES



5/2-way solenoid valve, actuated by permanent signal. Interface according to 1/4" Namur standard. Adding the „Flex-Pack“, converts the valve into a 3/2-way-Namur-valve with exhaust-air recirculation („purge“).

MNH 350 701 with pneumatic spring return,
MNH 351 701 with combined spring.

Body parts are made from stainless steel 316L / 1.4404. Customer has the choice between two versions VES and KES, for details refer to the table below.

Valves are available with solenoid operators:
230V/50Hz, 110V/50Hz, 24V/50Hz, 48V=,
24V=, 12V=

Valves are generally equipped with manual override.

Delivery includes 1 pin, 2 screws, 2 O-rings.

Instead of the Flex-Pack the „Flex-regulator“ Type DRF 601 converts the function of the valve and offers the possibility to control opening- and closing-speed of a spring-return actuator independently.

Delivery of FP 701 K includes longer screws, seals as well as a plug to close port 3 of the valve.

Delivery of FP 701 VES includes longer screws and seals.

Type Pilot head Seals Other rubber parts

VES 1.4404 PUR FKM

KES PA PUR FKM

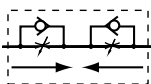
Type Material Orifice 4 Orifice 2-3 Weight

FP 701 K PA 7 mm 4 mm 0,012 kg

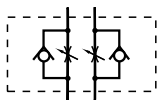
FP 701 VES 1.44.04 7 mm 4 mm 0,025 kg

Type	Function	Port size	Air flow	Oper. press.	Power Cons.	Weight
MNH 350 701 VES	air-spring	G 1/4"	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~ 0,57 kg	❄️⊞
MNH 350 701 KES	air-spring	G 1/4"	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~ 0,49 kg	
MNH 351 701 VES	comb. spring	G 1/4"	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~ 0,57 kg	❄️
MNH 351 701 KES	comb. spring	G 1/4"	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~ 0,49 kg	
MNH 350 701 NPT VES	air-spring	1/4" NPT	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~ 0,57 kg	❄️⊞
MNH 350 701 NPT KES	air-spring	1/4" NPT	1250 l/min	1,5 - 10 bar	3 W = / 5 VA ~ 0,49 kg	
MNH 351 701 NPT VES	comb. spring	1/4" NPT	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~ 0,57 kg	❄️
MNH 351 701 NPT KES	comb. spring	1/4" NPT	1250 l/min	2,5 - 10 bar	3 W = / 5 VA ~ 0,49 kg	

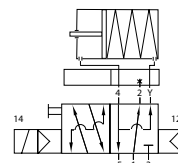
DRN 3 611 VES/DRN 5 611 VES DRF 3 611 VES



DRN 3 611 VES



DRN 5 611 VES



MNH 350 701
and Flex Regulator
DRF 3 611 VES



Block form flow regulator as intermediate plate,
interface according to 1/4" Namur standard.

Type DRN 3 611 VES:

For 3/2-way valves with exhaust air recirculation.
To regulate the forward stroke of a single acting
pneumatic actuator and to regulate the exhaust air
going into the spring return unit.

Type DRN 5 611 VES:

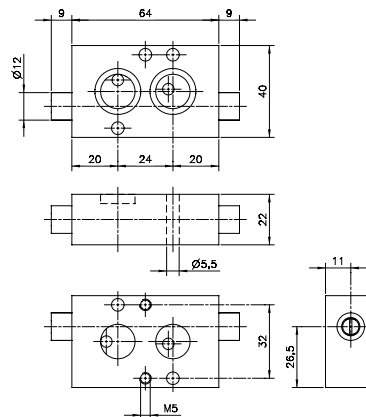
For 5/2 and 5/3 way valves only. To regulate the
forward- and backward-stroke of a double acting
pneumatic actuator.

Type DRF 3 611 VES:

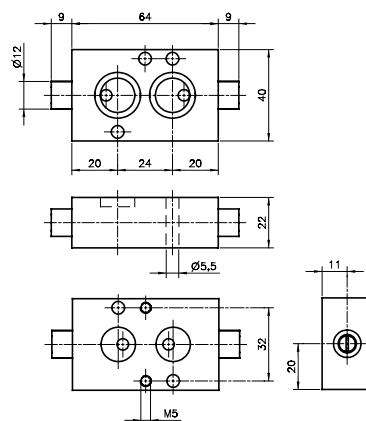
For the Hafner Namur-Flex valve. To regulate the
forward stroke of a single acting actuator and
to regulate the exhaust air going into the spring
return unit.

To be operated with a screw-driver.

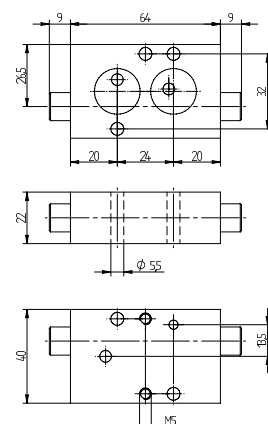
Delivery includes 1 pin, 2 screws, 2 O-Rings.



DRN 3 611 VES

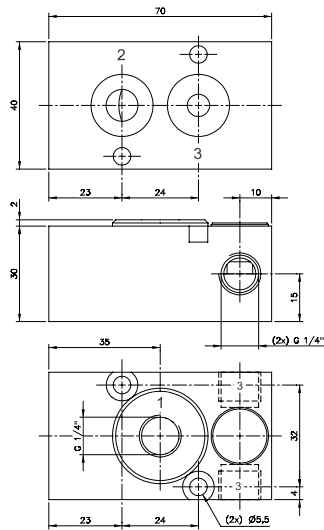
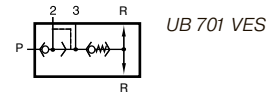


DRN 5 611 VES

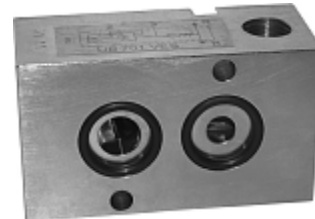


DRF 3 611 VES

Type	Function	Port size	Max. air flow	Operating press.	Weight	
DRN 3 611 VES	3-way valves	Ø 5mm	650 l/min	0,5 - 10 bar	0,42 kg	❄
DRN 5 611 VES	5-way valves	Ø 5mm	650 l/min	0,5 - 10 bar	0,42 kg	❄
DRF 3 611 VES	3-way Namur Flex	Ø 5mm	650 l/min	0,5 - 10 bar	0,42 kg	



UB 701 VES



The Hafner Namur air-recirculation block guarantees, that only exhausting air from the actuation side is going into the spring chamber and for sure no ambient atmosphere.

Valve is designed for spring return pneumatic actuators with 1/4" Namur-Interface to be controlled by a remote piloted 3/2-way valve.

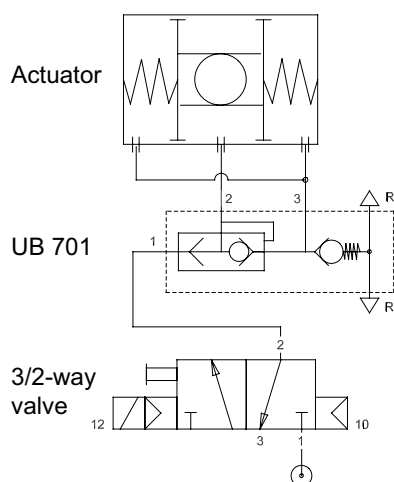
Standard with G 1/4" pilot port. Materials being used:

Body: Stainless steel 1.4404
Membrane: NBR
Other inner parts: Stainless steel 1.4404, 1.4310, 1.4031

One of the two exhaust ports 3 to be closed by a plug.
Plug is not included.

Delivery includes 2 screws and 2 O-Rings.

Function:



Type	Namur	Port size	Air flow	Operating pressure
UB 701 VES	1/4"	G 1/4"	1250 l/min	1 - 10 bar

Pneumatically actuated valves in Stainless Steel with Namur interface



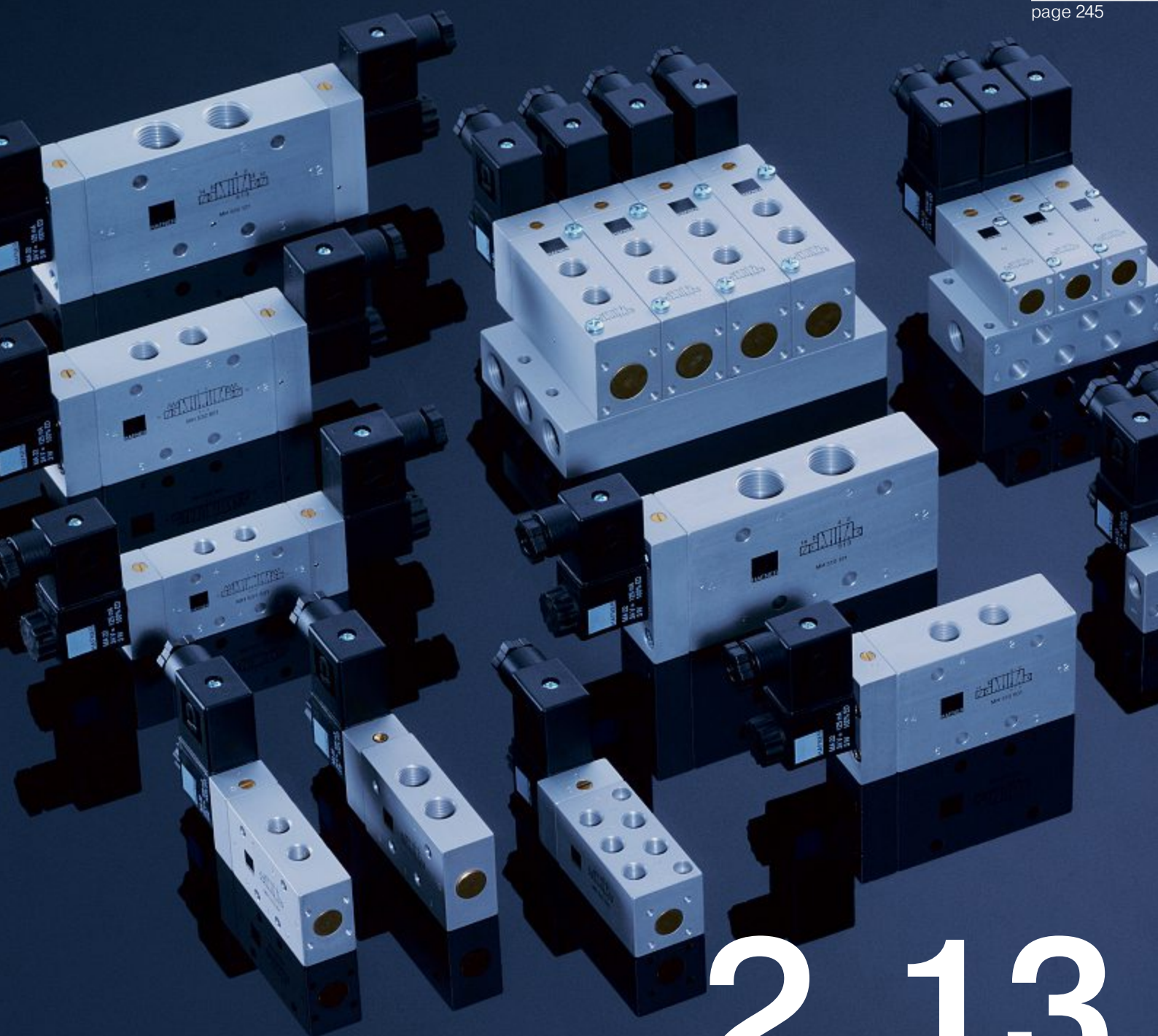
Dimensions can be taken from chapter 2.9.2 as technical drawings are identical to the products in aluminum.

Selected products displayed on this page are also available NPT ported.

For 1/4"-size: Due to the specific design of the internal parts pressure has to be applied to port 1.

For type PN 531 701 VES: pressure at port 1 has to be \geq pressure at 2 and 4. If pressure supply is lost, 2 or 4 can exhaust and actuator might move.

Type	Namur	Port size	Function	Air flow	Oper. press.	Act. press.
PN 310 701 VES	1/4"	G 1/4" - G 1/8"	3/2-way air ret.	1250 l/min	1,5 - 10 bar	the same
PN 311 701 VES	1/4"	G 1/4" - G 1/8"	3/2-way spring ret.	1250 l/min	3 - 10 bar	2,5 - 10 bar
PN 510 701 VES	1/4"	G 1/4" - G 1/8"	5/2-way air ret.	1250 l/min	1,5 - 10 bar	the same
PN 511 701 VES	1/4"	G 1/4" - G 1/8"	5/2-way spring ret.	1250 l/min	3 - 10 bar	2,5 - 10 bar
PN 520 701 VES	1/4"	G 1/4" - G 1/8"	5/2-way double pil.	1250 l/min	1 - 10 bar	the same
PN 531 701 VES	1/4"	G 1/4" - G 1/8"	5/3-way	1250 l/min	3 - 10 bar	3 - 10 bar



2.13

Coils and Connectors

MD 401/MD 401 L



16 mm wide solenoid system for valves type MD and MK, including valve-head.

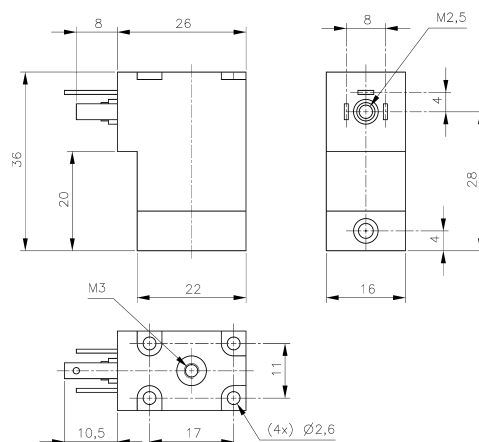
Coil made from 25 % glass filled thermoplastic PA material, epoxy filled. Valve head glass filled thermoplastic PA including a manual override to push.

MD 401

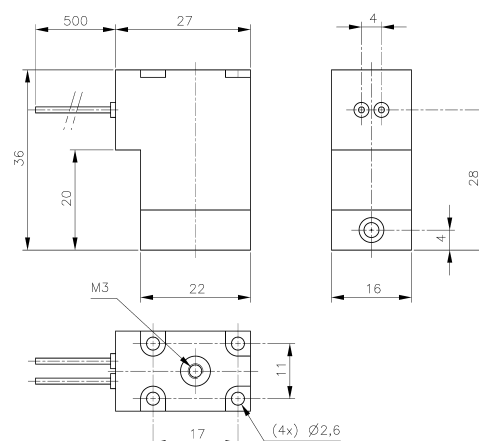
Interface form C (DIN EN 175301-803), with 8 mm contact distance, connectors are displayed on page 2.13.4. Equipped with appropriate connector coil offers IP 65.

MD 401 L (Flying leads version)

Have a standard cable length of 500 mm, others are available on request. The coils are not grounded, take national safety regulations into consideration!

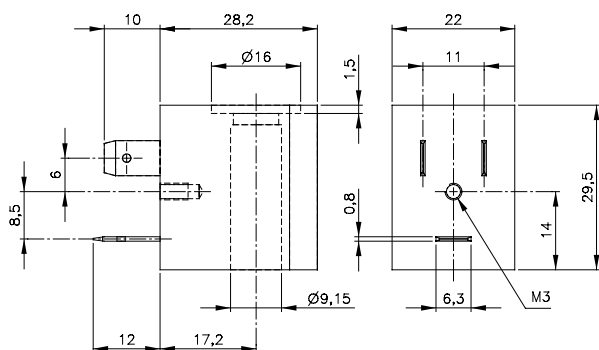


MD 401

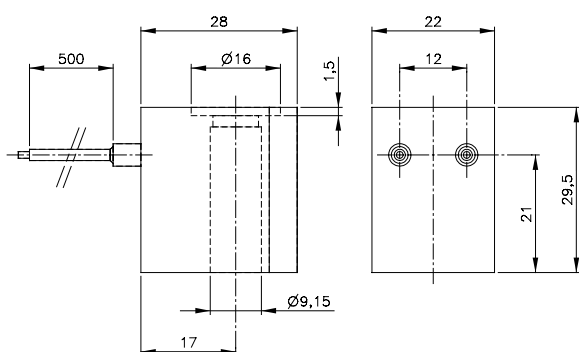


MD 401 L

Type	Voltage	Ampere	Power cons.	Connection
MD 401 6DC	6 V=	300 mA	1,8 W	Form C (DIN EN 175301-803)
MD 401 6DC L	6 V=	300 mA	1,8 W	Flying leads 500 mm long
MD 401 12DC	12 V=	150 mA	1,8 W	Form C (DIN EN 175301-803)
MD 401 12DC L	12 V=	150 mA	1,8 W	Flying leads 500 mm long
MD 401 24DC	24 V=	75 mA	1,8 W	Form C (DIN EN 175301-803)
MD 401 24DC L	24 V=	75 mA	1,8 W	Flying leads 500 mm long
MD 401 24AC	24 V~	125 mA	3 VA	Form C (DIN EN 175301-803)
MD 401 24AC L	24 V~	125 mA	3 VA	Flying leads 500 mm long
MD 401 110AC	110 V~	27 mA	3 VA	Form C (DIN EN 175301-803)
MD 401 110AC L	110 V~	27 mA	3 VA	Flying leads 500 mm long
MD 401 230AC	230 V~	13 mA	3 VA	Form C (DIN EN 175301-803)
MD 401 230AC L	230 V~	13 mA	3 VA	Flying leads 500 mm long



MA 22/MA 22 D/MA 22 U



MA 22 L

MA 22 U

Same as MA 22 but with UL-certification.



AC-coils can be operated at 50 Hz and 60 Hz.



MA 22
MA 22 D
MA 22 U



MA 22 L



22 mm wide coils for solenoid valves of MH-type, 22 mm, 30 mm and 40 mm wide.

MA 22

Housing made from heat resistant thermoplastic polyester material 30 % glass filled. Interface industryform B (DIN / ISO 436 50), connectors are displayed on page 2. 13.3 and 2. 13.4. Equipped with appropriate connector, solenoid offers IP 65. Isolation class F. Wire class H.

MA 22 L (Flying leads version)

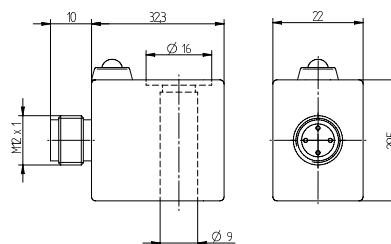
Housing made from heat resistant thermoplastic polyester material with 30 % glass filled. Standard cable length of 500 mm, others are available on request. The coils are not grounded, please take national safety regulations into consideration! Isolation class F. Wire class H.

MA 22 D (Epoxy version)

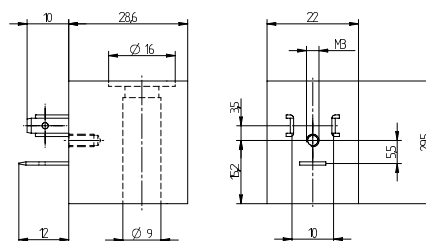
Housing made from Epoxy, interface industryform B (DIN/ISO 436 50). Isolation class F. Wire class H. Equipped with connector ST 22 and ST 222 V (please refer to page 2. 13.4) solenoid system offers IP 65. Equipped with connector ST 22 L 500 and additional O-rings the system offers IP 67.

Type	Voltage	Tolerance	Ampere	Power cons.	Connection
MA 22 12 DC	12 V=	±10 %	250 mA	3 W	Industryform B (DIN 436 50)
MA 22 24DC	24 V=	±10 %	125 mA	3 W	Industryform B (DIN 436 50)
MA 22 L700 24DC	24 V=	±10 %	125 mA	3 W	Flying leads 700 mm long
MA 22 48DC	48 V=	±10 %	62 mA	3 W	Industryform B (DIN 436 50)
MA 22 220DC	220 V=	±10 %	14 mA	3 W	Industryform B (DIN 436 50)
MA 22 24AC	24 V~	±10 %	200 mA	5 VA	Industryform B (DIN 436 50)
MA 22 110AC	110 V~	±10 %	45 mA	5 VA	Industryform B (DIN 436 50)
MA 22 L500 110AC	110 V~	±10 %	45 mA	5 VA	Flying leads 500 mm long
MA 22 230AC	230 V~	±10 %	22 mA	5 VA	Industryform B (DIN 436 50)
MA 22 L500 230AC	230 V~	±10 %	22 mA	5 VA	Flying leads 500 mm long
MA 22 D 24DC	24 V=	±10 %	125 mA	3 W	Industryform B (DIN 436 50)
MA 22 D 24AC	24 V=	±10 %	200 mA	5 VA	Industryform B (DIN 436 50)
MA 22 D 230AC	230 V~	±10 %	22 mA	5 VA	Industryform B (DIN 436 50)
MA 22 U 24DC	24 V=	±10 %	125 mA	3 W	Industryform B (DIN 436 50)
MA 22 U 24AC	24 V=	±10 %	200 mA	5 VA	Industryform B (DIN 436 50)
MA 22 U 110AC	110 V~	±10 %	45 mA	5 VA	Industryform B (DIN 436 50)
MA 22 U 230AC	230 V~	±10 %	22 mA	5 VA	Industryform B (DIN 436 50)

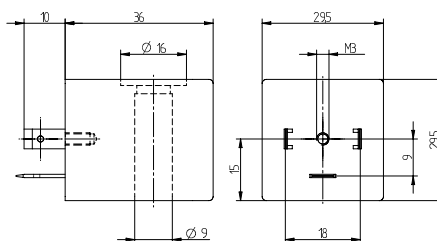
MA 22 D M12/MA 22 DIN/MA 30/ST 22 M12



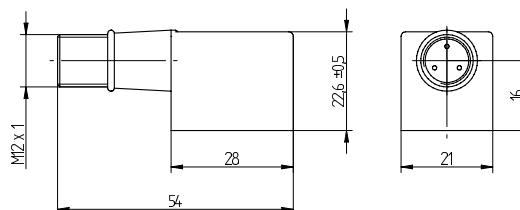
MA 22 D M12



MA 22 DIN



MA 30



ST 22 M12

Coils for solenoid valves of type MH and MNH.

MA 22 D M12x1

Housing made from Epoxy. Isolation class F.
Wire class H.

Connection M12x1 according to DIN EN 60947-5-2.
Coil with yellow LED.

MA 22 DIN

Housing made from heat resistant thermoplastic polyester material 30% glass filled. Isolation class F.
Wire class H.

Form B according to EN 175301-803. Equipped with appropriate connector, solenoid offers IP 65.

MA 30

Housing made from heat resistant thermoplastic polyester material 30% glass filled. Isolation class F.
Wire class H.

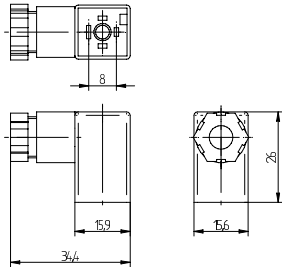
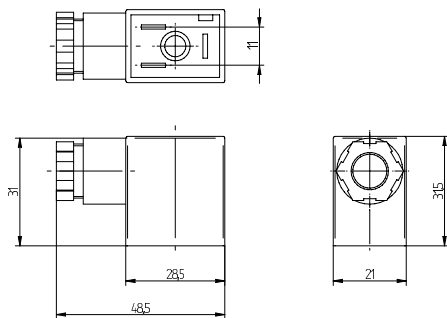
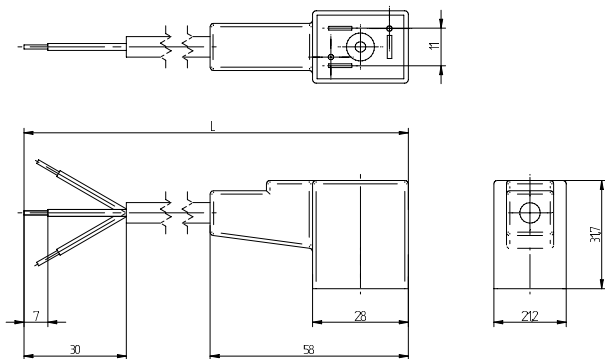
Form A according to EN 17301-803. Equipped with appropriate connector, solenoid offers IP 65.

ST 22 M12

Connector with M12 x 1 connection which can be used with the standard Hafner MA 22 coils.
Connector is without LED in order to be more flexible regarding different voltages.

AC-coils can be operated at 50 Hz and 60 Hz.

Type	Voltage	Tolerance	Ampere Max.	Power LED	Connection
MA 22 D 24DC M12	24 V=	± 10 %	175 mA	4,2 W yellow	M12x1
ST 22 M12	0 - 250 V		4 A	no	Industrial B - M12x1
MA 22 24DC DIN		± 10 %	110 mA	2,6 W	Form B - EN 175301-803
MA 22 230AC DIN	230 V~	± 10 %	26 mA	6 VA	Form B - EN 175301-803
MA 30 24DC	24 V~	± 10 %	83 mA	2 W	Form A - EN 175301-803
MA 30 110AC	110 V~	± 10 %	27 mA	3 VA	Form A - EN 175301-803
MA 30 230AC	230 V~	± 10 %	13 mA	3 VA	Form A - EN 175301-803

**ST 16/ST 162 V __****ST 22/ST 222 V __****ST 22 L 5000/ ST 222 V __ L 1500**

Connectors as accessories for Hafner valves.

Type ST 16

Connector which can be used with the Hafner MD 401 solenoid system. Using the enclosed flat seal, fastening screw and nut appropriately the system reaches protection class IP 65 in accordance to IEC 60 529.

Type ST 162 V __

Connector with **LED and varistor** which can be used with the Hafner MD 401 solenoid system. Interface according to EN 175301-803 (form C). Using the enclosed flat seal, fastening screw and nut appropriately the system reaches protection class IP 65 in accordance to IEC 60 529.

Type ST 22

Connector which can be used with the Hafner MA 22 coils. Using the enclosed flat seal, fastening screw and nut appropriately the system reaches protection class IP 65 in accordance to IEC 60 529.

Type ST 222 V __

Connector with **LED and varistor** which can be used with the Hafner MA 22 coils. Using the enclosed flat seal, fastening screw and nut appropriately the system reaches protection class IP 65 in accordance to IEC 60 529.

Type ST 22 L 5000

Connector with **5 meter moulded cable** which can be used with the Hafner MA 22 coils.

In combination with the Hafner Epoxy coils type MA 22 D, adding 2 O-rings at the top of the solenoid system and fastening screw and nut appropriately the system reaches protection class IP 67 in accordance to IEC 60 529. Seal is part of the housing.

Type ST 222 V __ L 1500

Connector with **1,5 meter moulded cable, LED and varistor** which can be used with the Hafner MA 22 coils. In combination with the Hafner Epoxy coils type MA 22 D, adding 2 O-rings at the top of the solenoid system and fastening screw and nut appropriately the system reaches protection class IP 67 in accordance to IEC 60 529. Seal is part of the housing.

Other connectors are available on request.

Type	Form	LED	VAR	Operat. voltage	Max. current	Cable diameter	Cable length [mm]	Cable material
ST 16	C, ISO 15219	no	no	0 - 250 V	6 A	5 - 6,5 mm		
ST 162 V 24	C, ISO 15219	red	yes	24 V ± 10 %	6 A	5 - 6,5 mm		
ST 162 V 230	C, ISO 15219	red	yes	230 V ± 10 %	6 A	5 - 6,5 mm		
ST 22	Industrial	no	no	0 - 250 V	10 A	6 - 8 mm		
ST 222 V 24	Industrial	red	yes	24 V ± 10 %	10 A	6 - 8 mm		
ST 222 V 230	Industrial	red	yes	230 V ± 10 %	10 A	6 - 8 mm		
ST 22 L 5000	Industrial	no	no	0 - 250 V	6 A	6,5 mm	5.000	PVC
ST 222 V 24 L 1500	Industrial	red	yes	24 V ± 10 %	6 A	6,5 mm	1.500	PUR
ST 222 V110 L 1500	Industrial	red	yes	110 V ± 10 %	6 A	6,5 mm	1.500	PVC
ST 222 V230 L 1500	Industrial	red	yes	230 V ± 10 %	6 A	6,5 mm	1.500	PVC

ST 22 Ex/ST 30 Ex nA/ ST 30 Ex ia



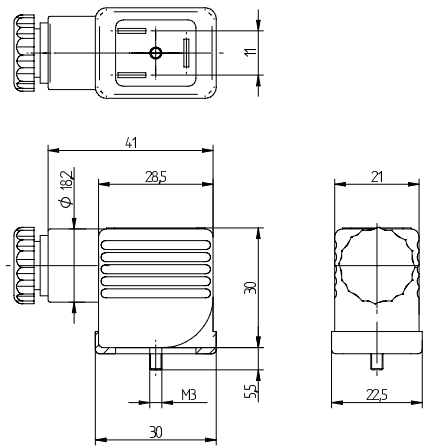
Connectors as accessories for explosion-proof coils.

Type ST 22 Ex
Connector to be used in combination with MA 22 Ex nA.
Connector is classified for zone 2 and 22 cat. IIG/D.
Includes flat seal.

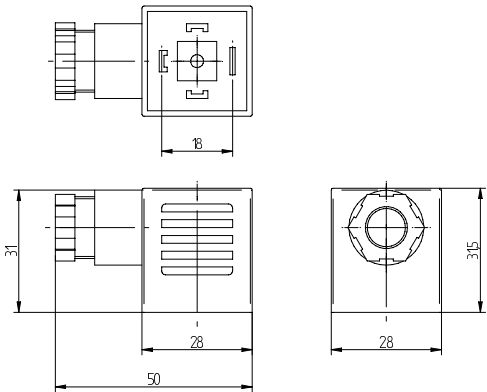
Type ST 30 Ex ia
Connector to be used in combination with MA 30 Ex ia.
Connector is classified for zone 21, cat. IID. Can also
be used in combination with intrinsically safe coils in
zone 1 (cat. IIG). Includes flat silicon seal.

Type ST 30 Ex nA
Connector to be used in combination with MA 30 Ex nA.
Connector is classified for zone 2 and 22, cat. IIIG and
IIID. Includes profiled NBR seal.

Other connectors are available on request.

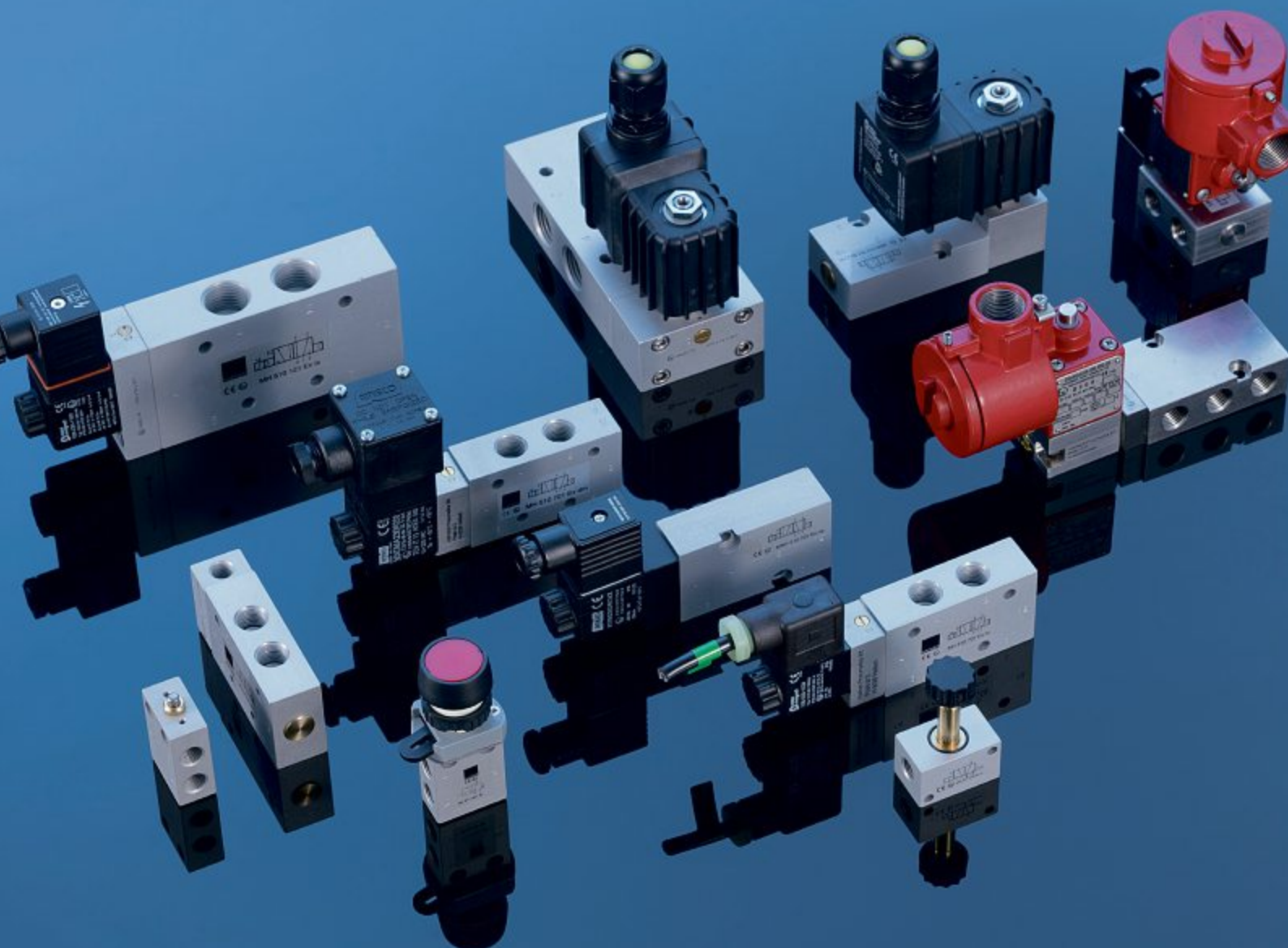


ST 22 Ex



ST 30 Ex nA/ ST 30 Ex ia

Type	Form	LED	VAR	Operat. voltage	Max. current	Cable diameter
ST 22 Ex	Industrial	no	no	0 - 250 V	10 A	6 - 8 mm
ST 30 Ex ia	A, ISO 4400	no	no	0 - 250 V	10 A	6 - 8 mm
ST 30 Ex nA	A, ISO 4400	no	no	0 - 250 V	10 A	4 - 8 mm



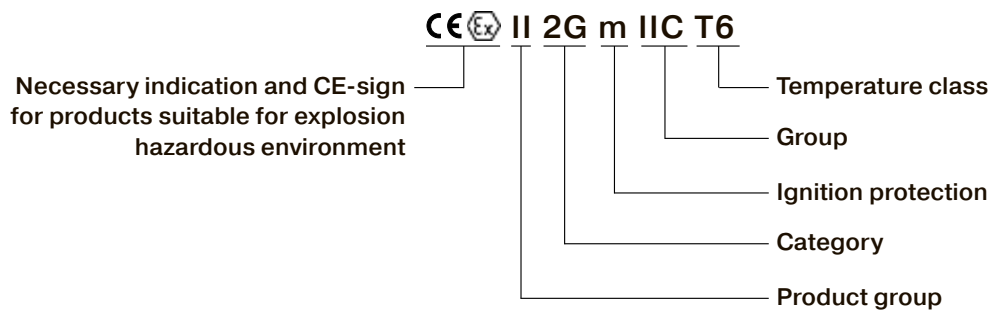
2.14

Products for Explosion Hazardous Environment



General information on Hafner products for explosion hazardous environment

Example marking of an electric product for explosion hazardous environment:



Product group:

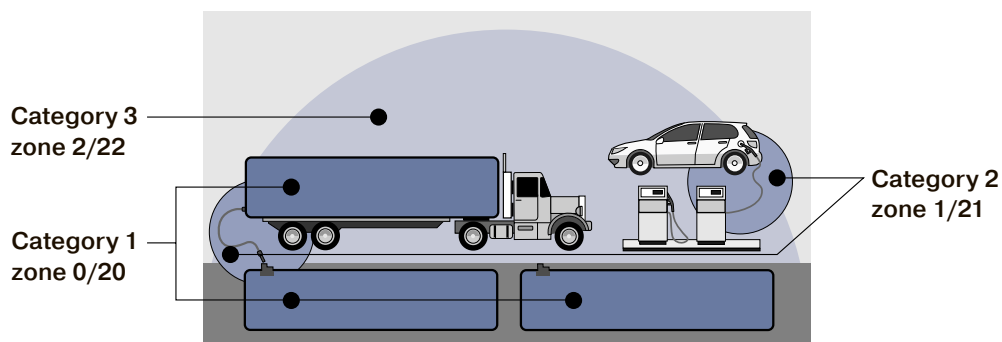
Product group I

Products from product group I are distinguished between M1 and M2. Both are suitable for mining applications. They are not in our focus as Hafner does not offer suitable equipment.

