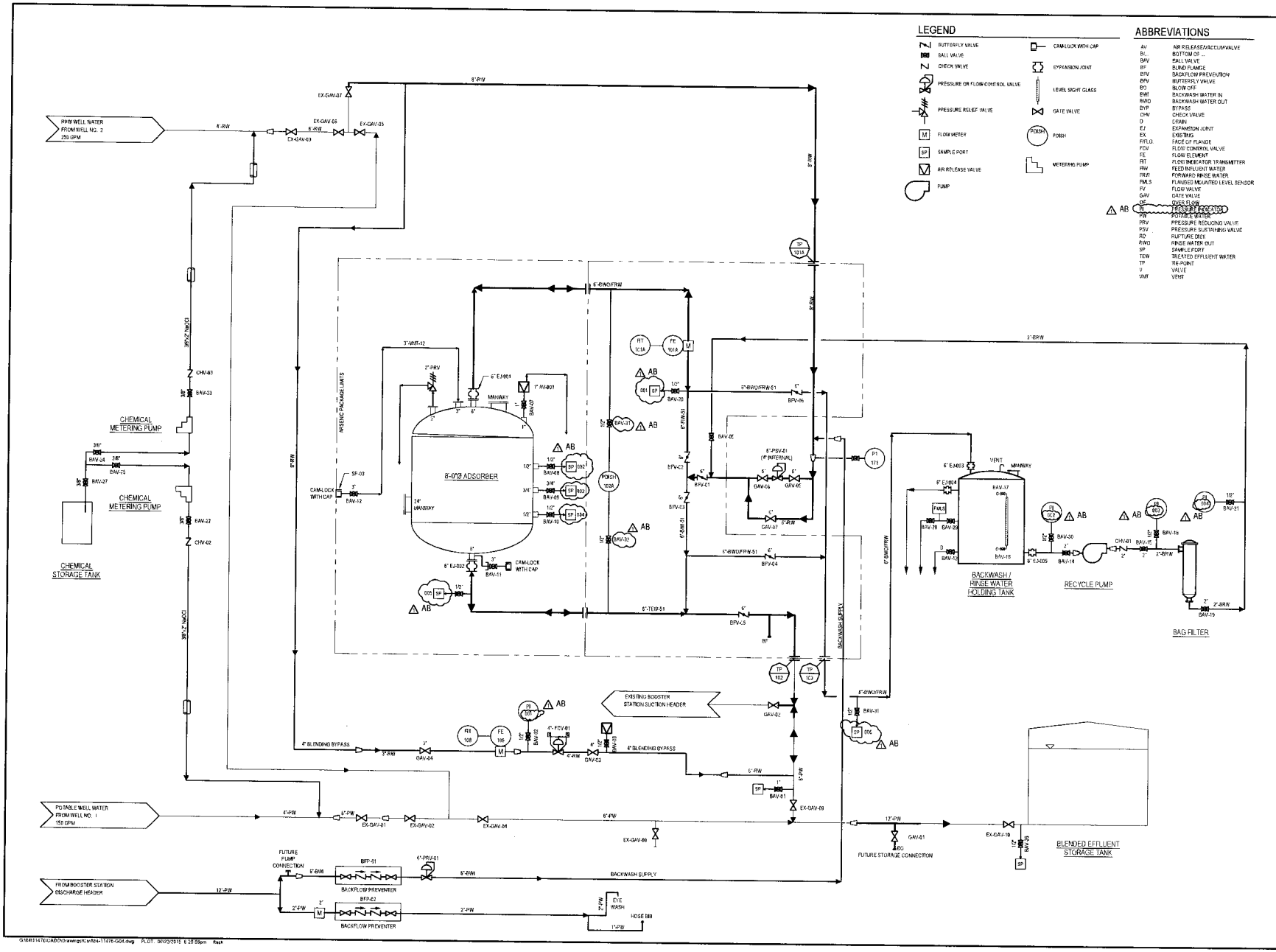
Arizona Water Company
W-01445A-15-0277

Amendment to Application

PART 7 OF 12

Appendices

Appendix A – Process Flow Diagram



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REVISIONS: ASE 2015 AB-BLDS

The installation shown is to be installed in accordance with Arizona Water Company standard specifications on file with the Arizona Department of Environmental Quality

P.E. No.:

STAMP:

LEGAL DESC.: SEC 17 - T5S - R9E

AZ 1811:

DATE: 12/17/2014

DRAWN BY: S.JS

SCALE: NTS

CHECKED BY: FHT

PROJECT DESC.: VALLEY FARMS ARSENIC REMOVAL FACILITY
10604 E. VAH KI INN ROAD - VALLEY FARMS, AZ 85191

PROJECT SHEET DESC.: PROCESS FLOW DIAGRAM

ENG. No.: G4

SHEET 4 OF 25

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Appendix B – Blending Plan

Scenario 2 Blending								
Effluent Concentration (ppb)	Well 1 Flowrate (gpm)	Well 1 Concentration (ppb)	Well 2 Flowrate (gpm)	Well 2 Concentration (ppb)	Bypass Flowrate (gpm)	Treated Flowrate (gpm)	Total Flowrate (gpm)	Goal Concentration (ppb)
3	0	3.5	250	14.5	87	163	250	7.0
4	0	3.5	250	14.5	71	179	250	7.0
5	0	3.5	250	14.5	53	197	250	7.0
6	0	3.5	250	14.5	29	221	250	7.0
7	0	3.5	250	14.5	0	250	250	7.0

Scenario 3 Blending								
Effluent Concentration (ppb)	Well 1 Flowrate (gpm)	Well 1 Concentration (ppb)	Well 2 Flowrate (gpm)	Well 2 Concentration (ppb)	Bypass Flowrate (gpm)	Treated Flowrate (gpm)	Total Flowrate (gpm)	Goal Concentration (ppb)
3	150	3.5	250	14.5	132	118	400	7.0
4	150	3.5	250	14.5	121	129	400	7.0
5	150	3.5	250	14.5	107	143	400	7.0
6	150	3.5	250	14.5	91	159	400	7.0
7	150	3.5	250	14.5	70	180	400	7.0

Appendix C - Process Description

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 4 PROCESS DESIGN DESCRIPTION

SEVERN
TRENT
SERVICES

Severn Trent Water Purification, Inc.
SORB 33® As Removal System – Project 22643

□□□□E□□ □E□□□□T□□□

□□□□□F□r□ □W□□□□□□□ □ □r□□□□□W□□□r □□□ □□□□

□□□□r□ Tr□□□□□r□□□□ Ste. 102, 5415 W. Sligh Avenue, Tampa, FL 33634 USA www.severntrentservices.com

Chapter 1 □T□□□□□T□□

1.1 □r□□□□ □□□ □□□□□□□□□ □□□□r□□□□

The SORB 33® Arsenic Adsorption System is a commercially available product specifically designed for arsenic (chemical symbol – □□) removal for small systems at the wellhead. SORB 33® products are standard packaged systems engineered for arsenic removal. A central component of the integrated SORB 33® system is the Bayoxide® E33 iron-based adsorption media developed and manufactured by Lanxess specifically for the removal of arsenic from drinking water. The granular ferric oxide media exhibits a high capacity for arsenic adsorption and, unlike other iron-based media, is delivered in a dry crystalline form. The E33 media is robust, easy to handle, stored and shipped dry and has NSF 61 approval for use in drinking water.

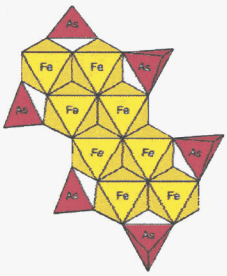
Water from the source well is pumped through a vessel, called an adsorber, containing the media. As the water passes through the fixed bed of media, the arsenic is reduced to well below 10 micrograms per liter (μ□□) (the US EPA's Maximum Contaminant Level) until the media reaches its capacity. The spent media, which will pass the EPA's TCLP test for toxicity, is then removed and disposed of as non-hazardous waste. Unlike several other arsenic removal technologies, there is no chemical regeneration or flocculation, making the process simple, reliable, and minimizes labor. The media's high capacity for arsenic enables long operating life (typically 6 to 36 months between media change-outs depending on well usage), thus minimizing operational attention requirements.

1.2 □r□□□□ □d□□r□□□□ □□□□ □□r□

□r□□□□ **F□r□ □ □** □□□□□□□□□□: Arsenic in ground water is generally found in one of two inorganic valence states – As^{+3} or arsenite, □□□□□, and As^{+5} or arsenate, □□□). The more common and stable form is As(V). It exists in two ionic forms depending upon the water's pH. It is present in an oxidizing environment, i.e., where the electromotive force (EMF) or ORP of the water is positive or slightly negative. As(III) exists where the EMF is more negative. It readily oxidizes to Arsenic (V) when exposed to air or to a disinfecting oxidant. As a rule of thumb, Arsenic (III) will be found in waters containing higher levels of iron and/or manganese.

□**d**□□**r**□□□□ □□□□□□□: Severn Trent Services' SORB 33® Arsenic Removal Process is a fixed bed adsorption system using a granular ferric oxide media, or adsorbent, called Bayoxide® E33 for the adsorption of dissolved arsenic onto the solid media. It employs a simple "□□□ □ □ **Tr**□□□" process that flows pressurized well water through a fixed bed pressure vessel containing the media where arsenic removal occurs.

In the SORB 33 Process, both As(III) and As(V) oxyanions are removed from water via a combination of adsorption or occlusion (adhesion) by reaction with ferric oxide ions. Above pH 7, the primary mechanism is the adsorption of arsenic oxyanions ($HAsO_3$) to the surface hydroxyl groups of ferric oxide hydroxide (FeO-OH) as illustrated here:



Adsorption is a continuous process conducted at a specific flow, or loading, rate, normally about 7 gpm/ft², downward through the fixed bed adsorber for operating periods of about 1-4 months on-stream duration. In addition to specific flow rate, the other key process parameter is empty bed contact time (E□□T). This variable dictates the amount of water contact time within the bed required to effectively complete arsenic adsorption; the typical design value is 3.5 minutes.

The media adsorbs As(V) with rapid kinetics, but will also adsorb As(III) more slowly. Arsenite is nonionic at normal water pH's, and therefore, it will not be adsorbed as an anion. Adsorption kinetics for As(III) are slower than that of As(V), most likely because it is first oxidized by the media to As(V) before it is adsorbed.

1.3 □r□□□□□ □d□□r□□□□□ □□r□□r□ □□□□

Arsenic removal performance via adsorption is illustrated graphically using a "Breakthrough Curve" such as the one shown below. Performance of an adsorbent is measured by the number of bed volumes of water that can be treated with one bed volume (□□) of media before it exhausts, i.e. can no longer adsorb arsenic efficiently. The adsorption curve below is the predicted performance for Bayoxide E33 media used to treat the water. The projected volume per vessel in the table below represents the concentration at which the treated water's Arsenic level is nearing the MCL of 10 μg/L. This is called the breakthrough point.

Monitoring of SORB 33 performance is done by routine analysis of the treated water. Initially, this can be done on a monthly basis. As the treated water Arsenic level increases, this frequency is increased to semi-monthly so as to be able to schedule media replacement as close to the breakthrough point as possible without exceeding the MCL.

Figure □ is the breakthrough curve for each of the adsorbers. Based upon pilot test results, the media can treat 83.1 million gallons (71,200 BV's).

Bayoxide E33 performance is unlike breakthrough curves for water softening resins or other adsorbents, which breakthrough rapidly to influent levels leaving little time for media change-out. Using Bayoxide E33, arsenic will continue to be adsorbed even after it exceeds the MCL.

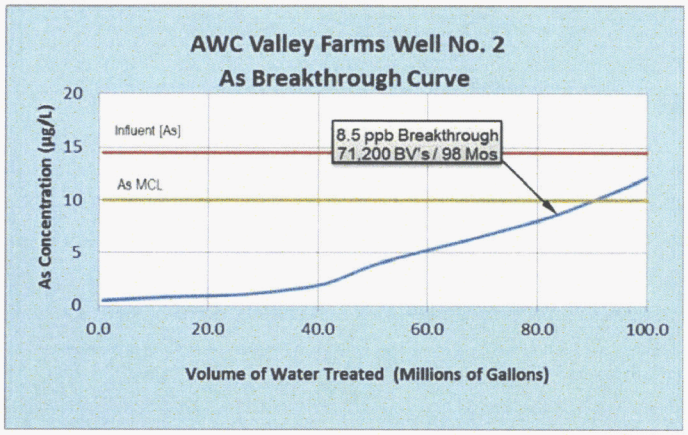


Figure □

1.4 W□□r □□□□□□□□ □ □□□□□ □□r□□ □□□r □□□□

The constituent's analysis (assays) in the water used to determine the SORB 33 system performance is listed in Table □. Assay values not reported are listed as not available (□□□).

pH			Alkalinity		ppm	Chromium		ppb Cr
EMF (ORP)		mV	Chloride		ppm Cl^-	Iron		ppb Fe
Water Temp.		°F	Fluoride		ppm F	Manganese		ppb Mn
Arsenic		ppb As	Hardness		ppm	Selenium		ppb Se
As(III)		ppb As	Phosphate		ppm PO_4	Tungsten		ppb W
TTI Dissolved Solids		ppm	Silica		ppm SiO_2	Uranium		ppb U
Turbidity		NTU	Sulfide		ppb S	Vanadium		ppb V

Table □

General system information and system design parameters at minimum treatment flow are shown below in Table □□. Table □□ reflects the system at maximum treatment flow with no bypass. Each of the key variables including system size, media volume, performance, service and backwash rates are listed in this table.

Client:	□r□□□□ W□□r □□□ □□□□	Average Flow:	□□□□ MGD Avg
Name of Site:	Valley Farms - Well 2	Well Capacity:	□□□ gpm
Primary Contact:	Jeff Pals	Treatment Flow:	□□□ gpm
Engineer:	GHD	Op Factor: 2.4 Hrs/Day or	23.8% Bypass

SORB 33® Model No:	EAS-3008	Contact Time (EBCT) & Bed Depth:	6.1 Min / 3.1 ft
Adsorber No & Size:	One 8.0 ft Diameter	Average Treatment Rate:	36,360 gals/Day
System Footprint:	10'L x 10'W x 12'H	Design Flow Rate per Adsorber:	190 gpm
Flow Configuration:	Parallel w/ Bypass	Loading Rate (Specific Velocity):	3.8 gpm/ft^2
Adsorptive Media:	Bayoxide E33 Granules	Estimated Working Capacity:	71,200 BV's
Media Quantity:	4,968 lbs (2.25 MT) 156 cubic ft	Media Cycle Life:	98.6 Months
Backwash Volume:	7,150 gals/vessel	Volume Treated per Cycle:	83.1 million gals
SORB Backwash Rate:	550 gpm	Arsenic Analysis:	□□□ µg/L As
pH Adjustment:			
Special Features:		Pres:	100 psig

Table □□

Client:	[illegible]	Average Flow:	[illegible] MGD Avg
Name of Site:	Valley Farms - Well 2	Well Capacity:	[illegible] gpm
Primary Contact:	Jeff Pals	Treatment Flow:	[illegible] gpm
Engineer:	GHD	Op Factor: 2.4 Hrs/Day or [illegible]	0.0% Bypass

SORB 33® Model No:	EAS-3008	Contact Time (EBCT) & Bed Depth:	4.7 Min / 3.1 ft
Adsorber No & Size:	One 8.0 ft Diameter	Average Treatment Rate:	36,360 gals/Day
System Footprint:	10'L x 10'W x 12'H	Design Flow Rate per Adsorber:	250 gpm
Flow Configuration:	Parallel w/ Bypass	Loading Rate (Specific Velocity):	5.0 gpm/ft^2
Adsorptive Media:	Bayoxide E33 Granules	Estimated Working Capacity:	71,200 BV's
Media Quantity:	4,968 lbs (2.25 MT) 156 cubic ft	Media Cycle Life:	75.1 Months
Backwash Volume:	7,150 gals/vessel	Volume Treated per Cycle:	83.1 million gals
SORB Backwash Rate:	550 gpm	Arsenic Analysis:	[illegible] µg/L As
pH Adjustment:			
Special Features:		Pres:	100 psig

Table [illegible]

1.5 [illegible]

Safety at a water treatment site is of no less priority than the importance of good operation and maintenance of a plant. The STWP SORB System is designed and constructed with the understanding that safety features are inherent in the physical facilities of the plant. The OSHA standard has been the guideline for the system during design and construction. The operators of the system should also observe it.

Severn Trent recommends the system owners and operators draft Standard Operating procedures (SOP's) to address any routinely performed procedures with safety acknowledgements of the task incorporated. These tasks include valve position changes, backwashing, rinsing, treatment valving, etc.

Chapter 2 □□□□E□□ □□E□□T□□□

The following sections describe each of the water treatment steps with the equipment provided by Severn Trent Water Purification. Other equipment not provided by STWP should be referenced by the other vendors' documentation.

The Valley Farms SORB 33® Arsenic Removal System consists of the following equipment supplied by STWP:

- One 8'-Ø SORB 33® adsorber operated manually

2.1 □d□□r□□□□□ Tr□□□□ □□□

Arsenic removal via adsorption is done by a downward flow of water through a fixed bed of media contained in a pressure vessel. SORB 33® adsorption units are designed to match well pump capacities unless otherwise specified by the client.

Flow meter (FIT-101A) in the feed line totalizes the volume of well water being fed to the vessel. It is important to record the totalizer reading when media is replaced in the vessel, because the media life and performance are determined by the volume of water treated prior to breakthrough. Routine arsenic analysis of treated water samples is used to monitor treatment performance and determine when the media must be replaced.

As water is treated through the adsorbers, the pressure differential ("d□□□□□" or Δ□), measured by the differential pressure switch (PDIS-102A) and confirmed by pressure instruments (PI-171 & PI-172), will slowly increase across the vessel. The vessel should be taken off-line for media backwashing when its ΔP increases above 10 psi.

Figure □ is a simplified piping & instrumentation flow diagram of the treatment process, based upon the 250 gpm design in Table □.

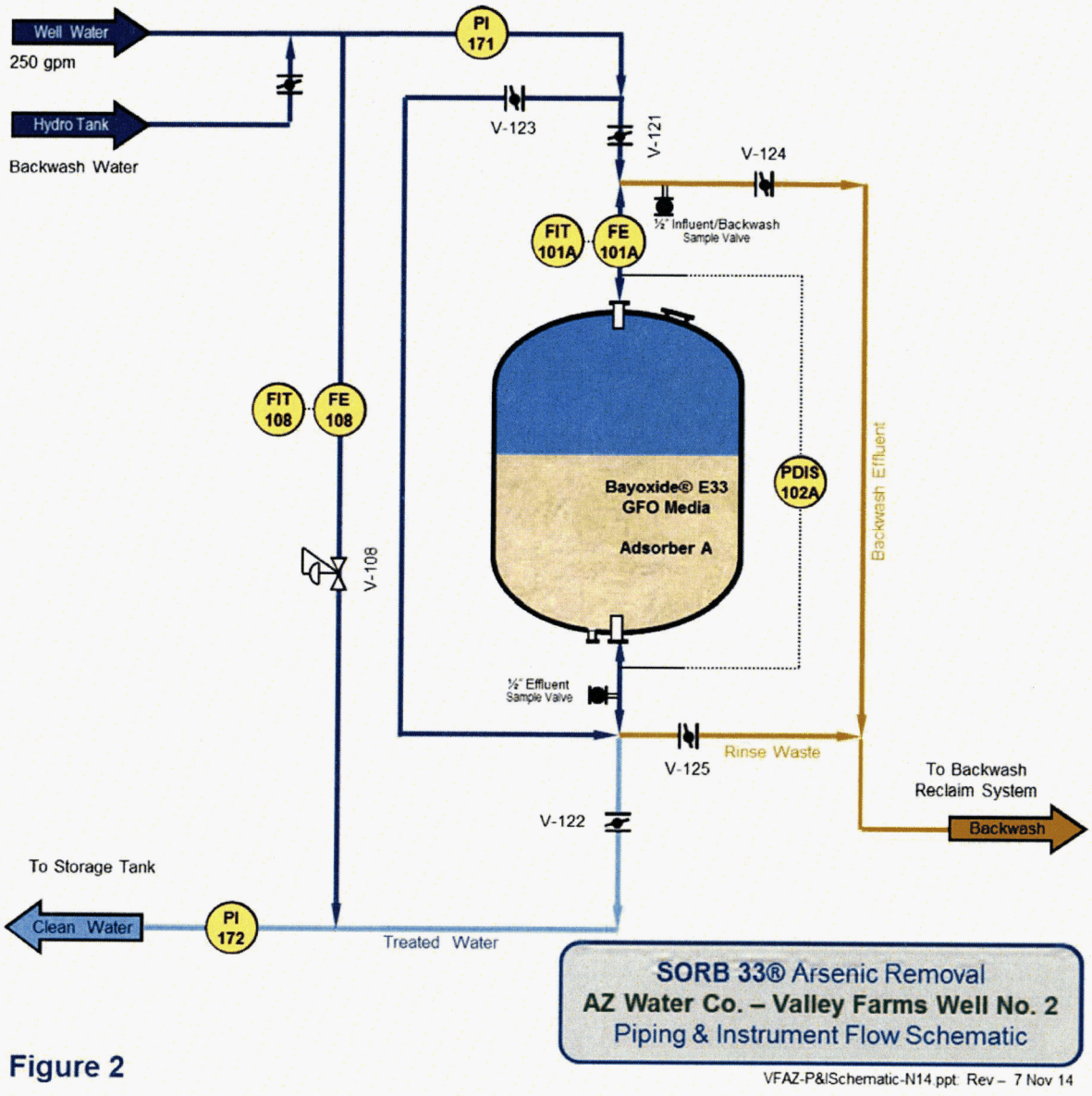


Figure 2

2.2 M□d□ □□□□□ □□□ □□d □□□□

Adsorber backwash events are initiated by the operator based upon an increasing differential pressure through the vessel. The differential pressure is measured by the difference between the influent and effluent pressure gauges, PI-171 and PI-172. The differential pressure switch will send a signal once a DP of 10 psi has been reached.

Table □ describes the step by step sequence of operations during the adsorption cycle and backwash events. The positions of the valves in each of the service and backwash steps are listed further below in Table □.

Valve & Loop Nos	Step No			Action: Auto or Manual
V-121A V-122A	1	Adsorber Valves	Open Raw Water Feed Valve and Treated Effluent Water Valve to allow service flow to the adsorber	M
V-108			Throttle Bypass Valve to control correct amount of treatment bypass	M
FIT-101A			Flowmeter measures adsorber feed flow and totalizes volume treated	
V-121A V-122A V-123A V-124A V-108	2	Backwash Sequence	Turn off well. The backwash will be supplied by a hydro tank Open Backwash Water Influent Valve and Backwash Waste Effluent Valve Close Raw Water Feed Valve, Treated Effluent Valve, and Bypass Valve Open backwash water supply	M
V-123A V-124A	3	Backwash Sequence	Throttle backwash water supply valve to control the backwash rate at Continue backwash for . Sample effluent every 2 min for clarity and to ensure no media is backwashed out of the adsorber.	M
V-121A V-123A V-124A V-125A	4	Backwash Sequence	Turn close the backwash water supply valve Open RWF Valve and Forward Rinse Out Valve Close BWI Valve and BWE Valve	M
V-121A V-125A	5	Forward Rinse	Throttle the backwash water supply valve to control the rinse rate at Continue rinse for . Sample effluent for clarity	M
V-121A V-122A V-125A V-108	6	Backwash Sequence	Turn close the backwash water supply valve Open TEW Valve Close RWO Valve Open and throttle bypass valve Turn on well to begin service	M

Table

Valve & Loop Nos	Step No	Service Mode	Backwash	Rinse	Unit	
		Adsorber Valves				
V-121A		RWW - Raw Water Feed				
V-122A		TEW - Treated Effluent Water				
V-123A		BWI - Backwash Water Influent				
V-124A		BWE - Backwash Waste Effluent				
V-125A		RWO- Forward Rinse Waste				
		Common Valves				
V-108		TBW - Treatment Bypass Water	T			
		- Open; - Close; T - Throttle				

Table

2.3 □□□□□□ M□□□□r□□□ □ □□□ □□□□

The SORB 33 System is designed be operated unattended except when backwashes are conducted. The flow rates and pressure differential of the adsorber should be checked on a routine basis.

The treated effluent quality should be visually checked routinely. Also, the adsorber backwash effluents should be checked every time to observe the dirt load in the initial effluent after 2 minutes of backwashing and near the termination of each backwash. The initial samples should be turbid or red with solids. The terminal samples should be light orange in turbidity. The forward rinse effluents from each filter should be checked 1 minute after rinse flow has started. This effluent should be clear.

The following sampling and analysis schedule is recommended. Field test kits are adequate for analyses:

- Treated effluent from the adsorber: As – twice per month
- Feed Water: As – once per month; pH - daily
- Backwash Effluent: Qualitative Solids Level of initial & terminal backwashes, rinse – every event.

2.4 □□□d□□ □□□□ □ □r W□□□ □□

While the media removes arsenic to non-detect levels (< 2 ppb) for the first 25%-50% of the bed's life, STS uses a conservative effluent concentration of 3 ppb to prevent any chance of exceeding the maximum blend target. As the effluent arsenic increases, the bypass will have to be decreased to meet the blend target of 7 ppb arsenic.

The following schemes to blend treated and untreated well water are dictated by the following treatment scenarios.

W□□□ □ □□

$$(Q_{bypass} * C_{bypass}) + (Q_{treated} * C_{treated}) = (Q_{blend} * C_{blend})$$

1. Minimum Treatment Flow for Well 2
    a. 164 gpm treated
    b. 86 gpm bypassed (34%)

2. Maximum Treatment Flow for Well 2
    a. The bypass must be closed once the effluent arsenic concentration meets the target blend concentration (7 ppb in this case)
    b. 250 gpm treated
    c. 0 gpm bypassed (0%)

W□□□ □ □ □

$$(Q_{bypass} * C_{bypass}) + (Q_{treated} * C_{treated}) + (Q_{well1} * C_{well1}) = (Q_{blend} * C_{blend})$$

3. Minimum Treatment Flow for Well 2 (Well 1 fully bypasses system)
    a. 117 gpm treated
    b. 133 gpm bypassed (53%)

4. Maximum Treatment Flow for Well 2 (Well 1 fully bypasses system)
    a. Despite reaching an effluent arsenic concentration of 7 ppb, some water can still be bypassed due to Well 1's low level of arsenic (3.5 ppb)
    b. 180 gpm treated
    c. 70 gpm bypassed (28%)

Appendix D - Media Information

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 3 MEDIA INFORMATION

A. BAYOXIDE E33™
B. PREPARATION & HANDLING
C. MSDS
D. SPECIFICATIONS
E. NSF CERTIFICATION

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 3 **MEDIA INFORMATION**

BAYOXIDE E33™

A. PREPARATION & HANDLING

SEVERN TRENT SERVICES

Severn Trent Water Purification, Inc.
SORB 33® As Removal Systems

M□d□ □r□□□r□□□□ □ □□d□□ □r□□□d□r□□

□□ ME□□ □T□□□E

1. Until installation, Bayoxide® E33 As media should be stored in original shrink-wrapped bags, in a dry warehouse or covered securely with tarps. Bags should be stored on pallets to keep them off the ground.
2. If media support gravel is to be used, it should also be stored similarly to the E33 media.
3. Any small tears in bags from unloading or delivery should be sealed with duct tape.
4. Damage to bag lifting loops may require rebagging to permit safe handling later.
5. Inspect bags periodically to make sure rodents or insects have not damaged them.

□□ □E□□□T□ F□□ □T□T□□

1. Have Severn Trent Services review operating manual, backwash sequence, and control design before plant start-up.
2. Flush and disinfect all process piping and vessels. Make sure any fine passages in underdrain components do not become plugged with debris.
3. Backwash water source should be clean potable water containing no chemical other than chlorine. If other chemicals are present, such as pipe corrosion inhibitors, they could adsorb onto the media and shorten its life. Have Severn Trent Services review any proposed chemical additions.
4. Hydrotest all piping and tanks.
5. Test all valves and calibrate control equipment.
6. Test backwashing sequence before adding gravel or media to adsorber vessels.
7. Set backwash water rate at no less than 10 gpm/ft² and no more than 13 gpm/ft² with the upper value preferred for initial backwash. It is very important that flowmeter calibration (mag meters excluded) be verified by an independent method such as rise rate tests inside the empty adsorber vessel (16 to 19.25 inches/minute) or in another tank such as the backwash reclaim tank (rise rate diameter dependent).
8. Backwash water source should be flow-regulated with maximum flow positively limited to prevent too high a rate.
9. Control action should bring backwash flow up from zero flow in a controlled manner, to prevent water hammer to the media or gravel.
10. Control action should also be smooth when starting or stopping regular forward flow to an adsorber, again to prevent water hammer to the media or gravel. Water hammer can crush the media over time.
11. Check stored support gravel for contamination. Discard contaminated gravel. Add support gravel and backwash as required.
12. Leave adsorber vessels 2/3 full of water for media installation.

Preparation

1. All media is to be saturated fully with chlorine prior to being put into service. Media will adsorb approximately 12-15 grams of free chlorine (Cl_2) per cubic foot of media.
   For calculating chlorine, saturation is assumed at 13.0 grams Cl_2 per cubic feet of media
2. NSF approved 12.5% Sodium Hypochlorite should be used to saturate the media and is added directly to the 2/3 full of water vessel.
3. Calculate the concentration of chlorine in ppm required for saturation in the vessel
   a. Volume of media per vessel in cuft. x 1.5 x 7.48 (gal/cuft) = approximated volume of water in the vessel

$$\text{M Fr} = \frac{\text{cuft (media per vessel) x } 13.0 \text{ g/cuft (g Cl2 / cuft media) x } 1000 \text{ (mg Cl2 / g Cl2)}}{\text{gal. water per vessel x } 3.78 \text{ (gal water / Liter)}}$$

   b. Calculate the required gallons of 12.5% sodium hypochlorite solution to be added <u>per vessel</u>

$$= \frac{\text{calculated ppm of free chlorine} \times \text{gal. water per vessel}}{143{,}946 \text{ (conversion factor)} - \text{calculated ppm of free chlorine}}$$

4. Add the calculated gallons of 12.5% hypochlorite solution directly to the vessel and mix with a shovel or rake. Allow for the solution to mix for 5-10 minutes. Water is ready for the media to be added. All media must be submerged under water after adding.

Media Handling

5. Take care not to damage bag lifting loops with sharp edges from forklifts or from rough handling. Bags with damaged lifting loops either must be rebagged or remain on the original pallet and be installed more slowly under careful supervision by cutting the sides of the bag.
6. Crane straps or cables should be at least 10 feet long to prevent lifting straps from being at sharp angles during lifting. Four lifting cables or straps will be needed, one for each bag lifting loop.
7. As bags are lifted off pallets, sweep off any debris on the bottom of the bags. Small abrasion tears from moving may be sealed with duct tape. If holes are due to animal or insect infestation, the media may be contaminated and should be inspected carefully.
8. Position bag over the top manhole of the adsorber vessel. Untie the elephant trunk that is folded up on the bottom of the bag. A loop of rope may be tied around the trunk to control the flow of media from the bag.
9. Dusk masks should be worn to avoid breathing the non-hazardous media dust.
10. Untie the first trunk seal cord, and extend the trunk into the manhole. Open the second upper trunk seal cord, and allow the media to fall into the water inside the adsorber. A large funnel may be used but may not be necessary if the trunk extends down past the manhole opening.

11. Install the required number of bags of media.
12. Level the media in the vessel with a rake or shovel so that all the media is covered with water. Close and seal the top manhole. Allow to soak at least 3 hrs, preferably overnight, to allow the media to become saturated with chlorine and water.

E□ □i□T□□ □□□□W□□□

1. Set up each adsorber for backwash. Begin backwash water flow, ramping up smoothly from zero to maximum flow over a 2 minute period.
2. Backwash the new media at up to 13 gpm/ft² to remove fines. This process may take 20 minutes or longer the first time. Initial color of the water will be dark red just like the media. Normal sized media will not be discharged if the correct backwash water rate is used.
3. Take samples of dirty backwash water after backwash start at 1, 3, 5, 10, 15, 20, and 25 minute intervals (and perhaps longer) in clear sample bottles or other clear containers to determine that full size media particles are not being discharged, and to determine when the water clarity has improved as much as possible.
4. When two consecutive samples are nearly without color and are similar in appearance, cease backwashing by smoothly ramping backwash water flow down to zero over a 2 minute period.
5. After initial backwash, it is recommended that initial media levels be checked in all of the adsorbers for future reference. The bed surface is leveled and media height is expanded about 7% by backwashing, so future measurements should also be taken after backwashing.

