USER/ MAINTENANCE MANUAL

Project : **Fuel Injection Pump Test Rig**

Client : **CENTRAL ORGANISATION FOR MODERNISATION OF WORKSHOP**

PO. No. : **COFMOW/IR/S-4039/OP-1877**

PO Date : **15th JULY 2011**

Neometrix Engineering (P) Limited. E-148,Sec-63 Noida-201301.
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USER/ Maintenance Manual Of Computerized Diesel Fuel Injection Pump Test Rig

INDEX

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Chapter 1

Do's & Do not's for the System:

Chapter 1 .1 Do:

- ✓ Read the User Manual in detail before operating the System.
- ✓ As certain what tools and equipment are required to carry out the job.
- ✓ Use proper tools to suit the job and avoid unnecessary dismantling.
- ✓ Ensure that all nuts, screws, pipe connectors and covers are properly tightened.
- ✓ Check the Oil Pressure before operation.
- ✓ Check the proper grounding of the system before operating.
- ✓ Check all the supplies voltage.
- ✓ Make sure the coupling is tight before operating.
- ✓ There should be no loose wiring and all the naked contacts are well insulated.
- ✓ All the power supplies are in operation mode before running the application.
- ✓ Make sure all rotating elements are covered.
- ✓ Insulate electrical (internal and external) motor connections.
- ✓ In case of high vibration in the system immediately shut down the testing.
- ✓ Before starting the test ensure proper mounting of the motor with the pulley
- ✓ Only trained/qualified service personnel are authorized to service the unit.
- ✓ Connect the unit only to the recommended mains sockets.
- ✓ Take extra care while installing or removing the cables.
- ✓ Turn off the main MCB of the power supply when not to be used for a long time.

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Chapter 1 .2 Do Not:

- Do not touch any wire inside the panel.
- Do not run the machine without lubrication oil in cam box.
- Do not attend the unit when in operation.
- Do not change the setting of pressure relief valve.
- Do not touch any rotating part when in operation.
- Do not put anything on the top of machine when in operation.
- Do not put the system in irregular surface.
- Do not change the disturb the setting of electrical instrument like Stroke counter, Temperature controller, RPM indicator, Discharge Volume
- Do not run the motor/start test if the mounting bolts/fasteners are loose.
- Do not tamper with the power supply trim pots as this may lead to change in voltage levels and damage expensive components.
- Do not open the door of panel without turning OFF the main MCB.
- Do not increase the voltage level of the power supply beyond the rated voltage of the test motor.
- Do not pull the wires coming out of the test bench.
- Do not start the test sequence without the coupling the motor with the shaft.
- Do not tamper or change the wiring without the presence of trained NEOMETRIX Personnel as this may lead to unwanted results and also damage the components.
- Do not open the cover of flywheel when the system is in operation.

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Chapter 2.0

Warnings:

- Make sure that all electronic products are earth-grounded, to ensure Personal safety and proper operation.

- Do not open the cover of flywheel when the system is in operation.

- Rotating PARTS in the system please be careful.

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Chapter 3.0

Description of Fuel Injection Pump Test Rig :

An **Injection Pump** is the device that pumps fuel into the cylinders of a engine Traditionally, the pump is driven indirectly from the camshaft by gears, chains or a toothed belt . Fuel injection pumps should be removed on a regular basis and tested and calibrated to assure that the each pump delivers the correct amount of fuel. Fuel injection pump should be calibrated to ensure that they deliver the correct amount of fuel.

Fuel injection pump test rig is use to calibrate and test the fuel injection pump use in locomotive engines. Fuel injection pump delivery is measure through flowmeter in the form of discharge volume. The measurement is display on computer and Discharge volume meter.

Mainly the fuel injection pumps of diesel engine are calibrated and tested , assuring that each pump delivers the required amount of fuel for given rack position.

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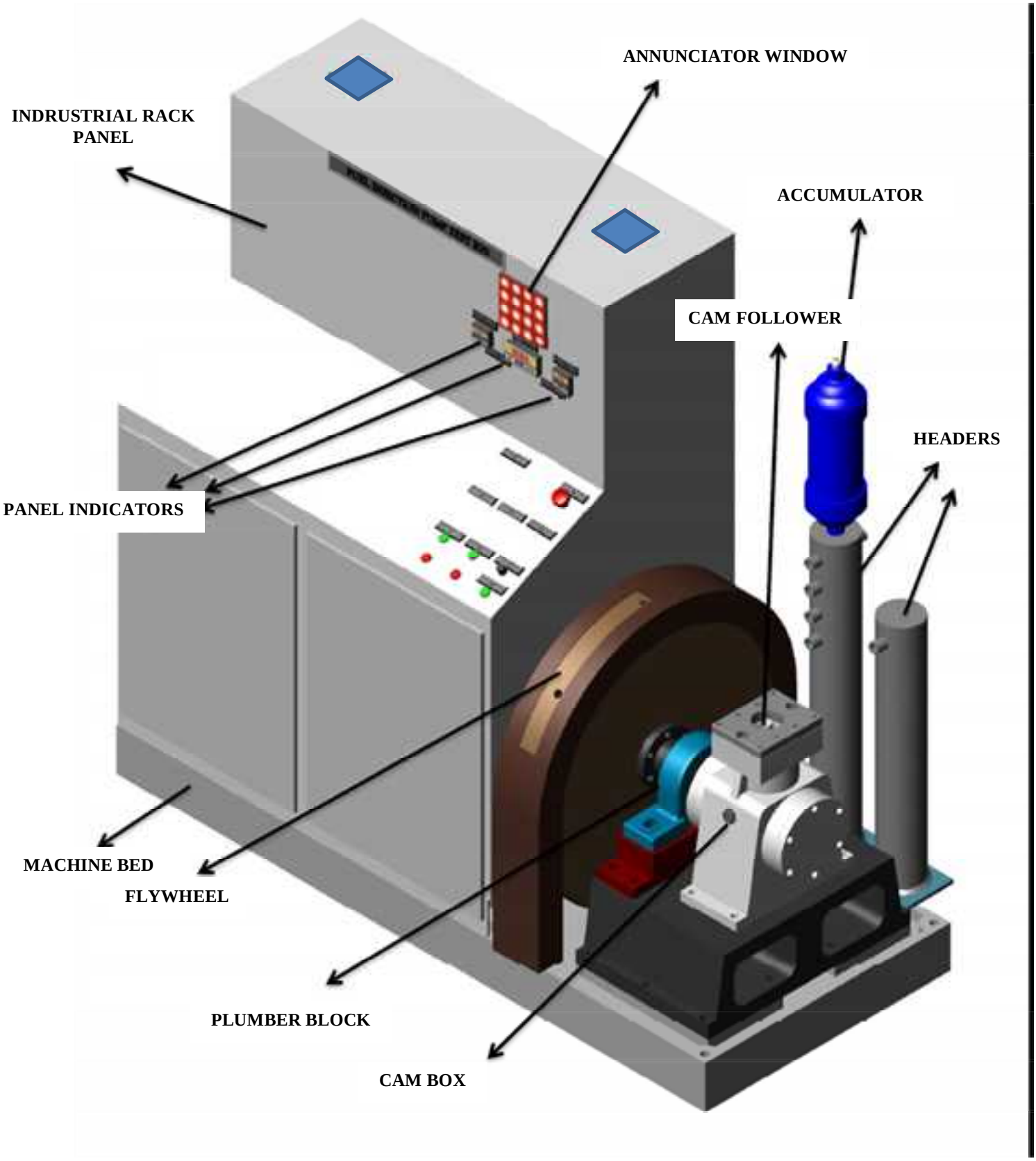

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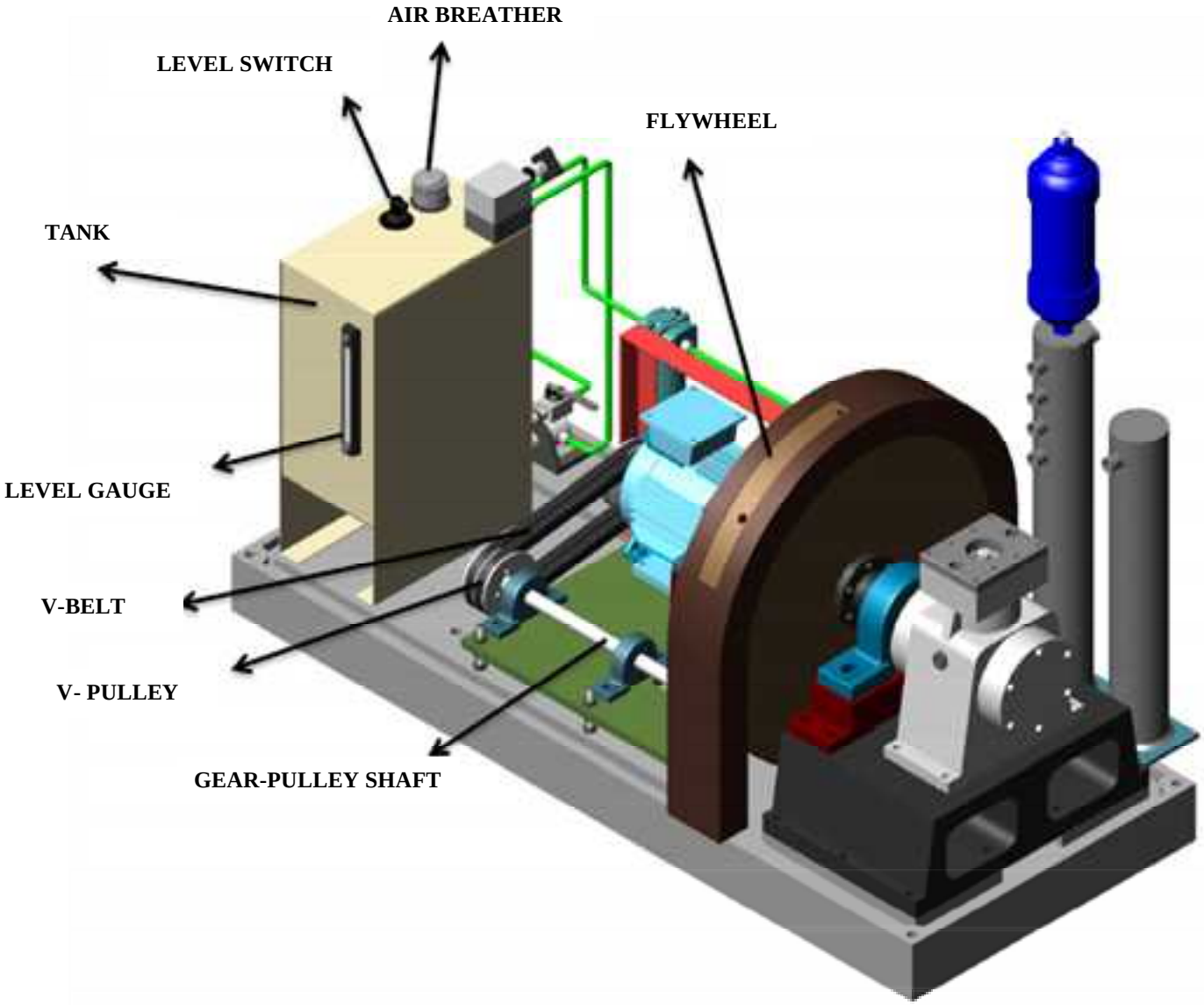

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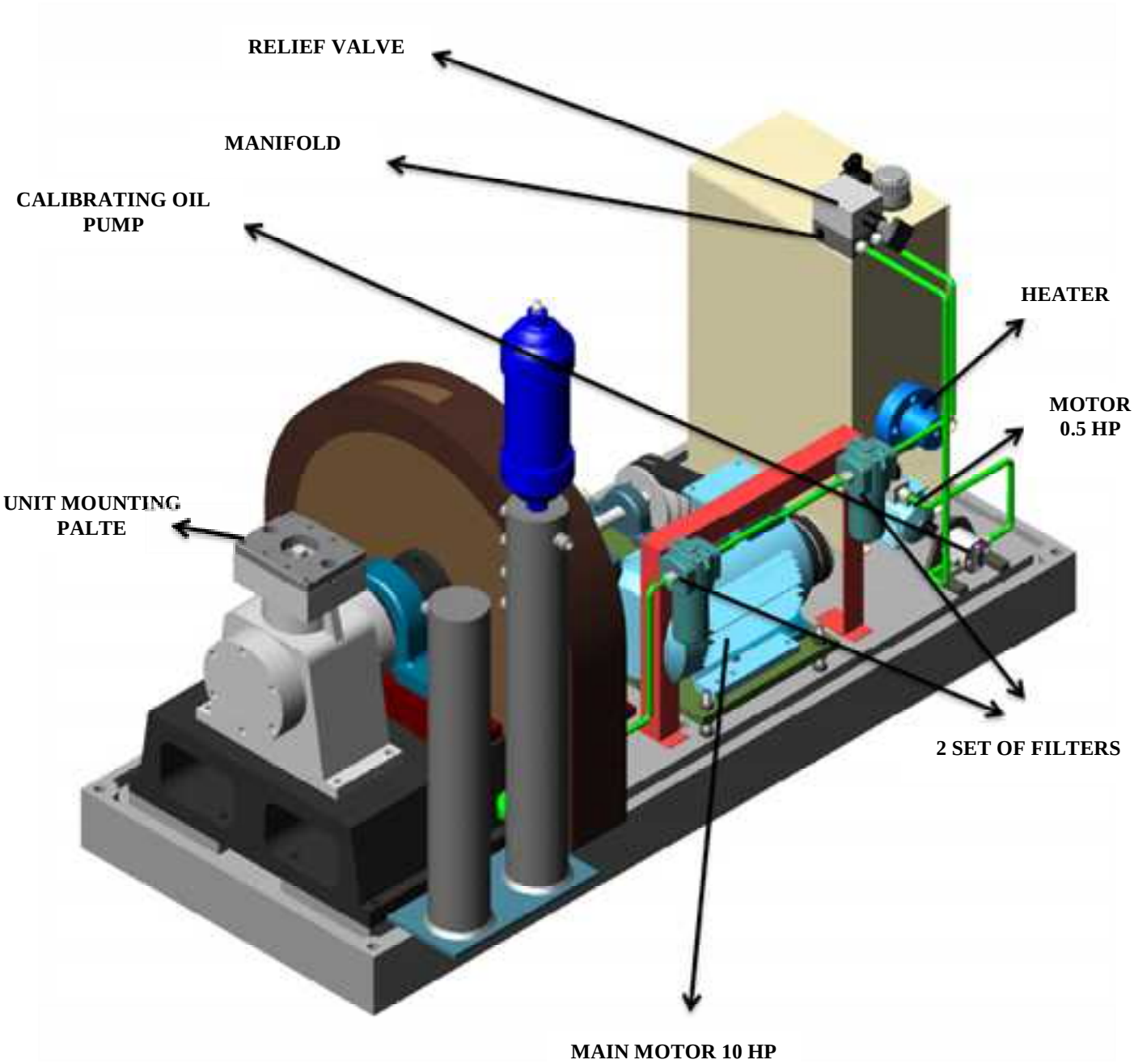

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Chapter 4

Introduction

The system consist of a 45 liters tank consist of strainer, level sensor with low level cut off indicator interlocked with the test bench control unit , level gauge for measuring the level manually, air breather and 2 KW heater and digital temperature controller to maintain the oil at working temperature @ 43 to 48 degree . Calibrating oil temperature is display on digital temperature controller as well as on computer. The system is operating at 40 PSI pressure.

The test bench consists of self-contained close loop, continuous lubrication system for all moving parts. The lubrication pump is interlocked with test bench control to avoid operation of machine without lubrication.

Chapter 4.1 Technical Specification:

- Working RPM : 500
- Working Stroke: 300
- Operating Temperature : 43 to 48 degree
- Operating Pressure : 40 PSI
- Drive Motor : 10 Hp
- Transfer Pump motor : 0.5 Hp
- Oil used for calibration: - Diesel or Make IOCL
- Oil used for Lubrication: - Servo super multigrade 20W40
  Specifications: - (a) Meets API CF/FS, and E-DL 2/E-PL 2 OF IS: 13656-2002 specifications. (b) Recommended for automotive petrol and diesel vehicle
- Maximum discharge: 401+4/-11 CC per 300 strokes at 28 mm rack position
  351+5/-10 CC per 300 strokes at 30 mm rack position
- Minimum discharge: 45+1/-5 CC per 300 strokes at 9 mm rack position
  34+1/-5 CC per 300 strokes at 9 mm rack position

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Chapter 4.2 Major Component :

The complete rig is divided into 3 major parts which are as follow:

1) Power Pack
2) Drive motor with timings gear
3) Cambox

4.2.1 Power Pack and Calibrating fluid supply:

A 45 liters supply tank in provided for storage of calibrating fluid. A consist of heater of 2 KW mounted inside the tank to warm the calibrating fluid and control @ 43 to 48 degree. The calibrating fluid is delivered to injection pump by transfer pump which is drive through motor of 0.5 Hp and located under the supply tank.

Accessories of Power pack:

a) **Level gauge**: Level gauge are used to measure the level of oil manually

b) **Level Switch**: Level gauge are used to measure the level of oil Electrically

c) Air Breather

d) Suction Strainer

The 2 filters of **3 µ** and **10 µ** are provided after transfer pump. A adjustable pressure relief valve is provided which is set at working pressure @ 40 psi. After that the calibrating oil is transfer to header – 1 having length 1070 mm , capacity 28 lts . The pressure and temperature is measure in the Header -1. The pressure is measure by Pressure transmitter and pressure gauge and the temperature is measure by Temperature transmitter and temperature gauge. The header -1 is use as reservoir. Then from header 1 the calibrating fluid is transfer to unit through ball valve and accumulator.

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The accumulator is use to supply the constant pressure to the unit. The diaphragm type accumulator having 2.5 lts capacity is use in the supply system. **The diaphragm accumulators functions by drawing in fluid from the hydraulic circuit when the pressure increases and thus, compresses the gas. It returns this energy to the circuit as the pressure decreases by the expansion of the gas**.

When the test start then the calibrating fluid is transferred to Header-2 through unit then from header- 2 the fluid is transfer to flow meter which calibrate the flow in Liter per minute. Then from flow meter is oil is return to tank .

4.2.2 Drive motor with timing gear arrangement:

This arrangement consist of drive motor of 10 hp which consist 1 st pulley , then from 2nd pulley the power is transmit to large through V- belt drive .

The speed of drive motor is accelerate and deaccelerate and is controlled by adjustable variable frequency drive.

The large pulley consist of shaft of 30mm diameter, the power from shaft is transferred to small gear. From Small gear the power is transmit to large gear through timing chain and the large gear consist shaft which transmit he power to flywheel.

A **flywheel** is a rotating mechanical device that is used to store rotational energy. Flywheels have a significant moment of inertia, and thus resist changes in rotational speed. The amount of energy stored in a flywheel is proportional to the square of its rotational speed.

A flywheel of 750 mm diameter is provided. The moment of inertia of flywheel is 525 pound feet square.

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4.2.3 CamBox:

A cambox with cam is provided with mounting pump plate on the top of cambox. A main drive shaft of 70 mm diameter passes through cambox having cam mounted on the shaft. Fuel injection pump is driven by camfollower which rides on the cam. The lubrication of cam follower assembly is provided by lubrication oil inside the cambox. Lubrication oil is circulated from the base of the cambox and lubricates the cam and camfollower assembly.

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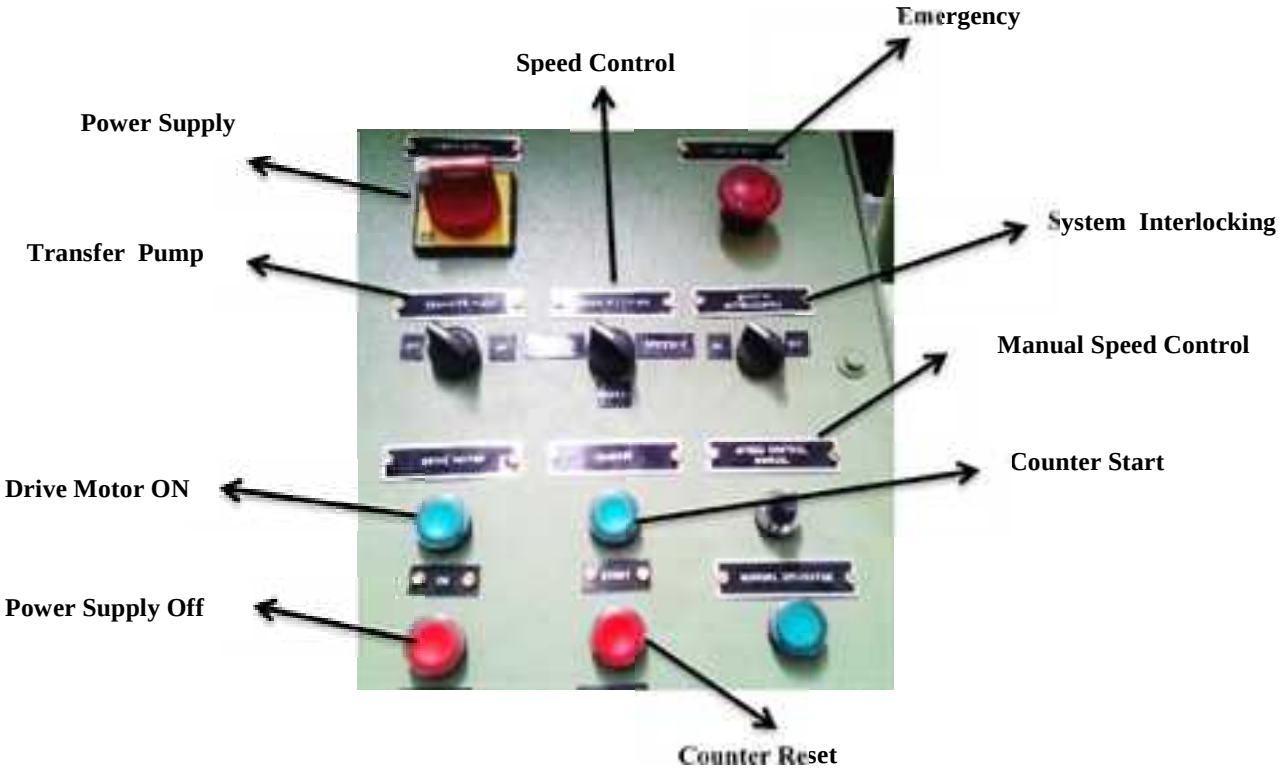
Chapter 5 Operating Procedure

Chapter 5 .1 Testing of Pump at FULL SPEED:



Operating Panel

a) **Step 1**:
Set the adjustable rack position at the Full setting. Insure that all connection is tight. Now Switch On Power supply .

b) **Step 2**:
Open the inlet ball valve and switch ON the **TRANSFER PUMP** selector switch to start the calibrating fluid supply circuit.

c) Step 3:
Turn the selector switch to **SPEED 2**.

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d) Step 4:
Switch ON the **DRIVE MOTOR** to start the timing gear arrangement along with camfollower. Insure that the drive motor automatically run at the speed of **500 RPM**.

e) Step 5:
Now Press the **START COUNTER PUSH BUTTON**. As soon as start push button is push stroke counter begin to start the 300 stroke in ascending order and is shown on stroke counter digital display. As soon as one test is complete stroke counter display reset to zero by pressing Reset Push Button.

As the start counter is push, simultaneously the calibrating fluid will be diverted to measuring flowmeter and parallel the stroke counter begin to count.

f) Step 6:
Read and record the amount the amount fluid through flowmeter.

a) Step 7:
In the case of manual speed control selector switches to middle position and adjust the RPM manually.

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Chapter 5 .2 Testing of Pump at IDLE SPEED:

b) Step 1:
Set the adjustable rack position at the idle setting. Insure that all connection is tight. Now Switch On Power supply.

c) Step 2:
Open the inlet ball valve and switch ON the **TRANSFER PUMP** selector switch to start the calibrating fluid supply circuit.

d) Step 3:
Turn the selector switch to **SPEED 1.**

e) Step 4:
Switch ON the **DRIVE MOTOR** to start the timing gear arrangement along with camfollower. Insure that the drive motor automatically run at the speed of 500 RPM. Adjust rack position of pump to 9 mm. for both pumps 15mm & 17mm.

f) Step 5:
Now Press the **START COUNTER PUSH BUTTON**. As soon as start push button is push stroke counter begin to start the 300 stroke in ascending order and is shown on stroke counter digital display. As soon as one test is complete stroke counter display reset to zero by pushing Rest button .

As the start counter is push, simultaneously the calibrating fluid will be diverted to measuring flowmeter and parallel the stroke counter begin to count.

g) Step 6:
Read and record the amount the amount fluid through flowmeter.

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Chapter 5.3 When the test of pump is over:

a) **Step 1:**
Switch OFF the Drive motor
b) **Step 2:**
Switch OFF the transfer pump.
c) **Step 3:**
Open the High pressure tube.
d) **Step 4:**
Remove the injection pump.
e) **Step 5:**
Switch Off the power supply**.**

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Chapter 6 Bill Of Material

Project :- FIP					
Hydraulic BOM					
S.No.	**Item Name**	**Item Description**		**Make**	**Qty.**
1	Tank	Capacity : 45 lts , Dimension 420X250X670 mm3	Neometrix made	Neometrix	1
2	Suction Strainer	Working at 8 lpm, **End Connection:1/2'' threaded BSPP**	S C 3 - 0 0 5, End Connection : G1/2	Hydroline	1
3	Level Gauge	0-254mm Visible Range	LG2 - 10	Hydroline	1
4	Heater	2KW, Immersion HEATER in SS 304, Length 150 mm , Socket 1.5", 230 Volt , 2000 Watt ,contact type	Standard	Baba Heatting Edge	1
5	Ball valve	Port size **:1/2 '' BSP both side**			3
6	Pump for 0.5 hp motor	Flow rate 8 lpm **, port size NPT :- 1/4" X 1/4"** , US GPM :- 2.2, M3/hr. :- 0.5	PG0A 200-530	Yuken	1
7	Motor	Speed: RPM 1370 ,0.5 Hp, 4pole motor, Foot Mounted	HX71B4	ABB	1
8	Inline Pressure Line Filter	Working at 40 psi 8 lpm, 10 micron: **End Connection : 1 inch on both side**	40-LE-0005-H10XL-A-00-07-0-RO-V-00	Rexroth	1
9	Electrical indicator	Working at 40 psi , , 8 lpm, 10 micron	40-LE-0005-H10XL-A-00-07-0-RO-V-00	Rexroth	1
10	Inline Pressure	Working at 40 psi , 8 lpm, 3 micron, **End Connection : 1**	40-LE-0005-H3XL-A-00-07-0-RO-V-00	Rexroth	1

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	Line Filter	**inch on both side**			
11	Electrical indicator	Working at 40 psi , 8 lpm, 3 micron	40-LE-0005-H3XL-A-00-07-0-RO-V-00	Rexroth	1
12	Pressure Relief valve	Manifold Mounted Set @ 40 psi, manual fine control, **End Connection : 1/2 "**	DBDH 10P 1X/25	Rexroth	1
13	Hearder-1	Length 820 mm	Standard	Neometrix	1
14	Pressure Transmitter	Pressure Transmitter with Piezoresistive Sensor, Specifications according to the data-sheet PE81.01Wetted parts of SS1.4571, Case of SS1.4571 (IP65),Accuracy: ±0.25% of FSD (BFSL), 1 year stability: ≤ 0.2% of FSDResponse Time: ≤ 1 ms, Repeatability: ≤ 0.05% of FSD,Adjustability of zero/ span: ±10%Medium Temperature: -30 to 100 Deg. C, Ambient Temperature: -20 to 80 Deg. CPower supply DC 10...30 V (Reverse Polarity & short circuiting protected)Output signal 4...20 mA, 2-wire at 1000 Ohms load resistanceElectrical connection: 4-pin L-plug DIN EN 175301-803, IP 65Shock Resistance: 1000g, Vibration Resistance: 20gProcess connection of SS1.4571, **End Connection 1/2"BSP(M)Range: 0- 10 Bar,**	S-10	Wika	1

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15	Pressure Gauge	Specification: 0-10(kg/cm2)1%Accuracy½" BSP male with Lower back mounted with front panel mounted Glyceriene Filled ,Indication only in psi & kg/cm2 , PM 02.02 casing with bayonet bezel of SS, with blow-out disc, window of laminated safety glass, Bourdon Tube in SS1.4571,SS movement, accuracy class 0.5, Ingress protection: IP65,Over-range protection: 130% FSD, Medium Temperature ≤ 2000CLower back connection of SS1.4571 **End Connetion 1/2" BSP(M)**	233.50.100	Wika /pyramid	1
16	Temperature Gauge	Accuracy:+/-1%FSV Stem OD 8mm WIKA Gas actuated thermometer, stainless steel series, nominal size 100, with capillary . Case: stainless steel, Stem material: stainless steel ,Design of connection: 4, compression fitting, sliding on stem Process connection: 1/2 " BSP(M) Stem diameter: 8 mm Stem length: 80mm , Capillary: stainless steel with SS316 armouring, Capillary length: 3m , Design of case mounting: Panel mounting Stainless steel Connector position: axial Location of process connection: Process connection at stem **Scale range: 0...100°C**	F73.100	H-Guru	1

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17	RTD	RTDwith 5m long PTFE insulated, SS braided 3-core cableElement: Simplex, 3 WireCalibration: As per DIN43760, Range: 0-100 Deg. CInsulation: Mineral (Compacted MgO)Sheath: SS316, OD: 6 mm, Length below head: 60 mm**Process connection:1/ 2''BSP(M)**, adjustable compression fitting,	RH06S-W3-A3-2-ABP12-60-100-5TT	Radix	1
18	Accumulator	Diaphragm accumulator ,Capacity: 2.5 lts with florocarbon seal, Accumulator Shell: Carbon steel, **End Connection : M 18X 1.5**	AM-2.5-V-30-CMO	EPE	1
19	Filler Breather	Flange mounted , tank top mounted	FSB 25	Hydroline	1
20	Header-2	Length : 700 mm	Standard	Neometrix	1
21	Flow Meter	Working at 40 psi , Max pressure: 5 bar , **END connection :1/2 inch VCO fitting**	CMF010M334N6BZEZZZ	Emersion	1
22	Level switch	stem length : 450mm	SDN-102	Shridhan Automation	1
23	Panel	Dimension:1140x745x1500mm 3		Standard	1
24	Hoses	1/2 inch, Length: 750 mm		Parker	1
25	Circular Level Gauge	Plastic sight glass**, 3/4 inch BSPP**	SGP 06	Hydroline	1

Chapter 7
List Of Attachment

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Chapter 7.1 List Of Drawings:

7.1.1 Mechanical circuit diagram
7.1.2 Electrical circuit diagram

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Chapter 8
Chapter 8.1 MAINTENANCE

Chapter 8.1.1 Daily Check:

a) Check the cambox oil level. Insure that oil level inside the cambox will be at the midpoint of level gauge.
b) Check the calibrating oil fluid level on level gauge on the tank. Insure that the minimum oil inside the tank is ¾ of the height of the tank.
c) Check the proper grounding of the system before operating.
d) Make sure the coupling is tight before operating.
e) Ensure that all nuts, screws, pipe connectors and covers are properly tightened.
f) Make sure that the proper support is given to the bed by anti-vibration mounting pad.

Chapter 8.1.2 Halfly Check:

a) Drain the cambox lubrication oil and replace with new oil
b) Apply small amount of grease to timing gear and chain.
c) Lubricate all the plumber block with grease
d) Clean the filter by removing the filter element located after supply tank.