Product group II

All other products for explosion hazardous environment are in this group.

Category:



Category I

An area in which an explosive mixture is continuously present or present for long periods >1000 hours/year.

Category II

An area in which an explosive mixture is occasionally present 10 – 1000 hours/year.

Category III

An area in which an explosive mixture is not likely to occur in normal operation and if it occurs it will exist only for a short time <10 hours/year.

General information on Hafner products for explosion hazardous environment

	Zones for Gases	Zones for Dust
Category 1	Zone O Area in which an explosion hazardous atmosphere consisting of air and inflammable gases, vapors or fog is present constantly or over a longer period of time. > 1000 hours/year	Zone 20 Area in which an explosion hazardous atmosphere consisting of a dust-cloud or a mix of air and dust is present constantly or over a longer period of time. > 1000 hours/year
Category 2	Zone 1 Area in which there is a probability that under normal conditions an explosion hazardous atmosphere consisting of air and inflammable gases, vapors or fog can be present. 10 – 1000 hours/year	Zone 21 Area in which there is a probability that under normal conditions an explosion hazardous atmosphere consisting of a dust-cloud or a mix of air and dust can be present. 10 – 1000 hours/year
Category 3	Zone 2 Area in which once and a while an explosion hazardous atmosphere consisting of air and inflammable gases, steam or vapors can be present. < 10 hours/year	Zone 22 Area in which once and a while an explosion hazardous atmosphere consisting of a dust-cloud or a mix of air and dust can be present. < 10 hours/year

■ Covered by the Hafner product range

Ignition protection (examples):

	General definition:	For Hafner products:
c	Constructional safety	general protection for mechanical ATEX
i	Intrinsic safety	called ia for solenoids
na	Non sparking	
m	Encapsulation	with cable
me	Encapsulation enhanced safety	called Ex emb with junction box
d	Flameproof enclosure	with junction box
dm	Flameproof encapsulation	with junction box

Group:

For various substances the explosive and spark ignition capability of a potentially explosive mixture are characteristics. Vapors and gases are classified in groups. The criteria for the subdivision are the maximum experimental safe gap and the minimum ignition current. Those are determined under precisely defined test conditions for various vapors and gases. Please refer to IEC60079-1A and IEC60079-3.

The hazard increases from group IIA to IIC, therefore the requirements applicable to electrical equipment become more strict. Consequently products classified IIC can also be used in IIB and IIA.

Temperatur classes:

Temperature class	Max. permitted surface temperature of equipment
T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C
T6	85°C

T6 contains all other temperature classes

Non-electric valves for explosion hazardous environment

The following **manually and mechanically actuated valves** are available for the use in explosion hazardous environment in zones 1, 2, 21, 22 gas and dust:

Type	Function	Port size	Further inform. on valve on page
BV 311 301 EX	3/2-way, stem actuated	G 1/8"	2.1.1.4
BV 511 301 EX	5/2-way, stem actuated	G 1/8"	2.1.2.2
BA 311 301 EX	3/2-way, for panel mounting	G 1/8"	2.2.1
BA 511 301 EX	5/2-way, for panel mounting	G 1/8"	2.2.2
BA 22_	Actuator elements		2.2.3



The products are marked:

Ⓔ II2G/D c T6 -10° C ≤ Ta ≤ 50° C

Delivery contains a manual as well as a declaration of conformity.

A declaration of the manufacturer that the actuation elements BA 22_ do not require a certification can be supplied on request. For the use in dust atmosphere we recommend the use of a dust protection cap.

The following **pneumatically actuated valves** are available for the use in explosion hazardous environment in zone zone 1, 2, 21, 22 gas and dust:

Type	Function	Port size	Further information on valve on page		
			Aluminum	Low Temp.	Stainl. Steel
P 310 502 EX	3/2-way, single sol.	G 1/8"	2.4.1.1		
P 310 501 EX	3/2-way, single sol.	G 1/8"	2.4.1.2	2.11.3.1	
P 310 701 EX	3/2-way, single sol.	G 1/4" - 1/4" NPT	2.4.1.2	2.11.3.1	2.12.2.1
P 310 801 EX	3/2-way, single sol.	G 1/4"	2.4.1.2		
P 310 101 EX	3/2-way, single sol.	G 3/8"	2.4.1.3		
P 310 121 EX	3/2-way, single sol.	G 1/2" - 1/2" NPT	2.4.1.3		2.12.2.1
P 320 502 EX	3/2-way, double sol.	G 1/8"	2.4.1.5		
P 320 501 EX	3/2-way, double sol.	G 1/8"	2.4.1.6	2.11.3.1	
P 320 701 EX	3/2-way, double sol.	G 1/4" - 1/4" NPT	2.4.1.6	2.11.3.1	
P 320 801 EX	3/2-way, double sol.	G 1/4"	2.4.1.6		
P 320 101 EX	3/2-way, double sol.	G 3/8"	2.4.1.7		
P 320 121 EX	3/2-way, double sol.	G 1/2" - 1/2" NPT	2.4.1.7		
P 510 502 EX	5/2-way, single sol.	G 1/8"	2.4.2.1		
P 510 501 EX	5/2-way, single sol.	G 1/8"	2.4.2.2	2.11.3.2	
P 510 701 EX	5/2-way, single sol.	G 1/4" - 1/4" NPT	2.4.2.2	2.11.3.2	2.12.2.2
P 510 801 EX	5/2-way, single sol.	G 1/4"	2.4.2.2		
P 510 101 EX	5/2-way, single sol.	G 3/8"	2.4.2.3		
P 510 121 EX	5/2-way, single sol.	G 1/2" - 1/2" NPT	2.4.2.3		2.12.2.2
P 520 502 EX	5/2-way, double sol.	G 1/8"	2.4.2.5		
P 520 501 EX	5/2-way, double sol.	G 1/8"	2.4.2.6	2.11.3.2	
P 520 701 EX	5/2-way, double sol.	G 1/4" - 1/4" NPT	2.4.2.6	2.11.3.2	2.12.2.3
P 520 801 EX	5/2-way, double sol.	G 1/4"	2.4.2.6		
P 520 101 EX	5/2-way, double sol.	G 3/8"	2.4.2.7		
P 520 121 EX	5/2-way, double sol.	G 1/2" - 1/2" NPT	2.4.2.7		2.12.2.3
P 531 501 EX	5/3-way, centre closed	G 1/8"	2.4.3.1	2.11.3.3	
P 531 701 EX	5/3-way, centre closed	G 1/4" - 1/4" NPT	2.4.3.1	2.11.3.3	2.12.2.3
P 531 801 EX	5/3-way, centre closed	G 1/4"	2.4.3.1		
P 531 101 EX	5/3-way, centre closed	G 3/8"	2.4.3.2		
P 531 121 EX	5/3-way, centre closed	G 1/2" - 1/2" NPT	2.4.3.2		2.12.2.3
P 532 501 EX	5/3-way, centre exhausted	G 1/8"	2.4.3.1	2.11.3.3	
P 532 701 EX	5/3-way, centre exhausted	G 1/4" - 1/4" NPT	2.4.3.1	2.11.3.3	2.12.2.3
P 532 801 EX	5/3-way, centre exhausted	G 1/4"	2.4.3.1		
P 532 101 EX	5/3-way, centre exhausted	G 3/8"	2.4.3.2		
P 532 121 EX	5/3-way, centre exhausted	G 1/2" - 1/2" NPT	2.4.3.2		2.12.2.3
P 533 501 EX	5/3-way, centre pressurised	G 1/8"	2.4.3.1	2.11.3.3	
P 533 701 EX	5/3-way, centre pressurised	G 1/4" - 1/4" NPT	2.4.3.1	2.11.3.3	2.12.2.3
P 533 801 EX	5/3-way, centre pressurised	G 1/4"	2.4.3.1		
P 533 101 EX	5/3-way, centre pressurised	G 3/8"	2.4.3.2		
P 533 121 EX	5/3-way, centre pressurised	G 1/2" - 1/2" NPT	2.4.3.2		2.12.2.3



The products are marked:

Ⓔ II2G/D c T6 -10° C ≤ Ta ≤ 50° C

Delivery contains a manual as well as a declaration of conformity.







ATEX-certified pneumatically actuated valves for low-temperature applications as well as stainless steel products are available on request.







Solenoid valves for explosion hazardous environment

General information – overview

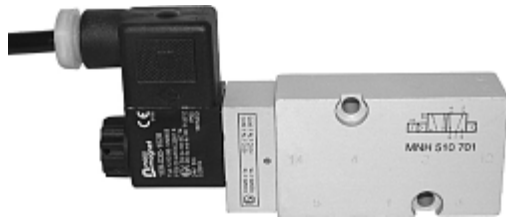
2.14.3.1
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Our customers have the choice between numerous solenoid systems of different ignition protection types. Those can be combined with valves made from aluminum or stainless steel designed for different temperature classes.

Valve	Temp.-range	Ignition protection type		
		Ex na (non-sparking)	Ex ia (intrinsically safe)	Ex m (encapsulation)
				
	Aluminum	-10°C ... + 50°C	✓	✓
	Stainless steel 	-10°C ... + 50°C	✓	✓
	Aluminum	-40°C ... + 50°C ❄	n.a.	✓
	Stainless steel 	-40°C ... + 50°C ❄	n.a.	✓
	Zone	2, 22	1, 21, 2, 22	1, 21, 2, 22
IEC-Ex rated			✓	✓
Reference:		2.14.3.4.3	2.14.3.3.5	2.14.3.2.4

Valve	Temp.-range	Ignition protection class		
		Ex e mb (encapsulation with junction box)	Ex dm (encapsulation with junction box)	Ex d (flameproof with junction box)
				
	Aluminum	-10°C ... + 50°C	✓	✓
	Stainless steel 	-10°C ... + 50°C	✓	✓
	Aluminum	-40°C ... + 50°C ❄	✓	✓
	Stainless steel 	-40°C ... + 50°C ❄	✓	✓
	Zone	1, 21, 2, 22	1, 21, 2, 22	1, 21, 2, 22
IEC-Ex rated				on request
Reference:		2.14.3.5.4	2.14.3.7.5	2.14.3.6.5

ATEX-approved valves – Ex m – standard temperature range – aluminum



Material: Aluminum, anodized
Zone: 1, 2, 21, 22
Temperature range: -10°C ... +50°C
Ignition protection type: Ex m (encapsulation)
Temperature class: T4

Marking on valve   II2G/D c T4 -10°C ≤ Ta ≤ 50°C

A low temperature version for -20°C ... +50°C is also available on request. Please notice that the system is restricted by the minimum ambiente temperature for the coil of -20°C.

The following solenoid valves are available:

Type	Function	Port size	Installation	Further inform. on valve
MH 210 501 Ex m	2/2-way, single sol.	G 1/8"	in-line	2.5.1.1.11
MH 210 701 Ex m	2/2-way, single sol.	G 1/4"	in-line	2.5.1.1.11
MH 311 012 Ex m	3/2-way direct acting	M5	in-line	2.5.1.1.2
MH 311 015 Ex m	3/2-way direct acting	G 1/8"	in-line	2.5.1.1.2
MH 311 013 Ex m	3/2-way direct acting	G 1/8"	banjo screw	2.5.1.1.6
MH 311 017 Ex m	3/2-way direct acting	G 1/4"	banjo screw	2.5.1.1.6
MH 312 Ex m	3/2-way direct acting	M5	manifold	2.5.1.2.2
MH 315 Ex m	3/2-way direct acting	G 1/8"	manifold	2.5.1.2.2
MH 310 501 Ex m	3/2-way, single sol.	G 1/8"	in-line	2.5.1.1.12
MOH 310 501 Ex m	3/2-way, n.o. single sol.	G 1/8"	in-line	2.5.1.1.12
MH 310 701 Ex m	3/2-way, single sol.	G 1/4"	in-line	2.5.1.1.12
MOH 310 701 Ex m	3/2-way, n.o. single sol.	G 1/4"	in-line	2.5.1.1.12
MH 310 801 Ex m	3/2-way, single sol.	G 1/4"	in-line	2.5.1.1.12
MOH 310 801 Ex m	3/2-way, n.o. single sol.	G 1/4"	in-line	2.5.1.1.12
MH 310 101 Ex m	3/2-way, single sol.	G 3/8"	in-line	2.5.1.1.13
MOH 310 101 Ex m	3/2-way, n.o. single sol.	G 3/8"	in-line	2.5.1.1.13
MH 310 121 Ex m	3/2-way, single sol.	G 1/2" - 1/2" NPT	in-line	2.5.1.1.13
MOH 310 121 Ex m	3/2-way, n.o. single sol.	G 1/2" - 1/2" NPT	in-line	2.5.1.1.13
MH 310 501 G Ex m	3/2-way, single sol.	G 1/8"	dual use*	2.5.1.1.14
MOH 310 501 G Ex m	3/2-way, n.o. single sol.	G 1/8"	dual use*	2.5.1.1.14
MH 310 701 G Ex m	3/2-way, single sol.	G 1/4" - 1/4" NPT	dual use*	2.5.1.1.14
MOH 310 701 G Ex m	3/2-way, n.o. single sol.	G 1/4" - 1/4" NPT	dual use*	2.5.1.1.14
MH 310 101 G Ex m	3/2-way, single sol.	G 3/8"	dual use*	2.5.1.1.15
MOH 310 101 G Ex m	3/2-way, n.o. single sol.	G 3/8"	dual use*	2.5.1.1.15
MH 310 121 G Ex m	3/2-way, single sol.	G 1/2"	dual use*	2.5.1.1.15
MOH 310 121 G Ex m	3/2-way, n.o. single sol.	G 1/2"	dual use*	2.5.1.1.15
MH 320 501 Ex m	3/2-way, double sol.	G 1/8"	in-line	2.5.1.1.16
MH 320 701 Ex m	3/2-way, double sol.	G 1/4"	in-line	2.5.1.1.16
MH 320 801 Ex m	3/2-way, double sol.	G 1/4"	in-line	2.5.1.1.16
MH 320 101 Ex m	3/2-way, double sol.	G 3/8"	in-line	2.5.1.1.17
MH 320 121 Ex m	3/2-way, double sol.	G 1/2"	in-line	2.5.1.1.17
MH 320 501 G Ex m	3/2-way, double sol.	G 1/8"	dual use*	2.5.1.1.18
MH 320 701 G Ex m	3/2-way, double sol.	G 1/4"	dual use*	2.5.1.1.18
MH 320 101 G Ex m	3/2-way, double sol.	G 3/8"	dual use*	2.5.1.1.18
MH 320 121 G Ex m	3/2-way, double sol.	G 1/2"	dual use*	2.5.1.1.18
MH 510 501 Ex m	5/2-way, single sol.	G 1/8"	in-line	2.5.2.1.3
MH 510 701 Ex m	5/2-way, single sol.	G 1/4"	in-line	2.5.2.1.3
MH 510 801 Ex m	5/2-way, single sol.	G 1/4"	in-line	2.5.2.1.3
MH 510 101 Ex m	5/2-way, single sol.	G 3/8"	in-line	2.5.2.1.4
MH 510 121 Ex m	5/2-way, single sol.	G 1/2" - 1/2" NPT	in-line	2.5.2.1.4
MH 510 501 G Ex m	5/2-way, single sol.	G 1/8"	dual use*	2.5.2.1.5
MH 510 701 G Ex m	5/2-way, single sol.	G 1/4" - 1/4" NPT	dual use*	2.5.2.1.5
MH 510 101 G Ex m	5/2-way, single sol.	G 3/8"	dual use*	2.5.2.1.6
MH 510 121 G Ex m	5/2-way, single sol.	G 1/2"	dual use*	2.5.2.1.6

Type	Function	Port size	Installation	Further inform. on valve
MH 510 504 Ex m	5/2-way, single sol.	5 mm orifice	manifold**	2.5.2.2.4
MH 510 704 Ex m	5/2-way, single sol.	7 mm orifice	manifold**	2.5.2.2.4
MH 520 501 Ex m	5/2-way, double sol.	G 1/8"	in-line	2.5.2.1.9
MH 520 701 Ex m	5/2-way, double sol.	G 1/4"	in-line	2.5.2.1.9
MH 520 801 Ex m	5/2-way, double sol.	G 1/4"	in-line	2.5.2.1.9
MH 520 101 Ex m	5/2-way, double sol.	G 3/8"	in-line	2.5.2.1.10
MH 520 121 Ex m	5/2-way, double sol.	G 1/2" - 1/2" NPT	in-line	2.5.2.1.10
MH 520 501 G Ex m	5/2-way, double sol.	G 1/8"	dual use*	2.5.2.1.11
MH 520 701 G Ex m	5/2-way, double sol.	G 1/4" - 1/4" NPT	dual use*	2.5.2.1.11
MH 520 101 G Ex m	5/2-way, double sol.	G 3/8"	dual use*	2.5.2.1.12
MH 520 121 G Ex m	5/2-way, double sol.	G 1/2"	dual use*	2.5.2.1.12
MH 520 504 Ex m	5/2-way, double sol.	5 mm orifice	manifold**	2.5.2.2.8
MH 520 704 Ex m	5/2-way, double sol.	7 mm orifice	manifold**	2.5.2.2.8
MH 53_ 501 Ex m	5/3-way, diff. versions	G 1/8"	in-line	2.5.3.1.2
MH 53_ 701 Ex m	5/3-way, diff. versions	G 1/4"	in-line	2.5.3.1.2
MH 53_ 801 Ex m	5/3-way, diff. versions	G 1/4"	in-line	2.5.3.1.2
MH 53_ 101 Ex m	5/3-way, diff. versions	G 3/8"	in-line	2.5.3.1.3
MH 53_ 121 Ex m	5/3-way, diff. versions	G 1/2" - 1/2" NPT	in-line	2.5.3.1.3
MH 53_ 501 G Ex m	5/3-way, diff. versions	G 1/8"	dual use*	2.5.3.1.4
MH 53_ 701 G Ex m	5/3-way, diff.versions	G 1/4" - 1/4" NPT	dual use*	2.5.3.1.4
MH 53_ 101 G Ex m	5/3-way, diff. versions	G 3/8"	dual use*	2.5.3.1.5
MH 53_ 121 G Ex m	5/3-way, diff. versions	G 1/2"	dual use*	2.5.3.1.5
MH 53_ 504 Ex m	5/3-way, diff. versions	5 mm orifice	manifold**	2.5.3.2.4
MH 53_ 704 Ex m	5/3-way, diff. versions	7 mm orifice	manifold**	2.5.3.2.4

Valves with interface according to Namur standard

MNH 350 701 Ex m	3/2-way & 5/2-way	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.3
MNH 310 701 Ex m	3/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.1.1
MNH 310 711 Ex m	3/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.1.1
MNH 310 121 Ex m	3/2-way, single sol.	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.1.2
MNH 510 701 Ex m	5/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.2.1
MNH 510 711 Ex m	5/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.2.1
MNH 510 121 Ex m	5/2-way, single sol.	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.2.2
MNH 520 701 Ex m	5/2-way, double sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.2.3
MNH 520 121 Ex m	5/2-way, double sol.	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.2.3
MNH 53_ 701 Ex m	5/3-way, diff. versions	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.4
MNH 53_ 121 Ex m	5/3-way, diff. versions	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.4

* dual use valves can either be used in-line or on a manifold plate.
** all ports in plate


Solenoids are described on page 2.14.3.2.4.



Delivery contains valve with the appropriate operator system, coil, manual and declaration of conformity.

ATEX-approved valves – Ex m – standard temperature range – stainless steel

2.14.3.2.2
page 257



Material: Stainless steel, 316L 
Zone: 1, 2, 21, 22
Temperature range: -10°C ... +50°C
Ignition protection type: Ex m (encapsulation)
Temperature class: T4

Marking on valve   II2G/D c T4 -10°C ≤ Ta ≤ 50°C

A low temperature version for -20°C ... +50°C is also available on request. Please notice that the system is restricted by the minimum applicable temperature of the coil of -20°C.

The following **solenoid valves** are available:

Type	Function	Port size	Installation	Further information on valve on page
MH 311 015 VES Ex m	3/2-way direct acting	G 1/8"	in-line	2.12.3.1
MH 310 701 VES Ex m	3/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.2
MOH 310 701 VES Ex m	3/2-way, n.o. single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.2
MH 310 121 VES Ex m	3/2-way, single sol.	G 1/2" - 1/2" NPT	in-line	2.12.3.3
MH 320 121 VES Ex m	3/2-way, double sol.	G 1/2"	in-line	2.12.3.3
MH 510 701 VES Ex m	5/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.4
MH 510 121 VES Ex m	5/2-way, single sol.	G 1/2" - 1/2" NPT	in-line	2.12.3.4
MH 520 701 VES Ex m	5/2-way, double sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.5
MH 520 121 VES Ex m	5/2-way, double sol.	G 1/2" - 1/2" NPT	in-line	2.12.3.5
MH 53_ 701 VES Ex m	5/3-way, different versions	G 1/4" - 1/4" NPT	in-line	2.12.3.6
MH 53_ 121 VES Ex m	5/3-way, different versions	G 1/2" - 1/2" NPT	in-line	2.12.3.6

Valves with interface according to Namur standard				
MNH 350 701 VES Ex m	3/2-way & 5/2-way	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.3
MNH 310 701 VES Ex m	3/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.1
MNH 510 701 VES Ex m	5/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.2
MNH 520 701 VES Ex m	5/2-way, double sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.2

Solenoids are described on page 2.14.3.2.4.

Delivery contains valve with the appropriate operator system, coil, manual and declaration of conformity.

MA 36 EEx m II T4 CSA FM

CSA / FM approved encapsulated coils for gas and dust explosion-hazardous environment.

Voltage: Delivery on request:
12VDC, 24VDC, 110VAC,
220VAC, 240VAC

Voltage tolerance: - 10...+ 10%

Relative duty cycle: 100 %

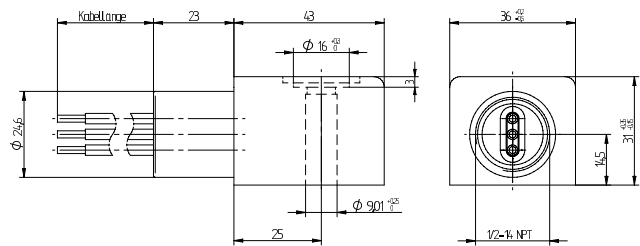
Temperature range: -20°C ... +60°C

Protection according
to EN 60529: IP 65

Material solenoid coil: Thermoplasticpolyester

Coil rating according to
DIN VDE 0580: Class H

Conduit: 1/2" NPT



MA 36 EEx m II T4 CSA FM

As the coil is 36 mm wide, a spacer plate called "ZPN 8" has to be used, in case of combination with our NAMUR-valve series 700. If used with NAMUR-valve series 121 a spacer plate called "ZPN 6-5" has to be used. You can find both plates on page 2.10.14.

CSA/FM approval is only valid as long as the associated components are used.

Please notice:
The coil is not approved according to ATEX.

Hazardous Locations:

Ex m II T4 and Division 1

Specifications in accordance to CSA certificate:
Class I, Division 1, Groups A, B, C and D; Class II, Groups E, F and G; Class III
Class I, Division 2, Groups A, B, C, D.

Specifications in accordance to FM certificate:
Explosion-proof Class I, Division 1, Groups A, B, C, D, T4, Ta = 60 °C
encapsulation/explosion-proof Class I, Zone 1, AEx m II T4, Ta = 60 °C
dust-ignition-proof for Class II/III, Division 1, Groups E, F and G, T4, Ta = 60 °C
Nonincendive Class I, Division 2, Groups A, B, C, D, T4, Ta = 60 °C
Suitable for Class II, III, Division 2, Groups E, F, G, T4, Ta = 60 °C

The current standards can be found in the certificates.

Type	Voltage	Operating press.	Power cons.	Temperature class
MA 36 EEx M II T4 CSA FM 12=	12 V=	max. 10 bar	4,5 Watt	T4 (135° C)
MA 36 EEx M II T4 CSA FM 24=	24 V=	max. 10 bar	4,6 Watt	T4 (135° C)
MA 36 EEx M II T4 CSA FM 110~	110 V~	max. 10 bar	6,8 VA	T4 (135° C)
MA 36 EEx M II T4 CSA FM 220~	220 V~	max. 10 bar	7,7 VA	T4 (135° C)
MA 36 EEx M II T4 CSA FM 240~	240 V~	max. 10 bar	7,7 VA	T4 (135° C)

62 mm

hose line
H052V2V-F3G1
Stand. length:
3 m

29,5 mm

22 mm

Marking on coil:   II 2G Ex mb IIT T4 Gb
II 2D Ex mb tb IIIC T130°C Db


Type	Operating press.	Power consumption	Temperature class
MA 22 EEx M II T4 24=	max. 10 bar	5,0 Watt	T4 (135° C)
MA 22 EEx M II T4 110~	max. 10 bar	4,5 VA	T4 (135° C)
MA 22 EEx M II T4 230~	max. 10 bar	5,1 VA	T4 (135° C)

ATEX-approved valves – Ex ia – standard temperature range – aluminum



Material: Aluminum, anodized
Zone: 1, 2, 21, 22
Temperature range: -10°C ... +50°C
Ignition protection type: Ex ia (intrinsically safe)
Temperature class: T6

Marking on valve

CE  II2G/D c T6 -10°C ≤ Ta ≤ 50°C

Please notice:

Maximum operating pressure for valves with Ex ia solenoid system is 8 bar!

Coil is 30 mm wide!

Solenoids are described on page 2.14.3.3.5.

Delivery contains valve with the appropriate operator system, coil, connector, manual and declaration of conformity.

The following solenoid valves are available:

Type	Function	Port size	Installation	Further inform. on valve on page
MH 210 501 Ex ia	2/2-way, single sol.	G 1/8"	in-line	2.5.1.1.11
MH 210 701 Ex ia	2/2-way, single sol.	G 1/4"	in-line	2.5.1.1.11
MH 311 012 Ex ia	3/2-way direct acting	M5	in-line	2.5.1.1.2
MH 311 015 Ex ia	3/2-way direct acting	G 1/8"	in-line	2.5.1.1.2
MH 310 501 Ex ia	3/2-way, single sol.	G 1/8"	in-line	2.5.1.1.12
MOH 310 501 Ex ia	3/2-way, n.o. single sol.	G 1/8"	in-line	2.5.1.1.12
MH 310 701 Ex ia	3/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.5.1.1.12
MOH 310 701 Ex ia	3/2-way, n.o. single sol.	G 1/4" - 1/4" NPT	in-line	2.5.1.1.12
MH 310 801 Ex ia	3/2-way, single sol.	G 1/4"	in-line	2.5.1.1.12
MOH 310 801 Ex ia	3/2-way, n.o. single sol.	G 1/4"	in-line	2.5.1.1.12
MH 310 101 Ex ia	3/2-way, single sol.	G 3/8"	in-line	2.5.1.1.13
MOH 310 101 Ex ia	3/2-way, n.o. single sol.	G 3/8"	in-line	2.5.1.1.13
MH 310 121 Ex ia	3/2-way, single sol.	G 1/2" - 1/2" NPT	in-line	2.5.1.1.13
MOH 310 121 Ex ia	3/2-way, n.o. single sol.	G 1/2" - 1/2" NPT	in-line	2.5.1.1.13
MH 310 101 G Ex ia	3/2-way, single sol.	G 3/8"	dual use*	2.5.1.1.15
MOH 310 101 G Ex ia	3/2-way, n.o. single sol.	G 3/8"	dual use*	2.5.1.1.15
MH 310 121 G Ex ia	3/2-way, single sol.	G 1/2"	dual use*	2.5.1.1.15
MOH 310 121 G Ex ia	3/2-way, n.o. single sol.	G 1/2"	dual use*	2.5.1.1.15
MH 320 501 Ex ia	3/2-way, double sol.	G 1/8"	in-line	2.5.1.1.16
MH 320 701 Ex ia	3/2-way, double sol.	G 1/4"	in-line	2.5.1.1.16
MH 320 801 Ex ia	3/2-way, double sol.	G 1/4"	in-line	2.5.1.1.16
MH 320 101 Ex ia	3/2-way, double sol.	G 3/8"	in-line	2.5.1.1.17
MH 320 121 Ex ia	3/2-way, double sol.	G 1/2" - 1/2" NPT	in-line	2.5.1.1.17
MH 320 121 G Ex ia	3/2-way, double sol.	G 1/2"	dual use*	2.5.1.1.18
MH 510 501 Ex ia	5/2-way, single sol.	G 1/8"	in-line	2.5.2.1.3
MH 510 701 Ex ia	5/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.5.2.1.3
MH 510 801 Ex ia	5/2-way, single sol.	G 1/4"	in-line	2.5.2.1.3
MH 510 101 Ex ia	5/2-way, single sol.	G 3/8"	in-line	2.5.2.1.4
MH 510 121 Ex ia	5/2-way, single sol.	G 1/2" - 1/2" NPT	in-line	2.5.2.1.4
MH 510 101 G Ex ia	5/2-way, single sol.	G 3/8"	dual use*	2.5.2.1.6
MH 510 121 G Ex ia	5/2-way, single sol.	G 1/2"	dual use*	2.5.2.1.6
MH 520 501 Ex ia	5/2-way, double sol.	G 1/8"	in-line	2.5.2.1.9
MH 520 701 Ex ia	5/2-way, double sol.	G 1/4" - 1/4" NPT	in-line	2.5.2.1.9
MH 520 801 Ex ia	5/2-way, double sol.	G 1/4"	in-line	2.5.2.1.9
MH 520 101 Ex ia	5/2-way, double sol.	G 3/8"	in-line	2.5.2.1.10
MH 520 121 Ex ia	5/2-way, double sol.	G 1/2" - 1/2" NPT	in-line	2.5.2.1.10
MH 520 101 G Ex ia	5/2-way, double sol.	G 3/8"	dual use*	2.5.2.1.12
MH 520 121 G Ex ia	5/2-way, double sol.	G 1/2"	dual use*	2.5.2.1.12
MH 53_ 501 Ex ia	5/3-way, different versions	G 1/8"	in-line	2.5.3.1.2
MH 53_ 701 Ex ia	5/3-way, different versions	G 1/4" - 1/4" NPT	in-line	2.5.3.1.2
MH 53_ 801 Ex ia	5/3-way, different versions	G 1/4"	in-line	2.5.3.1.2
MH 53_ 101 Ex ia	5/3-way, different versions	G 3/8"	in-line	2.5.3.1.3
MH 53_ 121 Ex ia	5/3-way, different versions	G 1/2" - 1/2" NPT	in-line	2.5.3.1.3
MH 53_ 101 G Ex ia	5/3-way, different versions	G 3/8"	dual use*	2.5.3.1.5
MH 53_ 121 G Ex ia	5/3-way, different versions	G 1/2"	dual use*	2.5.3.1.5

Valves with interface according to Namur standard

MNH 350 701 Ex ia	3/2-way & 5/2-way	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.3
MNH 310 701 Ex ia	3/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.1.1
MNH 310 711 Ex ia	3/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.1.1
MNH 310 121 Ex ia	3/2-way, single sol.	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.1.2
MNH 510 701 Ex ia	5/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.2.1
MNH 510 711 Ex ia	5/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.2.1
MNH 510 121 Ex ia	5/2-way, single sol.	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.2.2
MNH 520 701 Ex ia	5/2-way, double sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.2.3
MNH 520 121 Ex ia	5/2-way, double sol.	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.2.3
MNH 53_ 701 Ex ia	5/3-way, different versions	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.4
MNH 53_ 121 Ex ia	5/3-way, centre closed	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.4

* dual use valves can either be used in-line or on a manifold plate.

ATEX-approved valves – Ex ia – low temperature range – aluminum

2.14.3.3.2
page 261



Material: Aluminum, anodized
Zone: 1, 2, 21, 22
Temperature range: -40°C ... +50°C ❄️
Ignition protection type: Ex ia (intrinsically safe)
Temperature class: T6

Marking on valve   II2G/D c T6 -40°C ≤ Ta ≤ 50°C

Please notice:
Maximum operating pressure for valves with Ex ia solenoid system is 8 bar!

Coil is 30 mm wide!