F□ □T□□T□□ □□□ □□E□□T□□

1. After initial backwash, the adsorber should be run in the forward flow mode at its normal service flowrate with the initial effluent discarded to sewer, ditch or dirty backwash tank for 3 to 5 minutes. This allows effluent turbidity to drop quickly to normal levels, and prevents small particles loosened by backwashing to be discharged to the distribution system. This is also recommended practice for subsequent backwashes as well.
2. Ongoing monitoring should include flow rate, influent and effluent arsenic concentration, differential pressure across the media and amount of water treated (recorded in bed volumes – volume the media bed displaces in an adsorber).
3. High differential pressure across the adsorber can cause the media to be crushed. Backwashes should be scheduled before differential pressure reaches 10 psi or if effluent arsenic begins to rise (evidence of channeling within the media).
4. When the predicted useful life of the media is approaching, check arsenic removal performance more frequently.
5. Normal backwash water rate should be 11 gpm/ft² for 12 minutes, with a forward rinse at service flowrate for 2 minutes. Control should include a smooth 2 minute ramp up from and down to zero flow.

□□□□T□□W□

1. If an adsorber is not to be used for a period of time, chlorinated influent with 5-10 ppm free Cl_2 should be run through the adsorber about 15 minutes per week with the effluent discarded to the dirty backwash tank.
2. For extended shutdown, add chlorine to the water on top of the media until a 5 mg/l residual is obtained, then drain water down until 6 inches of water covers the media. Check water for a residual every two months and add chlorine if it is below 0.5 mg/L. Backwash the adsorber before placing back in service.

□□ □T□□T□□ □□□ □□□E□T□□ □E□□□E

Severn Trent Water Purification (STWP) process engineer should be onsite during media installation, initial backwashing, and plant startup. Follow up plant inspection and consultation with plant operators should be conducted by an STS engineer 2 months after startup, 6 months after startup and then yearly. Startup and inspection services are currently available for $1,250 per day, plus expenses at cost. Typical startup time required, depending on number of adsorber vessels, is one day for media loading, one to two days for initial backwash, and two days for initial operation, plus travel days. A typical inspection visit would require one to two days onsite and two additional days for travel and written report.

□□□□□ □□□□ Proper media storage, backwashing, operating practice, and experienced follow up attention is required to maximize media performance and media life. Changes to these procedures or recommendations could void the media performance warranty. Consult with Severn Trent Services about any deviation from recommended practices.

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 3 **MEDIA INFORMATION**

BAYOXIDE E33™

B. MSDS

MATERIAL SAFETY DATA SHEET

LANXESS
Energizing Chemistry

LANXESS Corporation
Product Safety & Regulatory Affairs
111 RIDC Park West Drive
Pittsburgh, PA 15275-1112
USA

TRANSPORTATION EMERGENCY

CALL CHEMTREC:	(800) 424-9300
INTERNATIONAL:	(703) 527-3887

NON-TRANSPORTATION

LANXESS Emergency Phone:	(800) 410-3063
LANXESS Information Phone:	(800) LANXESS

1. Product and Company Identification

Product Name:	BAYOXIDE E 33
Material Number:	2653218
Color Index Name:	Pigment Yellow 42
CAS-No.:	20344-49-4
Formula:	FeOOH

2. Hazards Identification

Emergency Overview

Color: Brown **Form:** solid Granules **Odor:** Odorless.
Product poses little or no hazard if spilled. May cause mechanical irritation (abrasion).

Potential Health Effects

Primary Routes of Entry: Inhalation, Skin Contact, Eye Contact, Ingestion

Medical Conditions Aggravated by Exposure: Respiratory disorders

HUMAN EFFECTS AND SYMPTOMS OF OVEREXPOSURE

General Effects of Exposure
Acute Effects of Exposure
For Product: BAYOXIDE E 33
No applicable information was found concerning any adverse acute health effects from overexposure to this product.

Chronic Effects of Exposure
For Product: BAYOXIDE E 33
No applicable information was found concerning any adverse chronic health effects from overexposure to this product.

Carcinogenicity:
No Carcinogenic substances as defined by IARC, NTP and/or OSHA

3. Composition/Information on Ingredients

Hazardous Components
This material is not hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29 CFR 1910.1200.

4. First Aid Measures

Eye Contact
In case of contact, flush eyes with plenty of lukewarm water. Get medical attention if irritation develops.

Skin Contact
In case of skin contact, wash affected areas with soap and water.

Inhalation
If inhaled, remove to fresh air. Get medical attention if irritation develops.

Ingestion
If ingested, do not induce vomiting unless directed to do so by medical personnel. Get medical attention.

5. Fire-Fighting Measures

Suitable Extinguishing Media: Material is not combustible. Use extinguishing media suitable for other combustible materials in the area.

Special Fire Fighting Procedures
Firefighters should be equipped with self-contained breathing apparatus to protect against potentially toxic and irritating fumes.

6. Accidental release measures

Spill and Leak Procedures
Spills should be swept up and placed in appropriate containers for disposal. Clean up promptly by scoop or vacuum. Avoid creating dusty conditions.

7. Handling and Storage

Storage Period
Unlimited in tightly closed containers.

Handling/Storage Precautions

Handle in accordance with good industrial hygiene and safety practices. Wash thoroughly after handling. Keep container closed when not in use. Avoid breathing dust.

Further Info on Storage Conditions
Material can be stored safely at ambient temperatures.

8. Exposure Controls / Personal Protection

Country specific exposure limits have not been established or are not applicable

Industrial Hygiene/Ventilation Measures
Under normal conditions of use, special ventilation is not required.

Respiratory Protection
Although no exposure limit has been established for this product, the OSHA PEL for Particulates Not Otherwise Regulated (PNOR) of 15 mg/m3 - total dust, 5 mg/m3 - respirable fraction is recommended. In addition, the ACGIH recommends 3 mg/m3 - respirable particles and 10 mg/m3 - inhalable particles for Particles (insoluble or poorly soluble) Not Otherwise Specified (PNOS)., The following respirator is recommended if airborne concentrations exceed the appropriate standard/guideline., NIOSH approved, air-purifying particulate respirator with N-95 filters.

Eye Protection
safety glasses.

Skin and body protection
No special skin protection requirements during normal handling and use.

Additional Protective Measures
Employees should wash their hands and face before eating, drinking, or using tobacco products. Educate and train employees in the safe use and handling of this product.

9. Physical and chemical properties

Form:	solid
Appearance:	Granules
Color:	Brown
Odor:	Odorless
pH:	4 - 8 @ 50 g/l
Melting Point:	Begins at 1,000 °C (1,832 °F)
Flash Point:	not applicable
Lower Explosion Limit:	Not Established
Upper Explosion Limit:	Not Established
Vapor Pressure:	not applicable
Specific Gravity:	4 - 5 @ 20 °C (68 °F)
Solubility in Water:	Insoluble
Autoignition Temperature:	Not Applicable
Viscosity, Dynamic:	not applicable
Bulk Density:	300 - 1,000 kg/m3

10. Stability and Reactivity

Hazardous Reactions

Hazardous polymerization does not occur.

Stability
Stable

Conditions to avoid
At temperatures greater than 356 F (180 C) the product will be converted to Fe2O3.

11. Toxicological Information

Toxicity Data for BAYOXIDE E 33
Acute Oral Toxicity
LD50: > 5,000 mg/kg (Rat)

Skin Irritation
rabbit, Non-irritating

Eye Irritation
rabbit, Non-irritating

Toxicity Data for C.I. Pigment Yellow 42
Acute Oral Toxicity
LD50: > 5,000 mg/kg (Rat)

Skin Irritation
rabbit, Non-irritating

Eye Irritation
rabbit, Non-irritating

Carcinogenicity
Rat, Male/Female, intraperitoneal, 8 w,
ambiguous

12. Ecological Information

Ecological Data for BAYOXIDE E 33
Acute and Prolonged Toxicity to Fish
LC0: > 1,000 mg/l (Golden orfe (Leuciscus idus))

Toxicity to Microorganisms
NOEC: > 1,000 mg/l, (Pseudomonas putida)

Ecological Data for C.I. Pigment Yellow 42
Acute and Prolonged Toxicity to Fish
EC50: > 1,000 mg/l (Golden orfe (Leuciscus idus), 48 h)

Toxicity to Microorganisms
> 10,000 mg/l, (Pseudomonas putida)

13. Disposal considerations

Waste Disposal Method
Waste disposal should be in accordance with existing federal, state and local environmental control laws.

Empty Container Precautions
Recondition or dispose of empty container in accordance with governmental regulations.

14. Transportation information

Land transport (DOT)
Non-Regulated

Sea transport (IMDG)
Non-Regulated

Air transport (ICAO/IATA)
Non-Regulated

15. Regulatory Information

United States Federal Regulations

OSHA Hazcom Standard Rating: Non-Hazardous

US. Toxic Substances Control Act: Listed on the TSCA Inventory.

US. EPA CERCLA Hazardous Substances (40 CFR 302):
Components
None

SARA Section 311/312 Hazard Categories:
Non-hazardous under Section 311/312

US. EPA Emergency Planning and Community Right-To-Know Act (EPCRA) SARA Title III Section 302 Extremely Hazardous Substance (40 CFR 355, Appendix A):
Components
None

US. EPA Emergency Planning and Community Right-To-Know Act (EPCRA) SARA Title III Section 313 Toxic Chemicals (40 CFR 372.65) - Supplier Notification Required:
Components
None

US. EPA Resource Conservation and Recovery Act (RCRA) Composite List of Hazardous Wastes and Appendix VIII Hazardous Constituents (40 CFR 261):
If discarded in its purchased form, this product would not be a hazardous waste either by listing or by characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time

of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste. (40 CFR 261.20-24)

State Right-To-Know Information
The following chemicals are specifically listed by individual states; other product specific health and safety data in other sections of the MSDS may also be applicable for state requirements. For details on your regulatory requirements you should contact the appropriate agency in your state.

Potential exposure to the California Proposition 65 chemicals in this product have been determined to be below the No Significant Risk Level (NSRL)., The concentrations reported below in units of parts per million (ppm) or parts per billion (ppb) are maximum values.

Massachusetts, New Jersey or Pennsylvania Right to Know Substance Lists:

Weight %	Components	CAS-No.
1 - 100%	C.I. Pigment Yellow 42	20344-49-4

MA Right to Know Extraordinarily Hazardous Substance List:

Weight %	Components	CAS-No.
25 ppm	Arsenic	7440-38-2
350 ppm	Chromium	7440-47-3
200 ppm	Nickel (Ni)	7440-02-0

California Prop. 65:
To the best of our knowledge, this product does not contain any of the listed chemicals, which the state of California has found to cause cancer, birth defects or other reproductive harm.

16. Other Information

NFPA 704M Rating

Health	1
Flammability	0
Reactivity	0
Other	

0=Insignificant 1=Slight 2=Moderate 3=High 4=Extreme

HMIS Rating

Health	1
Flammability	0
Physical Hazard	0

0=Minimal 1=Slight 2=Moderate 3=Serious 4=Severe
* = Chronic Health Hazard

LANXESS Corporation's method of hazard communication is comprised of Product Labels and Material Safety Data Sheets. HMIS and NFPA ratings are provided by LANXESS Corporation as a customer service.

Contact Person:	Product Safety Department
Telephone:	(800) LANXESS
MSDS Number:	000000004623
Version Date:	04/01/2005
Report Version:	1.1

This information is furnished without warranty, express or implied. This information is believed to be accurate to the best knowledge of LANXESS Corporation. The information in this MSDS relates only to the specific material designated herein. LANXESS Corporation assumes no legal responsibility for use of or reliance upon the information in this MSDS.

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 3 **MEDIA INFORMATION**
BAYOXIDE E33™
C. SPECIFICATIONS

LANXESS
Energizing Chemistry

Product Information

Bayoxide® E 33

Description

Type	Technical Oxide
Delivery form	Granules
Chemical class	Synthetic iron hydroxide FeOOH
CAS-No.	20344-49-4

Specification

Technical Data	**min**	**max**	**Test method**
Fe_2O_3-Content	70		DIN 55913 (1972)
Bulk Density [g/cm³]	0.4	0.6	DIN ISO 787 part 11 (1995)
Specific Surface Area [m²/g]	120	200	DIN 66131 (1993)
water-soluble content [%]		1.0	as per DIN EN ISO 787 Teil 3 (1995)
Water content (ex works) [%]		20	Test method SSP 27472
Sieve analysis < 0.5 mm [%]		20	Test method K006-00
Sieve analysis > 2.0 mm [%]		5.0	Test method K006-00
Trace elements	**min**	**max**	**Test methods**
Al [mg/kg]		350	Atomic spectroscopy
Ba [mg/kg]		10	Atomic spectroscopy
Co [mg/kg]		100	Atomic spectroscopy
Cr [mg/kg]		250	Atomic spectroscopy
Cu [mg/kg]		100	Atomic spectroscopy
Mn [mg/kg]		3000	Atomic spectroscopy
Ni [mg/kg]		300	Atomic spectroscopy
Pb [mg/kg]		3	Atomic spectroscopy
Zn [mg/kg]		100	Atomic spectroscopy

Informative technical data (guide values)

			Test method
Density [g/ml]	~	3.6	as per DIN EN ISO 787 Teil 10 (1995)

Edition: 2006-09-26
Previous Edition: Not available

LANXESS
Energizing Chemistry

Bayoxide® E 33

Packaging

500-kg-bulk bag

Transport and storage

Protect against weathering. Store in a dry place and avoid extreme fluctuations in temperature.

Avoid crushing the granules.

Special conditions for opened packaging: Close bags after use to prevent the absorption of moisture and contamination.

Restrictions in usage

Interfering ions, the pH of the water and other factors may influence the performance of Bayoxide E 33. The user of the product is responsible for monitoring the quality of the treated water to ensure that it complies with local regulations.

The product must not be used for the treatment of water at a pH below 5 and above 10.

Safety

The product is not classified as dangerous under the relevant EC Directives and corresponding national regulations valid in the individual EU member states. It is not dangerous according to transport regulations.

In countries outside the EU, compliance with the respective national legislation concerning the classification, packaging, labelling and transport of dangerous substances must be ensured.

The safety data sheet should be observed. This contains information on handling, product safety and ecology.

Safety data sheet no.:	411144

Edition: 2006-09-26
Previous Edition: Not available

LANXESS
Energizing Chemistry

Bayoxide® E 33

Disposal of waste product

The spent media is to be disposed of in approved landfills provided local regulations are observed. The media is educted from the adsorber vessel into a purpose built tanker. Operators should confirm that they can meet any local landfill tipping conditions.

For disposal within EC, the appropriate code according to the European Waste Catalogue (EWC) should be used.

LANXESS Deutschland GmbH
Business Unit
Inorganic Pigments
D-51369 Leverkusen

Edition: 2006-09-26
Previous Edition: Not available

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

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SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 3 **MEDIA INFORMATION**

BAYOXIDE E33™

D. NSF CERTIFICATION

NSF Live safer.℠ Close wir return to

NSF Product and Service Listings

These Listings were Last Updated on **Thursday, May 06, 2004** at 4:15 AM Eastern Time. Please contact NSF International to confirm the status of any Listing, report errors, or make suggestions.

Warning: NSF is concerned about fraudulent downloading and manipulation of website text. If you have received this listing in hard copy, always confirm this certification/listing information by going directly to http://www.nsf.org/Certified/PwsComponents/Listings.asp?TradeName=bay& for the latest most accurate information.

NOTE: Unless otherwise indicated for Materials, Certification is only for the Water Contact Material shown in the Listing. Click here for a list of Abbreviations used in these Listings.

BAYER AG

Cert-Link℠ (Click here to visit this Company's Website)

RHEINUFERSTRASSE 7-9
BUILDING 54
KREFELD, 47812
GERMANY
49 2151 88 3790

Facility : KREFELD, GERMANY

Process Media

Trade Designation	Size	Water Contact Temp	Water Contact Material
Adsorption			
Bayoxide E33[1]	0.5 mm - 2 mm	CLD 23	NA

[1] The Certification of this media is only for applications with minimum flow greater than or equal to 0.025 gpm per pound of media.

NOTE: Certified for water treatment plant applications.
This product has not been evaluated for point of use applications.

Number of matching Manufacturers is 1
Number of matching Products is 1
Processing time was 0 seconds

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Appendix E - Initial Start-up and Monitoring Form

ADEQ Arizona Department of Environmental Quality

Initial Start-Up Monitoring Form
For Ground Water Systems with Treatment Plants and/or Blending Plans

Please mail completed form and all Field & Lab analyses to:
ADEQ Drinking Water Monitoring and Protection Unit
1110 W. Washington St., Mail Code 5415B-2,

PWS ID Number (5 digits):	AZ04 –	**PWS Name:**			
Contact Person/Title:		**Phone #**		**E-Mail Address:**	
Choose One:	☐ Treatment Plant Only	☒ Treatment Plant & Blending Plan		☐ Blending Plan Only	
Entry Point to the Distribution System (EPDS) #:		**Contaminant:**	☒ Arsenic ☐ Fluoride ☐ Nitrate ☐ Other:		

Samples	MM/DD/YY	Sample Time (24h)	Raw Water Result (mg/L) (Insert well registration numbers below) Well # 55-616687	Well # 55-	Well # 55-	Well # 55-	Well # 55-	Treated Water Result (mg/L)	Finished Blended Water Results (mg/L)	Test Method
Day 1										☐Field ☐Lab
Day 2										☐Field ☐Lab
Day 3										☐Field ☐Lab
Day 4										☐Field ☐Lab
Day 5										☐Field ☐Lab
Week 2										☐Lab
Week 3										☐Lab
Week 4										☐Lab
Month 2										☐Lab
Month 3										☐Lab

If Water System chooses to take Field Tested Water Samples, any of the following Field Test Kits are acceptable: *ITS Arsenic Quick II Test Kit, Pat No. 481303, ITS Fluoride eXact Xtra Micro Strips, Part No. 486611 or Hach Nitrate Color Disc Test Kit Model NI-14.* All Water Samples from week 2 thru Month 3 must be submitted to a Certified Laboratory for analysis. Hard copies of Certified Lab Results must be provided with this form.

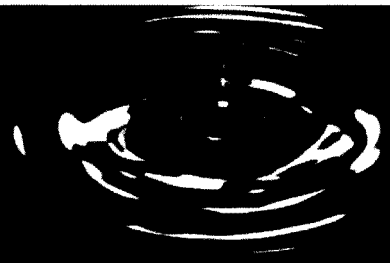
I hereby certify that the information listed above is accurate to the best of my knowledge. Furthermore, unless otherwise directed by the State, I understand that quarterly compliance monitoring shall commence for the above noted contaminant after initial monitoring has been completed. This quarterly routine compliance monitoring frequency shall remain in effect for the life of the treatment plant.

Water System Owner/Representative (Print)	Signature	Date

Appendix F - Component O&M and Information

1. Bag Filter
2. Chlorination Shed
3. Chlorine Metering Pumps
4. Float Switch
5. Level Transmitter
6. Pressure Switch
7. Recycle Pump

Arizona Water Company
Valley Farms Arsenic Removal Facility



Pressure Switch

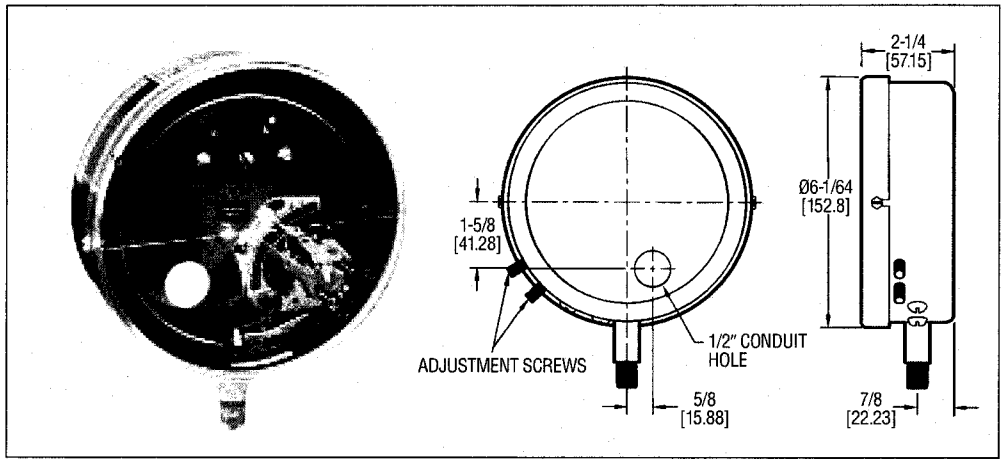
Contractor:
Felix Construction Company
1326 W Industrial Dr
Coolidge, AZ 85142
Ph: (480) 464-0011
Fx: (480) 464-0078
www.felixconstruction.com

Mercoid®

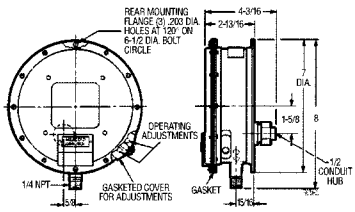
Series DA/DS

Bourdon Tube Pressure Switches

Visible setpoint, adjustable deadband, snap action switch pressure ranges to 5000 psi



Weather-Proof
Types DAW, DSW, DRW



Customers tell us that this is the best pressure switch made. Our most popular, Model DA combines extremely high sensitivity and repeatability with easily adjustable set and reset points through non-interactive external adjustments. Visible calibrated dial for setpoints and on/off indicator to indicate switch actuation are included. Choose either high current snap-switch or hermetically sealed contact mercury switch. The DS Model has a fixed deadband.

FEATURES

- DA Series is equipped with two external adjustments. One sets high pressure operating point, the other sets reset point. Deadband, or the difference between set and reset points is adjustable over the full scale. DS Series has a single external adjustment and fixed deadband.
- Visible calibrated dial, on/off indication.
- SPDT snap-action or sealed mercury switches.
- Minimum deadband obtainable at any point in range.
- Pressure Ranges vacuum to 5000 psig.
- U.L. and C.S.A. listed. Many models FM listed.

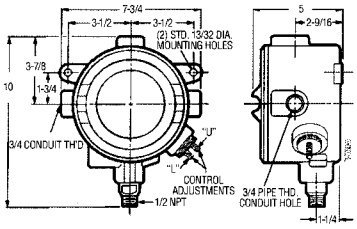
PHYSICAL DATA

Max. Temperature: 180°F. For higher temperature media applications, a remote connection or siphon (pigtail) should be used.
Pressure Connection: 1/4" NPT. (1/2" on range 15S).
Housing: pressed steel with transparent cover.
Wiring Connections: 3 screw type.
Wetted Parts: same as Bourdon tube material.
Weight: 4 lb. (std); 6 lb. (wea-proof); 8 lb. (exp-proof).
Max. Press.: Max. adjustment operating range.

Suggested Specification

Pressure switch shall be Mercoid Series DA operated by a (brass) (type 316 stainless steel) (type 403 stainless steel) Bourdon tube actuating a (mercury switch) (snap-switch). Switch shall have deadband fixed or adjustable up to a maximum of 100% of switch range. Switch shall have calibrated dial and one or two pointers indicating set and reset points. Switch shall have visible on/off indication. Setpoints shall be adjustable without removing switch cover or shutting down process.

Explosion-Proof
Types DAH, DRH, DSH



STOCKED MODELS in bold

BOURDON TUBE MATERIAL	ADJUSTABLE OPERATING RANGE (PSIG)	SNAP ACTION SWITCH – SPDT 15A @ 120/240 VAC		SNAP ACTION SWITCH – SPDT 15A @ 120/240 VAC		MERCURY SWITCH – SPDT 4A @ 120V., 2A @ 240V. AC/DC	
		FIXED DEADBAND PSIG	MODEL NUMBER	MINIMUM DEADBAND PSIG	MODEL NUMBER	MINIMUM DEADBAND PSIG	MODEL NUMBER
BRASS	0-30" Hg. Vac.	3" Hg. Vac.	**DS-7231-153-2***	9" Hg. Vac.	**DA-7031-153-2***	2" Hg. Vac.	**DA-31-153-2***
	1/8-15	1.5	DS-7231-153-1	4	DA-7031-153-1	1	**DA-31-153-1**
	1/8-20	1.5	DS-7231-153-3A	4	**DA-7031-153-3A**	1	**DA-31-153-3A**
	1-35	1.5	DS-7231-153-4	5	DA-7031-153-4	1.75	**DA-31-153-4**
	2-60	2	DS-7231-153-5	6	**DA-7031-153-5**	3	**DA-31-153-5**
	5-100	2.5	DS-7231-153-6	9	**DA-7031-153-6**	3.75	**DA-31-153-6**
	5-150	3	**DS-7231-153-7**	16	**DA-7031-153-7**	6	**DA-31-153-7**
	10-200	4	**DS-7231-153-8**	16	**DA-7031-153-8**	8	**DA-31-153-8**
	10-300	5	DS-7231-153-9	25	**DA-7031-153-9**	12	**DA-31-153-9**
403SS	2-60	3	DS-7221-153-5S	9	DA-7021-153-5S	4	**DA-21-153-5S**
	5-100	3.5	DS-7221-153-6S	13	DA-7021-153-6S	6	**DA-21-153-6S**
	10-200	4	DS-7221-153-8S	15	DA-7021-153-8S	8	**DA-21-153-8S**
	10-300	6	DS-7221-153-9S	19	DA-7021-153-9S	14	**DA-21-153-9S**
	25-600	10	DS-7221-153-10S	45	DA-7021-153-10S	25	**DA-21-153-10S**
	100-1500	30	DS-7221-153-12S	130	DA-7021-153-12S	90	**DA-21-153-12S**
	500-5000	200	DS-7221-153-15S*	900	DA-7021-153-15S*	450	DA-21-153-15S*
316SS	10-150	4	DS-7241-153-24E	11	DA-7041-153-24E	6	**DA-41-153-24E**
	10-300	8	DS-7241-153-9E	28	DA-7041-153-9E	18	**DA-41-153-9E**

Additional features available on special order, include other electrical ratings and circuits, lower minimum differentials, special housings, diaphragm seals and manual reset. For severe vibration, a special Delrin Bushed Movement is available.
*Range 2 and 15S not FM approved. Other ranges FM approved. For FM approved models specify DAF or DSF. Example DAF-31-153-1.

STOCKED MODELS in bold High Current Capacity† or Extra Low Deadband Mercury Switches (SPST)†

BOURDON TUBE MATERIAL	ADJUSTABLE OPERATING RANGE (PSIG)	MERCURY SWITCH – SPST – HIGH CURRENT 10A @ 120V., 5A @ 240V. AC/DC			MERCURY SWITCH – SPST – LOW DEADBAND 5A @ 120VAC., 2A @ 240VAC., 2.5A @ 120VDC		
		MINIMUM DEADBAND PSIG	OPEN ON INC. MODEL NUMBER	CLOSE ON INC. MODEL NUMBER	MINIMUM DEADBAND PSIG	OPEN ON INC. MODEL NUMBER	CLOSE ON INC. MODEL NUMBER
BRASS	0-30" Hg. Vac.	2" Hg. Vac.	**DA-31-2-2***	**DA-31-3-2***	1" Hg. Vac.	DA-531-2-2*	DA-531-3-2*
	1/8-15	1	**DA-31-2-1**	**DA-31-3-1**	0.5	**DA-531-2-1**	DA-531-3-1
	1/8-20	1	**DA-31-2-3A**	**DA-31-3-3A**	0.5	**DA-531-2-3A**	DA-531-3-3A
	1-35	1.75	**DA-31-2-4**	**DA-31-3-4**	0.75	DA-531-2-4	DA-531-3-4
	2-60	3	**DA-31-2-5**	**DA-31-3-5**	1.0	**DA-531-2-5**	DA-531-3-5
	5-100	3.75	**DA-31-2-6**	**DA-31-3-6**	2.0	**DA-531-2-6**	DA-531-3-6
	5-150	6	**DA-31-2-7**	**DA-31-3-7**	3.0	**DA-531-2-7**	DA-531-3-7
	10-200	8	**DA-31-2-8**	**DA-31-3-8**	3.5	**DA-531-2-8**	DA-531-3-8
	10-300	14	**DA-31-2-9**	**DA-31-3-9**	6.0	DA-531-2-9	DA-531-3-9
403SS	2-60	4	DA-21-2-5S	DA-21-3-5S	2.5	DA-521-2-5S	DA-521-3-5S
	5-100	6	DA-21-2-6S	DA-21-3-6S	3.0	DA-521-2-6S	DA-521-3-6S
	10-200	8	**DA-21-2-8S**	DA-21-3-8S	4.0	DA-521-2-8S	DA-521-3-8S
	10-300	14	**DA-21-2-9S**	**DA-21-3-9S**	7	DA-521-2-9S	DA-521-3-9S
	25-600	25	**DA-21-2-10S**	DA-21-3-10S	15	**DA-521-2-10S**	DA-521-3-10S
	100-1500	90	DA-21-2-12S	DA-21-3-12S	50	DA-521-2-12S	DA-521-3-12S
	500-5000	450	DA-21-2-15S*	DA-21-3-15S*	200	DA-521-2-15S*	DA-521-3-15S*
316SS	10-150	6	DA-41-2-24E	DA-41-3-24E	3.0	DA-541-2-24E	DA-541-3-24E
	10-300	18	DA-41-2-9E	DA-41-3-9E	5.0	DA-541-2-9E	DA-541-3-9E

†Also available in Weather-proof (DAW-33) or Explosion-proof (DAH-31) Housings.
*Range 2 and 15S not FM approved. Other ranges FM approved. For FM approved models specify DAF or DSF. Example DAF-31-2-1.

STOCKED MODELS in bold Weather-proof Models

Bourdon Tube Material	Adjustable Operating Range (PSIG)	SNAP ACTION SWITCH – SPDT 15A @ 120/240 VAC		SNAP ACTION SWITCH – SPDT 15A @ 120/240 VAC		MERCURY SWITCH – SPDT 4A @ 120V., 2A @ 240V. AC/DC	
		Fixed Deadband PSIG	Model Number	Minimum Deadband PSIG	Model Number	Minimum Deadband PSIG	Model Number
BRASS	0-30" Hg. Vac.	3" Hg. Vac.	DSW-7233-153-2*	9" Hg. Vac.	DAW-7033-153-2*	2" Hg. Vac.	**DAW-33-153-2***
	1/8-15	1.5	DSW-7233-153-1	4	DAW-7033-153-1	1	**DAW-33-153-1**
	1/8-20	1.5	DSW-7233-153-3A	4	**DAW-7033-153-3A**	1	**DAW-33-153-3A**
	1-35	1.5	DSW-7233-153-4	5	DAW-7033-153-4	1.75	**DAW-33-153-4**
	2-60	2	DSW-7233-153-5	6	**DAW-7033-153-5**	3	**DAW-33-153-5**
	5-100	2.5	DSW-7233-153-6	9	**DAW-7033-153-6**	3.75	**DAW-33-153-6**
	5-150	3	DSW-7233-153-7	16	**DAW-7033-153-7**	6	**DAW-33-153-7**
	10-200	4	DSW-7233-153-8	16	DAW-7033-153-8	8	**DAW-33-153-8**
	10-300	5	DSW-7233-153-9	25	DAW-7033-153-9	14	**DAW-33-153-9**
403SS	2-60	3	DSW-7223-153-5S	9	DAW-7023-153-5S	4	DAW-23-153-5S
	5-100	3.5	DSW-7223-153-6S	13	DAW-7023-153-6S	6	**DAW-23-153-6S**
	10-200	4	DSW-7223-153-8S	15	DAW-7023-153-8S	8	DAW-23-153-8S
	10-300	6	DSW-7223-153-9S	19	DAW-7023-153-9S	14	**DAW-23-153-9S**
	25-600	10	DSW-7223-153-10S	45	DAW-7023-153-10S	25	**DAW-23-153-10S**
	100-1500	30	DSW-7223-153-12S	130	DAW-7023-153-12S	90	DAW-23-153-12S
	500-5000	200	DSW-7223-153-15S*	900	DAW-7023-153-15S*	450	DAW-23-153-15S*
316SS	10-150	4	DSW-7243-153-24E	11	**DAW-7043-153-24E**	6	**DAW-43-153-24E**
	10-300	8	DSW-7243-153-9E	28	**DAW-7043-153-9E**	18	**DAW-43-153-9E**

*Range 2 and 15S not FM approved. All other DAW ranges are FM approved.