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Chapter 9

Spare Part List:

a) Roller for cam box
b) Filter element with O ring and Strainer
c) Rubber coupling for calibrating oil pump
d) Flexible pipe for unit injector
e) Oil seal for cam box
f) Anti-vibration mounting pad 6 pieces
g) Oil level controller with sensor
h) Single phase preventor
i) Earth leakage circuit breaker
j) Test stand injector
k) Pipeline connecting FIP
l) Signal conditioning card
m) Digital Panel indiactor
n) Panel Light
o) Lights
p) Pressure Gauge
q) Pressure transmitter
r) Pressure Regulator

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Chapter 10 Catalogs

Chapters

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Chapter 10.1 Pumps

EI-GP4-007
REV-01

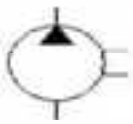
YTC

GEAR PUMP

B1

PG0-Series Gear Pumps

- Stainless Steel body
- Hardened and ground integral gear shaft
- Special aluminum alloy bush bearing
- Axially balanced for high volumetric efficiency in excess of 95%.



Rating

Model Number	Geometric Displacement cm³/rev	Flow Rate LPM At 1500rev/min	Maximum Pressure Bar Continuous	Maximum Pressure Bar Intermittent	Shaft Speed range rpm Max	Shaft Speed range rpm Min	Weight Kg
PG0A200-066	0.66	1.0	180	220	4500	1000	2 (Approx
PG0A200-100	1.0	1.5	200	240	4500	1000	
PG0A200-160	1.6	2.4	200	240	4000	800	
PG0A200-210	2.1	3.2	200	240	4000	800	
PG0A200-320	3.2	4.8	200	240	3500	600	
PG0A200-420	4.2	6.3	180	220	3500	600	
PG0A200-530	5.3	8.0	180	220	3500	600	
PG0A200-640	6.4	9.6	160	200	3500	600	

PG0A200	-066	-S	-1	-S	-B	-R
Series	Size	Shaft	Mounting	Port	Drive Shaft Seal	Direction of Rotation Viewed From Shaft Side
PG0A200	066 100 160 210 320 420 530 640	S: Straight G: Tang*	1: SAE 'A'-2 Bolt 2: SAEAA'-2 Bolt	S: SAE 'O' Ring Port P: BSPF Port	B: Single Nitrile V: Single Viton	R: Clockwise L: Counter clockwise

Example – PG0A200-066-S-1-S-B-R
066: 0.66cc/rev, S: Straight shaft, 1: SAE'A'-2 Bolt flange, S: SAE'O'Ring Port B: Single Nitrile R: Clockwise
*For Tang consult factory.

PG0-Series Gear Pumps

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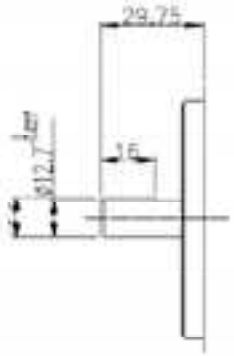
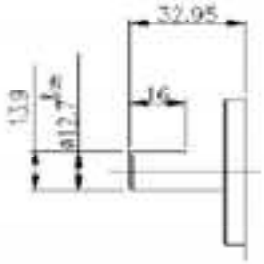
YTC GEAR PUMP

For SAE 'AA'-2 Bolt Mounting

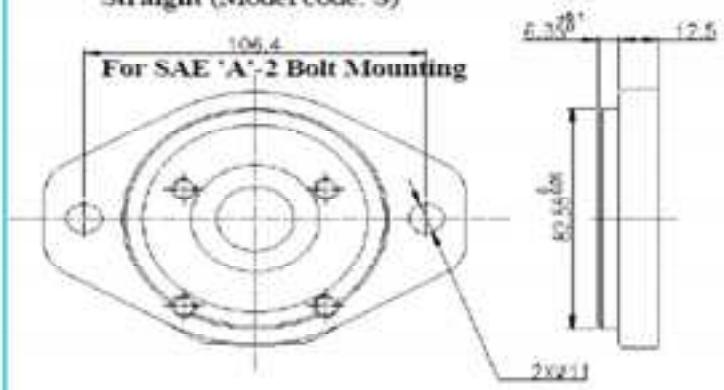


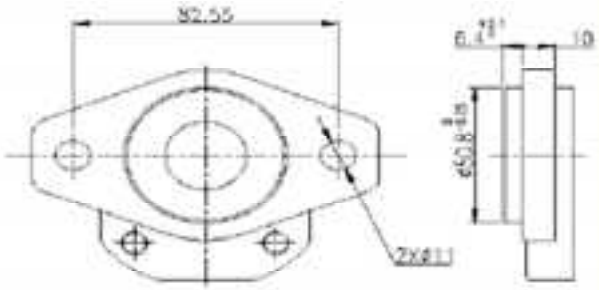


Shaft

Straight (Model code: S)

For SAE 'A'-2 Bolt Mounting





Flange

SAE 'A'-2 Bolt Flange (Model code: 1)

SAE 'AA'-2 Bolt Flange (Model code: 2)

Neometrix Engineering (P) Limited. E-148,Sec-63 Noida-201301.
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YTC

GEAR PUMP

Ports

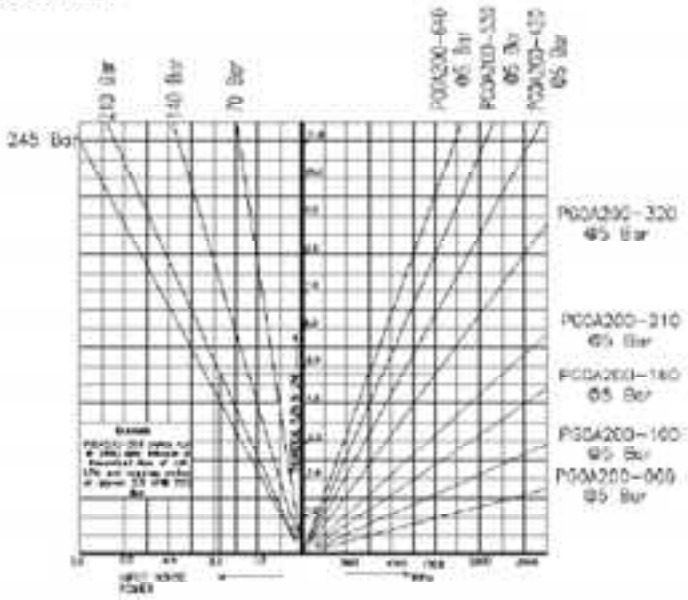
For SAE 'A'-2 Bolt Flange

Model No	BSPF Port		SAE'O' Ring Port		C	D
	Inlet	Outlet	Inlet	Outlet		
PG0A200-066	3/8"NPT	3/8"NPT	9/16"-18UNF	9/16"-18UNF	34.27	31.00
PG0A200-100	3/8"NPT	3/8"NPT	9/16"-18UNF	9/16"-18UNF	34.77	31.57
PG0A200-160	3/8"NPT	3/8"NPT	9/16"-18UNF	9/16"-18UNF	35.72	32.52
PG0A200-210	3/8"NPT	3/8"NPT	3/4"-16UNF	9/16"-18UNF	36.65	33.45
PG0A200-320	3/8"NPT	3/8"NPT	3/4"-16UNF	9/16"-18UNF	38.52	35.32
PG0A200-420	1/2"NPT	1/2"NPT	3/4"-16UNF	9/16"-18UNF	40.40	37.20
PG0A200-530	1/4"NPT	1/4"NPT	7/8"-14UNF	3/4"-16UNF	42.40	39.20
PG0A200-640	1/2"NPT	1/2"NPT	7/8"-14UNF	3/4"-16UNF	44.15	40.95

Seals: -

Nitrile (Temp.range: -15°C+80°C), Viton (Temp.range: -10°C+140°C).

Performance Chart



PG0-Series Gear Pumps

4

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Chapte10.2 MOTOR:

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- TEFC, S1 Duty
  415V+/-10%, 50Hz+/-5%
  Combined variation (absolute sum 10%)
  Insulation class F
  Temperature rise class B (75°C)

2 Pole Ambient 45°C

Output		Frame Size	Rated	Current		Efficiency			Power factor			Torque		T_n	T_{ad}	T_{acc}	Weight	GD^2
kw	hp		spd.(rpm)	I_n(A)	I_s/I_n	FL	3/4FL	1/2FL	FL	3/4FL	1/2FL	T_s/T_n	T_{max}/T_n	N_m	(S)	(S)	kg	kgm^2
0.37	0.5	HX71A2	2790	1.0	4.2	0.60	63.0	59.0	46.0	0.60	0.73	2.0	2.4	1.3	5	12	10	0.001
0.55	0.75	HX71C2	2790	1.4	4.3	68.0	64.0	57.0	0.81	0.74	0.63	1.8	2.3	1.9	5	12	14	0.002
0.75	1.0	HX80A2	2780	1.8	4.8	73.0	72.0	68.0	0.82	0.76	0.66	2.0	2.3	2.6	7	16	10	0.002
1.1	1.5	HX80C2	2780	2.5	4.8	74.0	73.0	70.0	0.81	0.74	0.63	2.1	2.3	3.8	7	16	14	0.003
1.5	2.0	HX90SLA2	2840	3.2	5.7	77.5	76.0	74.0	0.82	0.76	0.66	2.1	2.7	5.0	6	14	22	0.007
2.2	3.0	HX90SLC2	2840	4.5	5.8	79.5	79.0	77.0	0.86	0.76	0.66	2.0	2.8	7.4	5	10	24	0.008
3.7	5.0	HX100LB2	2830	7.2	6.0	80.0	79.5	77.5	0.87	0.84	0.74	2.2	2.7	12.5	5	10	35	0.026
5.5	7.5	HX132SMA2	2875	10.5	6.0	84.2	83.5	81.0	0.85	0.81	0.72	2.3	3.0	18.3	9	20	55	0.044
*7.5	10	HX132SMB2	2850	14.0	6.0	85.0	84.5	84.0	0.88	0.86	0.80	2.1	3.0	25.1	9	20	60	0.052
7.5	10	HX132SMC2i	2870	13.4	6.4	86.0	86.0	85.0	0.91	0.88	0.80	2.4	3.0	25.0	9	20	70	0.072
9.3	12.5	HX132SMC2	2860	16.5	6.0	86.0	85.5	85.0	0.89	0.87	0.81	2.5	3.5	31.1	9	20	70	0.072
*11	15	HX160MLA2	2895	20.0	6.0	87.5	86.5	84.0	0.85	0.81	0.72	2.2	2.8	36.3	12	28	110	0.113
11	15	HX160MLB2i	2900	20.0	6.2	88.5	88.0	87.0	0.86	0.81	0.72	2.2	2.8	36.2	12	28	120	0.128
*15	20	HX160MLB2	2895	27.0	6.0	88.5	87.5	86.5	0.87	0.84	0.76	2.4	2.8	49.5	12	28	120	0.128
15	20	HX160MLD2i	2900	26.0	6.4	90.0	90.0	88.0	0.87	0.84	0.76	2.2	3.0	49.4	12	28	130	0.152
*18.5	25	HX160MLD2	2900	32.5	6.0	91.0	90.5	88.5	0.90	0.84	0.76	2.5	2.9	60.9	12	28	130	0.152

4 Pole Ambient 45° C

Output		Frame Size	Rated	Current		Efficiency			Power factor			Torque		T_n	T_{ad}	T_{acc}	Weight	GD^2
kw	hp		spd.(rpm)	I_n(A)	I_s/I_n	FL	3/4FL	1/2FL	FL	3/4FL	1/2FL	T_s/T_n	T_{max}/T_n	N_m	(S)	(S)	kg	kgm^2
0.25	0.33	HX71A4	1385	0.8	3.5	63.0	61.0	55.0	0.80	0.64	0.51	1.9	2.2	1.7	7	16	13	0.002
0.37	0.50	HX71B4	1370	1.1	3.5	63.0	61.0	55.0	0.70	0.58	0.46	2.0	2.5	2.6	7	16	13	0.003
0.55	0.75	HX80B4	1400	3.5	1.5	65.0	64.0	58.0	0.80	0.67	0.51	1.8	2.3	3.8	6	14	13	0.008
0.75	1.0	HX80D4	1380	4.5	2.0	68.0	67.0	62.0	0.80	0.69	0.55	1.8	2.3	5.8	4	9	15	0.007
1.1	1.5	HX90SLB4	1420	5.0	2.6	74.0	73.5	71.0	0.80	0.72	0.57	1.9	2.6	7.4	5	10	23	0.012
1.5	2	HX90SLD4	1415	5.0	3.4	76.0	75.5	72.5	0.80	0.75	0.62	1.9	2.6	10.1	5	10	25	0.015
2.2	3	HX100LA4	1415	5.0	4.8	78.0	77.5	75.0	0.80	0.73	0.60	2.1	2.7	14.9	5	12	35	0.020
3.7	5	HX112M4AK	1425	6.0	7.6	83.0	83.0	82.0	0.80	0.76	0.65	2.2	2.8	24.8	5	12	45	0.044
5.5	7.5	HX132SMB4	1440	6.0	11.2	84.5	84.5	82.0	0.80	0.71	0.58	2.2	3.0	36.5	7	16	60	0.060
7.5	10	HX132SMC4	1440	6.0	14.8	86.0	86.0	84.5	0.80	0.74	0.63	2.1	3.0	49.7	7	16	70	0.068
9.3	12.5	HX160MLA4	1450	6.0	19.0	88.0	88.0	87.0	0.80	0.73	0.60	2.1	2.7	61.3	7	16	105	0.167
11	15	HX160MLB4	1455	6.0	22.0	89.0	89.0	88.0	0.80	0.74	0.63	2.2	2.8	72.2	8	18	125	0.206
*15	20	HX160MLD4	1455	6.0	29.5	88.5	87.5	86.5	0.80	0.76	0.66	2.1	2.8	99.1	12	28	145	0.252

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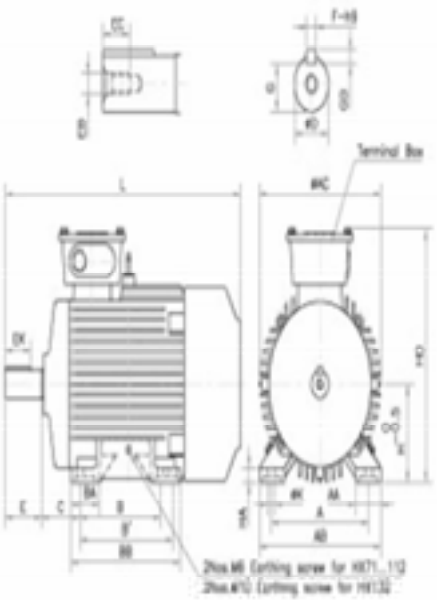
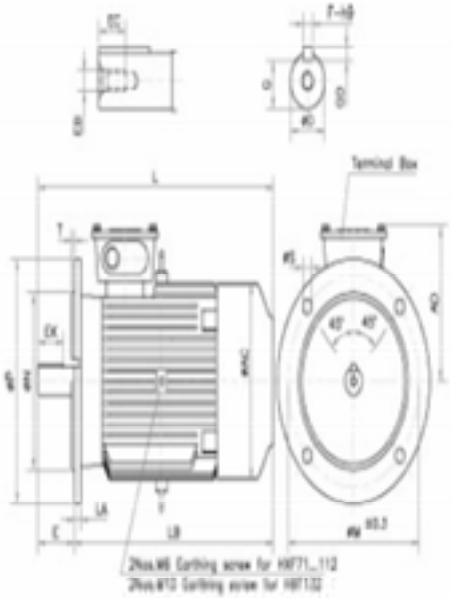
HX 71...132 (Foot Mounted)

Mounting Designation B3, B6, B7, B8, V5, V6



HXF 71...132 (Flange Mounted)

Mounting Designation B5, V1



Frame	A	AA	AB	AC	B	BF	BA	BB	C	D – Tol.	E	EB	EC	EK
HX 71	112	25	130	136	90	–	26	110	45	14 – j6	30	M5	12	16
HX 80	125	25	147	152	100	–	30	126	50	19 – j6	40	M6	17	24
HX 90SL	140	27	162	174	100	125	30	151	56	24 – j6	50	M8	19	32
HX 100L	160	42	200	200	140	–	47	180	63	28 – j6	60	M10	22	42
HX 112M	190	48	230	221	140	–	47	180	70	28 – j6	60	M10	22	42
HX 132SM	216	48	256	259	140	178	47	218	89	38 – k6	80	M12	28	60

Frame	AC	AD	D – Tol.	E	EB	EC	EK	F	G	GD	L	LA	LB	M
HX 71	136	114	14 – j6	30	M5	12	16	5	11	5	253	9	223	130
HX 80	152	120	19 – j6	40	M6	17	24	6	15.5	6	290	10	260	165
HX 90SL	174	146	24 – j6	50	M8	19	32	8	20	7	332	10	282	165
HX 100L	200	161	28 – j6	60	M10	22	42	8	24	7	367	11	327	215
HX 112M	221	171	28 – j6	60	M10	22	42	8	24	7	392	11	332	215
HX 132SM	259	191	38 – k6	80	M12	28	60	10	33	8	468	12	388	265

Frame	F	G	GD	H	HA	HD	K	L	Bearing	
									DS	NDS
HX 71	5	11	5	71	9	185	7	253	6203ZZ C3	6202ZZ C3
HX 80	6	15.5	6	80	10	200	10	290	6204ZZ C3	6203ZZ C3
HX 90SL	8	20	7	90	13	236	10	332	6205ZZ C3	6205ZZ C3
HX 100L	8	24	7	100	15	261	12	367	6306ZZ C3	6206ZZ C3
HX 112M	8	24	7	112	18	283	12	392	6307ZZ C3	6206ZZ C3
HX 132SM	10	33	8	132	20	323	12	468	6308ZZ C3	6307ZZ C3

Frame	N – Tol.	P	S	T	Bearing	
					DS	NDS
HX 71	100 – j6	160	10	3.5	6203ZZ C3	6202ZZ C3
HX 80	130 – j6	200	12	3.5	6204ZZ C3	6203ZZ C3
HX 90SL	130 – j6	200	12	3.5	6205ZZ C3	6205ZZ C3
HX 100L	180 – j6	250	15	4	6306ZZ C3	6206ZZ C3
HX 112M	180 – j6	250	15	4	6307ZZ C3	6206ZZ C3
HX 132SM	230 – j6	300	15	4	6308ZZ C3	6307ZZ C3

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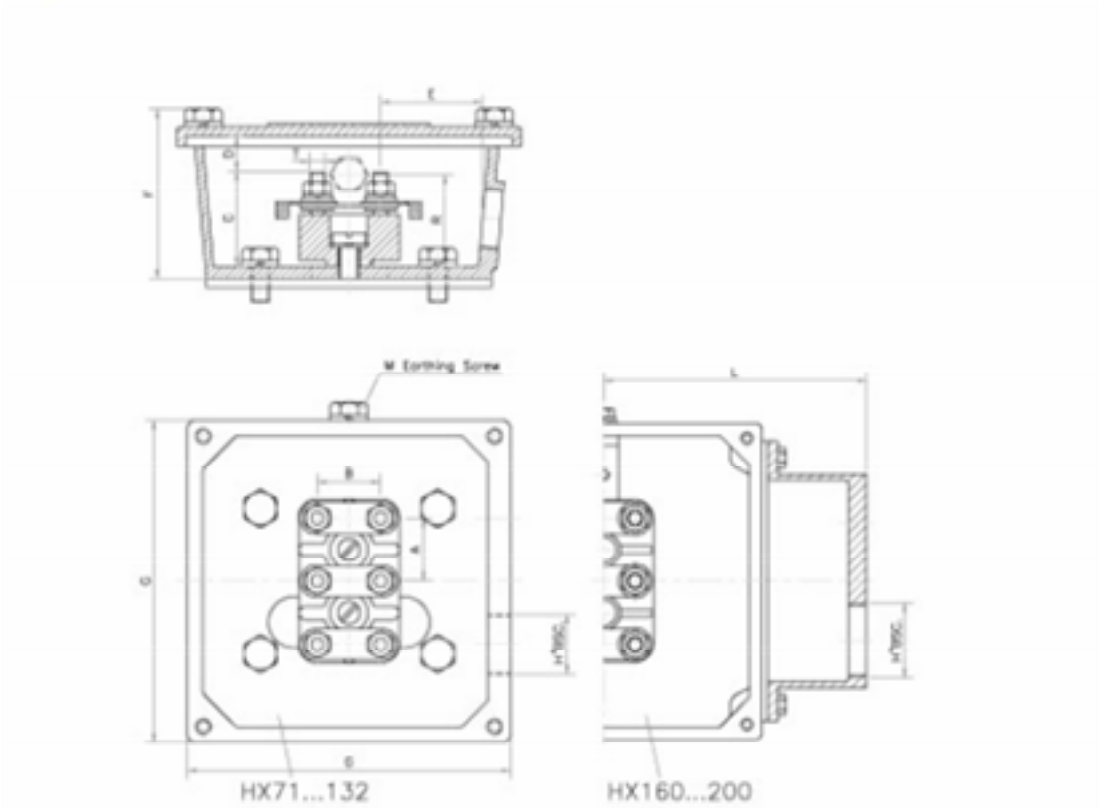
Terminal Box HX 71...200



Frame	T	A	B	C	D	E	F	G	H	L	M	R
HX 71	M4	16	16	26	8	20	42	74	3/4"	–	M4	–
HX 80	M4	16	16	26	8	20	42	74	3/4"	–	M4	–
HX 90SL	M5	20	20	30	11	32	55	102	3/4"	–	M6	–
HX 100L	M5	20	20	30	11	32	55	102	1"	–	M6	–
HX 112M	M5	20	20	30	11	32	55	102	1"	–	M6	–
HX 132SM	M5	20	20	30	11	32	55	102	1"	–	M6	–
HX 160ML	M8	32	32	59	23	56	95	160	1 1/2"	135	M6	52
HX 180ML	M8	32	32	59	23	56	95	160	1 1/2"	135	M6	52
HX 200ML	M8	32	32	59	23	56	95	160	1 1/2"	135	M6	52

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Major components

S. No.	Component	Material	Remarks
1	Housing	Cast iron / fabricated steel	Optimally sized fins for efficient cooling
2	Stator	Insulated silicon steel (CRNGO), Super enemal copper wire IS:4800 part 5 Type 2, Advanced NPN based class 'F' insulation	Low loss, consistency in performance
3	Rotor	Aluminum die cast or copper strips in Insulated silicon steel (CRNGO)	Dynamically balanced
4	Shaft	Carbon steel 'EN 8'	Open key way
5	Endshield and bearing cover	Cast iron	
6	Bearing and lubrication	Ball / Roller Lithium complex based	Normal / C3 clearance
7	Oil seal	Synthetic rubber	
8	Fan	Polypropylene / Aluminum alloy	Bi-directional, aerodynamically designed
9	Fan cover	Deep Drawn steel	Lint free construction available
10	Terminal box	Aluminum / cast iron	IP:55 Top / RHS / LHS Rotatable in the steps of 90°
11	Terminal plate	Bakelite / Epoxy	Steel / brass studs 3/8 Terminals
12	Paint	Polyurethane	Munsell blue shade/ Protection against corrosion

Maximum cable size of standard motor

S. No.	Frame Motor	Max. cable size DOL Starting	Max. cable size Star/Delta Starting	Terminal stud size
1	71-80	3c x 10 mm²	—	M4
2	90-132	3c x 16 mm²	2 x 3c x 10 mm²	M5
3	160-200	3c x 70 mm²	2 x 3c x 50 mm²	M8
4	225	2 x 3c x 120 mm²	2 x 3c x 120 mm²	M10
5	250-280	2 x 3c x 185 mm²	2 x 3c x 185 mm²	M12
6	315-355	*2 x 3c x 300 mm²	2 x 3c x 300 mm²	M16

* Terminal box suitable for 2 x 3c x 400 mm² is also available and can be supplied on request.

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Shipping dimensions

Frame	Length mm	Width mm	Height mm	Gross Wt. Kg
71	280	200	230	10
80	320	240	250	15
90	415	265	320	30
100	440	255	365	50
112	435	275	325	60
132	605	420	515	90
160	830	500	615	160
180	865	500	655	230
200	895	570	695	330
225	1040	590	830	480
250	1100	650	910	500
280	1275	680	985	800
315	1470	1060	1160	1450
355 SM	1660	1160	1245	1650
355 ML	1730	1160	1245	1650
400	2120	1200	1495	*

*Available on request

Chapter 10.3 FILTER:

Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

Inline filter

RE 51400/09.10 1/16
Replaces: 09.09

Types 40/100 LEN 0040 to 0400; 40/100 LE 0003, 0015, 0018

Nominal sizes according to **DIN 24550**: 0040 to 0400
Additional nominal sizes: 0003, 0015, 0018
Nominal pressures 40, 100 bar
Connections up to G 1 1/2
Operating temperature -10 □ to +100 □

Table of contents

Application

- Filtration of pressure fluids and lubricants
- Filtration of fluids and gases
- Direct installation into pipe work
- Direct wear protection of downstream components and systems

Features

- Filters for inline installation
- Extremely large filter area
- Flow-optimised design due to 3D computer-supported design
- Low pressure drop
- Special highly efficient filter media
- Versatile application possibilities

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Design

Filter head with inlet, outlet and filter element spigot. Filter bowl is unscrewed downwards.

Materials: As per spare parts list.

Further design variants available on request.

Filter element

Pleated design with optimized pleat density and various filter media.

The filter element is the most important component of the system "FILTER" in view of prolonged life and wear protection of the systems.

The most important criteria for selection are the required degree of cleanliness of the operating medium, the initial pressure differential and the contamination retention capacity.

For further detailed information please refer to our "Filter Elements" brochure.

Accessories

Maintenance indicator

Basically, the filter is equipped with mechanical optical maintenance indicator. The electronic maintenance indicator is connected via the electronic switching element with 1 or 2 switching points, which has to be ordered separately. The electronic switching element is attached to the mechanical optical maintenance indicator and held by means of a locking ring.

Bypass valve

To protect the filter element during startup and over pressurisation due to maintenance.

Characteristic curves

Our software "BRFilterSelect" 1)makes it possible to optimise filter selection, see download area http://www.boschrexroth.com/filter.

Additional characteristic curves for the filters in this catalogue can be found in the BRFS filter calculation programme.

Quality and standardization

The development, manufacture and assembly of BRFS industrial filters and BRFS filter elements is carried out within the framework of a certified quality management system in accordance with ISO 9001:2000.

The pressure filters for hydraulic applications according to 51400 are pressure holding equipment according to article 1, section 2.1.4 of the pressure equipment directive 97/23/EG (DGRL) However, on the basis of the exception in article 1, section 3.6 of the DGRL hydraulic filters are exempt from the DGRL, if they are not classified higher than category I (guideline 1/19). They do not receive a CE mark.

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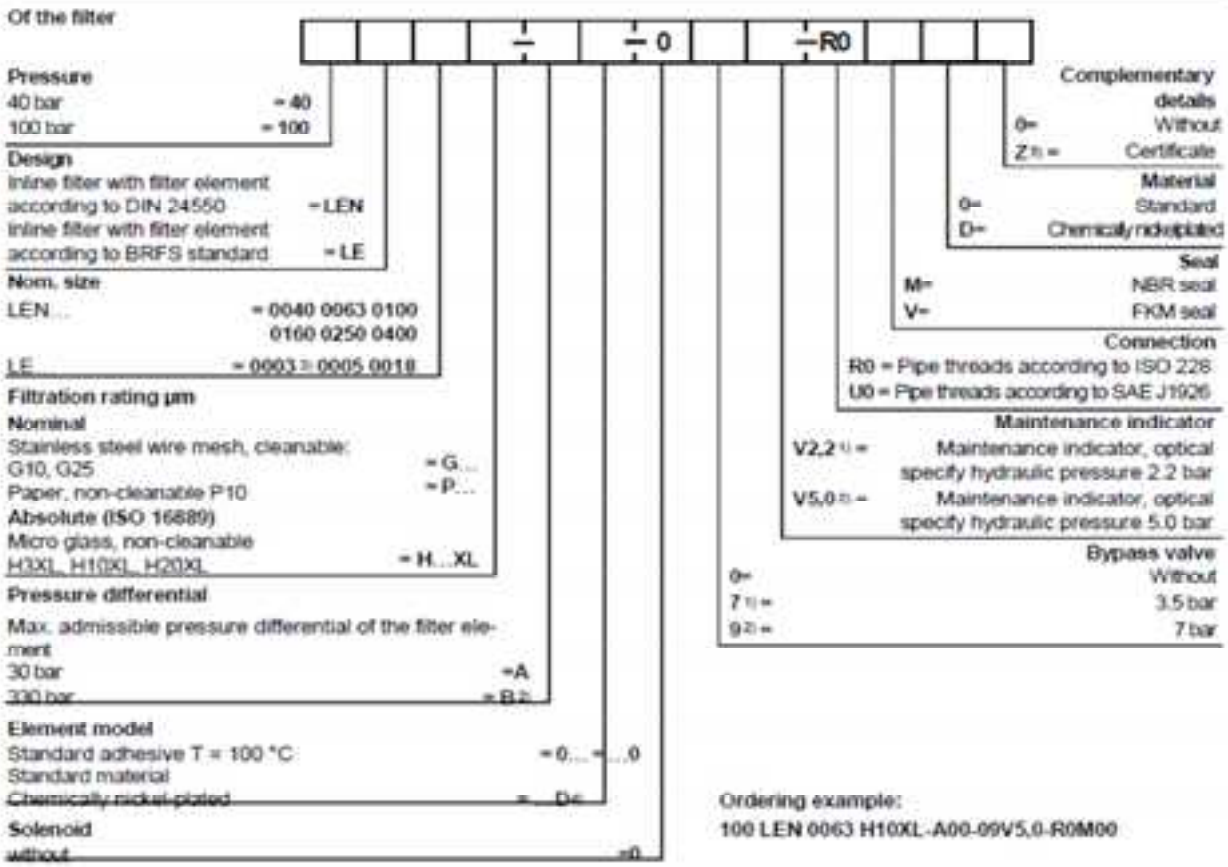
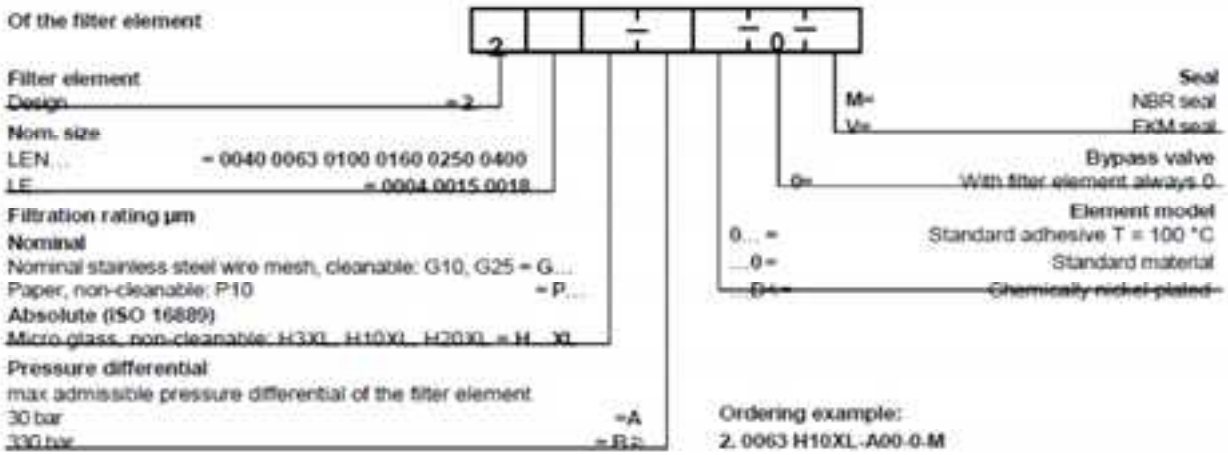
Ordering code



Ordering example:
100 LEN 0063 H10XL-A00-09V5,0-R0M00



Ordering example:
2. 0063 H10XL-A00-0-M

1) Only at pressure = 40 bar
2) Only at pressure = 100 bar
3) Filter element 2.0004
4) Only in connection with FKM seal
5) Manufacturer's inspection certificate M according to DIN 55350 T18