The following solenoid valves are available:

Type	Function	Port size	Installation	Further information on valve on page
MH 311 012 TT Ex ia	3/2-way direct acting	M5	in-line	2.11.4.1.1
MH 311 015 TT Ex ia	3/2-way direct acting	G 1/8"	in-line	2.11.4.1.1
MH 310 501 TT Ex ia	3/2-way, single sol.	G 1/8"	in-line	2.11.4.1.2
MOH 310 501 TT Ex ia	3/2-way, n.o. single sol.	G 1/8"	in-line	2.11.4.1.2
MH 310 701 GTT Ex ia	3/2-way, single sol.	G 1/4" - 1/4" NPT	dual use*	2.11.4.1.2
MOH 310 701 GTT Ex ia	3/2-way, n.o. single sol.	G 1/4" - 1/4" NPT	dual use*	2.11.4.1.2
MH 320 501 TT Ex ia	3/2-way, double sol.	G 1/8"	in-line	2.11.4.1.2
MH 320 701 GTT Ex ia	3/2-way, double sol.	G 1/4"	dual use*	2.11.4.1.2
MH 510 501 GTT Ex ia	5/2-way, single sol.	G 1/8"	dual use*	2.11.4.2.1
MH 510 701 GTT Ex ia	5/2-way, single sol.	G 1/4" - 1/4" NPT	dual use*	2.11.4.2.1
MH 520 501 GTT Ex ia	5/2-way, double sol.	G 1/8"	dual use*	2.11.4.2.2
MH 520 701 GTT Ex ia	5/2-way, double sol.	G 1/4" - 1/4" NPT	dual use*	2.11.4.2.2
MH 53_ 501 GTT Ex ia	5/3-way, different versions	G 1/8"	dual use*	2.11.4.2.2
MH 53_ 701 GTT Ex ia	5/3-way, different versions	G 1/4" - 1/4" NPT	dual use*	2.11.4.2.2

Valves with interface according to Namur standard


MNH 310 701 TT Ex ia	3/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.11.5.1
MNH 510 701 TT Ex ia	5/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.11.5.2.1
MNH 510 711 TT Ex ia	5/2-way, single sol.	G 1/4"	1/4" Namur	2.11.5.2.1
MNH 520 701 TT Ex ia	5/2-way, double sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.11.5.2.2
MNH 531 701 TT Ex ia	5/3-way, centre closed	G 1/4" - 1/4" NPT	1/4" Namur	2.11.5.2.2

* dual use valves can either be used in-line or on a manifold plate.

Solenoids are described on page 2.14.3.3.5.
Delivery contains valve with the appropriate operator system, coil, manual and declaration of conformity.

ATEX-approved valves – Ex ia – standard temperature range – stainless steel



Material: Stainless steel, 316L 
Zone: 1, 2, 21, 22
Temperature range: -10°C ... +50°C
Ignition protection type: Ex ia (intrinsically safe)
Temperature class: T6

Marking on valve   II2G/D c T6 -10°C ≤ Ta ≤ 50°C

Please notice:
Maximum operating pressure for valves with Ex ia solenoid system is 8 bar!

Coil is 30 mm wide!

The following solenoid valves are available:

Type	Function	Port size	Installation	Further information on valve on page
MH 311 015 VES Ex ia	3/2-way direct acting	G 1/8"	in-line	2.12.3.1
MH 310 701 VES Ex ia	3/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.2
MOH 310 701 VES Ex ia	3/2-way, n.o. single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.2
MH 310 121 VES Ex ia	3/2-way, single sol.	G 1/2"	in-line	2.12.3.3
MH 320 121 VES Ex ia	3/2-way, double sol.	G 1/2"	in-line	2.12.3.3
MH 510 701 VES Ex ia	5/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.4
MH 510 121 VES Ex ia	5/2-way, single sol.	G 1/2" - 1/2" NPT	in-line	2.12.3.4
MH 520 701 VES Ex ia	5/2-way, double sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.5
MH 520 121 VES Ex ia	5/2-way, double sol.	G 1/2" - 1/2" NPT	in-line	2.12.3.5
MH 53_ 701 VES Ex ia	5/3-way, different versions	G 1/4" - 1/4" NPT	in-line	2.12.3.6
MH 53_ 121 VES Ex ia	5/3-way, different versions	G 1/2" - 1/2" NPT	in-line	2.12.3.6

Valves with interface according to Namur standard				
MNH 350 701 VES Ex ia	3/2-way & 5/2-way	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.3
MNH 310 701 VES Ex ia	3/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.1
MNH 510 701 VES Ex ia	5/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.2
MNH 520 701 VES Ex ia	5/2-way, double sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.2

* dual use valves can either be used in-line or on a manifold plate.



Solenoids are described on page 2.14.3.3.5.

Delivery contains valve with the appropriate operator system, coil, manual and declaration of conformity.

ATEX-approved valves – Ex ia – low temperature range – stainless steel

2.14.3.3.4
page 263



Material: Stainless steel, 316L 
Zone: 1, 2, 21, 22
Temperature range: -40°C ... +50°C 
Ignition protection type: Ex ia (intrinsically safe)
Temperature class: T6

Marking on valve   II2G/D c T6 -40°C ≤ Ta ≤ 50°C

Please notice:
Maximum operating pressure for valves with Ex ia
solenoid system is 8 bar!

Coil is 30 mm wide!

The following solenoid valves are available:

Type	Function	Port size	Installation	Further information on valve on page
MH 311 015 VES TT Ex ia	3/2-way direct acting	G 1/8"	in-line	2.12.3.1
MH 310 701 VES TT Ex ia	3/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.2
MOH 310 701 VES TT Ex ia	3/2-way, n.o. single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.2
MH 510 701 VES TT Ex ia	5/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.4
MH 520 701 VES TT Ex ia	5/2-way, double sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.5
MH 53_ 701 VES TT Ex ia	5/3-way, different versions	G 1/4" - 1/4" NPT	in-line	2.12.3.6

Valves with interface according to Namur standard				
MNH 350 701 VES TT Ex ia	3/2-way & 5/2-way	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.3
MNH 310 701 VES TT Ex ia	3/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.1
MNH 510 701 VES TT Ex ia	5/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.2
MNH 520 701 VES TT Ex ia	5/2-way, double sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.2

* dual use valves can either be used in-line or on a manifold plate.

Solenoids are described on page 2.14.3.3.5.

Delivery contains valve with the appropriate operator
system, coil, manual and declaration of conformity.

MA 30 Ex ia tD II CT6 24 DC



ATEX approved intrinsic safety coil and connector for gas and dust explosion-hazardous environment. System is also IEC-Ex approved. Electrical connection according to DIN EN 175301-803-A / ISO 4400.

Coil:

Electrical characteristics: 21,6... 28 V DC
>37 mA
final temperature rise
18 K
275 Ohm +/-8 %

Relative duty cycle: 100 %

Temperature range: -40°... +50° C

Insulation class of insulating materials according to DIN VDE 0580:

F

Protection level with connector according to EN 60529:

IP 65

Moulding material: Thermoset resin (Epoxy)

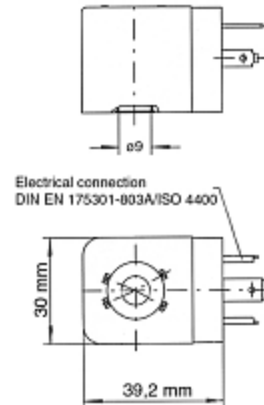
Marking on coil:

CE **Ex** II 2G Ex ia IIB/IIC T6
II 2D Ex tb IIIC T80°C

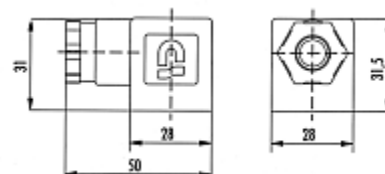
Barrier:

Electrical characteristics: 21,6... 28 V DC
Admissible peak value: 28 V DC
115 mA
1,6 W

When this solenoid system is used in combination with „ATEX certified“ mechanical components conforming EN 13463-1:2001 and PrEN 13463-5:2000, the entire valve can be used in explosive hazardous environment zone 1 and 21.



MA 30 Ex ia tD II CT6 24 DC



ST 30 Ex ia

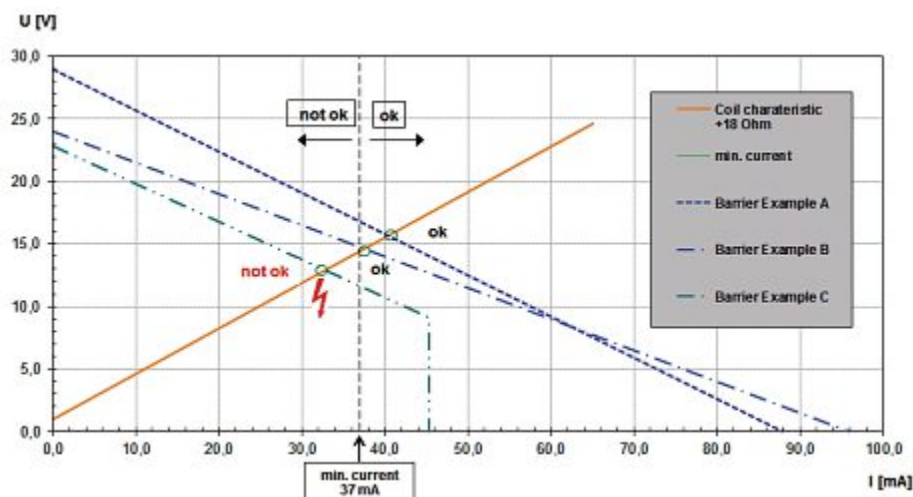
Order Code: MA 30 Ex ia tD II CT6 24 DC

As the coil is 30 mm wide, a spacer plate called „ZPN 5“ has to be used, in case of combination with our NAMUR-valve series 700 refer to page 2.10.14.

ST 30 Ex ia is an ATEX approved connector, especially designed for being used in combination with the intrinsic safety coil. For dust approval (zone 21), this original connector is mandatory. Delivery includes connector ST 30 Ex ia, flat nitril gasket and fixing screw (zinc-plated steel). Form according to A - ISO 4400, no LED, no varistor, operating voltage 0 – 250 V, max. current 10 A, cable diameter 6 – 8 mm.

How to select a suitable barrier:

I/U Characteristics supply units/solenoid coil



The ATEX approval is only valid as long as the associated components are used.

ATEX-approved valves – Ex nA – standard temperature range – aluminum

2.14.3.4.1
page 265



Material: Aluminum, anodized, head PA
Zone: 2, 22
Temperature range: -10°C ... +50°C
Ignition protection type: Ex nA (non-sparking)
Temperature class: T5

Marking on valve

CE Ex II3G/D c T5 -10°C ≤ Ta ≤ 50°C
II3G/D c T6 -10°C ≤ Ta ≤ 50°C


The following solenoid valves are available:

Type	Function	Port size	Installation	Further inform. on valve	Type	Function	Port size	Installation	Further inform. on valve
MH 210 501 Ex nA	2/2-way, single sol.	G 1/8"	in-line	2.5.1.1.11	MH 520 101 Ex nA	5/2-way, double sol.	G 3/8"	in-line	2.5.2.1.10
MH 210 701 Ex nA	2/2-way, single sol.	G 1/4"	in-line	2.5.1.1.11	MH 520 121 Ex nA	5/2-way, double sol.	G 1/2" - NPT	in-line	2.5.2.1.10
MH 311 012 Ex nA	3/2-way direct acting	M5	in-line	2.5.1.1.2	MH 520 501 G Ex nA	5/2-way, double sol.	G 1/8"	dual use*	2.5.2.1.11
MH 311 015 Ex nA	3/2-way direct acting	G 1/8"	in-line	2.5.1.1.2	MH 520 701 G Ex nA	5/2-way, double sol.	G 1/4" - NPT	dual use*	2.5.2.1.11
MH 311 013 Ex nA	3/2-way direct acting	G 1/8"	banjo screw	2.5.1.1.6	MH 520 101 G Ex nA	5/2-way, double sol.	G 3/8"	dual use*	2.5.2.1.12
MH 311 017 Ex nA	3/2-way direct acting	G 1/4"	banjo screw	2.5.1.1.6	MH 520 121 G Ex nA	5/2-way, double sol.	G 1/2"	dual use*	2.5.2.1.12
MH 312 Ex nA	3/2-way direct acting	M5	manifold	2.5.1.2.2	MH 520 504 Ex nA	5/2-way, double sol.	5 mm orifice	manifold	2.5.2.2.8
MH 315 Ex nA	3/2-way direct acting	G 1/8"	manifold	2.5.1.2.2	MH 520 704 Ex nA	5/2-way, double sol.	7 mm orifice	manifold	2.5.2.2.8
MH 310 501 Ex nA	3/2-way, single sol.	G 1/8"	in-line	2.5.1.1.12	MH 53_501 Ex nA	5/3-way, different versions	G 1/8"	in-line	2.5.3.1.2
MOH 310 501 Ex nA	3/2-way, n.o. single sol.	G 1/8"	in-line	2.5.1.1.12	MH 53_701 Ex nA	5/3-way, different versions	G 1/4"	in-line	2.5.3.1.2
MH 310 701 Ex nA	3/2-way, single sol.	G 1/4"	in-line	2.5.1.1.12	MH 53_801 Ex nA	5/3-way, different versions	G 1/4"	in-line	2.5.3.1.2
MOH 310 701 Ex nA	3/2-way, n.o. single sol.	G 1/4"	in-line	2.5.1.1.12	MH 53_101 Ex nA	5/3-way, different versions	G 3/8"	in-line	2.5.3.1.3
MH 310 801 Ex nA	3/2-way, single sol.	G 1/4"	in-line	2.5.1.1.12	MH 53_121 Ex nA	5/3-way, different versions	G 1/2" - NPT	in-line	2.5.3.1.3
MOH 310 801 Ex nA	3/2-way, n.o. single sol.	G 1/4"	in-line	2.5.1.1.12	MH 53_501 G Ex nA	5/3-way, different versions	G 1/8"	dual use*	2.5.3.1.4
MH 310 101 Ex nA	3/2-way, single sol.	G 3/8"	in-line	2.5.1.1.13	MH 53_701 G Ex nA	5/3-way, different versions	G 1/4" - NPT	dual use*	2.5.3.1.4
MOH 310 101 Ex nA	3/2-way, n.o. single sol.	G 3/8"	in-line	2.5.1.1.13	MH 53_101 G Ex nA	5/3-way, different versions	G 3/8"	dual use*	2.5.3.1.5
MH 310 121 Ex nA	3/2-way, single sol.	G 1/2" - NPT	in-line	2.5.1.1.13	MH 53_121 G Ex nA	5/3-way, different versions	G 1/2"	dual use*	2.5.3.1.5
MOH 310 121 Ex nA	3/2-way, n.o. single sol.	G 1/2" - NPT	in-line	2.5.1.1.13	MH 53_504 Ex nA	5/3-way, different versions	5 mm orifice	manifold	2.5.3.2.4
MH 310 501 G Ex nA	3/2-way, single sol.	G 1/8"	dual use*	2.5.1.1.14	MH 53_704 Ex nA	5/3-way, different versions	7 mm orifice	manifold	2.5.3.2.4
MOH 310 501 G Ex nA	3/2-way, n.o. single sol.	G 1/8"	dual use*	2.5.1.1.14	Valves with interface according to Namur standard				
MH 310 701 G Ex nA	3/2-way, single sol.	G 1/4" - NPT	dual use*	2.5.1.1.14	MNH 350 701 Ex nA	3/2-way & 5/2-way	G 1/4" - NPT	1/4" Namur	2.9.1.3
MOH 310 701 G Ex nA	3/2-way, n.o. single sol.	G 1/4" - NPT	dual use*	2.5.1.1.14	MNH 310 701 Ex nA	3/2-way, single sol.	G 1/4" - NPT	1/4" Namur	2.9.1.1.1
MH 310 101 G Ex nA	3/2-way, single sol.	G 3/8"	dual use*	2.5.1.1.15	MNH 310 711 Ex nA	3/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.1.1
MOH 310 101 G Ex nA	3/2-way, n.o. single sol.	G 3/8"	dual use*	2.5.1.1.15	MNH 310 121 Ex nA	3/2-way, single sol.	G 1/2" - NPT	1/2" Namur	2.9.1.1.2
MH 310 121 G Ex nA	3/2-way, single sol.	G 1/2"	dual use*	2.5.1.1.15	MNH 510 701 Ex nA	5/2-way, single sol.	G 1/4" - NPT	1/4" Namur	2.9.1.2.1
MOH 310 121 G Ex nA	3/2-way, n.o. single sol.	G 1/2"	dual use*	2.5.1.1.15	MNH 510 711 Ex nA	5/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.2.1
MH 320 501 Ex nA	3/2-way, double sol.	G 1/8"	in-line	2.5.1.1.16	MNH 510 121 Ex nA	5/2-way, single sol.	G 1/2" - NPT	1/2" Namur	2.9.1.2.2
MH 320 701 Ex nA	3/2-way, double sol.	G 1/4"	in-line	2.5.1.1.16	MNH 520 701 Ex nA	5/2-way, double sol.	G 1/4" - NPT	1/4" Namur	2.9.1.2.3
MH 320 801 Ex nA	3/2-way, double sol.	G 1/4"	in-line	2.5.1.1.16	MNH 520 121 Ex nA	5/2-way, double sol.	G 1/2" - NPT	1/2" Namur	2.9.1.2.3
MH 320 101 Ex nA	3/2-way, double sol.	G 3/8"	in-line	2.5.1.1.17	MNH 53_701 Ex nA	5/3-way, different versions	G 1/4" - NPT	1/4" Namur	2.9.1.4
MH 320 121 Ex nA	3/2-way, double sol.	G 1/2"	in-line	2.5.1.1.17	MNH 531 121 Ex nA	5/3-way, centre closed	G 1/2" - NPT	1/2" Namur	2.9.1.4
MH 320 501 G Ex nA	3/2-way, double sol.	G 1/8"	dual use*	2.5.1.1.18	* dual use valves can either be used in-line or on a manifold plate.				
MH 320 701 G Ex nA	3/2-way, double sol.	G 1/4"	dual use*	2.5.1.1.18					
MH 320 101 G Ex nA	3/2-way, double sol.	G 3/8"	dual use*	2.5.1.1.18					
MH 320 121 G Ex nA	3/2-way, double sol.	G 1/2"	dual use*	2.5.1.1.18					
MH 510 501 Ex nA	5/2-way, single sol.	G 1/8"	in-line	2.5.2.1.3					
MH 510 701 Ex nA	5/2-way, single sol.	G 1/4"	in-line	2.5.2.1.3					
MH 510 801 Ex nA	5/2-way, single sol.	G 1/4"	in-line	2.5.2.1.3					
MH 510 101 Ex nA	5/2-way, single sol.	G 3/8"	in-line	2.5.2.1.4					
MH 510 121 Ex nA	5/2-way, single sol.	G 1/2" - NPT	in-line	2.5.2.1.4					
MH 510 501 G Ex nA	5/2-way, single sol.	G 1/8"	dual use*	2.5.2.1.5					
MH 510 701 G Ex nA	5/2-way, single sol.	G 1/4" - NPT	dual use*	2.5.2.1.5					
MH 510 101 G Ex nA	5/2-way, single sol.	G 3/8"	dual use*	2.5.2.1.6					
MH 510 121 G Ex nA	5/2-way, single sol.	G 1/2"	dual use*	2.5.2.1.6					
MH 510 504 Ex nA	5/2-way, single sol.	5 mm orifice	manifold	2.5.2.2.4					
MH 510 704 Ex nA	5/2-way, single sol.	7 mm orifice	manifold	2.5.2.2.4					
MH 520 501 Ex nA	5/2-way, double sol.	G 1/8"	in-line	2.5.2.1.9					
MH 520 701 Ex nA	5/2-way, double sol.	G 1/4"	in-line	2.5.2.1.9					
MH 520 801 Ex nA	5/2-way, double sol.	G 1/4"	in-line	2.5.2.1.9					

Solenoids are described on page 2.14.3.4.3.
Delivery contains valve with the appropriate operator system, coil, manual and declaration of conformity.

ATEX-approved valves – Ex nA – standard temperature range – stainless steel



Material: Stainless steel, 316L 
 Zone: 2, 22
 Temperature range: -10°C ... +50°C
 Ignition protection type: Ex nA (non-sparking)
 Temperature class: T5

Marking on valve   II3G/D c T5 -10°C ≤ Ta ≤ 50°C
 II3G/D c T6 -10°C ≤ Ta ≤ 50°C

The following **solenoid valves** are available:

Type	Function	Port size	Installation	Further information on valve on page
MH 311 015 VES Ex nA	3/2-way direct acting	G 1/8"	in-line	2.12.3.1
MH 310 701 VES Ex nA	3/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.2
MOH 310 701 VES Ex nA	3/2-way, n.o. single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.2
MH 310 121 VES Ex nA	3/2-way, single sol.	G 1/2" - 1/2" NPT	in-line	2.12.3.3
MH 320 121 VES Ex nA	3/2-way, double sol.	G 1/2"	in-line	2.12.3.3
MH 510 701 VES Ex nA	5/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.4
MH 510 121 VES Ex nA	5/2-way, single sol.	G 1/2" - 1/2" NPT	in-line	2.12.3.4
MH 520 701 VES Ex nA	5/2-way, double sol.	G 1/4" - 1/4" NPT	in-line	2.12.3.5
MH 520 121 VES Ex nA	5/2-way, double sol.	G 1/2" - 1/2" NPT	in-line	2.12.3.5
MH 53_ 701 VES Ex nA	5/3-way, different versions	G 1/4" - 1/4" NPT	in-line	2.12.3.6
MH 53_ 121 VES Ex nA	5/3-way, different versions	G 1/2" - 1/2" NPT	in-line	2.12.3.6

Valves with interface according to Namur standard

MNH 350 701 VES Ex nA	3/2-way & 5/2-way	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.3
MNH 310 701 VES Ex nA	3/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.1
MNH 510 701 VES Ex nA	5/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.2
MNH 520 701 VES Ex nA	5/2-way, double sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.12.4.2

* dual use valves can either be used in-line or on a manifold plate.

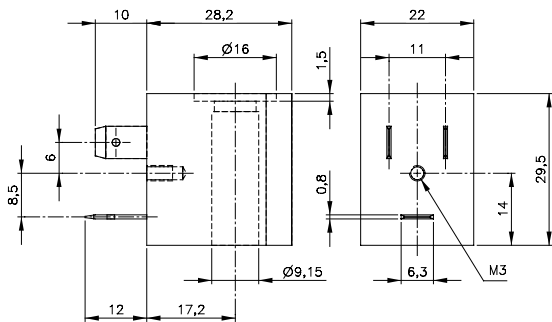
Solenoids are described on page 2.14.3.4.3.

Delivery contains valve with the appropriate operator system, coil, manual and declaration of conformity.

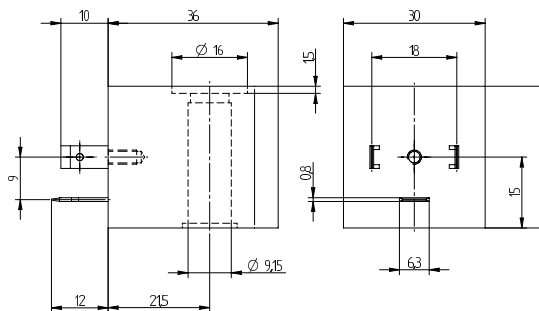
MA 22 EEx nA T5 24DC MA 30 EEx nA T6 24DC

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page 267

When this solenoid system is used in combination with "ATEX certified" mechanical components conforming EN 13463-1:2001 and PrEN 13463-5:2000, the entire valve can be used in explosive hazardous environment zone 2 and 22.



MA 22 EEx nA T5 24DC



MA 30 EEx nA T6 24DC



ATEX approved non-sparking coil for gas and dust explosion-hazardous environment.

Coil:

Voltage tolerance: 24 V DC +/- 10 %

Relative duty cycle: 100 %



Temperature range: -15°... +50° C



Insulation class of insulating materials according to DIN VDE 0580: F

Protection with connector according to EN 60529: IP 65

Moulding material: Termoplasticpolyester

Marking on coil:

T5:   II 3G Ex nA IIC T5 Gc
II 3D Ex tc IIIC 95°C Dc

T6:   II 3G Ex nA IIC T6 Gc
II 3D Ex tc IIIC 80°C Dc

Delivery content without ATEX approved connector.

30 mm wide ATEX connector available, type ST 30 Ex nA.

22 mm wide ATEX connector available, type ST 22 Ex.

Please refer to page 2.13.5.

The ATEX approval is only valid as long as the associated components are used.

Type	Operating press.	Power cons.	Temp. class	Connection
MA 22 EEx nA T5 24DC	max. 10 bar	3,0 Watt	T5 (100° C)	Industryform B (DW 436 50)
MA 30 EEx nA T6 24DC	max. 10 bar	2,0 Watt	T6 (85° C)	Form A (ISO 4400)

Other voltages are available on request.

ATEX-approved valves – Ex e mb – standard temperature range – aluminum



Material: Aluminum, anodized
Zone: 1, 2, 21, 22
Temperature range: -10°C ... +50°C
Ignition protection type: Ex e mb (encapsulation with junction box)
Temperature class: T6

Marking on valve

CE Ex II2G/D c T4 -10°C ≤ Ta ≤ 60°C
II2G/D c T6 -10°C ≤ Ta ≤ 50°C

The following solenoid valves are available:

Type	Function	Port size	Installation	Further information on valve on page
MH 310 501 Ex e mb	3/2-way, single sol.	G 1/8"	in-line	2.5.1.1.12
MOH 310 501 Ex e mb	3/2-way, n.o. single sol.	G 1/8"	in-line	2.5.1.1.12
MH 310 701 Ex e mb	3/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.5.1.1.12
MOH 310 701 Ex e mb	3/2-way, n.o. single sol.	G 1/4" - 1/4" NPT	in-line	2.5.1.1.12
MH 310 801 Ex e mb	3/2-way, single sol.	G 1/4"	in-line	2.5.1.1.12
MOH 310 801 Ex e mb	3/2-way, n.o. single sol.	G 1/4"	in-line	2.5.1.1.12
MH 310 101 Ex e mb	3/2-way, single sol.	G 3/8"	in-line	2.5.1.1.13
MOH 310 101 Ex e mb	3/2-way, n.o. single sol.	G 3/8"	in-line	2.5.1.1.13
MH 310 121 Ex e mb	3/2-way, single sol.	G 1/2" - 1/2" NPT	in-line	2.5.1.1.13
MOH 310 121 Ex e mb	3/2-way, n.o. single sol.	G 1/2" - 1/2" NPT	in-line	2.5.1.1.13
MH 320 501 Ex e mb	3/2-way, double sol.	G 1/8"	in-line	2.5.1.1.16
MH 320 701 Ex e mb	3/2-way, double sol.	G 1/4"	in-line	2.5.1.1.16
MH 320 801 Ex e mb	3/2-way, double sol.	G 1/4"	in-line	2.5.1.1.16
MH 320 101 Ex e mb	3/2-way, double sol.	G 3/8"	in-line	2.5.1.1.17
MH 320 121 Ex e mb	3/2-way, double sol.	G 1/2"	in-line	2.5.1.1.17
MH 510 501 Ex e mb	5/2-way, single sol.	G 1/8"	in-line	2.5.2.1.3
MH 510 701 Ex e mb	5/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.5.2.1.3
MH 510 801 Ex e mb	5/2-way, single sol.	G 1/4"	in-line	2.5.2.1.3
MH 510 101 Ex e mb	5/2-way, single sol.	G 3/8"	in-line	2.5.2.1.4
MH 510 121 Ex e mb	5/2-way, single sol.	G 1/2" - 1/2" NPT	in-line	2.5.2.1.4
MH 520 501 Ex e mb	5/2-way, double sol.	G 1/8"	in-line	2.5.2.1.9
MH 520 701 Ex e mb	5/2-way, double sol.	G 1/4" - 1/4" NPT	in-line	2.5.2.1.9
MH 520 801 Ex e mb	5/2-way, double sol.	G 1/4"	in-line	2.5.2.1.9
MH 520 101 Ex e mb	5/2-way, double sol.	G 3/8"	in-line	2.5.2.1.10
MH 520 121 Ex e mb	5/2-way, double sol.	G 1/2" - 1/2" NPT	in-line	2.5.2.1.10
MH 53_501 Ex e mb	5/3-way, different versions	G 1/8"	in-line	2.5.3.1.2
MH 53_701 Ex e mb	5/3-way, different versions	G 1/4" - 1/4" NPT	in-line	2.5.3.1.2
MH 53_801 Ex e mb	5/3-way, different versions	G 1/4"	in-line	2.5.3.1.2
MH 53_101 Ex e mb	5/3-way, different versions	G 3/8"	in-line	2.5.3.1.3
MH 53_121 Ex e mb	5/3-way, different versions	G 1/2" - 1/2" NPT	in-line	2.5.3.1.3

Valves with interface according to Namur standard

MNH 350 701 Ex e mb	3/2-way & 5/2-way	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.3
MNH 310 701 Ex e mb	3/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.1.1
MNH 310 711 Ex e mb	3/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.1.1
MNH 310 121 Ex e mb	3/2-way, single sol.	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.1.2
MNH 510 701 Ex e mb	5/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.2.1
MNH 510 711 Ex e mb	5/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.2.1
MNH 510 121 Ex e mb	5/2-way, single sol.	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.2.2
MNH 520 701 Ex e mb	5/2-way, double sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.2.3
MNH 520 121 Ex e mb	5/2-way, double sol.	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.2.3
MNH 53_701 Ex e mb	5/3-way, different versions	G 1/4" - 1/4" NPT	1/4" Namur	2.9.1.4
MNH 531 121 Ex e mb	5/3-way, centre closed	G 1/2" - 1/2" NPT	1/2" Namur	2.9.1.4

Solenoids are described on page 2.14.3.5.4.

Example drawings including the solenoid are displayed on page 2.14.3.5.5.

Delivery contains valve with the appropriate operator system, coil, manual and declaration of conformity.

ATEX-approved valves – Ex e mb – low temperature range – aluminum

2.14.3.5.2
page 269



Material: Aluminum, anodized
Zone: 1, 2, 21, 22
Temperature range: -40°C ... +50°C ❄️
Ignition protection type: Ex e mb (encapsulation with junction box)
Temperature class: T6

Marking on valve

CE Ex II2G/D c T4 -40°C ≤ Ta ≤ 60°C
II2G/D c T6 -40°C ≤ Ta ≤ 50°C

The following solenoid valves are available:

Type	Function	Port size	Installation	Further information on valve on page
MH 310 501 TT Ex e mb	3/2-way, single sol.	G 1/8"	in-line	2.11.4.1.2
MOH 310 501 TT Ex e mb	3/2-way, n.o. single sol.	G 1/8"	in-line	2.11.4.1.2
MH 310 701 GTT Ex e mb	3/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.11.4.1.2
MOH 310 701 GTT Ex e mb	3/2-way, n.o. single sol.	G 1/4" - 1/4" NPT	in-line	2.11.4.1.2
MH 320 501 TT Ex e mb	3/2-way, double sol.	G 1/8"	in-line	2.11.4.1.2
MH 320 701 TT Ex e mb	3/2-way, double sol.	G 1/4"	in-line	2.11.4.1.2
MH 510 501 GTT Ex e mb	5/2-way, single sol.	G 1/8"	in-line	2.11.4.2.1
MH 510 701 GTT Ex e mb	5/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.11.4.2.1
MH 520 501 GTT Ex e mb	5/2-way, double sol.	G 1/8"	in-line	2.11.4.2.2
MH 520 701 GTT Ex e mb	5/2-way, double sol.	G 1/4" - 1/4" NPT	in-line	2.11.4.2.2
MH 53_ 501 GTT Ex e mb	5/3-way, different versions	G 1/8"	in-line	2.11.4.2.2
MH 53_ 701 GTT Ex e mb	5/3-way, different versions	G 1/4" - 1/4" NPT	in-line	2.11.4.2.2

Valves with interface according to Namur standard

MNH 310 701 TT Ex e mb	3/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.11.5.1
MNH 510 701 TT Ex e mb	5/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.11.5.2.1
MNH 510 711 TT Ex e mb	5/2-way, single sol.	G 1/4"	1/4" Namur	2.11.5.2.1
MNH 520 701 TT Ex e mb	5/2-way, double sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.11.5.2.2
MNH 531 701 TT Ex e mb	5/3-way, centre closed	G 1/4" - 1/4" NPT	1/4" Namur	2.11.5.2.2



Solenoids are described on page 2.14.3.5.4.

Example drawings including the solenoid are displayed on page 2.14.3.5.5.

Delivery contains valve with the appropriate operator system, coil, manual and declaration of conformity.

ATEX-approved valves – Ex e mb – low temperature range – stainless steel



Material: Stainless steel, 316L 
 Zone: 1, 2, 21, 22
 Temperature range: -40°C ... +50°C 
 Ignition protection type: Ex e mb (encapsulation with junction box)
 Temperature class: T6

Marking on valve   II2G/D c T4 -40°C ≤ Ta ≤ 60°C
 II2G/D c T6 -40°C ≤ Ta ≤ 50°C

The following **solenoid valves** are available:

Type	Function	Port size	Installation	Further information on valve on page
MH 310 701 VES TT Ex e mb	3/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.10.3.2
MOH 310 701 VES TT Ex e mb	3/2-way, n.o. single sol.	G 1/4" - 1/4" NPT	in-line	2.10.3.2
MH 510 701 VES TT Ex e mb	5/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.10.3.4
MH 520 701 VES TT Ex e mb	5/2-way, double sol.	G 1/4" - 1/4" NPT	in-line	2.10.3.5
MH 53_701 VES TT Ex e mb	5/3-way, different version	G 1/4" - 1/4" NPT	in-line	2.10.3.6

Valves with interface according to Namur standard

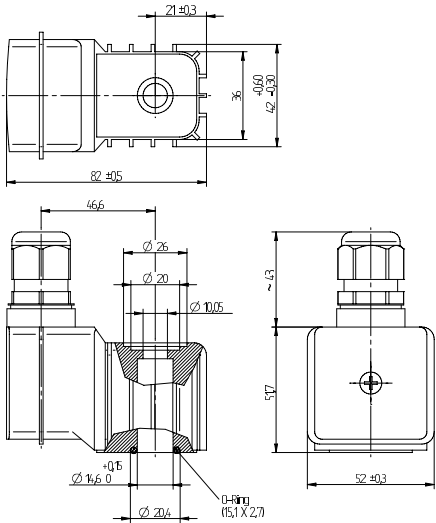
MNH 350 701 VES TT Ex e mb	3/2-way & 5/2-way	G 1/4" - 1/4" NPT	1/4" Namur	2.10.4.3
MNH 310 701 VES TT Ex e mb	3/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.10.4.1
MNH 310 711 VES TT Ex e mb	3/2-way, single sol.	G 1/4"	1/4" Namur	2.10.4.1
MNH 510 701 VES TT Ex e mb	5/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.10.4.2
MNH 510 711 VES TT Ex e mb	5/2-way, single sol.	G 1/4"	1/4" Namur	2.10.4.2
MNH 520 701 VES TT Ex e mb	5/2-way, double sol.	G 1/4" - 1/4" NPT	1/4" Namur	2.10.4.2

Solenoids are described on page 2.14.3.5.4.