POPULAR MODELS Explosion-proof Models

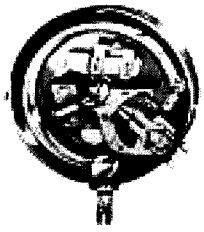
BOURDON TUBE MATERIAL	ADJUSTABLE OPERATING RANGE (PSIG)	SNAP ACTION SWITCH – SPDT 15A @ 120/240 VAC		SNAP ACTION SWITCH – SPDT 15A @ 120/240 VAC		MERCURY SWITCH – SPDT 4A @ 120V., 2A @ 240V. AC/DC	
		FIXED DEADBAND PSIG	MODEL NUMBER	MINIMUM DEADBAND PSIG	MODEL NUMBER	MINIMUM DEADBAND PSIG	MODEL NUMBER
BRASS	0-30" Hg. Vac.	3" Hg. Vac.	DSH-7231-153-2*	9" Hg. Vac.	DAH-7031-153-2*	2" Hg. Vac.	DAH-31-153-2*
	1/8-15	1.5	DSH-7231-153-1	4	DAH-7031-153-1	1	DAH-31-153-1
	1/8-20	1.5	DSH-7231-153-3A	4	DAH-7031-153-3A	1	DAH-31-153-3A
	1-35	1.5	DSH-7231-153-4	5	DAH-7031-153-4	1.75	DAH-31-153-4
	2-60	2	DSH-7231-153-5	6	DAH-7031-153-5	3	DAH-31-153-5
	5-100	2.5	DSH-7231-153-6	9	DAH-7031-153-6	3.75	DAH-31-153-6
	5-150	3	DSH-7231-153-7	16	DAH-7031-153-7	6	DAH-31-153-7
	10-200	4	DSH-7231-153-8	16	DAH-7031-153-8	8	DAH-31-153-8
	10-300	5	DSH-7231-153-9	25	DAH-7031-153-9	14	DAH-31-153-9
403SS	2-60	3	DSH-7221-153-5S	9	DAH-7021-153-5S	4	DAH-21-153-5S
	5-100	3.5	DSH-7221-153-6S	13	DAH-7021-153-6S	6	DAH-21-153-6S
	10-200	4	DSH-7221-153-8S	15	DAH-7021-153-8S	8	DAH-21-153-8S
	10-300	6	DSH-7221-153-9S	19	DAH-7021-153-9S	14	DAH-21-153-9S
	25-600	10	DSH-7221-153-10S	45	DAH-7021-153-10S	25	DAH-21-153-10S
	100-1500	30	DSH-7221-153-12S	130	DAH-7021-153-12S	90	DAH-21-153-12S
	500-5000	200	DSH-7221-153-15S*	900	DAH-7021-153-15S*	450	DAH-21-153-15S*
316SS	10-150	4	DSH-7241-153-24E	11	DAH-7041-153-24E	6	DAH-41-153-24E
	10-300	8	DSH-7241-153-9E	28	DAH-7041-153-9E	18	DAH-41-153-9E

*Range 2 and 15S not FM approved. Other ranges FM approved. For FM approved models specify DAHF or DSHF. Example DAHF-31-153-1.

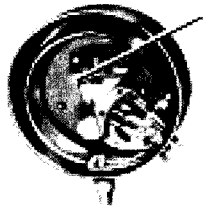
Mercoid® Series DA/DS Bourdon Tube Pressure Switches

Type DA

Adjustable Deadband, Fully Automatic, Double Adjustments



Snap Action Switch

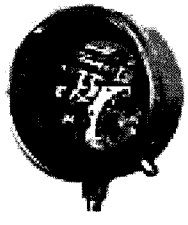


Mercury Switch Contact

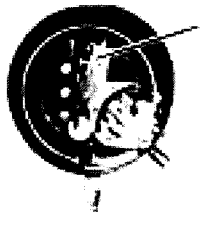
Equipped with two external adjustments, one for setting *high* pressure operating point, the other for setting *low* pressure operating point. Deadband, or the difference between high and low setpoints, is adjustable over full scale. Mercoid's most popular operating mode, available on most Series D pressure and temperature controls.

Type DS

Fixed Deadband, Fully Automatic, Single Adjustment



Snap Action Switch

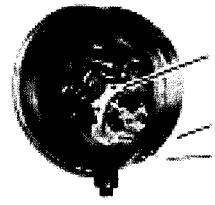


Mercury Switch Contact

Equipped with single adjustment for setting operating point only. A single pointer on scale sets pressure point at which switch action occurs. Fixed deadband is factory set and cannot be altered in the field. Available on series D-200, D-7200 and D-9200 only.

Type DR

Semi-Automatic, Manual Reset, Single Adjustment

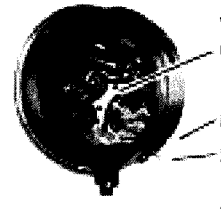


Manual Reset (–2 or –3 circuits only)

Equipped with a single adjustment for setting operating point to operate the circuit automatically upon a pressure increase or decrease. Pushbutton reset must be operated manually to restore the circuit to original position after automatic operation. Suffix "L," i.e. DR-31-153L denotes control will operate automatically on *increase*; suffix "U" denotes control will operate automatically on *decrease*.

Type DL

Semi-Automatic, Manual Lock Reset, Single Adjustment

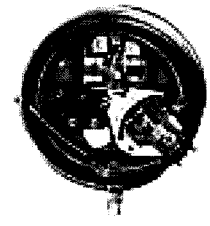


Manual Lock Reset (–2 or –3 circuits only)

Equipped with a single adjustment for setting operating point. Control will operate at setpoint only upon a *decrease* in pressure. Manual lock feature permits circuit to be reset and locked in position. Lock remains in effect until pressure rises above control setting. Lock then releases and circuit is held in reset position until further automatic operation upon pressure decrease.

Type D-400, DA-7400

Two-Stage, Fully Automatic, 2 Set Pts.



Provides two stage control by actuating one circuit upon a rise or fall in pressure and a second circuit on a further rise or fall. Each setpoint has a fixed deadband.

Mercoid®

Series DA

Bourdon Tube Pressure Switches — General Data and Accessories

FEATURES

External Setpoints
Deadband Adjustable (over 100% of scale) or Fixed
Visible Calibrated Dial, PSI/kg
Visible Operation
On/Off Indication
Repeatability ±1% of full scale
Minimum Deadband Obtainable at any Point in Range
Welded Stainless Steel Bourdon Tubes Provide Reduced Chance of Leakage in Case of Fire
Pressure Ranges to 8000 psig
UL, CSA Listed (most models, features)

PHYSICAL DATA

Max. Temp.: 180°F. For higher media applications, a remote connection or siphon (pigtail) should be used.

Pressure Connection: 1/4" NPT std. 1/2" NPT on range 15S, 16S

Wetted Parts: Same as bourdon tube material except range 23K, 24K, 9K.

Weight: 4 lb. std., 6 lb. weatherproof 8 lb. exp. proof

Max. Press.: Max. adjustment operating range. Use of a surge tank, snubber of capillary tubing connection is recommended where pulsation, pressure surge or water hammer may occur.

Suggested Specification

Pressure switch shall be Mercoid Series DA operated by a (brass) (type 316 stainless steel) (type 403 stainless steel) Bourdon tube actuating a (mercury switch) (snap-switch). Switch shall have deadband adjustable up to a maximum of 100% of switch range. Switch shall have calibrated dial and two pointers indicating set and reset points. Switch shall have visible on/off indication. Setpoints shall be adjustable without removing switch cover or shutting down process.

Mounting Flange

For Surface Mounting (Field Installation)

For DA, DAF, DS, DSF, DR, DRF and DL controls only. May be ordered separately for field installation.

Part No. 17-26
(except on 15S, 16S)
Part No. 17-31
(for range 15S, 16S only)

Mounting Bracket

For use with standard NEMA 1 enclosure general purpose controls only: Series DA, DAF, DS, DSF, DR, DRF, DL. Note: *not* adaptable for Range 15S and 16S.

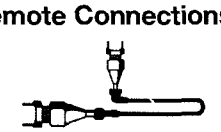
Part No. 33-25

Conduit Hub

For 1/2" rigid conduit. Mercury switch type controls with standard general purpose NEMA-1 or optional weather-resistant NEMA-3 or NEMA-4 enclosures are suitable for Class 1, Div. 2 applications when ordered with this hub. Available for DA Series.

Part No. 42-413

Remote Connections



Part No. 49-62HP – 6 ft. copper remote connection, 2500 psig max.

Part No. 49-210 – 12 ft. 316 s.s. connection with 303 s.s. fittings, 3000 psig max.

Breathers & Drains

STANDARD BREATHER

STANDARD DRAIN

For Class I, Groups C, D and Class II, Groups E, F, G (water only). Mercoid s.s. drains are flame-tight, but not watertight which permits water to escape continuously.

Mercoid s.s. breathers include a water shedding cap and provide effective case ventilation.

For Series DAH, DAHF, DRH, DRHF, DSH, DSHF.
Part No. 42-274 – Standard drain.

Part No. 42-276 – Standard breather.

For Series DAE, DRE.
Part No. 42-275 – Drain with 1/4" connection.
***Part No. 42-276** – Standard breather with 1/2" connection.
***Part No. 42-279** – Reducer (3/4" to 1/2") for breather.

*Breather and reducer must be ordered together.

Pigtail Siphon

1/4" NPT

Recommended for steam applications 35 psig or higher. For Series D-30, D-530, D-230, D-7030, D-7230 pressure controls. Please specify.

Part No. 42-58 2000 psig max.

Miscellaneous

Oxygen & Acetylene Service
Spec. 23444

Fungus Proof
Spec. 23720

FM Approval –
DAF, DRF, DSF

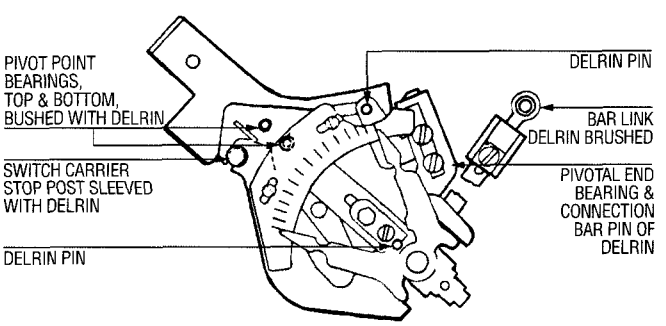
Factory Mutual Approved Series D Pressure Switches

FM

Cover Over External Adjustments

DELRIN* Bushed Movement "B"

*Registered Trademark of E.I. DuPont de Nemours & Co.



Provides longer service life for Series D pressure and temperature controls. Vibration and pulsation are the prime causes of control wear. Almost all types of vibration will have some effect on the life and continued accuracy of controls.

To offset the wearing of metal surfaces found in bearings and pivot points, the control mechanism is designed to incorporate Delrin bushed movements at each possible wear point. Also for environments where corrosion may be a factor.

Add Letter B After Type and Suffix Nos. Example: DS-221-2B, DA-31-3B, DAH-41-3B.

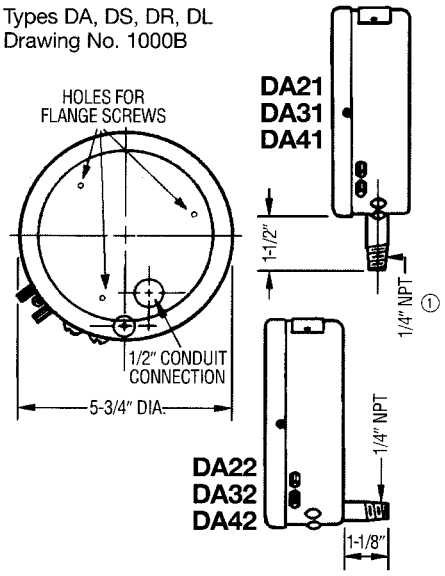
Mercoid®

Series DA

Bourdon Tube Pressure Switches — Control Dimensions

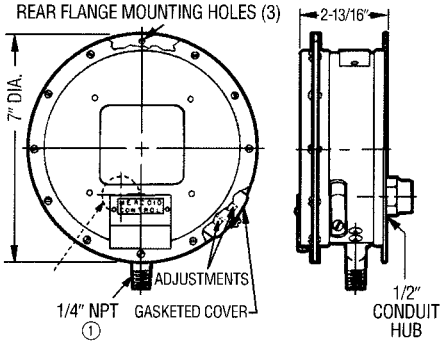
General Purpose

Types DA, DS, DR, DL
Drawing No. 1000B



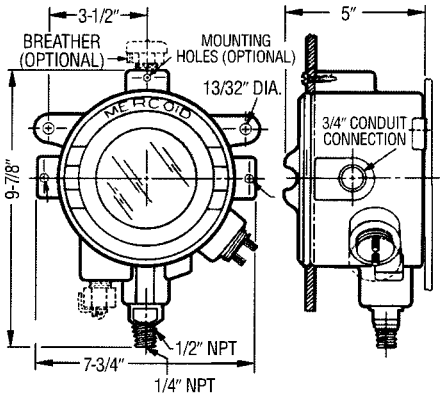
Weather-Proof

Types DAW, DSW, DRW
Drawing No. 1062



Explosion-Proof

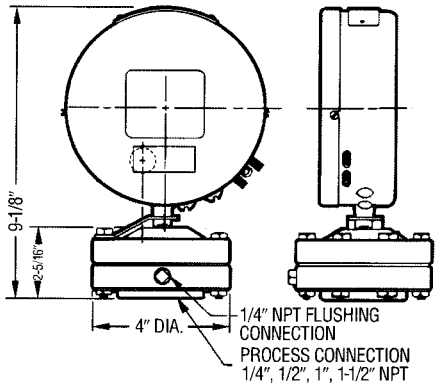
Types DAH, DRH, DSH
Drawing No. 1350



***Consult factory for Cenelec approved DAH models.**

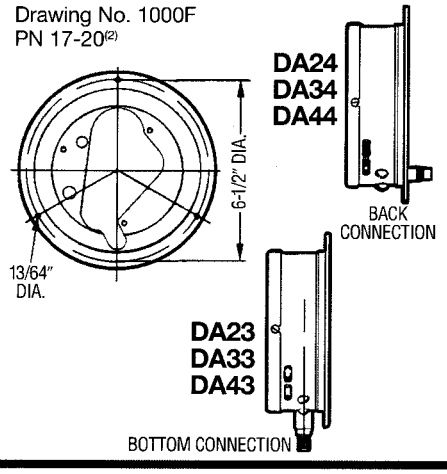
Diaphragm Seal

Types MSAG
Drawing No. 2305



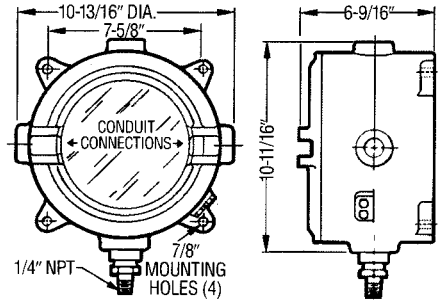
Flange for Surface Mounting

Drawing No. 1000F
PN 17-20(2)



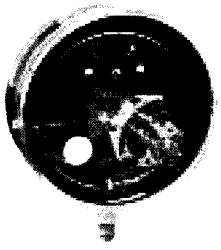
Explosion-Proof

Types DAE, DRE, DSE
Drawing No. 98D



(1.) 1/2" NPT Connection for ranges 15S, 16S

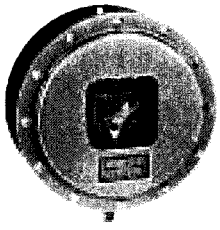
(2.) Use PN 17-31 for ranges 15S, 16S



General Purpose

NEMA 1 Enclosure

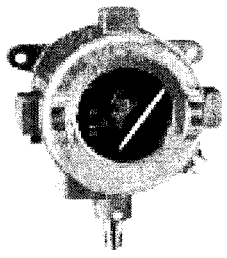
For indoor use and other general purpose applications under normal atmospheric conditions. Provides protection against dust and light splashing. Heavy gauge plain steel case. Flanged case available. Transparent cover for visible on-off operation. Locking device prevents tampering. Pressure connection, 1/4" NPT. Electrical connection back of case for 1/2" conduit or BX. Shipping wt. 4 lbs. See above for dimensions. *Furnished as standard unless otherwise specified.*



Watertight, Dust-tight/ Type W

NEMA 3S, 4, & 4X Enclosure

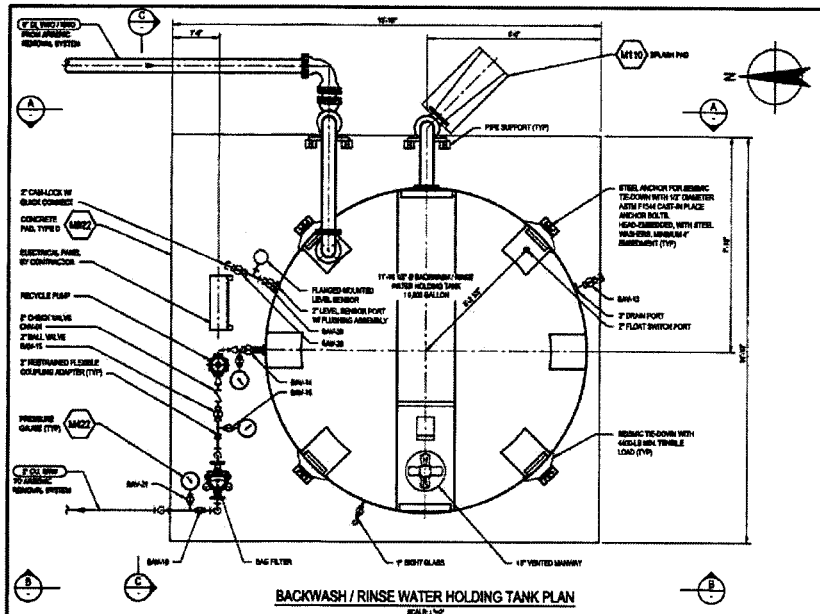
For outdoor or indoor applications. Complies with hose test and requirements for watertight, dust-tight, drip-tight weatherproof, weather-resistant, splash-proof, sleet-proof, and moisture-resistant. Flanged, heavy gauge steel case with transparent cover for visible on-off operation. External adjustments protected by cover. Bottom pressure connection. 1/4" NPT. Electrical connection back of case for 1/2" conduit, removable 1/2" hub. Shipping wt. 6 lbs. See above for dimensions. *Optional, add "W" to prefix, i.e. DAW, DRW, DSW, when ordering.*

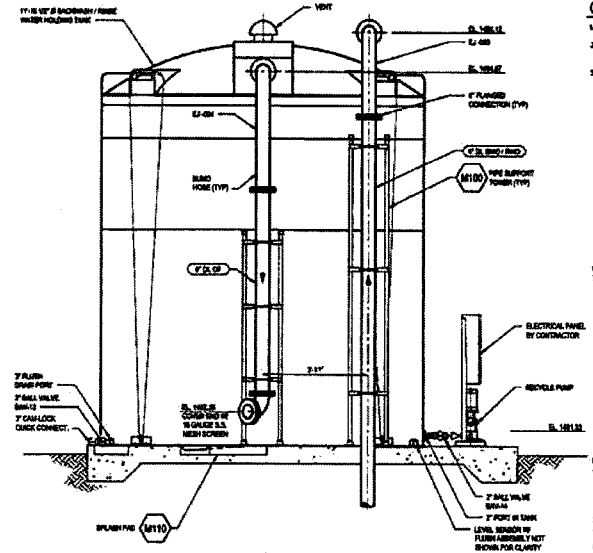


Explosion-Proof Type H

Hazardous Area Enclosure suitable for Class I, Groups C & D, Class II, Groups E, F & G; NEMA 7 & 9 applications. Control mechanism is an integral part of enclosure and cannot be replaced in the field. For surface, panel or pipe mounting. Aluminum case with glass window in cover for visible on-off operation. Bottom pressure connection, 1/2" NPT male × 1/4" NPT female. External adjustments. Available with breather and drain. Shipping wt. 8 lbs. (3.6 kg.). See above for dimensions. Optional housing, to order add "H" to prefix. Example: DAH, DRH, or DSH. Not available on D80 Series.

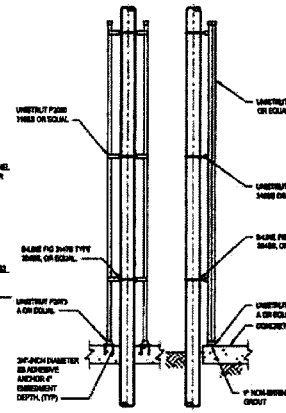
NOTE: Standard general purpose NEMA 1 and NEMA 4 enclosures are suitable for Class I, Division 2 applications with addition of conduit hub (mercury switch models only).



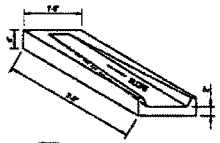


GENERAL NOTES

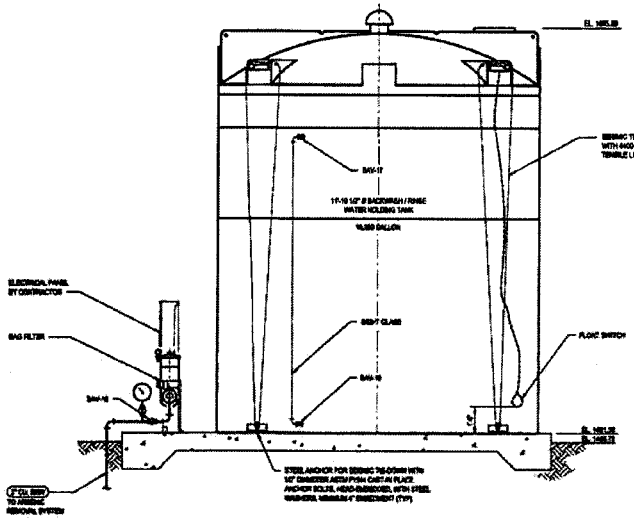
1. PROVIDE INSULATING COUPLINGS BETWEEN DISSIMILAR METALS.
2. EQUIPMENT, VALVE, VESSEL, FLOWMETER, AND GAUGE MANUFACTURERS AND MODELS PER SITE SPECIFICATIONS U.N.O.
3. ALL ABOVE GROUND PIPING SHALL BE D.I.P., CLASS 350 WITH FLANGED JOINTS. ABOVE GROUND PIPING SHALL INCLUDE EPOXY COATING IN ADDITION TO ITS FACTORY COATING. THE EPOXY COATING SHALL BE TINTED AND AS FOLLOWS:
   - 3.1. SURFACE PREP: PER MANUFACTURER
   - 3.2. PRIMER: SERIES 69 OF MIL-B-24 SPOXOLINE ≥ 4.0 DFT.
   - 3.3. INTERMEDIATE: SERIES 69 OR MIL-B-24 SPOXOLINE ≥ 5.0 DFT.
   - 3.4. FINISH: SERIES 73, 1447, OR 1827 ENDURA SHIELD
   - 3.5. COLOR: DESERT SANDS

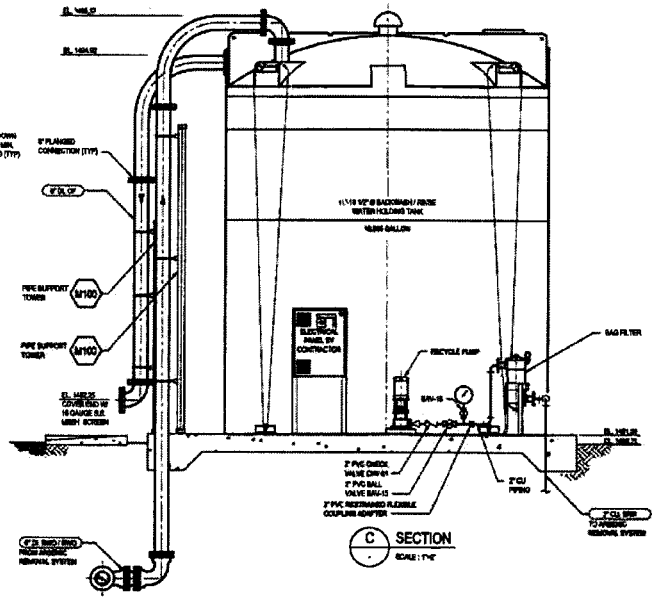


M100 PIPE SUPPORT RACK
SCALE: NTS



M110 SPLASH PAD
SCALE: NTS





EQUIPMENT TABLE

RECYCLE PUMP	
	QUANTITY
MANUFACTURER (VERTICAL IN-LINE)	MAKE
	MODEL
	SIZE
	CAPACITY
	HEAD
	POWER
	VOLTAGE

BAG FILTER	
	QUANTITY
	SIZE
	MODEL
	BAG STYLE
	MATERIAL
	MICRON
	PRESSURE
	RATING
	HOUSING MATERIAL
	LINING

BAG TYPE	
	MODEL
	BAG SIZE
	BAG TYPE
	CONNECTION
	GASKET TYPE
	HOUSING
	MATERIAL
	CAP MATERIAL
	SEAL
	GASKET TYPE

SCALE 1"=2" AT ORIGINAL SIZE

GHD
7500 North 16th Street, Suite 300, Phoenix, Arizona 85020 USA
T (602) 862-3500 F (602) 862-3501
E phxmail@ghd.com W www.ghd.com

"ARIZONA BLUE STAKE, INC." 263-1100 1-800-STAKE-IT

The installation shown to be installed in accordance with the Arizona Water Company Standard Specifications as the Environmental Quality

DESIGN:	SEC 17 - 7S - 5BE
DRAWN:	
CHK'D:	
DATE:	12/17/2014
SCALE:	AS SHOWN
DESIGN PE:	PHT
DRAWN BY:	SJS

ARIZONA WATER COMPANY
3805 N. BLACK CANYON HWY. POST OFFICE BOX 29006
PHOENIX, ARIZONA 85038-9006
(602) 240-6860

PROJECT MGR.:
PROJECT DESC.: VALLEY FARMS ARSENIC REMOVAL FACILITY
16904 E. VIA DI WAY ROAD - VALLEY FARMS, AZ 85191
PROJECT SHEET DESC.: BACKWASH / RINSE WATER HOLDING TANK PLAN, SECTIONS, AND DETAILS

M4

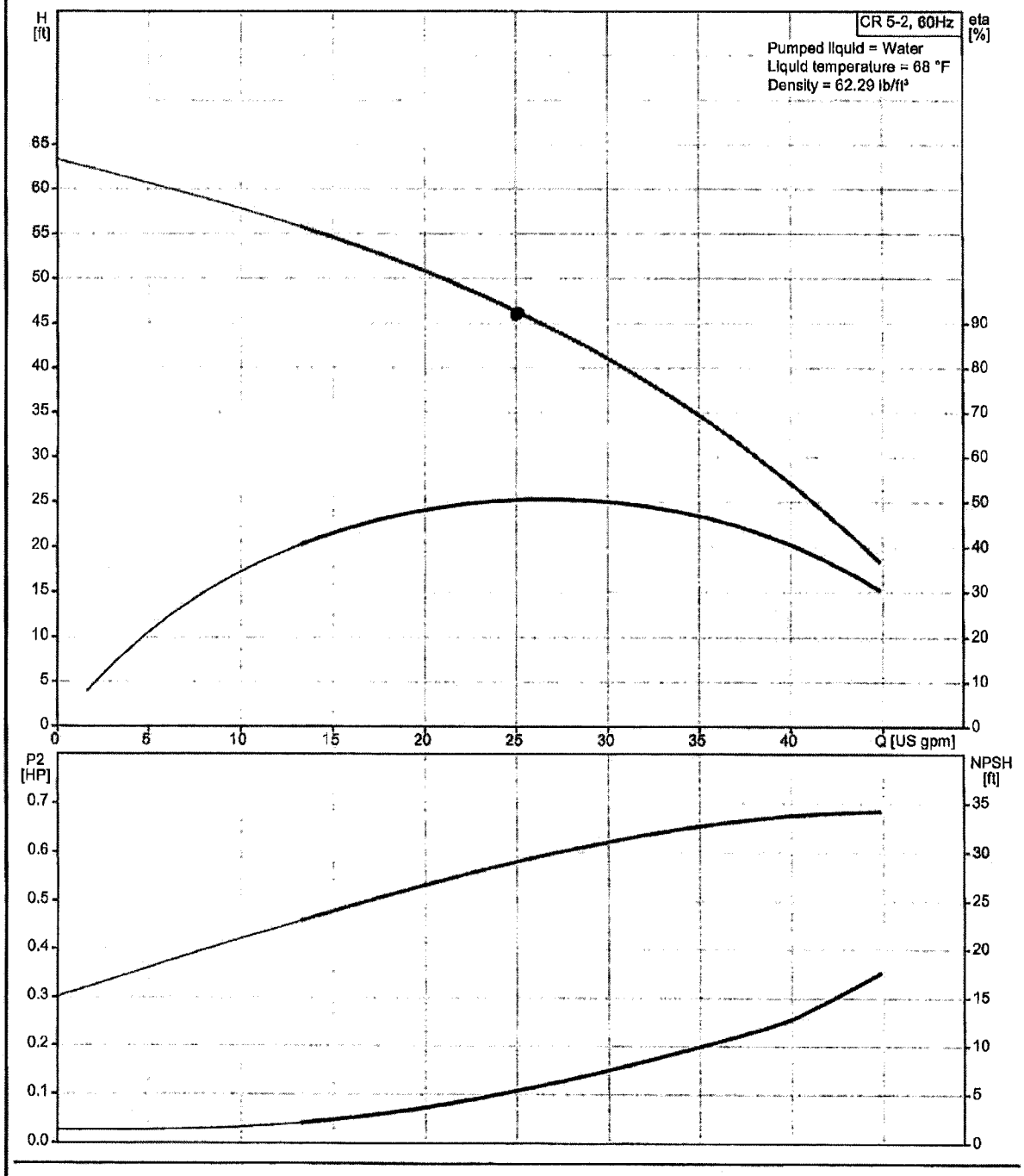
SHEET 10 OF 25

25GPM @ 46FT TDH

GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

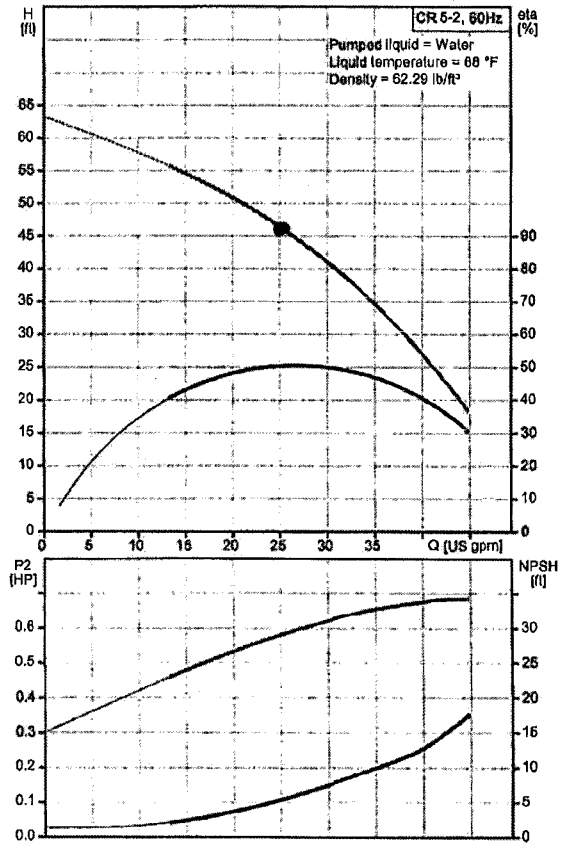
CR 5-2 60 Hz



GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Description	Value
General Information:	
Product name:	CR 5-2 A-B-A-E-HQQE
Position	
Product No.:	
EAN:	
Price:	On request
Technical:	
Speed for pump data:	3464 rpm
Rated flow:	
Rated head:	
Head max:	68.2 ft
Impellers:	2
Shaft seal:	HQQE
Approvals on nameplate:	ANSI/NSF61
Curve tolerance:	ISO 9906:1999 Annex A
Stages:	2
Pump version:	A
Model:	A
Cooling:	TEFC
Materials:	
Pump housing:	Cast Iron EN-JL1030 ASTM 25 B
Impeller:	Stainless steel DIN W.-Nr. 1.4301 AISI 304
Material code:	A
Code for rubber:	E
Installation:	
Maximum ambient temperature:	104 °F (122°F w/DE-RATE)
Max pressure at stated temperature:	232 psi / 250 °F 232 psi / -4 °F
Flange standard:	OVAL
Connect code:	B
Pipe connection:	1 1/4" NPT
Flange size for motor:	56C
Liquid:	
Liquid temperature range:	-4 .. 248 °F
Electrical data:	
Motor type:	BALDOR
Number of poles:	2
Rated power - P2:	0.75 HP
Main frequency:	60 Hz
Rated voltage:	1 x 115/208-230 V
Service factor:	1.25
Rated current:	9,60/5,00-4,60 A
Rated speed:	3450 rpm
Enclosure class (IEC 34-5):	54 (Protect. splashing/dust)
Insulation class (IEC 85):	B
Motor protection:	None



GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Description	Value
Others:	
Net weight:	55.2 lb
Gross weight:	66.2 lb
Shipping volume:	1.77 ft³

Electrical data

Mounting designation	NEMA
Insulation class	F & B
Efficiency class*	Energy efficient Premium efficiency - on request for 15 Hp and above
Enclosure class	TEFC - Totally Enclosed Fan Cooled (Grundfos standard) ODP - Open Drip Proof - on request
60 Hz standard voltages	1 x 115/208-230 V 3 x 208-230/460 V 3 x 575 V
Approvals	The motors are rated for: Baldor ML

* 1-10 Hp ML motors are premium efficiency as standard.