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Preferred types

Inline filter with bypass, filtration rating 10 µm and nominal pressure 40 bar

Type	Flow in l/min at ν = 30 mm²/s and Δp = 0.8 bar	Material number	
		Connection R0	Connection U0
40 LE 0003 H10XL-A00-07V2,2-R0M00	33	R928000016	-
40 LEN 0040 H10XL-A00-07V2,2-...M00	43	R928000010	R928022989
40 LEN 0063 H10XL-A00-07V2,2-...M00	64	R928000011	R928022990
40 LEN 0100 H10XL-A00-07V2,2-...M00	84	R928000012	R928022991
40 LE 0015 H10XL-A00-07V2,2-...M00	133	R928000017	R928022998
40 LE 0018 H10XL-A00-07V2,2-...M00	153	R928000018	R928022999
40 LEN 0160 H10XL-A00-07V2,2-...M00	218	R928000013	R928023000
40 LEN 0250 H10XL-A00-07V2,2-...M00	285	R928000014	R928023865
40 LEN 0400 H10XL-A00-07V2,2-...M00	346	R928000015	R928023866

Inline filter with bypass, filtration rating 3 µm and nominal pressure 40 bar

Type	Flow in l/min at ν = 30 mm²/s and Δp = 0.8 bar	Material number	
		Connection R0	Connection U0
40 LE 0003 H3XL-A00-07V2,2-R0M00	14	R928000007	-
40 LEN 0040 H3XL-A00-07V2,2-...M00	17	R928000001	R928023868
40 LEN 0063 H3XL-A00-07V2,2-...M00	28	R928000002	R928023869
40 LEN 0100 H3XL-A00-07V2,2-...M00	42	R928000003	R928023870
40 LE 0015 H3XL-A00-07V2,2-...M00	61	R928000008	R928023872
40 LE 0018 H3XL-A00-07V2,2-...M00	77	R928000009	R928028071
40 LEN 0160 H3XL-A00-07V2,2-...M00	98	R928000004	R928028073
40 LEN 0250 H3XL-A00-07V2,2-...M00	146	R928000005	R928028074
40 LEN 0400 H3XL-A00-07V2,2-...M00	210	R928000006	R928028076

Inline filter without bypass, filtration rating 10 µm and nominal pressure 40 bar

Type	Flow in l/min at ν = 30 mm²/s and Δp = 0.8 bar	Material number	
		Connection R0	Connection U0
40 LE 0003 H10XL-A00-00V2,2-R0M00	33	R928020015	-
40 LEN 0040 H10XL-A00-00V2,2-...M00	43	R928020009	R928028077
40 LEN 0063 H10XL-A00-00V2,2-...M00	64	R928020010	R928028078
40 LEN 0100 H10XL-A00-00V2,2-...M00	84	R928020011	R928028082
40 LE 0015 H10XL-A00-00V2,2-...M00	133	R928020016	R928028083
40 LE 0018 H10XL-A00-00V2,2-...M00	153	R928020017	R928028084
40 LEN 0160 H10XL-A00-00V2,2-...M00	218	R928020012	R928028091
40 LEN 0250 H10XL-A00-00V2,2-...M00	285	R928020013	R928028092
40 LEN 0400 H10XL-A00-00V2,2-...M00	346	R928020014	R928028093

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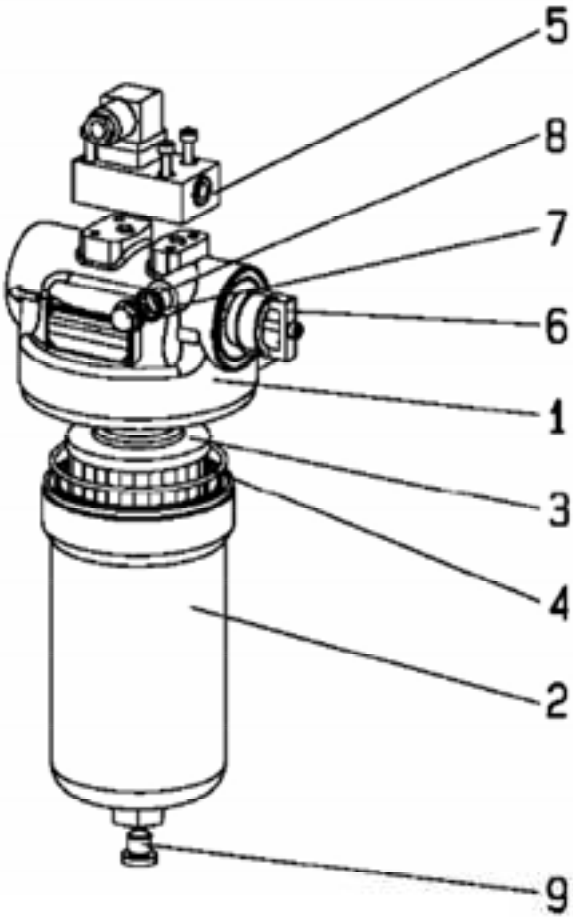
Spare parts list



		Size LEN			0040	0063	0100			0160	0250	0400
		LE		0003				0015	0018			
Part	Piec	Description	Material									
1	1	Filter head	Al	Please indicate ordering information "Filter"								
2	1	Filter bowl	Carbon steel	Please indicate ordering information "Filter"								
3	1	Filter element	Various	Please indicate ordering information "Filter Element"								
4	1	Seal ring	NBR / FKM	Please indicate ordering information "Filter"								
5	1	Maintenance indicator	Various	See ordering information "Maintenance indicator"								
6	1	Bypass valve 1)	Al / plastic	Part No. 5359				Part No. 5118		Part No. 5360		
7	1	Bleed screw	5.8	Part No. 4158								
8	1	Seal ring	Soft steel	Please indicate ordering information "Filter"								
9	1	Blanking plug	Steel	-						Part No. 778		

All part numbers BRFS-specific.

Spare parts (insert for DIN filters)

Mechanical optical
Maintenance indicator **ABZ F V NV2 1X DIN**

Rexroth power unit accessories
Filter
Maintenance indicator
Mechanical optical maintenance indicator for low-pressure filters
switching point 2.2 bar *[32 psi]* = NV2

DIN = Identification for DIN and SAE models

Sealing material
M= See table below
V= See table below

Unit series
1X = Unit series 10 to 19 (10 to 19; unchanged installation and connection dimensions)

Mechanical optical Maintenance indicator	Material no.
ABZFV-NV2-1X/M-DIN	R901025312

The ordering details for filter elements can be found on page 3.

Sealing kits must be ordered by stating the complete part key.

Sealing material and surface coating for pressure fluids

			Ordering detail: Sealing material	Ordering detail: Element model and material
Mineral oils				
Mineral oil	HLP	according to DIN 51524	M	_0
Fire-resistant hydraulic fluids				
Emulsions	HFA-E	according to DIN 24320	M	_0
Synthetic water solutions	HFA-S	according to DIN 24320	M	_D
Water solutions	HFC	according to VDMA 24317	M	_D
Phosphate esters	HFD-R	according to VDMA 24317	V	_D
Organic esters	HFD-U	according to VDMA 24317	V	_D
Hydraulic fluids that are fast biodegradable				
Triglycerides (rape seed oil)	HETG	according to VDMA 24568	M	_D
Synthetic esters	HEES	according to VDMA 24568	V	_D
Polyglycoles	HEPG	according to VDMA 24568	V	_D

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Installation, commissioning and maintenance

Installation

Verify operating pressure with name plate information.

Screw the filter housing (position 1) to the fastening device considering the flow direction (direction arrows) and withdrawal height of the filter element (position 3).

Remove the plugs from the filter inlet and outlets. Fit the filter into the pipe work, ensuring that it is fitted free of tension.

⚠ Warning!

Assemble and disassemble the filter only when system is depressurised!

Vessel is under pressure!

When disassembling the filter, please note that the filter inlet and the filter outlet need to be emptied separately!

Remove the filter bowl only if it is not pressurised!

Do not replace the maintenance indicator while the filter is under pressure!

Functional and safety warranty only applicable when using genuine Rexroth spare parts!

Service filter only by trained personnel!

Commissioning

Switch on system pump.

Bleed filter by opening the plug / bleed valve (position 7), close when operating fluid vents.

Maintenance

If the red indicator pin shows out of the maintenance indicator and/or if the switching process in the electric display is triggered, the filter element is clogged and needs to be replaced or cleaned respectively.

Filter element replacement

Switch of the operating pump.

Open the plug / bleed valve (position 7) and relieve pressure.

Unscrew the filter bowl (position 2) and remove the filter element (position 3) from the centering spigot on the filter head (position 1) by turning it lightly.

Check the filter head for cleanliness and clean if necessary.

Replace filter elements H...-XL und P... Clean the filter element with material G ...

The efficiency of the cleaning process depends on the type of contamination and the value of the pressure differential before the filter element was exchanged. If the pressure differential after replacing the filter element is more than 50% of the value before replacing the filter element then the G... element also needs to be replaced.

Install the cleaned or new filter element with light turning movements back on to the centering spigot.

Check the seal ring Pos. 4 in the filter bowl for damage or wear and replace if necessary.

Screw on the filter bowl and tighten via the hexagon using a suitable tool

Bleed filter by opening the plug / bleed valve (position 7), close when operating fluid vents.

Technical modifications reserved!

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Chapter 10.4 ACCUMULATOR:

EPE
Filters . Accumulators
an ISO 9001 Company

EPE Accumulators are widely used in Hydraulic Systems for following applications :

- Fluid Power Storage
- Counter Balance
- Pulsation Damper
- Hydraulic Semi-Shock Damper
- Emergency Energy Reserve
- Shock Absorber
- Volume Compensator
- Hydraulic Spring
- Pressure Compensator
- Fluid Separator

EPE PROCESS FILTERS & ACCUMULATORS PVT LTD
An ISO 9001 Company
Techni Towers
C-54/A, A.P.I.E., Balanagar
Hyderabad -500 037. A.P. India.
Tel. Nos. : 23778803/23778804/23871445
Fax Nos. : 040-23871447
Internet : www.epe-india.com
E-mail : business@epe-india.com

Repairable Diaphragm Accumulators Type-AM

Technical Features

Design	:	Screwed Shell, Repairable
Max. Working pressure	:	210 Bar.
Test pressure	:	1.43 times Max. Working Pressure
Temperature range	:	-10° C to +80° C
Allowable pre. Ratio (P2/P0):		6:1
Nominal capacity	:	0.1 to 2.5 Ltrs.
Material of Construction		
Body	:	Carbon Steel / Stainless Steel
Diaphragm	:	Nitrile / Viton / EPDM
Connections - Gas Side	:	5/8" UNF (M)
Fluid Side	:	M18 x 1.5 (F)

Identification Code

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General

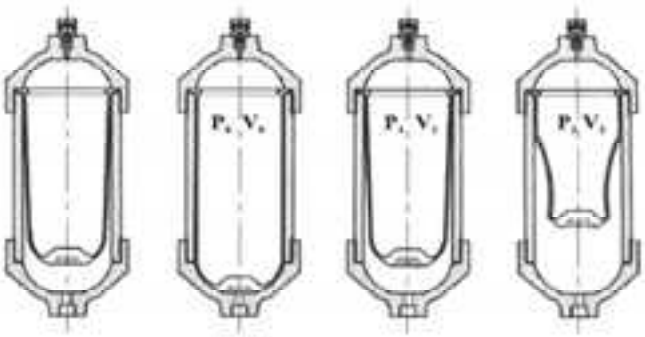

Fig A

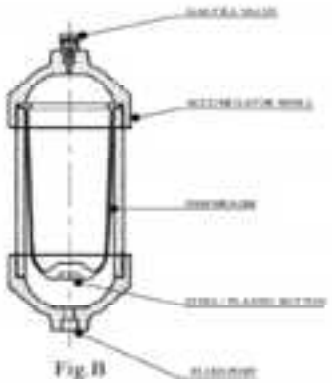

Fig B

Definition and Operation - *(Refer Fig A)*

A hydro-pneumatic accumulator is a device used specifically for storage of liquid under pressure. As liquids, for all practical purposes, are incompressible, this objective is achieved by utilising the compressibility of gases.

- A flexible rubber separator i.e., a diaphragm is fitted into the accumulator shell.
- An inert gas - nitrogen - is filled into the diaphragm through a pressure valve to a pressure P_0. The diaphragm expands, filling the entire volume V_0 of the accumulator shell.
- When the system (circuit) pressure P_1 is higher than the gas precharge pressure P_0, the hydraulic liquid enters the accumulator shell and the diaphragm is compressed reducing the gas volume to V_1.
- Should the liquid pressure rise to P_2, the volume of gas reduces to V_2 with an attendant rise in the pressure, thus balancing the Liquid pressure.

A potential energy is now created in the accumulator to be utilized whenever needed.

Construction - *(Refer Fig B)*

- An accumulator shell is a combination of forged and machined components specifically designed for leak proof assembly.
- Diaphragm is a flexible rubber component separating hydraulic fluid and nitrogen.
- Fluid Port connects the accumulator to the hydraulic system.
- Gas Fill Valve is a non-return valve provided on the accumulator for inflating the diaphragm in the accumulator with the help of a Pre-loading and Checking Set.

Accumulator Selection

- While choosing the most suitable accumulator size, following aspects should be considered.
- Maximum operating pressure of the system should be lower than maximum working pressure of the accumulator indicated in the catalogue or on the product name-plate.
- Pressure ratio P_1/P_0 should be less than 6.
- The material of the body and diaphragm should be compatible with the fluid used and with the operating temperature.

EPE Diaphragm Accumulators are charged with nitrogen before shipment, unless otherwise specified in the order, at a pressure of

- 10 bar for despatch within India
- Nil for exports

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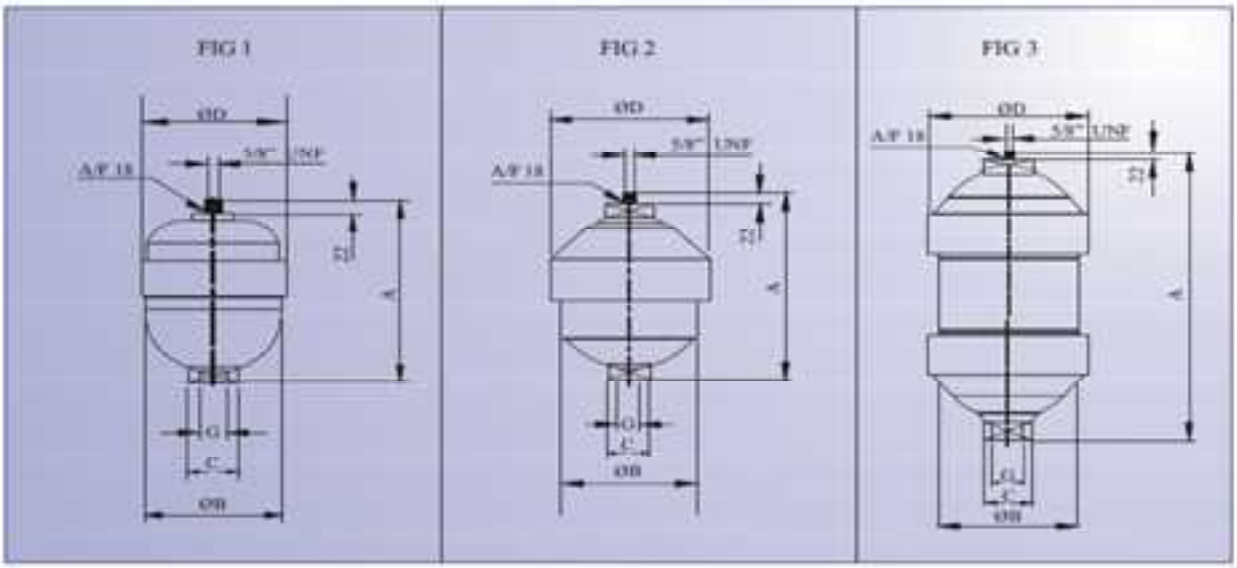
USER/ Maintenance Manual Of Computerized Diesel Fuel Injection Pump Test Rig



Dimensions

Type	Fig.	Max. Work Pre. (bar)	Gas Volume (Liters)	Dry Weight (kgs)	Fluid Port Connection G		A	B	C (A/F)	D
					Standard	On request				
AM-0.1	1	210	0.1	1.7	M18 x 1.5 (F)	1/2" BSP(F)	127	74	36	77
AM-0.35			0.32	2.5			150	91		99
AM-0.5	2		0.48	3.72		1/2" BSP(F) - 3/4" BSP(F)	169	94		116
AM-0.75			0.72	6.17			201	116		136
AM-1	3		0.9	9.3			259	120	40	
AM-1.5			1.4	10.4			299			
AM-2			1.9	12.25			364			
AM-2.5			2.4	14.55			454			

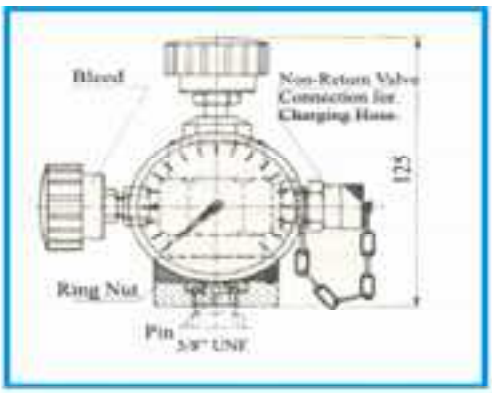
Checking & Charging

Pre-Loading & Checking Set type-PC is to be used for checking / charging of repairable Diaphragm Accumulators. When charging, the nitrogen bottles must be capable of delivering pressure higher than the desired accumulator gas pressure.

Use dry industrial nitrogen. ***NEVER USE OXYGEN OR AIR.***

Proceed as follows:

- Fit the suitable pre-charging equipment to the gas valve;
- Connect it to the nitrogen cylinder with the charging hose;
- Slowly introduce nitrogen into the accumulator until reaching a pressure slightly above the required level;
- Close the valve of nitrogen cylinder and disconnect the charging hose from the equipment;
- Wait for the gas temperature stabilization;



A PRESSURE REDUCING VALVE MUST BE INSTALLED BETWEEN THE NITROGEN GAS CYLINDER AND THE ACCUMULATOR WHEN THE GAS CYLINDER PRESSURE IS HIGHER THAN MAX PERMISSIBLE PRESSURE OF ACCUMULATOR.

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Installation & Maintenance

General

The EPE diaphragm accumulator is designed, manufactured and tested in accordance with current standards. The maximum working pressure, model, precharge pressure, serial number & year of manufacture are marked on the accumulator shell, besides the manufacturers mark and legal conformity stamp (if required).

Instructions

- Do not machine or weld the accumulator body.
- The precharge gas must be nitrogen unless otherwise agreed between the manufacturer and the user.
- Do not use liquids incompatible with the material of construction.
- For system and personnel safety, ensure that all the necessary precautions required for pressure vessels are taken.

Preliminary checking

On receipt of an accumulator, check to ascertain that

- the accumulator is not damaged in transit.
- the identification code is as per the order.

Before installation, it is essential to check that

- the working pressure marked on the accumulator shell is higher than the maximum operating pressure of the system and
- the accumulator is precharged to the required pressure.

Installation

An accumulator may be installed in any position. However, the vertical position (fluid port down) is preferred.

- Leave sufficient space to allow use of the precharging equipment.
- Leave the markings clearly visible.
- Ensure space for easy removal of accumulator from system.

Connection to the fluid port requires

- An isolation and unloading valve.
- A relief valve.
- A pressure gauge connection.

This can easily be obtained by using safety blocks as per EPE Model B10 and B20.

Mounting: There must be no additional forces or moments acting on the accumulator other than those due to the fluid power system. The accumulator mountings (brackets, clamps etc.) must ensure that the mechanical movements and vibrations are safely absorbed so that liquid and gas connections do not become additionally loaded.

No machining or welding should be carried out on the accumulator for the purpose of mounting.

Putting into service

Before the system is pressurised, check that

- The precharged gas is at required pressure.
- The setting of the safety or relief valve is lower than the max. working pressure of the accumulator and
- Air is vented from the piping.

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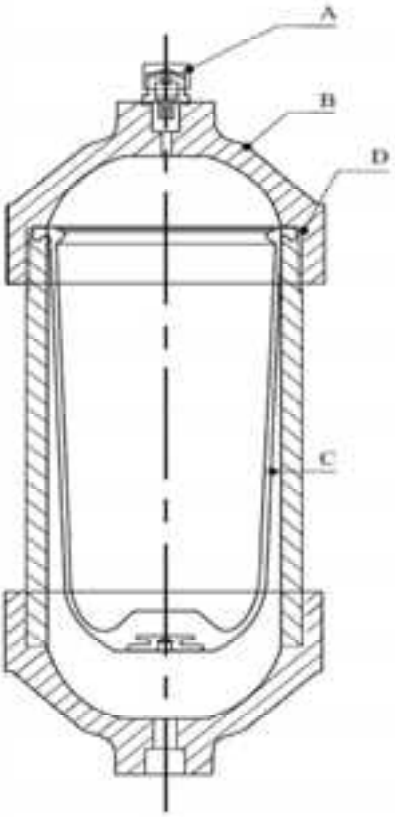

Installation & Maintenance

Periodic Checks

The accumulator should be checked to ensure that the gas precharge has not reduced.

Before checking, the accumulator must be isolated from the system and the fluid removed.

An initial check is required during the first week of installation.

A second check should be carried out approximately 3 months later and subsequent checks after every 3 to 6 months.

Maintenance

General

Before removing the accumulator for servicing, isolate it from hydraulic circuit and reduce pressure to zero by exhausting the fluid from the accumulator to reservoir.

Repair

Repair work can involve replacing the diaphragm, seals or gas fill valve. For safety and functionality, use only parts supplied or recommended by EPE. Before any repair work is undertaken both the liquid and the gas chamber have to be depressurized.

Disassembly

- Firmly fasten the lower part of the accumulator in a vice.
- Remove the gas fill valve (A) (after depressurizing the accumulator completely).
- Unscrew the top cover (B) using a band or chain pipe wrench or spanner.
- Extract the diaphragm (C) along with seals (D).

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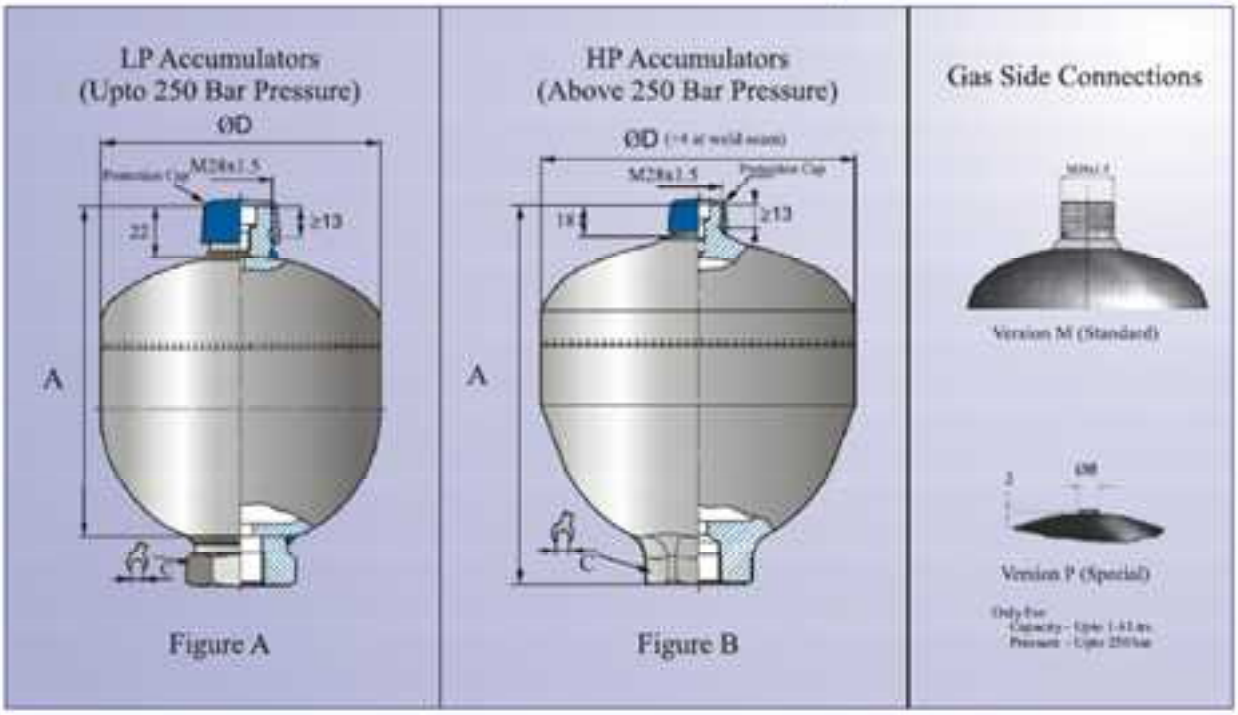
USER/ Maintenance Manual Of Computerized Diesel Fuel Injection Pump Test Rig

Welded Diaphragm type Accumulators

Technical Features

Design	:	Welded Shell, Non-repairable
Max. Working pressure	:	40 - 350 Bar.
Test pressure	:	1.43 times Max. Working Pressure
Temperature range	:	-10° C to +80° C
Allowable pre. Ratio (P2/P0):		8:1 (4:1 for AMW-2.8)
Nominal capacity	:	0.075 to 5 Ltrs.
MOC - Body	:	Carbon Steel-Welded
Diaphragm	:	Nitrile / Epichloridrin (ECO)
Connections - Gas Side	:	M28x1.5 (M) OR Dia 8
Fluid Side	:	Female Threaded - 1/2", 3/4" OR With external and internal threads.



Dimensions

Model	AMW-0.07	AMW-0.16	AMW-0.22	AMW-0.32	AMW-0.5	AMW-0.75	AMW-0.75	AMW-0.75	AMW-0.75	AMW-1.0
Capacity (ltrs)	0.075	0.16	0.32	0.32	0.5	0.75	0.75	0.75	0.75	1.0
MWP (bar)	250	250	210	250	160	160	210	250	350	210
Weight (kgs)	0.62	1.0	1.4	1.7	1.6	2.6	2.6	3.7	4.6	3.5
Figure	A	A	A	A	A	A	A	A	B	A
Height A	91	99.5	114	120	127	143.5	144	150.5	169	158
Diameter D	Ø64	Ø75	Ø92.5	Ø95	Ø103	Ø121	Ø121.5	Ø127	Ø132.5	Ø136
Standard Conn	E1	C1	C1	C1	C2	E2	C2	C2	C4	C2

Model	AMW-1.4	AMW-1.4	AMW-1.4	AMW-2.0	AMW-2.0	AMW-2.0	AMW-2.8	AMW-3.5	AMW-3.5	AMW-5.0
Capacity (ltrs)	1.4	1.4	1.4	2.0	2.0	2.0	2.8	3.5	3.5	5.0
MWP (bar)	140	250	350	100	250	350	350	250	350	40
Weight (kgs)	4.2	6.0	7.5	3.5	7.5	11.5	14.5	13.5	16.5	9.0
Figure	A	A	B	A	A	B	B	A	B	A
Height A	169	176	200	218	229	220	265	286	305	247
Diameter D	Ø147	Ø155	Ø160	Ø144.3	Ø155	Ø180	Ø180	Ø174	Ø180	Ø213
Standard Conn	E6	C2	C4	E3	C3	C5	C5	C3	C5	E4

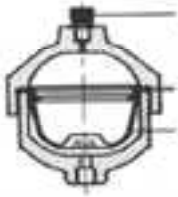
Note :

- Charging of welded Accumulators is undertaken using pre-loading & Checking Set ***Type-PCM***.
- For further details / connections please refer the catalogue "***Welded Diaphragm Accumulators, Type - AMW***".

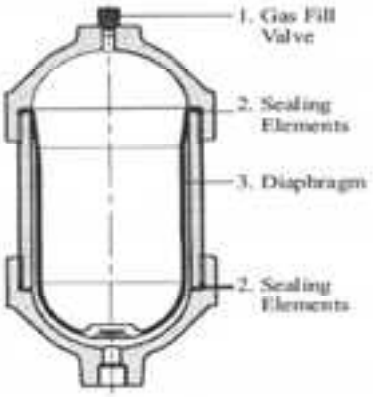
Spare Parts

AM 0.1 & AM 0.35

AM 0.5 & AM 0.75



AM 1 to AM 2.5



Installation & Maintenance

Reassembly

After careful cleaning, replace all damaged components. Wet the outer surface of the diaphragm and seals with the operating liquid. Reassemble the top cover and tighten it firmly.

Precharge

Carry out precharging using EPE pre-loading and checking equipment, ***Type - PC***. Only dry industrial nitrogen should be used.

Follow procedure as explained in "***Checking & Charging***" on page-3.

Mounting Instructions

The accumulators should be properly fitted / clamped on the system. Clamping should not cause the shell or the accumulator connection to be stressed due to over tightening. It is necessary, especially with larger capacities / lengths, horizontal mounting or with heavy units, to use fasteners (clamps, brackets etc) that support the accumulator and prevent dangerous vibrations.

To achieve a high degree of efficiency, the accumulator should be fitted as close as possible to the installation it serves. The space necessary for charging & gauging kit is atleast 150mm above the gas fill valve.

Position

It is suggested that the accumulators are installed vertically with gas side on top. The manufacturers name plate stating the initial pressure must be visible. Moreover access to the vent screw, if any, must be kept unobstructed.

The mounting must be such that, should a rupture occur on the pipe system at the liquid connection, or should the gas fill valve break, the accumulator cannot be pulled from its mounting by the forces involved. No welding or other mechanical process must be carried out on the accumulator shell for the purpose of attaching fasteners.

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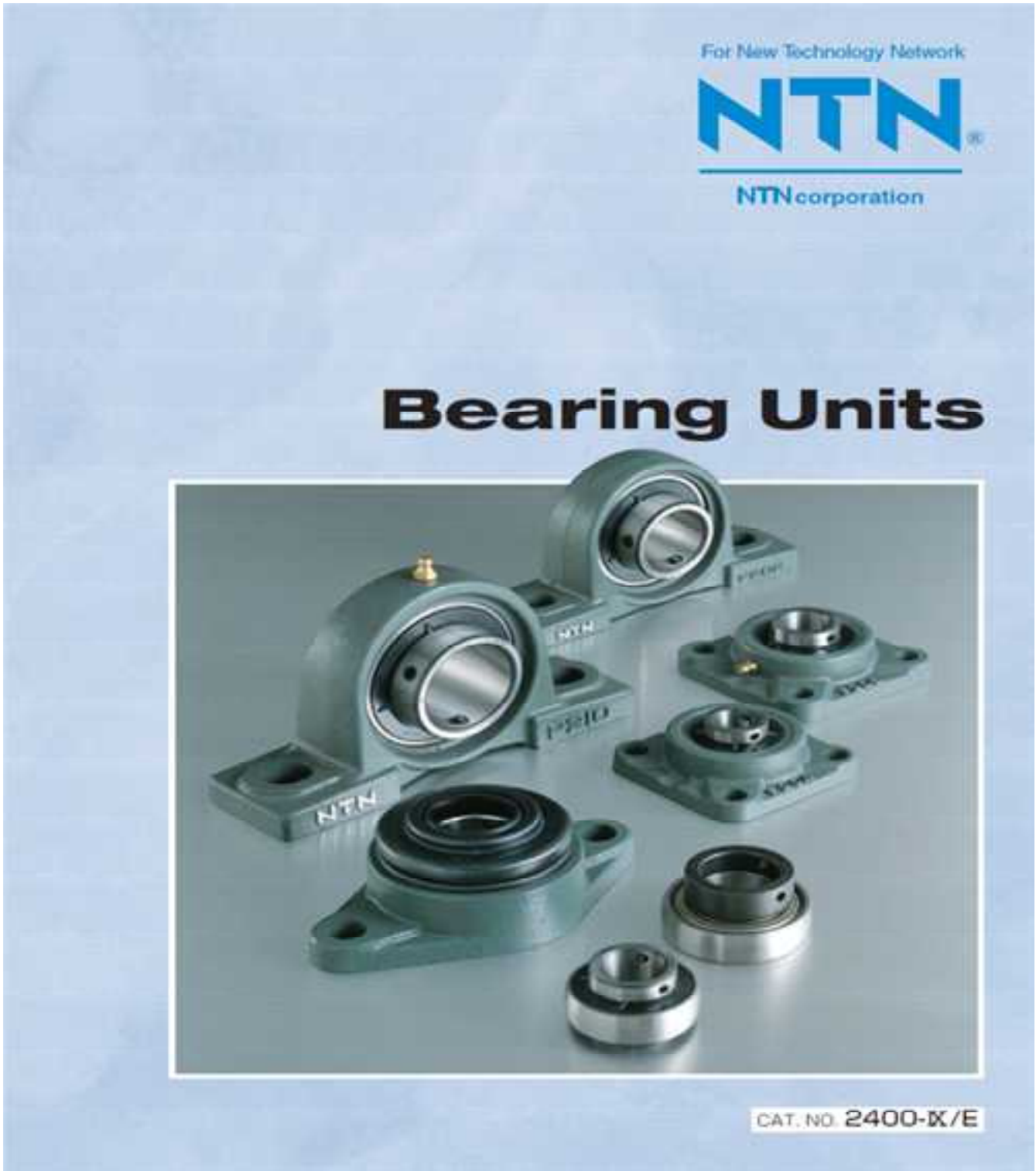
Chapter 10.5 Plumber Block:



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Technical Data NTN

1. Construction

The **NTN** bearing unit is a combination of a radial ball bearing, seal, and a housing of high-grade cast iron or pressed steel, which comes in various shapes.