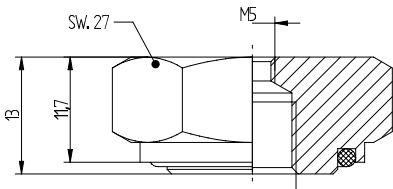
Example drawings including the solenoid are displayed on page 2.14.3.5.5.

Delivery contains valve with the appropriate operator system, coil, manual and declaration of conformity.
 1/2" stainless steel valves in standard temperature range on request.

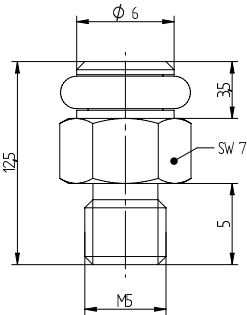
When this solenoid system is used in combination with “ATEX certified” mechanical components conforming EN 13463-1:2001 and PrEN 13463-5:2000, the entire valve can be used in explosive hazardous environment zone 1 and 21.



MA 52 EEx e mb IIC T6



M G1/8 M5



ESR M5



Details of junction box

ATEX approved encapsulated coil with junction box for gas and dust explosion-hazardous environment.

Voltage tolerance:	- 10...+ 10%
Relative duty cycle:	100 %
Temperature range:	-40°C...+50°C
Insulation class of insulating Materials according to DIN VDE 0580:	F
Protection according to EN 60529:	IP 65 (IP 67 with nut type M G1/8 M5 in combination with exhaust protection fitting type ESR M5)
Moulding material:	Thermoplasticpolyester
Cable Gland:	M20 x 1,5 for cable diameters 6 – 13 mm

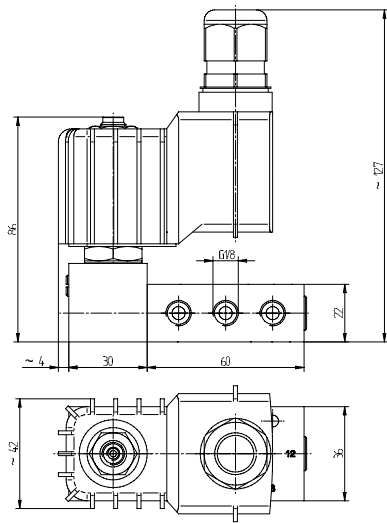
Please note:
Same coil for DC and AC.

Marking on coil:   II 2G Ex e mb IIC T6 Gb
II 2D Ex tb mb IIIC T80°C Db

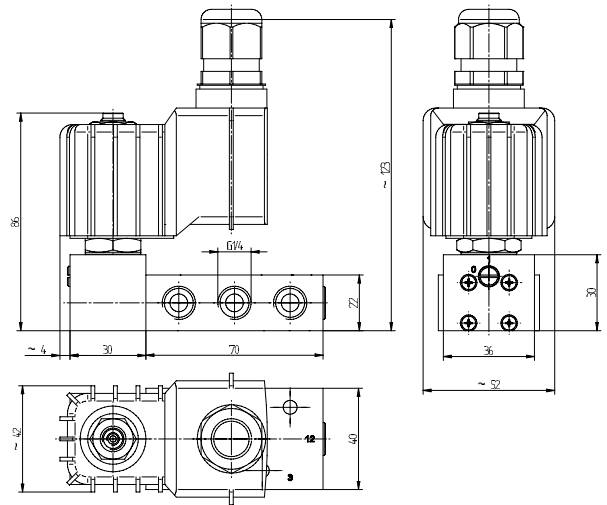
The ATEX approval is only valid as long as the associated components are used.

Type	Operating press.	Power cons.	Temperature class
MA 52 EEx e mb IIC T6 24	max. 10 bar	4,8 Watt / 4,3 VA	T6 (85° C)
MA 52 EEx e mb IIC T6 110	max. 10 bar	4,4 VA	T6 (85° C)
MA 52 EEx e mb IIC T6 230	max. 10 bar	4,8 VA	T6 (85° C)

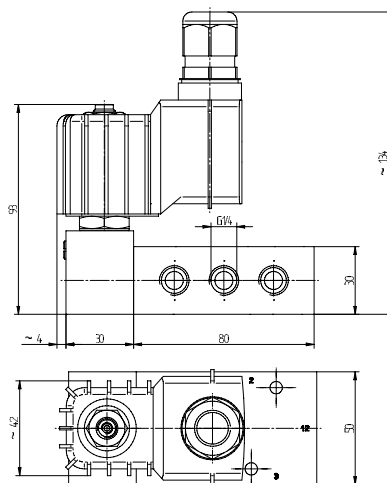
Example drawings of solenoid valves with Ex e mb solenoid system



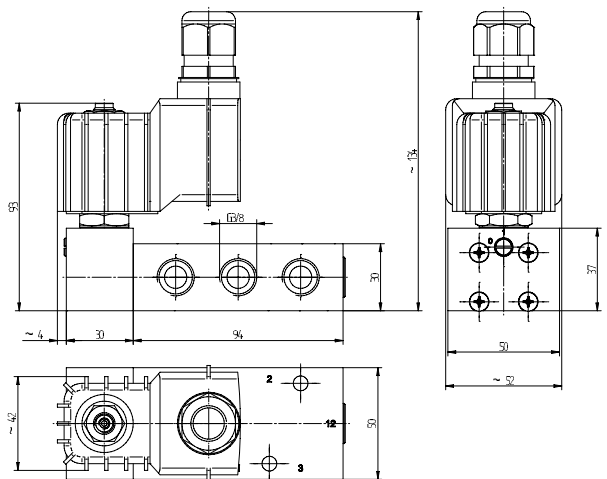
MH 510 501 Ex e mb IIC T6



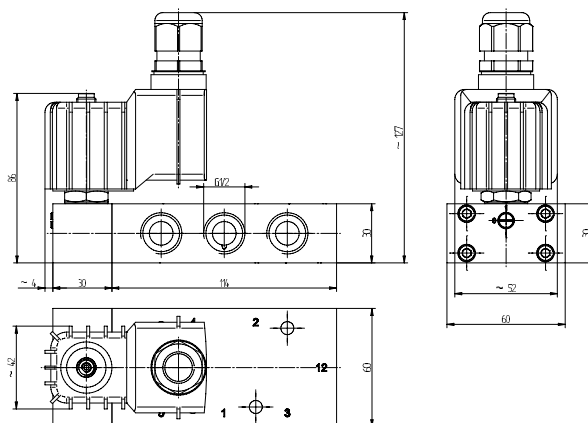
MH 510 701 Ex e mb IIC T6 /
MNH 510 701 EX e mb IIC T6



MH 510 801 Ex e mb IIC T6



MH 510 101 Ex e mb IIC T6



MH 510 121 Ex e mb IIC T6 /
MNH 510 121 Ex e mb IIC T6

ATEX-approved valves – Ex d – standard temperature range – aluminum

2.14.3.6.1
page 273



Interface between valve body and solenoid system according to CNOMO, therefore the types are called MC.

Base plate assembly due to solenoid coil is not possible.

Flameproof solenoids are displayed on page 2.14.3.6.5.

Example drawings including the solenoid are displayed on page 2.14.3.6.6.

Material: Aluminum, anodized
Zone: 1, 2, 21, 22
Temperature range: -10°C ... +50°C
Solenoid coil limited to +40°C
Ignition protection type: Ex d – flameproof
Temperature class: T6 (solenoid)

Marking on valve   II2G/D c T6 -10°C ≤ Ta ≤ 40°C

The following solenoid valves are available:

Type	Function	Port size	Installation	Further information on valve on page
MC 210 501 Ex d	2/2-way, single sol.	G 1/8"	in-line	2.5.1.1.11
MC 210 701 Ex d	2/2-way, single sol.	G 1/4"	in-line	2.5.1.1.11
MC 310 501 Ex d	3/2-way, single sol.	G 1/8"	in-line	2.5.1.1.12
MOC 310 501 Ex d	3/2-way, n.o. single sol.	G 1/8"	in-line	2.5.1.1.12
MC 310 701 Ex d	3/2-way, single sol.	G 1/4"	in-line	2.5.1.1.12
MOC 310 701 Ex d	3/2-way, n.o. single sol.	G 1/4"	in-line	2.5.1.1.12
MC 310 121 Ex d	3/2-way, single sol.	G 1/2"	in-line	2.5.1.1.13
MOC 310 121 Ex d	3/2-way, n.o. single sol.	G 1/2"	in-line	2.5.1.1.13
MC 320 501 Ex d	3/2-way, double sol.	G 1/8"	in-line	2.5.1.1.16
MC 320 701 Ex d	3/2-way, double sol.	G 1/4"	in-line	2.5.1.1.16
MC 320 121 Ex d	3/2-way, double sol.	G 1/2"	in-line	2.5.1.1.17
MC 510 501 Ex d	5/2-way, single sol.	G 1/8"	in-line	2.5.2.1.3
MC 510 701 Ex d	5/2-way, single sol.	G 1/4"	in-line	2.5.2.1.3
MC 510 121 Ex d	5/2-way, single sol.	G 1/2"	in-line	2.5.2.1.4
MC 520 501 Ex d	5/2-way, double sol.	G 1/8"	in-line	2.5.2.1.9
MC 520 701 Ex d	5/2-way, double sol.	G 1/4"	in-line	2.5.2.1.9
MC 520 121 Ex d	5/2-way, double sol.	G 1/2"	in-line	2.5.2.1.10
MC 53_ 501 Ex d	5/3-way, different version	G 1/8"	in-line	2.5.3.1.2
MC 53_ 701 Ex d	5/3-way, different version	G 1/4"	in-line	2.5.3.1.2
MC 53_ 121 Ex d	5/3-way, different version	G 1/2"	in-line	2.5.3.1.3

Valves with interface according to NAMUR-standard				
MNC 350 701 Ex d	3/2-way & 5/2-way	G 1/4"	1/4" NAMUR	2.9.1.3
MNC 310 701 Ex d	3/2-way, single sol.	G 1/4"	1/4" NAMUR	2.9.1.1.1
MNC 310 711 Ex d	3/2-way, single sol.	G 1/4"	1/4" NAMUR	2.9.1.1.1
MNC 310 121 Ex d	3/2-way, single sol.	G 1/2"	1/2" NAMUR	2.9.1.1.2
MNC 510 701 Ex d	5/2-way, single sol.	G 1/4"	1/4" NAMUR	2.9.1.2.1
MNC 510 711 Ex d	5/2-way, single sol.	G 1/4"	1/4" NAMUR	2.9.1.2.1
MNC 510 121 Ex d	5/2-way, single sol.	G 1/2"	1/2" NAMUR	2.9.1.2.2
MNC 520 701 Ex d	5/2-way, double sol.	G 1/4"	1/4" NAMUR	2.9.1.2.3
MNC 520 121 Ex d	5/2-way, double sol.	G 1/2"	1/2" NAMUR	2.9.1.2.3
MNC 53_ 701 Ex d	5/3-way, different version	G 1/4"	1/4" NAMUR	2.9.1.4
MNC 53_ 121 Ex d	5/3-way, different version	G 1/2"	1/2" NAMUR	2.9.1.4

Delivery contains valve with appropriate operator system, coil, manual and declaration of conformity.

ATEX-approved valves – Ex d – low temperature range – aluminium



Material: Aluminum, anodized
Zone: 1, 2, 21, 22
Temperature range: -50°C ... +50°C ❄️
Solenoid coil limited to
-40°C ... +40°C,
solenoids for -65°C on request
Ignition protection type: Ex d – flameproof
Temperature class: T6 (solenoid)

Interface between valve body and solenoid system
according to CNOMO, therefore the types are called
MC.

Base plate assembly due to solenoid coil is not
possible.

Flameproof solenoids type MA 52 EEx d IIC T6 24DC VES
are displayed on page 2.14.3.6.5.

Marking on valve   II2G/D c T6 -50°C ≤ Ta ≤ 40°C

Example drawings including the solenoid are
displayed on page 2.14.3.6.6.

The following **solenoid valves** are available:

Type	Function	Port size	Installation	Further information on valve on page
MC 310 501 TT Ex d	3/2-way, single sol.	G 1/8"	in-line	2.11.4.1.2
MOC 310 501 TT Ex d	3/2-way, n.o. single sol.	G 1/8"	in-line	2.11.4.1.2
MC 310 701 GTT Ex d	3/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.11.4.1.2
MOC 310 701 GTT Ex d	3/2-way, n.o. single sol.	G 1/4" - 1/4" NPT	in-line	2.11.4.1.2
MC 320 501 TT Ex d	3/2-way, double sol.	G 1/8"	in-line	2.11.4.1.2
MC 320 701 GTT Ex d	3/2-way, double sol.	G 1/4"	in-line	2.11.4.1.2
MC 510 501 GTT Ex d	5/2-way, single sol.	G 1/8"	in-line	2.11.4.2.1
MC 510 701 GTT Ex d	5/2-way, single sol.	G 1/4" - 1/4" NPT	in-line	2.11.4.2.1
MC 520 501 GTT Ex d	5/2-way, double sol.	G 1/8"	in-line	2.11.4.2.2
MC 520 701 GTT Ex d	5/2-way, double sol.	G 1/4" - 1/4" NPT	in-line	2.11.4.2.2
MC 53_ 501 GTT Ex d	5/3-way, different version	G 1/8"	in-line	2.11.4.2.2
MC 53_ 701 GTT Ex d	5/3-way, different version	G 1/4" - 1/4" NPT	in-line	2.11.4.2.2

Valves with interface according to NAMUR-standard				
MNC 310 701 TT Ex d	3/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" NAMUR	2.11.5.1
MNC 510 701 TT Ex d	5/2-way, single sol.	G 1/4" - 1/4" NPT	1/4" NAMUR	2.11.5.2.1
MNC 510 711 TT Ex d	5/2-way, single sol.	G 1/4"	1/4" NAMUR	2.11.5.2.1
MNC 520 701 TT Ex d	5/2-way, double sol.	G 1/4" - 1/4" NPT	1/4" NAMUR	2.11.5.2.2
MNC 531 701 TT Ex d	5/3-way, different version	G 1/4" - 1/4" NPT	1/4" NAMUR	2.11.5.2.2

ATEX-approved valves – Ex d – standard temperature range – stainless steel

2.14.3.6.3
page 275




Interface between valve body and solenoid system according to CNOMO, therefore the types are called MC.

Base plate assembly due to solenoid coil is not possible.

Flameproof solenoids type MA 52 EEx d IIC T6 24DC VES are displayed on page 2.14.3.6.5.

Example drawings including the solenoid are displayed on page 2.14.3.6.6.

Material: Stainless steel, 316L 
Zone: 1, 2, 21, 22
Temperature range: -10°C ... +50°C
Solenoid coil limited to +40°C
Ignition protection type: Ex d – flameproof
Temperature class: T6 solenoid

Marking on valve   II2G/D c T6 -10°C ≤ Ta ≤ 40°C





The following **solenoid valves** are available:

Type	Function	Port size	Installation	Further information on valve on page
MC 310 701 VES Ex d	3/2-way, single sol.	G 1/4"	in-line	2.12.3.2
MOC 310 701 VES Ex d	3/2-way, n.o. single sol.	G 1/4"	in-line	2.12.3.2
MC 310 121 VES Ex d	3/2-way, single sol.	G 1/2"	in-line	2.12.3.3
MC 510 701 VES Ex d	5/2-way, single sol.	G 1/4"	in-line	2.12.3.4
MC 510 121 VES Ex d	5/2-way, single sol.	G 1/2"	in-line	2.12.3.4
MC 520 701 VES Ex d	5/2-way, double sol.	G 1/4"	in-line	2.12.3.5
MC 520 121 VES Ex d	5/2-way, double sol.	G 1/2"	in-line	2.12.3.5
MC 53_ 701 VES Ex d	5/3-way, different version	G 1/4"	in-line	2.12.3.6
MC 53_ 121 VES Ex d	5/3-way, different version	G 1/2"	in-line	2.12.3.6
Valves with interface according to NAMUR-standard				
MNC 350 701 VES Ex d	3/2-way & 5/2-way	G 1/4"	1/4" NAMUR	2.12.4.3
MNC 310 701 VES Ex d	3/2-way, single sol.	G 1/4"	1/4" NAMUR	2.12.4.1
MNC 510 701 VES Ex d	5/2-way, single sol.	G 1/4"	1/4" NAMUR	2.12.4.2
MNC 520 701 VES Ex d	5/2-way, double sol.	G 1/4"	1/4" NAMUR	2.12.4.2

Delivery contains valve with appropriate operator system, coil, manual and declaration of conformity.

ATEX-approved valves – Ex d – low temperature range – stainless steel



Material:	Stainless steel, 316L 	Interface between valve body and solenoid system according to CNOMO, therefore the types are called MC.
Zone:	1, 2, 21, 22	
Temperature range:	-50°C ... +50°C  Solenoid coil limited to -40°C ... +40°C, solenoids for -65°C on request	Base plate assembly due to solenoid coil is not possible.
Ignition protection type:	Ex d – flameproof	
Temperature class:	T6 (solenoid)	Flameproof solenoids type MA 52 EEx d IIC T6 24DC VES are displayed on page 2.14.3.6.5.
Marking on valve	  II2G/D c T6 -50°C ≤ Ta ≤ 40°C	Example drawings including the solenoid are displayed on page 2.14.3.6.6.

The following **solenoid valves** are available:

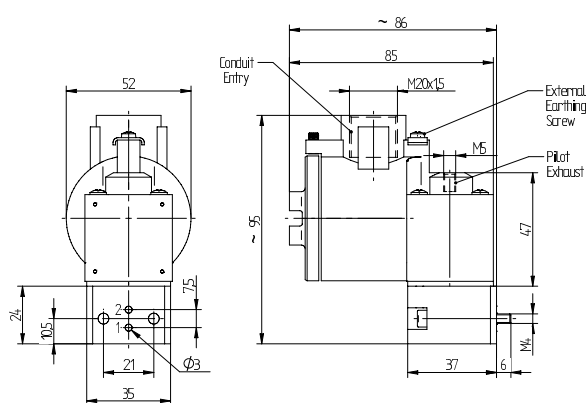
Type	Function	Port size	Installation	Further information on valve on page
MC 310 701 VES TT Ex d	3/2-way, single sol.	G 1/4"	in-line	2.12.3.2
MOC 310 701 VES TT Ex d	3/2-way, n.o. single sol.	G 1/4"	in-line	2.12.3.2
MC 510 701 VES TT Ex d	5/2-way, single sol.	G 1/4"	in-line	2.12.3.4
MC 520 701 VES TT Ex d	5/2-way, double sol.	G 1/4"	in-line	2.12.3.5
MC 53_701 VES TT Ex d	5/3-way, different version	G 1/4"	in-line	2.12.3.6

Valves with interface according to NAMUR-standard				
MNC 350 701 VES TT Ex d	3/2-way & 5/2-way	G 1/4"	1/4" NAMUR	2.12.4.3
MNC 310 701 VES TT Ex d	3/2-way, single sol.	G 1/4"	1/4" NAMUR	2.12.4.1
MNC 510 701 VES TT Ex d	5/2-way, single sol.	G 1/4"	1/4" NAMUR	2.12.4.2
MNC 520 701 VES TT Ex d	5/2-way, double sol.	G 1/4"	1/4" NAMUR	2.12.4.2

MA 52 EEx d IIC T6 24 DC/ MA 52 EEx d IIC T6 24 DC VES



2.14.3.6.5
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When this solenoid system is used in combination with "ATEX certified" mechanical components conforming EN 13463-1:2001 and PrEN 13463-5:2000, the entire valve can be used in explosive hazardous environment zone 1 and 21.



MA 52 EEx D IIC T6_ _ (VES)

ATEX approved flameproof coil for gas and dust explosion hazardous environment.
Solenoids with IEC-Ex certificate on request.

Voltage:	24VDC
Voltage tolerance:	- 10...+ 10 %
Relative duty cycle:	100 %
Temperature range:	-40°C...+40°C, up to -65°C on request, valve limited to -50°C
Ignition protection type:	flameproof
Protection according to ENBS60529 : 1992 :	IP 66 with appropriate cable gland
Material solenoid coil:	Stainless Steel
Coil rating according to DIN VDE 0580:	Class F
Cable Gland:	M20 x 1.5
Marking on coil:	  II 2G Ex d IIC T6 II 2D Ex tD A21 IP66 T85°C

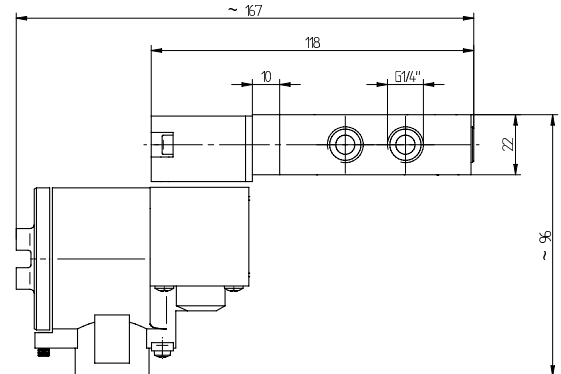
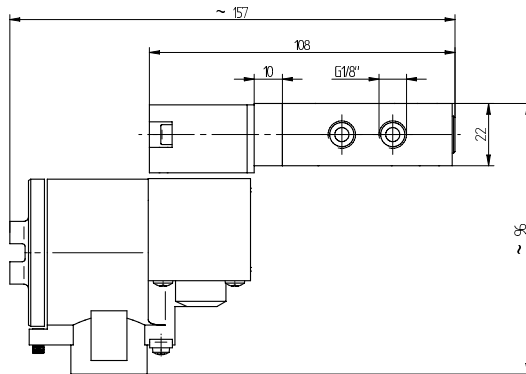
Delivery content without cable gland. Ex d rated cable glands can be supplied on request.

Technical details pilot head :

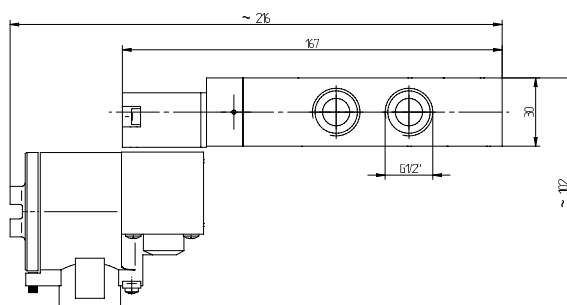
Material :	Standard: Aluminum Type VES: Stainless Steel
Manual override:	bistable to turn, others on request

The ATEX approval is only valid as long as the associated components are used.

Type	Operating press.	Power cons.	Temperature class
MA 52 EEx d IIC T6 24 DC	max. 10 bar	3,0 Watt	T6 (85° C)
MA 52 EEx d IIC T6 24 DC VES	max. 10 bar	3,0 Watt	T6 (85° C)

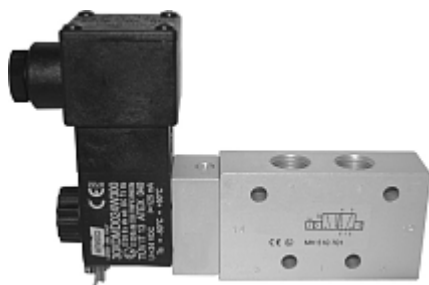


Technical drawing of a mechanical part, showing a side view and a top view. The side view on the left shows a cylindrical component with a central hole and a flange. The top view on the right shows a rectangular plate with a central hole and four smaller holes. Dimensions are given in millimeters (mm). The top view dimensions include a total width of 64 mm, a central hole diameter of $\Phi 6.6$, and a distance of 32 mm between the central hole and the outer holes. The side view dimensions include a total height of 57 mm and a distance of 12 mm from the top edge to the center of the central hole. The top view also shows a distance of 14 mm from the left edge to the center of the central hole. The side view shows a distance of 12 mm from the top edge to the center of the central hole. The top view shows a distance of 12 mm from the top edge to the center of the central hole. The side view shows a distance of 12 mm from the top edge to the center of the central hole. The top view shows a distance of 12 mm from the top edge to the center of the central hole.



ATEX-approved valves – Ex dm – standard temperature range – aluminum

2.14.3.7.1
page 279



Material: Aluminum, anodized
Zone: 1, 2, 21, 22
Temperature range: -10°C ... +50°C
Ignition protection type: Ex dm (encapsulated-flameproof with junction box)
Temperature class: T5

Marking on valve:   II2G/D c T5 -10°C ≤ Ta ≤ 50°C

Base plate assembly due to width of solenoid coil (36 mm) is not possible.

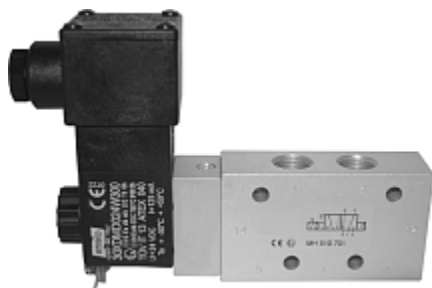
Encapsulated flameproof solenoids are displayed on page 2.14.3.7.5.

The following solenoid valves are available:

Type	Function	Port size	Installation	Further inform. on valve	Valves with interface according to NAMUR-standard				
Type	Function	Port size	Installation	Further inform. on valve	Type	Function	Port size	Installation	Further inform. on valve
MH 210 501 Ex dm	2/2-way, single sol.	G 1/8"	in-line	2.5.1.1.11	MNH 350 701 Ex dm	3/2-way & 5/2-way	G 1/4"	1/4" Namur	2.9.1.3
MH 210 701 Ex dm	2/2-way, single sol.	G 1/4"	in-line	2.5.1.1.11	MNH 310 701 Ex dm	3/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.1.1
MH 311 012 Ex dm	3/2-way direct acting	M5	in-line	2.5.1.1.2	MNH 310 711 Ex dm	3/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.1.1
MH 311 015 Ex dm	3/2-way direct acting	G 1/8"	in-line	2.5.1.1.2	MNH 310 121 Ex dm	3/2-way, single sol.	G 1/2"	1/2" Namur	2.9.1.1.2
MH 310 501 Ex dm	3/2-way, single sol.	G 1/8"	in-line	2.5.1.1.12	MNH 510 701 Ex dm	5/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.2.1
MOH 310 501 Ex dm	3/2-way, n.o. single sol.	G 1/8"	in-line	2.5.1.1.12	MNH 510 711 Ex dm	5/2-way, single sol.	G 1/4"	1/4" Namur	2.9.1.2.1
MH 310 701 Ex dm	3/2-way, single sol.	G 1/4"	in-line	2.5.1.1.12	MNH 510 121 Ex dm	5/2-way, single sol.	G 1/2"	1/2" Namur	2.9.1.2.2
MOH 310 701 Ex dm	3/2-way, n.o. single sol.	G 1/4"	in-line	2.5.1.1.12	MNH 520 701 Ex dm	5/2-way, double sol.	G 1/4"	1/4" Namur	2.9.1.2.3
MH 310 801 Ex dm	3/2-way, single sol.	G 1/4"	in-line	2.5.1.1.12	MNH 520 121 Ex dm	5/2-way, double sol.	G 1/2"	1/2" Namur	2.9.1.2.3
MOH 310 801 Ex dm	3/2-way, n.o. single sol.	G 1/4"	in-line	2.5.1.1.12	MNH 53_701 Ex dm	5/3-way, different version	G 1/4"	1/4" Namur	2.9.1.4
MH 310 101 Ex dm	3/2-way, single sol.	G 3/8"	in-line	2.5.1.1.13	MNH 53_121 Ex dm	5/3-way, different version	G 1/2"	1/2" Namur	2.9.1.4
MOH 310 101 Ex dm	3/2-way, n.o. single sol.	G 3/8"	in-line	2.5.1.1.13					
MH 310 121 Ex dm	3/2-way, single sol.	G 1/2"	in-line	2.5.1.1.13					
MOH 310 121 Ex dm	3/2-way, n.o. single sol.	G 1/2"	in-line	2.5.1.1.13					
MH 320 501 Ex dm	3/2-way, double sol.	G 1/8"	in-line	2.5.1.1.16					
MH 320 701 Ex dm	3/2-way, double sol.	G 1/4"	in-line	2.5.1.1.16					
MH 320 801 Ex dm	3/2-way, double sol.	G 1/4"	in-line	2.5.1.1.16					
MH 320 101 Ex dm	3/2-way, double sol.	G 3/8"	in-line	2.5.1.1.17					
MH 320 121 Ex dm	3/2-way, double sol.	G 1/2"	in-line	2.5.1.1.17					
MH 510 501 Ex dm	5/2-way, single sol.	G 1/8"	in-line	2.5.2.1.3					
MH 510 701 Ex dm	5/2-way, single sol.	G 1/4"	in-line	2.5.2.1.3					
MH 510 801 Ex dm	5/2-way, single sol.	G 1/4"	in-line	2.5.2.1.3					
MH 510 101 Ex dm	5/2-way, single sol.	G 3/8"	in-line	2.5.2.1.4					
MH 510 121 Ex dm	5/2-way, single sol.	G 1/2"	in-line	2.5.2.1.4					
MH 520 501 Ex dm	5/2-way, double sol.	G 1/8"	in-line	2.5.2.1.9					
MH 520 701 Ex dm	5/2-way, double sol.	G 1/4"	in-line	2.5.2.1.9					
MH 520 801 Ex dm	5/2-way, double sol.	G 1/4"	in-line	2.5.2.1.9					
MH 520 101 Ex dm	5/2-way, double sol.	G 3/8"	in-line	2.5.2.1.10					
MH 520 121 Ex dm	5/2-way, double sol.	G 1/2"	in-line	2.5.2.1.10					
MH 53_501 Ex dm	5/3-way, different version	G 1/8"	in-line	2.5.3.1.2					
MH 53_701 Ex dm	5/3-way, different version	G 1/4"	in-line	2.5.3.1.2					
MH 53_801 Ex dm	5/3-way, different version	G 1/4"	in-line	2.5.3.1.2					
MH 53_101 Ex dm	5/3-way, different version	G 3/8"	in-line	2.5.3.1.3					
MH 53_121 Ex dm	5/3-way, different version	G 1/2"	in-line	2.5.3.1.3					

Delivery contains valve with appropriate operator system, coil, manual and declaration of conformity.

ATEX-approved valves – Ex dm – low temperature range – aluminum



Material: Aluminum, anodized
Zone: 1, 2, 21, 22
Temperature range: -50°C ... +50°C ❄️
Ignition protection type: Ex dm (encapsulated-flameproof with junction box)
Temperature class: T5

Marking on valve:   II2G/D c T5 -50°C ≤ Ta ≤ 50°C

Base plate assembly due to width of solenoid coil (36 mm) is not possible.

Encapsulated flameproof solenoids are displayed on page 2.14.3.7.5.

The following **solenoid valves** are available:

Type	Function	Port size	Installation	Further information on valve on page
MH 311 012 TT Ex dm	3/2-way direct acting	M5	in-line	2.11.4.1.1
MH 311 015 TT Ex dm	3/2-way direct acting	G 1/8"	in-line	2.11.4.1.1
MH 310 501 TT Ex dm	3/2-way, single sol.	G 1/8"	in-line	2.11.4.1.2
MOH 310 501 TT Ex dm	3/2-way, n.o. single sol.	G 1/8"	in-line	2.11.4.1.2
MH 310 701 GTT Ex dm	3/2-way, single sol.	G 1/4"	in-line	2.11.4.1.2
MOH 310 701 GTT Ex dm	3/2-way, n.o. single sol.	G 1/4"	in-line	2.11.4.1.2
MH 320 501 TT Ex dm	3/2-way, double sol.	G 1/8"	in-line	2.11.4.1.2
MH 320 701 GTT Ex dm	3/2-way, double sol.	G 1/4"	in-line	2.11.4.1.2
MH 510 501 GTT Ex dm	5/2-way, single sol.	G 1/8"	in-line	2.11.4.2.1
MH 510 701 GTT Ex dm	5/2-way, single sol.	G 1/4"	in-line	2.11.4.2.1
MH 520 501 GTT Ex dm	5/2-way, double sol.	G 1/8"	in-line	2.11.4.2.2
MH 520 701 GTT Ex dm	5/2-way, double sol.	G 1/4"	in-line	2.11.4.2.2
MH 53_ 501 GTT Ex dm	5/3-way, different version	G 1/8"	in-line	2.11.4.2.2
MH 53_ 701 GTT Ex dm	5/3-way, different version	G 1/4"	in-line	2.11.4.2.2


Valves with interface according to NAMUR-standard

MNH 310 701 TT Ex dm	3/2-way, single sol.	G 1/4"	1/4" Namur	2.11.5.1
MNH 510 701 TT Ex dm	5/2-way, single sol.	G 1/4"	1/4" Namur	2.11.5.2.1
MNH 510 711 TT Ex dm	5/2-way, single sol.	G 1/4"	1/4" Namur	2.11.5.2.1
MNH 520 701 TT Ex dm	5/2-way, double sol.	G 1/4"	1/4" Namur	2.11.5.2.2
MNH 53_ 701 TT Ex dm	5/3-way, different version	G 1/4"	1/4" Namur	2.11.5.2.2

ATEX-approved valves – Ex dm – standard temperature range – stainless steel

2.14.3.7.3
page 281



Material: Stainless steel, 316L 
Zone: 1, 2, 21, 22
Temperature range: -10°C ... +50°C
Ignition protection type: Ex dm (encapsulated-flameproof with junction box)
Temperature class: T5

Marking on valve:   II2G/D c T5 -10°C ≤ Ta ≤ 50°C

If the coil will be used with a NAMUR-valve of series 700, an 8 mm distance plate is required. Please contact us.

Encapsulated flameproof solenoids are displayed on page 2.14.3.7.5.

The following solenoid valves are available:



Type	Function	Port size	Installation	Further information on valve on page
MH 311 015 VES Ex dm	3/2-way direct acting	G 1/8"	in-line	2.12.3.1
MH 310 701 VES Ex dm	3/2-way, single sol.	G 1/4"	in-line	2.12.3.2
MOH 310 701 VES Ex dm	3/2-way, n.o. single sol.	G 1/4"	in-line	2.12.3.2
MH 310 121 VES Ex dm	3/2-way, single sol.	G 1/2"	in-line	2.12.3.3
MOH 310 121 VES Ex dm	3/2-way, n.o. single sol.	G 1/2"	in-line	2.12.3.3
MH 510 701 VES Ex dm	5/2-way, single sol.	G 1/4"	in-line	2.12.3.4
MH 510 121 VES Ex dm	5/2-way, single sol.	G 1/2"	in-line	2.12.3.4
MH 520 701 VES Ex dm	5/2-way, double sol.	G 1/4"	in-line	2.12.3.5
MH 520 121 VES Ex dm	5/2-way, double sol.	G 1/2"	in-line	2.12.3.5
MH 53_ 701 VES Ex dm	5/3-way, different version	G 1/4"	in-line	2.12.3.6
MH 53_ 121 VES Ex dm	5/3-way, different version	G 1/2"	in-line	2.12.3.6

Valves with interface according to NAMUR-standard				
MNH 350 701 VES Ex dm	3/2-way & 5/2-way	G 1/4"	1/4" NAMUR	2.12.4.3
MNH 310 701 VES Ex dm	3/2-way, single sol.	G 1/4"	1/4" NAMUR	2.12.4.1
MNH 510 701 VES Ex dm	5/2-way, single sol.	G 1/4"	1/4" NAMUR	2.12.4.2
MNH 520 701 VES Ex dm	5/2-way, double sol.	G 1/4"	1/4" NAMUR	2.12.4.2

Delivery contains valve with appropriate operator system, coil, manual and declaration of conformity.