Optional motors

The Grundfos standard range of motors covers a wide variety of application demands. However, for special applications or operating conditions, custom-built motor solutions can be provided.

For special applications or operating conditions, Grundfos offers custom-built motors such as:

- explosion proof motors
- motors with anti-condensation heating unit
- low-noise motors
- premium efficiency motors
- motors with thermal protection.

Motor protection

Single-phase Grundfos specified motors up to 7.5 Hp have a built-in thermal overload switch.

Three-phase motors **must** be connected to a motor starter in accordance with local regulations.

Terminal box positions

As standard the terminal box is mounted on the suction side of the pump.

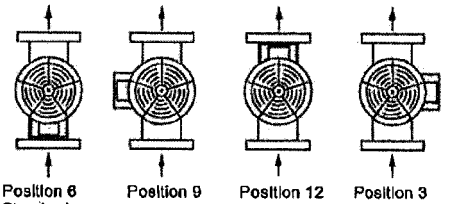


Fig. 3 Terminal box positions

Viscosity

The pumping of liquids with densities or kinematic viscosities higher than those of water will cause a considerable pressure drop, a drop in the hydraulic performance and a rise in the power consumption.

In such situations, the pump should be fitted with a larger motor. If in doubt, contact Grundfos.

Ambient temperature and altitude

If the ambient temperature exceeds the maximum temperature limits of the pump or the pump is installed at an altitude exceeding the altitude values in the chart below, the motor must not be fully loaded due to the risk of overheating.

Overheating may result from excessive ambient temperatures or the low density and consequently low cooling effect of the air at high altitudes. In such cases, it may be necessary to use a motor with a higher rated output (P_2).

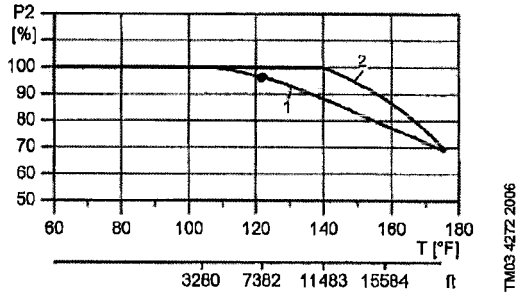


Fig. 4 Relationship between motor output (P_2) and ambient temperature/altitude

Legend

Pos.	Description
1	NEMA energy efficient motors
2	NEMA premium-efficiency motors

Example: From fig. 4 it appears that P_2 must be reduced to 88 % when a pump with a NEMA premium-efficiency ML motor is installed 15,584 ft (4750 m) above sea level. At an ambient temperature of 167 °F (75 °C), P_2 of a standard-efficiency motor must be reduced to 74 % of rated output.

In cases where both the maximum temperature and the maximum altitude are exceeded, the derating factors must be multiplied. Example: 0.89 x 0.89 = 0.79.

MOTOR SUITABLE FOR USE IN 122°F WITH DE-RATE OF 4% PER ABOVE FIG.4.

.75HP X .96 = .72HP (PUMP REQUIRES UNDER 7HP PER PUMP CURVE)

Operating range of the shaft seal

The operating range of the shaft seal depends on operating pressure, pump type, type of shaft seal and liquid temperature. The following curves apply to clean water and water with anti-freeze liquids. For selecting the right shaft seal, see *Pumped liquids* on page 13.

CR 1s - CR 20

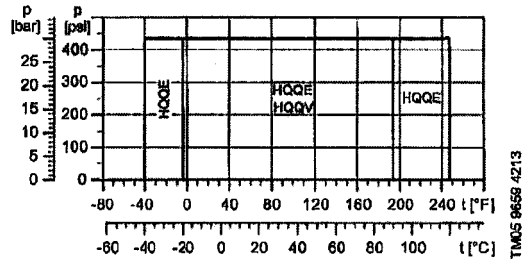


Fig. 5 Operating range of standard shaft seals for CR 1s - CR 20

CR 32 - CR 150 (3.0-60 Hp)

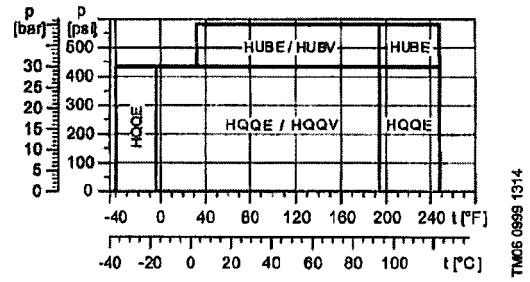


Fig. 6 Operating range of standard shaft seals for CR 32 - CR 150 (3.0-60 Hp)

CR 120 - CR 150 (75-100 Hp)

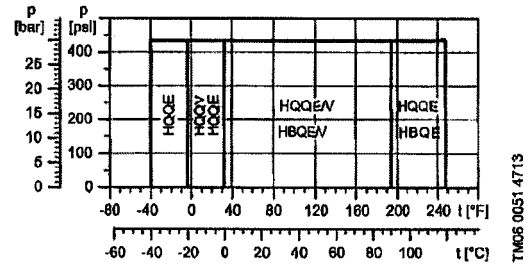


Fig. 7 Operating range of standard shaft seals for CR 120 - CR 150 (75-100 Hp)

Shaft seal	Description	Max. temp. range [°F]
HQQE	O-ring (cartridge) (balanced seal), SIC/SIC, EPDM	-40 °F to +248 °F
HBQE	O-ring (cartridge) (balanced seal), Carbon/SIC, EPDM	+32 °F to +248 °F
HBQV	O-ring (cartridge) (balanced seal), Carbon/SIC, FKM	+32 °F to +194 °F
HQQV	O-ring (cartridge) (balanced seal), SIC/SIC, FKM	-4 °F to +194 °F
HUBE	O-ring (cartridge) (balanced seal), TC/carbon, EPDM	+32 °F to +248 °F
HUBV	O-ring (cartridge) (balanced seal), TC/carbon, FKM	+32 °F to +194 °F

Note: TC= tungsten carbide

See section *Lists of variants - on request* on page 77.

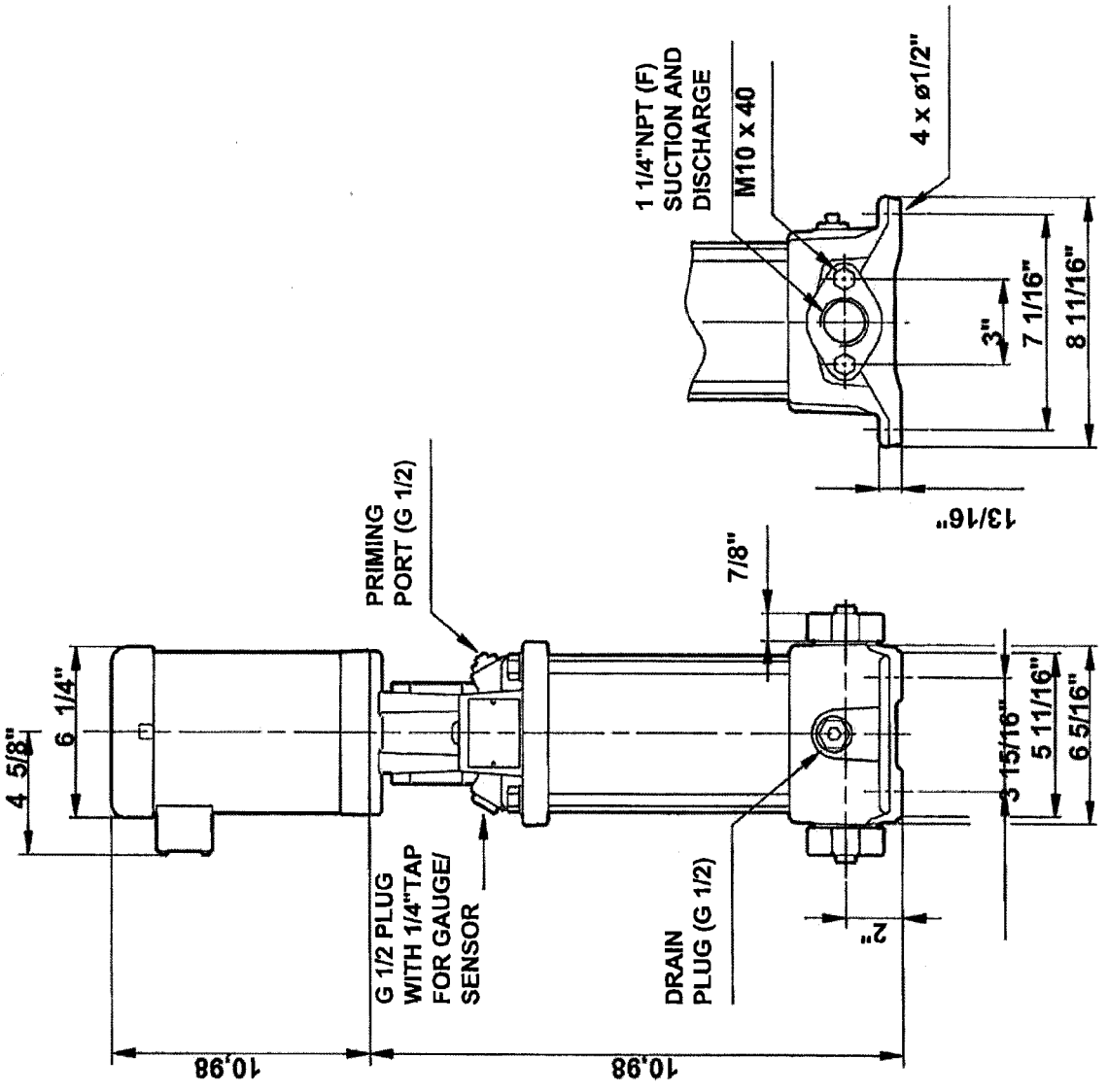
In case of extreme temperatures:

- low temperatures down to -40 °F or
- high temperatures up to +356 °F.

GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

CR 5-2 60 Hz



Note! All units are in [mm] unless otherwise stated.
Disclaimer: This simplified dimensional drawing does not show all details.

LIMITED WARRANTY

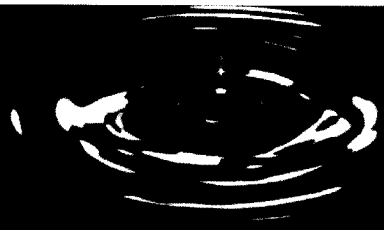
Products manufactured by GRUNDFOS PUMPS CORPORATION (Grundfos) are warranted to the original user only to be free of defects in material and workmanship for a period of 12 months from date of installation, but not more than 18 months from date of manufacture. Grundfos' liability under this warranty shall be limited to repairing or replacing at Grundfos' option, without charge, F.O.B. Grundfos' factory or authorized service station, any product of Grundfos' manufacture. Grundfos will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by Grundfos are subject to the warranty provided by the manufacturer of said products and not by Grundfos' warranty. Grundfos will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Grundfos' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of Grundfos' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact Grundfos or an authorized service station for instructions. Any defective product to be returned to Grundfos or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limit actions on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

Arizona Water Company
Valley Farms Arsenic Removal Facility



FIELD INSTRUMENT'S
Submittal

Installing Contractor: Felix Construction
Equipment Supplier: Felix Construction

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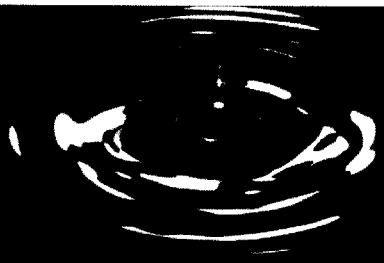
Arizona Water Company
Valley Farms Arsenic Removal
Facility



Level Transmitter

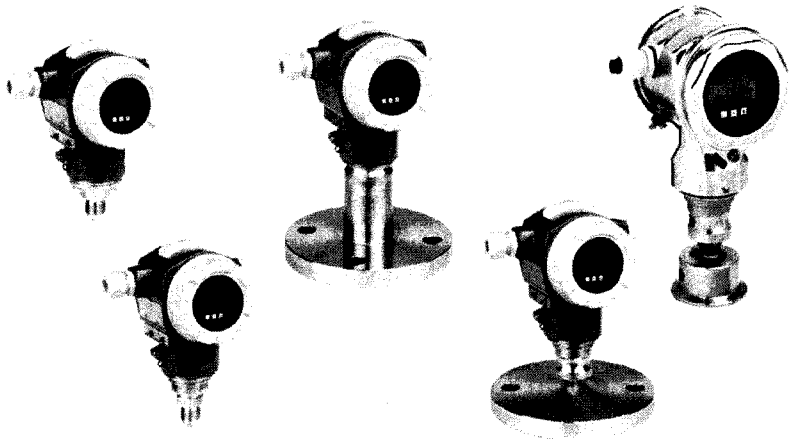
Contractor:
Felix Construction Company
1326 W Industrial Dr
Coolidge, AZ 85142
Ph: (480) 464-0011
Fx: (480) 464-0078
www.felixconstruction.com

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Cerabar S PMC71, PMP71, PMP75

Process pressure measurement
Pressure transmitter with ceramic and metal sensors
Overload-resistant and function-monitored; Communication via HART, PROFIBUS PA or FOUNDATION Fieldbus



Application

The Cerabar S pressure transmitter is used for the following measuring tasks:

- Absolute pressure and gauge pressure in gases, steams or liquids in all areas of process engineering and process measurement technology
- Level, volume or mass measurement in liquids
- High process temperature
  - without diaphragm seals up to 150°C (302°F)
  - with typical diaphragm seals up to 400°C (752°F)
- High pressure up to 700 bar
- International usage thanks to a wide range of approvals

Your benefits

- Very good reproducibility and long-term stability
- High reference accuracy: up to ±0.075%, as PLATINUM version: ±0.05%
- Turn down 100:1, higher on request
- Used for process pressure monitoring up to SIL3, certified according to IEC 61508 by TÜV SÜD
- HistoROM®/M-DAT memory module
- Function-monitored from the measuring cell to the electronics
- Continuous modularity for differential pressure, hydrostatic and pressure (Deltabar S – Deltapilot S – Cerabar S), e.g.
  - replaceable display
  - universal electronic
- Quick commissioning thanks to quick setup menu
- Easy and safe menu-guided operation on-site, via 4...20 mA with HART, via PROFIBUS PA or via FOUNDATION Fieldbus
- Extensive diagnostic functions
- Device versions in conformity with ASME-BPE

TI383P/00/EN/06.09
No. 71095447

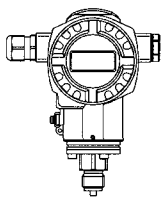
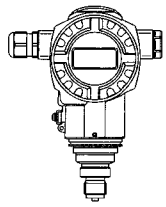
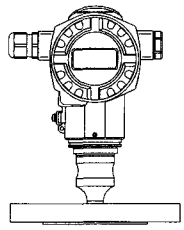
Endress+Hauser

People for Process Automation

Table of contents

Function and system design

Device selection

Cerabar S – Product family	PMC71	PMP71	PMP75
	 P01-PMC71xxx-16-xx-xx-xx-000	 P01-PMP71xxx-16-xx-xx-xx-000	 P01-PMP75xxx-16-xx-xx-xx-000
	With capacitive measuring cell and ceramic measuring process isolating diaphragm (Ceraphire®)	**With piezoresistive measuring cell and metallic welded process isolating diaphragm**	**With diaphragm seal**
Field of application	– Gauge pressure and absolute pressure – Level		
Process connections	– Diverse thread – DN 32 – DN 80 – ANSI 1 1/2" – 4" – JIS 50 A – 100 A	– Diverse thread – DN 25 – DN 80 – ANSI 1 1/2" – 4" – JIS 25 A – 100 A – Oval flange adapter – Prepared for diaphragm seal mount	– Wide range of diaphragm seals, → see the following section "Overview of diaphragm seal for PMP 75"
Measuring ranges	from –100/0...100 mbar to –1/0...40 bar	from –100/0...100 mbar to –1/0...700 bar	from –400/0...400 mbar to –1/0...400 bar
OPL [1]	max. 60 bar	max. 1050 bar	max. 600 bar
Process temperature range	–25...+125°C/–20...+150°C [2] (–13...+257°F/–4...+302°F)	–40...+125°C (–40...+257°F)	-70...400°C (-94...+752°F)
Ambient temperature range	–40...+85°C (–40...+185°F)	–40...+85°C (–40...+185°F) [3]	–40...+85°C (–40...+185°F)
Ambient temperature range separate housing	–40 to +60°C (–40 to +140°F)		
Reference accuracy	– Up to ±0.075% of the set span – PLATINUM version: up to ±0.05% of the set span		Up to ±0.075% of the set span
Supply voltage	– For non-hazardous areas: 10.5...45 V DC – Ex ia: 10.5...30 V DC		
Output	4...20 mA with superimposed HART protocol, PROFIBUS PA, FOUNDATION Fieldbus		
Options	– PMP71, PMP75: Gold-Rhodium-coated process isolating diaphragm – PMP71, PMP75: NACE-compliant materials – PMC71, PMP71, PMP75: inspection certificate 3.1 – HistoROM®/M-DAT memory module – Separate housing		
Specialities	– Metal-free measurement with PVDF connection – Cleaning of the transmitter for the use in paint shops	– Oil volume-minimised process connections – gas-tight, elastomer-free	– Wide range of diaphragm seals – For high media temperatures – Oil volume-minimised process connections – Completely welded versions

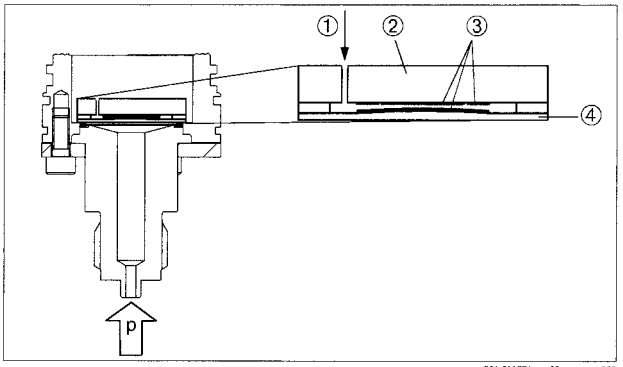
1) OPL = Over pressure limit; dependent on the lowest-rated element, with regard to pressure, of the selected components

2) High temperature version "T" for feature 100 "Additional option 1" or for feature 110 "Additional option 2"

3) lower temperature on request

Measuring principle

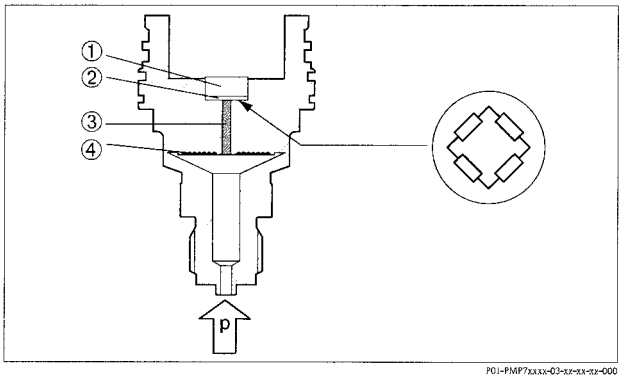
Ceramic process isolating diaphragm used for PMC71 (Ceraphire®)



Ceramic sensor

1 Atmospheric vent (gauge pressure only)
2 Ceramic substrate
3 Electrodes
4 Ceramic process isolating diaphragm

Metallic process isolating diaphragm used for PMP71 and PMP75



Metal sensor

1 Measuring element
2 Wheatstone bridge
3 Channel with fill fluid
4 Metal process isolating diaphragm

Ceramic process isolating diaphragm used for PMC71 (Ceraphire®)

The ceramic sensor is a dry sensor, i.e. the process pressure acts directly on the robust ceramic process isolating diaphragm and deflects it. A pressure-dependent change in capacitance is measured at the electrodes of the ceramic carrier and the process isolating diaphragm. The measuring range is determined by the thickness of the ceramic process isolating diaphragm.

Advantages:
- Guaranteed overload resistance up to 40 times the nominal pressure
- Thanks to highly-pure 99.9% ceramic (Ceraphire®, see also "www.endress.com/ceraphire")
  - extremely high chemical resistance compared to Alloy
  - less relaxation
  - high mechanical stability
- Suitable for vacuums
- Second process barrier (Secondary Containment) for enhanced integrity
- Process temperature up to 150°C (302°F)

Metallic process isolating diaphragm used for PMP71 and PMP75

PMP71

The operating pressure deflects the process isolating diaphragm and a fill fluid transfers the pressure to a resistance measuring bridge (semi-conductor technology). The pressure-dependent change of the bridge output voltage is measured and evaluated.

Advantages:
- Can be used for process pressure up to 700 bar
- High long-term stability
- Guaranteed overload resistance up to 4 times the nominal pressure
- Second process barrier (Secondary Containment) for enhanced integrity
- Significantly less thermal effect compared to diaphragm seal systems

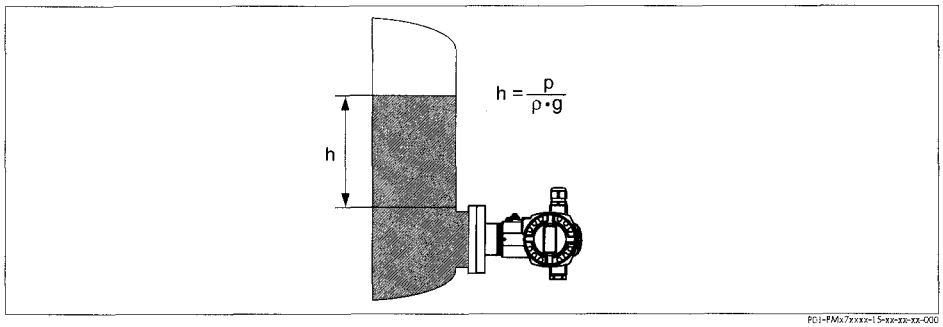
PMP75

The operating pressure acts on the process isolating diaphragm of the diaphragm seal and is transferred to the process isloating diaphragm of the sensor by a diaphragm seal fill fluid. The process isolating diaphragm is deflected and a fill fluid transfers the pressure to a resistance measuring bridge. The pressure-dependent change of the bridge output voltage is measured and evaluated.

Advantages:
- Can be used for process pressure up to 400 bar
- High long-term stability
- Guaranteed overload resistance up to 4 times the nominal pressure
- Second process barrier (Secondary Containment) for enhanced integrity

Level measurement (level, volume and mass)

Design and operation mode



Level measurement with Cerabar S

h *Height (level)*
p *Pressure*
ρ *Density of the medium*
g *Gravitation constant*

Your benefits

- Choice of three level operating modes in the device software
- Volume and mass measurements in any tank shapes by means of a freely programmable characteristic curve
- Choice of diverse level units with automatic unit conversion
- A customised unit can be specified
- Has a wide range of uses, as well
  - in the event of foam formation
  - in tanks with agitators of screen fittings
  - in the event of liquid gases

Communication protocol

- 4...20 mA with HART communication protocol
- PROFIBUS PA
  - The Endress+Hauser devices meet the requirements as per the FISCO model.
  - Due to the low current consumption of 13 mA ± 1 mA
    - up to 7 Cerabar S for Ex ia, CSA IS and FM IS applications
    - up to 27 Cerabar S for all other applications, e.g. in non-hazardous areas, Ex nA, etc.

    can be operated at one bus segment with installation as per FISCO.

  Further information on PROFIBUS PA, such as requirements for bus system components, can be found in the Operating Instructions BA034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and in the PNO guideline.
- FOUNDATION Fieldbus
  - The Endress+Hauser devices meet the requirements as per the FISCO model.
  - Due to the low current consumption of 15 mA ± 1 mA
    - up to 6 Cerabar S for Ex ia, CSA IS and FM IS applications
    - up to 24 Cerabar S for all other applications, e.g. in non-hazardous areas, Ex nA, etc.

    can be operated at one bus segment with installation as per FISCO.

  Further information on FOUNDATION Fieldbus, such as requirements for bus system components can be found in the Operating Instructions BA013S "FOUNDATION Fieldbus Overview".

Input

Measured variable

Absolute pressure and gauge pressure, from which level (level, volume or mass) is derived

Measuring range

PMC71 – with ceramic process isolating diaphragm (Ceraphire®) for gauge pressure

Nominal value	Measurement limit		Smallest calibratable Span [4]	MWP [1]	OPL [2]	Vacuum resistance	Versions in the order code [3]
	lower (LRL) [bar]	upper (URL) [bar]	[bar]	[bar]	[bar]	[bar_{abs}]	
100 mbar	–0.1	+0.1	0.005	2.7	4	0.7	1C
250 mbar	–0.25	+0.25	0.005	3.3	5	0.5	1E
400 mbar	–0.4	+0.4	0.005	5.3	8	0	1F
1 bar	–1	+1	0.01	6.7	10	0	1H
2 bar	–1	+2	0.02	12	18	0	1K
4 bar	–1	+4	0.04	16.7	25	0	1M
10 bar	–1	+10	0.1	26.7	40	0	1P
40 bar	–1	+40	0.4	40	60	0	1S

PMC71 – with ceramic process isolating diaphragm (Ceraphire®) for absolute pressure

Nominal value	Measurement limit		Smallest calibratable Span [4]	MWP [1]	OPL [2]	Versions in the order code [3]
	lower (LRL) [bar_{abs}]	upper (URL) [bar_{abs}]	[bar]	[bar_{abs}]	[bar_{abs}]	
100 mbar	0	+0.1	0.005	2.7	4	2C
250 mbar	0	+0.25	0.005	3.3	5	2E
400 mbar	0	+0.4	0.005	5.3	8	2F
1 bar	0	+1	0.01	6.7	10	2H
2 bar	0	+2	0.02	12	18	2K
4 bar	0	+4	0.04	16.7	25	2M
10 bar	0	+10	0.1	26.7	40	2P
40 bar	0	+40	0.4	40	60	2S

1) The MWP (maximum working pressure) for the measuring device depends on the weakest element of the components selected with regard to pressure, i.e. the process connection (→ 🖹 32 ff) has to taken into consideration in addition to the sensor (→ see Table above). Pay attention to the pressure-temperature dependence also. For the appropriate standards and further information, see → 🖹 31, "Pressure specification".
2) OPL: Over Pressure Limit; depends on the weakest link in terms of pressure of the selected components.
3) Versions in the order code → 🖹 77 ff, feature 40 "Sensor range; Sensor overload limit (= OPL)"
4) Turn down > 100:1 on request or can be set at the device

PMP71 and PMP75 – with metallic process isolating diaphragm for gauge pressure

Nominal value	Measurement limits		Smallest calibratable Span [5]	MWP [1]	OPL [2]	Vacuum resistance [3]	Versions in the order code [4]
	lower (LRL)	upper (URL)				Silicone oil/ Inert oil	
	[bar]	[bar]	[bar]	[bar_{rel}]	[bar_{rel}]	[bar_{abs}]	
400 mbar	–0.4	+0.4	0.005	4	6	0.01/0.04	1F
1 bar	–1	+1	0.01	6.7	10	0.01/0.04	1H
2 bar	–1	+2	0.02	13.3	20	0.01/0.04	1K
4 bar	–1	+4	0.04	18.7	28	0.01/0.04	1M
10 bar	–1	+10	0.1	26.7	40	0.01/0.04	1P
40 bar	–1	+40	0.4	100	160	0.01/0.04	1S
100 bar	–1	+100	1.0	100	400	0.01/0.04	1U
400 bar	–1	+400	4.0	400	600	0.01/0.04	1W
700 bar [6]	–1	+700	7.0	700	1050	0.01/0.04	1X

PMP71 and PMP75 – with metallic process isolating diaphragm for absolute pressure

Nominal value	Measurement limits		Smallest calibratable Span [5]	MWP [1]	OPL [2]	Vacuum resistance [3]	Versions in the order code [4]
	lower (LRL)	upper (URL)				Silicone oil/ Inert oil	
	[bar_{abs}]	[bar_{abs}]	[bar]	[bar_{abs}]	[bar_{abs}]	[bar_{abs}]	
400 mbar	0	+0.4	0.005	4	6	0.01/0.04	2F
1 bar	0	+1	0.01	6.7	10	0.01/0.04	2H
2 bar	0	+2	0.02	13.3	20	0.01/0.04	2K
4 bar	0	+4	0.04	18.7	28	0.01/0.04	2M
10 bar	0	+10	0.1	26.7	40	0.01/0.04	2P
40 bar	0	+40	0.4	100	160	0.01/0.04	2S
100 bar	0	+100	1.0	100	400	0.01/0.04	2U
400 bar	0	+400	4.0	400	600	0.01/0.04	2W
700 bar [6]	0	+700	7.0	700	1050	0.01/0.04	2X

1) The MWP (maximum working pressure) for the measuring device depends on the weakest element of the components selected with regard to pressure, i.e. the process connection (→ 32 ff) has to taken into consideration in addition to the sensor (→ see Table above). Pay attention to the pressure-temperature dependence also. Pay attention to the pressure-temperature dependence also. For the appropriate standards and further information, → 31, "Pressure specifications".
2) OPL: Over pressure limit (= Sensor overload limit)
3) The vacuum resistance applies to the measuring cell at a reference conditions. The pressure and temperature application limits of the selected filling oil must also be observed for the PMP75. → 69, section "Diaphragm seal filling oils".
4) Versions in the order code → 77 ff, feature 40 "Sensor range; Sensor Overload limit (= OPL)"
5) Turn down > 100:1 on request or can be set at the device
6) PMP71 only, PMP75 on request

Explanation of terms

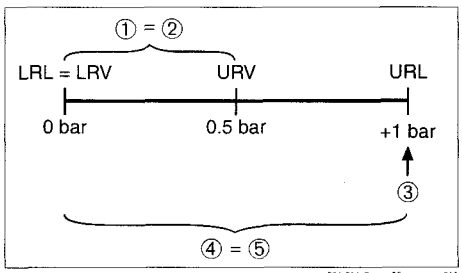
Explanation of terms: Turn down (TD), set span and on zero based span

Case 1:
- |Lower range value (LRV)| ≤ |Upper range value (URV)|

Example:
- Lower range value (LRV) = 0 bar
- Upper range value (URV) = 0.5 bar
- Nominal value (URL) = 1 bar

Turn down:
- TD = URL / |URV| = 2:1

set span:
- URV – LRV = 0.5 bar
  This span is based on the zero point.



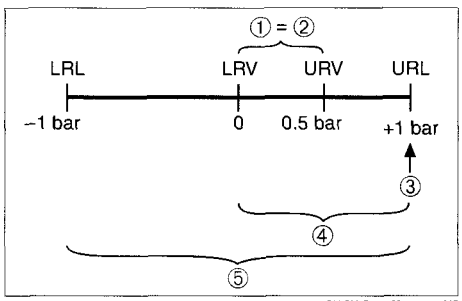
Example: 1 bar measuring cell

Case 2:
- |Lower range value (LRV)| ≤ |Upper range value (URV)|

Example:
- Lower range value (LRV) = 0 bar
- Upper range value (URV) = 0.5 bar
- Nominal value (URL) = 1 bar

Turn down:
- TD = URL / |URV| = 2:1

set span:
- URV – LRV = 0.5 bar
  This span is based on the zero point.



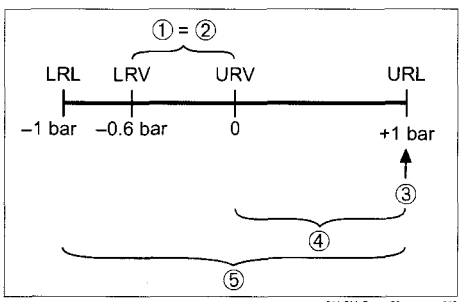
Example: 1 bar measuring cell

Case 3:
- |Lower range value| ≥ |Upper range value|

Example:
- Lower range value (LRV) = –0.6 bar
- Upper range value (URV) = 0 bar
- Nominal value (URL) = 1 bar

Turn down:
- TD = URL / |LRV| = 1.67:1

set span:
- URV – LRV = 0.6 bar
  This span is based on the zero point.