The outer surface of the bearing and the internal surface of the housing are spherical, so that the unit is self-aligning.

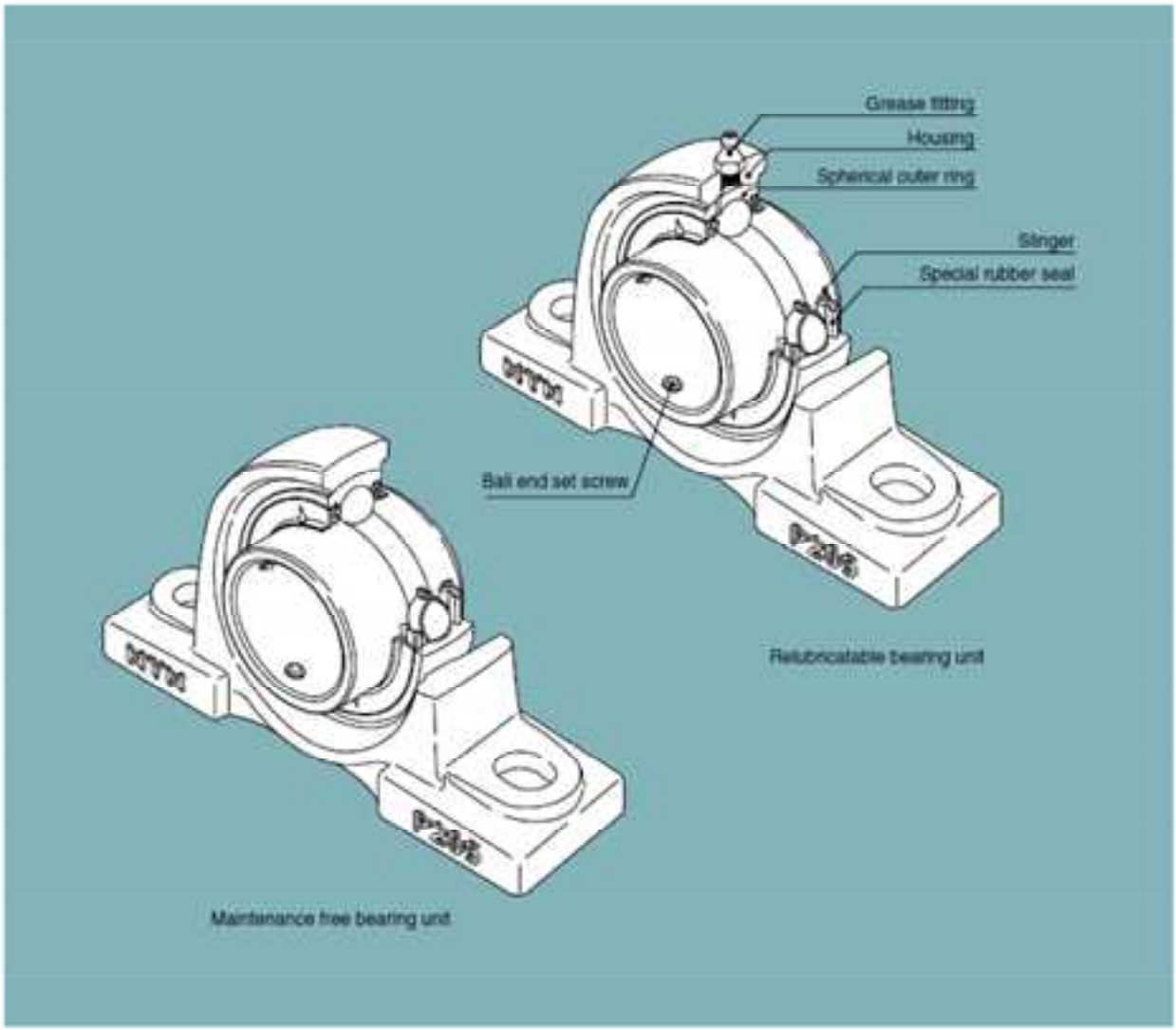
The inside construction of the ball bearing for the unit is such that steel balls and retainers of the same type as in series 62 and 63 of the **NTN** deep groove ball bearing are used. A duplex seal consisting of a combination of an oil-proof synthetic rubber seal and a slinger, unique to **NTN**, is provided on both sides.

Depending on the type, the following methods of fitting to the shaft are employed:

(1) The inner ring is fastened onto the shaft in two places by set screws.

(2) The inner ring has a tapered bore and is fitted to the shaft by means of an adapter.

(3) In the eccentric locking collar system the inner ring is fastened to the shaft by means of eccentric grooves provided at the side of the inner ring and on the collar.



2. Design Features and Advantages

2.1 Maintenance free type

The **NTN** Maintenance free bearing unit contains a high-grade lithium-based grease, good for use over a long period, which is ideally suited to sealed-type bearings. Also provided is an excellent sealing device, unique to **NTN**, which prevents any leakage of grease or penetration of dust and water from outside.

It is designed so that the rotation of the shaft causes the sealed-in grease to circulate through the inside space, effectively providing maximum lubrication. The lubrication effect is maintained over a long period with no need for replenishment of grease.

To summarize the advantages of the **NTN** maintenance free bearing unit:

(1) As an adequate amount of good quality grease is sealed in at the time of manufacture, there is no need for replenishment. This means savings in terms of time and maintenance costs.
(2) Since there is no need for any regreasing facilities, such as piping, a more compact design is possible.
(3) The sealed-in design eliminates the possibility of grease leakage, which could lead to stained products.

2.2 Relubricatable type

The **NTN** relubricatable type bearing unit has an advantage over other similar units being so designed as to permit regreasing even in the case of misalignment of 2° to the right or left. The hole through which the grease fitting is mounted usually causes structural weakening of the housing.

However, as a result of extensive testing, in the **NTN** bearing unit the hole is positioned so as to minimize this adverse effect. In addition, the regreasing groove has been designed to minimize weakening of the housing.

While the **NTN** maintenance free type bearing unit is satisfactory for use under normal operating conditions in-doors, in the following circumstances it is necessary to use the relubricatable type bearing unit:

(1) Cases where the temperature of the bearing rises above 100°C, 212°F:
*- Normal temperature of up to 200°C, 392°F heatresistant bearing units.
(2) Cases where there is excessive dust, but space does not permit using a bearing unit with a cover.
(3) Cases where the bearing unit is constantly exposed to splashes of water or any other liquid, but space does not permit using a bearing unit with a cover.
(4) Cases in which the humidity is very high, and the machine in which the bearing unit is used is run only intermittently.
(5) Cases involving a heavy load of which the C_0/P_0 value is about 10 or below, and the speed is 10 rpm or below, or the movement is oscillatory.
(6) Cases where the number of revolutions is relatively high and the noise problem has to be considered; for example, when the bearing is used with the fan of an air conditioner.

2.3 Special sealing feature

2.3.1 Standard bearing units

The sealing device of the ball bearing for the **NTN** bearing unit is a combination of a heat-resistant and oil-proof synthetic rubber seal and a slinger of an exclusive **NTN** design.

The seal, which is fixed in the outer ring, is steelreinforced, and its lip, in contact with the inner ring, is designed to minimize frictional torque.

The slinger is fixed to the inner ring of the bearing with which it rotates. There is a small clearance between its periphery and the outer ring.

These two types of seals on both sides of the bearing prevent grease leakage, and foreign matter is prevented from entering the bearing from outside.

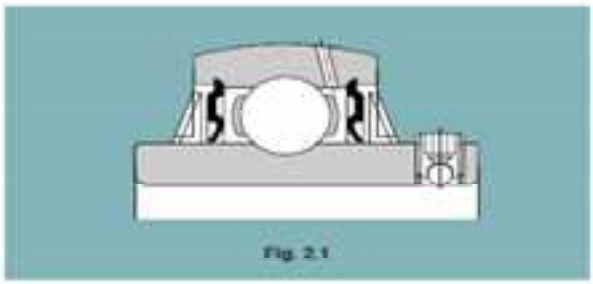


Fig. 2.1

2.3.2 Bearing units with covers

The **NTN** bearing unit with a cover consists of a standard bearing unit and an outside covering for extra protection against dust. Special consideration has been given to its design with respect to dust-proofing.

Sealing devices are provided in both the bearing and the housing, so that units of this type operate satisfactorily even in such adverse environments as flour mills, steel mills, foundries, galvanizing plants and chemical plants, where excessive dust is produced and/or liquids are used. They are also eminently suitable for outdoor environments where dust and rain are inevitable, and in heavy industrial machinery such as construction and transportation equipment.

The rubber seal of the cover contacts with the shaft by its two lips, as shown in Fig. 2.2 and 2.3. By filling the groove between the two lips with grease, an excellent sealing effect is obtained and, at the same time, the contacting portions of the lips are lubricated. Furthermore, the groove is so

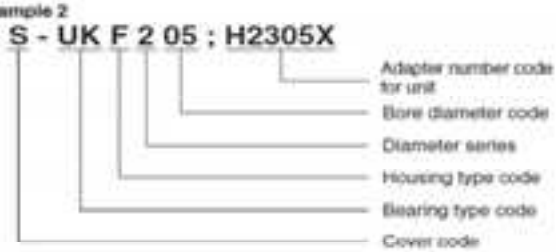
4. Bearing unit part numbering

4.1 Bearing unit part numbering

NTN Bearing unit part numbers are in accordance with the Japanese Industrial Standard JIS. The code for the bearing type, housing type, diameter series and bore diameter are expressed from left to right within the part number.

Example 1

Example 2



4.2 Ball bearing insert part numbering

The part number for the insert bearing matches the part number for the bearing unit.

Example

Each bearing unit can take any number of different ball bearing inserts. The available insert types are shown in Fig. 4.3(1)-4.3(9).

4.3 Housing part numbering

Housing part numbers are expressed by the housing type code, the bearing outer diameter series code and the bore diameter codes of the insert bearing that would be used for the unit.

The available housings are shown in Table 4.3(1)-4.3(9).

Example

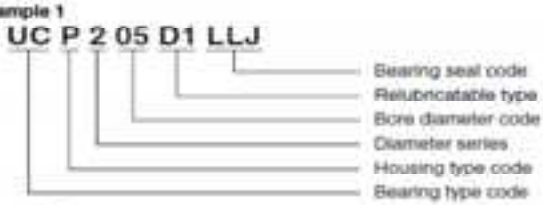
4.4 Supplemental codes

Typical supplementary codes added after the Bearing unit part number are shown below.

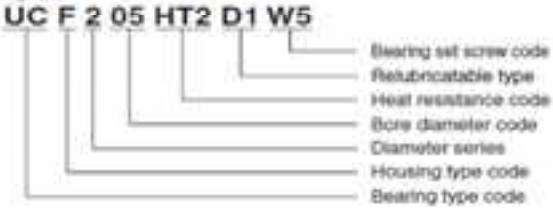
Table 4.1 Examples of supplementary codes

Item	Supplementary code	Content
For heat resistance and cold resistance	HT2	Heat resistance
	CT1	Cold resistance
Housing material	N1	Spheroidal graphite cast iron (FCD450)
Lubrication method	No code	Maintenance free type
	D1	Relubricatable type
Bearing seal	No code	Standard nitrile rubber seal
	U	Non-contact shield plate
	LLJ	Triple lip seal
Set screw	No code	Set screw with ball (Except for stainless bearing)
	W3	Cup point
	W4	Double point
	W5	Round head dog point set screw (With one piece)
	W6	Round head key bolt (With one piece)

Example 1



Example 2



Bearing specifications for heat resistance and cold resistance are shown in Table 4.2.

Table 4.2 Bearing specifications for heat resistance and cold resistance

Item	Code	Operating range (°C)	Grease	Bearing seal	Bearing clearance
Heat resistance	HT2	Room temp. ~180°C	Li soap + Silicon oil	Non-contact shield plate	C4
Cold resistance	CT1	−60°C ~ Room temp.	Li soap + Silicon oil	Non-contact shield plate	CN

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Technical Data NTN

Table 4.3 (1) Cast iron pillow block type units

Housing Type (Material : Cast iron)		Cover	Bearing Type UC	UEL / REL	UK	AS / AH	AEL / JEL	CS
Pillow Block		—	UCP	UELP RELP	UKP	ASP ARP	AELP JELP	—
		Steel	S(M)-UCP	—	S(M)-UKP	S(M)-ASP S(M)-ARP	—	—
		Cast Iron	C(M)-UCP	—	C(M)-UKP	C(M)-ASP C(M)-ARP	—	—
Thick Pillow Block		—	UCIP	UELIP RELIP	UKIP	—	—	—
		Steel	S(M)-UCIP	—	S(M)-UKIP	—	—	—
		Cast Iron	C(M)-UCIP	—	C(M)-UKIP	—	—	—
High-Center Pillow Block		—	UCHP	UELHP RELHP	UKHP	ASHP ARHP	AELHP JELHP	—
		Steel	S(M)-UCHP	—	S(M)-UKHP	S(M)-ASHP S(M)-ARHP	—	—
Narrow Pillow Block		—	UCUP	UELUP RELUP	UKUP	ASUP ARUP	AELUP JELUP	—
		Steel	S(M)-UCUP	—	S(M)-UKUP	S(M)-ASUP S(M)-ARUP	—	—
Light Pillow Block		—	—	—	—	ASPB ARPB	AELPB JELPB	CSPB
Pillow Block Low-Center		—	UCPL	UELPL RELPL	UKPL	ASPL ARPL	AELPL JELPL	—

Remarks 1. The codes "S-" and "C-" at the head of the type codes indicate steel plate covered bearing units and cast iron covered bearing units, respectively.
2. Single-sided closed covered bearing units made of steel and cast iron are also available.
These bearing units are identified with the codes "SM-"(steel plate) and "CM-"(cast iron) at the head of the type codes, respectively.
3. "UC" type stainless steel bearings are also available. For further details, consult **NTN** (Stainless Series Bearing unit)

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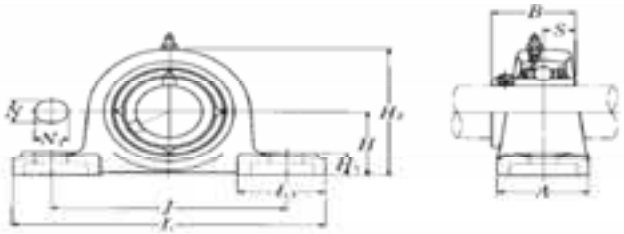
UCP3 NTN

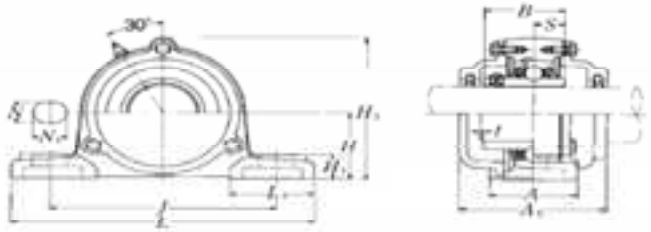
Pillow blocks cast housing
Set screw type



Shaft dia. mm / inch	Unit number [1]	Nominal dimensions mm											Bolt size mm / inch	Bearing number
		H	L	J	A	N	N_1	H_1	H_2	L_1	B	S		
25	UCP305D1	45	175	132	45	17	20	15	85	54	38	15	M14	UC305D1
13/16	UCP305-013D1													UC305-013D1
7/8	UCP305-014D1	1 49/64	6 7/8	5 13/16	1 25/32	21/32	25/32	19/32	3 11/32	2 1/8	1.4961	0.591	1/2	UC305-014D1
15/16	UCP305-015D1													UC305-015D1
1	UCP305-100D1													UC305-100D1
30	UCP306D1	50	180	140	50	17	20	18	95	54	43	17	M14	UC306D1
1 1/16	UCP306-101D1													UC306-101D1
1 1/8	UCP306-102D1	1 31/32	7 3/32	5 1/2	1 15/32	21/32	25/32	23/32	3 3/4	2 1/8	1.6929	0.669	1/2	UC306-102D1
1 3/16	UCP306-103D1													UC306-103D1
35	UCP307D1	56	210	160	58	17	25	20	106	60	49	19	M14	UC307D1
1 1/4	UCP307-104D1													UC307-104D1
1 5/16	UCP307-105D1	2 13/64	8 9/32	6 5/16	2 3/32	21/32	31/32	25/32	4 3/16	2 3/8	1.8899	0.748	1/2	UC307-105D1
1 3/8	UCP307-106D1													UC307-106D1
1 7/16	UCP307-107D1													UC307-107D1
40	UCP308D1	60	220	170	60	17	27	22	116	60	52	19	M14	UC308D1
1 1/2	UCP308-108D1	2 23/64	8 21/32	6 11/16	2 3/8	21/32	1 1/16	7/8	4 9/16	2 3/8	2.0472	0.748	1/2	UC308-108D1
1 9/16	UCP308-109D1													UC308-109D1
45	UCP309D1	67	245	190	67	20	30	24	129	65	57	22	M16	UC309D1
1 7/8	UCP309-110D1													UC309-110D1
1 15/16	UCP309-111D1	2 41/64	9 21/32	7 15/32	2 5/8	25/32	1 13/16	15/16	5 3/32	2 9/16	2.2441	0.866	5/8	UC309-111D1
1 3/4	UCP309-112D1													UC309-112D1
50	UCP310D1	75	275	212	75	20	35	27	143	75	61	22	M16	UC310D1
1 13/16	UCP310-113D1													UC310-113D1
1 7/8	UCP310-114D1	2 61/64	10 13/16	8 11/32	2 15/16	25/32	1 3/8	1 1/16	5 5/8	2 15/16	2.4016	0.866	3/8	UC310-114D1
1 15/16	UCP310-115D1													UC310-115D1
55	UCP311D1	80	310	230	80	20	38	30	154	85	66	25	M16	UC311D1
2	UCP311-200D1													UC311-200D1
2 1/16	UCP311-201D1	3 5/32	12 7/32	9 1/32	3 5/32	25/32	1 1/2	1 13/16	6 1/16	3 11/32	2.5984	0.984	3/8	UC311-201D1
2 1/8	UCP311-202D1													UC311-202D1
2 3/16	UCP311-203D1													UC311-203D1

Remarks: 1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".
Note: Please refer to page 36 for size of grease fitting.

UCP3 NTN



Cast dust cover type
Open end: C-UCP···D1
Closed end: CM-UCP···D1

Housing [1] number	Unit number [1] cast dust cover type	Nominal dimensions mm s max.	mm H_1	inch A_1	Mass of unit kg UCP	lb C(CM)
P305D1	C(CM)-UCP305D1	2	91	80	1.4	1.8
P305D1	C(CM)-UCP305-013D1					
P305D1	C(CM)-UCP305-014D1	5/64	3 19/32	3 5/32	3.1	4.0
P305D1	C(CM)-UCP305-015D1					
P305D1	C(CM)-UCP305-100D1					
P306D1	C(CM)-UCP306D1	2	105	85	1.8	2.5
P306D1	C(CM)-UCP306-101D1					
P306D1	C(CM)-UCP306-102D1	5/64	4 1/8	3 11/32	4.0	5.5
P306D1	C(CM)-UCP306-103D1					
P307D1	C(CM)-UCP307D1	3	115	95	2.5	3.2
P307D1	C(CM)-UCP307-104D1					
P307D1	C(CM)-UCP307-105D1	1/8	4 17/32	3 3/4	5.5	7.1
P307D1	C(CM)-UCP307-106D1					
P307D1	C(CM)-UCP307-107D1					
P308D1	C(CM)-UCP308D1	3	125	105	3.1	4.0
P308D1	C(CM)-UCP308-108D1	1/8	4 29/32	4 1/8	6.8	8.8
P308D1	C(CM)-UCP308-109D1					
P309D1	C(CM)-UCP309D1	3	140	110	4.1	5.4
P309D1	C(CM)-UCP309-110D1					
P309D1	C(CM)-UCP309-111D1	1/8	5 1/2	4 11/32	9.0	12
P309D1	C(CM)-UCP309-112D1					
P310D1	C(CM)-UCP310D1	3	156	120	5.6	7.0
P310D1	C(CM)-UCP310-113D1					
P310D1	C(CM)-UCP310-114D1	1/8	6 5/32	4 23/32	12	15
P310D1	C(CM)-UCP310-115D1					
P311D1	C(CM)-UCP311D1	4	166	125	7.3	9.9
P311D1	C(CM)-UCP311-200D1					
P311D1	C(CM)-UCP311-201D1	5/32	6 17/32	4 29/32	16	19
P311D1	C(CM)-UCP311-202D1					
P311D1	C(CM)-UCP311-203D1					

63

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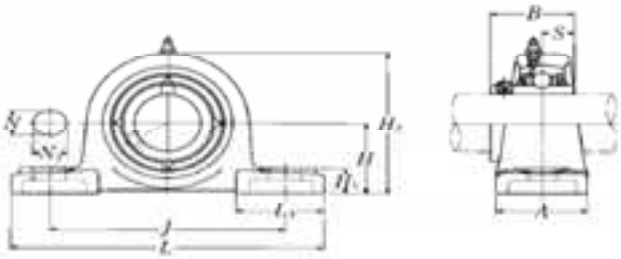
UCP3 NTN

Pillow blocks cast housing
Set screw type



Shaft dia. mm / inch	Unit number [1]	Nominal dimensions mm / inch: H	L	J	A	N	N1	H1	H4	L1	B	S	Bolt size mm / inch	Bearing number
60	UCP312D1	85	330	250	85	25	38	32	165	95	71	26	M20	UC312D1
2 3/4	UCP312-204D1													UC312-204D1
2 15/16	UCP312-205D1	3 11/32	13	9 27/32	3 11/32	1/32	1 1/2	1 1/4	6 1/2	3 3/4	2.7953	1.024	3/4	UC312-205D1
3 1/8	UCP312-206D1													UC312-206D1
3 7/16	UCP312-207D1													UC312-207D1
65	UCP313D1	90	340	260	90	25	38	33	176	105	75	30	M20	UC313D1
2 1/2	UCP313-208D1	3 35/64	13 3/8	10 1/4	3 17/32	1/32	1 1/2	1 5/16	6 15/16	4 1/8	2.9528	1.181	3/4	UC313-208D1
2 15/16	UCP313-209D1													UC313-209D1
70	UCP314D1	95	360	280	90	27	40	35	187	105	78	33	M22	UC314D1
2 3/4	UCP314-210D1													UC314-210D1
2 11/16	UCP314-211D1	3 47/64	14 3/16	11 1/32	3 17/32	1 1/16	1 5/16	1 3/8	7 3/8	4 1/8	3.0709	1.299	7/8	UC314-211D1
2 3/4	UCP314-212D1													UC314-212D1
75	UCP315D1	100	380	290	100	27	40	35	199	110	82	32	M22	UC315D1
2 13/16	UCP315-213D1													UC315-213D1
2 7/8	UCP315-214D1	3 15/16	14 31/32	11 13/32	3 15/16	1 1/16	1 5/16	1 3/8	7 25/32	4 11/32	3.2283	1.260	7/8	UC315-214D1
2 15/16	UCP315-215D1													UC315-215D1
3	UCP315-300D1													UC315-300D1
80	UCP316D1	106	400	300	110	27	40	40	210	110	88	34	M22	UC316D1
3 1/16	UCP316-301D1													UC316-301D1
3 1/8	UCP316-302D1	4 11/64	15 3/4	11 13/16	4 11/32	1 1/16	1 5/16	1 5/16	8 1/32	4 11/32	3.3858	1.339	7/8	UC316-302D1
3 3/16	UCP316-303D1													UC316-303D1
85	UCP317D1	112	420	320	110	33	45	40	220	120	96	40	M27	UC317D1
3 1/4	UCP317-304D1													UC317-304D1
3 5/16	UCP317-305D1	4 13/32	16 17/32	12 23/32	4 11/32	1 5/16	1 25/32	1 5/16	8 21/32	4 23/32	3.7795	1.575	1	UC317-305D1
3 7/16	UCP317-307D1													UC317-307D1
90	UCP318D1	119	430	330	110	33	45	45	235	120	96	40	M27	UC318D1
3 7/16	UCP318-307D1	4 11/64	16 15/16	13	4 11/32	1 5/16	1 25/32	1 25/32	9 1/4	4 23/32	3.7795	1.575	1	UC318-307D1
3 1/2	UCP318-308D1													UC318-308D1

Remarks: 1) These numbers indicate relubricatable type. If maintenance free type is needed, please order without suffix "D1".
Note: Please refer to page 36 for size of grease fitting.

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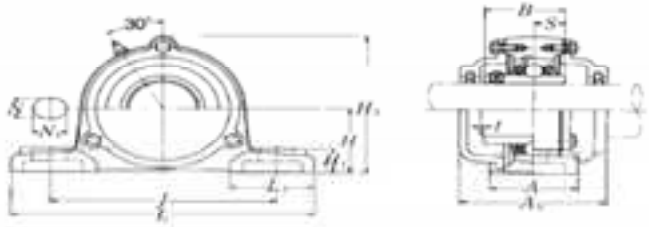
UCP3 NTN



Cast dust cover type
Open end: C-UCP···D1
Closed end: CM-UCP···D1

Housing [1] number	Unit number [1] cast dust cover type	Nominal dimensions mm s max.	Nominal dimensions inch H_1	Nominal dimensions inch A_1	Mass of unit kg UCP	Mass of unit lb C(CM)
P312D1	C(CM)-UCP312D1	4	179	135	9.4	11
P312D1	C(CM)-UCP312-204D1					
P312D1	C(CM)-UCP312-205D1	5/32	7 1/16	6 5/16	21	24
P312D1	C(CM)-UCP312-206D1					
P312D1	C(CM)-UCP312-207D1					
P313D1	C(CM)-UCP313D1	4	190	140	10	12
P313D1	C(CM)-UCP313-208D1	5/32	7 15/32	5 1/2	22	26
P313D1	C(CM)-UCP313-209D1					
P314D1	C(CM)-UCP314D1	4	200	140	12	14
P314D1	C(CM)-UCP314-210D1					
P314D1	C(CM)-UCP314-211D1	5/32	7 7/8	5 1/2	26	31
P314D1	C(CM)-UCP314-212D1					
P315D1	C(CM)-UCP315D1	4	210	150	14	17
P315D1	C(CM)-UCP315-213D1					
P315D1	C(CM)-UCP315-214D1	5/32	8 9/32	5 29/32	31	37
P315D1	C(CM)-UCP315-215D1					
P315D1	C(CM)-UCP315-300D1					
P316D1	C(CM)-UCP316D1	4	221	155	17	21
P316D1	C(CM)-UCP316-301D1					
P316D1	C(CM)-UCP316-302D1	5/32	8 11/16	6 3/32	37	46
P316D1	C(CM)-UCP316-303D1					
P317D1	C(CM)-UCP317D1	5	235	170	19	24
P317D1	C(CM)-UCP317-304D1					
P317D1	C(CM)-UCP317-305D1	13/64	9 1/4	6 11/16	42	53
P317D1	C(CM)-UCP317-307D1					
P318D1	C(CM)-UCP318D1	5	248	170	22	27
P318D1	C(CM)-UCP318-307D1	13/64	9 25/32	6 11/16	49	60
P318D1	C(CM)-UCP318-308D1					

65

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Chapter10.6 FLOWMETER:

Product Data Sheet
PS-00374, Rev. Q
July 2010

Micro Motion® ELITE® Coriolis Flow and Density Meters

Micro Motion® ELITE® Coriolis meters are the leading precision flow and density measurement solutions. ELITE meters offer the most accurate and repeatable measurement available for liquids, gases, or slurries.

Best precision flow and density measurement

- Unique design delivers unparalleled measurement sensitivity and stability
- Guarantees consistent, reliable performance over the widest flow range
- Smart Meter Verification for quick, complete meter diagnosis without process interruption
- 2-wire loop-powered option for installation simplification

Superior performance in the most challenging applications

- Industry standard for custody transfer and critical process control
- Best two-phase flow capability for batching, loading, and entrained air applications
- Immune to fluid, process, or environmental effects for superb measurement confidence

ELITE®	Peak performance Coriolis meter
ELITE HC	Peak performance high capacity meter
F-Series	High performance compact drainable Coriolis meter
H-Series	Hygienic compact drainable Coriolis meter
T-Series	Straight tube full-bore Coriolis meter
R-Series	General purpose flow-only Coriolis meter
LF-Series	Extreme low-flow Coriolis meter

Micro Motion

EMERSON. Process Management

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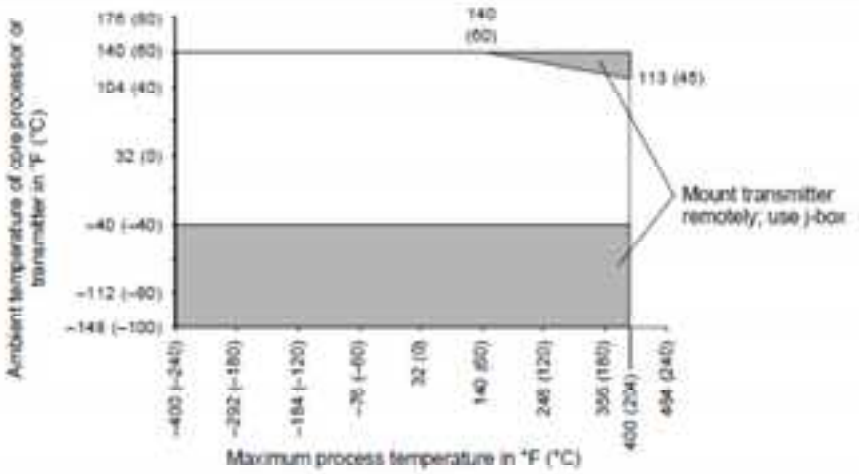
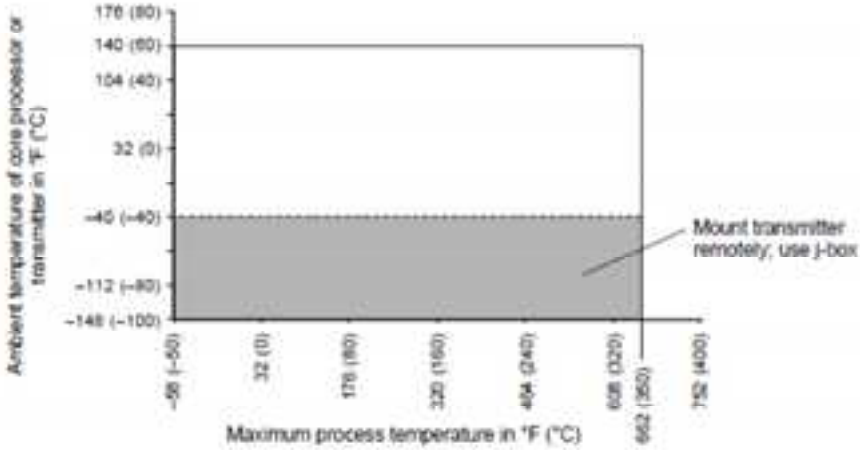
Temperature limits

All models except high-temperature models[1][2][3][4]



High-temperature models



(1) *Temperature limits may be further restricted by hazardous area approvals. See pages 11–17.*

(2) *The temperature graphs shown here are for use only as a general guide.*

(3) *When ambient temperature is below –40 °F (–40 °C), a core processor or Model 2400S transmitter must be heated to bring its local ambient temperature to between –40 °F (–40 °C) and +140 °F (+60 °C). Long-term storage of electronics at ambient temperatures below –40 °F (–40 °C) is not recommended.*

(4) *The temperature limits shown apply only when the electronics are not covered (for example, by insulation). If the sensor case must be insulated, use extended mount electronics.*

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Accuracy and repeatability

			Electronics option	
			Model 2400S, enh. core processor	Other MVD transmitter, std. core processor
Mass and volume flow[1]	Liquid	Accuracy	±0.05% of rate[2][3]	±0.10% of rate[4]
		Repeatability	±0.025% of rate	±0.05% of rate
	Gas	Accuracy	±0.35% of rate[3]	±0.35% of rate
		Repeatability	±0.20% of rate	±0.20% of rate
Density[5][6]	Liquid	Accuracy	±0.0002 g/cm³ (±0.2 kg/m³)	±0.0005 g/cm³ (±0.5 kg/m³)
		Repeatability	±0.0001 g/cm³ (±0.1 kg/m³)	±0.0002 g/cm³ (±0.2 kg/m³)
Temperature		Accuracy	±1 °C ± 0.5% of reading	±1 °C ± 0.5% of reading
		Repeatability	±0.2 °C	±0.2 °C
			lb/min	kg/h
Zero stability		CMFS010M	0.000075	0.002
		CMFS010H, P	0.00015	0.004
		CMFS015M	0.00037	0.01
		CMFS015H, P	0.00073	0.02
		CMF010M, H	0.000075	0.002
		CMF010P	0.00015	0.004
		CMF025	0.001	0.027
		CMF050	0.006	0.163
		CMF100	0.025	0.680
		CMF200	0.08	2.18
		CMF300	0.25	6.80
		CMF400	1.50	40.91

(1) Accuracy options vary by model. Models CMF010, CMFS010, CMFS015, sensors with Model 2200S transmitter, and all high-temperature models have fewer accuracy options. See Ordering information on page 40.