ATEX-approved valves – Ex dm – low temperature range – stainless steel



Material: Stainless steel, 316L 
Zone: 1, 2, 21, 22
Temperature range: -50°C ... +50°C 
Ignition protection type: Ex dm (encapsulated-flameproof with junction box)
Temperature class: T5

Marking on valve:   II2G/D c T5 -50°C ≤ Ta ≤ 50°C

If the coil will be used with a NAMUR-valve of series 700, an 8 mm distance plate is required. Please contact us.

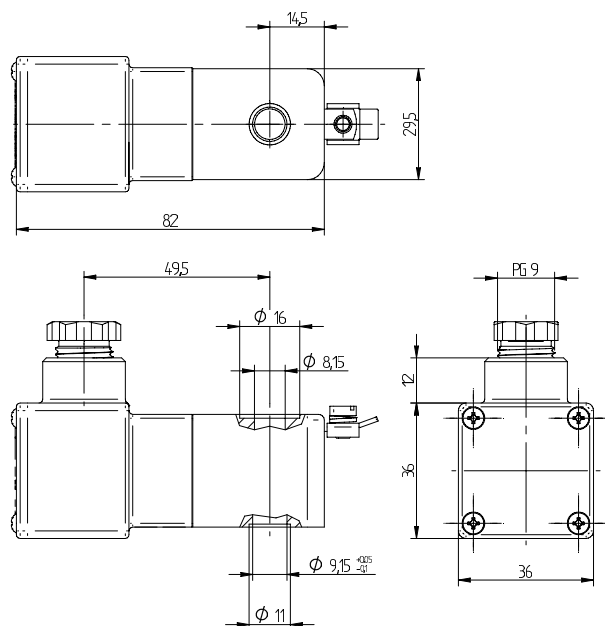
Encapsulated flameproof solenoids are displayed on page 2.14.3.7.5.

The following solenoid valves are available:

Type	Function	Port size	Installation	Further information on valve on page
MH 311 015 VES TT Ex dm	3/2-way direct acting	G 1/8"	in-line	2.12.3.1
MH 310 701 VES TT Ex dm	3/2-way, single sol.	G 1/4"	in-line	2.12.3.2
MOH 310 701 VES TT Ex dm	3/2-way, n.o. single sol.	G 1/4"	in-line	2.12.3.2
MH 510 701 VES TT Ex dm	5/2-way, single sol.	G 1/4"	in-line	2.12.3.4
MH 520 701 VES TT Ex dm	5/2-way, double sol.	G 1/4"	in-line	2.12.3.5
MH 53_ 701 VES TT Ex dm	5/3-way, different version	G 1/4"	in-line	2.12.3.6

Valves with interface according to NAMUR-standard				
MNH 350 701 VES TT Ex dm	3/2-way & 5/2-way	G 1/4"	1/4" NAMUR	2.12.4.3
MNH 310 701 VES TT Ex dm	3/2-way, single sol.	G 1/4"	1/4" NAMUR	2.12.4.1
MNH 510 701 VES TT Ex dm	5/2-way, single sol.	G 1/4"	1/4" NAMUR	2.12.4.2
MNH 520 701 VES TT Ex dm	5/2-way, double sol.	G 1/4"	1/4" NAMUR	2.12.4.2

When this solenoid system is used in combination with "ATEX certified" mechanical components conforming EN 13463-1:2001 and PrEN 13463-5:2000, the entire valve can be used in explosive hazardous environment zone 1 and 21.



MA 36 EEx dm IIC T5_ _



ATEX approved encapsulated coil with flameproof junction box for gas and dust explosion-hazardous environment.

Voltages: 12VDC, 24VDC, 24VAC, 110VAC, 230VAC

Voltage tolerance: - 10...+ 10%

Relative duty cycle: 100 %

Temperature range: -50°C...+50°C

Ignition protection type: Coil encapsulated, junction box flameproof

Protection with connector according to EN 60529: IP 66

Moulding material: Thermoplasticpolyester

Coil rating according to DIN VDE 0580: Class F

Cable Gland: PG 9 DIN 40-430 for cable diameters 6 – 8 mm

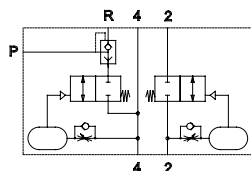
Marking on coil:   II 2G Ex db mb IIC T5 Gb II 2D Ex tb IIIC T95°C IP66 Db

As the coil is 36 mm wide, a spacer plate called "ZPN 8" has to be used, in case of combination with our NAMUR-valve series 700. If used with NAMUR-valve series 121 a spacer plate called "ZPN 6-5" has to be used. You can find both plates on page 2. 10. 14.

The ATEX approval is only valid as long as the associated components are used.

Type	Operating press.	Power cons.	Temperature class
MA 36 EEx dm IIC T5 12 DC	max. 10 bar	3,0 Watt	T5 (100 °C)
MA 36 EEx dm IIC T5 24 DC	max. 10 bar	3,0 Watt	T5 (100 °C)
MA 36 EEx dm IIC T5 24 AC	max. 10 bar	4,8 VA	T5 (100 °C)
MA 36 EEx dm IIC T5 110 AC	max. 10 bar	4,8 VA	T5 (100 °C)
MA 36 EEx dm IIC T5 230 AC	max. 10 bar	4,8 VA	T5 (100 °C)

CBN 700 Ex



CBN 700 Ex





Control block for double acting actuators with interface according to 1/4" NAMUR-standard, to be used on process-valves with inflatable seal.

The control-block receives it's signals to open and close from a standard 5/2-way NAMUR-valve. The block is to be put between the actuator and the NAMUR-valve (flange-version). The closing-signal is fed through to the actuator, the seal is inflated with time-delay.

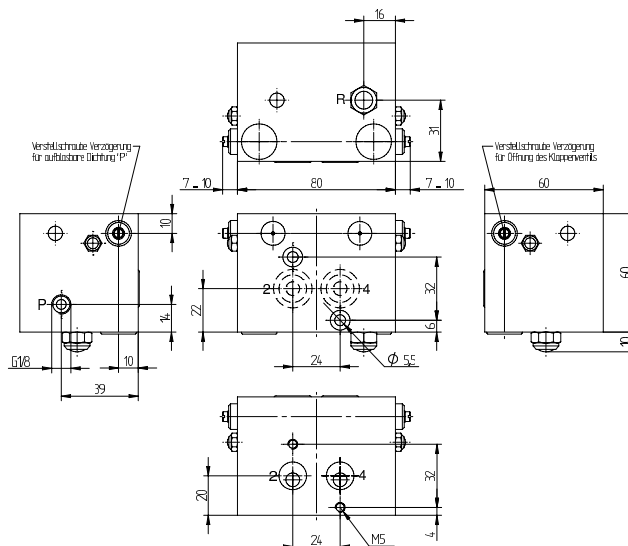
When the process-valves is to be closed first the seal is deflated, with time-delay the actuator opens the process-valve.

Opening- and closing-time-delay can be adjusted independently but they are related to the operating pressure.

At 6 bar time-delay can be adjusted between 0 and 2 seconds.

Marking on valve:   II 3G/D c T6 -10°C ≤ Ta ≤ 50°C

Zone: 2,22



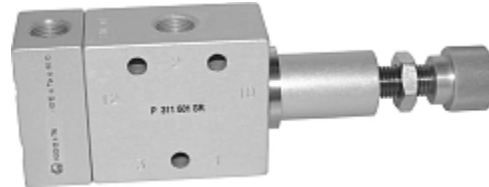
CBN 700 Ex

Type	NAMUR	Port size	Air flow act.	Air flow seal	Weight
CBN 700 Ex	1/4"	G 1/8"	900 l/min	400 l/min	0,80 kg



P 311 501 SR Ex

P 411 701 SR Ex



P 311 501 SR pneumatically actuated 3/2-way valve with mechanical spring return.

Valve can be used normally closed (pressure at port 1) and normally open (pressure at port 3).

Can also be used as 2/2-way valve.

Unused port to be closed by silencer or plug.

P 411 701 SR pneumatically actuated 4/2-way valve with mechanical spring return.

Valve either blocks all ports or is open from 1 to 4 and from 3 to 2.

Port 5 is a vent port and should have a silencer installed.

Valve can be used as an adjustable pneumatic pressure switch. By turning the hand-wheel the required minimum actuation pressure can be set between 3 and 6 bar. Adjustment is not independent from operation pressure.

Please take care about the hysteresis of the spring.

Marking on valve: II 3G/D c T6 $-10^{\circ}\text{C} \leq T_a \leq 50^{\circ}\text{C}$

Zone: 2,22

Type	Port size	Air flow	Operating press.	Regulating range act. press.	Max. act. press.	Weight
P 311 501 SR Ex	G 1/8"	650 l/min	2 - 10 bar	3 - 6 bar	10 bar	0,16 kg
P 411 701 SR Ex	G 1/4"	1250 l/min	2 - 10 bar	3 - 6 bar	10 bar	0,21 kg

In addition to high-quality pneumatic valves, Hafner is also offering cylinders, air preparation units, fittings and tube. Further information such as datasheets and drawings can be found online <http://www.hafner-pneumatik.com/our-products>.



Pneumatic Cylinders

- Mini cylinders
- Round cylinders according to ISO 6432
- Round cylinders with larger diameters
- Compact cylinders according to ISO 21287
- Compact cylinders according to UNITOP
- Short stroke cylinders
- Profile cylinders according to ISO 15552
- Tie-rod cylinders
- Clamping cylinders
- Fixtures and accessories
- Stainless steel cylinders



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We offer two different lines of air preparation units:

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- Basic and inexpensive range of FRL-units
- Robust design
- Connection plates are interchangeable, therefore high flexibility on port sizes

Futura line

- Well designed and modern line of FRL-units
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- Wide range of accessories such as fine filters, precision pressure regulators, oil bowls with level sensor, unique lubricator filling system, metal bowls etc. available



Fittings

- Automatic quick couplings
- Function fittings
- Silencers
- Fittings made from stainless steel
- Cutting-ring fittings
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Phone +36 - 96 - 57 30 12
Fax +36 - 96 - 21 06 15

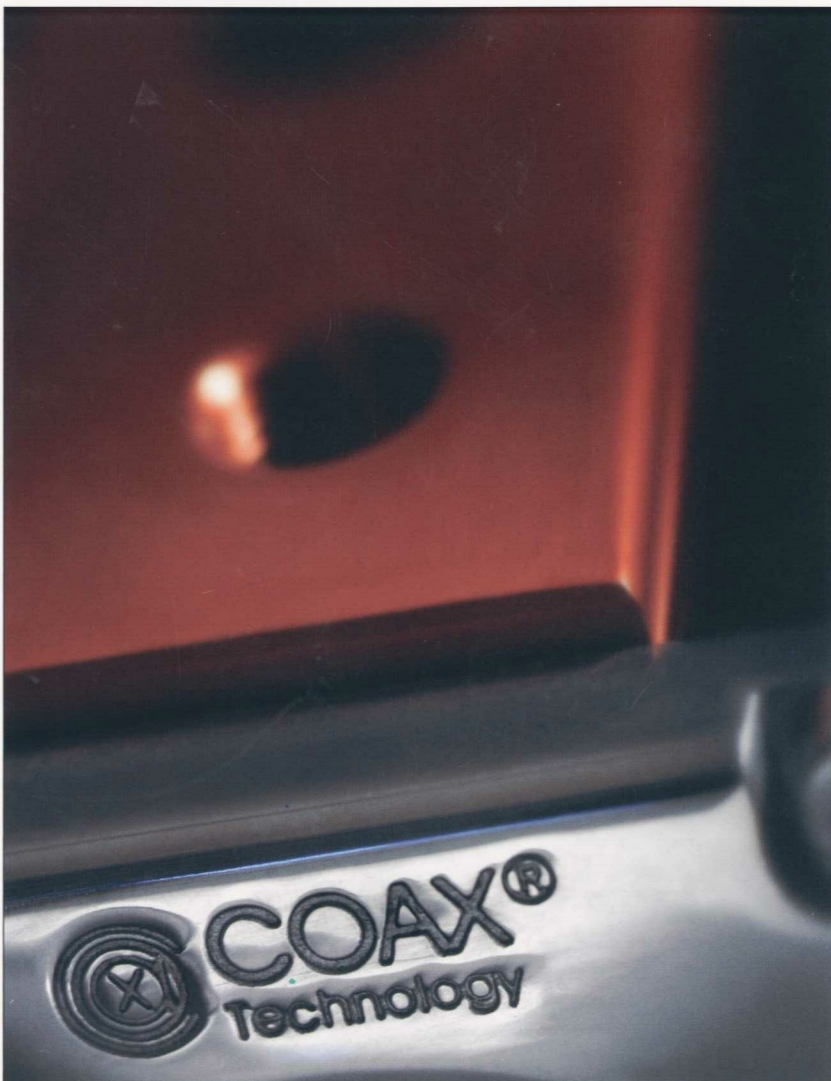
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Quiet operation

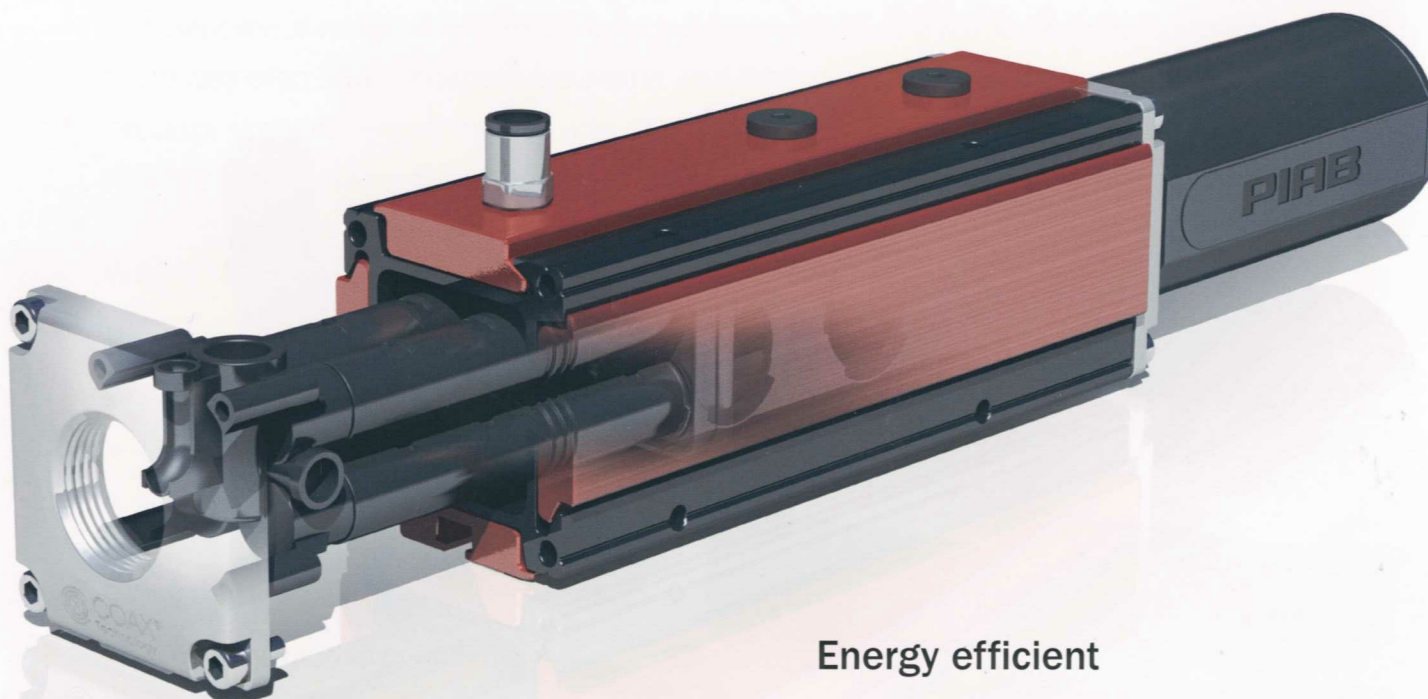
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Durable

PIAB sets the standard when it comes to reliable operation. The P6010 pump range is designed for the most demanding environments. The pump housing is so strong it can be used as a support. Because there are no moving parts, there is no heat generation and virtually no maintenance. Downtime and work stoppage can be drastically reduced. Exceptional performance in a durable package — the P6010 is built to last.

Energy efficient

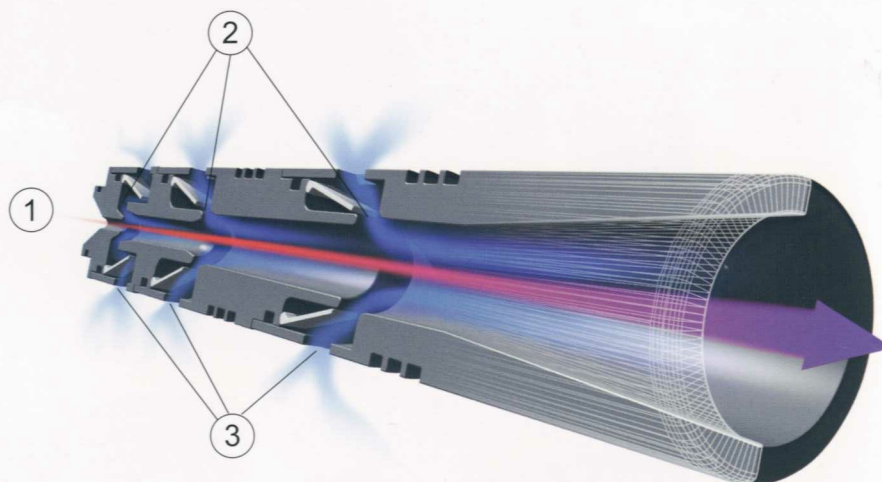
Powered by COAX® technology, the P6010 can reduce energy costs up to 25% or more compared to other methods of generating vacuum. Powerful suction at low feed pressures is characteristic for this advanced design. Lower supply pressure results in a measurable decrease in energy consumption. In addition, the P6010 with COAX® maintains performance levels during periods of fluctuating supply pressure when other pumps lose suction capacity and may even drop parts. The P6010's compact size is deceiving. COAX® technology puts powerful suction in a small package and the pump can be easily mounted close to the point of suction. The result... a smaller pump requirement with lower energy needs. For the ultimate in operating efficiency, integrated control options are also available. Refer to pages 6–7 for details.

COAX® — The next dimension in vacuum technology

It's all about simplicity--- You want to save time and money. Your vacuum system should be easy to design, install, start up and maintain. It should offer operational reliability and show flexibility to changes in working conditions. This is why the COAX® technology was developed.



When compressed air (1) flows through the pump nozzles (2), air from outside the pump will be entrained by the jet of air at the nozzle outlet. Suction will be generated at the openings to the various stages (3). Exhaust then exits the pump.



Unique multistage ejector

COAX®, a patented technology, is a new and improved design on PIAB's innovative multistage concept for creating vacuum with compressed air. COAX® integrates the internal components of a multistage vacuum pump into a vacuum cartridge. The result is a smaller, more efficient, more reliable and highly flexible technology that allows you to design a modular system.

Energy is put to maximum use with the COAX® technology. The vacuum pump/cartridge consumes less air than conventional ejectors. COAX® vacuum cartridges are up to twice as fast and provide 3 times more flow than a typical conventional ejector with the same air consumption. COAX® is also designed for low and fluctuating feed pressures (25-87 psi) with sustained vacuum performance for maximum reliability.

Choose the right COAX® cartridge for your application

PIAB has developed two main types of COAX® cartridges, Pi and Si, for different applications.



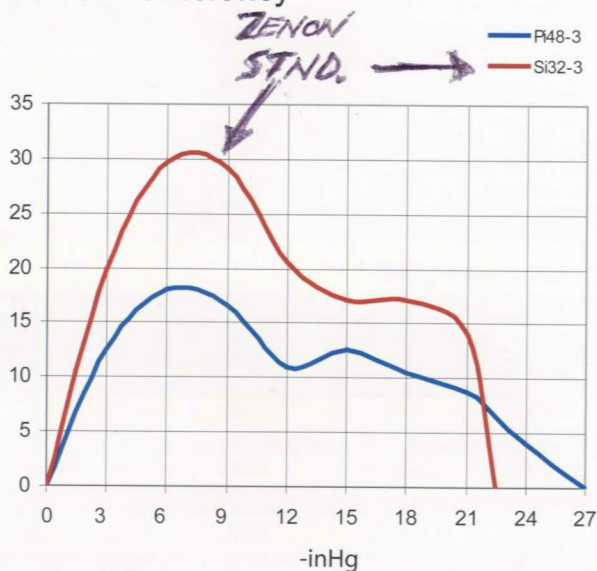
Pi

Pi cartridges have been developed to achieve a high vacuum level at low feed pressures. They are ideal when pressures in compressed air lines fluctuate. Pi cartridges are recommended in situations such as handling sheet metal or glass or other non-porous products, where you need good vacuum flow and a high-level vacuum. Pi can deliver high vacuum levels down to 27-inHg.

Si

Si cartridges are designed to provide extra vacuum flow. They are highly recommended for handling porous materials such as corrugated board and for high-volume evacuation in, for example, a fast-cycling system where it is necessary to compensate for leakage in order to maintain the vacuum level. Si cartridges can deliver moderate vacuum levels down to 22-inHg.

Vacuum efficiency



Vacuum Efficiency =
Vacuum flow/air consumption x vacuum level

P6010 SI32-3



- ▶ COAX® patented technology
- ▶ Substantially lower air-consumption as compared to conventional ejectors
- ▶ Modular design
- ▶ High flow - suitable for handling of porous objects and in case of leakage
- ▶ Short evacuation time
- ▶ "Classic" mounting style option available
- ▶ Supplied with a vacuum gauge and optional vacuum filter

TECHNICAL DATA

Description	Unit	Value
Feed pressure, max	psi	101.5
Noise level	dBA	65-70 (Classic style = 50-65)
Temperature range	°F	14-176
Weight	lb	3.74-3.96
Material		Al, PA, NBR, SS, TPE

VACUUM FLOW

P6010 Cartridge Type	Feed pressure	Air consumption	Vacuum flow (scfm) at different vacuum levels										Max vacuum
	psi	scfm	0	3	6	9	12	15	18	21	24	27	-inHg
Si32-3x1	58	2.65	10.6	6.14	4.03	2.54	1.70	0.85	0.21	—	—	—	18.0
Si32-3x1	72.5	3.18	12.1	6.99	4.66	2.97	1.80	1.27	0.74	0.38	—	—	21.0
Si32-3x1	87	3.71	12.7	7.42	5.51	3.60	1.91	1.27	1.06	0.74	—	—	22.2
Si32-3x2	58	5.30	21.2	12.3	8.05	5.09	3.39	1.70	0.42	—	—	—	18.0
Si32-3x2	72.5	6.36	24.2	14.0	9.32	5.93	3.60	2.54	1.48	0.76	—	—	21.0
Si32-3x2	87	7.42	25.4	14.8	11.0	7.20	3.81	2.54	2.12	1.48	—	—	22.2
Si32-3x3*	58	7.95	31.8	18.4	12.1	7.63	5.09	2.54	0.64	—	—	—	18.0
Si32-3x3*	72.5	9.54	36.2	21.0	14.0	8.90	5.51	3.81	2.33	1.14	—	—	21.0
Si32-3x3*	87	11.1	38.1	22.2	16.5	10.8	5.72	3.81	3.18	2.33	—	—	22.2
Si32-3x4*	58	10.6	42.4	24.6	16.1	10.2	6.78	3.39	0.85	—	—	—	18.0
Si32-3x4*	72.5	12.7	48.3	28.0	18.6	11.9	7.20	5.09	2.97	1.53	—	—	21.0
Si32-3x4*	87	14.8	50.9	29.7	22.0	14.4	7.63	5.09	4.24	2.97	—	—	22.2

EVACUATION TIME

P6010 Cartridge Type	Feed pressure	Air consumption	Evacuation time (s/cf) to reach different vacuum levels (-inHg)									Max vacuum
	psi	scfm	3	6	9	12	15	18	21	24	27	-inHg
Si32-3x1	58	2.65	0.85	1.98	3.97	6.80	11.9	28.3	—	—	—	18.0
Si32-3x1	72.5	3.18	0.57	1.70	3.12	5.95	9.90	17.0	28.3	—	—	21.0
Si32-3x1	87	3.71	0.57	1.42	2.83	5.10	9.35	15.0	22.7	—	—	22.2
Si32-3x2	58	5.30	0.42	0.99	1.98	3.40	5.95	14.2	—	—	—	18.0
Si32-3x2	72.5	6.36	0.28	0.85	1.56	3.12	5.10	8.50	14.2	—	—	21.0
Si32-3x2	87	7.42	0.28	0.71	1.42	2.55	4.82	7.65	11.3	—	—	22.2
Si32-3x3*	58	7.95	0.28	0.65	1.33	2.27	3.97	9.35	—	—	—	18.0
Si32-3x3*	72.5	9.54	0.20	0.57	1.05	1.98	3.40	5.67	9.35	—	—	21.0
Si32-3x3*	87	11.1	0.20	0.48	0.93	1.70	3.12	5.10	7.65	—	—	22.2
Si32-3x4*	58	10.6	0.23	0.51	0.99	1.70	3.12	7.08	—	—	—	18.0
Si32-3x4*	72.5	12.7	0.14	0.42	0.79	1.50	2.49	4.25	7.08	—	—	21.0
Si32-3x4*	87	14.8	0.14	0.37	0.71	1.27	2.35	3.68	5.67	—	—	22.2

* Vacuum performance is reduced by 20-30% when using the 3/4" NPSF "Classic" style cover plate (code LK) between 0-9 -inHg.

ORDERING INFORMATION

1. Vacuum Cartridge Module		P6010 Code
a	Si32-3 x1	AB
b	Si32-3 x1 with non-return valve	AF
a	Si32-3 x2	AC
b	Si32-3 x2 with non-return valve	AG
a	Si32-3 x3	AD
b	Si32-3 x3 with non-return valve	AH
a	Si32-3 x4	AE
b	Si32-3 x4 with non-return valve	AI

2. Mounting and cover plate		P6010 Code
Mounting T-slot		01

3. Function and cover plate		P6010 Code
Cover plates Standard style NPSF threads (No function)		LJ
Cover plates Classic style NPSF threads (No function)		LK

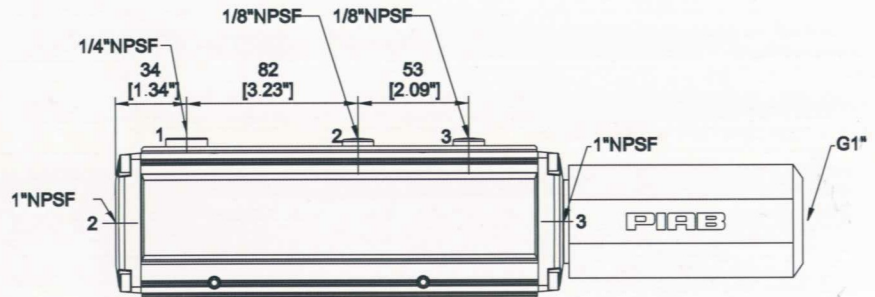
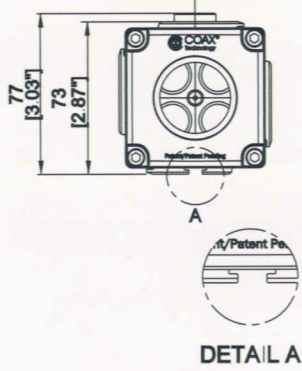
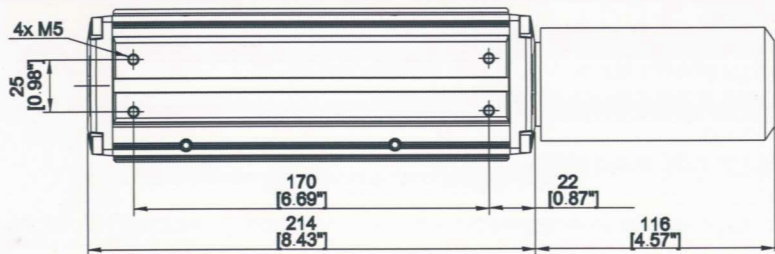
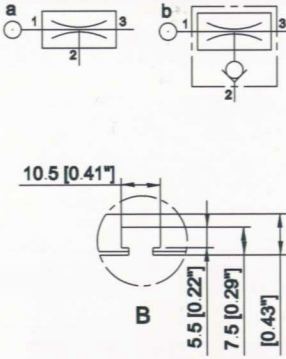
4. Connections for vacuum and exhaust		P6010 Code
2 x 1" NPSF with silencer 1" Standard style		56
2 x 3/4" NPSF with silencer 3/4" Classic style		58

5. Vacuum filter		P6010 Code
None		XX
Vacuum filter, 1" NPT (Standard size)		FA
Vacuum filter, 3/4" NPT (Classic size)		FB

Example	Ordering number
P6010, Si32-3 x1, mounting T-slot, cover plates (no function), 2 x 1" NPSF with silencer 1" & vacuum filter 1"	P6010.AB.01.LJ.56.FA

ORDERING INFORMATION, ACCESSORIES

Description	PartNo
Silencer G3/4"	32.16.002
Silencer G1"	01.12.499
Manometer 250 kPa	01.12.533
Manometer 1 Mpa	01.12.532
Vacuum gauge 30 -inHg/100-kPa	31.01.613
Vacuum filter, 3/4" NPT	PPSF.75-X35
Vacuum filter 1" NPT	PPSF1.0-X50
Seal kit P6010, NBR seals	01.12.495
Seal kit for vacuum & exhaust end connections, P6010, NBR seals	01.12.497



Standard style

P6010 SI32-3

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NUMBERS
1030393



- ▶ COAX® patented technology
- ▶ Substantially lower air-consumption as compared to conventional ejectors
- ▶ Modular design
- ▶ High flow - suitable for handling of porous objects and in case of leakage
- ▶ Short evacuation time
- ▶ "Classic" mounting style option available
- ▶ Supplied with a vacuum gauge and optional vacuum filter

TECHNICAL DATA

Description	Unit	Value
Feed pressure, max	psi	101.5
Noise level	dBA	65-70 (Classic style = 50-65)
Temperature range	°F	14-176
Weight	lb	3.74-3.96
Material		Al, PA, NBR, SS, TPE

VACUUM FLOW

P6010 Cartridge Type	Feed pressure	Air consumption	Vacuum flow (scfm) at different vacuum levels										Max vacuum
	psi	scfm	0	3	6	9	12	15	18	21	24	27	-inHg
Si32-3x1	58	2.65	10.6	6.14	4.03	2.54	1.70	0.85	0.21	—	—	—	18.0
Si32-3x1	72.5	3.18	12.1	6.99	4.66	2.97	1.80	1.27	0.74	0.38	—	—	21.0
Si32-3x1	87	3.71	12.7	7.42	5.51	3.60	1.91	1.27	1.06	0.74	—	—	22.2
Si32-3x2	58	5.30	21.2	12.3	8.05	5.09	3.39	1.70	0.42	—	—	—	18.0
Si32-3x2	72.5	6.36	24.2	14.0	9.32	5.93	3.60	2.54	1.48	0.76	—	—	21.0
Si32-3x2	87	7.42	25.4	14.8	11.0	7.20	3.81	2.54	2.12	1.48	—	—	22.2
Si32-3x3*	58	7.95	31.8	18.4	12.1	7.63	5.09	2.54	0.64	—	—	—	18.0
Si32-3x3*	72.5	9.54	36.2	21.0	14.0	8.90	5.51	3.81	2.33	1.14	—	—	21.0
Si32-3x3*	87	11.1	38.1	22.2	16.5	10.8	5.72	3.81	3.18	2.33	—	—	22.2
Si32-3x4*	58	10.6	42.4	24.6	16.1	10.2	6.78	3.39	0.85	—	—	—	18.0
Si32-3x4*	72.5	12.7	48.3	28.0	18.6	11.9	7.20	5.09	2.97	1.53	—	—	21.0
Si32-3x4*	87	14.8	50.9	29.7	22.0	14.4	7.63	5.09	4.24	2.97	—	—	22.2

EVACUATION TIME

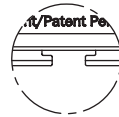
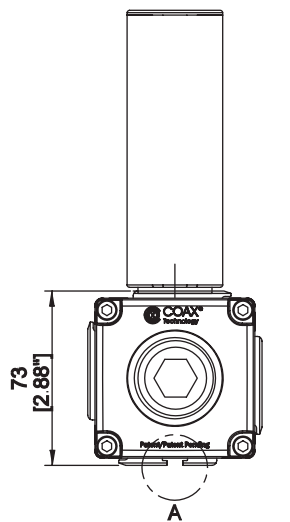
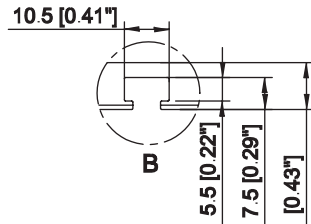
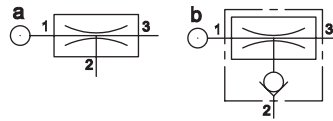
P6010 Cartridge Type	Feed pressure	Air consumption	Evacuation time (s/cf) to reach different vacuum levels (-inHg)									Max vacuum
	psi	scfm	3	6	9	12	15	18	21	24	27	-inHg
Si32-3x1	58	2.65	0.85	1.98	3.97	6.80	11.9	28.3	—	—	—	18.0
Si32-3x1	72.5	3.18	0.57	1.70	3.12	5.95	9.90	17.0	28.3	—	—	21.0
Si32-3x1	87	3.71	0.57	1.42	2.83	5.10	9.35	15.0	22.7	—	—	22.2
Si32-3x2	58	5.30	0.42	0.99	1.98	3.40	5.95	14.2	—	—	—	18.0
Si32-3x2	72.5	6.36	0.28	0.85	1.56	3.12	5.10	8.50	14.2	—	—	21.0
Si32-3x2	87	7.42	0.28	0.71	1.42	2.55	4.82	7.65	11.3	—	—	22.2
Si32-3x3*	58	7.95	0.28	0.65	1.33	2.27	3.97	9.35	—	—	—	18.0
Si32-3x3*	72.5	9.54	0.20	0.57	1.05	1.98	3.40	5.67	9.35	—	—	21.0
Si32-3x3*	87	11.1	0.20	0.48	0.93	1.70	3.12	5.10	7.65	—	—	22.2
Si32-3x4*	58	10.6	0.23	0.51	0.99	1.70	3.12	7.08	—	—	—	18.0
Si32-3x4*	72.5	12.7	0.14	0.42	0.79	1.50	2.49	4.25	7.08	—	—	21.0
Si32-3x4*	87	14.8	0.14	0.37	0.71	1.27	2.35	3.68	5.67	—	—	22.2

* Vacuum performance is reduced by 20-30% when using the 3/4" NPSF "Classic" style cover plate (code LK) between 0-9 -inHg.