Example: 1 bar measuring cell

1 *Set span*
2 *Zero based span*
3 *Nominal value ≙ Upper range limit (URL)*
4 *Nominal measuring range*
5 *Sensor measuring range*
LRL *Lower range limit*
URL *Upper range limit*
LRV *Lower range value*
URV *Upper range value*

Output

Output signal

- 4...20 mA with superimposed digital communication protocol HART 5.0, 2-wire
- Digital communication signal PROFIBUS PA (Profile 3.0)
  - signal coding: Manchester Bus Powered (MBP); Manchester II
  - data transmission rate: 31.25 KBit/s, voltage mode
- Digital communication signal FOUNDATION Fieldbus, 2-wire
  - signal coding: Manchester Bus Powered (MBP); Manchester II
  - data transmission rate: 31.25 KBit/s, voltage mode

Signal range – 4...20 mA HART

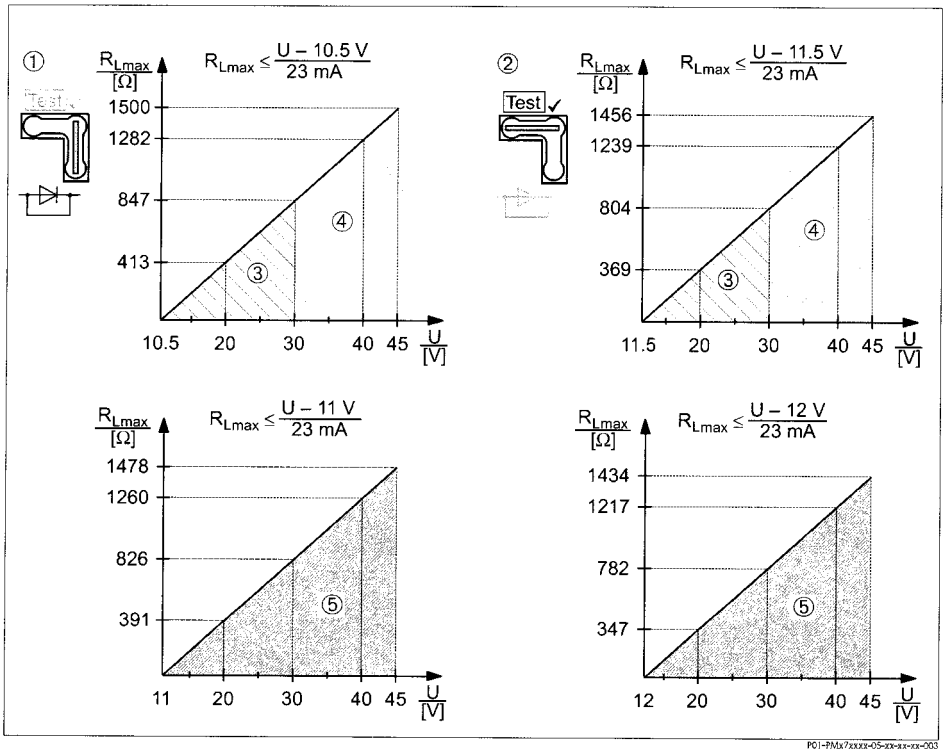
3.8 mA to 20.5 mA

Signal on alarm

As per NAMUR NE 43

- 4...20 mA HART
  Options:
  - Max. alarm*: can be set from 21...23 mA
  - Keep measured value: last measured value is kept
  - Min. alarm: 3.6 mA
  * Factory setting: 22 mA
- PROFIBUS PA: can be set in the Analog Input block,
  options: Last Valid Out Value, Fsafe Value (factory setting), Status bad
- FOUNDATION Fieldbus: can be set in the Analog Input Block,
  options: Last good Value, Fail Safe Value (factory setting), Wrong Value

Load – 4...20 mA HART



Load diagram, observe the position of the jumper and the explosion protection. (→ 🖹 17, section "Taking 4...20 mA test signal".)

1 Jumper for the 4...20 mA test signal inserted in "Non-test" position
2 Jumper for the 4...20 mA test signal inserted in "Test" position
3 Supply voltage 10.5 (11.5)...30 V DC for 1/2 G, 1 GD, 1/2 GD, FM IS, CSA IS, IECEx ia, NEPSI Ex ia
4 Supply voltage 10.5 (11.5)...45 V DC for devices for non-hazardous areas, 1/2 D, 1/3 D, 2 G Ex d, 3 G Ex nA, FM XP, FM DIP, FM NI, CSA XP, CSA Dust-Ex, NEPSI Ex d
5 Supply voltage 11 (12)...45 V DC for PMC71, Ex d[ia], NEPSI Ex d[ia]
R_{Lmax} Maximum load resistance
U Supply voltage

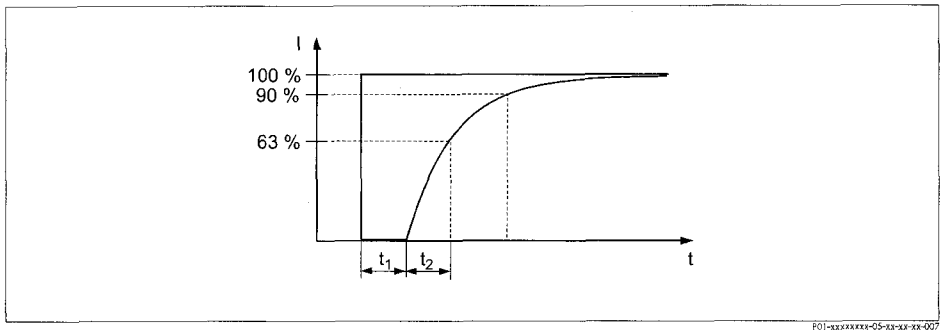
Note!
When operating via a handheld terminal or via PC with an operating program, a minimum communication resistance of 250 Ω must exist within the loop.

Resolution

- Current output: 1 µA
- Display: can be set (factory setting: presentation of the maximum accuracy of the transmitter)

Dynamic behavior current output

Dead time, Time constant (T63)



Presentation of the dead time and the time constant

Type	Dead time t_1	Time constant (T63), t_2
PMC71	90 ms	120 ms
PMP71	45 ms	■ 400 mbar measuring cell: 70 ms ■ measuring cells ≥ 1 bar: 35 ms
PMP75	PMP71 + influence from the diaphragm seal	

Dynamic behavior HART

Dead time, Time constant (T63)

A typical parametrization for the PLC of 3 to 4 values per second results in the following total dead time:

Type	Dead time t_1	Time constant (T63), t_2
PMC71	90 ms	120 ms
PMP71	45 ms	■ 400 mbar measuring cell: 70 ms ■ measuring cells ≥ 1 bar: 35 ms
PMP75	PMP71 + influence from the diaphragm seal	

Reading cycle

- HART commands: on average 3 to 4 per second on average.
  The Cerabar S commands the BURST MODE functionfor cyclic value transmission via the HART communication protocol.

Response time

≤ 250 ms

Cycle time (Update time)

On average 250...330 ms.

Dynamic behavior PROFIBUS PA

Dead time, Time constant (T63)

A typical cyclic parametrization for the PLC of 20 values per second results in the following total dead time:

Type	Dead time t_1	Time constant (T63), t_2
PMC71	340 ms	120 ms
PMP71	295 ms	■ 400 mbar measuring cell: 70 ms ■ measuring cells ≥ 1 bar: 35 ms
PMP75	PMP71 + influence from the diaphragm seal	

Response time

- cyclic: approx. 10 ms per request
- acyclic: < 50 ms

All values are typical values.

Cycle time (Update time)

The cycle time in a bus segment in cyclic data communication depends on the number of devices, on the segment coupler used and on the internal PLC cycle time.

Dynamic behavior FOUNDATION Fieldbus

Dead time, Time constant (T63)

If the macro cycle time (Hostsystem) is set to a typical value of 250 ms, the following total dead time results:

Type	Dead time t_1	Time constant (T63), t_2
PMC71	340 ms	120 ms
PMP71	295 ms	■ 400 mbar measuring cell: 70 ms ■ measuring cells ≥ 1 bar: 35 ms
PMP75	PMP71 + influence from the diaphragm seal	

Reading cycle

- cyclic: up to 5/s, dependent on the number and type of function blocks used in a closed-control loop
- acyclic: 10/s

Response time

- cyclic: < 80 ms
- acyclic: < 40 ms

All values are typical values.

Cycle time (Update time)

250 ms

Damping

A damping affects all outputs (output signal, display).

- Via on-site display, handheld terminal or PC with operating program, continuous from 0...999 s
- Additionally for HART and PROFIBUS PA: via DIP-switch on the electronic insert, switch position "on" = set value and "off"
- Factory setting: 2 s

Data of the FOUNDATION Fieldbus interface

Basic Data

Device Type	1007F (hex)
Device Revision	06 (hex)
DD Revision	01 (hex)
CFF Revision	01 (hex)
ITK Version	5.0
ITK-Certification Driver-No.	IT054600
Link-Master (LAS) cabable	yes
Link Master / Basic Device selectable	yes; Default: Basic Device
Number VCRs	44
Number of Link-Objects in VFD	50

Virtual communication references (VCRs)

Permanent Entries	44
Client VCRs	0
Server VCRs	5
Source VCRs	8
Sink VCRs	0
Subscriber VCRs	12
Publisher VCRs	19

Link Settings

Slot time	4
Min. Inter PDU delay	12
Max. response delay	10

Transducer Blocks

Block	Content	Output values
TRD1 Block	contains all parameters related to the measurement	■ Pressure or level (channel 1) ■ Process temperature (channel 2)
Service Block	contains service information	■ Pressure after damping (channel 3) ■ Pressure drag indicator (channel 4) ■ Counter for max. pressure transgression (channel 5)
Diagnostic Block	contains diagnostic information	Error code via DI channels (channel 0 to 16)
Display Block	contains parameters to configure the local display	no output values

Function Blocks

Block	Content	Number of Function Blocks	Execution time	Functionality
Resource Block	The Resource Block contains all the data that uniquely identifies the field device. It is an electronic version of a nameplate of the device.			enhanced
Analog Input Block 1 Analog Input Block 2	The AI block takes the manufacturer's input data, selected by channel number, and makes it available to other function blocks at its output. Enhancement: digital outputs for process alarms, fail safe mode		45 ms	enhanced
Digital Input Block	This block contains the discrete data of the diagnose block (selectable via a channel number 0 to 16) and provides them for the blocks at the output.		40 ms	standard
Digital Output Block	This block converts the discrete input and thus initiates an action (selectable via a channel number) in the dp flow block or in the service block. Channel 1 resets the counter for max. pressure transgressions..		60 ms	standard
PID Block	The PID block serves as proportional-integral-derivative controller and is used almost universally to do closed-loop-control in the field including cascade and feedforward. Input IN can be indicated on the display. The selection is performed in the display block (DISPLAY_MAIN_LINE_CONTENT).		120 ms	standard
Arithmetic Block	This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be done.		50 ms	standard
Input Selector Block	The input selector block provides selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI blocks. The block performs maximum, minimum, middle, average and 'first good' signal selection. INPUT IN1 to IN4 can be indicated on the display. The selection is performed in the display block (DISPLAY_MAIN_LINE_CONTENT).		35 ms	standard
Signal Characterizer Block	The signal characterizer block has two sections, each with an output that is a non-linear function of the respective input. The non-linear function is determined by a single look-up table with 21 arbitrary x-y pairs.		30 ms	standard
Integrator Block	The Integrator Function Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input block. The block may be used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, where the integrated or accumulated value is compared to pre-trip and trip settings, generating discrete signals when these settings are reached.		35 ms	standard
Analog Alarm Block	This block contains all process alarm conditions (working like a comparator) and represents them at the output.		35 ms	standard

Additional Function Block informations:

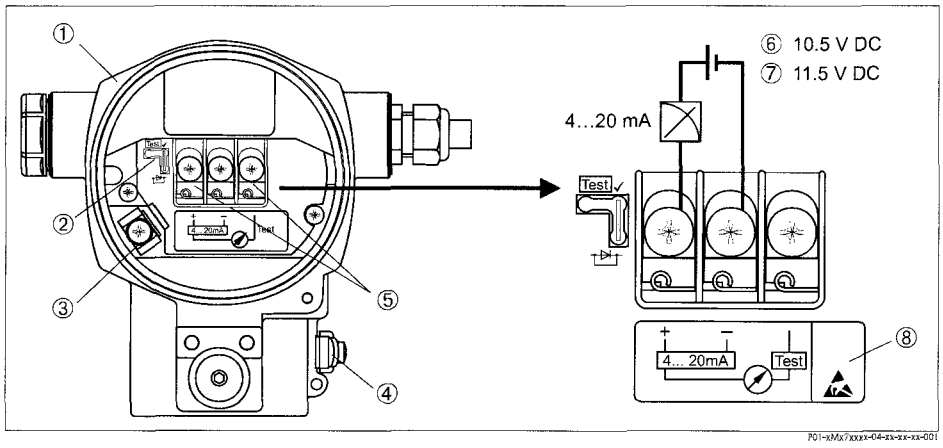
Instantiate Function Block	YES
Number of instantiate blocks	15

Power supply

Electrical connection

Note!
- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings. → 90 ff, sections "Safety Instructions" and "Installation/Control Drawings".
- Devices with integrated overvoltage protection must be earthed. → 29.
- Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.

4...20 mA HART



Electrical connection 4...20 mA HART

1 *Housing*
2 *Jumper for 4...20 mA test signal → 17, section "Taking 4...20 mA test signal".*
3 *Internal earth terminal*
4 *External earth terminal*
5 *4...20 mA test signal between plus and test terminal*
6 *Minimum supply voltage 10.5 V DC, if the jumper is inserted in accordance with the illustration.*
7 *Minimum supply voltage 11.5 V DC, if the jumper is inserted in "Test" position.*
8 *Devices with integrated overvoltage protection are labelled OVP (overvoltage protection) here (→ 29).*

PROFIBUS PA

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy. For further information on the network structure and grounding and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA034S "Guidelines for planning and commissioning PROFIBUS DP/PA" and the PNO Guideline.

Cable specifications:
- Use a twisted, shielded two-wire cable, preferably cable type A

Note!
For further information on the cable specifications, see Operating Instructions BA034S Guidelines for planning and commissioning PROFIBUS DP/PA", PNO Guideline 2.092 " PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

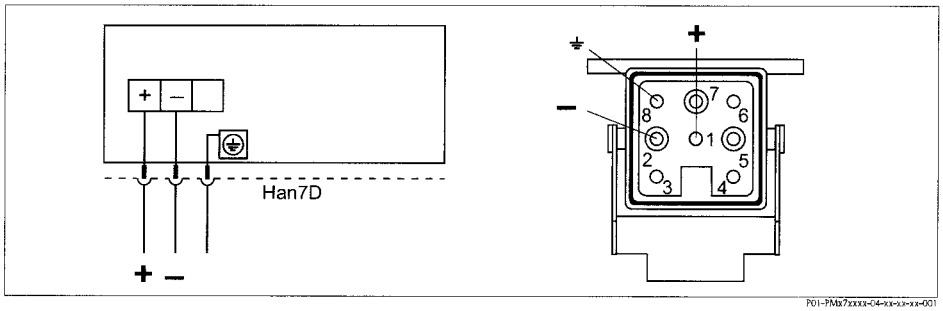
FOUNDATION Fieldbus

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the auxiliary energy. For further information on the network structure and grounding and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA013S "FOUNDATION Fieldbus Overview" and the FOUNDATION Fieldbus Guideline.

Cable specifications:
- Use a twisted, shielded two-wire cable, preferably cable type A

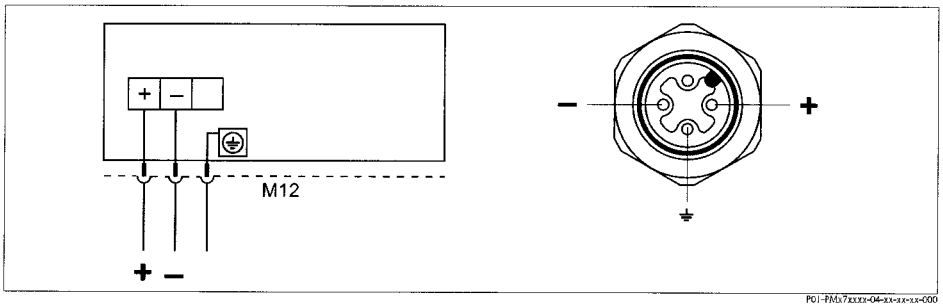
Note!
For further information on the cable specifications, see Operating Instructions BA013S "FOUNDATION Fieldbus Overview", FOUNDATION Fieldbus Guideline and IEC 61158-2 (MBP).

Devices with Harting plug Han7D



Left: electrical connection for devices with Harting plug Han7D
Right: view of the plug connector at the device

Devices with M12 plug



Left: electrical connection for devices with M12 plug
Right: view of the plug at the device

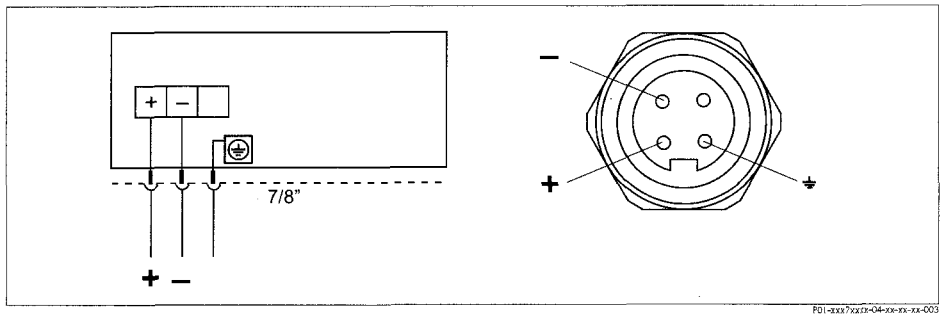
Endress+Hauser offers for devices with M12 plug the following accessories:

Plug-in jack M 12x1, straight
- Material: Body PA; coupling nut CuZn, nickel-plated
- Degree of protection (fully locked): IP67
- Order number: 52006263

Plug-in jack M 12x1, elbowed
- Material: Body PBT/PA; coupling nut GD-Zn, nickel-plated
- Degree of protection (fully locked): IP67
- Order number: 51006327

Cable 4x0.34 mm^2 with M12 socket, elbowed, screw plug, 5 m length
- Material: Body PUR; coupling nut CuSn/Ni; cable PVC
- Degree of protection (fully locked): IP67
- Order number: 52010285

Devices with 7/8" plug



Left: electrical connection for devices with 7/8" plug
Right: view of the plug at the device

Kabel gland

Approval	Typ	Clamping range
Standard, II1/2G Exia, IS	Plastic M20x1.5	5...10 mm
ATEX II1/2D, II1/3D, II1/2GD Exia, II1GD Exia II3G Ex nA	Metal M20x1.5 (Ex e)	7...10.5 mm

Terminals

for wire cross-sections of 0.5 to 2.5 mm^2

Taking 4...20 mA test signal

A 4...20 mA signal may be measured via the positive and test terminal without interrupting the measurement. The minimum supply voltage of the device can be reduced by simply changing the position of the jumper. As a result, operation is also possible with lower voltage sources. Observe the position of the jumper in accordance with the following table.

Jumper position for test signal	Description
	– Taking 4...20 mA test signal via plus and test terminal: possible. (Thus, the output current can be measured without interruption via the diode.) – Delivery status – minimum supply voltage: 11.5 V DC
	– Taking 4...20 mA test signal via plus and test terminal: not possible. – minimum supply voltage: 10.5 V DC

Supply voltage

Note!
- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.
- All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.
  → 📄 90 ff sections "Safety Instructions" and "Installation/Control Drawings".

4...20 mA HART

- Version for non-hazardous areas, jumper for 4...20 mA test signal in "Test" position (delivery status): 11.5...45 V DC
- Version for non-hazardous areas, jumper for 4...20 mA test signal in "Non-test" position: 10.5...45 V DC

PROFIBUS PA

- Version for non-hazardous areas: 9...32 V DC

FOUNDATION Fieldbus

- Version for non-hazardous areas: 9...32 V DC

Current consumption

- PROFIBUS PA: 13 mA ± 1 mA, switch-on current corresponds to IEC 61158-2, Clause 21
- FOUNDATION Fieldbus: 15 mA ± 1 mA, switch-on current corresponds to IEC 61158-2, Clause 21

Cable entry

→ 📄 77 ff, feature 30 "Ordering information".

Cable specification

- Endress+Hauser recommends using shielded, twisted-pair two-wire cables.
- Terminals for wire cross-sections 0.5...2.5 mm^2
- Cable external diameter: 5...9 mm

Residual ripple

Without influence on 4...20 mA signal up to ± 5% residual ripple within the permitted voltage range [according to HART hardware specification HCF_SPEC-54 (DIN IEC 60381-1)]

Influence of power supply

≤ 0.0006% of URL/1 V

Performance characteristics – general

Reference operating conditions

- As per IEC 60770
- Ambient temperature T_U = constant, in the range of: +21...+33°C (+69.8...+91.4°F)
- Humidity φ = constant, in the range of: 5...80 % r.H
- Ambient pressure p_U = constant, in the range of: 860...1060 mbar
- Position of the measuring cell: constant, in the range of: ±1°
- Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value
- Zero based span
- Process isolating diaphragm material PMC71: Al_2O_3 (Aluminium oxide ceramic)
- Process isolating diaphragm material PMP71 and PMP75: AISI 316L/1.4435
- Filling oil PMP71 and PMP75: silicone oil
- Supply voltage: 24 V DC ± 3 V DC
- Load with HART: 250 Ω

Uncertainty of measurement for small absolute pressure ranges

The smallest extended uncertainty of measurement that can be returned by our standards is:
- 0.4% of the set span in the range of 1...30 mbar and
- 1% of the set span in the range < 1 mbar.

Long-term stability

PMC71/PMP71/PMP75:
- For measuring ranges ≥ 1 bar: ± 0.05 % of URL/year

PMC71:
- 100 mbar ... 40 bar: ±0.2 % of URL/10 years
- 100 mbar ... 40 bar (absolute pressure sensor): ±0.3 % of URL/10 years

PMP71 gauge pressure sensors:

	1 year	5 years	10 year
Measuring range [bar]	**% of URL**		
1	±0.020	±0.080	±0.180
10	±0.025	±0.050	±0.075
40	±0.025	±0.075	±0.100
100	±0.050	±0.150	±0.200
400	–	–	1

Influence of the installation position

- PMC71 [1]: ≤ 0.18 mbar
- PMP71 [1, 2]
  - Process connections thread G 1 A, G 1 1/2, G 2, 1 1/2 MNPT, 2 MNPT, M44x1.25, EN/DIN, ANSI and JIS flanges: ≤ 10 mbar
  - Process connections thread: G 1/2, 1/2 MNPT, JIS G 1/2, JIS R 1/2, M20x1.5: ≤ 4 mbar

1) Device rotated 180°, process connection pointing upwards.
2) This value is doubled for devices with inert oil.

Note!
Position-dependent zero shift can be corrected. → 24, section "General installation instructions" and → 74 ff section "Installation instructions".

Performance characteristics – ceramic process isolating diaphragm

Reference accuracy – PMC71

The reference accuracy comprises the non-linearity according to limit point setting, hysteresis and non-reproducibility as per IEC 60770. The data refer to the calibrated span.

Measuring cell	Gauge pressure sensor	Absolute pressure sensor
	% of the set span	
100 mbar	■ TD 1:1 to TD 10:1 = ±0.075 ■ TD > 10:1 = ±0.0075 x TD	■ TD 1:1 to TD 5:1 = ±0.075 ■ TD > 5:1 = ±0.015 x TD
250 mbar	■ TD 1:1 to TD 15:1 = ±0.075 ■ TD > 15:1 = ±0.005 x TD	■ TD 1:1 to TD 10:1 = ±0.075 ■ TD > 10:1 = ±0.0075 x TD
400 mbar, 1 bar, 2 bar, 4 bar, 10 bar	■ TD 1:1 to TD 15:1 = ±0.075 ■ TD > 15:1 = ±0.005 x TD	■ TD 1:1 to TD 15:1 = ±0.075 ■ TD > 15:1 = ±0.005 x TD
40 bar	■ TD 1:1 to TD 10:1 = ±0.075 ■ TD > 10:1 = ±0.0075 x TD	■ TD 1:1 to TD 10:1 = ±0.075 ■ TD > 10:1 = ±0.0075 x TD
Platinum version: 1 bar, 2 bar, 4 bar, 10 bar	■ TD 1:1 = ±0.05	■ TD 1:1 = ±0.05

Total performance – PMC71

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility as well as the thermal change of the zero point.

Measuring cell	PMC71	PMC71 High temperature version
	% of URL	
100 mbar, 250 mbar, 400 mbar	±0.2	±0.46
1 bar, 2bar, 4 bar, 10 bar, 40 bar	±0.15	±0.46
All specifications apply to the temperature range –10...+60°C (+14...+140°F).		

Total Error - PMC71

The total error comprises the long-term stability and the total performance:

Measuring cell	PMC71	PMC71 High temperature version
	% of URL/year	
100 mbar, 250 mbar, 400 mbar	±0.25	±0.51
1 bar, 2bar, 4 bar, 10 bar, 40 bar	±0.2	±0.51

Warm-up period – PMC71

- 4...20 mA HART : < 10 s
- PROFIBUS PA: 6 s
- FOUNDATION Fieldbus: 50 s

Thermal change of the zero output and the output span – PMC71

PMC71

Measuring cell	–10...+60 °C (+14...+140 °F)	–20...–10 °C, +60...+125 °C (–4...+14°F, +140...+257°F)
	% of the set span	
100 mbar, 250 mbar, 400 mbar	±(0.088 x TD + 0.088)	±(0.138 x TD + 0.138)
1 bar, 2bar, 4 bar, 10 bar, 40 bar	±(0.088 x TD + 0.04)	±(0.175 x TD + 0.075)

PMC71 High temperature version

Measuring cell	–10...+60 °C (+14...+140 °F)	–20...–10 °C, +60...+150 °C (–4...+14°F, +140...+302°F)
	% of the set span	
100 mbar, 250 mbar, 400 mbar	±(0.088 x TD + 0.088)	—
1 bar, 2bar, 4 bar, 10 bar, 40 bar	±(0.088 x TD + 0.04)	±(0.50 x TD)
100 mbar (Absolute pressure sensor)	—	±(1.25 x TD)
250 mbar, 400 mbar, 1 bar, 2 bar, 4 bar, 10 bar (Absolutdrucksensor)	—	±(0.75 x TD)
40 bar (Absolute pressure sensor)	—	±(0.50 x TD)

Performance characteristics – metallic process isolating diaphragm

Reference accuracy – PMP71, PMP75

The reference accuracy comprises the non-linearity according to limit point setting, hysteresis and non-reproducibility as per IEC 60770. The data refer to the calibrated span.

Measuring cell	Sensor	without capillary (PMP71 and PMP75)	with capillary (only PMP75)
		% of the set span	
400 mbar	Gauge pressure/ Absolute pressure	■ TD 1:1 = ±0.15 ■ TD > 1:1 = ±0.15 x TD	■ TD 1:1 = ±0.15 ■ TD > 1:1 = ±0.15 x TD
1 bar	Gauge pressure/ Absolute pressure	■ TD 1:1 to TD 2.5:1 = ±0.075 ■ TD > 2.5:1 = ±0.03 x TD	■ TD 1:1 to TD 2.5:1 = ±0.1 ■ TD > 2.5:1 = ±0.04 x TD
2 bar	Gauge pressure	■ TD 1:1 to TD 5:1 = ±0.075 ■ TD > 5:1 = ±0.015 x TD	■ TD 1:1 to TD 2.5:1 = ±0.1 ■ TD > 2.5:1 = ±0.04 x TD
2 bar	Absolute pressure	■ TD 1:1 to TD 5:1 = ±0.075 ■ TD > 5:1 = ±0.015 x TD	■ TD 1:1 to TD 5:1 = ±0.075 ■ TD > 5:1 = ±0.015 x TD
4 bar	Gauge pressure/ Absolute pressure	■ TD 1:1 to TD 10:1 = ±0.075 ■ TD > 10:1 = ±0.0075 x TD	■ TD 1:1 to TD 10:1 = ±0.075 ■ TD > 10:1 = ±0.0075 x TD
10 bar, 40 bar	Gauge pressure/ Absolute pressure	■ TD 1:1 to TD 15:1 = ±0.075 ■ TD > 15:1 = ±0.005 x TD	■ TD 1:1 to TD 15:1 = ±0.075 ■ TD > 15:1 = ±0.005 x TD
100 bar	Gauge pressure/ Absolute pressure	■ TD 1:1 to TD 10:1 = ±0.075 ■ TD > 10:1 = ±0.0075 x TD	■ TD 1:1 to TD 10:1 = ±0.075 ■ TD > 10:1 = ±0.0075 x TD
400 bar	Gauge pressure/ Absolute pressure	■ TD 1:1 to TD 5:1 = ±0.15 ■ TD > 5:1 = ±0.03 x TD	■ TD 1:1 to TD 5:1 = ±0.15 ■ TD > 5:1 = ±0.03 x TD
700 bar (only PMP71)	Absolute pressure	■ TD 1:1 to TD 5:1 = ±0.15 ■ TD > 5:1 = ±0.03 x TD	—
Platinum version [1] 1 bar, 2 bar, 4 bar, 10 bar, 40 bar, 100 bar	Gauge pressure/ Absolute pressure	■ TD 1:1 = ±0.05	—

1) Platinum version not for flush-mounted process connections G 1/2 and M20.

Total performance – PMP71

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility as well as the thermal change of the zero point.

Measuring cell	PMP71	PMP71 with Gold-Rhodium-coated process isolating diaphragm
	% of URL	
400 mbar	±0.25	±1.25
1 bar	±0.15	±0.75
2 bar	±0.15	±0.45
4 bar	±0.15	±0.3
10 bar, 40 bar	±0.15	±0.15
100 bar	±0.25	±0.25
400 bar	±0.3	±0.3
700 bar	±0.3	±0.3
All specifications apply to the temperature range –10...+60°C (+14...+140°F).		

Total Error - PMP71

The total error comprises the long-term stability and the total performance:

Measuring cell	% of URL/year
400 mbar	■ ±0.3
1 bar, 2 bar, 4 bar, 10 bar, 40 bar	■ ±0.2
100 bar	■ ±0.3
400 bar	■ ±0.35
700 bar	■ ±0.35

Warm-up period – PMP71, PMP75

- 4...20 mA HART : < 10 s
- PROFIBUS PA: 6 s
- FOUNDATION Fieldbus: 50 s

Thermal change of the zero output and the output span – PMP71 and PMP75

PMP71 and PMP75 (basic device)

Measuring cell	–10...+60 °C (+14...+140°F)	–40...–10 °C, +60...+85 °C (–40...+14°F, +140...+185°F)
	% of the set span	
400 mbar	±(0.2 x TD + 0.015)	±(0.4 x TD + 0.03)
1 bar, 2 bar, 4 bar, 10 bar, 40 bar	±(0.1 x TD + 0.01)	±(0.4 x TD + 0.02)
100 bar	±(0.2 x TD + 0.015)	±(0.4 x TD + 0.03)
400 bar	±(0.35 x TD + 0.02)	±(0.7 x TD + 0.04)
700 bar	±(0.35 x TD + 0.02)	±(0.7 x TD + 0.04)

Note!
When using a PMP75, the influence from the respective diaphragm seal must be taken into account.
(→ 🖹 68 ff "Planning instructions, diaphragm seal systems" and → 🖹 47 ff "Process connections PMP75 (with metallic process isolating diaphragm)").

Operating conditions (installation)

General installation instructions

- For PMP75: → 74, "Installation instructions" section.
- The position-dependent zero shift can be corrected directly at the device via operating key, for devices with external operation even in hazardous areas. Diaphragm seals also shift the zero point, depending on the installation position.
  (→ 74 ff, section "Installation instructions").
- The housing of the Cerabar S can be rotated up to 380°. → 27, section "Turn the housing".
- Endress+Hauser offers a mounting bracket for installing on pipes or walls. → 25, section "Wall and pipe-mounting".

Installation instructions for devices without diaphragm seal – PMC71 and PMP71

Cerabar S transmitters without diaphragm seal are mounted as per the norms for a manometer (DIN EN 837-2). We recommend the use of shut-off devices and siphons. The orientation depends on the measuring application.

Pressure measurement in gases

- Mount Cerabar S with shut-off device above the tapping point so that condensate can flow into the process.

Pressure measurement in steams

- Mount Cerabar S with siphon above the tapping point.
  The siphon reduces the temperature to almost ambient temperature.
- Fill the siphon with fluid before commissioning.