(2) When flow rate is less than zero stability / 0.0005, accuracy = ±[(zero stability / flow rate) • 100]% of rate, and repeatability = ±[½(zero stability / flow rate) • 100]%.

(3) When ordered with the ±0.10% factory calibration option, accuracy on liquid = ±0.10% when flow rate ≥ zero stability / 0.001. When flow rate < zero stability / 0.001, accuracy = ±[(zero stability / flow rate) • 100]% of rate and repeatability = ±[½(zero stability / flow rate) • 100]% of rate.

(4) When flow rate is less than zero stability / 0.001, accuracy = ±[(zero stability / flow rate) • 100]% of rate and repeatability = ±[½(zero stability / flow rate) • 100]% of rate.

(5) When flow rate is less than zero stability / 0.0035, accuracy equals ±[(zero stability / flow rate) • 100]% of rate and repeatability equals ±[½(zero stability / flow rate) • 100]% of rate.

(6) Specifications for ±0.0002 g/cm³ (±0.2 kg/m³) density accuracy are based on reference conditions of water at 68 to 140 °F (20 to 60 °C) and 15 to 30 psig (1 to 2 bar).

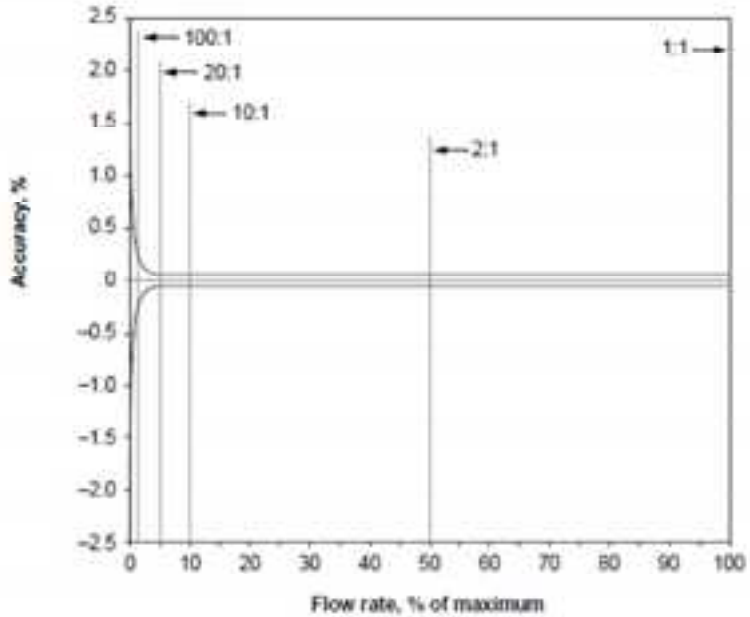
Liquid flow performance

		Mass		Volume[1]			
		lb/min	kg/h	gal/min	l/h	bbl/h	m^3/h
Maximum flow rate	CMFS010	4	108	0.5	108		
	CMFS015	12	330	1.5	330		
	CMF010	4	108	0.5	108		
	CMF025	80	2180	10	2180		
	CMF050	250	6800	30	6800		
	CMF100	1000	27,200	120	27,200		
	CMF200	3200	87,100	385	87,100	550	87
	CMF300	10,000	272,000	1200	272,000	1700	272
	CMF400	20,000	545,000	2400	545,000	3400	545

Typical accuracy, turndown, and pressure drop with CMF100 and 2400S or enhanced core processor

The graph below is an example of the relationship between accuracy, turndown, and pressure drop when measuring the flow of water with a Model CMF100 sensor and Model 2400S transmitter or enhanced core processor.

Actual pressure drop is dependent on process conditions. To determine accuracy, turndown, and pressure drop with your process variables, use the Micro Motion product selector, available at www.micromotion.com.



Turndown from maximum flow rate		*500:1*	*100:1*	*20:1*	*10:1*	*2:1*
Accuracy	±%	1.25	0.25	0.05	0.05	0.05
Pressure drop	psi	~0	~0	0.2	0.7	13.5
	bar	~0	~0	0.01	0.05	0.93

(1) Specifications for volumetric flow rate are based on a process-fluid density of 1 g/cm³ (1000 kg/m³). For fluids with density other than 1 g/cm³ (1000 kg/m³), the volumetric flow rate equals the mass flow rate divided by the fluid's density.

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Gas flow performance

When selecting sensors for gas applications, measurement accuracy is a function of fluid mass flow rate independent of operating temperature, pressure, or composition. However, pressure drop through the sensor is dependent upon operating temperature, pressure, and fluid composition. Therefore, when selecting a sensor for any particular gas application, it is highly recommended that each sensor be sized using the Micro Motion product selector, available at www.micromotion.com

		Mass		Volume[1]	
		lb/min	kg/h	SCFM	Nm³/h
Flow rates that produce approximately 10 psid (0.68 bar) pressure drop on air[2]	CMFS010	0.3	8	4	6
	CMFS015	1	24	12	18
	CMF010M, H	0.30	8	4	6
	CMF010P	0.2	6	3	5
	CMF025	4	110	60	90
	CMF050	10	300	145	230
	CMF100	50	1300	640	1000
	CMF200	150	4000	2000	3100
	CMF300	490	13,300	6500	10,300
	CMF400	1250	34,000	16,600	26,250
Flow rates that produce approximately 50 psid (3.4 bar) pressure drop on natural gas[3]	CMFS010	1	30	30	45
	CMFS015	3	90	90	130
	CMF010M, H	1	30	30	45
	CMF010P	0.9	25	20	35
	CMF025	16	450	380	600
	CMF050	40	1140	970	1530
	CMF100	185	5000	4300	6700
	CMF200	560	15,200	13,000	20,500
	CMF300	1850	50,500	43,000	68,000
	CMF400	4700	128,000	109,000	172,000

(1) Standard (SCFM) reference conditions are 14.7 psia and 68 °F. Normal (Nm³/h) reference conditions are 1.013 bar and 0 °C.

(2) Air at 68 °F (20 °C) and 100 psi (6.8 bar).

(3) Natural gas with MW 16.675 at 68 °F (20 °C) and 500 psi (34.0 bar).

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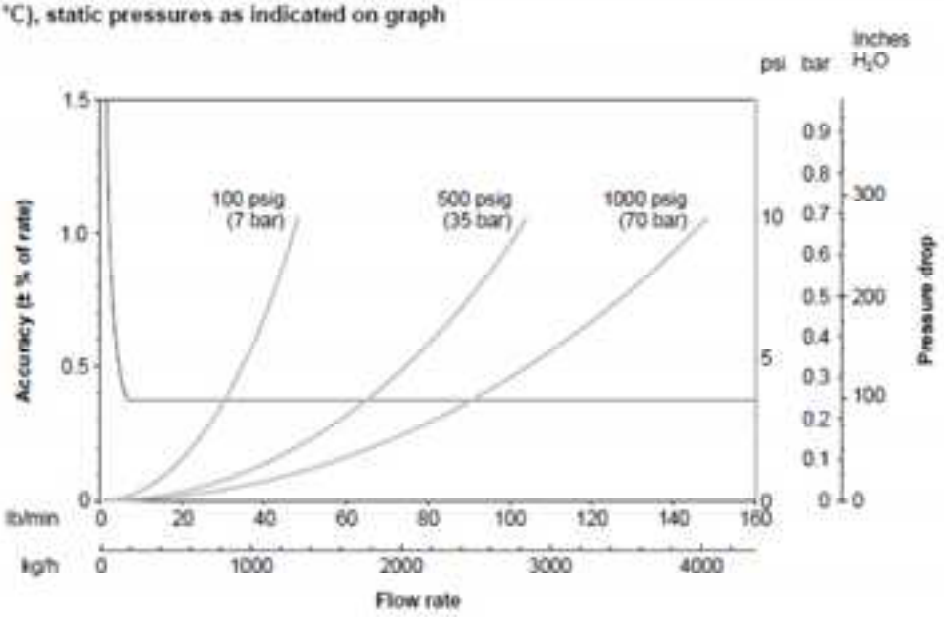
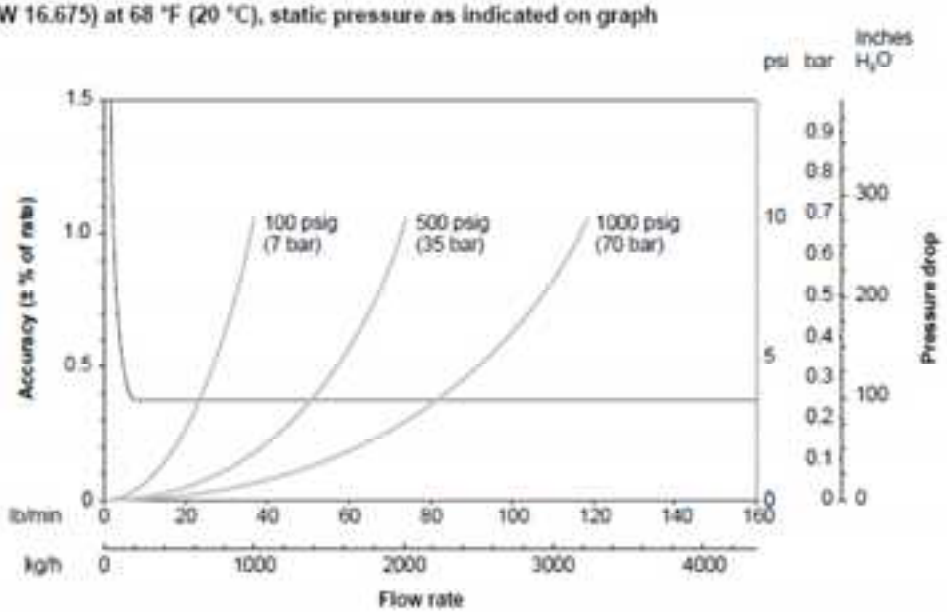
Gas flow performance *continued*

Typical mass flow accuracy and pressure drop with CMF100 and transmitter with MVD technology

Air at 68 °F (20 °C), static pressures as indicated on graph



Natural gas (MW 16.675) at 68 °F (20 °C), static pressure as indicated on graph



Standard or Normal Volumetric Capability

Standard and normal volumes are "quasi mass" flow units for any fixed composition fluid. Standard and normal volumes do not vary with operating pressure, temperature, or density. With knowledge of density at standard or normal conditions (available from reference sources), a Micro Motion meter can be configured to output in standard or normal volume units without the need for pressure, temperature, or density compensation. Contact your local sales representative for more information.

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Density range (liquid only)

Range	Up to 5 g/cm³	Up to 5000 kg/m³

Vibration limits

Meets IEC 68.2.6, endurance sweep, 5 to 2000 Hz, 50 sweep cycles at 1.0 g

Power consumption

Meter with core processor	4 watts maximum
Meter with Model 2400S transmitter	7 watts maximum
Meter with Model 2200S transmitter	Loop-powered, 0.8 watts maximum
Meter with Model 1700/2700 transmitter	Refer to transmitter documentation

Pressure ratings

Sensor rating[1]		316L and 304L stainless steel		Alloy C-22		High pressure	
		psi	bar	psi	bar	psi	bar
	CMFS010	1813	125	3263	225	6000	413
	CMFS015	1813	125	3263	225	6000	413
	CMF010	1813	125	3263	225	6000	413
	CMF025	1500	103	2755	190	—	—
	CMF050	1500	103	2683	185	—	—
	CMF100	1450	100	2465	170	—	—
	CMF200	1580	108	2755	190	—	—
	CMF300	1730	119	2683	185	—	—
	CMF400	1500	103	2855	197	2973	205

PED compliance Sensors comply with council directive 97/23/EC of 29 May 1997 on Pressure Equipment

Dual seal compliance CSA sensors comply with ANSI/ISA 12.27.01-2003 requirements for process sealing between electrical systems and flammable or combustible process fluids

Housing rating[3]		ASME B31.3 secondary containment rating[3] [5]		Burst pressure[3]	
		psi	bar	psi	bar
	CMFS010	850	58	5169	356
	CMFS015	850	58	5169	356
	CMF010[4]	425	29	3042	209
	CMF025	850	58	5480	377
	CMF050	850	58	5286	364
	CMF100	625	43	3299	227
	CMF200	550	37	2786	192
	CMF300	275	18	1568	108
	CMF400	250	17	1556	107

(1) Process connection rating may differ from sensor rating. Please choose process connections accordingly.

(2) For operating temperatures above 300 °F (148 °C), pressure needs to be derated as follows. Linear interpolation may be used between values. Process connection derating may differ from sensor rating.

	Flow tubes			Housing	
	316L sensors	304L sensors	Alloy C-22 sensors	316L sensors	304L sensors
up to 300 °F (up to 148 °C)	None	None	None	None	None
at 400 °F (at 204 °C)	7.2% derating	5.4% derating	None	7.2% derating	5.4% derating
at 500 °F (at 260 °C)	13.8% derating	11.4% derating	4.7% derating	—	—
at 600 °F (at 316 °C)	19.2% derating	16.2% derating	9.7% derating	—	—
at 650 °F (at 343 °C)	21.0% derating	18.0% derating	11.7% derating	—	—

(3) The housing of high-temperature models is rated for neither secondary containment nor burst pressure.

(4) Optional rupture disks for high-pressure CMF010P will burst if pressure inside sensor housing reaches 400 psi (27 bar).

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Environmental effects

Process temperature effect

Process temperature effect is defined as:

- For mass flow measurement, the worst-case zero offset due to process fluid temperature change away from the zeroing temperature.
- For density measurement, the maximum measurement offset due to process fluid temperature change away from the density calibration temperature.

	Process temperature effect		
	% of maximum flow rate per °C	density accuracy per °C[1]	
		g/cm³	kg/m³
CMFS010, CMFS015, CMF010, CMF025, CMF050, and CMF100	±0.0002	±0.000015	±0.015
CMF200	±0.0005	±0.000015	±0.015
CMF300	±0.0005	±0.000015	±0.015
CMF400	±0.0007	±0.000015	±0.015

Pressure effect

Pressure effect is defined as the change in sensor flow and density sensitivity due to process pressure change away from the calibration pressure. Pressure effect can be corrected.

	Pressure effect on flow accuracy			
	% of rate per psi		% of rate per bar	
	liquid	*gas*	*liquid*	*gas*
CMFS010	None	None	None	None
CMFS015	None	None	None	None
CMF010	None	None	None	None
CMF025	None	None	None	None
CMF050	None	None	None	None
CMF100	–0.0002	None	–0.003	None
CMF200	–0.0008	–0.0004	–0.012	–0.006
CMF300	–0.0006	–0.0003	–0.009	–0.0045
CMF400	–0.0015	–0.0015	–0.022	–0.0022

	Pressure effect on density accuracy	
	g/cm³ per psi	kg/m³ per bar
CMFS010	None	None
CMFS015	None	None
CMF010	None	None
CMF025	0.000004	0.058
CMF050	–0.000002	–0.029
CMF100	–0.000006	–0.087
CMF200	0.000001	0.0145
CMF300	0.0000002	0.0029
CMF400	–0.00001	–0.145

(1) For –100 °C and above.

Materials of construction

Wetted parts[1][2][3]	304L or 316L stainless steel; or alloy C-22
Housing	304L stainless steel[4]
Junction box	300-series stainless steel[4] or polyurethane-painted aluminum; NEMA 4X (IP66)
Core processor	300-series stainless steel[4] or polyurethane-painted aluminum; NEMA 4X (IP66)
Model 2400S transmitter	Polyurethane-painted aluminum or 316L stainless steel; NEMA 4X (IP66)
Model 2200S transmitter	Polyurethane-painted aluminum or 316L stainless steel; NEMA 4X (IP66/67)

(1) General corrosion guides do not account for cyclical stress, and therefore should not be relied upon when choosing a wetted material for your Micro Motion sensor. Please refer to the Micro Motion corrosion guide for proper material compatibility information.

(2) The outer flange ring on lap-joint type flanges is non-wetted and is 304L stainless steel. Consult factory for other materials.

(3) Models CMF010P, CMFS010P, CMFS015P, and CMF400P have nickel alloy tubes and stainless steel fittings. Material compatibility is never better than 316L stainless steel. Refer to the Micro Motion Corrosion Guide for the Micro Motion policy on fixed bi-metallic sensor capability.

(4) 316L stainless steel is available.

Weight

Weights provided are the weight of the flowmeter with 150 lb weld neck raised face flanges.

	With junction box		With core processor, Model 2400S, or Model 2200S transmitter[1]	
	lb	kg	lb	kg
CMFS010	—	—	9	4
CMFS015	—	—	9	4
CMF010	14	7	19	9
CMF025	8	4	13	6
CMF050	12	6	17	8
CMF100	29	13	34	16
CMF200	63	29	68	31
CMF300	165	75	170	77
CMF400	441	200	446	202

(1) Weight stated for sensor with aluminum core processor. Add 4 lb (2 kg) for stainless steel core processor or stainless steel Model 2400S transmitter.

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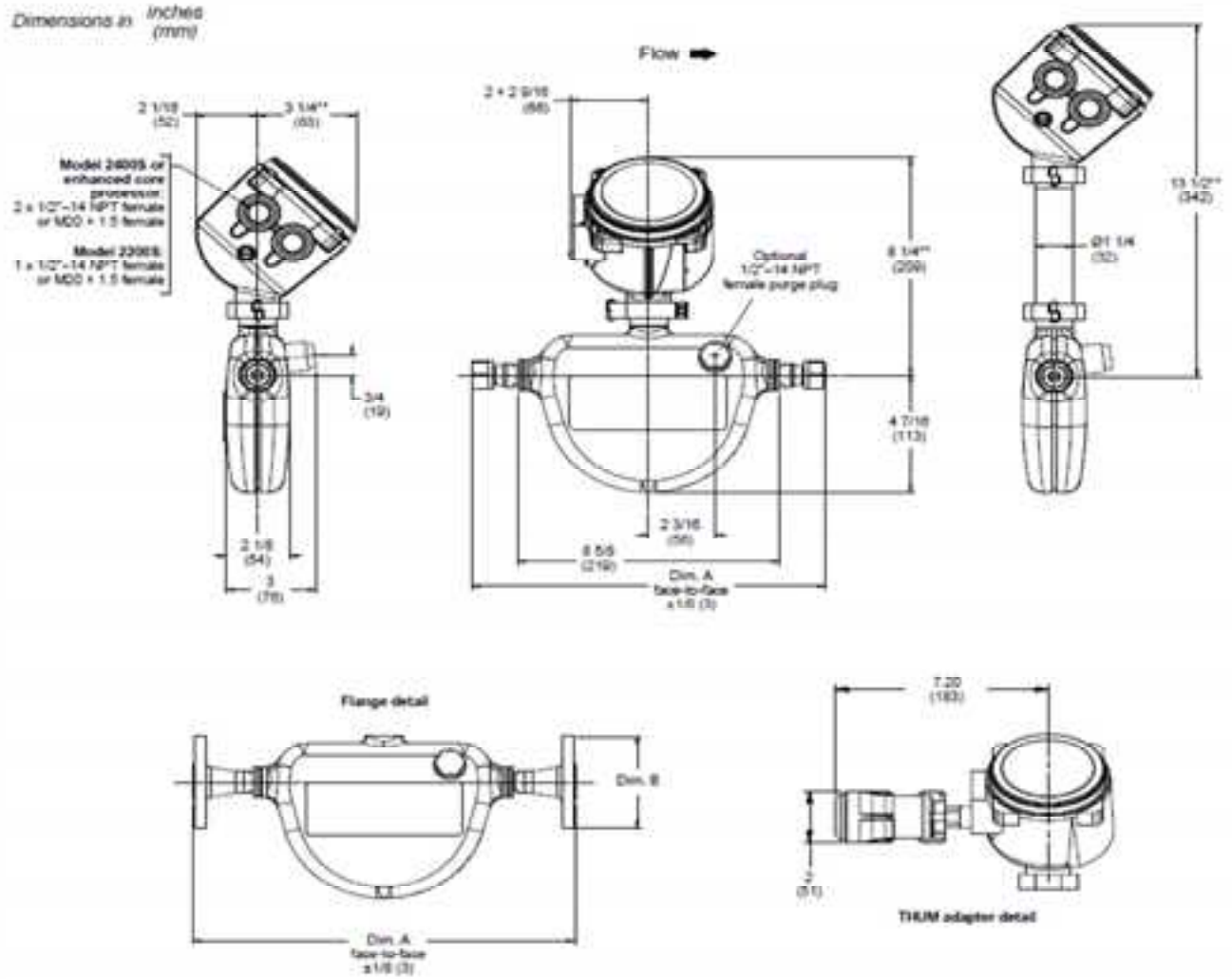
Dimensions

Models CMFS010 and CMFS015



* For dimensions A and B, see fittings options on pages 29 and 30.
** Electronics with painted aluminum housing shown. For stainless steel housing, add 0.40 inches (10 mm).

Model	No. of flow tubes	Flow tube ID inches (mm)
CMFS010	2	0.07 (1.8)
CMFS015	2	0.11 (2.9)

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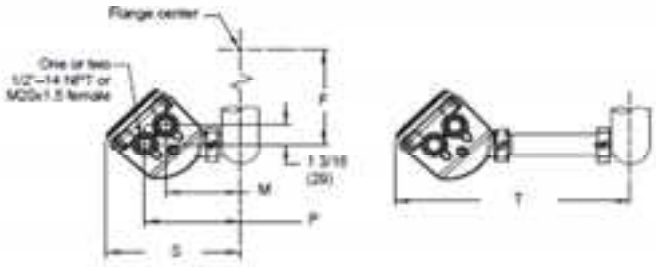
Dimensions *continued*

Electronics detail

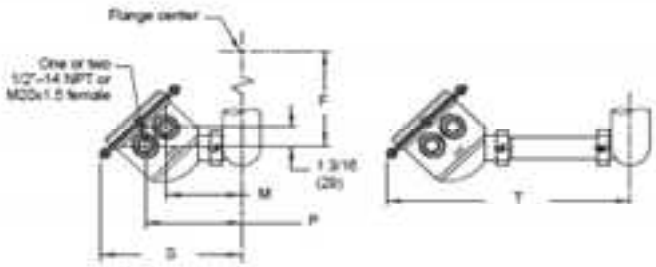
Enhanced core processor, Model 2400S, or Model 2200S with painted aluminum housing

Model	Dimensions in inches (mm)				
	F	M	P	S	T
CMF010	5 13/16 (147)	3 7/8 (98)	5 (127)	7 1/8 (180)	12 1/2 (318)
CMF025	7 7/16 (189)	3 13/16 (97)	4 15/16 (126)	7 1/16 (179)	12 1/2 (318)
CMF050	10 1/16 (255)	4 1/16 (103)	5 3/16 (132)	7 5/16 (185)	12 11/16 (322)
CMF100	14 1/8 (360)	4 3/4 (121)	6 15/16 (150)	8 (204)	13 3/8 (340)
CMF200	6 7/8 (175)	5 7/8 (150)	7 (178)	9 1/8 (232)	14 1/2 (368)
CMF300	9 3/8 (238)	7 5/16 (183)	8 5/16 (212)	10 1/2 (266)	15 7/8 (403)
CMF400	12 3/8 (314)	8 7/16 (215)	9 9/16 (244)	11 11/16 (297)	17 1/16 (434)



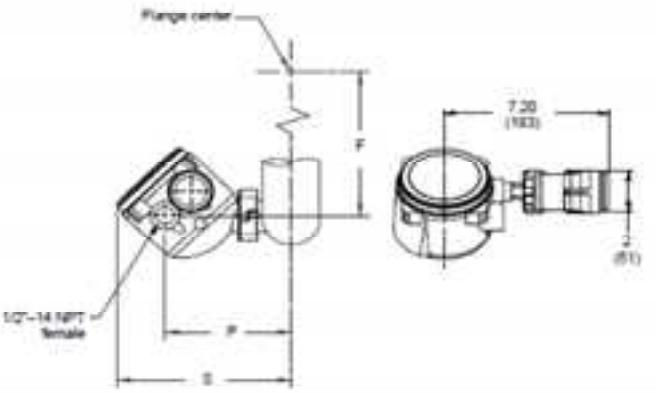
Enhanced core processor, Model 2400S, or Model 2200S with stainless steel housing

Model	Dimensions in inches (mm)				
	F	M	P	S	T
CMF010	5 13/16 (147)	4 1/16 (103)	5 3/16 (132)	7 9/16 (192)	12 13/16 (325)
CMF025	7 7/16 (188)	4 1/16 (103)	5 3/16 (132)	7 9/16 (192)	12 13/16 (325)
CMF050	10 1/16 (255)	4 (102)	5 1/8 (130)	7 9/16 (192)	12 3/4 (324)
CMF100	14 5/16 (360)	4 7/8 (124)	6 (152)	8 3/8 (213)	13 5/8 (346)
CMF200	6 7/8 (175)	5 3/4 (147)	6 7/8 (175)	9 7/16 (239)	14 5/8 (372)
CMF300	9 3/8 (238)	7 1/4 (183)	8 5/16 (212)	10 3/4 (273)	16 (406)
CMF400	12 3/8 (314)	8 1/2 (216)	9 5/8 (245)	12 1/16 (306)	17 1/4 (439)



Model 2200S with THUM adapter

Model	Dimensions in inches (mm)		
	F	P	S
CMF010	5 13/16 (147)	5 3/16 (132)	7 9/16 (192)
CMF025	7 7/16 (188)	5 3/16 (132)	7 9/16 (192)
CMF050	10 1/16 (255)	5 1/8 (130)	7 9/16 (192)
CMF100	14 3/16 (360)	6 (152)	8 3/8 (213)
CMF200	6 7/8 (175)	6 7/8 (175)	9 7/16 (239)
CMF300	9 3/8 (238)	8 5/16 (212)	10 3/4 (273)
CMF400	12 3/8 (314)	9 5/8 (245)	12 1/16 (306)

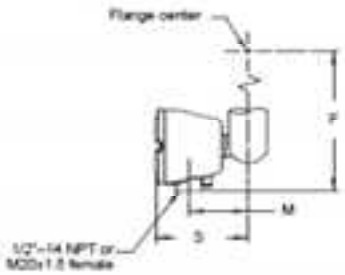


Dimensions *continued*

Electronics detail

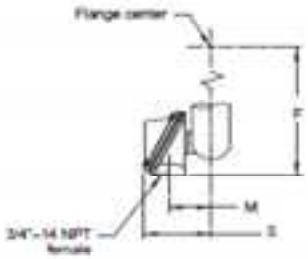
Standard core processor

Model	Dimensions in inches (mm)		
	F	M	S
CMF010	8 7/16 (214)	2 7/8 (73)	4 9/16 (116)
CMF025	10 1/16 (255)	3 1/16 (78)	4 11/16 (119)
CMF050	12 11/16 (322)	3 1/16 (77)	4 3/4 (121)
CMF100	16 13/16 (426)	3 13/16 (96)	5 1/2 (139)
CMF200	9 1/2 (241)	4 13/16 (122)	6 1/2 (165)
CMF300	11 15/16 (303)	6 1/8 (155)	7 13/16 (199)
CMF400	15 (380)	7 3/8 (186)	9 1/8 (231)



Junction box

Model	Dimensions in inches (mm)		
	F	M	S
CMF010	7 3/4 (197)	2 (50)	3 5/16 (84)
CMF025	9 11/16 (246)	2 1/16 (53)	3 7/16 (87)
CMF050	12 (305)	2 3/16 (55)	3 1/2 (89)
CMF100	16 1/8 (409)	3 15/16 (74)	4 1/4 (108)
CMF200	8 13/16 (223)	3 15/16 (100)	5 1/4 (134)
CMF300	11 1/4 (286)	5 1/4 (133)	6 9/16 (167)
CMF400	14 5/16 (363)	6 3/8 (162)	7 11/16 (195)