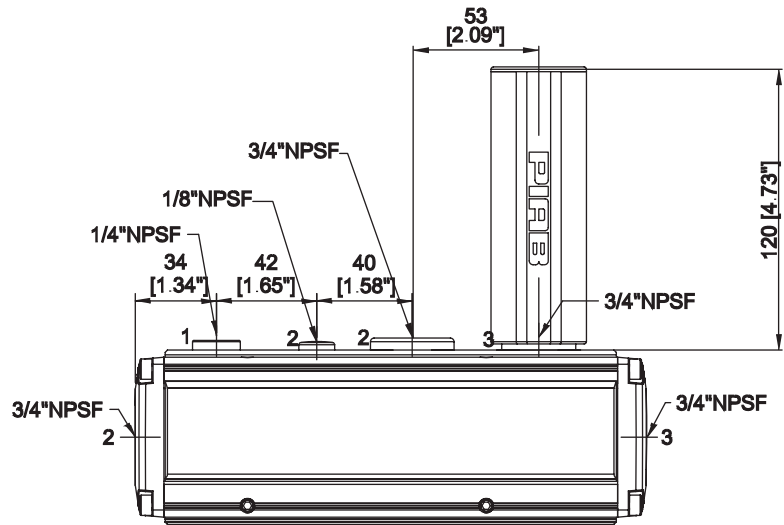
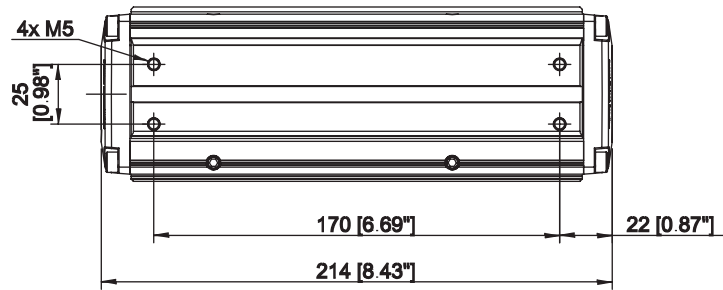
ORDERING INFORMATION

1. Vacuum Cartridge Module		P6010 Code
a	Si32-3 x1	AB
b	Si32-3 x1 with non-return valve	AF
a	Si32-3 x2	AC
b	Si32-3 x2 with non-return valve	AG
a	Si32-3 x3	AD
b	Si32-3 x3 with non-return valve	AH
a	Si32-3 x4	AE
b	Si32-3 x4 with non-return valve	AI
2. Mounting and cover plate		P6010 Code
Mounting T-slot		01
3. Function and cover plate		P6010 Code
Cover plates Standard style NPSF threads (No function)		LJ
Cover plates Classic style NPSF threads (No function)		LK
4. Connections for vacuum and exhaust		P6010 Code
2 x 1" NPSF with silencer 1" Standard style		56
2 x 3/4" NPSF with silencer 3/4" Classic style		58
5. Vacuum filter		P6010 Code
None		XX
Vacuum filter, 1" NPT (Standard size)		FA
Vacuum filter, 3/4" NPT (Classic size)		FB
Example		Ordering number
P6010, Si32-3 x1, mounting T-slot, cover plates (Standard-no function), 2 x 1" NPSF with silencer 1" & vacuum filter 1"		P6010.AB.01.LJ.56.FA
P6010, Si32-3 x1, mounting T-slot, cover plates (Classic-no function), 2 x 3/4" NPSF with silencer 3/4" & vacuum filter 3/4"		P6010.AB.01.LK.58.FB





DETAIL A



DETAIL B

Classic style

ORDERING INFORMATION, ACCESSORIES

Description	PartNo
Silencer G3/4"	32.16.002
Silencer G1"	01.12.499
Manometer 250 kPa	01.12.533
Manometer 1 Mpa	01.12.532
Vacuum gauge 30 -inHg/100 -kPa	31.01.613
Vacuum filter, 3/4" NPT	PPSF.75-X35
Vacuum filter 1" NPT	PPSF1.0-X50
Seal kit P6010, NBR seals	01.12.495
Seal for vacuum & exhaust end connections, P6010, NBR seals	01.12.497

P6010 PI48-3



- ▶ COAX® patented technology
- ▶ Substantially lower air-consumption as compared to conventional ejectors
- ▶ Modular design
- ▶ Low feed pressure that ensures high reliability even in case of pressure drops
- ▶ Short evacuation time
- ▶ "Classic" mounting style option available
- ▶ Supplied with a vacuum gauge and optional vacuum filter

TECHNICAL DATA

Description	Unit	Value
Feed pressure, max	psi	101.5
Noise level	dBA	65-70 (Classic style = 50-65)
Temperature range	°F	14-176
Weight	lb	3.74-3.96
Material		Al, PA, NBR, SS, TPE

VACUUM FLOW

P6010 Cartridge Type	Feed pressure	Air consumption	Vacuum flow (scfm) at different vacuum levels										Max vacuum
	psi	scfm	0	3	6	9	12	15	18	21	24	27	-inHg
Pi48-3x1	32	3.43	10.6	4.24	3.18	1.91	1.17	0.95	0.55	0.15	—	—	21.6
Pi48-3x1	44	4.24	11.9	5.30	3.81	2.33	1.38	1.06	0.74	0.53	0.21	—	27.0
Pi48-3x1	58	5.38	12.1	5.30	4.45	3.18	2.33	1.40	0.76	0.55	0.17	—	25.4
Pi48-3x2	32	6.87	21.2	8.48	6.36	3.81	2.33	1.91	1.10	0.30	—	—	21.6
Pi48-3x2	44	8.48	23.7	10.6	7.63	4.66	2.75	2.12	1.48	1.06	0.42	—	27.0
Pi48-3x2	58	10.8	24.2	10.6	8.90	6.36	4.66	2.75	1.48	1.10	0.34	—	25.4
Pi48-3x3*	32	10.3	31.8	12.7	9.54	5.72	3.60	2.97	1.65	0.44	—	—	21.6
Pi48-3x3*	44	12.7	35.6	15.9	11.4	6.99	4.24	3.18	2.33	1.59	0.64	—	27.0
Pi48-3x3*	58	16.1	36.2	15.9	13.3	9.54	6.99	4.24	2.33	1.65	0.51	—	25.4
Pi48-3x4*	32	13.7	42.4	17.0	12.7	7.63	4.66	3.81	2.12	0.59	—	—	21.6
Pi48-3x4*	44	17.0	47.5	21.2	15.3	9.32	5.51	4.24	2.97	2.12	0.85	—	27.0
Pi48-3x4*	58	21.5	48.3	21.2	17.8	12.7	9.32	5.51	2.97	2.12	0.68	—	25.4

EVACUATION TIME*

P6010 Cartridge Type	Feed pressure	Air consumption	Evacuation time (s/cf) to reach different vacuum levels (-inHg)									Max vacuum
	psi	scfm	3	6	9	12	15	18	21	24	27	-inHg
Pi48-3x1	32	3.43	0.71	2.27	2.55	8.50	14.2	22.7	48.2	—	—	21.6
Pi48-3x1	44	4.24	0.57	1.70	3.40	8.50	12.7	19.8	28.3	45.3	113	27.0
Pi48-3x1	58	5.38	0.57	1.56	3.12	5.10	8.22	16.7	25.5	48.2	127	25.4
Pi48-3x2	32	6.87	0.37	1.13	1.27	4.25	7.08	11.3	24.1	—	—	21.6
Pi48-3x2	44	8.48	0.28	0.85	1.70	3.68	6.52	9.92	14.2	22.7	56.7	27.0
Pi48-3x2	58	10.8	0.28	0.79	1.56	2.55	4.25	8.50	12.7	24.1	65.2	25.4
Pi48-3x3*	32	10.3	0.23	0.76	0.85	2.83	4.82	7.65	16.1	—	—	21.6
Pi48-3x3*	44	12.7	0.20	0.57	1.13	2.35	4.25	6.52	9.35	15.0	36.8	27.0
Pi48-3x3*	58	16.1	0.20	0.51	1.05	1.70	2.75	5.67	8.50	16.1	42.5	25.4
Pi48-3x4*	32	13.7	0.17	0.57	0.65	2.12	3.68	5.67	12.2	—	—	21.6
Pi48-3x4*	44	17.0	0.14	0.42	0.85	1.78	3.12	5.10	7.08	11.3	28.3	27.0
Pi48-3x4*	58	21.5	0.14	0.40	0.79	1.27	2.07	4.25	6.52	12.2	31.2	25.4

* Vacuum performance is reduced by 20-30% when using the 3/4" NPSF "Classic" style cover plate (code LK) between 0-9 -inHg.

ORDERING INFORMATION

1. Vacuum Cartridge Module		P6010 Code
a	Pi48-3 x1	AJ
b	Pi48-3 x1 with non-return valve	AN
a	Pi48-3 x2	AK
b	Pi48-3 x2 with non-return valve	AO
a	Pi48-3 x3	AL
b	Pi48-3 x3 with non-return valve	AP
a	Pi48-3 x4	AM
b	Pi48-3 x4 with non-return valve	AQ

2. Mounting and cover plate		P6010 Code
Mounting T-slot		01

3. Function and cover plate		P6010 Code
Cover plates Standard style NPSF threads (No function)		LJ
Cover plates Classic style NPSF threads (No function)		LK

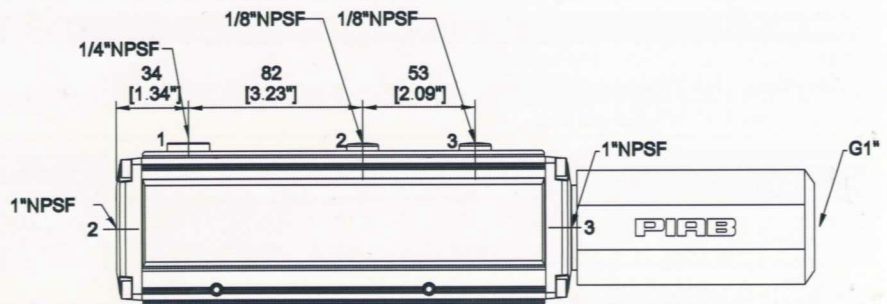
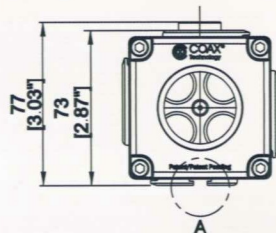
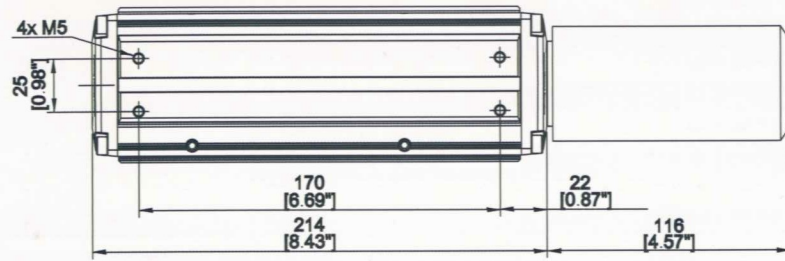
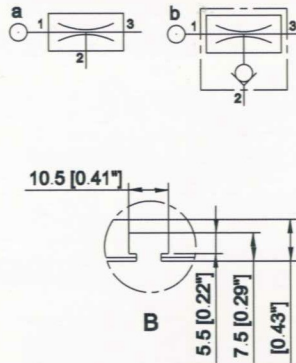
4. Connections for vacuum and exhaust		P6010 Code
2 x 1" NPSF with silencer 1" Standard style		56
2 x 3/4" NPSF with silencer 3/4" Classic style		58

5. Vacuum filter		P6010 Code
None		XX
Vacuum filter, 1" NPT (Standard size)		FA
Vacuum filter, 3/4" NPT (Classic size)		FB

Example	Ordering number
P6010, Pi48-3 x1, mounting T-slot, cover plates (no function), 2 x1" NPSF with silencer 1" & vacuum filter 1"	P6010.AJ.01.LJ.56.FA

ORDERING INFORMATION, ACCESSORIES

Description	PartNo
Silencer G3/4"	32.16.002
Silencer G1"	01.12.499
Manometer 250 kPa	01.12.533
Manometer 1 Mpa	01.12.532
Vacuum gauge 30 -inHg/100-kPa	31.01.613
Vacuum filter, 3/4" NPT	PPSF.75-X35
Vacuum filter 1" NPT	PPSF1.0-X50
Seal kit P6010, NBR seals	01.12.495
Seal kit for vacuum & exhaust end connections, P6010, NBR seals	01.12.497



Standard style

VACUUM GAUGE AND MANOMETERS

BAAN NUMBERS
1030394



- Analog indicator, spring joint – lever system
- The instruments include nut for installation on a panel

TECHNICAL DATA

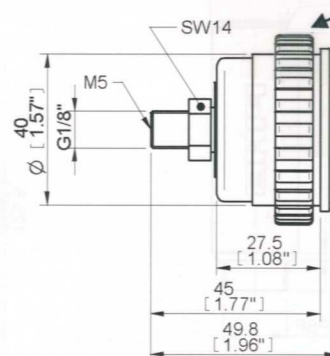
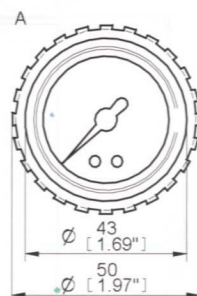
Description	Unit	Value
Accuracy, of full scale	%	2.5
Material		CuZn, ABS, PMMA

TECHNICAL DATA, SPECIFIC

Description	Unit	31.01.613	31.01.602	31.01.603	31.01.626
Weight	oz		3.17	1.94	1.76
Signal range			0–30 -inHg	0–145 psi	0–36.25 psi
Medium			Vacuum	Positive pressure	

ORDERING INFORMATION

	Description	Part No.
B	Vacuum gauge 30 -inHg/100 -kPa (Without panel mount nut)	31.01.602 (31.01.613)
A	Manometer 150 psi/1 MPa	31.01.603
A	Manometer 36.25 psi/250 -kPa	31.01.626



Nut not included
with Part#
31.01.613

Valves



ACIER INOXYDABLE

PINACLE
STAINLESS STEEL INC.

MONTREAL
(514) 745-0389

MISSISSAUGA
(905) 785-2002

EDMONTON
(781) 448-0811

PINACLE
STAINLESS STEEL INC.

VALVES

SPECIFICATION	D1
1 PC Reduced Port 800 WOG Ball Valve, Threaded	D2
2 PC Full Port 1000 WOG Ball Valve, Threaded	D4
2 PC Full Port 2000/1500 WOG Ball Valve, Threaded	D6
3 PC Full Port 1000 WOG Ball Valve, Butt weld	D8
3 PC Full Port 1000 WOG Ball Valve, Threaded	D10
3 PC Full Port 1000 WOG Ball Valve, Socket weld	D12
1 PC Class 150 Regular Port Ball Valve, Flanged	D14
2 PC Class 150 Full Port Ball Valve Flanged	D16
2 PC Class 300 Full Port Ball Valve Flanged	D18
2 PC Class 150 Full Port "FS" Ball Valve, Flanged	D20
Full Port 200 WOG Swing Check Valve, Threaded	D22
800 WOG Y-Check Valve, Threaded, Socket weld	D24
Full Port 200 WOG Globe Valve, Threaded	D26
Full Port 200 WOG Gate Valve, Threaded	D28
3 Way Reduced Port 1000 WOG Ball Valve, Threaded "L" Port	D30
3 Way Reduced Port 1000 WOG Ball Valve, Threaded "T" Port	D32

INDEX (cont'd)

800 WOG Y Strainer Valve, Threaded, Socketweld..... D34

6000 PSI Stainless Steel Needle Valve..... D36

Class 150 Flange End Swing Check Valve D38

Class 150 Flange End Gate Valve..... D40

Class 150 Flange End Globe Valve..... D42

FLOW PATTERNS..... D44

TUBE VALVES - SEE OUR SECTION "F"



VALVES

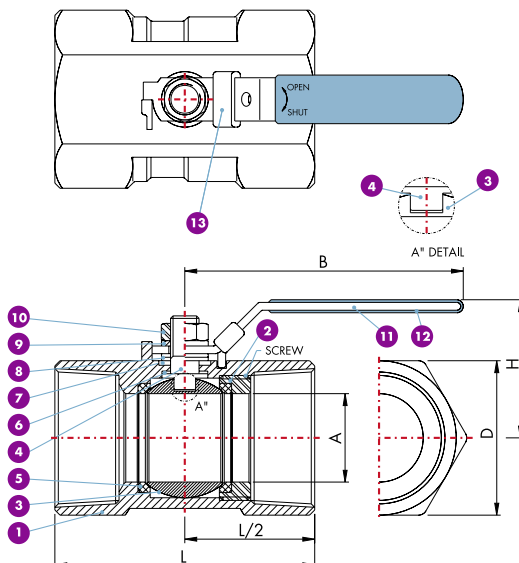
THREADED / SOCKETWELD / FLANGED / BUTTWELD

- BALL / GATE / GLOBE / CHECK
- NEEDLE
- STRAINER



DESIGN FEATURES

- Pressure rating: 800 PSI WOG (NON-SHOCK)
- Steam rating: 125 PSI WSP
- Investment cast body
- Bottom-loaded, Blow-out-proof stem
- Adjustable stem packing
- Stainless Steel handle with vinyl grip
- Locking device

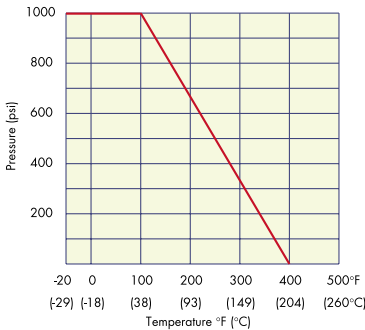


1 PC REDUCED PORT
800 WOG BALL VALVE, THREADED

DIMENSIONS

CODES	SIZE		A		B		D		L		H		Cv Factor	Weight lb
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm		
13TBV1025	1/4"	8	0.20	5.0	2.36	60	0.67	17.0	1.54	39.0	1.22	31	1.0	0.17
13TBV10375	3/8"	10	0.28	7.0	2.76	70	0.83	21.0	1.73	44.0	1.38	35	2.5	0.24
13TBV105	1/2"	15	0.36	9.2	3.39	86	0.98	25.0	2.22	56.0	1.69	43	5.5	0.38
13TBV1075	3/4"	20	0.49	12.5	3.39	86	1.26	32.0	2.32	59.0	1.81	46	10.0	0.55
13TBV11	1"	25	0.63	16.0	4.09	104	1.50	38.0	2.80	71.0	1.97	50	15.5	0.99
13TBV1125	1 1/4"	32	0.79	20.0	4.09	104	1.93	49.0	3.11	79.0	2.13	54	20.0	1.63
13TBV115	1 1/2"	40	0.96	24.5	4.96	126	2.09	53.0	3.27	83.0	2.56	65	37.0	1.83
13TBV12	2"	50	1.26	32.0	4.96	126	2.56	65.0	3.94	100.0	2.83	72	60.0	2.76

**PRESSURE
TEMPERATURE
RATINGS
(BODY)**



MATERIALS LIST

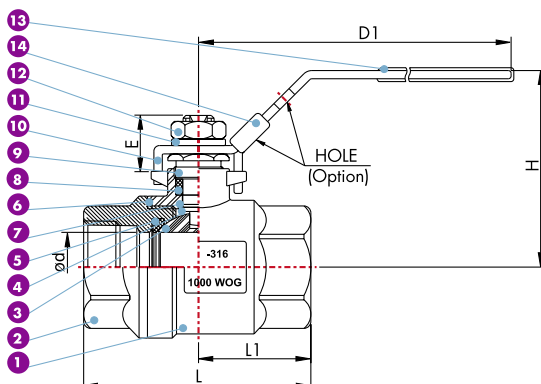
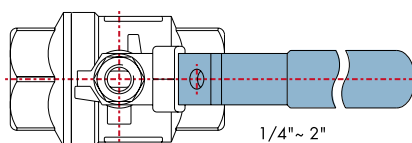
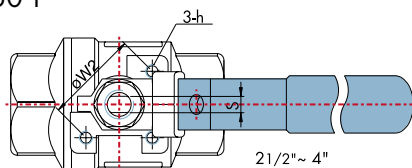
NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	1
3	BALL	ASTM A351 Gr. CF8M	1
4	STEM	ASTM A276 Gr. 316	1
5	SEAT	PTFE	2
6	THRUST WASHER	PTFE	1
7	GLAND PACKING	PTFE	1
8	WASHER	SS304	2
9	SPRING WASHER	SS304	1
10	STEM NUT	SS304	1
11	HANDLE	SS304	1
12	HANDLE SLEEVE	VINYL GRIP	1
13	LOCKING PLATE	SS304	1

*** SIZES SHOWN ARE APPROXIMATE AND MAY VARY**



DESIGN FEATURES

- Blow-out-proof stem design
- Steam Rating: 125 PSI WSP
- Temperature range: -50°F to 450°F
- Locking device
- Threaded type:
ANSI B1.20.1 (NPT)

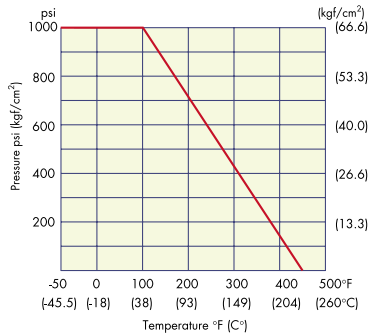


2 PC FULL PORT
1000 WOG BALL VALVE, THREADED

DIMENSIONS

CODES	SIZE		d		E		L		L1		H		S		D1		h	Cv	Weight
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	(Option)	Factor	Lb
13TBV2025	1/4"	8	0.43	11.0	0.61	15.5	2.28	57.8	1.13	28.8	2.25	57.2	0.21	5.45	4.06	103		16	0.57
13TBV20375	3/8"	10	0.49	12.5	0.61	15.5	2.28	57.8	1.13	28.8	2.25	57.2	0.21	5.45	4.06	103		16	0.53
13TBV205	1/2"	15	0.59	15.0	0.57	14.5	2.43	61.7	1.21	30.7	2.33	59.1	0.21	5.45	4.06	103		26	0.66
13TBV2075	3/4"	20	0.79	20.0	0.83	21.0	2.76	70.1	1.38	35.0	2.46	62.6	0.21	5.45	4.06	103		55	0.93
13TBV21	1"	25	0.98	25.0	0.77	19.5	3.20	81.3	1.58	40.2	2.78	70.7	0.24	6.20	5.00	127		110	1.53
13TBV2125	1 1/4"	32	1.26	32.0	1.09	27.9	3.78	96.0	1.86	47.2	3.00	76.2	0.24	6.20	5.00	127		180	2.23
13TBV215	1 1/2"	40	1.50	38.0	1.50	27.5	4.43	112.5	2.19	55.6	3.51	89.1	0.37	9.40	6.02	153		270	4.10
13TBV22	2"	50	2.00	50.8	1.08	26.7	4.96	126.0	2.46	62.4	3.87	98.2	0.37	9.40	7.60	193		500	6.27
13TBV225	2 1/2"	65	2.56	65.0	1.02	26.0	6.63	168.5	3.35	85.0	4.35	110.6	0.37	9.40	7.60	193	M8xP1.25	800	13.77
13TBV23	3"	80	3.15	80.0	1.50	38.0	7.54	191.4	3.78	95.9	4.88	124.0	0.47	12.00	10.98	279	M10xP1.5	1150	22.03
13TBV24	4"	100	3.94	100.0	1.89	48.0	8.52	216.5	4.26	108.3	6.63	168.5	0.47	16.00	13.19	335	M10xP1.5	2120	37.89

**PRESSURE
TEMPERATURE
RATINGS
(PTFE SEATS)**



MATERIALS LIST

NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	1
3	BALL	ASTM A351 Gr. CF8M	1
4	STEM	ASTM A276 Gr. 316	1
5	SEAT	PTFE+15% G/F	2
6	GASKET	PTFE	1
7	THRUST WASHER	PTFE	1
8	PACKING	PTFE	1
9	GLAND	SS304	1
10	HANDLE	SS304	1
11	SPRING WASHER	SS304	1
12	HANDLE NUT	SS304	1
13	HANDLE SLEEVE	VINYL GRIP	1
14	LOCKING PLATE*	SS304	1

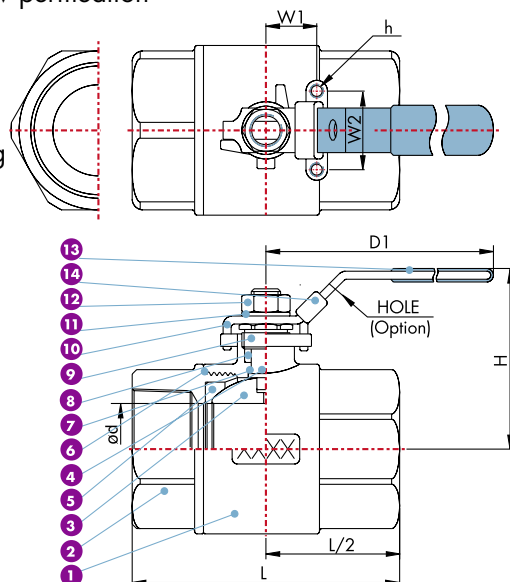
* OPTION

* SIZES SHOWN ARE APPROXIMATE AND MAY VARY



DESIGN FEATURES

- Working pressure: 1/4"~1" 2000 PSI
1 1/4"~2" 1500 PSI
- Steam Rating: 150 PSI WSP
- Investment casting body & cap
- ME-PTFE Seal Kits: Replaces PTFE, RPTFE and FPA
Low deformation under load
Low permeation
- Temperature rating:
-45.5°C (-50°F) to
246°C (475°F)
- Long cycle life
- Adjustable stem packing
- Blow-out proof stem
- Locking device
- Design specification:
ANSI B16.34
CLASS 900
- Test standard: API 598
- Option:
Seal weld cap to body

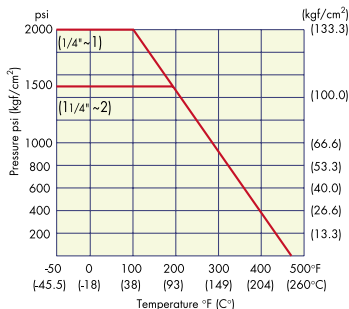


2 PC FULL PORT 2000/1500 WOG BALL VALVE, THREADED

DIMENSIONS

CODES	SIZE		d		L		H	D1		W1		W2		h	Cv Factor	Weight Lb
	inch	mm	inch	mm	inch	mm	inch	inch	mm	inch	mm	inch	mm	(Option)		
13TBVMM025	1/4"	8	0.43	11.0	2.34	59.5	2.24	4.06	103	0.50	12.7	1.12	28.5	M5 x P0.8	16	0.81
13TBVMM0375	3/8"	10	0.49	12.5	2.34	59.5	2.24	4.06	103	0.50	12.7	1.12	28.5	M5 x P0.8	16	0.79
13TBVMM05	1/2"	15	0.59	15.0	2.52	64.5	2.27	4.06	103	0.50	12.7	1.12	28.5	M5 x P0.8	26	0.93
13TBVMM075	3/4"	20	0.79	20.0	3.03	77.0	2.70	5.00	127	0.88	22.4	1.38	35.0	M6 x P1.0	55	1.76
13TBVMM1	1"	25	0.98	25.0	3.56	90.5	2.86	5.00	127	0.88	22.4	1.38	35.0	M6 x P1.0	110	2.73
13TBVMM125	1 1/4"	32	1.26	32.0	3.92	99.5	3.45	6.14	156	1.00	25.4	1.50	38.1	M6 x P1.0	180	4.52
13TBVMM15	1 1/2"	40	1.50	38.0	4.65	118.0	3.66	7.60	193	1.00	25.4	1.50	38.1	M6 x P1.0	270	5.68
13TBVMM2	2"	50	2.00	50.8	5.37	136.5	4.11	7.60	193	1.00	25.4	1.50	38.1	M6 x P1.0	500	9.76

PRESSURE TEMPERATURE RATINGS (ME-PTFE SEATS)



MATERIALS LIST

NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	1
3	BALL	ASTM A351 Gr. CF8M	1
4	STEM	ASTM A276 Gr. 316	1
5	SEAT	ME-PTFE*	2
6	GASKET	ME-PTFE*	1
7	THRUST WASHER	ME-PTFE*	1
8	PACKING	ME-PTFE*	1
9	GLAND	SS304	1
10	HANDLE	SS304	1
11	SPRING WASHER	SS304	1
12	HANDLE NUT	SS304	1
13	HANDLE SLEEVE	VINYL GRIP	1
14	LOCKING PLATE	SS304	1

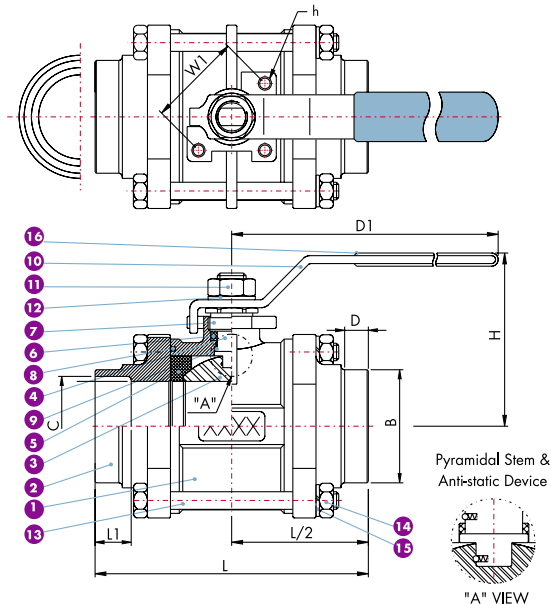
*ME-PTFE IS MOLECULARLY ENHANCED PTFE

* SIZES SHOWN ARE APPROXIMATE AND MAY VARY



DESIGN FEATURES

- Pressure rating: 1000 PSI WOG (NON-SHOCK)
- Steam Rating: 150 PSI WSP
- Investment cast body & cap
- Anti-static blow-out-proof stem
- Adjustable stem packing
- Stainless Steel handle with vinyl grip

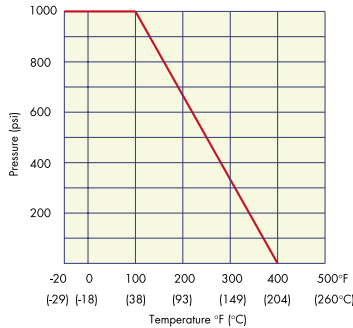


3 PC FULL PORT 1000 WOG BALL VALVE, BUTTWELD

DIMENSIONS

SIZE		B		C		D		L		L1		H		D1		W1		h	Cv	Weight
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	inch	mm	inch	mm		Factor	Lb	
1/4"	8							2.56	65			4.02	4.02	102	1.42	36	M5 x P0.8	6	1.06	
3/8"	10							2.56	65			4.02	4.02	102	1.42	36	M5 x P0.8	12	1.01	
1/2"	15	0.67	17.0	0.55	14.0	0.24	6.0	2.80	71	0.35	9.0	4.02	4.02	102	1.42	36	M5 x P0.8	19	1.28	
3/4"	20	0.94	24.0	0.83	21.0	0.24	6.0	3.35	85	0.35	9.0	4.96	4.96	126	1.42	36	M5 x P0.8	37	2.02	
1"	25	1.18	30.0	1.06	27.0	0.28	7.0	3.74	95	0.41	10.5	4.96	4.96	126	1.42	36	M5 x P0.8	64	2.62	
1 1/4"	32	1.46	37.0	1.34	34.0	0.28	7.0	4.41	112	0.41	10.5	5.91	5.91	150	1.97	50	M6 x P1.0	103	4.57	
1 1/2"	40	1.73	44.0	1.61	41.0	0.31	8.0	4.84	123	0.47	12.0	5.91	5.91	150	1.97	50	M6 x P1.0	143	6.06	
2"	50	2.20	56.0	2.09	53.0	0.31	8.0	5.55	141	0.47	12.0	7.32	7.32	186	1.97	50	M6 x P1.0	360	8.98	
2 1/2"	65	3.00	76.1	2.84	72.1	0.31	8.0	6.81	173	0.47	12.0	10.71	10.71	272	2.76	70	M8 x P1.25	440	17.9	
3"	80	3.50	89.0	3.35	85.0	0.31	8.0	7.56	192	0.47	12.0	10.71	10.71	272	4.02	102	M10 x P1.5	520	28.03	
4"	100	4.25	108.0	4.09	104.0	0.31	8.0	8.86	225	0.47	12.0	13.19	13.19	335	4.02	102	M10 x P1.5	820	46.57	

PRESSURE TEMPERATURE RATINGS (BODY)



MATERIALS LIST

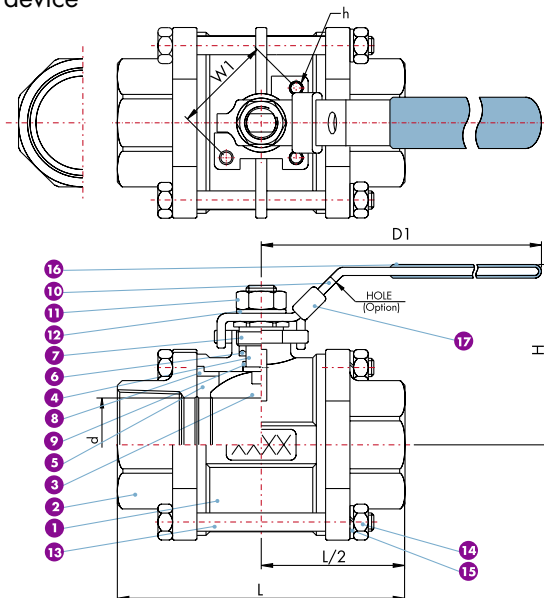
NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	2
3	BALL	ASTM A351 Gr. CF8M	1
4	STEM	ASTM A276 Gr. 316	1
5	SEAT	PTFE	2
6	PACKING	GRAFOIL	1
7	GLAND	SS304	1
8	GASKET	GRAFOIL	2
9	THRUST WASHER	PTFE	1
10	HANDLE	SS304	1
11	HANDLE NUT	SS304	1
12	SPRING WASHER	SS304	1
13	BOLTS	ASTM A193 Gr. B8	4-6
14	BOLT NUTS	ASTM A194 Gr. 8	4-6
15	BOLT WASHERS	SS304	4-6
16	HANDLE SLEEVE	VINYL GRIP	1