Pressure measurement in liquids

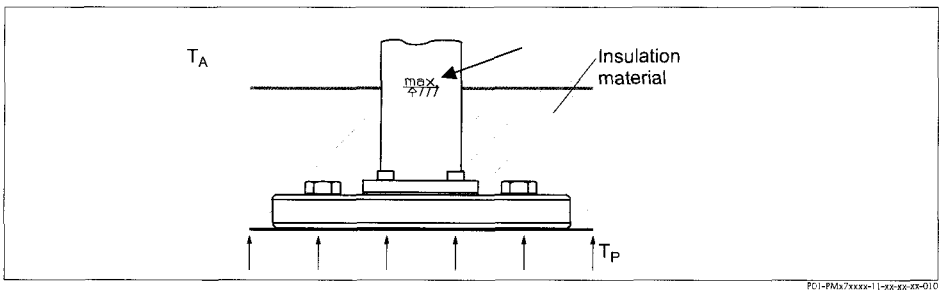
- Mount Cerabar S with shut-off device below or at the same level as the tapping point.

Level measurement

- Mount Cerabar S below the lowest measuring point.
- Do not mount the device at the following positions:
  In the fill flow, in the tank outlet or at a point in the container which could be affected by pressure pulses from an agitator or a pump.
- The calibration and functional test can be carried out more easily if you mount the device after a shut-off device.

Heat insulation – PMC71 high temperature version and PMP75

The PMC71 high temperature version and the PMP75 must only be insulated up to a certain height. The maximum permitted insulation height is labelled on the devices and applies to an insulation material with a heat conductivity ≤ 0.04 W/(m x K) and to the maximum permitted ambient and process temperature (→ see table below). The data were determined under the most critical application "quiescent air".

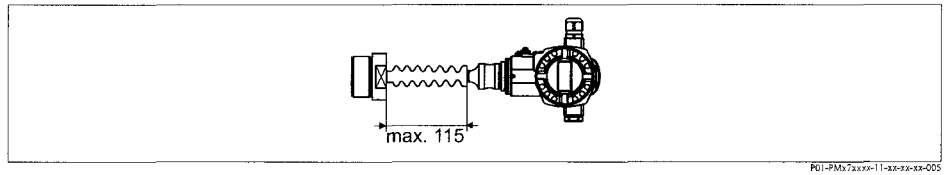


Maximum insulation height, here e.g. PMC71 with flange

	PMC71 high temperature version	PMP75
Ambient temperature (T_A)	≤ 70°C (158°F)	≤ 70°C (158°F)
Process temperature (T_P)	≤ 150°C (302°F)	max. 350°C (662°F), depending on the diaphragm seal filling oil used (→ 69)

Mounting with temperature isolator

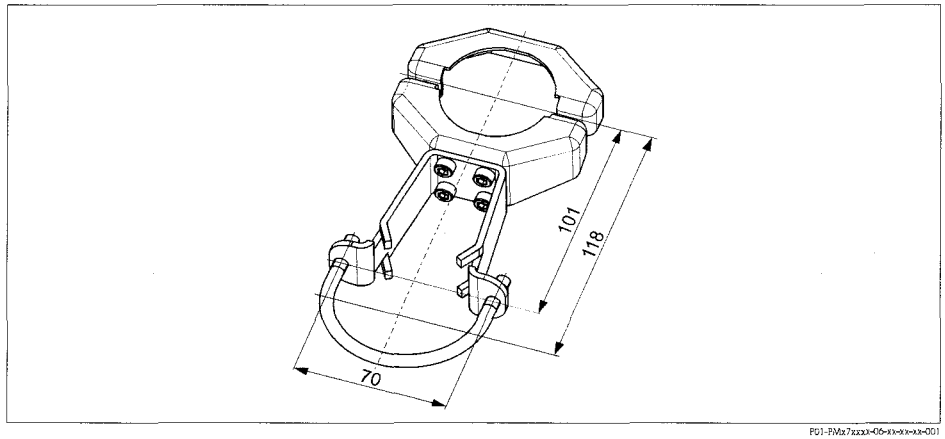
Endress+Hauser recommends the use of temperature isolators in the event of constant extreme fluid temperatures which lead to the maximum permissible ambient temperature of +85°C (+185°F) being exceeded. Depending on the filling oil used, Cerabar S devices with temperature isolators can be used for maximum temperatures of up to 260°C (+500°F). → For the temperature application limits of filling oils, → 🖹 69, "Diaphragm seal filling oil" section.
To minimise the influence of rising heat, Endress+Hauser recommends the device be mounted horizontally or with the housing pointing downwards.
The additional installation height also brings about a zero point shift of maximum 21 mbar due to the hydrostatic columns in the temperature isolator. The position-dependent zero shift can be corrected.



PMP75 with temperature isolator

Wall and pipe-mounting

Endress+Hauser offers a mounting bracket for installing the device on pipes or walls. → 🖹 77 ff, feature 110, "Additional options 2".



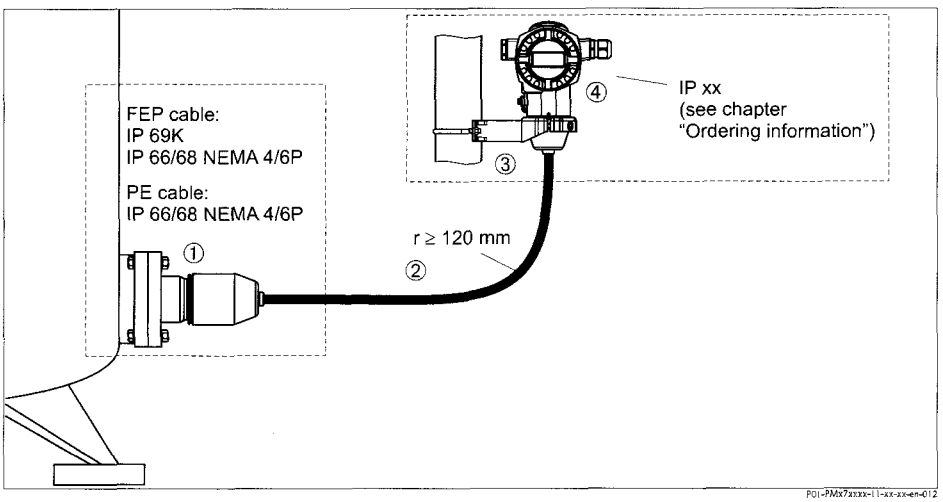
"Separate housing" version

With the "separate housing" version, you are able to mount the housing with the electronics insert at a distance from the measuring point. This facilitates zero-interference measurement:
- Under particularly difficult measuring conditions (at installation locations that are cramped or difficult to access)
- If rapid cleaning of the measuring point is required
- If the measuring point is exposed to vibrations.

You can choose between different cable versions:
- PE (2 m, 5 m and 10 m)
- FEP (5 m).

→ 77 ff, Feature 110, "Additional options 2", Version "G".

For the dimensions, → 60.



In the case of the "separate housing" version, the sensor is delivered with the process connection and cable ready mounted. The housing and a mounting bracket are enclosed as separate units. The cable is provided with a socket at both ends. These sockets are simply connected to the housing and the sensor.

1 Process connection with sensor
2 Cable, both ends are fitted with a socket
3 Mounting bracket provided, suitable for pipe and wall mounting
4 Housing with electronic insert

Degree of protection for the process connection with sensor with the use of
- FEP cable:
  - IP 69K
  - IP 66 NEMA 4/6P
  - IP 68 (1.83 mH_2O for 24 h) NEMA 4/6P
- PE cable:
  - IP 66 NEMA 4/6P
  - IP 68 (1.83 mH_2O for 24 h) NEMA 4/6P

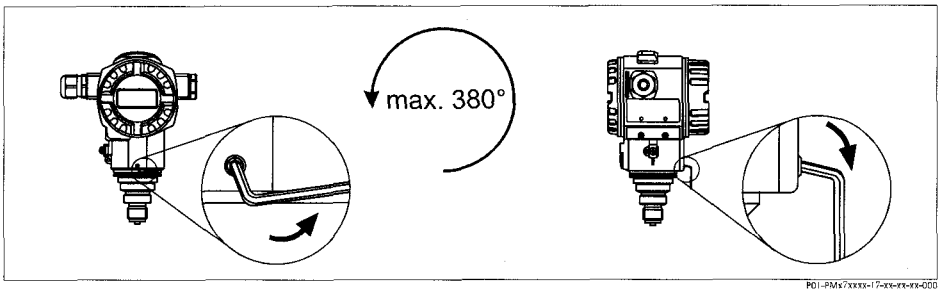
Technical data of the PE and FEP cable:
- Minimum bending radius: 120 mm (4.72 inch)
- Cable extraction force: max. 450 N
- Resistance to UV light

Use in hazardous area:
- Intrinsically safe installations (Ex ia/IS)
- FM/CSA IS: for Div.1 installatin only

Turn the housing

The housing can be rotated up to 380° after loosening the Allen screw.

Your benefits
- Simple mounting by optimally aligning the housing
- Good, accessible device operation
- Optimum readability of the on-site display (optional).



Align the housing by loosening the Allen screw.
T14 housing: 2 mm Allen key; T17 housing: 3 mm Allen key

Oxygen applications

Oxygen and other gases can react explosively to oils, grease and plastics, such that, among other things, the following precautions must be taken:
- All components of the system, such as measuring devices, must be cleaned in accordance with the BAM (DIN 19247) requirements.
- Dependent on the materials used, a certain maximum temperature and a maximum pressure for oxygen applications must not be exceeded.

The devices suitable for gaseous oxygen applications are listed in the following table with the specification p_{max}.

Order code for devices cleaned for oxygen applications	**p_{max} for oxygen applications**	**T_{max} for oxygen applications**
PMC71 – * * ● ** * ** 2 * *, Devices with sensors, nominal value < 10 bar	Overpressure limit (OPL) of sensor[1, 2]	60°C (140°F)
PMC71 – * * * ** * ** 2 * *, Devices with sensors, nominal value ≥ 10 bar	30 bar	60°C (140°F)
PMP71 – * * * ** * * ** N * *	Depends on the weakest link in terms of pressure of the selected components: over pressure limit (OPL) of sensor[1] or process connection (1.5 x PN) or filling fluid (160 bar)	85°C (185°F)
PMP75 – * * * ** * * * ** N ● ●	Depends on the weakest link in terms of pressure of the selected components: over pressure limit (OPL) of sensor[1] or process connection (1.5 x PN) or filling fluid (160 bar)	85°C (185°F)

1) → 🖹 77 ff "Ordering information", feature 40 "Sensor range; sensor overload limit (= OPL)"

2) PMC71 with PVDF thread or flange p_{max} = 15 bar (225 psi)

Silicone-free applications

Cleaning of the transmitter for the use e.g. in paint shops → 🖹 79 "Ordering information PMC71", feature 80 "Seal", version "L" and "M".

Ultra pure gas applications

Endress+Hauser also offers the degreased device for special applications, such as ultra pure gas.
No special restrictions regarding the process conditions apply to this device.

→ 🖹 79, "Ordering information PMC71", feature 80 "Seal" or → 🖹 83, "Ordering information PMC71", feature 90 "Fill fluid".

Applications with hydrogen

With regard to materials in which hydrogen build-up takes place, hydrogen atoms can diffuse through the metal process isolating diaphragm. This can result in incorrect measurement results.
Endress+Hauser offers process isolating diaphragms with Gold-Rhodium coating for this application.

→ 82 "Ordering information PMP71" and → 86 "Ordering information PMP75", feature 60 "Membrane material" version "6".

Operating conditions (environment)

Ambient temperature limits

- PMC71:
  - –40...+85°C (–40...+185°F)
  - High temperature version: –20...+70°C (–4...+158°F)
    (Version "T" for feature 100 "Additional options 1" or feature 110 "Additional options 2"),
    → For the maximum insulation height see → 25.
- PMP71: –40...+85°C (–40...+185°F)
  devices for lower temperatures on request
- PMP75: –40...+85°C (–40...+185°F)
  devices for lower temperatures on request
  → For the maximum insulation height see → 25.
- On-site display: –20...+70°C (–4...+158°F)
  Extended temperature application range with restrictions in optical properties such as display speed and contrast: –40...+85°C (–40...+185°F)
- Separate housing: –40 to +60°C (–40 to +140°F)

Note!
For high-temperature applications, either a PMP75 with a temperature isolator or with a capillary can be used. If vibrations also occur in the application, Endress+Hauser recommends you use a PMP75 with a capillary. If a PMP75 with a temperature isolator or capillary is used, we recommend a suitable retaining unit for mounting (see "Wall and pipe-mounting" Section on → 25).

For devices for use in hazardous areas, see Safety instructions, Installation or Control Drawing. (→ 90, sections "Safety Instructions" and "Installation/Control Drawings".)

The device can be used in this temperature range. The values of the specification, such as thermal change, may be exceeded. → DIN 16086.

Storage temperature range

- –40...+ 90°C (–40...+ 194°F)
- On-site display: –40...+85°C (–40...+185°F)
- Separate housing: –40 to +60°C (–40 to +140°F)

Degree of protection

- → 77 ff, feature 30 "Housing, Cable entry, Protection".
- Degree of protection IP 68 for T17 housing: 1.83 mH_2O for 24 h
- Seperate housing → 26.

Climate class

Class 4K4H (air temperature: –20...55°C/–4...+131°F, relative humidity: 4...100%) fulfilled as per DIN EN 60721-3-4 (condensation possible)

1) With PMC71, avoid condensate in the device (avoid moisture collecting in the device).

Vibration resistance

Device/Additional option	Test standard	Vibration resistance
PMC71 [1]	GL	guaranteed for 3...25 Hz: ±1.6 mm; 25...100 Hz: 4 g in all 3 planes
PMP71		
PMP75 [2, 3]		
with mounting bracket	IEC 61298-3	guaranteed for 10...60 Hz: ±0.15 mm; 60...500 Hz: 2 g in all 3 planes

1) not for high temperature version with Ex d[ia], CSA XP or FM XP

2) with aluminium T14 housing only

3) For applications with high temperatures, either a PMP75 with a temperature isolator or with a capillary can be used. If vibrations also occur in the application, Endress+Hauser recommends using a PMP75 with a capillary. If a PMP75 with a temperature isolator or capillary is used, it must be mounted with a mounting bracket. (→ 25).

Electromagnetic compatibility

- Electromagnetic compatibility to EN 61326 and NAMUR recommendation EMC (NE21). For details refer to the declaration of conformity.
- With enhanced immunity against electromagnetic fields as per EN 61000-4-3: 30 V/m with closed cover [1]
- Maximum deviation: < 0.5% of span
- All EMC measurements were performed with a turn down (TD) = 2:1.

1) for devices with T14 housing

Overvoltage protection

- Overvoltage protection:
  - Nominal functioning DC voltage: 600 V
  - Nominal discharge current: 10 kA
- Surge current check $\hat{i}$ = 20 kA as per DIN EN 60079-14: 8/20 µs satisfied
- Arrester AC current check I = 10 A satisfied

→ 79 ff, feature 100 "Additional options 1" and feature 110 "Additional options 2", version "M Overvoltage protection".

Note!
Devices with integrated overvoltage protection must be earthed.

Operating conditions (Process)

Process temperature limits

PMC71 (with ceramic process isolating diaphragm)

- –25...+125°C (–13...+257°F)
- High temperature version: –20...+150°C (–4...+302°F)
  → 🖹 79, feature 100 "Additional options 1", Version "T".
- Observe the process temperature range of the seal. See also the following section "Process temperature range, seals".

Extreme jumps in temperature can result in temporary measuring errors. Temperature compensation takes effect after several minutes. Internal temperature compensation is faster the smaller the temperature jump and the longer the time interval.

PMP71 (with metallic process isolating diaphragm)

Description	Temperature operating range
Process connections with internal process isolating diaphragm	–40...+125°C (–40...+257°F) (+150 °C/302°F for max. one hour)
Process connections with flush-mounted process isolating diaphragm, G 1 A, G 1 1/2 A, G 2 A, 1 NPT, 1 1/2 NPT, 2 NPT, M 44 x 1.25, EN/DIN, ANSI and JIS flanges	–40...+100°C (–40...+212°F)
Process connections with flush-mounted process isolating diaphragm, G 1/2 A, M 20	–20...+85°C (–4...+185°F)

Lower temperatures on request.

PMP75 (with metallic process isolating diaphragm)

- depending on the diaphragm seal and filling oil from -70°C (-94°F) up to +400°C (+752°F). Observe the temperature application limits of the diaphragm seal oil. → 🖹 69, section "Diaphragm seal filling oils".

Note!

- Do not use diaphragm seals with 0.09 mm PTFE foil on AISI 316L (1.4435/1.4404) for vacuum applications, upper temperature limit +204°C (+400°F).
- For oxygen applications, observe → 🖹 27, section "Oxygen applications".

Process temperature range, seals

PMC71 (with ceramic process isolating diaphragm)

Version for feature 80 in the order code	Seal	Process temperature range
A, L	FKM Viton	–25...+125°C/150°C [1] (–13...+257°F/302°F)
B [2, 3]	EPDM (FDA 21CFR177.2600; 3A Class II; USP Class VI) DVGW (KTW, W270, W534), WRAS, ACS, NSF61	–20...+125°C/150°C [1] (–4...+257°F/302°F)
B [3]	EPDM	–20...+125°C (–4...+257°F)
D, M	Kalrez, Compound 4079	+5...+125°C/150°C [1] (+41...+257°F/302°F)
E	Chemraz, Compound 505	–10...+125°C/150°C [1] (+14...+257°F/302°F)
F [2, 4]	HNBR (FDA 21CFR177.2600; 3A Class II; KTW; AFNOR; BAM)	–25...+125°C (–13...+257°F)
F [4]	NBR	–10...+100°C (+14...+212°F)
G	FKM Viton, FDA	–5...+125°C (+23 ...+257°F)
1	FKM Viton, cleaned from oil and greace	–10...+125°C/150°C [1] (+14...+257°F/302°F)
2	FKM Viton, cleaned for oxygen service	–10...+60 °C (+14...+140°F)
The process temperature ranges specified here refer to permanent application of the PMC71. They may be exceeded for a short time (e.g. for cleaning).		

1) +150°C (+302°F): for high temperature version
→ 🖹 79, feature 100 "Additional options 1" and feature 110 "Additional options 2", Version "T".

2) These seals are used for devices with 3A-approved process connections.

3) With applications of saturated steam a Cerabar S with metallic process isolating diaphragm is to be used.

4) For devices with NBR or HNBR seals, the values for "Toatal Performance" (→ 🖹 20) and "Thermal change" (→ 🖹 21) must be multiplied by the factor 3.

Pressure specifications

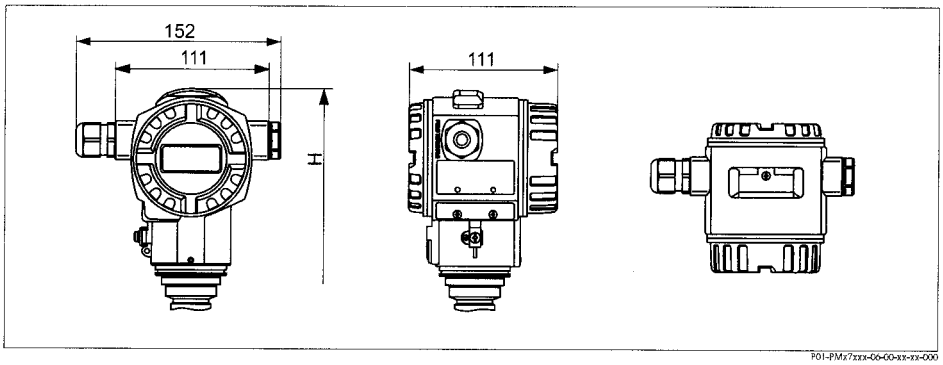
- The maximum pressure for the measuring device is dependent on the lowest-rated element with regard to pressure, see the following sections for this:
  – → 🖹 7 ff, section "Measuring range"
  – chapter "Mechanical construction".
  The MWP (maximum working pressure) is specified on the nameplate. This value refers to a reference temperature of 20°C (68°F) or 100°F for ANSI flanges and may be applied to the device for an unlimited time. Observe temperature dependency.
- The pressure values permitted at higher temperatures can be found in the following standards:
  – EN 1092-1: 2001 Tab. 18 [1]
  – ASME B 16.5a – 1998 Tab. 2-2.2 F316
  – ASME B 16.5a – 1998 Tab. 2.3.8 N10276
  – JIS B 2220.
- The test pressure corresponds to the over pressure limit of the measuring instrument (Over Pressure Limits OPL = 1.5 x MWP [2]) and may fit only temporally limited, so that no permanent damage develops.
- The Pressure Equipment Directive (EC Directive 97/23/EC) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.
- In the case of sensor range and process connections where the OPL (Over pressure limit) of the pressure connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If you want to use the entire sensor range, select a process connection with a higher OPL value (1.5 x PN; PN = MWP).
- In oxygen applications, the values for "p_{max} and T_{max} for oxygen applications" as per → 🖹 27, "Oxygen applications" may not be exceeded.

1) With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

2) The equation does not apply for PMP71 and PMP75 with a 40 bar or 100 bar measuring cell.

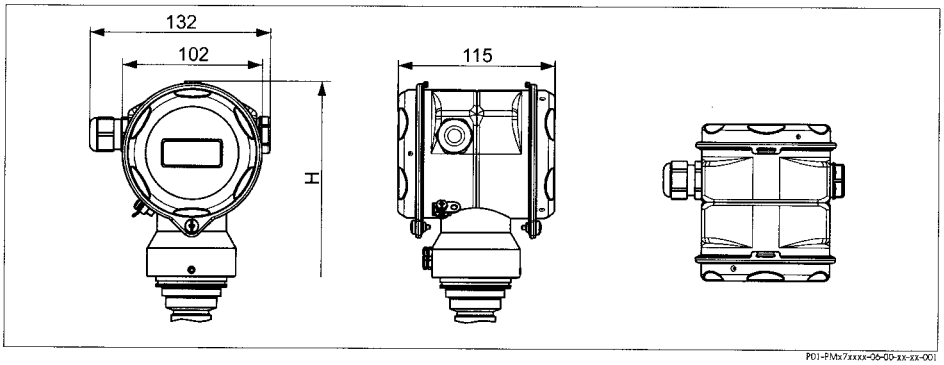
Mechanical construction

Housing dimensions T14



Front view, left-hand side view, top view
→ See the process connection in question for installation height. Housing weight → 🗎 61.

Housing dimensions T17

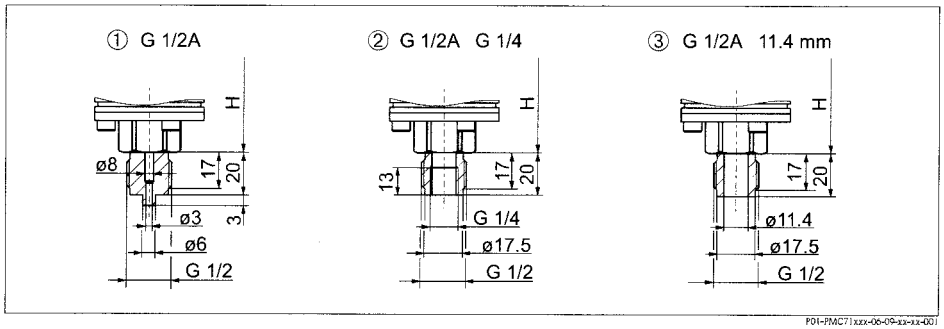


Front view, left-hand side view, top view
→ See the process connection in question for installation height. Housing weight → 🗎 61.

Process connections PMC71 (with ceramic process isolating diaphragm)

Note!
Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection (→ 77, feature 70 "Process connection") has to be ordered with a CSA approval (→ 77, feature 10 "Approval"). These devices are fitted with a separate plate bearing the registration number 0F10525.5C.

Thread, internal process isolating diaphragm

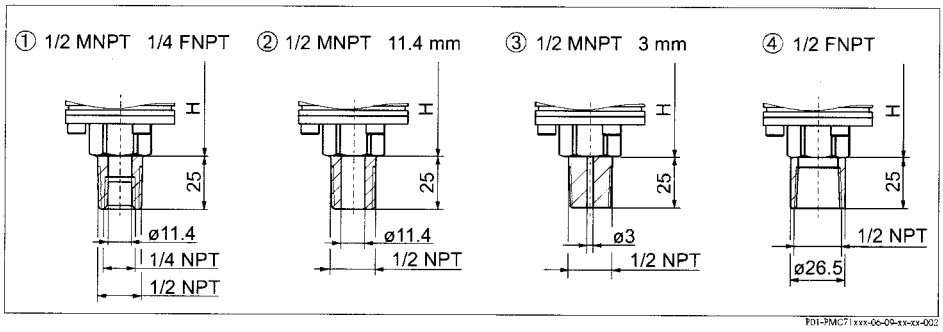


Process connections PMC71, thread ISO 228
Installation height → 34.

1 *Thread ISO 228 G 1/2 A EN 837;*
Material version GA: AISI 316L, version GB: Alloy C276/2.4819, version GC: Monel,
Version GD: PVDF (max.: 15 bar/225 psi, max.: −10...+60°C/+14...+140°F); mount version "GD" with a mounting bracket only (→ 25); Weight: 0.63 kg

2 *Thread ISO 228 G 1/2 A G 1/4 (female);*
Material version GE: AISI 316L, version GF: Alloy C276/2.4819, version GG: Monel; Weight: 0.63 kg

3 *Thread ISO 228 G 1/2 A hole 11.4 mm;*
Material version GH: AISI 316L, version GJ: Alloy C276/2.4819, version GK: Monel; Weight: 0.63 kg



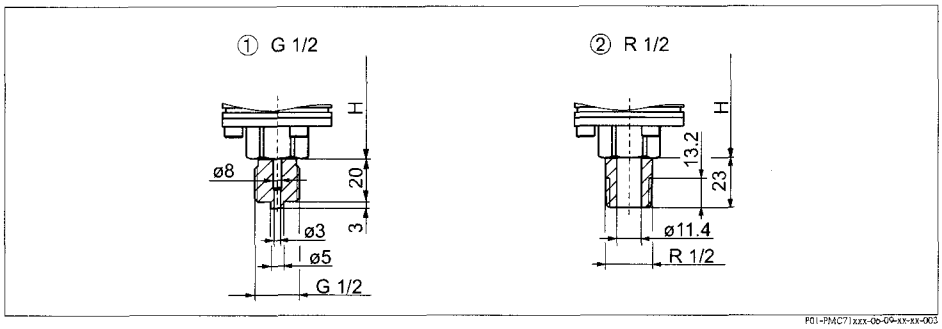
Process connections PMC71, thread ANSI
Installation height → 34.

1 *Thread ANSI 1/2 MNPT 1/4 FNPT;*
Material version RA: AISI 316L, version RB: Alloy C276/2.4819, version RC: Monel; Weight: 0.63 kg

2 *Thread ANSI 1/2 MNPT hole 11.4;*
Material version RD: AISI 316L, version RE: Alloy C276/2.4819, version RF: Monel; Weight: 0.63 kg

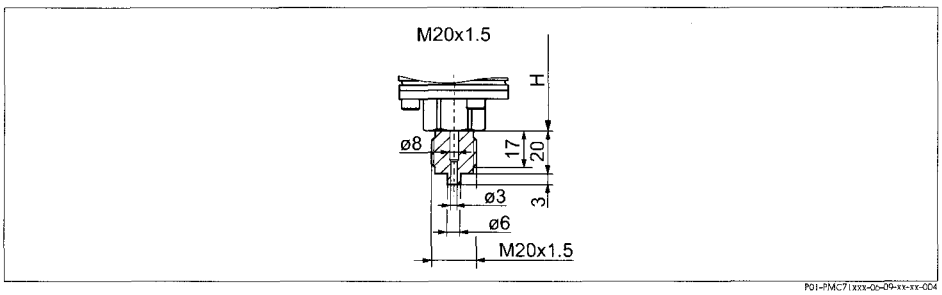
3 *Thread ANSI 1/2 MNPT hole 3 mm;*
Material version RG: PVDF (max.: 15 bar/225 psi, max.: −10...+60°C/+14...+140°F), mount with mounting bracket only (→ 25); Weight: 0.63 kg

4 *Thread ANSI 1/2 FNPT;*
Material version RH: AISI 316L, version RJ: Alloy C276/2.4819, version RK: Monel; Weight: 0.63 kg



Process connections PMC71, thread JIS
Installation height → 🖹 34.

1 Version GL: thread JIS B0202 G 1/2 (male), material: AISI 316L; Weight: 0.63 kg
2 Version RL: thread JIS B0203 R 1/2 (male), material: AISI 316L; Weight: 0.63 kg



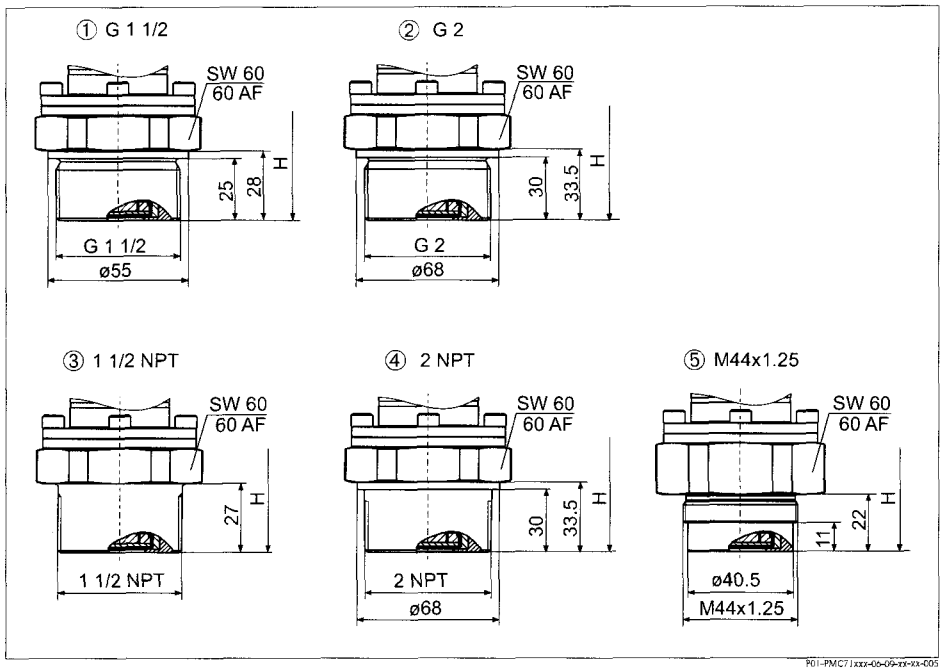
Process connections PMC71 thread DIN 13 M 20x1.5 hole 3 mm
Material version GP: AISI 316L, version GQ: Alloy C276/2.4819
Installation height → 🖹 34; Weight: 0.63 kg.

Installation height H for devices with thread connection and internal process isolating diaphragm

Description	Housing T14	Housing T17
PMC71	155 mm	171 mm
PMC71 with Ex d[ia], CSA XP or FM XP	225 mm	241 mm (Ex d = 311 mm)
PMC71 High temperature version [1]	235 mm	251 mm
PMC 71 High temperature version [1] with Ex d[ia], CSA XP or FM XP	305 mm	321 mm (Ex d = 391 mm)

1) High temperature version, → 🖹 79, feature 100 "Additional options 1" and feature 110 "Additional options 2", versions "T"

Thread, flush-mounted process isolating diaphragm



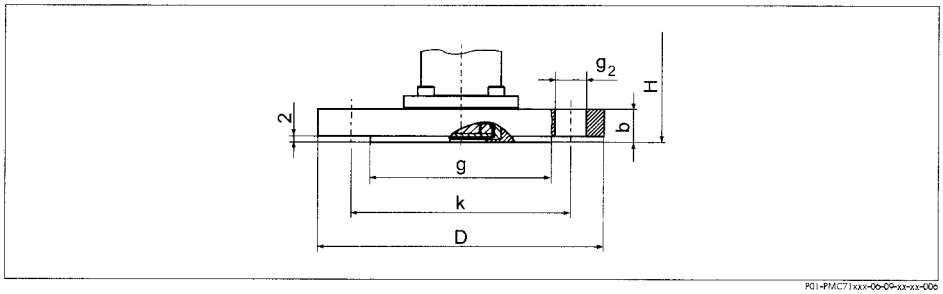
Process connections PMC71,
→ Installation height see table below.