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Fitting options

	Fitting code[1]	Dim. A face-to-face inches (mm)	Dim. B outside diameter inches (mm)
Models CMFS010 and CMFS015			
316L stainless steel sensors			
1/2-inch ANSI CL150 weld neck raised face flange	313	12.64 (321)	3 1/2 (89)
1/2-inch ANSI CL300 weld neck raised face flange	314	13.00 (330)	3 3/4 (95)
1/2-inch ANSI CL600 weld neck raised face flange	315	13.50 (343)	3 3/4 (95)
DN15 PN40 weld neck flange; DIN 2635 type C face	300	12.21 (310)	3 3/4 (95)
DN15 PN40 weld neck flange; DIN 2635 type N grooved face	301	12.21 (310)	3 3/4 (95)
DN15 PN40 weld neck flange; EN 1092-1 Form B1	176	12.21 (310)	3 3/4 (95)
DN15 PN40 weld neck flange; EN 1092-1 Form D	310	12.21 (310)	3 3/4 (95)
DN15 PN100 weld neck flange; DIN 2637 type E face	302	12.76 (324)	4 1/8 (105)
DN15 PN100 weld neck flange; EN 1092-1 Form B2	177	12.76 (324)	4 1/8 (105)
DN15 PN100 weld neck flange; DIN 2637 type N grooved face	303	12.76 (324)	4 1/8 (105)
DN15 PN100 weld neck flange; EN 1092-1 Form D	178	12.76 (324)	4 1/8 (105)
DN25 PN40 weld neck flange EN1092-1 Form B1	172	12.37 (314)	4 1/2 (115)
DN25 PN40 weld neck flange EN1092-1 Form D	183	12.37 (314)	4 1/2 (115)
JIS 15mm 10K weld neck raised face flange	304	11.98 (304)	3 3/4 (95)
JIS 15mm 20K weld neck raised face flange	305	11.98 (304)	3 3/4 (95)
1/4-inch NPT female Swagelok size 4 VCO fitting	323	12.16 (309)	—
Swagelok compatible size 4 VCO union fitting	334	12.16 (309)	—
1/2-inch NPT female Swagelok size 8 VCO fitting	319	11.52 (293)	—
Swagelok compatible size 8 VCO union fitting	335	11.52 (293)	—
1/2-inch sanitary fitting (Tri-Clamp compatible)	321	11.52 (293)	1 (25)
1/4-inch tube compression fitting	324	12.16 (309)	—
6 mm tube compression fitting	325	12.16 (309)	—
EHEDG certified, 3-A approved fittings			
3/4-inch sanitary fitting (Tri-Clamp compatible)	344	11.52 (293)	1.0 (25)
ISO clamp DN10; ISO 2852 facing/ISO 1127 pipe	345	11.2 (284)	1.34 (34)
ISO clamp DN15; ISO 2852 facing/DIN 11850 pipe	346	11.2 (284)	1.34 (34)
Nickel alloy sensors			
1/2-inch ANSI CL150 lap joint flange	520	12.64 (321)	3 1/2 (89)
1/2-inch ANSI CL300 lap joint flange	521	13.00 (330)	3 3/4 (95)
JIS 15mm 10K lap joint flange	522	12.98 (330)	3 3/4 (95)
DN15 PN40 lap joint flange; DIN 2656 type C face	523	13.22 (336)	3 3/4 (95)
DN15 PN40 lap joint flange; EN 1092-1 Form B1	524	13.22 (336)	3 3/4 (95)
1/4-inch NPT female Swagelok size 4 VCO fitting	323	12.16 (309)	—
Swagelok compatible size 4 VCO union fitting	334	12.16 (309)	—

(1) *Fittings listed here are standard options. Other types of fittings are available. The face to face dimensions for any custom fittings ordered using a 998 or 999 fitting code are not represented in this table. It is necessary to confirm face to face dimensions of these fittings at time of ordering. Contact your local Micro Motion representative.*

Fitting options *continued*

	Fitting code[1]	Dim. A face-to-face inches (mm)	Dim. B outside diameter inches (mm)
High-pressure models CMFS010P and CMFS015P			
Nickel alloy sensors with stainless steel fittings			
1/4-inch NPT female Swagelok size 4 VCO fitting	323	12.16 (309)	—
Swagelok compatible size 4 VCO union fitting	334	12.16 (309)	—
1/2-inch NPT female Swagelok size 8 VCO fitting	319	11.52 (293)	—
Swagelok compatible size 8 VCO union fitting	335	11.52 (293)	—
1/4-inch tube compression fitting	324	12.16 (309)	—
6 mm tube compression fitting	325	12.16 (309)	—
1/2-inch ANSI CL900/1500 weld neck raised face flange	150	14.48 (368)	4.75 (121)
1/2-inch ANSI CL2500 weld neck raised face flange	191	15.48 (393)	5.25 (133)
High-pressure model CMF010P			
316L stainless steel sensors			
1/4-inch NPT female Swagelok size 4 VCO fitting	323	6 7/16 (164)	—
Swagelok compatible size 4 VCO union fitting	334	6 7/16 (164)	—
1/4-inch tube compression fitting	324	6 7/16 (164)	—
6 mm tube compression fitting	325	6 7/16 (164)	—

(1) *Fittings listed here are standard options. Other types of fittings are available. The face to face dimensions for any custom fittings ordered using a 998 or 999 fitting code are not represented in this table. It is necessary to confirm face to face dimensions of these fittings at time of ordering. Contact your local Micro Motion representative.*

Fitting options *continued*

	Fitting code[1]	Dim. A face-to-face inches (mm)	Dim. B outside diameter inches (mm)
Model CMF010			
316L stainless steel sensors			
1/2-inch ANSI CL150 weld neck raised face flange	313	7 7/8 (199)	3 1/2 (89)
1/2-inch ANSI CL300 weld neck raised face flange	314	8 3/16 (209)	3 3/4 (95)
1/2-inch ANSI CL600 weld neck raised face flange	315	8 11/16 (221)	3 3/4 (95)
1/2-inch sanitary fitting (Tri-Clamp compatible)	321	6 15/16 (177)	1 (25)
DN15 PN40 weld neck flange; DIN 2635 type C face	300	7 7/16 (189)	3 3/4 (95)
DN15 PN40 weld neck flange; EN 1092-1 Form B1	176	7 7/16 (189)	3 3/4 (95)
DN15 PN40 weld neck flange; EN 1092-1 Form D	310	7 7/16 (189)	3 3/4 (95)
DN15 PN100 weld neck flange; DIN 2637 type E face	302	8 (203)	4 1/8 (105)
DN15 PN100 weld neck flange; EN 1092-1 Form B2	177	8 (203)	4 1/8 (105)
DN15 PN100 weld neck flange; EN 1092-1 Form D	178	8 (203)	4 1/8 (105)
DN25 PN40 Weld Neck Flange; EN 1092-1 Form B1	172	7 9/16 (193)	4 1/2 (115)
DN25 PN40 Weld Neck Flange; EN 1092-1 Form D	183	7 9/16 (193)	4 1/2 (115)
JIS 15mm 10K weld neck raised face flange	304	7 3/16 (183)	3 3/4 (95)
JIS 15mm 20K weld neck raised face flange	305	7 3/16 (183)	3 3/4 (95)
1/4-inch NPT female Swagelok size 4 VCO fitting	323	6 7/16 (164)	—
Swagelok compatible size 4 VCO union fitting	334	6 7/16 (164)	—
1/4-inch tube compression fitting	324	6 7/16 (164)	—
6 mm tube compression fitting	325	6 7/16 (164)	—
304L stainless steel sensors			
1/2-inch ANSI CL150 weld neck raised face flange	413	7 7/8 (199)	3 1/2 (89)
1/2-inch ANSI CL300 weld neck raised face flange	414	8 3/16 (209)	3 3/4 (95)
DN15 PN40 weld neck flange; DIN 2526 type C face	423	7 7/16 (189)	3 3/4 (95)
DN15 PN40 weld neck flange; EN 1092-1 Form B1	421	7 7/16 (189)	3 3/4 (95)
Nickel alloy sensors			
1/2-inch ANSI CL150 lap joint flange	520	7 7/8 (199)	3 1/2 (89)
1/2-inch ANSI CL300 lap joint flange	521	8 3/16 (209)	3 3/4 (95)
DN15 PN40 lap joint flange; DIN 2656 type C face	523	9 7/16 (240)	3 3/4 (95)
DN15 PN40 lap joint flange; EN 1092-1 Form B1	524	9 7/16 (240)	3 3/4 (95)
JIS 15mm 10K lap joint flange	522	8 3/16 (208)	3 3/4 (95)
1/4-inch NPT female Swagelok size 4 VCO fitting	323	6 7/16 (164)	—
Swagelok compatible size 4 VCO union fitting	334	6 7/16 (164)	—

(1) *Fittings listed here are standard options. Other types of fittings are available. The face to face dimensions for any custom fittings ordered using a 998 or 999 fitting code are not represented in this table. It is necessary to confirm face to face dimensions of these fittings at time of ordering. Contact your local Micro Motion representative.*

Fitting options *continued*

	Fitting code[1]	Dim. A face-to-face inches (mm)	Dim. B outside diameter inches (mm)
Model CMF025			
316L stainless steel sensors			
Wafer style; 1/2-inch ANSI (150 lb; 300 lb; 600 lb bolt kit)	009	2 3/8 (60)	1 13/16 (46)
Wafer style; 15mm DIN 2526; type C face (PN40 bolt kit)	016	2 3/8 (60)	1 13/16 (46)
Wafer style; 15mm DIN 2512; type N grooved face (PN40 bolt kit)	017	2 3/8 (60)	1 13/16 (46)
Wafer style; 15mm DIN 2526; type E face (PN100 bolt kit)	018	2 3/8 (60)	1 13/16 (46)
Wafer style; 15mm DIN 2512; type N grooved face (PN100 bolt kit)	019	2 3/8 (60)	1 13/16 (46)
Wafer style; 15mm; standard JIS facing (10K; 20K bolt kit)	029	2 3/8 (60)	1 13/16 (46)
1/2-inch ANSI CL150 weld neck raised face flange	313	6 3/4 (172)	3 1/2 (89)
1/2-inch ANSI CL300 weld neck raised face flange	314	7 1/8 (181)	3 3/4 (95)
1/2-inch ANSI CL600 weld neck raised face flange	315	7 5/8 (194)	3 3/4 (95)
1/2-inch NPT female Swagelok size 8 VCO fitting	319	4 11/16 (119)	—
Swagelok compatible size 8 VCO union fitting	335	4 11/16 (119)	—
1/2-inch sanitary fitting (Tri-Clamp compatible)	321	4 11/16 (119)	1 (25)
DN15 PN40 weld neck flange; DIN 2635 type C face	300	6 5/16 (160)	3 3/4 (95)
DN15 PN40 weld neck flange; EN 1092-1 Form B1	176	6 5/16 (160)	3 3/4 (95)
DN15 PN40 weld neck flange; DIN 2635 type N grooved face	301	6 5/16 (160)	3 3/4 (95)
DN15 PN40 weld neck flange; EN 1092-1 Form D	310	6 5/16 (160)	3 3/4 (95)
DN15 PN100 weld neck flange; DIN 2637 type E face	302	6 15/16 (176)	4 1/8 (105)
DN15 PN100 weld neck flange; EN 1092-1 Form B2	177	6 15/16 (176)	4 1/8 (105)
DN15 PN100 weld neck flange; DIN 2637 type N grooved face	303	6 15/16 (176)	4 1/8 (105)
DN15 PN100 weld neck flange; EN 1092-1 Form D	178	6 15/16 (176)	4 1/8 (105)
DN25 PN40 Weld Neck Flange; EN 1092-1 Form B1	172	6 7/16 (164)	4 1/2 (115)
DN25 PN40 Weld Neck Flange; EN 1092-1 Form D	183	6 7/16 (164)	4 1/2 (115)
JIS 15mm 10K weld neck raised face flange	304	6 1/8 (156)	3 3/4 (95)
JIS 15mm 20K weld neck raised face flange	305	6 1/8 (156)	3 3/4 (95)
304L stainless steel sensors			
1/2-inch ANSI CL150 weld neck raised face flange	413	6 3/4 (172)	3 1/2 (89)
1/2-inch ANSI CL300 weld neck raised face flange	414	7 1/8 (181)	3 3/4 (95)
DN15 PN40 weld neck flange; DIN 2526 type C face	423	6 5/16 (160)	3 3/4 (95)
DN15 PN40 weld neck flange; EN 1092-1 Form B1	421	6 5/16 (160)	3 3/4 (95)
Nickel alloy sensors			
1/2-inch ANSI CL150 lap joint flange	520	6 3/4 (172)	3 1/2 (89)
1/2-inch ANSI CL300 lap joint flange	521	7 1/8 (181)	3 3/4 (95)
DN15 PN40 lap joint flange; DIN 2656 type C face	523	7 5/16 (186)	3 3/4 (95)
DN15 PN40 lap joint flange; EN 1092-1 Form B1	524	7 5/16 (186)	3 3/4 (95)
JIS 15mm 10K lap joint flange	522	7 1/8 (181)	3 3/4 (95)

(1) Fittings listed here are standard options. Other types of fittings are available. The face to face dimensions for any custom fittings ordered using a 998 or 999 fitting code are not represented in this table. It is necessary to confirm face to face dimensions of these fittings at time of ordering. Contact your local Micro Motion representative.

Fitting options *continued*

	Fitting code[1]	Dim. A face-to-face inches (mm)	Dim. B outside diameter inches (mm)
Model CMF050			
316L stainless steel sensors			
Wafer style; 1/2-inch ANSI (150 lb; 300 lb; 600 lb bolt kit)	009	3 1/2 (89)	1 13/16 (46)
Wafer style; 15mm DIN 2526; type C face (PN40 bolt kit)	016	3 1/2 (89)	1 13/16 (46)
Wafer style; 15mm DIN 2512; type N grooved face (PN40 bolt kit)	017	3 1/2 (89)	1 13/16 (46)
Wafer style; 15mm DIN 2526; type E face (PN100 bolt kit)	018	3 1/2 (89)	1 13/16 (46)
Wafer style; 15mm DIN 2512; type N grooved face (PN100 bolt kit)	019	3 1/2 (89)	1 13/16 (46)
Wafer style; 15mm; standard JIS facing (10K; 20K bolt kit)	029	3 1/2 (89)	1 13/16 (46)
1/2-inch ANSI CL150 weld neck raised face flange	313	7 15/16 (202)	3 1/2 (89)
1/2-inch ANSI CL300 weld neck raised face flange	314	8 5/16 (211)	3 3/4 (95)
1/2-inch ANSI CL600 weld neck raised face flange	315	8 13/16 (224)	3 3/4 (95)
3/4-inch NPT female Swagelok size 12 VCO fitting	320	6 1/2 (165)	—
Swagelok compatible size 12 VCO union fitting	336	6 1/2 (165)	—
3/4-inch sanitary fitting (Tri-Clamp compatible)	322	6 1/2 (165)	1 (25)
DN15 PN40 weld neck flange; DIN 2635 type C face	300	7 1/2 (191)	3 3/4 (95)
DN15 PN40 weld neck flange; EN 1092-1 Form B1	176	7 1/2 (191)	3 3/4 (95)
DN15 PN40 weld neck flange; DIN 2635 type N grooved face	301	7 1/2 (191)	3 3/4 (95)
DN15 PN40 weld neck flange; EN 1092-1 Form D	310	7 1/2 (191)	3 3/4 (95)
DN15 PN100 weld neck flange; DIN 2637 type E face	302	8 1/16 (205)	4 1/8 (105)
DN15 PN100 weld neck flange; EN 1092-1 Form B2	177	8 1/16 (205)	4 1/8 (105)
DN15 PN100 weld neck flange; DIN 2637 type N grooved face	303	8 1/16 (205)	4 1/8 (105)
DN15 PN100 weld neck flange; EN 1092-1 Form D	178	8 1/16 (205)	4 1/8 (105)
DN25 PN40 Weld Neck Flange; EN 1092-1 Form B1	172	7 11/16 (195)	4 1/2 (115)
DN25 PN40 Weld Neck Flange; EN 1092-1 Form D	183	7 11/16 (195)	4 1/2 (115)
JIS 15mm 10K weld neck raised face flange	304	7 1/4 (184)	3 3/4 (95)
JIS 15mm 20K weld neck raised face flange	305	7 1/4 (184)	3 3/4 (95)
304L stainless steel sensors			
1/2-inch ANSI CL150 weld neck raised face flange	413	7 15/16 (202)	3 1/2 (89)
1/2-inch ANSI CL300 weld neck raised face flange	414	8 5/16 (211)	3 3/4 (95)
DN15 PN40 weld neck flange; DIN 2526 type C face	423	7 1/2 (191)	3 3/4 (95)
DN15 PN40 weld neck flange; EN 1092-1 Form B1	421	7 1/2 (191)	3 3/4 (95)
Nickel alloy sensors			
1/2-inch ANSI CL150 lap joint flange	520	7 15/16 (202)	3 1/2 (89)
1/2-inch ANSI CL300 lap joint flange	521	8 5/16 (211)	3 3/4 (95)
DN15 PN40 lap joint flange; DIN 2656 type C face	523	8 1/2 (216)	3 3/4 (95)
DN15 PN40 lap joint flange; EN 1092-1 Form B1	524	8 1/2 (216)	3 3/4 (95)
JIS 15mm 10K lap joint flange	522	8 1/4 (210)	3 3/4 (95)

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Fitting options *continued*

	Fitting code[1]	Dim. A face-to-face inches (mm)	Dim. B outside diameter inches (mm)
Model CMF100			
316L stainless steel sensors			
Wafer style; 1-inch ANSI (150 lb bolt kit)	010	4 (102)	2 1/2 (64)
Wafer style; 1-inch ANSI (300 lb; 600 lb bolt kit)	011	4 (102)	2 1/2 (64)
Wafer style; 25mm type C face (PN40 bolt kit)	020	4 (102)	2 1/2 (64)
Wafer style; 25mm DIN 2512 type N grooved face (PN40 bolt kit)	021	4 (102)	2 1/2 (64)
Wafer style; 25mm type E face (PN100 bolt kit)	022	4 (102)	2 1/2 (64)
Wafer style; 25mm DIN 2512; type N grooved face (PN100 bolt kit)	023	4 (102)	2 1/2 (64)
Wafer style; 25mm; standard JIS face (10K; 20K; 30K bolt kit)	030	4 (102)	2 1/2 (64)
1-inch ANSI CL150 weld neck raised face flange	328	9 1/4 (235)	4 1/4 (108)
1-inch ANSI CL300 weld neck raised face flange	329	9 3/4 (248)	4 7/8 (124)
1-inch ANSI CL600 weld neck raised face flange	330	10 1/4 (260)	4 7/8 (124)
1 1/2-inch ANSI CL600 weld neck raised face flange	331	10 7/8 (276)	6 1/8 (156)
1-inch sanitary fitting (Tri-Clamp compatible)	339	8 3/8 (213)	2 (50)
DN25 PN40 weld neck flange; DIN 2635 type C face	306	8 5/16 (211)	4 1/2 (115)
DN25 PN40 weld neck flange; EN 1092-1 Form B1	179	8 5/16 (211)	4 1/2 (115)
DN25 PN40 weld neck flange; DIN 2635 type N grooved face	307	8 5/16 (211)	4 1/2 (115)
DN25 PN40 weld neck flange; EN 1092-1 Form D	311	8 5/16 (211)	4 1/2 (115)
DN25 PN100 weld neck flange; DIN 2637 type E face	308	9 11/16 (246)	5 1/2 (140)
DN25 PN100 weld neck flange; EN 1092-1 Form B2	180	9 11/16 (246)	5 1/2 (140)
DN25 PN100 weld neck flange; DIN 2637 type N grooved face	309	9 11/16 (246)	5 1/2 (140)
DN25 PN100 weld neck flange; EN 1092-1 Form D	181	9 11/16 (246)	5 1/2 (140)
JIS 25mm 10K weld neck raised face flange	317	8 5/16 (211)	4 15/16 (125)
JIS 25mm 20K weld neck raised face flange	318	8 5/16 (211)	4 15/16 (125)
304L stainless steel sensors			
1-inch ANSI CL150 weld neck raised face flange	415	9 1/4 (235)	4 1/4 (108)
1-inch ANSI CL300 weld neck raised face flange	416	9 3/4 (248)	4 7/8 (124)
DN25 PN40 weld neck flange; DIN 2526 type C face	424	8 9/16 (217)	4 1/2 (115)
DN25 PN40 weld neck flange; EN 1092-1 Form B1	422	8 9/16 (217)	4 1/2 (115)
Nickel alloy sensors			
1-inch ANSI CL150 lap joint flange	530	9 1/4 (235)	4 1/4 (108)
1-inch ANSI CL300 lap joint flange	531	9 3/4 (248)	4 7/8 (124)
DN25 PN40 lap joint flange; DIN 2656 type C face	533	9 9/16 (243)	4 1/2 (115)
DN25 PN40 lap joint flange; EN 1092-1 Form B1	534	9 9/16 (243)	4 1/2 (115)
JIS 25mm 10K lap joint flange	532	9 5/16 (237)	4 15/16 (125)

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Ordering information

Model	Product Description
	Standard models
CMFS010M	Micro Motion Coriolis ELITE sensor; 1/10 to 1/6-inch (2 to 4 mm); 316L stainless steel
CMFS010H	Micro Motion Coriolis ELITE sensor; 1/10 to 1/6-inch (2 to 4 mm); alloy C-22
CMFS015M	Micro Motion Coriolis ELITE sensor; 1/6 to 1/4-inch (4 to 6 mm); 316L stainless steel
CMFS015H	Micro Motion Coriolis ELITE sensor; 1/6 to 1/4-inch (4 to 6 mm); alloy C-22
CMF010M	Micro Motion Coriolis ELITE sensor; 1/10 to 1/6-inch (2 to 4 mm); 316L stainless steel
CMF010H	Micro Motion Coriolis ELITE sensor; 1/10 to 1/6-inch (2 to 4 mm); alloy C-22
CMF010L	Micro Motion Coriolis ELITE sensor; 1/10 to 1/6-inch (2 to 4 mm); 304L stainless steel
CMF025M	Micro Motion Coriolis ELITE sensor; 1/4 to 1/2-inch (6 to 13 mm); 316L stainless steel
CMF025H	Micro Motion Coriolis ELITE sensor; 1/4 to 1/2-inch (6 to 13 mm); alloy C-22
CMF025L	Micro Motion Coriolis ELITE sensor; 1/4 to 1/2-inch (6 to 13 mm); 304L stainless steel
CMF050M	Micro Motion Coriolis ELITE sensor; 1/2 to 1-inch (13 to 25 mm); 316L stainless steel
CMF050H	Micro Motion Coriolis ELITE sensor; 1/2 to 1-inch (13 to 25 mm); alloy C-22
CMF050L	Micro Motion Coriolis ELITE sensor; 1/2 to 1-inch (13 to 25 mm); 304L stainless steel
CMF100M	Micro Motion Coriolis ELITE sensor; 1 to 2-inch (25 to 50 mm); 316L stainless steel
CMF100H	Micro Motion Coriolis ELITE sensor; 1 to 2-inch (25 to 50 mm); alloy C-22
CMF100L	Micro Motion Coriolis ELITE sensor; 1 to 2-inch (25 to 50 mm); 304L stainless steel
CMF200M	Micro Motion Coriolis ELITE sensor; 2 to 3-inch (50 to 75 mm); 316L stainless steel
CMF200H	Micro Motion Coriolis ELITE sensor; 2 to 3-inch (50 to 75 mm); alloy C-22
CMF200L	Micro Motion Coriolis ELITE sensor; 2 to 3-inch (50 to 75 mm); 304L stainless steel
CMF300M	Micro Motion Coriolis ELITE sensor; 3 to 4-inch (75 to 100 mm); 316L stainless steel
CMF300H	Micro Motion Coriolis ELITE sensor; 3 to 4-inch (75 to 100 mm); alloy C-22
CMF300L	Micro Motion Coriolis ELITE sensor; 3 to 4-inch (75 to 100 mm); 304L stainless steel
CMF400M	Micro Motion Coriolis ELITE sensor; 4 to 6-inch (100 to 150 mm); 316L stainless steel
CMF400H	Micro Motion Coriolis ELITE sensor; 4 to 6-inch (100 to 150 mm); alloy C-22
	High-pressure models
CMFS010P	Micro Motion Coriolis ELITE sensor; 1/10 to 1/6-inch (2 to 4 mm); high pressure; nickel alloy with stainless steel fittings
CMFS015P	Micro Motion Coriolis ELITE sensor; 1/6 to 1/4-inch (4 to 6 mm); high pressure; nickel alloy with stainless steel fittings
CMF010P	Micro Motion Coriolis ELITE sensor; 1/10 to 1/6-inch (2 to 4 mm); high pressure; nickel alloy with stainless steel fittings
CMF400P	Micro Motion Coriolis ELITE sensor; 4 to 6-inch (100 to 150 mm); high pressure; nickel alloy with stainless steel fittings
	High-temperature models
CMF200A	Micro Motion Coriolis ELITE sensor; 2 to 3-inch (50 to 75 mm); high temperature; 316L stainless steel
CMF200B	Micro Motion Coriolis ELITE sensor; 2 to 3-inch (50 to 75 mm); high temperature; alloy C-22
CMF300A	Micro Motion Coriolis ELITE sensor; 3 to 4-inch (75 to 100 mm); high temperature; 316L stainless steel
CMF300B	Micro Motion Coriolis ELITE sensor; 3 to 4-inch (75 to 100 mm); high temperature; alloy C-22
CMF400A	Micro Motion Coriolis ELITE sensor; 4 to 6-inch (100 to 150 mm); high temperature; 316L stainless steel
CMF400B	Micro Motion Coriolis ELITE sensor; 4 to 6-inch (100 to 150 mm); high temperature; alloy C-22
Code	**Process Connections**
###	See process fitting options on pages 29–39

Continued on next page

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Ordering information *continued*

Code	Case Options
	For all models except CMFS010 and CMFS015
N	Standard pressure containment
P	Purge fittings (see pages 21–24)
D	Rupture disks (two 400-psi [28 bar] disks) — Model CMF010P only
	For models CMFS010 and CMFS015
N	Standard case (300-series stainless steel)
J	Standard case (300-series stainless steel) with mounting bracket
M	316L stainless steel case
Q	316L stainless steel case with mounting bracket
H(1)	Hygienic; 32 Ra finish (0.8 µm); 316L stainless steel case
T(1)	Hygienic; 32 Ra finish (0.8 µm); 316L stainless steel case with mounting bracket
P	Purge fitting (see page 20); standard case
U	Purge fitting (see page 20); standard case with mounting bracket
Code	**Electronics Interface**
	For all models except Model CMFS010, Model CMFS015, and high-temperature models
0	Model 2400S transmitter
1	Extended mount Model 2400S transmitter
2	4-wire polyurethane-painted aluminum integral enhanced core processor for remote mount transmitters
3	4-wire stainless steel integral enhanced core processor for remote mount transmitters
4	4-wire polyurethane-painted aluminum integral extended mount enhanced core processor for remote mount transmitters
5	4-wire extended mount stainless steel integral enhanced core processor for remote mount transmitters
Q	4-wire polyurethane-painted aluminum integral core processor for remote mount transmitters
A	4-wire stainless steel integral core processor for remote mount transmitters
J(2)	2-wire integrally mounted Model 2200S transmitter
U(2)	2-wire extended Model 2200S transmitter
R	9-wire polyurethane-painted aluminum junction box
S	9-wire 316L stainless steel junction box
	For high-temperature models
0	Model 2400S transmitter
2	4-wire polyurethane-painted aluminum integral enhanced core processor for remote mount transmitters
3	4-wire stainless steel integral enhanced core processor for remote mount transmitters
Q	4-wire polyurethane-painted aluminum integral core processor for remote mount transmitters
A	4-wire stainless steel integral core processor for remote mount transmitters
C	Model 1700/2700 transmitter
R	9-wire polyurethane-painted aluminum junction box
S	9-wire 316L stainless steel junction box

Continued on next page

(1) Available only with process connection 321, 344, 345, or 346.
(2) Available only with calibration option Z.

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Ordering information *continued*

Code	Electronics Interface
	For Models CMFS010 and CMFS015
0	Model 2400S transmitter
1	Extended mount Model 2400S transmitter
2	4-wire polyurethane-painted aluminum integral enhanced core processor for remote mount transmitters
3	4-wire stainless steel integral enhanced core processor for remote mount transmitters
4	4-wire polyurethane-painted aluminum integral extended mount enhanced core processor for remote mount transmitters
5	4-wire extended mount stainless steel integral enhanced core processor for remote mount transmitters
J(1)	2-wire integrally mounted Model 2200S transmitter
U(1)	2-wire extended Model 2200S transmitter
Code	**Conduit Connections**
	For electronics interface codes 0, 1, J, U, and C
A	Not applicable
	For electronics interface codes 2, 3, 4, 5, Q, and A
B	1/2-inch NPT — no gland
E	M20 — no gland
F	Brass/nickel cable gland (cable diameter 0.335 to 0.394 inches [8.5 to 10 mm])
G	Stainless steel cable gland (cable diameter 0.335 to 0.394 inches [8.5 to 10 mm])
	For electronics interface codes R and S (9-wire junction box)
A	3/4-inch NPT — no gland
H	Brass/nickel cable gland
J	Stainless steel cable gland
Code	**Approvals**
	For electronics interface codes 0 and 1
M	Micro Motion Standard (no approval)
N	Micro Motion Standard / PED compliant
2	CSA C-US (U.S.A. and Canada) Class I, Div. 2
V	ATEX — Equipment Category 3 (Zone 2) / PED compliant
3	IECEx Zone 2
	For electronics interface codes 2, 3, 4, and 5
M	Micro Motion Standard (no approval)
N	Micro Motion Standard / PED compliant
A	CSA C-US (U.S.A. and Canada)
Z(2)	ATEX – Equipment Category 2 (Zone 1) / PED compliant
6(2)	ATEX – Equipment Category 2 (Zone 1, IIC modified) / PED compliant; Models CMF200, CMF300, and CMF400 only
I(2)	IECEx Zone 1
7(2)	IECEx Zone 1, IIC modified; Models CMF200, CMF300, and CMF400 only
P(3)	NEPSI
Continued on next page	

(1) Available only with calibration option Z.

(2) Models CMF200, CMF300, and CMF400 are rated for Group IIB with standard ATEX approval code Z and IECEx approval code I. The IIC modification option (approval codes 6 and 7) should be used only when necessary for the specific area classification.

(3) Available only with language option M (Chinese).

Ordering information *continued*

Code	Approvals
	For electronics interface codes J and U
M	Micro Motion Standard (no approval)
N	Micro Motion Standard / PED compliant
V	ATEX — Equipment Category 3 (Zone 2) / PED compliant
3	IECEx Zone 2
A	CSA C-US (U.S.A. and Canada)
Z	ATEX – Equipment Category 2 (Zone 1) / PED compliant
I	IECEx Zone 1
	For electronics interface codes Q, A, C, R, and S
M	Micro Motion Standard (no approval)
N	Micro Motion Standard / PED compliant
U	UL — Not available with electronics interface code C
C	CSA (Canada only) — Not available with electronics interface code C
A	CSA C-US (U.S.A. and Canada)
Z(1)	ATEX – Equipment Category 2 (Zone 1) / PED compliant
6(1)	ATEX – Equipment Category 2 (Zone 1, IIC modified) / PED compliant; Models CMF200, CMF300, and CMF400 only
I(1)	IECEx Zone 1
7(1)	IECEx Zone 1, IIC modified; Models CMF200, CMF300, and CMF400 only
P(2)	NEPSI
Code	**Language**
A	Danish CE requirements document and English installation manual
D	Dutch CE requirements document and English installation manual
E	English installation manual
F	French installation manual
G	German installation manual
H	Finnish CE requirements document and English installation manual
I	Italian installation manual
J	Japanese installation manual
M	Chinese installation manual
N	Norwegian CE requirements document and English installation manual
O	Polish installation manual
P	Portuguese installation manual
S	Spanish installation manual
W	Swedish CE requirements document and English installation manual
C	Czech installation manual
B	Hungarian CE requirements document and English installation manual
K	Slovak CE requirements document and English installation manual
T	Estonian CE requirements document and English installation manual
U	Greek CE requirements document and English installation manual
L	Latvian CE requirements document and English installation manual
V	Lithuanian CE requirements document and English installation manual
Y	Slovenian CE requirements document and English installation manual

Continued on next page

(1) Models CMF200, CMF300, and CMF400 are rated for Group IIB with standard ATEX approval code Z and IECEx approval code I. The IIC modification option (approval codes 6 and 7) should be used only when necessary for the specific area classification.

(2) Available only with language option M (Chinese).

Ordering information *continued*

Code[1]	Calibration Options
	For all models except CMFS010, CMFS015, CMF010, and high-temperature models
Z	0.10% mass flow and 0.0005 g/cm³ (0.5 kg/m³) density
D[2]	0.10% mass flow and 0.0002 g/cm³ (0.2 kg/m³) density
2[2]	0.05% mass flow and 0.0005 g/cm³ (0.5 kg/m³) density
3[2]	0.05% mass flow and 0.0002 g/cm³ (0.2 kg/m³) density
	For models CMFS010 and CMFS015
C	0.10% mass flow and 0.002 g/cm³ (2.0 kg/m³) density
K	0.10% mass flow and 0.0005 g/cm³ (0.5 kg/m³) density
2	0.05% mass flow and 0.0005 g/cm³ (0.5 kg/m³) density
	For model CMF010
Z	0.10% mass flow and 0.0005 g/cm³ (0.5 kg/m³) density
2	0.05% mass flow and 0.0005 g/cm³ (0.5 kg/m³) density
	For high-temperature models
Z	0.10% mass flow and 0.0005 g/cm³ (0.5 kg/m³) density
Code	**Measurement Application Software**
Z	No measurement application software
Code	**Factory Options**
Z	Standard product
X	ETO product
Typical Model Number:	**CMF050M 313 N 2 B A E Z Z Z**

(1) Density accuracy ratings apply to liquid flow only.
(2) Requires electronics interface codes 0–5.