* SIZES SHOWN ARE APPROXIMATE AND MAY VARY



DESIGN FEATURES

- Pressure rating: 1000 PSI WOG (NON-SHOCK)
- Steam Rating: 150 PSI WSP
- Investment cast body & cap
- Blow-out-proof stem
- Adjustable stem packing
- Stainless Steel handle with vinyl grip
- Locking device



3PC FULL PORT 1000 WOG BALL VALVE, THREADED

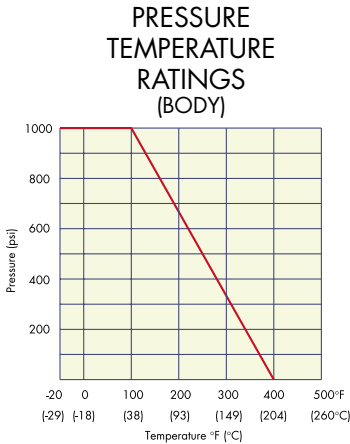
DIMENSIONS

CODES	SIZE		d		L		D1		H		W1		h	Cv Factor	Weight Lb
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm			
13TBV3025	1/4"	8	0.43	11.0	2.56	65	4.02	102	4.02	54	1.42	36	M5 x P0.8	6	1.06
13TBV30375	3/8"	10	0.49	12.5	2.56	65	4.02	102	4.02	54	1.42	36	M5 x P0.8	12	1.01
13TBV305	1/2"	15	0.59	15.0	2.80	71	4.02	102	4.02	55	1.42	36	M5 x P0.8	19	1.28
13TBV3075	3/4"	20	0.79	20.0	3.35	85	4.96	126	4.96	65	1.42	36	M5 x P0.8	37	2.02
13TBV31	1"	25	1.00	25.4	3.74	95	4.96	126	4.96	71	1.42	36	M5 x P0.8	64	2.62
13TBV3125	1 1/4"	32	1.26	32.0	4.37	111	5.91	150	5.91	89	1.97	50	M6 x P1.0	103	4.57
13TBV315	1 1/2"	40	1.57	40.0	4.76	121	5.91	150	5.91	94	1.97	50	M6 x P1.0	143	6.06
13TBV32	2"	50	2.00	50.8	5.51	140	7.32	186	7.32	100	1.97	50	M6 x P1.0	360	8.98
13TBV325	2 1/2"	65	2.56	65.0	6.81	173	10.71	272	10.71	121	2.76	70	M8 x P1.25	440	17.9
13TBV33	3"	80	3.15	80.0	7.56	192	10.71	272	10.71	134	4.02	102	M10 x P1.5	520	28.03
13TBV34	4"	100	3.94	100.0	8.86	225	13.19	335	13.19	172	4.02	102	M10 x P1.5	820	46.57

MATERIALS LIST

NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	2
3	BALL	ASTM A351 Gr. CF8M	1
4	STEM	ASTM A276 Gr. 316	1
5	SEAT	PTFE+15% G/F	2
6	PACKING	PTFE	1
7	GLAND	SS304	1
8	END SEALS	PTFE	2
9	THRUST WASHER	PTFE	1
10	HANDLE	SS304	1
11	HANDLE NUT	SS304	1
12	SPRING WASHER	SS304	1
13	BOLTS	ASTM A193 Gr. B8	4-6
14	BOLT NUTS	ASTM A194 Gr. 8	4-6
15	BOLT WASHERS	SS304	4-6
16	HANDLE SLEEVE	VINYL GRIP	1
17	LOCKING PLATE*	SS304	1

*OPTION

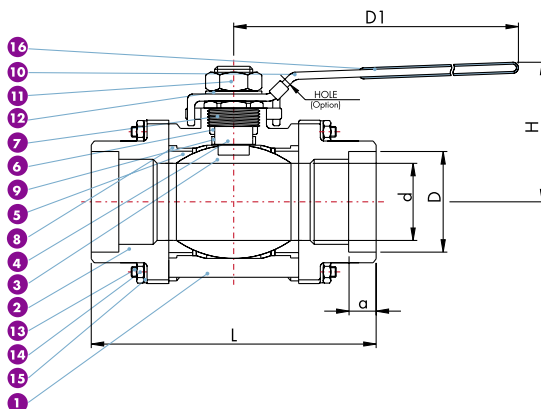
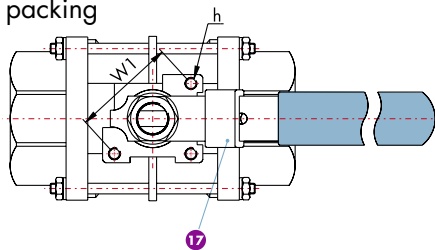


* SIZES SHOWN ARE APPROXIMATE AND MAY VARY



DESIGN FEATURES

- Pressure rating: 1000 PSI WOG (NON-SHOCK)
- Steam Rating: 150 PSI WSP
- Investment cast body & cap
- Blow-out-proof stem
- Adjustable stem packing
- Stainless Steel handle with vinyl grip
- Locking device



3PC FULL PORT 1000 WOG BALL VALVE, SOCKETWELD

DIMENSIONS

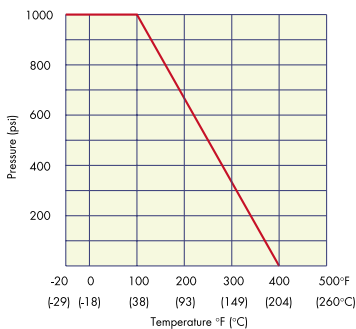
CODES	SIZE		a		d		D		D1	H	L		W1	h	Cv	Weight Lb
	inch	mm	inch	mm	inch	mm	inch	mm	inch	inch	inch	mm	inch		Factor	
13WBV3025	1/4"	8	0.39	10	0.43	11.0	0.56	14.1	4.02	2.13	2.56	65	1.42	M5 x P0.8	6	1.06
13WBV30375	3/8"	10	0.39	10	0.49	12.5	0.69	17.5	4.02	2.13	2.56	65	1.42	M5 x P0.8	12	1.01
13WBV305	1/2"	15	0.39	10	0.59	15.0	0.85	21.7	4.02	2.24	2.80	71	1.42	M5 x P0.8	19	1.28
13WBV3075	3/4"	20	0.51	13	0.79	20.0	1.07	27.1	4.96	2.64	3.35	85	1.42	M5 x P0.8	37	2.02
13WBV31	1"	25	0.51	13	1.00	25.4	1.33	33.8	5.00	2.76	3.74	95	1.42	M5 x P0.8	64	2.62
13WBV3125	1 1/4"	32	0.51	13	1.26	32.0	1.67	42.5	6.14	3.59	4.41	111	1.97	M6 x P1.0	103	4.57
13WBV315	1 1/2"	40	0.51	13	1.57	40.0	1.91	48.6	6.14	3.74	4.84	121	1.97	M6 x P1.0	143	6.06
13WBV32	2"	50	0.63	16	2.00	50.8	2.41	61.1	7.52	4.02	5.55	141	1.97	M6 x P1.0	360	8.98
13WBV325	2 1/2"	65	0.63	16	2.56	65.0	2.91	73.8	10.71	4.76	6.81	173	2.76	M8 x P1.25	440	17.9
13WBV33	3"	80	0.63	16	3.15	80.0	3.54	89.8	10.98	5.08	7.56	192	4.02	M10 x P1.5	520	28.03
13WBV34	4"	100	0.75	19	3.94	100.0	4.55	115.5	13.19	6.84	8.86	225	4.02	M10 x P1.5	820	46.57

MATERIALS LIST

NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	2
3	BALL	ASTM A351 Gr. CF8M	1
4	STEM	ASTM A276 Gr. 316	1
5	SEAT	PTFE+15% G/F	2
6	PACKING	PTFE	1
7	GLAND	SS304	1
8	END SEALS	PTFE	2
9	THRUST WASHER	PTFE	1
10	HANDLE	SS304	1
11	HANDLE NUT	SS304	1
12	SPRING WASHER	SS304	1
13	BOLTS	ASTM A193 Gr. B8	4-6
14	BOLT NUTS	ASTM A194 Gr. 8	4-6
15	BOLT WASHER	SS304	4-6
16	HANDLE SLEEVE	VINYL GRIP	1
17	LOCKING PLATE	SS304	1

*OPTION

PRESSURE TEMPERATURE RATINGS (BODY)

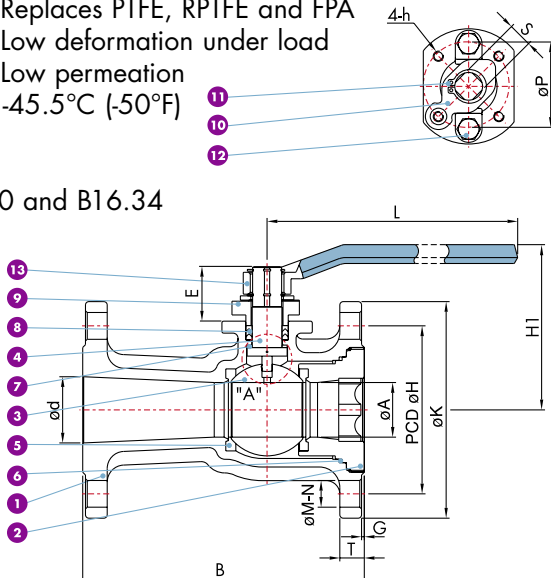




DESIGN FEATURES

- 1 PC 150# Regular Port
- ISO 5211 actuator mounting pad
- Blow-out-proof stem design
- Anti-static device
- Adjustable stem packing
- Locking device
- Body: ASTM A351 Gr.CF8M for TC-6000
- ME-PTFE Seal Kits: Replaces PTFE, RPTFE and FPA
Low deformation under load
Low permeation
- Temperature rating: -45.5°C (-50°F) to 246°C (475°F)
- Long cycle life
- ANSI B16.5, B16.10 and B16.34 full compliance
- Test standard: API 598

Pyramidal Stem & Anti-static Device

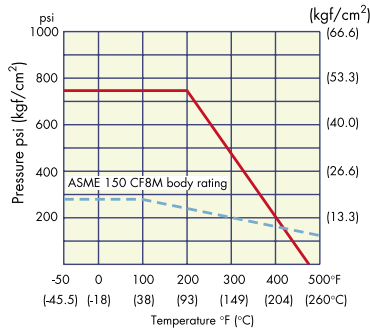


IPC CLASS 150 REGULAR PORT BALL VALVE, FLANGED

DIMENSIONS

CODES	SIZE		A	B	E	d	G	H	K	T	M	N	P	S	L	H1	h	Cv	Weight	
	inch	mm	inch	inch	inch	inch	mm	inch	inch	inch	inch	inch	inch	inch	inch	inch		Factor	Lb	
13FVAI1	1"	25	0.79	5.0	0.98	0.98	25	0.06	3.12	4.25	0.44	0.62	4	1.65	0.43	5.18	2.95	M5xP0.8	52	5.07
13FVAI15	1 1/2"	40	1.26	6.5	1.24	1.57	40	0.06	3.88	5.00	0.56	0.62	4	1.97	0.55	6.42	3.81	M6xP1.0	120	9.92
13FVAI2	2"	50	1.50	7.0	1.65	1.97	50	0.06	4.75	6.00	0.62	0.75	4	2.76	0.67	9.13	4.96	M8xP1.25	170	15.66
13FVAI25	2 1/2"	65	1.97	7.5	1.65	2.64	67	0.06	5.50	7.00	0.69	0.75	4	2.76	0.67	9.13	5.32	M8xP1.25	255	24.00
13FVAI3	3"	80	2.56	8.0	2.20	3.15	80	0.06	6.00	7.50	0.75	0.75	4	4.02	0.87	12.87	5.98	M10xP1.5	430	31.31
13FVAI4	4"	100	3.15	9.0	2.20	3.94	100	0.06	7.50	9.00	0.94	0.75	8	4.02	0.87	12.87	6.30	M10xP1.5	565	52.00
13FVAI6	6"	150	3.94	10.5	2.20	5.91	150	0.06	9.50	11.00	1.00	0.88	8	4.02	0.87	12.87	7.01	M10xP1.5	600	78.06

PRESSURE TEMPERATURE RATINGS (ME-PTFE SEATS)



MATERIALS LIST

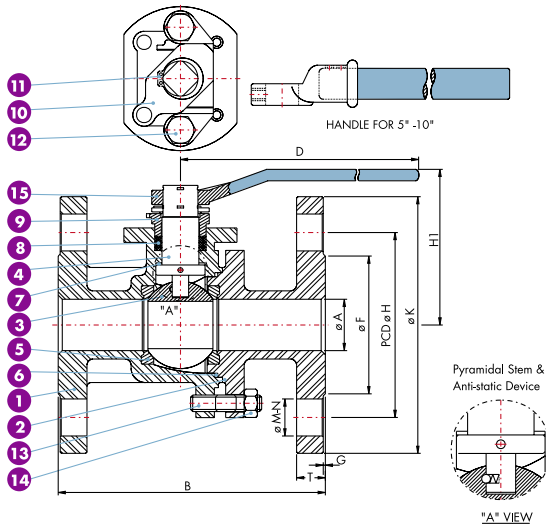
NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	1
3	BALL	ASTM A351 Gr. CF8M	1
4	STEM	ASTM A276 Gr. 316	1
5	SEAT	ME-PTFE*	2
6	GASKET	ME-PTFE*	1
7	THRUST WASHER	ME-PTFE*	1
8	PACKING	ME-PTFE*	1
9	GLAND	ASTM A351 Gr. CF8	1
10	STOPPER	SS304	1
11	SNAP RING	SS304	2
12	GLAND BOLT	ASTM A193 Gr. B8	2
13	HANDLE	ASTM A536 Gr. 65, 45 & 12	1

*ME-PTFE IS MOLECULARLY ENHANCED PTFE



DESIGN FEATURES

- 2 PC 150# Full Port
- Face to face: ANSI B16.10
- Flange dimension: ANSI B16.5
- Wall thickness: ANSI B16.34
- Test standard: API 598
- Option: Anti-static

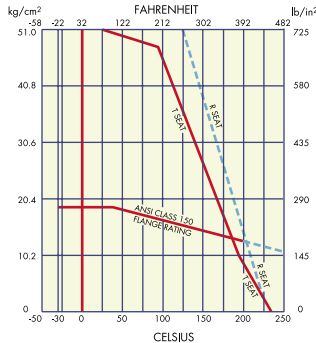


2PC CLASS 150 FULL PORT BALL VALVE FLANGED

DIMENSIONS

CODES	A		B		F		G		H		K		T		M		N		D		H1		Cv	Weight Lb
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm		
13FV205	1/2"	15	0.59	15.0	4.25	107.9	1.38	0.06	2.38	3.50	0.44	0.62	4	5.12	2.9	19	4.41							
13FV2075	3/4"	20	0.79	20.0	4.62	117.3	1.69	0.06	2.75	3.88	0.44	0.62	4	5.12	3.0	37	5.51							
13FV21	1"	25	0.98	25.0	5.00	127.0	2.00	0.06	3.12	4.25	0.44	0.62	4	6.46	3.7	54	6.62							
13FV2125	1 1/4"	32	1.26	32.0	5.50	139.7	2.50	0.06	3.50	4.62	0.50	0.62	4	6.46	3.9	103	9.5							
13FV215	1 1/2"	40	1.50	38.0	6.50	165.1	2.88	0.06	3.88	5.00	0.56	0.62	4	8.07	4.7	143	13.5							
13FV22	2"	50	1.97	50.0	7.00	177.8	3.62	0.06	4.75	6.00	0.62	0.75	4	8.07	5.2	360	18.74							
13FV225	2 1/2"	65	2.56	65.0	7.50	190.5	4.12	0.06	5.50	7.00	0.69	0.75	4	8.07	5.3	440	28.67							
13FV23	3"	80	3.15	80.0	8.00	203.2	5.00	0.06	6.00	7.50	0.75	0.75	4	12.83	6.1	520	39.69							
13FV24	4"	100	3.94	100.0	9.00	228.6	6.19	0.06	7.50	9.00	0.94	0.75	8	12.83	6.9	820	61.74							
13FV25	5"	125	4.92	125.0	14.00	355.6	7.31	0.06	8.50	10.00	0.94	0.88	8	42.20	9.4	1500	-							
13FV26	6"	150	5.91	150.0	15.50	393.7	8.50	0.06	9.50	11.00	1.00	0.88	8	42.20	9.8	1920	165.38							
13FV28	8"	200	7.87	200.0	18.00	457.2	10.62	0.06	11.75	13.50	1.12	0.88	8	42.52	11.7	3600	286.65							

PRESSURE TEMPERATURE RATINGS (BODY)



MATERIALS LIST

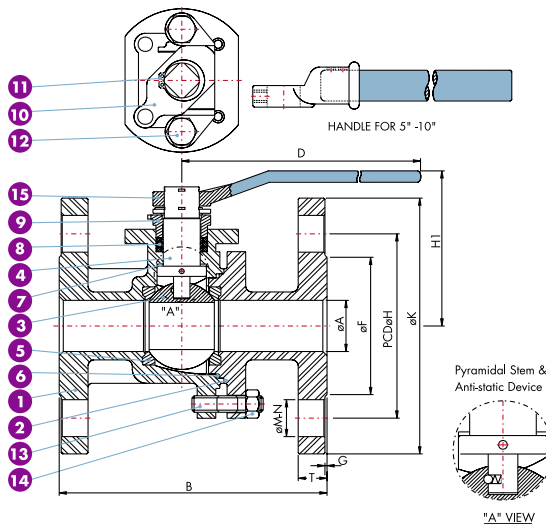
NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	1
3	BALL	ASTM A351 Gr. CF8M	1
4	STEM	ASTM A276 Gr. 316	1
5	SEAT	PTFE	2
6	GASKET	PTFE	1
7	THRUST WASHER	PTFE	1
8	PACKING	PTFE	1
9	GLAND	ASTM A351 Gr. CF8	1
10	STOPPER	SS304	1
11	SNAP RING	SS304	2
12	GLAND BOLT	ASTM A193 Gr. B8	2
13	STUD BOLT	ASTM A193 Gr. B8	4-12
14	SET NUT	ASTM A194 Gr. 8M	4-12
15	HANDLE	ASTM A536 Gr. 65, 45 & 12	1

* SIZES SHOWN ARE APPROXIMATE AND MAY VARY



DESIGN FEATURES

- 2 PC 300# Full Port
- Face to face: ANSI B16.10
- Flange dimension: ANSI B16.5
- Wall thickness: ANSI B16.34
- Test standard: API 598
- Option: Anti-static

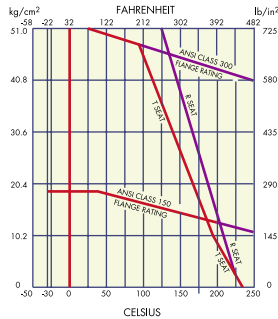


2PC CLASS 300 FULL PORT BALL VALVE FLANGED

DIMENSIONS

CODES	SIZE		A		B		F	G	H	K	T	M	N	D	H1	Cv	Weight
	inch	mm	inch	mm	inch	mm	inch	inch	inch	inch	inch	inch	inch	inch	inch	Factor	Lb
13FVB205	1/2"	15	0.59	15.0	5.50	139.7	1.38	0.06	2.62	3.75	0.56	0.62	4	5.12	2.9	19	5.58
13FVB2075	3/4"	20	0.79	20.0	6.00	152.4	1.69	0.06	3.25	4.62	0.62	0.75	4	5.12	3.0	37	7.72
13FVB21	1"	25	0.98	25.0	6.50	165.1	2.00	0.06	3.50	5.88	0.69	0.75	4	6.46	3.7	54	10.1
13FVB2125	1 1/4"	32	1.26	32.0	7.00	177.8	2.50	0.06	3.88	5.25	0.75	0.75	4	6.46	3.9	103	13.58
13FVB215	1 1/2"	40	1.50	38.1	7.50	190.5	2.88	0.06	4.50	6.12	0.81	0.88	4	8.07	4.7	143	20.95
13FVB22	2"	50	1.97	50.0	8.50	215.9	3.62	0.06	5.00	6.50	0.88	0.75	8	8.07	5.2	360	24.92
13FVB225	2 1/2"	65	2.56	65.0	9.50	241.3	4.12	0.06	5.88	7.50	1.00	0.88	8	8.07	5.3	440	41.45
13FVB23	3"	80	3.15	80.0	11.12	282.4	5.00	0.06	6.62	8.25	1.12	0.88	8	12.83	6.1	520	58.65
13FVB24	4"	100	3.94	100.0	12.00	304.8	6.19	0.06	7.88	10.00	1.25	0.88	8	12.83	6.9	820	91.29
13FVB25	5"	125	4.92	125.0	15.00	381.0	7.31	0.06	9.25	11.00	1.38	0.88	8	42.20	9.4	1500	—
13FVB26	6"	150	5.91	150.0	15.88	403.3	8.50	0.06	10.62	12.50	1.44	0.88	12	42.20	9.8	1920	202.86
13FVB28	8"	200	7.87	200.0	19.75	501.6	10.62	0.06	13.00	15.00	1.62	1.00	12	42.52	11.73	3600	384.33

PRESSURE TEMPERATURE RATINGS (BODY)



MATERIALS LIST

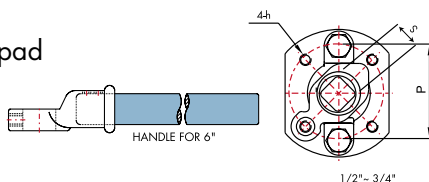
NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	1
3	BALL	ASTM A351 Gr. CF8M	1
4	STEM	ASTM A276 Gr. 316	1
5	SEAT	PTFE+15% G/F	2
6	GASKET	PTFE	1
7	THRUST WASHER	PTFE	1
8	PACKING	PTFE	1
9	GLAND	ASTM A351 Gr. CF8	1
10	STOPPER	SS304	1
11	SNAP RING	SS304	2
12	GLAND BOLT	ASTM A193 Gr. B8	2
13	STUD BOLT	ASTM A193 Gr. B8	4-12
14	SET NUT	ASTM A194 Gr. 8M	4-12
15	HANDLE	ASTM A536 Gr. 65, 45 & 12	1

* SIZES SHOWN ARE APPROXIMATE AND MAY VARY

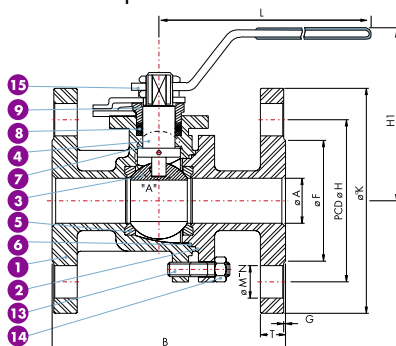
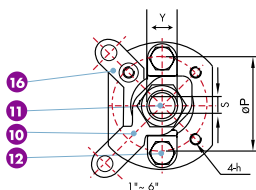
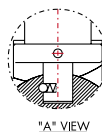


DESIGN FEATURES

- 2 PC 150# Full Port FS
- Steam rating: 150 PSI WSP
- ISO 5211 actuator mounting pad
- Blow-out-proof stem design
- Anti-static device
- Adjustable stem packing
- Locking device
- Body: ASTM A351 Gr.CF8M for TC-5000
ASTM A216 Gr.WCB for TC-5100
- ME-PTFE Seal Kits: Replaces PTFE, RPTFE and FPA
Low deformation under load
Low permeation
- Temperature rating: -45.5°C (-50°F) to 246°C (475°F)
- Long cycle life
- ANSI B16.5, B16.10 and B16.34 full compliance
- Test standard: API 598
- API 607 approval



Pyramidal Stem &
Anti-static Device

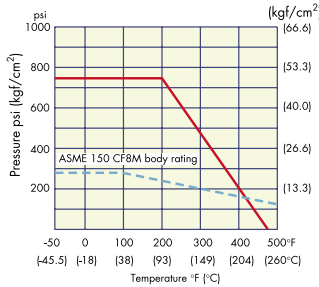


2PC CLASS 150 FULL PORT "FS" BALL VALVE, FLANGED

DIMENSIONS

SIZE	A	B	F	G	H	K	T	M	N	P	L	H1	h	Cv	Weight		
inch	mm	inch	inch	inch	inch	inch	inch	inch		inch	mm	inch	inch	Factor	Lb		
1/2"	15	0.59	4.25	1.38	0.06	2.38	3.50	0.44	0.62	4	1.65	42	5.18	2.91	M5xP0.8	26	4.41
3/4"	20	0.79	4.62	1.69	0.06	2.75	3.88	0.44	0.62	4	1.65	42	5.18	2.94	M5xP0.8	55	5.51
1"	25	0.98	5.00	2.00	0.06	3.12	4.25	0.44	0.62	4	1.97	50	6.42	3.44	M6xP1.0	110	6.62
1 1/4"	32	1.26	5.50	2.50	0.06	3.50	4.62	0.50	0.62	4	1.97	50	6.42	3.63	M6xP1.0	180	9.92
1 1/2"	40	1.50	6.50	2.88	0.06	3.88	5.00	0.56	0.62	4	2.76	70	9.13	4.76	M8xP1.25	270	13.23
2"	50	1.97	7.00	3.62	0.06	4.75	6.00	0.62	0.75	4	2.76	70	9.13	5.08	M8xP1.25	500	18.74
2 1/2"	65	2.56	7.50	4.12	0.06	5.50	7.00	0.69	0.75	4	2.76	70	9.13	5.55	M8xP1.25	800	28.67
3"	80	3.15	8.00	5.00	0.06	6.00	7.50	0.75	0.75	4	4.02	102	12.87	6.52	M10xP1.5	1150	39.69
4"	100	3.94	9.00	6.19	0.06	7.50	9.00	0.94	0.75	8	4.02	102	12.87	7.11	M10xP1.5	2120	61.74
6"	150	5.91	15.50	8.50	0.06	9.50	11.00	1.00	0.88	8	4.92	125	42.26	9.95	M12xP1.75	5100	165.38

PRESSURE TEMPERATURE RATINGS (ME-PTFE SEATS)



MATERIALS LIST

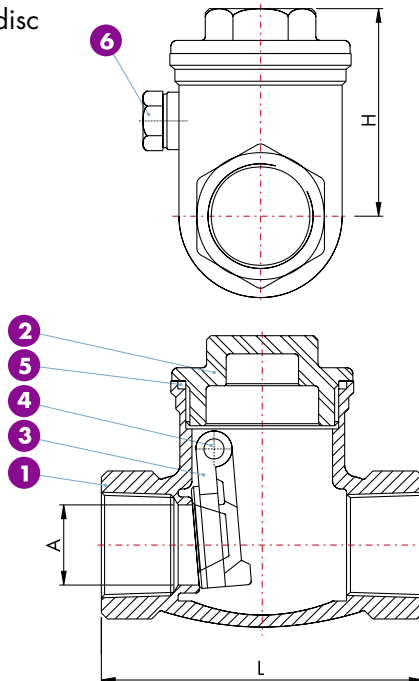
NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	1
3	BALL	ASTM A351 Gr. CF8M	1
4	STEM	ASTM A276 Gr. 316	1
5	SEAT	ME-PTFE*	2
6	GASKET	SPIRAL-WOUND GASKET	1
7	THRUST WASHER	ME-PTFE*	1
8	PACKING	ME-PTFE*	1
9	GLAND	ASTM A351 Gr. CF8	1
10	STOPPER	SS304	1
11	SNAP RING	SS304	2
12	GLAND BOLT	ASTM A193 Gr. B8	2
13	STUD BOLT	ASTM A193 Gr. B8	4~10
14	SET NUT	ASTM A194 Gr. 8	4~10
15	HANDLE	SS304	1
16	LOCKING PLATE	SS304	1

*ME-PTFE IS MOLECULARLY ENHANCED PTFE



DESIGN FEATURES

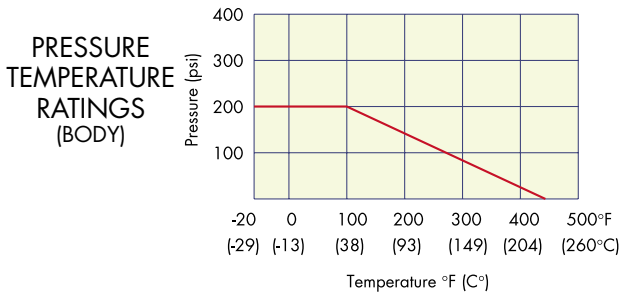
- Pressure rating: 200 PSI WOG (NON-SHOCK)
- Steam Rating: 150 PSI WSP
- Investment cast body & cap
- Screwed cap
- Swing type disc



FULL PORT
200 WOG SWING CHECK VALVE, THREADED

DIMENSIONS

CODES	SIZE		A		L		H		Cv Factor	Weight Lb
	inch	mm	inch	mm	inch	mm	inch	mm		
13TCV025	1/4"	8	0.39	10	2.56	65.0	1.77	45	–	0.73
13TCV0375	3/8"	10	0.47	12	2.56	65.0	1.77	45	4	0.68
13TCV05	1/2"	15	0.59	15	2.60	66.0	1.81	46	6.5	0.64
13TCV075	3/4"	20	0.79	20	3.19	81.0	2.13	54	15	1.08
13TCV1	1"	25	0.98	25	3.58	91.0	2.36	60	28	1.52
13TCV125	1 1/4"	32	1.26	32	4.19	106.5	2.83	72	45	2.32
13TCV15	1 1/2"	40	1.57	40	4.76	121.0	2.95	75	65	3.48
13TCV2	2"	50	1.97	50	5.59	142.0	3.23	82	120	5.16
13TCV25	2 1/2"	65	2.56	65	6.26	159.0	3.54	90	180	8.38
13TCV3	3"	80	3.15	80	7.48	190.0	4.09	104	280	13.01



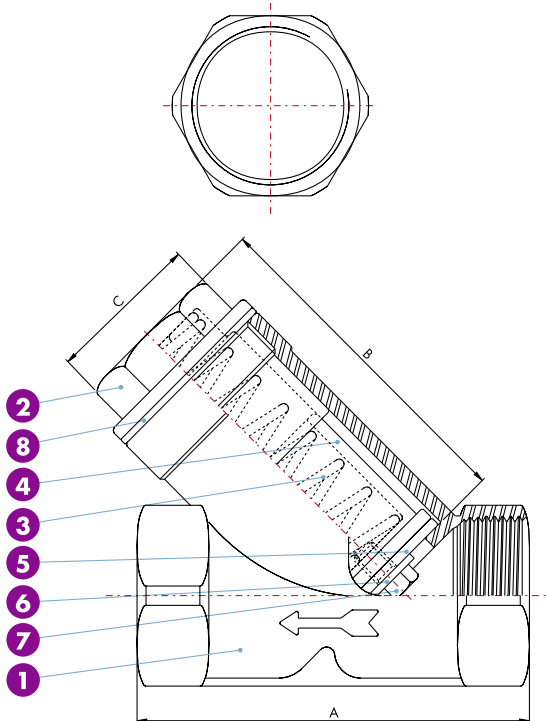
MATERIALS LIST

NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	1
3	DISC	ASTM A351 Gr. CF8M	1
4	HINGE PIN	SS316	1
5	GASKET	PTFE	1
6	PLUG	SS316	1



DESIGN FEATURES

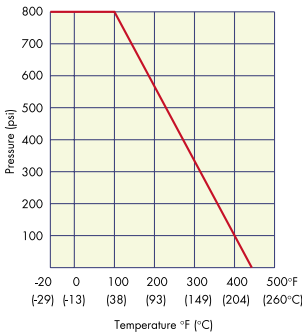
- Investment cast body & cap
- Screwed-in cap
- Connecting threads: ANSI B2.1/BS21



DIMENSIONS

CODES	SIZE		A		B		C		Cv Factor	Weight Lb	Cracking Pressure
	inch	mm	inch	mm	inch	mm	inch	mm			
13TYC025	1/4"	8	2.56	65	1.81	46	0.75	19	2	0.62	0.435
13TYC0375	3/8"	10	2.56	65	1.81	46	0.75	19	3.8	0.54	0.435
13TYC05	1/2"	15	2.56	65	1.81	46	0.75	19	6.3	0.71	0.435
13TYC075	3/4"	20	3.15	80	2.28	58	0.91	23	14	0.95	0.464
13TYC1	1"	25	3.54	90	2.72	69	1.06	27	27	1.62	0.464
13TYC125	1 1/4"	32	4.13	105	2.95	75	1.26	32	43	2.15	0.508
13TYC15	1 1/2"	40	4.72	120	3.35	85	1.61	41	64	3.15	0.508
13TYC2	2"	50	5.51	140	3.86	98	1.97	50	116	4.85	0.580
13TYC25	2 1/2"	65	6.69	170	4.62	117	2.56	65	185	9.75	0.653
13TYC3	3"	80	7.87	200	5.35	136	3.15	80	270	14.35	-

PRESSURE
TEMPERATURE
RATINGS
(BODY)



MATERIALS LIST

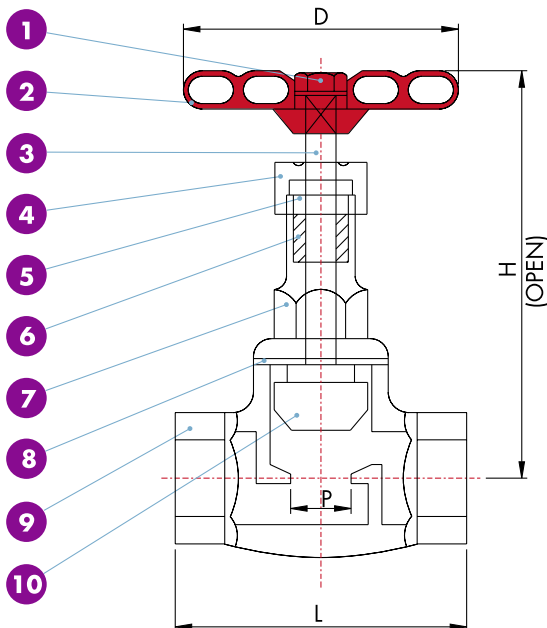
NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP	ASTM A351 Gr. CF8M	1
3	SPRING	SS304	1
4	DISC	SS316	1
5	SEAT	TEFLON	1
6	WASHER	SS304	1
7	BOLT	SS304	1
8	GASKET PACKING	TEFLON	1