1 Thread ISO 228 G 1 1/2 A;
Material version 1G: AISI 316L, version 1H: Alloy C276/2.4819, version 1J: Monel; Weight: 0.63 kg
2 Thread ISO 228 G 2 A;
Material version 1K: AISI 316L, version 1L: Alloy C276/2.4819, version 1M: Monel; Weight: 0.63 kg
3 Thread ANSI 1 1/2 MNPT;
Material version 2D: AISI 316L, version 2E: Alloy C276/2.4819, version 2F: Monel; Weight: 0.63 kg
4 Thread ANSI 2 MNPT;
Material version 2G: AISI 316L, version 2H: Alloy C276/2.4819, version 2J: Monel; Weight: 0.63 kg
5 Thread DIN 13 M 44x1.25;
Material version 1R: AISI 316L, version 1S: Alloy C276/2.4819; Weight: 0.63 kg

Installation height H for devices with thread connection and flush-mounted process isolating diaphragm

Description	Housing T14	Housing T17
PMC71/PMC71 high temperature version	215 mm	231 mm
PMC71/PMC71 high temperature version: with Ex d[ia], CSA XP or FM XP	280 mm	296 mm

EN/DIN flanges, connection dimensions as per EN 1092-1/DIN 2527



Process connection PMC71, EN/DIN flange with raised face (flush-mounted process isolating diaphragm)
Installation height → 38.

	Flange[1]							Boltholes			
Version	**Material**	**Nominal diameter**	**Nominal pressure**	**Shape [2]**	**Diameter** **D** [mm]	**Thick-ness** **b** [mm]	**Raised face** **g** [mm]	**Quantity**	**Diameter** g_2 [mm]	**Hole circle** **k** [mm]	**Flange weight [3]** [kg]
CP	AISI 316L	DN 32	PN 10-40	B1 (D)	140	18	77	4	18	100	1.9
CQ	AISI 316L	DN 40	PN 10-40	B1 (D)	150	18	87	4	18	110	2.2
BR	PVDF [4]	DN 50	PN 10-16	B1 (D)	165	21.4	102	4	18	125	0.6
B3	AISI 316L	DN 50	PN 10-40	B1 (D)	165	20	102	4	18	125	3.0
C3	AISI 316L	DN 50	PN 63	B2 (D)	180	26	108	4	22	135	4.6
BS	PVDF [4]	DN 80	PN 10/16	B1 (D)	200	21.4	138	8	18	160	1.0
B4	AISI 316L	DN 80	PN 10-40	B1 (D)	200	24	138	8	18	160	5.4

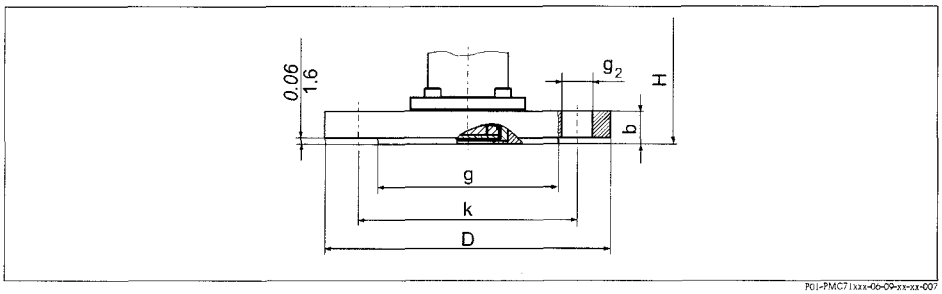
1) The roughness of the surface in contact with the medium, including the raised face of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

2) Designation in brackets as per DIN 2527

3) Housing weight → 61

4) Max.: 15 bar (225 psi), max.: –10...+60°C (+14...+140°F)

ANSI flange, connection dimensions as per ANSI B 16.5, raised face RF



Process connection PMC71, ANSI flange with raised face (flush-mounted process isolating diaphragm)
Installation height → 🖹 38.

	Flange [1]						Boltholes			
Version	**Material**	**Nominal diameter**	**Class**	**Diameter**	**Thickness**	**Raised face**	**Quantity**	**Diameter**	**Hole circle**	**Flange weight [2]**
				D	**b**	**g**		**g_2**	**k**	
		[in]	[lb./sq.in]	[in] *[mm]*	[in] *[mm]*	[in] *[mm]*		[in] *[mm]*	[in] *[mm]*	[kg]
AE	AISI 316/316L [3]	1 1/2	150	5 / *127*	0.69 / *17.5*	2.88 / *73.2*	4	0.62 / *15.7*	3.88 / *98.6*	1.0
AQ	AISI 316/316L [3]	1 1/2	300	6.12 / *155.4*	0.81 / *20.6*	2.88 / *73.2*	4	0.88 / *22.4*	4.5 / *114.3*	2.6
AF	AISI 316/316L [3]	2	150	6 / *152.4*	0.75 / *19.1*	3.62 / *91.9*	4	0.75 / *19.1*	4.75 / *120.7*	2.4
JR	ECTFE [4]	2	150	6 / *152.4*	0.75 / *19.1*	3.62 / *91.9*	4	0.75 / *19.1*	4.75 / *120.7*	2.4
A3	PVDF [5]	2	150	6 / *152.4*	0.75 / *19.1*	3.62 / *91.9*	4	0.75 / *19.1*	4.75 / *120.7*	0.5
AR	AISI 316/316L [3]	2	300	6.5 / *165.1*	0.88 / *22.4*	3.62 / *91.9*	8	0.75 / *19.1*	5 / *127*	3.2
AG	AISI 316/316L [3]	3	150	7.5 / *190.5*	0.94 / *23.9*	5 / *127*	4	0.75 / *19.1*	6 / *152.4*	4.9
JS	ECTFE [4]	3	150	7.5 / *190.5*	0.94 / *23.9*	5 / *127*	4	0.75 / *19.1*	6 / *152.4*	4.9
A4	PVDF [5]	3	150	7.5 / *190.5*	0.94 / *23.9*	5 / *127*	4	0.75 / *19.1*	6 / *152.4*	0.9
AS	AISI 316/316L [3]	3	300	8.25 / *209.5*	1.12 / *28.4*	5 / *127*	8	0.88 / *22.4*	6.62 / *168.1*	6.8
AH	AISI 316/316L [3]	4	150	9 / *228.6*	0.94 / *23.9*	6.19 / *157.2*	8	0.75 / *19.1*	7.5 / *190.5*	7.1
JT	ECTFE [4]	4	150	9 / *228.6*	0.94 / *23.9*	6.19 / *157.2*	8	0.75 / *19.1*	7.5 / *190.5*	7.1
AT	AISI 316/316L [3]	4	300	10 / *254*	1.25 / *31.8*	6.19 / *157.2*	8	0.88 / *22.4*	7.88 / *200.2*	11.6

1) The roughness of the surface in contact with the medium, including the raised face of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

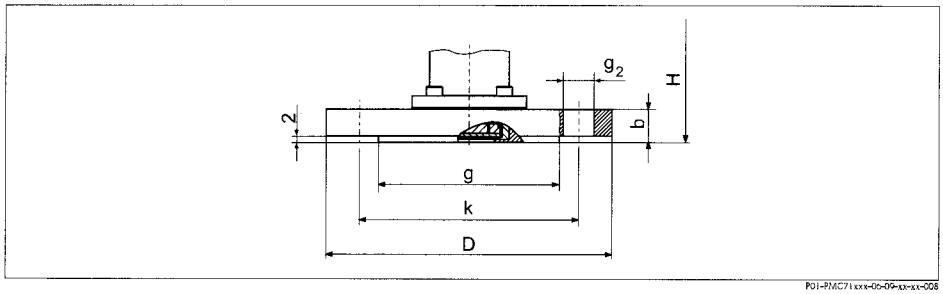
2) Housing weight → 🖹 61

3) Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)

4) ECTFE coating on AISI 316L/1.4435
When operating in hazardous area, avoid electrostatic charge of the plastic surface.

5) max.: 15 bar (225 psi), max.: –10...+60°C (+14...+140°F)

JIS flange, connection dimensions as per JIS B 2220 BL, raised face RF



Process connection PMC71, JIS flange with raised face RF (flush-mounted process isolating diaphragm), AISI 316L/ 1.4435
→ Installation height see table below.

	Flange [1]					Boltholes			
Versions	**Nominal dimension**	**Nominal pressure**	**Diameter** **D** [mm]	**Thickness** **b** [mm]	**Raised face** **g** [mm]	**Quantity**	**Diameter** **g_2** [mm]	**Hole circle** **k** [mm]	**Flange weight [2]** [kg]
KF	50 A	10 K	155	16	96	4	19	120	2.0
KL	80 A	10 K	185	18	127	8	19	150	3.3
KH	100 A	10 K	210	18	151	8	19	175	4.4

1) The roughness of the surface in contact with the medium, including the raised face of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8. Lower surface roughness on request.

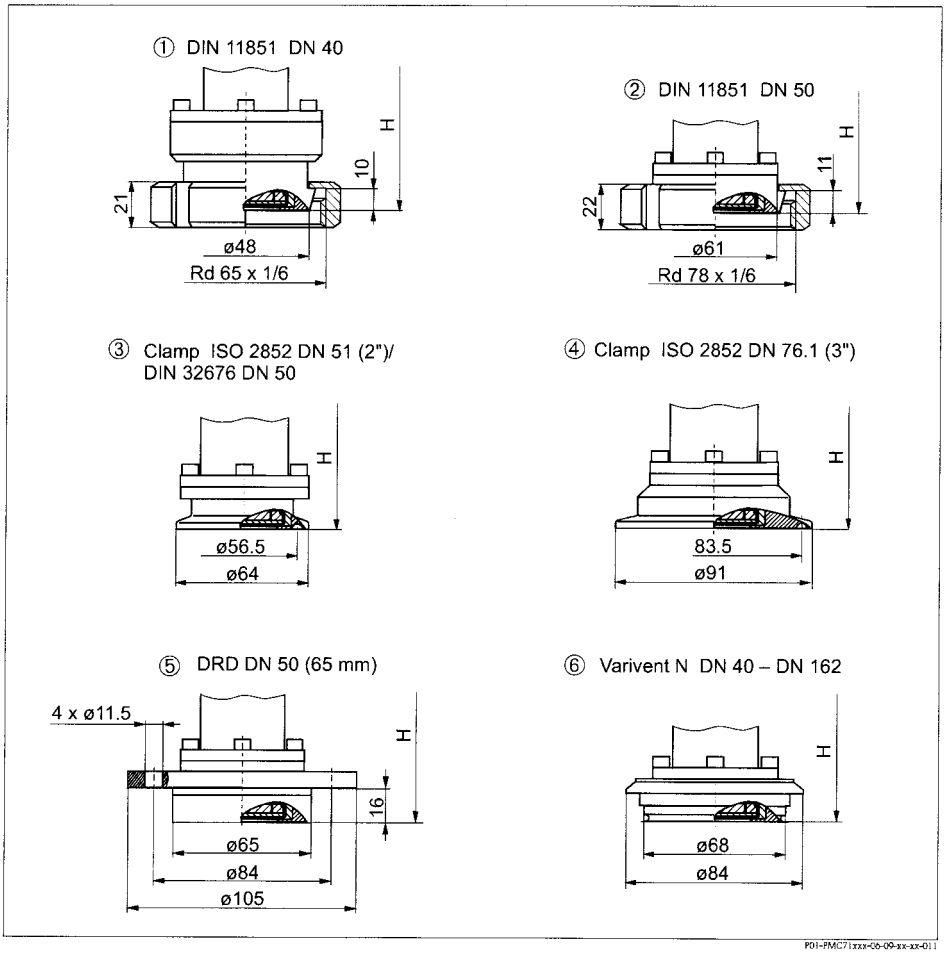
2) Housing weight see → ≧ 61

Installation height H for devices with flange

Description	T14 housing	T17 housing
PMC71	215 mm	231 mm
PMC71 with Ex d[ia], CSA XP or FM XP	280 mm	296 mm

Hygienic connections, flush-mounted process isolating diaphragm

Note!
Many process connections with an EPDM or HNBR seal are in accordance with the 3A-sanitary standard approved for PMC71. This means that a 3A-approved process connection in combination with an EPDM or HNBR seal must be selected when ordering for the 3A approval for the PMC71 version to be valid.
→ For ordering information on EPDM or HNBR seals, → 🗎 79 "Ordering information PMC71", feature 80 "Sensor seal", version B or F.



Process connections PMC71, Hygienic connections, material AISI 316L
surface roughness of the surfaces in contact with the medium ≤ 0.8 µm as standard. Lower surface roughness on request.

1 *Version MP: DIN 11851 DN 40 PN 25, 3A with HNBR or EPDM seal*
2 *Version MR: DIN 11851 DN 50 PN 25, 3A with HNBR or EPDM seal*
3 *Version TD: Tri-Clamp ISO 2852 (2"), DIN 32675 DN 50, 3A with HNBR or EPDM seal*
4 *Version TF: Tri-Clamp ISO 2852 (3"), 3A with HNBR or EPDM seal*
5 *Version TK: DRD DN50 (65 mm) PN 25, 3A with HNBR or EPDM seal*
6 *Version TR: Varivent Type N for pipes 40 – 162, PN 40, 3A with HNBR or EPDM seal*

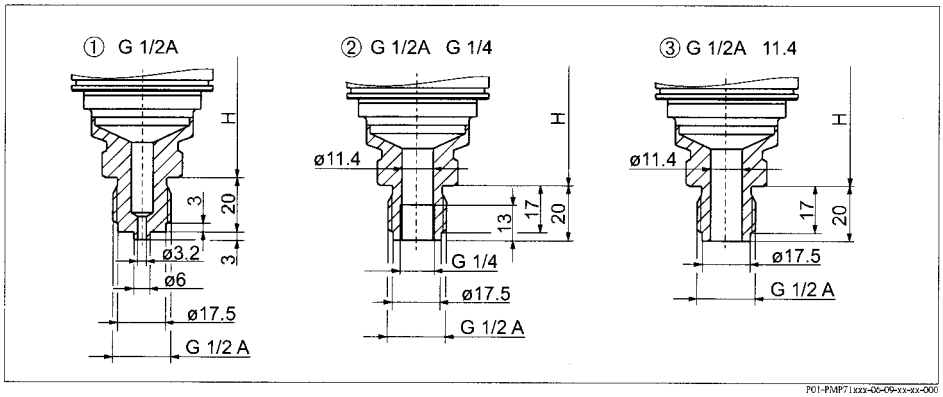
Installation height H for devices with hygienic connection and flush-mounted process isolating diaphragm

Description	T14 housing	T17 housing
PMC71/PMC71 high temperature version	215 mm	231 mm
PMC71/PMC71 high temperature version: with Ex d[ia], CSA XP or FM XP	280 mm	296 mm

Process connections PMP71 (with metallic process isolating diaphragm)

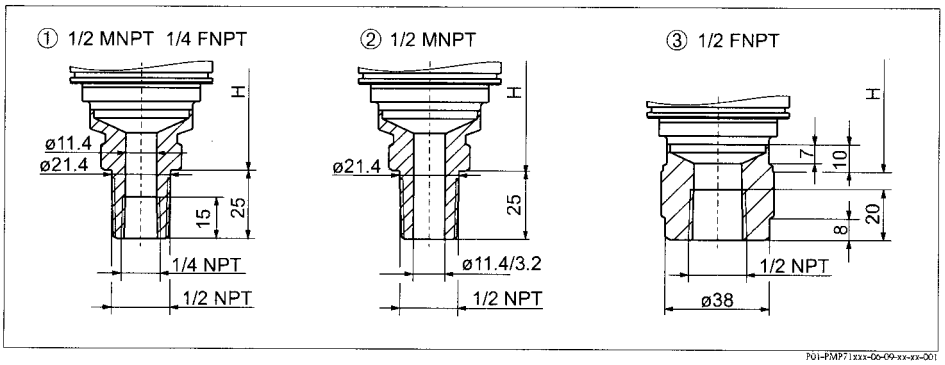
Note!
Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection (→ 78, feature 70 "Process connection") has to be ordered with a CSA approval (→ 77, feature 10 "Approval"). These devices are fitted with a separate plate bearing the registration number 0F10525.5C.

Thread, internal process isolating diaphragm



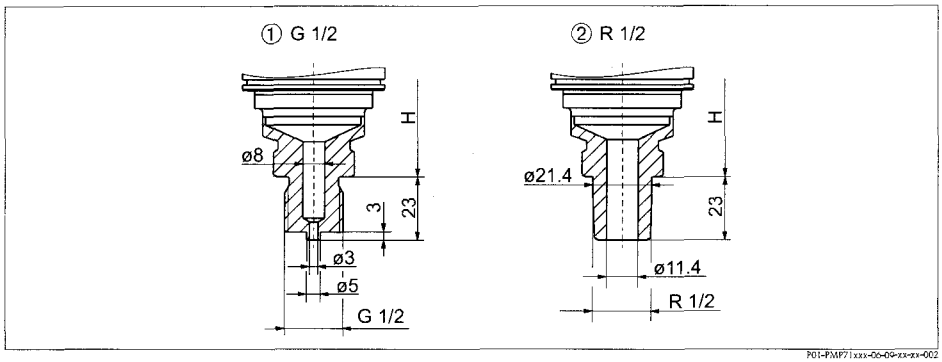
Process connections PMP71, thread ISO 228
Installation height H → 41.

1 *Thread ISO 228 G 1/2 A EN 837;*
Material version GA: AISI 316L, version GB: Alloy C276/2.4819; Weight: 0.6 kg
2 *Thread ISO 228 G 1/2 A G 1/4 (female);*
Material version GE: AISI 316L, version GF: Alloy C276/2.4819; Weight: 0.6 kg
3 *Thread ISO 228 G 1/2 A hole 11.4 mm;*
Material version GH: AISI 316L, version GJ: Alloy C276/2.4819; Weight: 0.6 kg



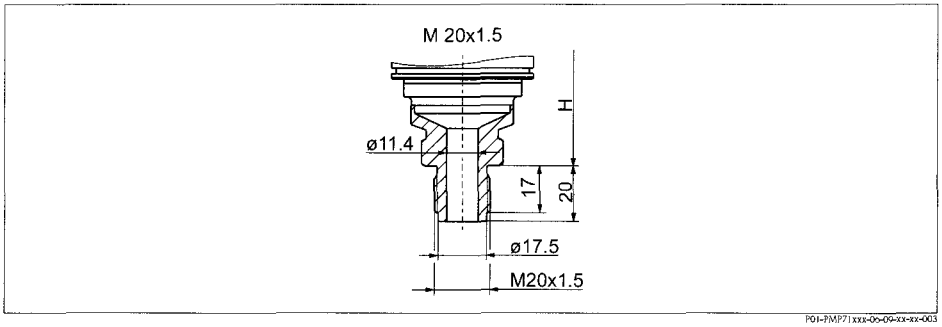
Process connections PMP71, thread ANSI
Installation height → 41.

1 *Thread ANSI 1/2 MNPT 1/4 FNPT;*
Material version RA: AISI 316L, version RB: Alloy C276/2.4819; Weight: 0.6 kg
2 *Thread ANSI 1/2 MNPT; hole: 400 bar = 11.4 mm , 700 bar = 3.2 mm*
Material version RD: AISI 316L, version RE: Alloy C276/2.4819; Weight: 0.6 kg
3 *Thread ANSI 1/2 FNPT;*
Material version RH: AISI 316L, version RJ: Alloy C276/2.4819; Weight: 0.7 kg



Process connections PMP71, thread JIS
→ Installation height H see table below.

1 Version GL: thread JIS B0202 G 1/2 (male), material: AISI 316L; Weight: 0.6 kg
2 Version RL: thread JIS B0203 R 1/2 (male), material: AISI 316L; Weight: 0.6 kg

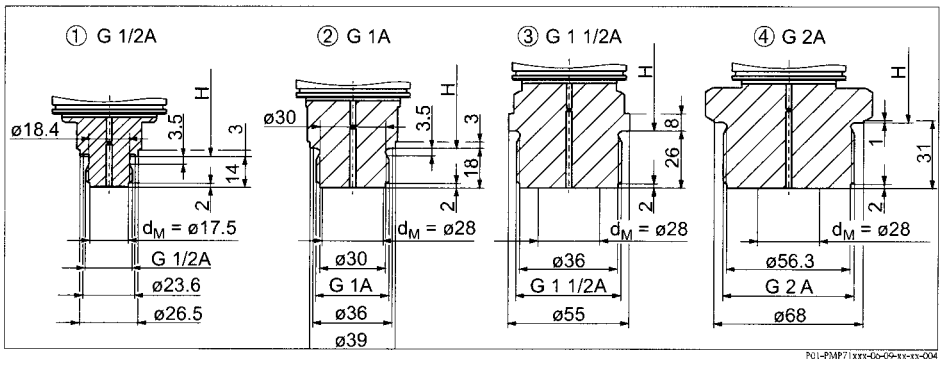


Process connections PMP71 thread DIN 13 M 20x1.5 hole 11.4 mm
Material version GP: AISI 316L, version GQ: Alloy C276/2.4819; Weight: 0.6 kg
→ Installation height H see table below.

Installation height H for devices with thread connection and internal flush-mounted process isolating diaphragm

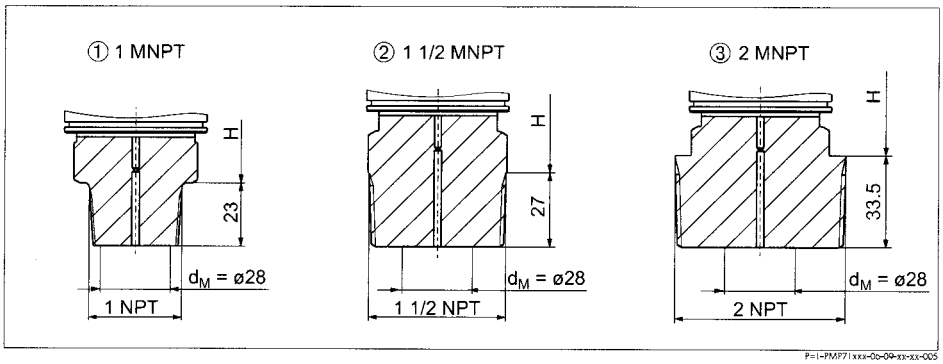
	T14 housing	**T17 housing**
Height H	165 mm	181 mm
	Note! The versions with 700 bar sensor are approx. 20 mm (0.79 inch) higher.	

Thread, flush-mounted process isolating diaphragm



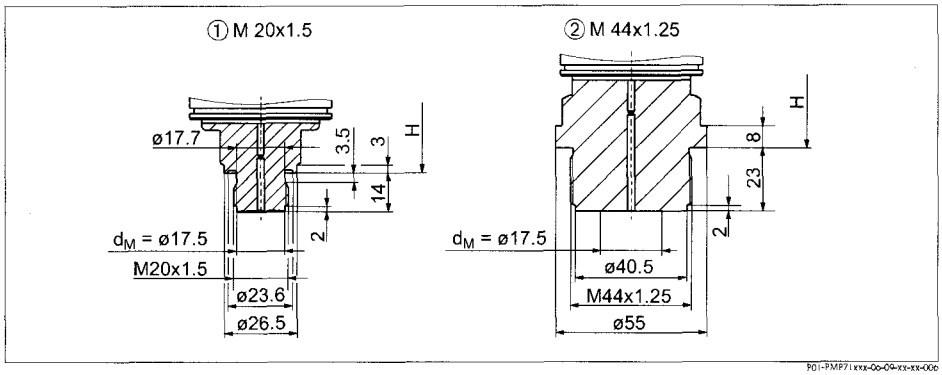
Process connections PMP71, thread ISO 228
Installation height → 43.

1 *Thread ISO 228 G 1/2 A DIN 3852 (viton seal provided);*
Material version 1A: AISI 316L, version 1B: Alloy C276/2.4819; Weight: 0.4 kg
2 *Thread ISO 228 G 1 A;*
Material version 1D: AISI 316L, version 1E: Alloy C276/2.4819; Weight: 0.7 kg
3 *Thread ISO 228 G 1 1/2 A*
Material version 1G: AISI 316L, version 1H: Alloy C276/2.4819; Weight: 1.1 kg
4 *Thread ISO 228 G 2 A*
Material version 1K: AISI 316L, version 1L: Alloy C276/2.4819; Weight: 1.5 kg



Process connections PMP71, thread ANSI
Installation height → 43.

1 *Thread ANSI 1 MNPT;*
Material version 2A: AISI 316L, version 2B: Alloy C276/2.4819; Weight: 0.7 kg
2 *Thread ANSI 1 1/2 MNPT;*
Material version 2D: AISI 316L, version 2E: Alloy C276/2.4819; Weight: 1.0 kg
3 *Thread ANSI 2 MNPT*
Material version 2G: AISI 316L, version 2H: Alloy C276/2.4819; Weight: 1.3 kg



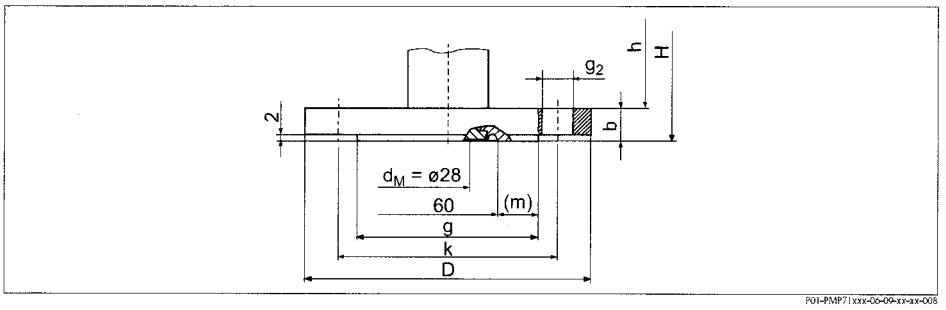
Process connections PMP71, thread DIN
→ Installation height see table, below.

1 Thread DIN 16288 M20;
Material version 1N: AISI 316L, version 1P: Alloy C276/2.4819; Weight: 0.4 kg
2 Thread DIN 13 M 44 x 1.25;
Material version 1R: AISI 316L, version 1S: Alloy C276/2.4819; Weight: 1.1 kg

Installation height H for devices with thread connection and flush-mounted process isolating diaphragm

Description	Housing T14	Housing T17
G 1/2	163 mm	179 mm
G 1	167 mm	183 mm
G 1 1/2 A	163 mm	179 mm
G 2 A	162 mm	178 mm
1 MNPT	162 mm	178 mm
1 1/2 MNPT	165 mm	181 mm
2 MNPT	159 mm	175 mm
M 20x1.5	163 mm	179 mm
M 44x1.25	170 mm	186 mm

EN/DIN flanges, connection dimensions as per EN 1092-1/DIN 2527



Process connection PMP71, EN/DIN flange with raised face, material AISI 316L

H: device height = height of device without flange h + flange thickness b
Height h → ≧ 46.

	Flange [1]							Boltholes			
Version	**Nominal diameter**	**Nominal pressure**	**Shape [2]**	**Diameter** D [mm]	**Thickness** b [mm]	**Raised face** g [mm]	**Width of the raised face** (m) [mm]	**Quantity**	**Diameter** g_2 [mm]	**Hole circle** k [mm]	**Flange weight [3]** [kg]
CN	DN 25	PN 10-40	B1 (D)	115	18	66 [4]	4	4	14	85	1.2
CP	DN 32	PN 10-40	B1 (D)	140	18	77 [4]	8.5	4	18	100	1.9
CQ	DN 40	PN 10-40	B1 (D)	150	18	87 [4]	-	4	18	110	2.2
B3	DN 50	PN 10-40	B1 (D)	165	20	102	-	4	18	125	3.0
B4	DN 80	PN 10-40	B1 (D)	200	24	138	-	8	18	160	5.3

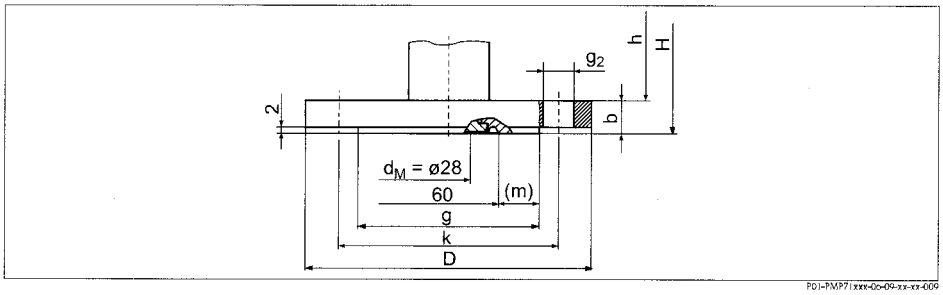
1) The roughness of the surface in contact with the medium, including the raised face of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

2) Designation as per DIN 2527 in brackets

3) Housing weight → ≧ 61

4) With these process connections the raised face is smaller than described in the standard. Due to a smaller raised face a special seal must be used. Refer to a manufacturer of seals or your local Endress+Hauser Sales Center.

ANSI flanges, connection dimensions as per ANSI B 16.5, raised face RF
JIS flanges, connection dimensions as per B 2220 BL, Raised face RF



Process connection PMP71, ANSI flange or JIS flange with raised face RF; material

H: device height = height of device without flange h + flange thickness b. For the height h → *46.*

	Flange [1]							**Boltholes**			
Version	**Material**	**Nominal diameter**	**Class/ Nominal pressure**	**Diameter** D [in] / *[mm]*	**Thickness** b [in] / *[mm]*	**Diameter raised face** g [in] / *[mm]*	**Width of the raised face** (m) [in] / *[mm]*	**Quantity**	**Diameter** g_2 [in] / *[mm]*	**Hole circle** k [in] / *[mm]*	**Flange weight** [2] [kg]
ANSI flange											
AN	AISI 316/316L [3]	1 in	300 lb./sq.in	4.88 / *124*	0.69 / *17.5*	2.76 [4] / *70*	0.2 /*5*	4	0.75 / *19.1*	3.5 / *88.9*	1.3
AE	AISI 316/316L [3]	1 1/2 in	150 lb./sq.in	5 / *127*	0.69 / *17.5*	2.88 [4] / *73.2*	0.52 /*6.6*	4	0.62 / *15.7*	3.88 / *98.6*	1.5
AQ	AISI 316/316L [3]	1 1/2 in	300 lb./sq.in	6.12 / *155.4*	0.81 / *20.6*	2.88 [4] / *73.2*	0.52 /*6.6*	4	0.88 /*22.4*	4.5 /*114.3*	2.6
AF	AISI 316/316L [3]	2 in	150 lb./sq.in	6 / *152.4*	0.75 / *19.1*	3.62 / *91.9*	-	4	0.75 / *19.1*	4.75 /*120.7*	2.4
AR	AISI 316/316L [3]	2 in	300 lb./sq.in	7.5 / *190.5*	0.88 / *22.3*	3.62 / *91.9*	-	8	0.75 / *19.1*	5 / *127*	3.2
AG	AISI 316/316L [3]	3 in	150 lb./sq.in	7.5 / *190.5*	0.94 / *23.9*	5 / *127*	-	4	0.75 /*19.1*	6 / *152.4*	4.9
AS	AISI 316/316L [3]	3 in	300 lb./sq.in	8.25 / *209.5*	1.12 / *28.4*	5 / *127*	-	8	0.88 / *22.4*	6.62 / *168.1*	6.7
AH	AISI 316/316L [3]	4 in	150 lb./sq.in	9 / *228.6*	0.94 / *23.9*	6.19 / *157.2*	-	8	0.75 / *19.1*	7.5 / *190.5*	7.1
AT	AISI 316/316L [3]	4 in	300 lb./sq.in	10 / *254*	1.25 / *31.8*	6.19 / *157.2*	-	8	0.88 / *22.4*	7.88 / *200.2*	11.6
JIS flange											
KA	AISI 316L	25 A	20 K	*125*	*16*	*67*	0.14 / 3.5	4	*19*	*90*	1.5
KF	AISI 316L	50 A	10 K	*155*	*16*	*96*	-	4	*19*	*120*	2.0
KL	AISI 316L	80 A	10 K	*185*	*18*	*127*	-	8	*19*	*150*	3.3
KH	AISI 316L	100 A	10 K	*210*	*18*	*151*	-	8	*19*	*175*	4.4

1) The roughness of the surface in contact with the medium, including the raised face of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

2) Housing weight → 61

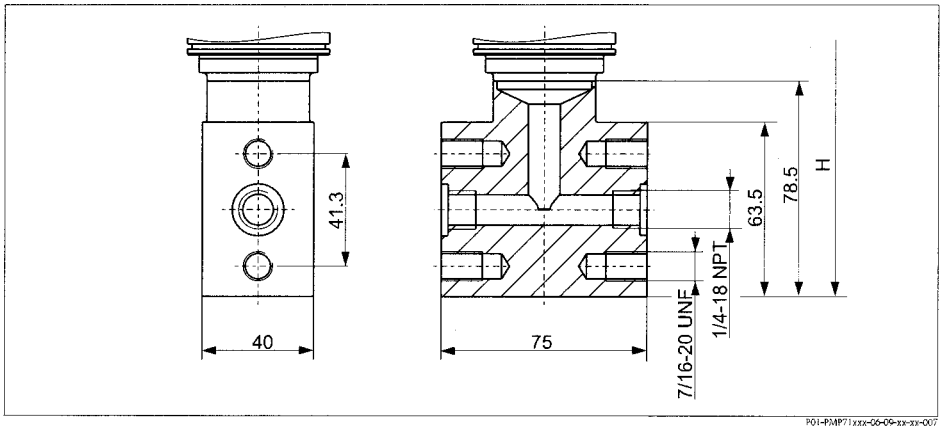
3) Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)

4) With these process connections the raised face is smaller than described in the standard. Due to a smaller raised face a special seal must be used. Refer to a manufacturer of seals or your local Endress+Hauser Sales Center.