Chapter 10.7 LEVEL SWITCH:

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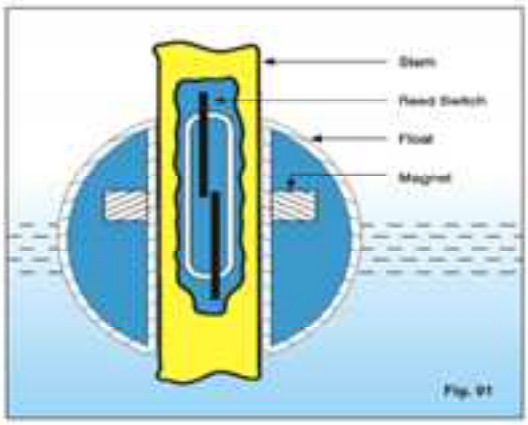
SHRIDHAN Automation
Reliable Level Monitoring & Control
(An ISO 9001- 2008 Company)

VERTICAL MOUNTING TYPE MAGNETIC FLOAT LEVEL SWITCHES - VFS

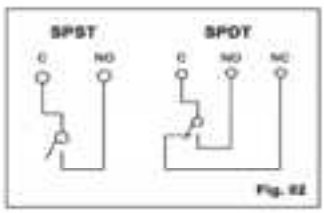
It is an established and reliable technique in industry for single / multiple liquid level sensing and control in open or pressurized vessels. It offers trouble free service in conductive / non-conductive liquids under widely varying temperatures, pressures, liquid viscosity and corrosive conditions. Besides, it provides high repeatability and effects of shocks / vibrations are minimal.

CONSTRUCTION & OPERATION

Magnetic reed switch being the sensing element, the float switch operates on a simple principle. A float encircling a fixed stationary stem is equipped with powerful permanent magnets. As the float rises or lowers with liquid level the magnetic field generated by the magnet that is present within the float actuates a hermetically sealed reed switch mounted inside the stem. This in turn makes or breaks the contact of the reed switch. **(Refer fig.01)**



The reed switches used, are available in SPST & SPDT type. (Refer fig.02)



SPST - Normally open contact (NO)
(Single pole single through)

SPDT - Changeover contact (C/O)
(Single pole double through)

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Typical Level Switch Construction

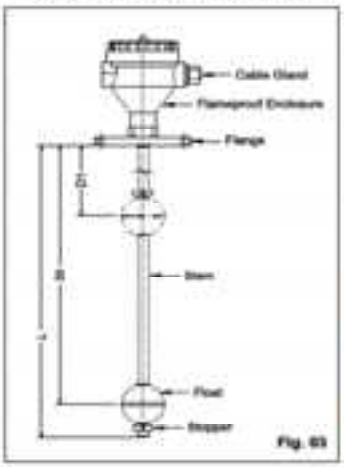
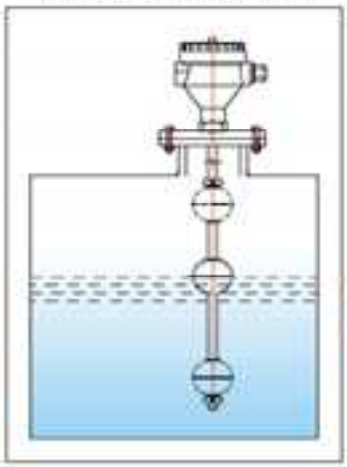
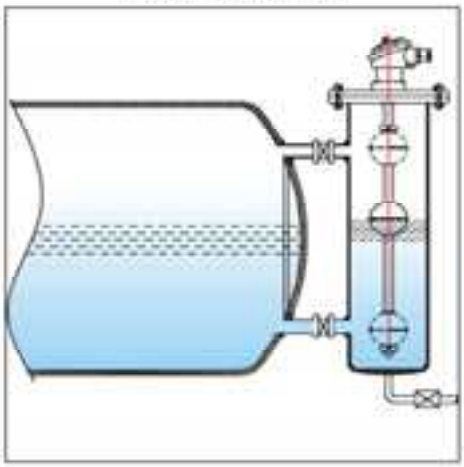


Fig. 03

Mounting Insertion for Tanks



External Cage Mounting



SPECIFICATIONS

Enclosure	:	Cast Al, W-proof to IP 66 / Ex-proof to Gr. IIA, IIB & Gr. IIC/ DIN Polyamide connector
Conduit Connection	:	Brass, ¾" ET / ½" NPT
Guided Stem MOC	:	SS316 / SS304 / Brass / SS316L / PP
Float MOC x Size	:	SS316 x Ø22, Ø28, Ø30, Ø40, Ø52, Ø89, SS316L x Ø52 PU foam x Ø22, Ø25, Ø35, PP x Ø44
Stem OD	:	Ø8, Ø12.7 in SS316 / SS304 / Brass / SS316L, Ø16 in PP
Operating Temperature	:	SS316 - Ø52, Ø40 Upto 150°C, Ø22, Ø28, Ø30 Upto 100°C, SS316L - Ø52 upto 150°C PU foam - Ø22, Ø25, Ø35 Upto 60°C, PP - Ø42, Ø44 upto 60°C
Operating pressure max.	:	SS316 - Ø52, Ø40 Upto 20Kg / cm², Ø22, Ø28, Ø30 Upto 8Kg / cm², SS316L upto 40Kg/cm²,PU foam - Ø22, Ø25, Ø35 - Atmospheric, PP upto 5kg/cm²
Min. specific gravity	:	0.7
No. of floats	:	Single / Multiple (Max.4) (More available on request)
Process connections	:	Flanged / Threaded / Triclover Flange
Preset levels	:	1 to 4 (Factory set) (More available on request)
Switch type	:	Glass encapsulated hermetically sealed reed contacts
Switching capacity	:	15VA (NO) / 100VA (NO) or 3VA (1C/O) / 50VA (1C/O)
Differential	:	Fixed (10 ± 2mm)
Accuracy / Repeatability	:	± 2mm / ± 1mm
Load	:	Resistive / Inductive
Insulation	:	100 Mega-Ohms at 500 VDC
Special Features	:	Intrinsically safe to Ex ib Gr IIA-IIB

Arc Suppression - Contact Protection Measures For Reed Switches

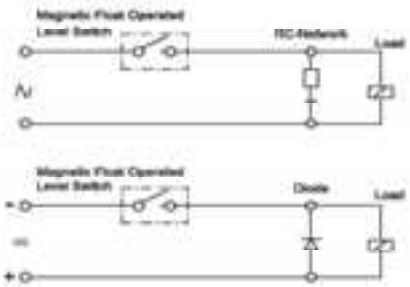


Fig. 04

Level Switch With Automatic Level Controller (Provided as optional for specific applications)

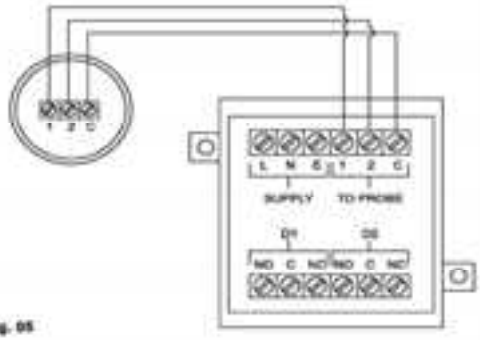


Fig. 05

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ORDERING INFORMATION FOR VERTICAL MOUNTING TYPE FLOAT SWITCHES

SPECIFY PART NO. → VFS [1] [2] [3] [4] [5]

Example : VFS [B] [A] [1] [S1] [1]

VFS [ ] [ ] [ ] [ ] [ ]

1 TERMINAL TYPE

- B : DIN Polyamide (upto 2 levels)
- C : Weather Proof IP 66 / SS304
- D : Weather Proof IP 66 / Cast Al.
- E : Ex. Proof IP 65 Gr. IIA, IIB, IIC
- F : Aluminum Junction Box
- G : Polycarbonate Enclosure
- H : Cable
- O : Others

2 CONNECTION TYPE

SIZE OF FLANGE

- A : Dia75-60PCD
- B : Dia75-65PCD
- C : Dia100-80PCD
- D : 2" #150
- E : 2 1/2" #150
- F : 2 1/2" TE
- G : 2" T
- H : 1 1/2" #150
- I : 3" TE
- J : 3" #150
- K : Dia45-38PCD
- L : Dia58.7-51PCD
- S : Others

ADAPTER

- 0 : 1/4" BSP
- 1 : 1" BSP
- 2 : 1 1/2" BSP
- 3 : 2" BSP
- 4 : 2" NPT
- 5 : 3/8" BSP
- 6 : 1/8" NPT
- 10 : Others

PLEASE NOTE : Flange / Adapter Material available in variants of **Stainless Steel / Mild Steel / Aluminium / Brass**

3 DIA OF STEM WITH MATERIAL

1. Dia 8 of SS304
2. Dia 12.7 of SS304
3. Dia 16.0 of PP
4. Dia 8 of PP
5. Dia 8 of SS316
6. Dia 12.7 of SS316
7. Dia 12.7 of SS316L
8. Dia 8 of Brass
9. Dia 12.7 of Brass
0. Others

4 FLOAT TYPE

Type	Material	Float	Dia Stem
S1	SS316	Dia28	Dia8
S2	SS316	Dia30	Dia8
S3	SS316	Dia40	Dia12.7
S4	SS316	Dia52	Dia12.7
S5	SS316L	Dia52	Dia 12.7
S6	SS316	Dia89	Dia12.7
S0	Others	Specify	Specify
P1	PU	Dia22	Dia8
P2	PU	Dia25	Dia8
P3	PU	Dia35	Dia12.7
P4	PP	Dia25	Dia8
P5	PP	Dia44	Dia16
P6	PVDF	Dia44	Dia16

5 ELECTRICAL SPECIFICATIONS

1. SDN 102
2. SDN 104
3. SDN 202
4. SDN 204

Refer table below

ELECTRICAL SPECIFICATIONS

Model Type	SDN 102	SDN 104	SDN 202	SDN 204
Switching Voltage (Max.)	200 V DC 125 V AC	300 V DC 240 V AC	28 V DC 28 V AC	500 V DC 250 V AC
Switching Current (Max.)	0.5A	3A	0.25A	1.5A
Contact Rating	15VA	100VA	3VA	50VA
Contact Form	SPST	SPST	SPDT	SPDT

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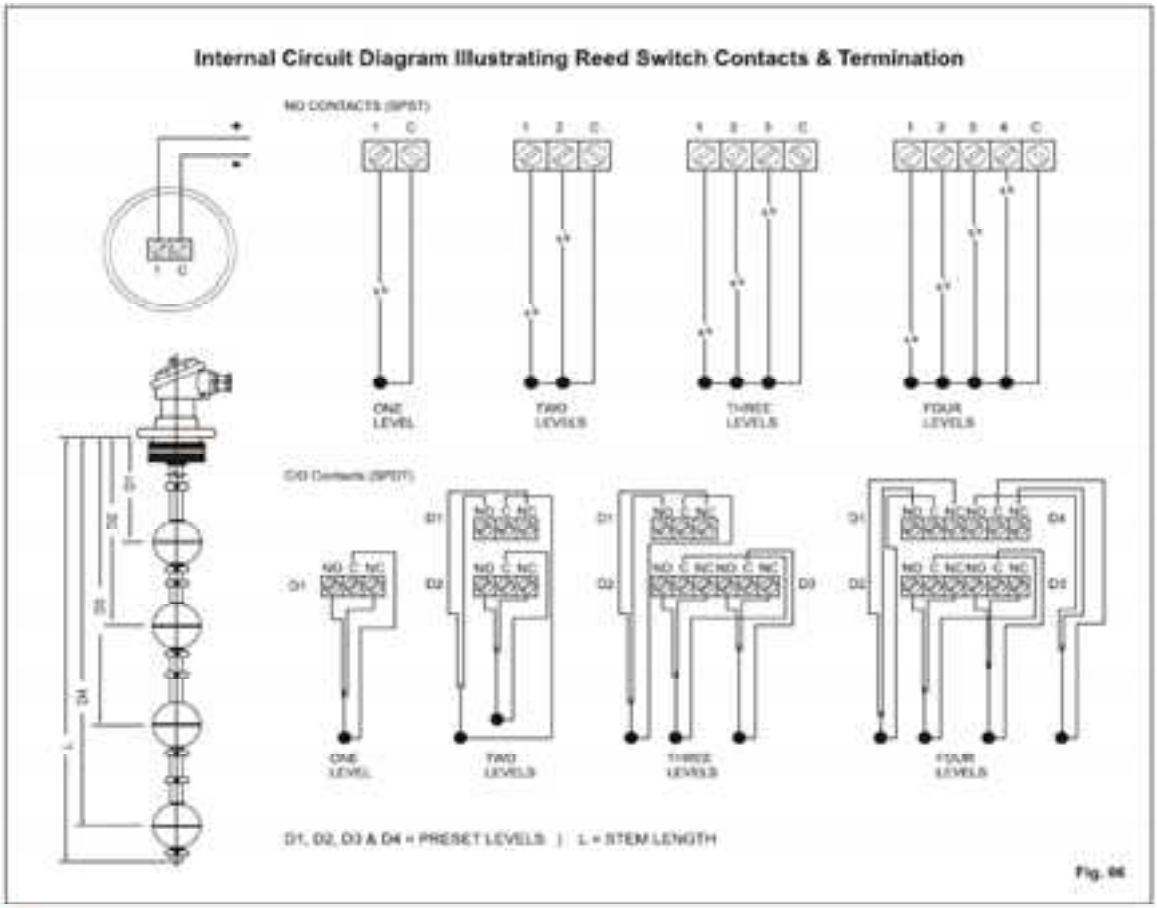


APPLICATION

Water / Waste water treatment plants, Cooling towers, Lubrication / Filtration systems, Paint shops, Food / Drug / Pharmaceutical / Chemical & Petrochemical industries.

ORDERING INFORMATION

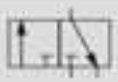
Specify part number as per earlier page, guided stem length (L), Preset levels (D1, D2, D3... Etc.), Specific gravity, operating temperature & pressure.

SHRIDHAN AUTOMATION PVT. LTD.,
#B-54, KSSIDC Industrial Estate, Kumbalagodu,
Mysore Road, Bengaluru - 560074, INDIA
Ph. : 080 - 28437847 / 28437848 ; Fax : 080 - 28437849
Email : info@shridhan.com ; Website : www.shridhan.com

Note: All dimensions in MM, unless otherwise specified.

Chapter 10.9 Pressure Relief valve

Pressure valves



Designation	Type	Size	Series	p_{max} in bar	Data sheet no.	Page
Pressure relief valves, direct operated						
Subplate mounting, block installation, threaded connection	DBD	6 ... 30	1X	630	25402	557
Subplate mounting	DB6D	6	1X	315	25408	573
Subplate mounting	ZDBT, DBT, DZT	6	1X	315	25724	579
Block installation	DBD	4	1X	315	25710	587
Block installation	KBD		A	350	18105-01	595
Sandwich plate valve	ZDBY, Z2DBYD	6; 10	1X	315	25722	603
Pressure relief valves, pilot operated						
Subplate mounting	DBV6V	6	1X	315	25726	615
Subplate mounting, threaded connection	DB; DBW	10 ... 32	5X	350	25802	619
Subplate mounting, block installation, threaded connection	DB, DBW	10; 25	1X, 4X	350	25818	639
Subplate mounting, flanged connection	DB, DBW	52	3X	315	25850	651
Block installation	DB.K	6; 10	4X	315	25731	663
Block installation	KTV	1	A	350	18111-02	671
Sandwich plate valve	ZDB, Z2DB	6	4X	315	25751	677
Sandwich plate valve	ZDBK, Z2DBK	6	1X	210	25754	685
Sandwich plate valve	ZDB, Z2DB	10	4X	315	25761	689
Sandwich plate valve	ZDBK, Z2DBK	10	1X	210	25764	697
Pump safety block	DBA; DBAW; DBAE	16; 25; 32	2X	350	25890	701
Pump safety block	DBA, DBAW	32; 40	1X	420	25880	725
Pressure reducing valves, direct operated						
Subplate mounting	DR.DP	6	5X	315	26564	743
Subplate mounting	DR.DP	10	4X	210	26580	747
with pressure monitoring; subplate mounting, sandwich plate valve	DRHD; ZDRHD	6	4X	200	26576	751
Sandwich plate valve	ZDR	6	4X	210	26570	759
Sandwich plate valve	ZDR	10	5X	210	26585	765

Continued on next page

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Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

Pressure relief valve, direct operated

RE 25402/10.05 1/16
Replaces: 02.03

Type DBD

Nominal sizes 6 to 30
Component series 1X
Maximum operating pressure 630 bar
Maximum flow 330 l/min

Overview of contents

Features

- As cartridge valve (cartridge)
- For threaded connections
- For manifold mounting
- Adjustment elements for pressure adjustment, optional:
  - Sleeve with hexagon and protection cap
  - Rotary knob / hand wheel
  - Lockable rotary knob

For information regarding the available spare parts see:
www.boschrexroth.com/spc

Ordering details

DBD | | | | 1X/ | | | *

Pressure relief valve, direct operated

Adjustment type for pressure adjustment	Nominal size 6	8	10	15	20	25	30	
Sleeve with hexagon and protective cap	●	●	●	●	●	●	●	= S
Rotary knob [1]	●	●	●	●	●	–	–	= H
Hand wheel [2]	–	–	–	–	–	●	●	= H
Lockable rotary knob [1,3]	●	●	●	●	●	–	–	= A
Nominal size	= 6	= 8	= 10	= 15	= 20	= 25	= 30	e.g.
(connection)	G1/4	G3/8	G1/2	G3/4	G1	G1 1/4	G1 1/2	= 10
Version								
As cartridge valve (cartridge)	●	–	●	–	●	–	●	= K
For threaded connections [4]	●	●	●	●	●	●	●	= G
For manifold mounting	●	–	●	–	●	–	●	= P
Component series 10 to 19 (10 to 19: unchanged installation and connection dimensions)								= 1X
Pressure stage								
Pressure setting up to 25 bar	●	●	●	●	●	●	●	= 25
Pressure setting up to 50 bar	●	●	●	●	●	●	●	= 50
Pressure setting up to 100 bar	●	●	●	●	●	●	●	= 100
Pressure setting up to 200 bar	●	●	●	●	●	●	●	= 200
Pressure setting up to 315 bar	●	●	●	●	●	●	●	= 315
Pressure setting up to 400 bar	●	●	●	●	●	–	–	= 400
Pressure setting up to 630 bar	–	–	●	–	–	–	–	= 630

Seal material
NBR seals = No code
FKM seals = V
(other seals on request)

⚠ Attention!
The compatibility of the seals and pressure fluid is to be taken into account!

Design testing
Without design testing = No code
Design tested safety valve to DGRL 97/23/EC = E

Further details in clear text

● = Available

[1] With nominal sizes 15 and 20 only the pressure stages 25, 50 or 100 bar are available

[2] Only available for pressure stages 25, 50 or 100 bar.

[3] Key with Material No. **R900008158** is included within the scope of supply

[4] Nominal sizes 8, 15, and 25 are not available with design tested „E" and adjustment element „S"

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Preferred types (readily available)

Type	Material number
DBDA 6 K1X/25	R900423780
DBDA 6 K1X/50	R900425083
DBDA 6 K1X/100	R900425080
DBDA 6 K1X/200	R900425081
DBDA 6 K1X/315	R900425082
DBDA 6 K1X/400	R900428387
DBDH 6 K1X/25	R900427600
DBDH 6 K1X/50	R900424734
DBDH 6 K1X/100	R900424199
DBDH 6 K1X/200	R900424200
DBDH 6 K1X/315	R900424201
DBDH 6 K1X/400	R900424202
DBDS 6 K1X/25	R900420245
DBDS 6 K1X/50	R900423727
DBDS 6 K1X/100	R900423723
DBDS 6 K1X/200	R900423724
DBDS 6 K1X/315	R900423725
DBDS 6 K1X/400	R900423726
DBDA 10 K1X/25	R900430305
DBDA 10 K1X/50	R900425966
DBDA 10 K1X/100	R900425161
DBDA 10 K1X/200	R900425162
DBDA 10 K1X/315	R900425164
DBDA 10 K1X/400	R900425165
DBDA 10 K1X/630	R900426835
DBDH 10 K1X/25	R900435222
DBDH 10 K1X/50	R900424185
DBDH 10 K1X/100	R900423891
DBDH 10 K1X/200	R900424190
DBDH 10 K1X/315	R900424193
DBDH 10 K1X/400	R900424194
DBDH 10 K1X/630	R900433807
DBDS 10 K1X/25	R900420276
DBDS 10 K1X/50	R900424153
DBDS 10 K1X/100	R900424147
DBDS 10 K1X/200	R900424149
DBDS 10 K1X/315	R900424150
DBDS 10 K1X/400	R900424152
DBDS 10 K1X/630	R900427601
DBDH 20 K1X/25	R900423028
DBDH 20 K1X/50	R900424112
DBDH 20 K1X/100	R900424109
DBDS 20 K1X/25	R900422542
DBDS 20 K1X/50	R900424205
DBDS 20 K1X/100	R900424267
DBDS 20 K1X/315	R900424271
DBDS 20 K1X/400	R900424203

Type	Material number
DBDH 30 K1X/25	R900445875
DBDH 30 K1X/50	R900424193
DBDS 30 K1X/25	R900422543
DBDS 30 K1X/50	R900424282
DBDS 30 K1X/100	R900424284
DBDS 30 K1X/200	R900424286
DBDS 30 K1X/315	R900424288
DBDA 6 G1X/25	R900432465
DBDA 6 G1X/50	R900424177
DBDA 6 G1X/100	R900425076
DBDA 6 G1X/200	R900426477
DBDA 6 G1X/315	R900426478
DBDA 6 G1X/400	R900428382
DBDH 6 G1X/25	R900426897
DBDH 6 G1X/50	R900424198
DBDH 6 G1X/100	R900424195
DBDH 6 G1X/200	R900424196
DBDH 6 G1X/315	R900424197
DBDH 6 G1X/400	R900424348
DBDH 6 P1X/25	R900430378
DBDH 6 P1X/50	R900428385
DBDH 6 P1X/100	R900424246
DBDH 6 P1X/200	R900427242
DBDH 6 P1X/315	R900424266
DBDH 6 P1X/400	R900434128
DBDS 6 G1X/25	R900423718
DBDS 6 G1X/50	R900423722
DBDS 6 G1X/100	R900423717
DBDS 6 G1X/200	R900423719
DBDS 6 G1X/315	R900423720
DBDS 6 G1X/400	R900423721
DBDS 6 P1X/25	R900429414
DBDS 6 P1X/50	R900423732
DBDS 6 P1X/100	R900423728
DBDS 6 P1X/200	R900423729
DBDS 6 P1X/315	R900423730
DBDS 6 P1X/400	R900423731
DBDH 10 G1X/50	R900424190
DBDH 10 G1X/100	R900424188
DBDH 10 G1X/200	R900424178
DBDH 10 G1X/315	R900424189
DBDH 10 G1X/630	R900423739

Continued onto page 4

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Function, section, symbol

The DBD pressure relief valves are direct operated poppet seat valves.

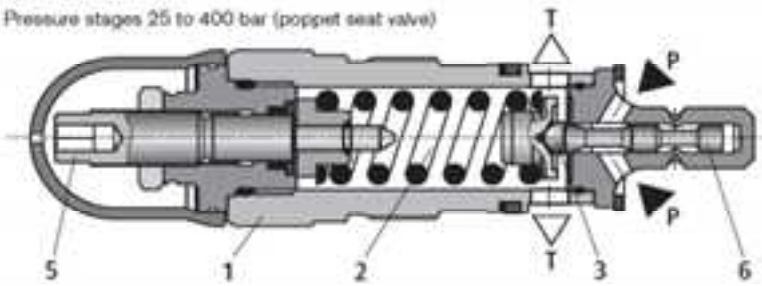
They are used to limit the pressure in a hydraulic system.

The valves mainly consist of sleeve (1), spring (2), poppet with damping spool (3) (pressure stages 25 to 400 bar) or ball (4) (pressure stage 630 bar) and adjustment element (5). The setting of the system pressure is infinitely variable via the adjustment element (5). The spring (2) pushes the poppet (3) or ball (4) onto the seat. The P channel is connected to the system. The pressure present in the system is applied to the poppet area (or ball).

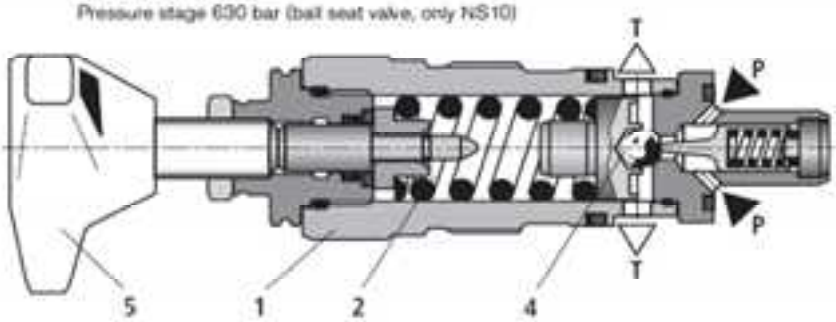
If the pressure in channel P rises above the value set at the spring (2), then the poppet (3) or the ball (4) opens against the spring (2). Now pressure fluid flows from channel P into channel T. The stroke of the poppet (3) is limited by a pin (6).

In order to obtain good pressure settings over the entire pressure range, the pressure range is split into 7 pressure stages. A pressure stage corresponds to a certain spring for a maximum operating pressure which may be set with it.

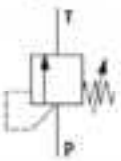
Type DBDH..K1X/...
Pressure stages 25 to 400 bar (poppet seat valve)



Type DBDH 10 K1X/...
Pressure stage 630 bar (ball seat valve, only NS10)



Symbol



04

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Technical data (for applications outside these parameters, please consult us!)

General

Nominal size		NS	6 and 8	10	15 and 20	25 and 30
Weight			See pages 8, 9 and 11			
Installation			Optional			
Ambient temperature range		°C	-30 to +80 (NBR seals) -15 to +80 (FKM seals)			
The minimum housing material strength			Housing materials are to be so selected that adequate safety is ensured for all conceivable operating pressures (e.g. with reference to the compressive strength, thread strength and tightening torque).			

Hydraulic

Maximum operating pressure	- Inlet	bar	400	630	400	315
	- Outlet	bar	315	315	315	315
Maximum flow (standard valve)			see characteristic curves on page 7			
Pressure fluid			Mineral oil (HL, HLP) to DIN 51524 [1]; fast bio-degradable pressure fluids to VDMA 24568 (also see RE 90221); HETG (rape seed oil) [1]; HEPG (polyglycole) [2]; HEES (synthetic ester) [2]; other pressure fluids on request			
Pressure fluid temperature range		°C	-30 to +80 (for NBR seals) -15 to +80 (for FKM seals)			
Viscosity range		mm^2/s	10 to 800			
Maximum permissible degree of pressure fluid contamination. Cleanliness class to ISO 4406 (c)			Class 20/18/15 [3]			

[1] Suitable for NBR and FKM seals

[2] Only suitable for FKM seals

[3] The cleanliness class stated for the components must be adhered to in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.
For the selection of filters see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

For deviating technical data for design tested safety valves see page 13.

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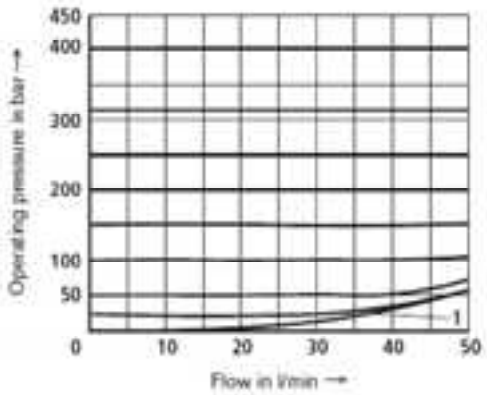
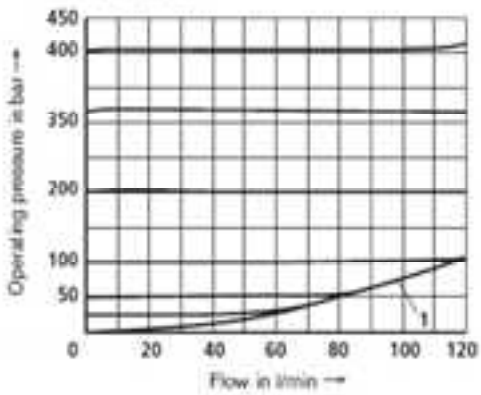
Characteristic curves (measured with HLP46, ϑ_{oil} = 40 °C ± 5 °C)

NS 6

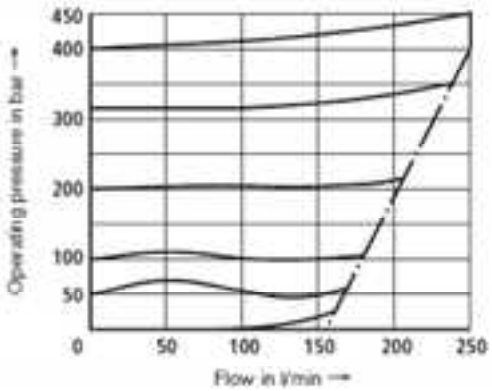


NS 8 and 10

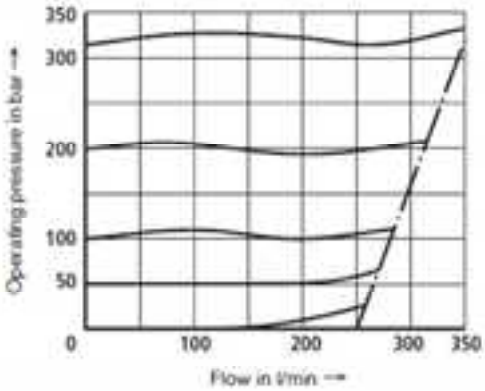


1 = Lowest settable pressure

NS 15 and 20



NS 25 and 30



04

⚠ Attention!

- The characteristic curves are valid for the output pressure = zero over the entire flow range and are measured without consideration of the housing pressure drop!
- The characteristic curves are only valid with the stated ambient and temperature conditions. It has to be taken into account that the characteristic curve is influenced by the changes in the boundry conditions!
- The characteristic curves refer to the given pressure stages (e.g. 200 bar). The further the pressure setting value is from the nominal pressure stage (e.g. < 200 bar), the greater the pressure increase with the flow.

General guidelines

Any hydraulic back pressures in port T are added 1:1 to the response pressure set at the adjustment element of the valve.