* SIZES SHOWN ARE APPROXIMATE AND MAY VARY



DESIGN FEATURES

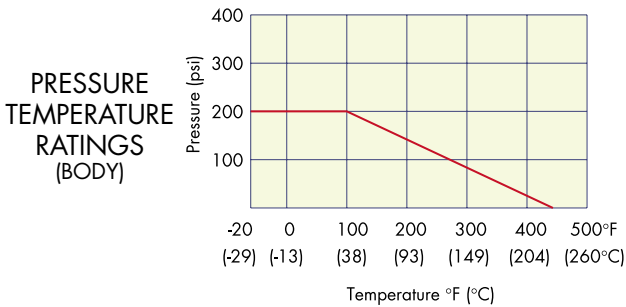
- Pressure rating: 200 PSI WOG (NON-SHOCK)
- Investment cast body & bonnet
- Screwed bonnet
- Rising stem and wheel



FULL PORT
200 WOG GLOBE VALVE, THREADED

DIMENSIONS

CODES	SIZE		P		L		H (OPEN)		D		Cv	Weight
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	Factor	Lb
13TGLV025	1/4"	8	0.39	10	2.05	52.0	4.02	102	2.36	60.0	1	1.04
13TGLV0375	3/8"	10	0.47	12	2.05	52.0	4.02	102	2.36	60.0	1.5	1.01
13TGLV05	1/2"	15	0.47	12	2.60	66.0	3.74	95	2.76	70.0	2.5	1.46
13TGLV075	3/4"	20	0.59	15	2.70	68.5	3.90	99	2.76	70.0	5.6	1.46
13TGLV1	1"	25	0.79	20	3.08	78.3	4.02	102	3.01	76.5	10.5	2.1
13TGLV125	1 1/4"	32	0.98	25	3.39	86.0	4.96	126	4.07	103.5	17	3.11
13TGLV15	1 1/2"	40	1.30	33	3.86	98.0	5.35	136	4.07	103.5	25	4.83
13TGLV2	2"	50	1.57	40	4.35	110.5	6.14	156	4.76	121.0	46	6.09



MATERIALS LIST

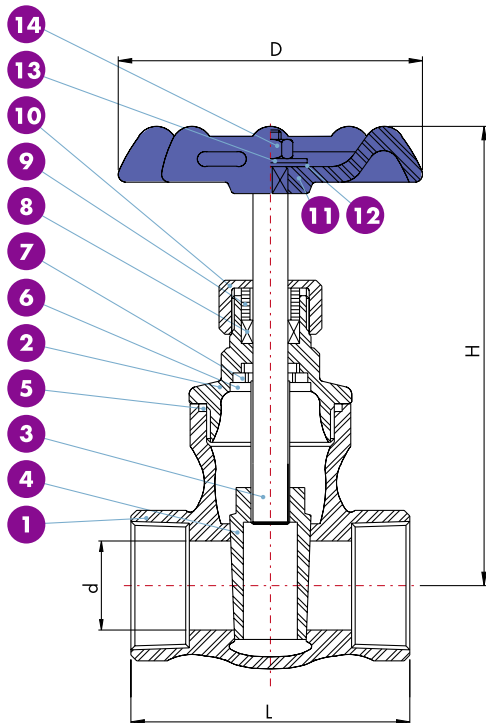
NO.	PART NAME	MATERIAL	QTY
1	NUT	SS304	1
2	HANDWHEEL	SS400	1
3	STEM	ASTM A276 Gr. 316	1
4	GLAND NUT	ASTM A351 Gr. CF8M	1
5	GLAND	ASTM A351 Gr. CF8M	1
6	GLAND PACKING	PTFE	1
7	BONNET	ASTM A351 Gr. CF8M	1
8	GASKET	PTFE	1
9	BODY	ASTM A351 Gr. CF8M	1
10	DISC	ASTM A351 Gr. CF8M	1

* SIZES SHOWN ARE APPROXIMATE AND MAY VARY



DESIGN FEATURES

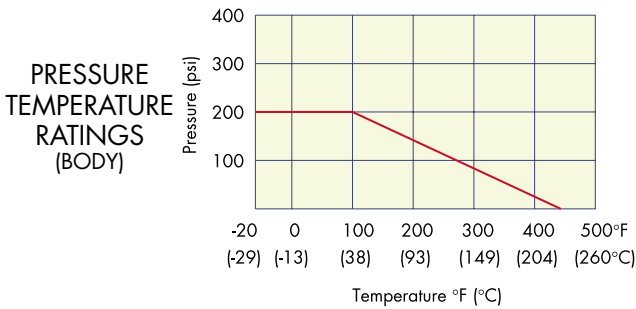
- Pressure rating: 200 PSI WOG (NON-SHOCK)
- Investment cast body & bonnet
- Non-rising stem
- Solid wedge disc



FULL PORT
200 WOG GATE VALVE, THREADED

DIMENSIONS

CODES	SIZE		d		L		H		D		Cv Factor	Weight Lb
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm		
13TGAV05	1/2"	15	0.63	16.1	2.24	57.0	3.88	98.6	2.76	70.0	15	0.93
13TGAV075	3/4"	20	0.80	20.3	2.38	60.5	4.06	103.0	2.76	70.0	37	1.24
13TGAV1	1"	25	1.02	26.0	2.64	67.0	4.53	115.0	3.01	76.5	72	1.61
13TGAV125	1 1/4"	32	1.25	31.8	2.99	76.0	5.04	128.0	3.01	76.5	110	2.14
13TGAV15	1 1/2"	40	1.57	40.0	3.43	87.0	6.81	173.0	4.07	103.5	165	2.96
13TGAV2	2"	50	1.98	50.3	3.74	95.0	7.44	189.0	4.76	121.0	320	4.26



MATERIALS LIST

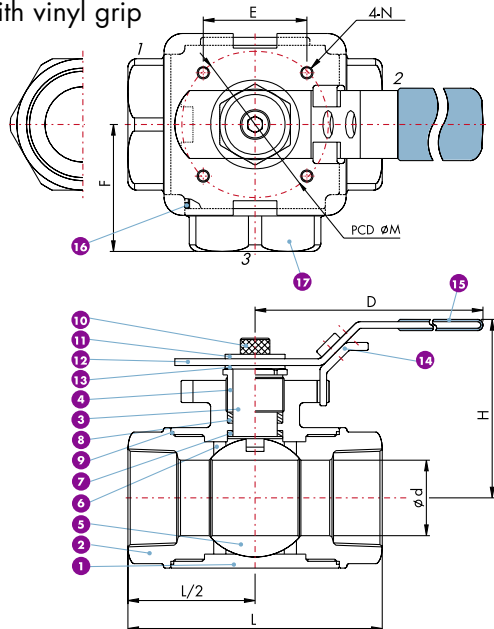
NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	BONNET	ASTM A351 Gr. CF8M	1
3	STEM	ASTM A276 Gr. 316	1
4	DISC	ASTM A351 Gr. CF8M	1
5	GASKET	PTFE	1
6	STOP RING	SS304	1
7	STEM HOLDER	SS316	1
8	STEM PACKING	PTFE	1
9	GLAND	SS304	1
10	GLAND NUT	SS316	1
11	HANDLEWHEEL	SS400	1
12	NAME PLATE	ALUMINUM	1
13	HANDLEWHEEL WASHER	SS304	1
14	HANDLEWHEEL NUT	SS304	1

* SIZES SHOWN ARE APPROXIMATE AND MAY VARY



DESIGN FEATURES

- "L" Port
- Pressure rating: 1000 PSI WOG (NON-SHOCK)
- Steam Rating: 150 PSI WSP
- Investment cast body & cap
- Bottom-loaded, Blow-out-proof stem
- Adjustable stem packing
- Stainless Steel handle with vinyl grip
- Locking device

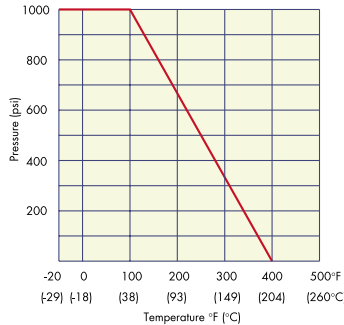


3 WAY REDUCED PORT 1000 WOG BALL VALVE, THREADED "L" PORT

DIMENSIONS

CODES	SIZE		d		L		H	D	E		F		M		N	Cv	Weight
	inch	mm	inch	mm	inch	mm	inch	inch	inch	mm	inch	mm	inch	mm		Factor	Lb
13TBVL025	1/4"	8	0.43	11.0	2.68	68	2.28	4.17	1.17	29.7	1.34	34.0	1.65	42	M5 x P0.8	6.0	1.32
13TBVL0375	3/8"	10	0.43	11.0	2.68	68	2.28	4.17	1.17	29.7	1.34	34.0	1.65	42	M5 x P0.8	6.0	1.32
13TBVL05	1/2"	15	0.50	12.7	2.95	75	2.40	5.43	1.17	29.7	1.48	37.5	1.65	42	M5 x P0.8	12.0	1.47
13TBVL075	3/4"	20	0.63	16.0	3.39	86	2.91	5.43	1.39	35.4	1.69	43.0	1.97	50	M6 x P1.0	15.5	2.62
13TBVL1	1"	25	0.79	20.0	4.06	103	3.19	6.38	1.39	35.4	2.03	51.5	1.97	50	M6 x P1.0	20.0	3.75
13TBVL125	1 1/4"	32	0.98	25.0	4.53	115	3.46	6.38	1.39	35.4	2.26	57.5	1.97	50	M6 x P1.0	37.0	5.27
13TBVL15	1 1/2"	40	1.26	32.0	4.92	125	4.09	8.66	1.95	49.5	2.46	62.5	2.76	70	M8 x P1.25	103.0	7.5
13TBVL2	2"	50	1.50	38.1	5.75	146	4.33	8.66	1.95	49.5	2.87	73.0	2.76	70	M8 x P1.25	143.0	12.13

PRESSURE TEMPERATURE RATINGS (BODY)



MATERIALS LIST

NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP2	ASTM A351 Gr. CF8M	2
3	STEM	ASTM A276 Gr. 316	1
4	GLAND NUT	SS304	1
5	BALL	ASTM A351 Gr. CF8M	1
6	SEAT	PTFE+15% G/F	4
7	THRUST WASHER	PTFE	1
8	PACKINGS	PTFE	1
9	JOINT GASKET1	PTFE	2
10	STEM BOLT	SS304	1
11	WASHER	SS304	1
12	HANDLE	SS304	1
13	STEM WASHER	SS304	1
14	LOCATING LOCK*	SS304	1
15	HANDLE SLEEVE	VINYL GRIP	1
16	JOINT GASKET	PTFE	1
17	CAP1	ASTM A351 Gr. CF8M	1

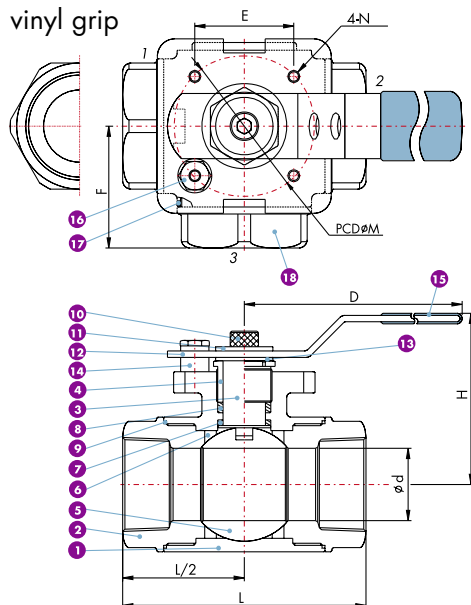
* OPTION

*** SIZES SHOWN ARE APPROXIMATE AND MAY VARY**



DESIGN FEATURES

- "T" Port
- Pressure rating: 1000 PSI WOG (NON-SHOCK)
- Steam Rating: 150 PSI WSP
- Investment cast body & cap
- Bottom-loaded, Blow-out-proof stem
- Adjustable stem packing
- Actuator mounting pad
- Stainless Steel handle with vinyl grip
- Locking device

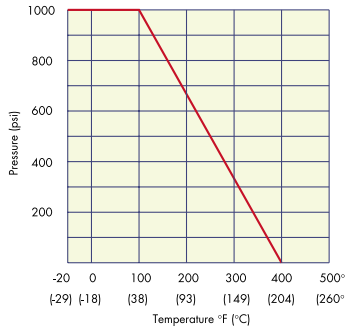


3 WAY REDUCED PORT 1000 WOG BALL VALVE, THREADED "T" PORT

DIMENSIONS

CODES	SIZE		d		L		H	D	E		F		M		N	Cv Factor	Weight Lb
	inch	mm	inch	mm	inch	mm	inch	inch	inch	mm	inch	mm	inch	mm			
13TBVT025	1/4"	8	0.43	11.0	2.68	68	2.28	4.17	1.17	29.7	1.34	34.0	1.65	42	M5 x P0.8	6.0	1.32
13TBVT0375	3/8"	10	0.43	11.0	2.68	68	2.28	4.17	1.17	29.7	1.34	34.0	1.65	42	M5 x P0.8	6.0	1.32
13TBVT05	1/2"	15	0.50	12.7	2.95	75	2.40	5.43	1.17	29.7	1.48	37.5	1.65	42	M5 x P0.8	12.0	1.47
13TBVT075	3/4"	20	0.63	16.0	3.39	86	2.91	5.43	1.39	35.4	1.69	43.0	1.97	50	M6 x P1.0	15.5	2.62
13TBVT1	1"	25	0.79	20.0	4.06	103	3.19	6.38	1.39	35.4	2.03	51.5	1.97	50	M6 x P1.0	20.0	3.75
13TBVT125	1 1/4"	32	0.98	25.0	4.53	115	3.46	6.38	1.39	35.4	2.26	57.5	1.97	50	M6 x P1.0	37.0	5.27
13TBVT15	1 1/2"	40	1.26	32.0	4.92	125	4.09	8.66	1.95	49.5	2.46	62.5	2.76	70	M8 x P1.25	103.0	7.5
13TBVT2	2"	50	1.50	38.1	5.75	146	4.33	8.66	1.95	49.5	2.87	73.0	2.76	70	M8 x P1.25	143.0	12.13

PRESSURE TEMPERATURE RATINGS (BODY)



MATERIALS LIST

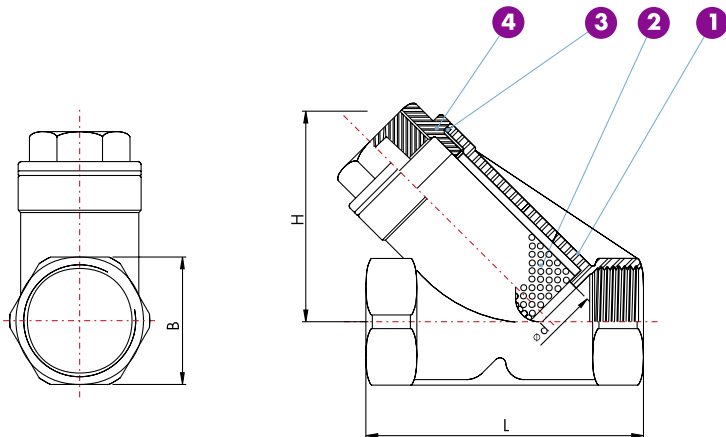
NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	CAP2	ASTM A351 Gr. CF8M	2
3	STEM	ASTM A276 Gr. 316	1
4	GLAND NUT	SS304	1
5	BALL	ASTM A351 Gr. CF8M	1
6	SEAT	PTFE+15% G/F	4
7	THRUST WASHER	PTFE	1
8	PACKINGS	PTFE	1
9	JOINT GASKET1	PTFE	2
10	STEM BOLT	SS304	1
11	WASHER	SS304	1
12	HANDLE	SS304	1
13	STEM WASHER	SS304	1
14	SET SCREW	SS304	1
15	HANDLE SLEEVE	VINYL GRIP	1
16	SET BOLT	SS304	1
17	JOINT GASKET	PTFE	1
18	CAP1	ASTM A351 Gr. CF8M	1

* SIZES SHOWN ARE APPROXIMATE AND MAY VARY



DESIGN FEATURES

- 800 WOG
- Investment cast body & cap
- SS316 screen. 4 mm thick perforated, 1.0 mm hole with 2.0 mm staggering
- Screwed-in cap
- Connecting threads: ANSI B2.1/BS21

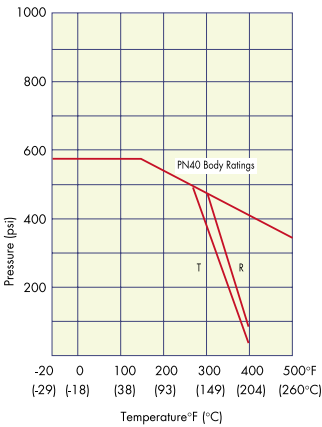


800 WOG "Y" STRAINER,
THREADED, SOCKETWELD

DIMENSIONS

CODES	SIZE		d		B		H		L		Weight	
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	Kg	Lb
13TYS025	1/4"	8	0.31	8	1.02	26	2.01	51	2.56	65	0.26	0.57
13TYS0375	3/8"	10	0.39	10	1.02	26	2.01	51	2.56	65	0.23	0.50
13TYS05	1/2"	15	0.59	15	1.02	26	2.01	51	2.56	65	0.30	0.66
13TYS075	3/4"	20	0.79	20	1.30	33	2.36	60	3.15	80	0.40	0.88
13TYS1	1"	25	0.98	25	1.61	41	2.83	72	3.54	90	0.70	1.54
13TYS125	1 1/4"	32	1.26	32	1.93	49	3.03	77	4.13	105	0.90	1.99
13TYS15	1 1/2"	40	1.57	40	2.20	56	3.43	87	4.72	120	1.30	2.87
13TYS2	2"	50	1.97	50	2.72	69	4.06	103	5.51	140	2.10	4.63
13TYS25	2 1/2"	65	2.56	65	3.43	87	4.72	120	6.69	170	4.30	9.47
13TYS3	3"	80	3.15	80	4.02	102	5.51	140	7.87	200	6.30	13.88

PRESSURE
TEMPERATURE
RATINGS



MATERIALS LIST

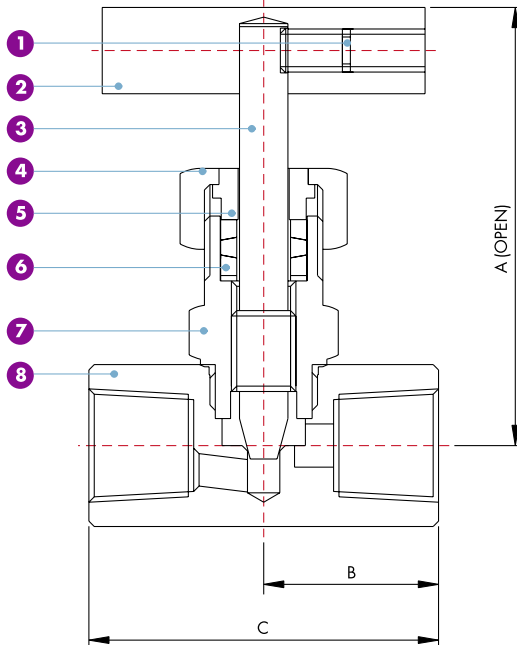
NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	SCREEN	SS316 SCREEN	1
3	GASKET	TEFLON	1
4	CAP	ASTM A351 Gr. CF8M	1

* SIZES SHOWN ARE APPROXIMATE AND MAY VARY



DESIGN FEATURES

- Investment casting
- Screwed-in bonnet
- Rising stem
- T handle operation
- Connecting threads ANSI B2.1, BS21 and DIN
- Working pressure: 6000 lb/IN²



DIMENSIONS

CODES	SIZE		A		B		C		Weight
	inch	mm	inch	mm	inch	mm	inch	mm	Lb
13TNV0125	1/8"	6	2.95	75	1.15	29.0	2.28	58	0.65
13TNV025	1/4"	8	2.95	75	1.15	29.0	2.28	58	0.61
13TNV0375	3/8"	10	2.95	75	1.15	29.0	2.28	58	0.73
13TNV05	1/2"	15	3.45	87	1.28	32.5	2.56	65	1.22
13TNV075	3/4"	20	3.55	90	1.38	35.0	2.76	70	1.44
13TNV1	1"	25	4.05	103	1.58	40.0	3.15	80	3.09

MATERIALS LIST

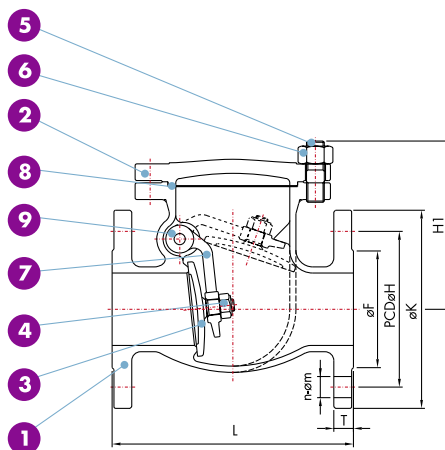
NO.	PART NAME	SPECIFICATION	QTY
1	SET SCREW	SS304	1
2	HANDLE	SS410	1
3	STEM	SS316	1
4	GLAND NUT	SS304	1
5	GLAND	SS304	1
6	PACKING	TEFLON	1
7	BONNET	ASTM A351 Gr. CF8M	1
8	BODY	ASTM A351 Gr. CF8M	1

**Please refer to our
Section "F" from page F-12
for more needle valves.**



DESIGN FEATURES

- Swing type
- Body: ASTM A351 Gr. CF8M
- Disc: ASTM A351 Gr. CF8M
- End Type: Flange end
- Face to Face: ANSI B16.10
- Flange Dimensions: ANSI B16.5 Class 150
- Wall thickness: ANSI B16.34



**CLASS 150 FLANGE END
SWING CHECK VALVE**

DIMENSIONS

CODES	SIZE		L		H1		K		H		F		T		M	N	Cv	Weight
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch		Factor	Lb
13FCV05	1/2"	15	4.25	108	2.87	73	3.50	89	2.38	1.38	35	0.44	11.1	0.62		4	9.5	5.05
13FCV075	3/4"	20	4.61	117	2.95	75	3.86	98	2.76	1.69	43	0.44	11.1	0.62		4	16	6.24
13FCV1	1	25	5.00	127	3.15	80	4.25	108	3.13	2.01	51	0.44	11.1	0.62		4	27	8.47
13FCV15	1 1/2"	40	6.50	165	4.37	111	5.00	127	3.88	2.87	73	0.56	14.3	0.62		4	70	10.23
13FCV2	2"	50	7.99	203	4.84	123	5.98	152	4.74	3.62	92	0.63	15.9	0.75		4	120	13.36
13FCV25	2 1/2"	65	8.50	216	5.28	134	7.01	178	5.49	4.13	105	0.69	17.5	0.75		4	170	27.10
13FCV3	3"	80	9.49	241	5.83	148	7.48	190	6.00	5.00	127	0.75	19.1	0.75		4	250	48.36
13FCV4	4"	100	11.50	292	6.22	158	9.02	229	7.50	6.18	157	0.94	23.9	0.75		8	470	72.81
13FCV5	5"	125	12.99	330	7.56	192	10.00	254	8.50	7.32	186	0.94	23.9	0.88		8	—	92.61
13FCV6	6"	150	14.02	356	8.78	223	10.98	279	9.51	8.50	216	1.00	25.4	0.88		8	1100	136.71
13FCV8	8"	200	19.49	495	11.14	283	13.50	343	11.75	10.63	270	1.13	28.6	0.88		8	2000	233.73
13FCV10	10"	250	24.49	622	12.52	318	15.98	406	14.25	12.76	324	1.19	30.2	1.00		12	—	359.42
13FCV12	12"	300	27.48	698	14.06	357	19.02	483	17.01	15.00	381	1.25	31.8	1.00		12	—	551.25

MATERIALS LIST

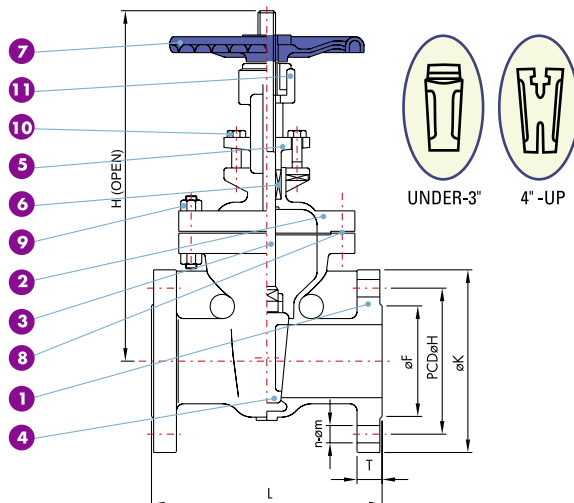
NO.	PART NAME	MATERIAL SS316	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	COVER	ASTM A351 Gr. CF8M	1
3	DISC	ASTM A351 Gr. CF8M	1
4	DISC NUT	ASTM A194 Gr. 8	1
5	COVER BOLT	ASTM A193 Gr. B8	4-12
6	COVER NUT	ASTM A194 Gr. 8	4-12
7	ARM	ASTM A351 Gr. CF8M	1
8	GASKET	PTFE	1
9	PLUG	SS316	1

Also available in Class 300



DESIGN FEATURES

- Rising stem
- Body: ASTM A351 Gr. CF8M
- Disc: ASTM A351 Gr. CF8M
- Stem: SS316
- End Type: Flange end
- Face to Face: ANSI B16.10
- Flange Dimensions: ANSI B16.5 150 lbs
- Wall thickness: ANSI B16.34



**CLASS 150 FLANGE END
GATE VALVE**

DIMENSIONS

CODES	SIZE		L		H1		K		H		F		T		M		N		Cv Factor	Weight Lb
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm		
13FGAV05	1/2"	15	4.25	108	8.03	204	3.94	100	2.38	1.38	35	0.44	11.1	0.62	4		19		7.28	
13FGAV075	3/4"	20	4.61	117	8.23	209	3.94	100	2.76	1.69	43	0.44	11.1	0.62	4		36		9.70	
13FGAV1	1	25	5.00	127	9.02	229	3.94	100	3.13	2.01	51	0.44	11.1	0.62	4		57		11.31	
13FGAV15	1 1/2"	40	6.50	165	11.14	283	5.51	140	3.88	2.87	73	0.56	14.3	0.62	4		140		17.09	
13FGAV2	2"	50	7.01	178	13.07	332	6.30	160	4.74	3.62	92	0.63	15.9	0.75	4		240		25.09	
13FGAV25	2 1/2"	65	7.48	190	15.63	397	7.09	180	5.49	4.13	105	0.69	17.5	0.75	4		360		46.31	
13FGAV3	3"	80	7.99	203	17.28	439	7.87	200	6.00	5.00	127	0.75	19.1	0.75	4		580		56.56	
13FGAV4	4"	100	9.02	229	20.39	518	8.82	224	7.50	6.18	157	0.94	23.9	0.75	8		950		82.42	
13FGAV5	5"	125	10.00	254	24.45	621	9.84	250	8.52	7.32	186	0.94	23.9	0.88	8		NA		110.25	
13FGAV6	6"	150	10.51	267	28.11	714	11.02	280	9.51	8.50	216	1.00	25.4	0.88	8		2400		119.07	
13FGAV8	8"	200	11.50	292	35.98	914	11.81	300	11.75	10.63	270	1.13	28.6	0.88	8		4200		198.45	
13FGAV10	10"	250	12.99	330	43.62	1108	13.98	355	14.25	12.76	324	1.19	30.2	1.00	12		6800		343.98	
13FGAV12	12"	300	14.02	356	61.14	1553	23.62	600	17.01	15.00	381	1.25	31.8	1.00	12		9900		534.71	

MATERIALS LIST

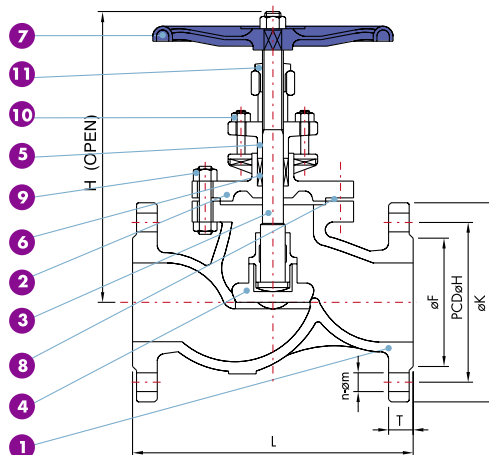
NO.	PART NAME	MATERIAL SS316	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	BONNET	ASTM A351 Gr. CF8M	1
3	STEM	ASTM A276 Gr. 316	1
4	DISC	ASTM A351 Gr. CF8M	1
5	GLAND	ASTM A351 Gr. CF8	1
6	GLAND PACKING	PTFE	1
7	HAND WHEEL	ASTM A536 Gr. B65, 45 & 12	1
8	GASKET	PTFE (OR NON ASBESTOS)	1
9	BONNET BOLT/NUT	ASTM A193 Gr. B8/ASTM A194 Gr. 8	4-16
10	GLAND BOLT/NUT	ASTM A193 Gr. B8/ASTM A194 Gr. 8	2
11	YOKE SLEEVE	BRONZE (OR DUCTILE-IRRESIST)	1

Also available in Class 300



DESIGN FEATURES

- Rising stem
- O.S. & Yoke, Flexible Wedge
- Body: ASTM A351 Gr. CF8M
- Disc: ASTM A351 Gr. CF8M
- Stem: SS316
- Packing: PTFE
- End Type: Flange end
- Face to Face: ANSI B16.10
- Flange Dimensions: ANSI B16.5 150 lbs
- Wall thickness: ANSI B16.34



**CLASS 150 FLANGE END
GLOBE VALVE**

DIMENSIONS

CODES	SIZE		L		H1		K		H		F		T		M		N		Cv Factor	Weight Lb
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm		
13FGLV05	1/2"	15	4.25	108	6.77	172	3.94	100	2.38	1.38	35	0.44	11.1	0.62	4		5		7.67	
13FGLV075	3/4"	20	4.61	117	6.77	172	3.94	100	2.76	1.69	43	0.44	11.1	0.62	4		8.5		9.31	
13FGLV1	1	25	5.00	127	6.89	175	3.94	100	3.13	2.01	51	0.44	11.1	0.62	4		11		11.66	
13FGLV15	1 1/2"	40	6.50	165	8.15	207	5.51	140	3.88	2.87	73	0.56	14.3	0.62	4		32		18.43	
13FGLV2	2"	50	7.99	203	9.13	232	6.30	160	4.74	3.62	92	0.63	15.9	0.75	4		48		28.44	
13FGLV25	2 1/2"	65	8.50	216	10.75	273	7.09	180	5.49	4.13	105	0.69	17.5	0.75	4		80		44.10	
13FGLV3	3"	80	9.49	241	11.93	303	7.87	200	6.00	5.00	127	0.75	19.1	0.75	4		110		56.91	
13FGLV4	4"	100	11.50	229	13.39	340	8.82	224	7.50	6.18	157	0.94	23.9	0.75	8		190		87.16	
13FGLV5	5"	125	14.02	356	15.16	385	9.84	250	8.50	7.32	186	0.94	23.9	0.88	8		—		117.97	
13FGLV6	6"	150	15.98	406	17.64	448	11.81	300	9.51	8.50	216	1.00	25.4	0.88	8		450		154.35	
13FGLV8	8"	200	19.49	495	21.46	545	13.98	355	11.75	10.63	270	1.13	28.6	0.88	8		800		294.37	
13FGLV10	10"	250	24.49	622	26.22	666	17.72	450	14.25	12.76	324	1.19	30.2	1.00	12		—		433.28	

MATERIALS LIST

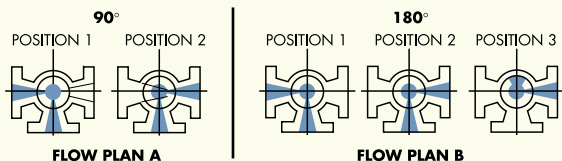
NO.	PART NAME	MATERIAL SS316	QTY
1	BODY	ASTM A351 Gr. CF8M	1
2	BONNET	ASTM A351 Gr. CF8M	1
3	STEM	ASTM A276 Gr. 316	1
4	DISC	ASTM A351 Gr. CF8M	1
5	GLAND	ASTM A351 Gr. CF8	1
6	GLAND PACKING	PTFE	1
7	HAND WHEEL	ASTM A536 Gr. B65, 45 & 12	1
8	GASKET	PTFE (OR NON ASBESTOS)	1
9	BONNET BOLT/NUT	ASTM A193 Gr. B8/ASTM A194 Gr. 8	4-16
10	GLAND BOLT/NUT	ASTM A193 Gr. B8/ASTM A194 Gr. 8	2
11	YOKE SLEEVE	BRONZE (OR DUCTILENI-RESIST)	1

Also available in Class 300

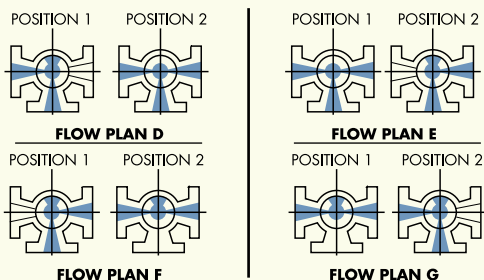
SPECIFICATIONS FLOW PATTERNS FOR 3-WAY VALVES

All flow patterns can be changed in the field without disassembling valve

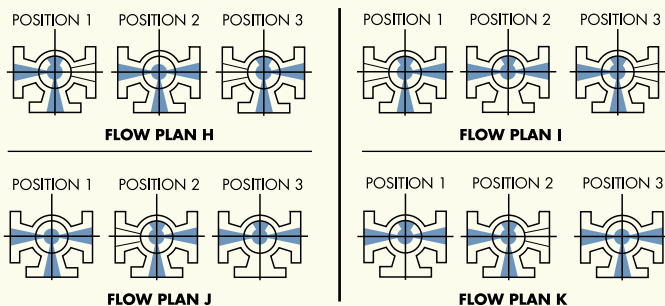
L-PORT:



T-PORT: 90°



T-PORT: 180°



CASTING DESIGNATION

CF8 = 304

CF8M = 316

CF3 = 304-L

CF3M = 316-L

PINACLE