Example:

- The valve pressure setting resulting from the spring loading (Pos. 2 on page 5) p_{spring} = 200 bar
- Hydraulic back pressure in port T: $p_{hydraulic}$ = 50 bar

⇒ Response pressure = $p_{spring} + p_{hydraulic}$ = 250 bar

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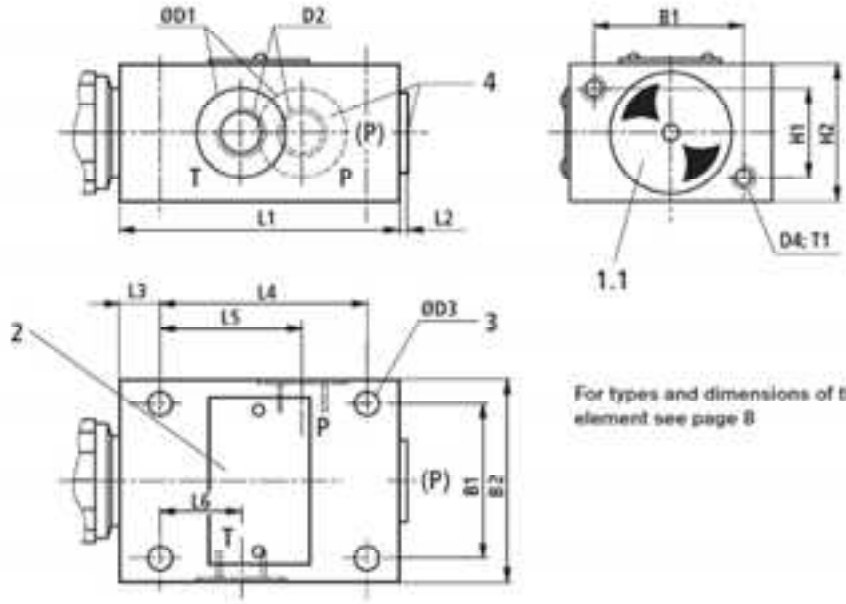
Unit dimensions: threaded connections (nominal dimensions in mm)



For types and dimensions of the adjustment element see page 8

1.1 Adjustment type „S" (example)
Set screw with hexagon and protective cap;
Internal hexagon (up to NS20)
External hexagon (NS25 and 30)

2 Name plate
3 4 off threaded fixing holes
4 Connection port (P), optional
(e.g. for pressure measuring, dimensions see dimensions D2, for tightening torques see table below

NS	B1	B2	ØD1	D2	ØD3	D4	H1	H2	L1	L2	L3	L4	L5	L6	T1	Weight
6	45	60	25	G1/4	6,6	M6	25	40	80	4	15	55	40	20	10	approx. 1,5 kg
(8) + 10	60	80	(28) 34	(G3/8) G1/2	9	M8	40	60	100	4	20	70	48	21	15	approx. 3,7 kg
(15) + 20	70	100	(42) 47	(G3/4) G1	9	M8	50	70	135	(4) 5,5	20	100	65	34	18	approx. 6,4 kg
(25) + 30	100	130	(56) 65	(G1 1/4) G1 1/2	11	M10	60	90	180	5,5	25	130	85	35	20	approx. 13,9 kg

Tightening torques M_A in Nm for fittings [1]:

	Plug (Pos. 4)	Plug
G1/4	30	60
G3/8	40	90
G1/2	60	130
G3/4	80	200
G1	135	380
G1 1/4	480	500
G1 1/2	560	600

[1] The tightening torques are standard values relating to the maximum operating pressue and the used of the torque wrench (tolerance ≤ 10%).

Tightening torques M_A in Nm for cartridges [2]:

	Pressue stage in bar		
Nom. size	Up to 200	Up to 400	Up to 630
6	50±5	80±5	–
10	100±5	150±10	200±10
20	150±10	300±15	–
30	350±20	500±30	–

[2] The tightening torques are standard values with a friction co-efficient of approx. 0.12 and the use of a torque wrench.

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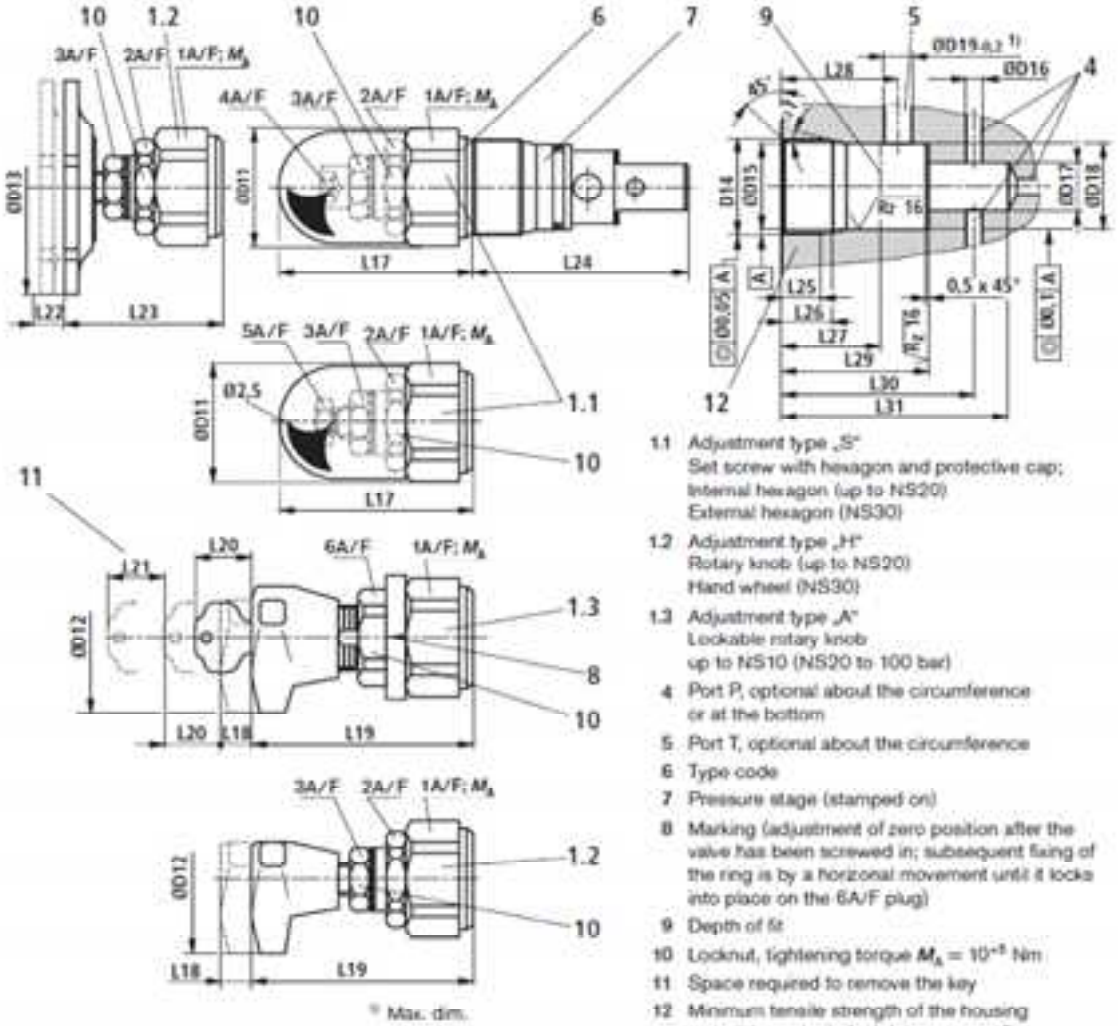
Unit dimensions: Cartridge valve (nominal dimensions in mm)



1.1 Adjustment type „S"
Set screw with hexagon and protective cap;
Internal hexagon (up to NS20)
External hexagon (NS30)

1.2 Adjustment type „H"
Rotary knob (up to NS20)
Hand wheel (NS30)

1.3 Adjustment type „A"
Lockable rotary knob
up to NS10 (NS20 to 100 bar)

4 Port P, optional about the circumference or at the bottom

5 Port T, optional about the circumference

6 Type code

7 Pressure stage (stamped on)

8 Marking (adjustment of zero position after the valve has been screwed in; subsequent fixing of the ring is by a horizonal movement until it locks into place on the 6A/F plug)

9 Depth of fit

10 Locknut, tightening torque M_A = 10^{+5} Nm

11 Space required to remove the key

12 Minimum tensile strength of the housing material, see technical data on page 6

Cartridge valve

NS	ØD11	ØD12	ØD13	L17	L18	L19	L20	L21	L22	L23	L24	1A/F	2A/F	3A/F	4A/F	5A/F	6A/F	M_A	Weight
6	34	60	–	72	11	83	28	20	–	–	64,5	32	30	19	6	–	30	see table on page 8	approx. 0,4 kg
10	38	60	–	68	11	79	28	20	–	–	77	36	30	19	6	–	30		approx. 0,5 kg
20	48	60	–	65	11	77	28	20	–	–	106	46	36	19	6	–	30		approx. 1 kg
30	63	–	80	83	–	–	–	–	11	56	±31	60	46	19	–	13	–		approx. 2,2 kg

Installation cavity

NS	D14	ØD15	ØD16	ØD17	ØD18	ØD19	L25	L26	L27	L28	L29	L30	L31	α1
6	M28 x 1,5	25 H9	6	15	24,9 +0,152 −0,2	12	15	19	30	36	45	56,5±5,5	65	15°
10	M35 x 1,5	32 H9	10	18,5	31,9 +0,162 −0,2	15	19	23	35	41,5	52	67,5±7,5	80	15°
20	M45 x 1,5	40 H9	20	24	39,9 +0,162 −0,2	22	21	27	45	55	70	91,5±8,5	110	20°
30	M60 x 2	55 H9	30	38,75	54,9 +0,174 −0,2	34	23	29	45	63	84	113,5±11,5	140	20°

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Unit dimensions: manifold mounting (nominal dimensions in mm)

Pressure relief valve

NS	B1	B2	ØD3	H2	L1	L2	L3	L4	L5	L6	L18	Port (P)	Weight
6	45	60	6,6	40	80	4	15	55	40	20	15	G1/4	approx. 1,5 kg
10	60	80	9	60	100	4	20	70	45	21	15	G1/2	approx. 3,7 kg
20	70	100	9	70	135	5,5	20	100	65	34	15	G3/4	approx. 8,4 kg
30	100	130	11	90	190	5,5	25	130	85	35	15	G1 1/4	approx. 13,5 kg

Subplates[1]

NS	Type	B3	B4	ØD5	ØD6	D7	ØD8	D9	ØD10	ØD11	H3
6	G300/01	45	60	7	11	M6	25	G1/4	6	7,5	25
10	(G301/01) G302/01	60	80	7	11	M8	(28) 34	(G3/8) G1/2	10	7,5	25
20	(G303/01) G304/01	70	100	11,5	17,5	M8	(42) 47	(G3/4) G1	(15) 20	7,5	40
30	(G305/01) G306/01	100	130	11,5	17,5	M10	(56) 61	(G1 1/4) G1 1/2	30	7,5	40

NS	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	T2	T3	T4	T5	T6	R1	Weight
6	110	9	94	22	55	10	39	42	62	65	15	1	15	9	15	6,5	25 *2	1,5 kg
10	135	10	115	27,5	70	12,5	40,5	48,5	72,5	80,5	15	1	(15) 16	9	15	6,5	30 *5	2 kg
20	170	15	140	20	100	20	(45) 42	54	85	(94) 97	15	1	20	13	(12) 22	6,5	40 *3	5,5 kg
30	190	12,5	165	17,5	130	22,5	42	52,5	102,5	(113) 117	15	1	24	11,5	22	6,5	55 *4	8 kg

[1] ⚠ Attention!
The stated subplates are not permitted for use with design tested safety valves in accordance to the pressure component directive 97/23/EC!

04

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Deviating technical data: design tested safety valve, type DBD, component series 1X in accordance to the pressure component directive 97/23/EC [1]

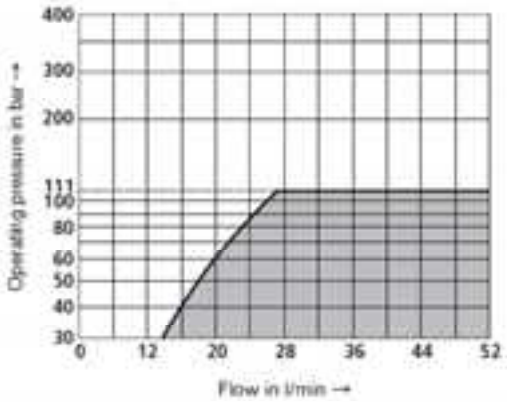
Hydraulic		
Maximum flow		See characteristic curves on pages 13 to 16
Pressure fluid		Mineral oil (HL, HLP) to DIN 51524 and DIN 51525
Pressure fluid temperature range	°C	–20 to +60 (for NBR seals) –15 to +60 (for FKM seals)
Viscosity value	mm²/s	12 to 230

[1] For applications outside these parameters, please consult us!

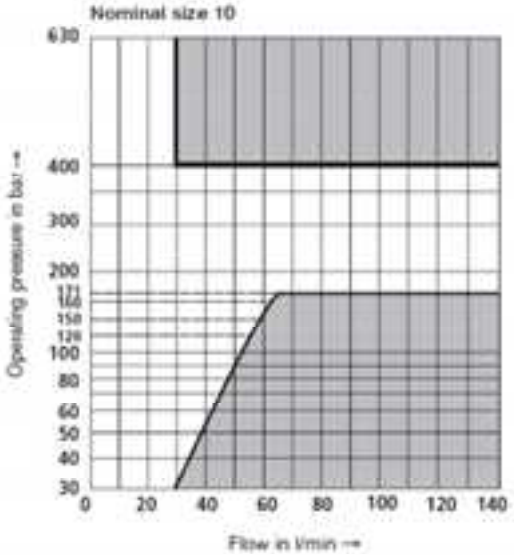
Characteristic curves: design tested safety valves type DBD, component series 1X in accordance to the pressure component directive 97/23/EC

Note!
Values which lie under the charateristic curve, in the dark area cannot be achieved with this valve!

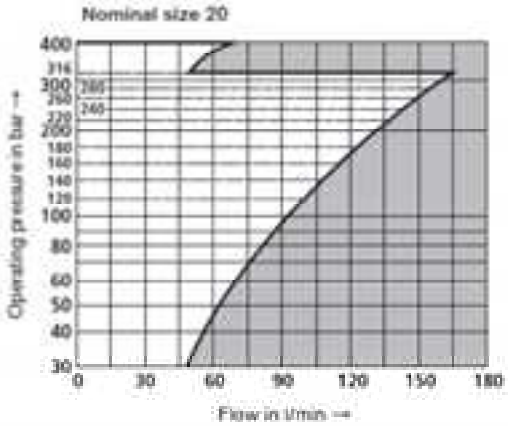
Nominal size 6



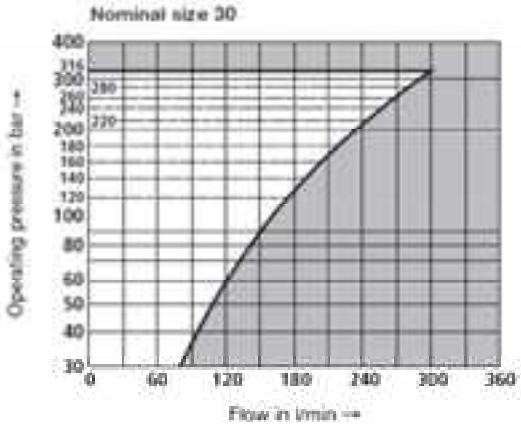
Nominal size 10



Nominal size 20



Nominal size 30



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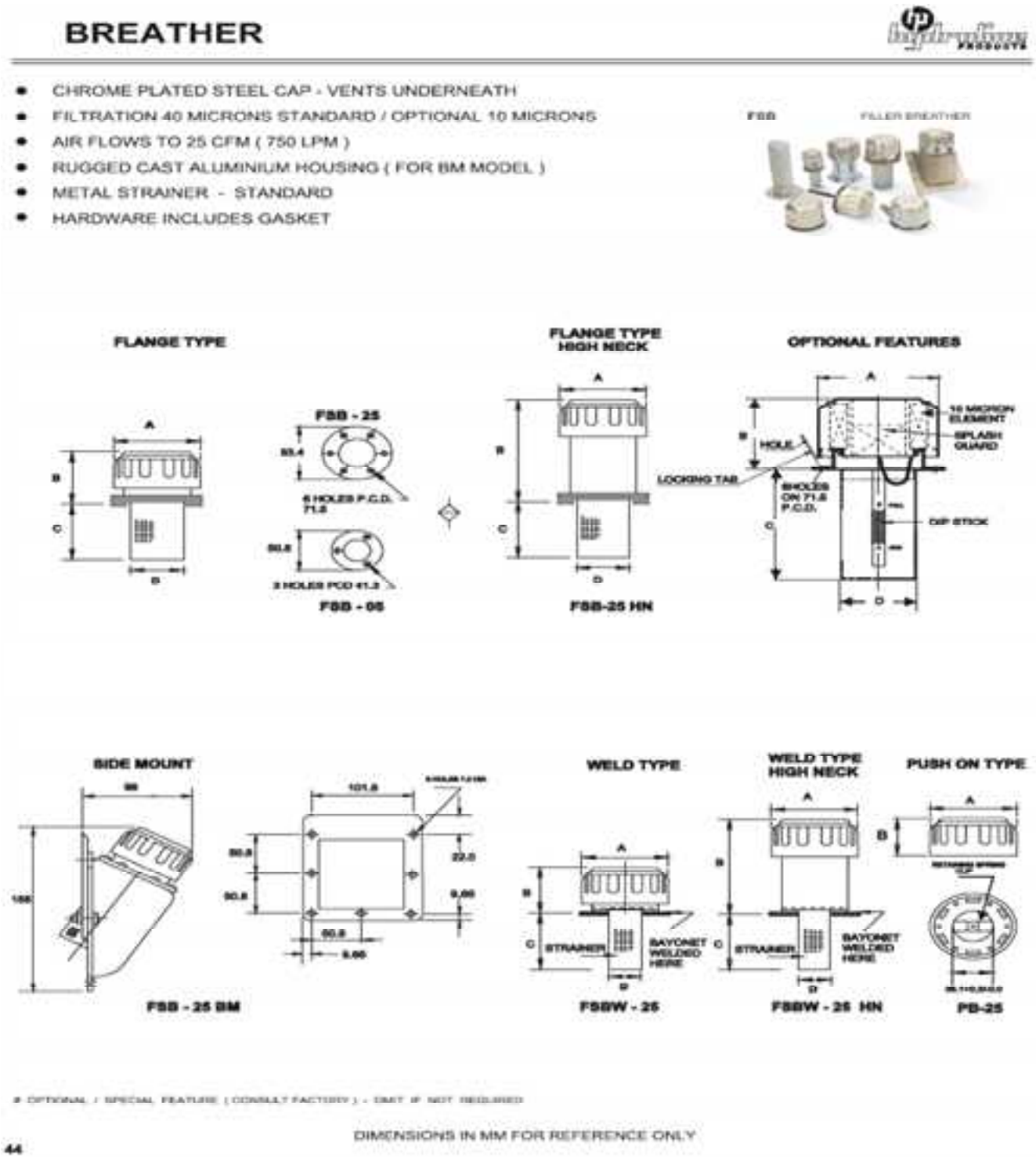
Chapter 10.10 AIR BREATHER:



44

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BREATHER

MODEL	DISPLACEMENT		RATING MICRONS	A	B	C	D	WT KGS
FSB - 05	150	LPM	40	45	49	65	28	0.10
FSB - 05 - 0	90	LPM	10					
FSB - 25	720	LPM	40	77	62	91	48	0.25
FSB - 25 - 0	400	LPM	10	77	62	91	48	0.25
FSBW - 25	720	LPM	40	77	62	91	30	0.25
FSB - 25-HN	720	LPM	40	77	122	91	48	0.40
FSBW - 25-HN	720	LPM	40	77	122	91	30	0.40
PB - 25	720	LPM	40	77	50	-	-	0.21

MODEL CODE ASSEMBLY

FSB	- 25	-	- BM	-	-
SERIES	CAPACITY CFM	FILTRATION MICRONS	FEATURE OPTIONAL (1)	STRAINER O OPTIONAL(2)	FEATURE SPECIAL
FSB	05	40 - STD		STD	D S - DIP STICK
FSB	25	10 - OPTIONAL	BM - SIDE MOUNT	# L - STD	L T - LOCKING TAB
				L - 102	D S - DIP STICK
FSBW			HN - HIGH NECK	L - 203	SG - SPLASH GUARD

OPTIONAL / SPECIAL FEATURE (CONSULT FACTORY) - OMIT IF NOT REQUIRED

DIMENSIONS IN MM FOR REFERENCE ONLY

Chapter 10.11 CIRCULAR LEVEL GAUGE:

BREATHER

MODEL	DISPLACEMENT		RATING MICRONS	A	B	C	D	WT KGS
FSB - 05	150	LPM	40	45	49	65	28	0.10
FSB - 05 - 0	90	LPM	10					
FSB - 25	720	LPM	40	77	62	91	48	0.25
FSB - 25 - 0	400	LPM	10	77	62	91	48	0.25
FSBW - 25	720	LPM	40	77	62	91	30	0.25
FSB - 25-HN	720	LPM	40	77	122	91	48	0.40
FSBW - 25-HN	720	LPM	40	77	122	91	30	0.40
PB - 25	720	LPM	40	77	50	-	-	0.21

MODEL CODE ASSEMBLY

FSB	- 25	-	- BM	-	-
SERIES	CAPACITY CFM	FILTRATION MICRONS	FEATURE OPTIONAL (1)	STRAINER (1) OPTIONAL (2)	FEATURE SPECIAL
FSB	05	40 - STD	BM - SIDE MOUNT	STD	D S - DIP STICK
FSB	25	10 - OPTIONAL		# L - STD	L T - LOCKING TAB
FSBW			HN - HIGH NECK	L - 152	D S - DIP STICK
				L - 203	SG - SPLASH GUARD

OPTIONAL / SPECIAL FEATURE (CONSULT FACTORY) - OMIT IF NOT REQUIRED

DIMENSIONS IN MM FOR REFERENCE ONLY

45

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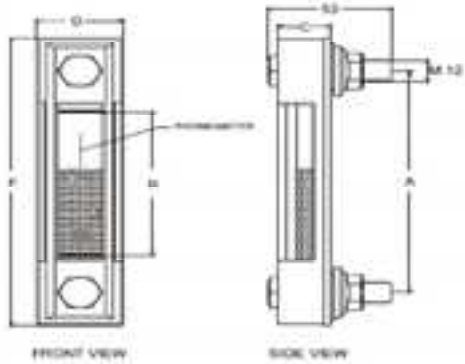
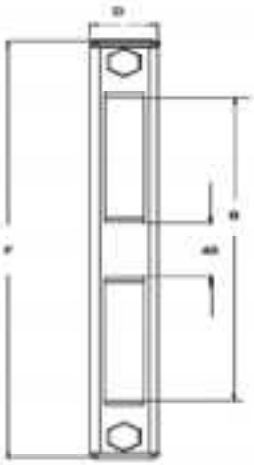
Chapter 10.12 LEVEL GAUGE

LEVEL GAUGE - LG 6

- 'O' RING TYPE CONSTRUCTION / STURDY DIE CAST COVER
- 3 SIZES 3", 5" & 10" BETWEEN BOLT CENTRES
- FOR NON PRESSURISED TANKS ONLY
- CAN BE MOUNTED ON TAPPED HOLES
- SUITABLE FOR MINERAL / PETROLEUM BASED OILS
- MAXIMUM TEMPERATURE 80° C



LG 6 - 03 & 05



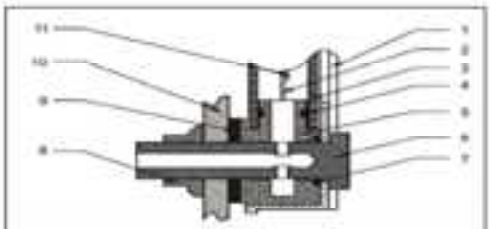
LG 6 - 10

MODEL	A	B	C	D	F	WT KGS
LG 6 - 03	76.2	32	23	35	111	0.23
LG 6 - 05	127.0	76	23	35	162	0.26
LG 6 - 10	254.0	200	23	35	289	0.36

MODEL CODE : ASSEMBLY

LG	- SS	T	- M 10	- X
SERIES	SIZE (INCH)	FEATURE (OPTIONAL #)	FEATURE (SPECIAL #)	FEATURE (OPTIONAL #)
LG 6	03 - 3"	T - THERMOMETER (OMIT IF NOT REQD.)	M12 - STD (M12 X 1.75 BOLT) Omit if 'M10'	No Nuts (For Fitting On Tapped Holes)
	05 - 5"		M10 - SPECIAL (M10 X 1.50 BOLT)	
	10 - 10"		UNC - SPECIAL (1/2" - 13 UNC)	

NOTE : BOLT TORQUE TO BE LIMITED TO 3 FT LBS
OPTIONAL / SPECIAL FEATURE - OMIT IF NOT REQUIRED



1	COVER
2	INDICATOR
3	TUBE
4	'O' RING (13.8 I.D. X 2.4 c.s.d.)
5	END PIECE
6	BOLT M12
7	'O' RING (12.0 I.D. X 3.0 c.s.d.)
8	NUT (FLANGED & SERRATED)
9	WASHER (27 O.D. 12 I.D. X 3 t)
10	TANK WALL
11	THERMOMETER (OPTIONAL)

DIMENSIONS IN MM FOR REFERENCE ONLY

1

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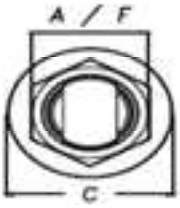
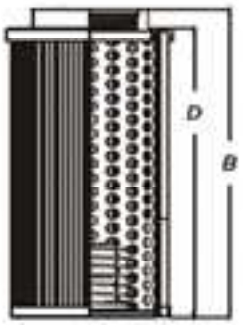
Chapter 7.13 SUCTION STRAINER:

SUCTION STRAINER - S C 3

- REUSABLE SS 100 MESH / 149 MICRON STD.
- ALUMINIUM DIE CAST NUT
- STEEL CAP / SUPPORT TUBE
- CONTINUOUS EPOXY BOND
- MAX. WORKING TEMP. 80° C.
- SUITABLE FOR HYDRAULIC / MINERAL OIL





MODEL NO	FLOW LPM	THREAD SIZE A	THREAD SIZE CODE	OVERALL LENGTH B	DIA NUT CAP LENGTH D	DIA NUT CAP C	NUT A/F	SCREEN AREA (SQ. CMS.)	WT KGS
SC3-003	6	1/4	02	90	77	46	24	187	0.10
SC3-003	12	3/8	03	90	77	46	24	187	0.10
SC3-005	20	1/2	04	105	92	46	30	226	0.10
SC3-007	25	3/4	06	109	94	64	35	406	0.20
SC3-010	40	1	08	139	124	64	46	542	0.20
SC3-015	60	1-1/4	10	139	125	86	51	929	0.30
SC3-020	80	1-1/2	12	168	154	86	60	1161	0.35
SC3-030	120	1-1/2	12	200	186	86	60	1393	0.40
SC3-040	160	2	16	235	220	100	70	1806	0.55
SC3-050	200	2	16	260	245	100	70	2032	0.60
SC3-075	300	2-1/2	20	211	186	150	90	2787	0.85
SC3-100	400	3	24	272	247	150	100	3677	1.00
SC3-150	600	3	24	345	320	150	100	4838	1.25

MODEL CODE : ASSEMBLY

SC3	-015	-**	-**	-**	-**	-**
SERIES	SIZE	PORT THDS. CODE SEE	PORT THDS. CONNECTION	MICRONS. OPTIONAL #	FEATURE. SPECIAL 1	FEATURE. SPECIAL 2
		REFER TABLE OMIT IF STD	B-BSPP - STD N-NPT - OPTIONAL	149 - SS 100 MESH - STD 125/100/74/43 - Microns OPTIONAL	RB3 - 3 PSI BYPASS Optional	

OMIT IF STANDARAD
CONSULT FACTORY, FOR OPTIONAL / SPECIAL FEATURE

DIMENSIONS IN MM FOR REFERENCE ONLY

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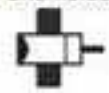
Chapter 7.14 PROXIMITY SENSOR:

Cylindrical Proximity Sensor E2K-X, Make: - OMRON, General purpose Threaded capacitive Sensor.

- Product Line up with M12, M18, and M30 Models.
- Fixed sensing distance requires no sensitivity adjustment.

Ordering information
Sensors

Appearance		Sensing distance	Output configuration	Model	
				Operation mode	
				NO	NC
Unshielded 	M12	4 mm	DC 3-wire, NPN	E2K-X4ME1 2M	E2K-X4ME2 2M
			AC 2-wire	E2K-X4MY1 2M	E2K-X4MY2 2M
	M18	8 mm	DC 3-wire, NPN	E2K-X8ME1 2M	E2K-X8ME2 2M
			AC 2-wire	E2K-X8MY1 2M	E2K-X8MY2 2M
	M30	15 mm	DC 3-wire, NPN	E2K-X15ME1 2M	E2K-X15ME2 2M
			AC 2-wire	E2K-X15MY1 2M	E2K-X15MY2 2M

Sensing Objects

The maximum sensing distance will decrease if the sensing object is a non-grounded metal object or dielectric object.

- Sensing Object Material the E2K-X can detect almost any type of object. The sensing distance of the E2K-X, however, will vary with the electrical characteristics of the object, such as the conductance and inductance of the object, and the water content and capacity of the object. The maximum sensing distance of the E2K-X will be obtained if the object is made of grounded metal.
- There are objects that cannot be detected indirectly. Therefore, be sure to test the E2K-X in a trial operation with the objects before using the E2K-X in actual applications.

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Ratings and specifications

Item	Model	E2K-X4ME□, E2K-X4MY□	E2K-X8ME□, E2K-X8MY□	E2K-X15ME□, E2K-X15MY□
Sensing distance		4mm ±10%	8 mm ±10%	15 mm ±10%
Set distance *1		0 to 2.8 mm	0 to 5.6 mm	0 to 10 mm
Differential travel		4% to 20% of sensing distance		
Detectable object		Conductors and dielectrics		
Standard sensing object		Grounded metal plate: 50 × 50 × 1 mm		
Response frequency		E Models: 100 Hz, Y Models: 10 Hz		
Power supply voltage*2 (operating voltage range)		E Models: 12 to 24 VDC (10 to 30 VDC) Y Models: 100 to 220 VAC (90 to 250 VAC)		
Current consumption		E Models: 15 mA max.		
Leakage current		Y Models: 2.2 mA max. (Refer to page 4.)		
Control output	Load current	E Models: 200 mA max.*2, Y Models: 10 to 200 mA		
	Residual voltage	E Models: 1 V max. (Load current: 200 mA, Cable length: 2 m), Y Models: Refer to *Engineering Data* on page 4.		
Indicators		E Models: Detection indicator (red), Y Models: Operation indicator (red)		
Operation mode (with sensing object approaching)		E1/Y1 Models: NO E2/Y2 Models: NC Refer to the timing charts under *I/O Circuit Diagrams* on page 4 for details.		
Protection circuits		E Models: Reverse polarity protection, Surge suppressor, Y Models: Surge suppressor		
Ambient temperature range		Operating/Storage: –25 to 70°C (with no icing or condensation)		Operating/Storage: –10 to 55°C (with no icing or condensation)
Ambient humidity range		Operating/Storage: 35% to 95% (with no condensation)		
Temperature influence		±20% max. of sensing distance at 23°C in the operating temperature range		
Voltage influence		E Models: ±2% max. of sensing distance at rated voltage at rated voltage ±20% Y Models: ±2% max. of sensing distance at rated voltage at rated voltage ±10%		
Insulation resistance		50 MΩ min. (at 500 VDC) between current-carrying parts and case		
Dielectric strength		E Models: 1,000 VAC, 50/60 Hz for 1 min between current-carrying parts and case Y Models: 2,000 VAC, 50/60 Hz for 1 min between current-carrying parts and case		
Vibration resistance		Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions		
Shock resistance		Destruction: 500 m/s² 3 times each in X, Y, and Z directions		
Degree of protection		IP66 (IEC), in-house standards: oil-resistant		
Connection method		Pre-wired Models (Standard cable length: 2 m)		
Weight (packed state)		Approx. 65 g	Approx. 145 g	Approx. 205 g
Materials	Case	Heat-resistant ABS		
	Sensing surface			
	Clamping nuts	Polyacetal		
Accessories		Instruction manual		

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Chapter 7.15Timing Chain:

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