Height h for devices with flange

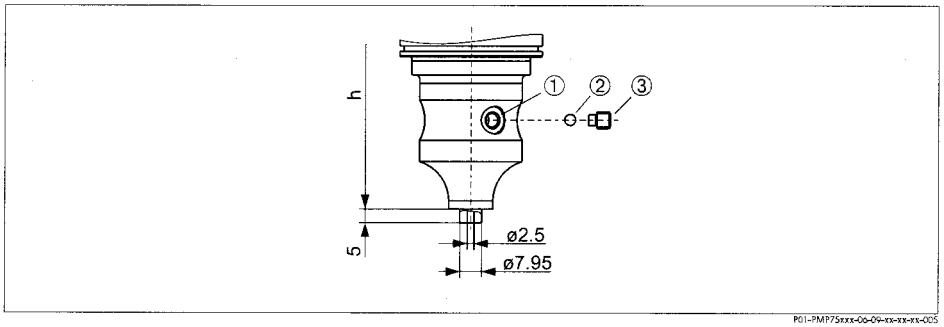
	T14 housing	T17 housing
Height h	165 mm	181 mm

Oval flange



Version UR: oval flange adapter 1/4-18 NPT according to IEC 61518, mounting: 7/16-20 UNF; Weight: 1.9 kg

Prepared for diaphragm seal mount

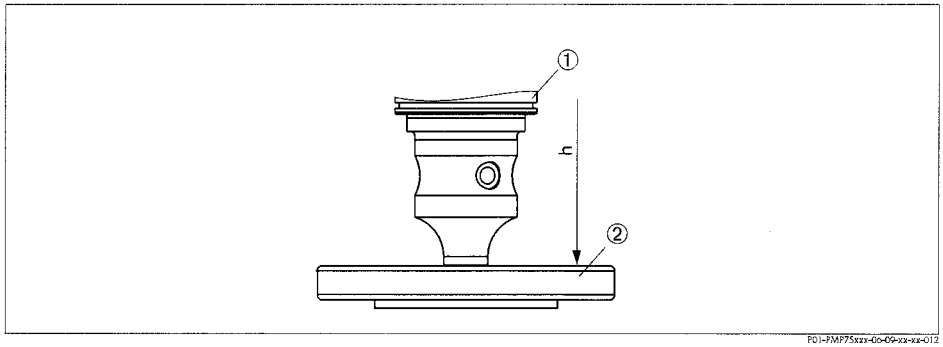


Version U1: prepared for diaphragm seal mount

1 *Hole for filling fluid*
2 *Bearing*
3 *Threaded pin with an internal hexagon 4 mm*

	T14 housing	T17 housing
Height h	190 mm	204 mm

PMP75 Basic unit



PMP75 Basic unit with diaphragm seal

1 PMP75 Basic unit
2 Diaphragm seal, here e.g. flange diaphragm seal

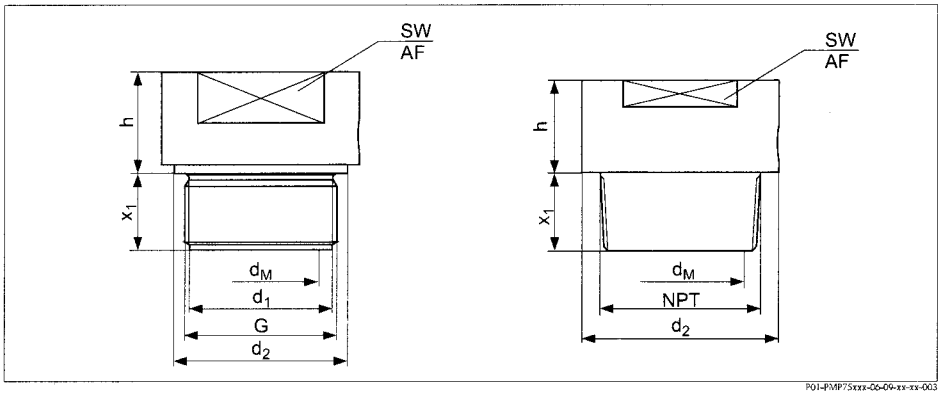
	T14 housing	T17 housing
Height	190 mm	204 mm

Process connections PMP75 (with metallic process isolating diaphragm)

Note!

- Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection (→ 86, feature 70 "Process connection") has to be ordered with a CSA approval (→ 85, feature 10 "Approval"). Devices with capillary are not CRN-approved. These devices are fitted with a separate plate bearing the registration number 0F10525.5C.
- Specifications for the "T_K Process" are listed in the following tables. These are typical values. The temperature coefficients apply to silicone oil and the process isolating diaphragm material AISI 316L/1.4435. For other filling oils, this temperature coefficient must be multiplied by the T_K correction factor of the corresponding filling oil. For the T_K correction factors, → 69, section "Diaphragm seal filling oils".
- With regard to the temperature coefficient "T_K Ambient", devices with a temperature isolator behave like devices with the same process connection with 0.1 m capillary.
- In addition, the temperature coefficient "T_K Ambient" is listed in relation to the capillary length for the diaphragm seal versions which can be supplied with capillaries as standard. This information is found on → 69 ff, section "Influence of the temperature on the zero point".
- The weights of the diaphragm seals are given in the tables. → 61 for the weight of the housing.
- The following drawings are drawings that illustrate how the system works in principle. In other words, the dimensions of a diaphragm seal supplied can deviate from the dimensions given in this document.

Thread, flush-mounted process isolating diaphragm



Process connections PMP75, left: thread ISO 228, right: thread ANSI

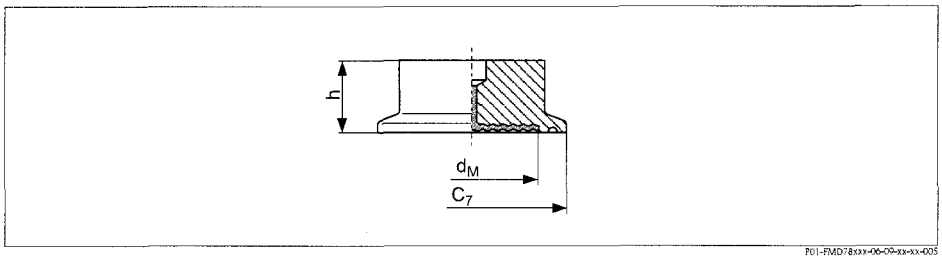
Threaded connection								Diaphragm seal					
Version	**Material** [1]	**Thread**	**Nominal pressure** PN	**Diameter** d_1 [mm]	**Diameter** d_2 [mm]	**Screw-in length** x_1 [mm]	**Across flats** SW/AF	**max. Diaphragm diameter** d_M [mm]	**T_K Ambient ≤ 40 bar** [mbar/10 K]	**T_K Ambient > 40 bar** [mbar/10 K]	**T_K Process** [mbar/10 K]	**Height** h [mm]	**Diaphragm seal weight** [kg]
1D	AISI 316L	G 1 A	400	30	39	21 [2]	41	30	+16.03	+24.33	+4.70	19	0.4
1E	Alloy C276								–	–	–		0.5
1G	AISI 316L	G 1 1/2 A	400	44	55	30	50	42	+5.4	+8.18	+3.50	20	0.9
1H	Alloy C276								–	–	–		1.0
1K	AISI 316L	G 2	400	56	68	30	65	50	+1.76	+2.68	+1.60	20	1.9
1L	Alloy C276								–	–	–		2.1
2A	AISI 316L	1 MNPT	400	–	48	28	41	24	+15.66	+24.42	+8.50	37	0.6
2B	Alloy C276								–	–	–		0.7
2D	AISI 316L	1 1/2 MNPT	400	–	52	30	46	36	+8.14	+12.39	+3.90	20	0.9
2E	Alloy C276								–	–	–		1.0
2G	AISI 316L	2 MNPT	400	–	78	30	65	38	+5.4	+8.18	+2.59	35	1.8
2H	Alloy C276								–	–	–		2.0

1) AISI 316L; Alloy C276/2.4819

2) 28 mm in conjucntion with high temperature oil

Note!
With the use of high temperature oils the design can deviate strongly.
For further information please contact your local Endress+Hauser Sales Center.

Tri-Clamp ISO 2852

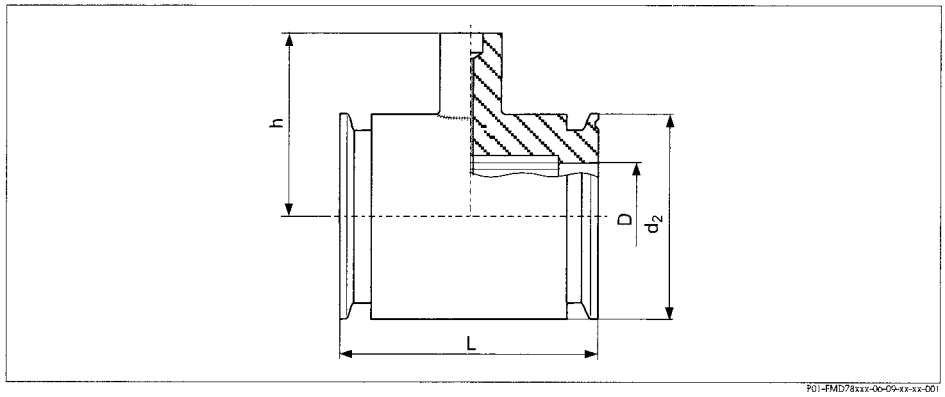


Process connection PMP75, material: AISI 316L, surface roughness of the surfaces in contact with the medium $R_a \leq 0.8$ µm as standard. Lower surface roughness on request.

Version	Nominal diameter ISO 2852	Nominal diameter DIN 32676	Nominal diameter	Diameter C_7	max. Diaphragm diameter d_M	Height h	T_K Ambient ≤ 40 bar	T_K Ambient > 40 bar	T_K Process	Diaphragm seal weight
			[in]	[mm]	[mm]	[mm]	[mbar/10 K]			[kg]
TB	DN 25	DN 25	1	50.5	24	37	+15.33	+24.0	+4.25	0.32
TC [1]	DN 38	DN 40	1 1/2	50.5	34	30	+8.14	+12.39	+1.91	1.0
TD [1]	DN 51	DN 50	2	64	48	30	+3.45	+4.81	+1.25	1.1
TF	DN 76.1	–	3	91	73	30	+0.3	+0.35	+0.18	1.2

1) Diaphragm seal versions optionally in conformity with ASME-BPE for use in biochemical processes, wetted surfaces $R_a \leq 0.38$ µm (15.75 µin; 180 grit), electropolished; to be ordered using feature 60 "Additional option", version "P" in the order code

Tri-Clamp pipe diaphragm seal ISO 2852

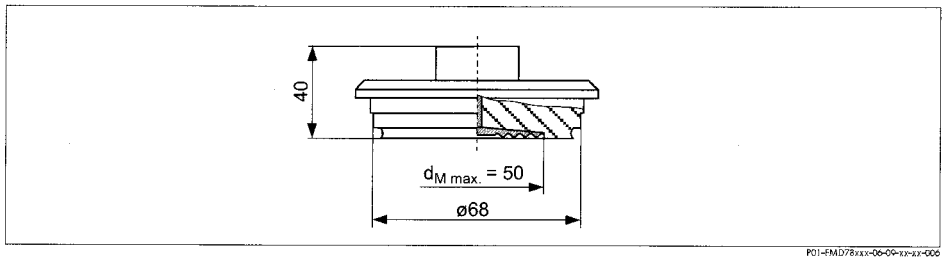


Process connection PMP75, material AISI 316L, surface roughness of the surfaces in contact with the medium $R_a \leq 0.8$ µm as standard. Lower surface roughness on request.

Version	Nominal diameter ISO 2852	Nominal diameter	Diameter D	Diameter d_2	Height h	Face-to-face-length L	T_K Ambient ≤ 40 bar	T_K Ambient > 40 bar	T_K Process	Dia-phragm seal weight
			[in]	[mm]	[mm]	[mm]	[mbar/10 K]			[kg]
SB	DN 25	1	22.5	50.5	67	126	+7.75	+8.69	+4.49	1.7
SC [1]	DN 38	1 1/2	35.5	50.5	67	126	+5.17	+5.69	+3.46	1.0
SD [1]	DN 51	2	48.6	64	79	100	+3.56	+3.91	+2.69	1.7

1) Including 3.1 and pressure test as per Pressure Equipment Directive, category II

Varivent N for pipes DN 40 – DN 162

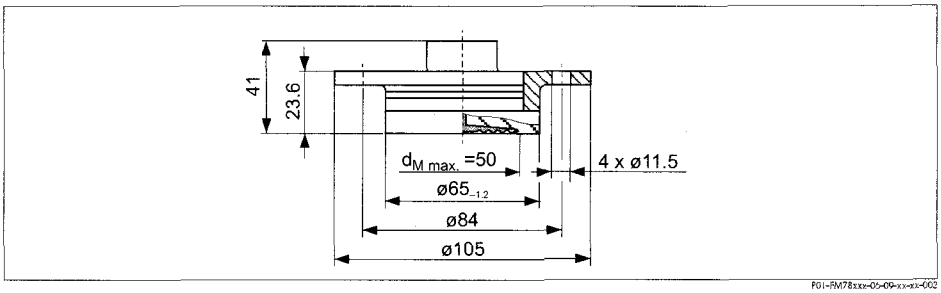


Process connection PMP75, surface roughness of the surfaces in contact with the medium $R_a \leq 0.8$ µm as standard. Lower surface roughness on request.

Version	Material	Nominal pressure	T_K Ambient ≤ 40 bar	T_K Ambient > 40 bar	T_K Process	Diaphragm seal weight
			[mbar/10 K]			[kg]
TR [1]	AISI 316L	PN 40	+2.26	+3.11	+1.65	1.3

1) Diaphragm seal versions optionally in conformity with ASME-BPE for use in biochemical processes, wetted surfaces $R_a \leq 0.38$ µm (15.75 µin; 180 grit), electropolished; to be ordered using feature 60 "Additional option", version "P" in the order code

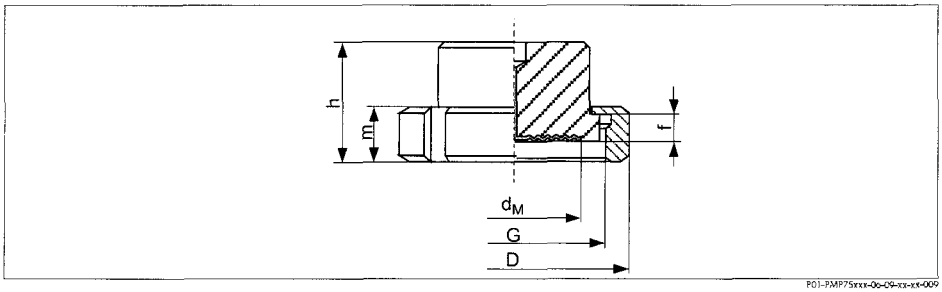
DRD DN50 (65 mm)



Process connection PMP75, surface roughness of the surfaces in contact with the medium $R_a \leq 0.8\ \mu m$ as standard. Lower surface roughness on request.

Version	Material	Nominal pressure	T_K Ambient ≤ 40 bar	T_K Ambient > 40 bar	T_K Process	Diaphragm seal weight
			[mbar/10 K]			[kg]
TK	AISI 316L	PN 25	+2.26	+3.11	+1.65	0.75

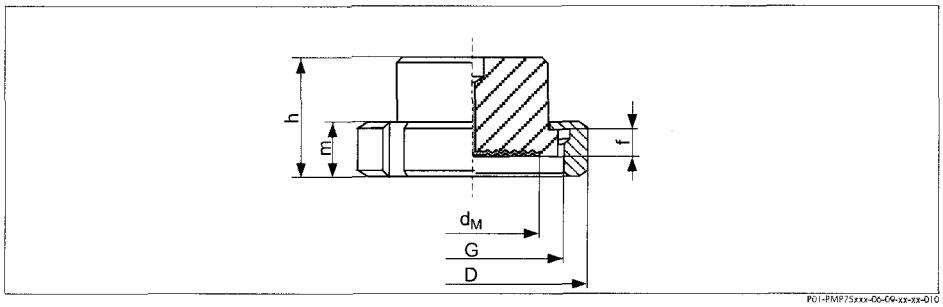
SMS nozzles with coupling nut



Process connection PMP75, material AISI 316L, surface roughness of the surfaces in contact with the medium $R_a \leq 0.8\ \mu m$ as standard. Lower surface roughness on request.

Version	Nominal diameter	Nominal pressure	Diameter D	Adapter height f	Thread G	Height m	Height h	max. diaphragm diameter d_M	T_K Ambient ≤ 40 bar	T_K Ambient > 40 bar	T_K Process	Weight diaphragm seal
	[inch]	[bar]	[mm]	[mm]		[mm]	[mm]	[mm]	[mbar/10 K]			[kg]
TG	1	PN 25	54	3.5	Rd 40 – 1/6	20	42.5	24	+15.66	+24.22	+7.25	0.25
TH	1 1/2	PN 25	74	4	Rd 60 – 1/6	25	57	36	+8.18	+12.39	+2.59	0.65
TI	2	PN 25	84	4	Rd 70 – 1/6	26	62	48	+5.4	+8.18	+1.10	1.05

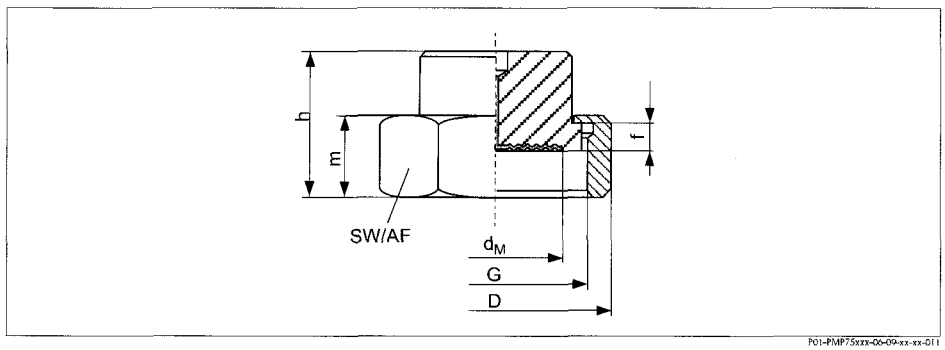
APV-RJT nozzles with coupling nut



Process connection PMP75, material AISI 316L, surface roughness of the surfaces in contact with the medium $R_a \leq 0.8\ \mu m$ as standard. Lower surface roughness on request.

Version	Nominal diameter	Nominal pressure	Diameter	Adapter height	Thread	Height	Height	max. diaphragm diameter	T_K Ambient ≤ 40 bar	T_K Ambient > 40 bar	T_K Process	Weight diaphragm seal
		PN	D	f	G	m	h	d_M				
	[inch]	[bar]	[mm]	[mm]		[mm]	[mm]	[mm]		[mbar/10 K]		[kg]
TL	1	PN 40	77	6.5	1 13/16 – 1/8"	22	42.6	21	+15.66	+24.42	+4.21	0.45
TM	1 1/2	PN 40	72	6.4	2 5/16 – 1/8"	22	42.6	28	+8.18	+12.39	+2.59	0.75
TN	2	PN 40	86	6.4	2 7/8 – 1/8"	22	42.6	38	+5.4	+8.18	+1.76	1.2

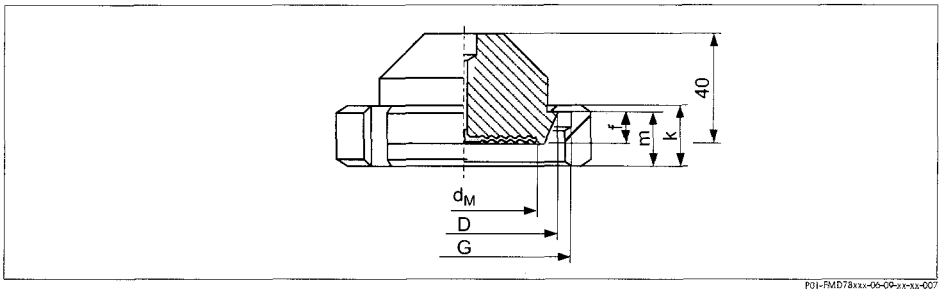
APV-ISS nozzles with coupling nut



Process connection PMP75, material AISI 316L, surface roughness of the surfaces in contact with the medium $R_a \leq 0.8\ \mu m$ as standard. Lower surface roughness on request.

Version	Nominal diameter	Nominal pressure	Diameter	Adapter height	Thread	Height	Across flat	Height	max. diaphragm seal	T_K Ambient ≤ 40 bar	T_K Ambient > 40 bar	T_K Process	Weight Diaphragm seal
			D	f	G	m	AF	h	d_M				
	[inch]	[bar]	[mm]	[mm]		[mm]		[mm]	[mm]		[mbar/10 K]		[kg]
TP	1	PN 40	54.1	4	1 1/2" – 1/8"	30	46.8	50	24	+15.66	+24.42	+4.21	0.4
TQ	1 1/2	PN 40	72	4	2" – 1/8"	30	62	50	34	+8.14	+12.39	+2.59	0.6
TS	2	PN 40	89	4	2 1/2" – 1/8"	30	77	50	45	+5.4	+8.18	+1.76	1.1

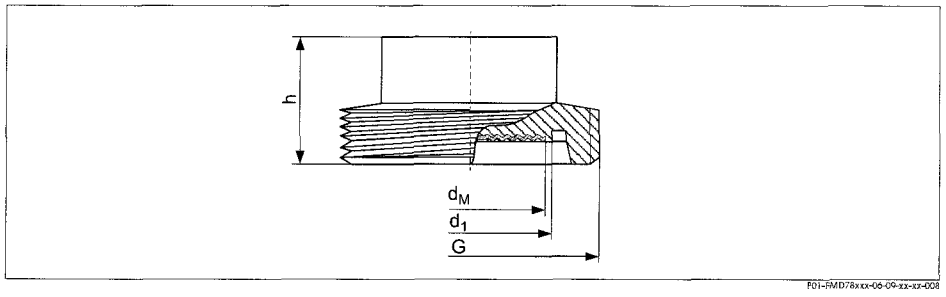
Taper adapter with coupling nut, DIN 11851



Process connection PMP75, material AISI 316L, surface roughness of the surfaces in contact with the medium $R_a \leq 0.8$ µm as standard. Lower surface roughness on request.

	Taper adapter				Slotted nut			Diaphragm seal				
Version	**Nominal diameter**	**Nominal pressure**	**Diameter** D [mm]	**Adapter height** f [mm]	**Thread** G	**Height** k [mm]	**Height** m [mm]	**max. Diaphragm diameter** d_M [mm]	**T_K Ambient ≤ 40 bar** [mbar/10 K]	**T_K Ambient > 40 bar** [mbar/10 K]	**T_K Process** [mbar/10 K]	**Diaphragm seal weight** [kg]
MR	DN 50	PN 25	68.5	11	Rd 78 x 1/6"	22	19	52	+2.21	+3.02	+1.40	1.1
MS	DN 65	PN 25	86	12	Rd 95 x 1/6"	35	21	66	+1.6	+2.1	+0.60	2.0
MT	DN 80	PN 25	100	12	Rd 110 x 1/4"	30	26	81	+0.66	+0.81	+0.40	2.55

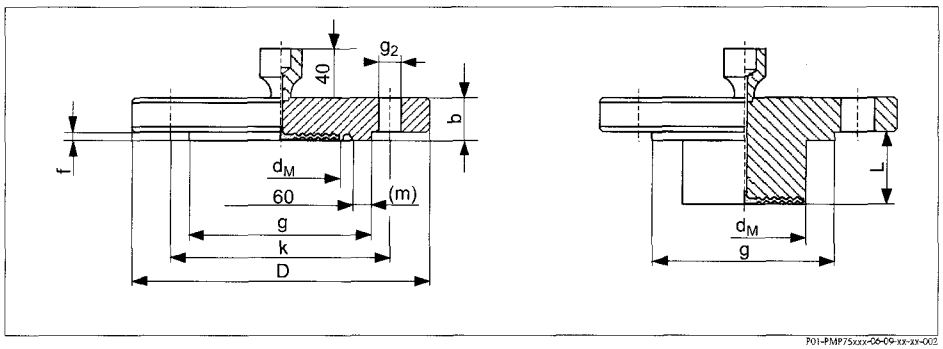
Threaded adapter, DIN 11851



Process connection PMP75, material AISI 316L, surface roughness of the surfaces in contact with the medium $R_a \leq 0.8$ µm as standard. Lower surface roughness on request.

	Threaded adapter					Diaphragm seal				
Version	**Nominal diameter**	**Nominal pressure**	**Diameter** d_1 [mm]	**Thread** G	**Height** h [mm]	**max. Diaphragm diameter** d_M [mm]	**T_K Ambient ≤ 40 bar** [mbar/10 K]	**T_K Ambient > 40 bar** [mbar/10 K]	**T_K Process** [mbar/10 K]	**Diaphragm seal weight** [kg]
M3	DN 50	PN 25	54	Rd 78 x 1/6"	35	52	+2.21	+3.02	+0.88	0.9
M4	DN 65	PN 25	71	Rd 95 x 1/6"	40	66	+1.6	+2.1	+0.60	1.7
M5	DN 80	PN 25	85	Rd 110 x 1/4"	40	81	+0.66	+0.81	+0.40	2.0

EN/DIN flanges, connection dimensions as per EN 1092-1/DIN 2527 and DIN 2501-1



Process connection PMP75, EN/DIN flange with flush-mounted process isolating diaphragm, material AISI 316L

	Flange [1]								Boltholes			Diaphragm seal				
Version	**Nominal diameter**	**Nominal pressure**	**Shape** [2]	**Diameter**	**Thickness**	**Raised face**			**Quantity**	**Diameter**	**Hole circle**	**max. Diaphragm diameter**	**T_K Ambient**		**T_K Process**	**Diaphragm seal weight**
				D	**b**	**g**	**f**	**(m)**		**g_2**	**k**	**d_M**	**≤ 40 bar**	**> 40 bar**		
				[mm]	[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[mm]	[mbar/10 K]			[kg]
CN	DN 25	PN 10-40	B1 (D)	115	18	66	3	3 [3]	4	14	85	32	+16.03	+24.33	+3.20	2.1
DN	DN 25	PN 63-160	E	140	24	68	2	-	4	18	100	28	+16.03	+24.33	+3.20	2.5
EN	DN 25	PN 250	E	150	28	68	2	-	4	22	105	28	+16.03	+24.33	+5.17	3.7
E1	DN 25	PN 400	E	180	38	68	2	-	4	26	130	28	+16.03	+24.33	+5.17	7.0
CP	DN 32	PN 10-40	B1 (D)	140	18	77	2.6	8.5 [3]	4	18	100	34	+8.14	+12.39	+2.59	1.9
CQ	DN 40	PN 10-40	B1 (D)	150	18	87	2.6	-	4	18	110	48	+5.40	+8.18	+2.15	2.2
B3	DN 50	PN 10-40	B1 (D)	165	26	102	3	-	4	18	125	59	+2.21	+3.02	+1.50	3.0
C3	DN 50	PN 63	B2 (E)	180	26	102	3	-	4	22	135	59	+2.21	+3.02	+1.00	4.6
EF	DN 50	PN 100/160	E	195	30	102	3	-	4	26	145	59	+2.21	+3.02	+1.00	6.2
ER	DN 50	PN 250	E	200	38	102	3	-	8	26	150	59	+2.21	+3.02	+1.15	7.7
E3	DN 50	PN 400	E	235	52	102	3	-	8	30	180	59	+2.21	+3.02	+1.15	14.7
B4	DN 80	PN 10-40	B1 (D)	200	24	138	3.5	-	8	18	160	89	+0.19	+0.25	+0.20	5.3
C4	DN 80	PN 100	B2 (E)	230	32	138	4	-	8	24	180	89	+0.19	+0.25	+0.35	8.9
C5	DN 100	PN 100	B2 (E)	265	36	175	5	-	8	30	210	89	+0.19	+0.25	+0.11	13.7
D3 [4]	DN 50	PN 10-40	B1 (D)	165	20	102	3	-	4	18	125	47	+3.45	+4.81	+1.67	[4]
D4 [4]	DN 80	PN 10-40	B1 (D)	200	24	138	3.5	-	8	18	160	72	+0.19	+0.25	+0.70	[4]

1) The roughness of the surface in contact with the medium, including the raised face of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 μm. Lower surface roughness on request.

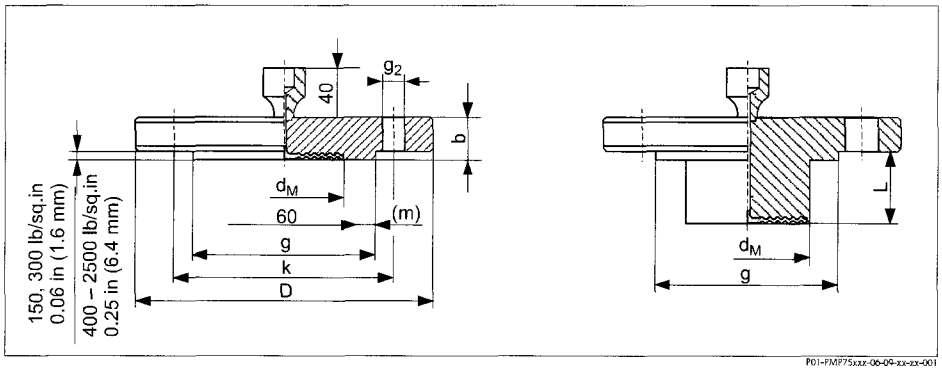
2) Designation as per DIN 2527 in brackets

3) With these process connections the width of the raised face is smaller than described in the standard. Due to a smaller width of the raised face a special seal must be used. Refer to a manufacturer of seals or your local Endress+Hauser Sales Center.

4) 50 mm, 100 mm or 200 mm extension selectable, for extension diameter and weight see the following table.

Version	Nominal diameter	Nominal pressure	Extension length [mm]	Extension diameter d_3 [mm]	Diaphragm seal weight [kg]
D3	DN 50	PN 10-40	50 / 100 / 200	48.3	3.2 / 3.8 / 4.4
D4	DN 80	PN 10-40	50 /100 / 200	76	6.2 / 6.7 / 7.8

ANSI flanges, connection dimensions as per ANSI B 16.5, raised face RF



Process connection PMP75, ANSI flange with and without extended diaphragm seal

	Flange [1]							Boltholes			Diaphragm seal				
Version	Material [2]	Nominal diameter	Class	Diameter D	Thickness b	Raised face g	Raised face (m)	Quantity	Diameter g_2	Hole circle k	max. Diaphragm diameter d_M	T_K Ambient ≤ 40 bar	T_K Ambient > 40 bar	T_K Process	Diaphragm seal weight
		[in]	[lb./ sq.in]	[in] *[mm]*	[in] *[mm]*	[in] *[mm]*	[in] *[mm]*		[in] *[mm]*	[in] *[mm]*	[in] *[mm]*	[mbar/10 K]			[kg]
AC	AISI 316/ 316L	1	150	4.25 *108*	0.56 *14.2*	2 *50.8*	-	4	0.62 *15.7*	3.12 *79.2*	1.26 *32*	+16.03	+24.33	+3.65	1.2
AN	AISI 316/ 316L	1	300	4.88 *124*	0.69 *17.5*	2.76 *70*	2 *5* [3]	4	0.75 *19.1*	3.5 *88.9*	1.26 *32*	+16.03	+24.33	+3.65	1.3
HC	AISI 316/ 316L	1	400/ 600	4.88 *124*	0.69 *17.5*	2 *50.8*	-	4	0.75 *19.1*	3.5 *88.9*	1.26 *32*	+16.03	+24.33	+5.17	1.4
HN	AISI 316/ 316L	1	900/ 1500	5.88 *149.4*	1.12 *28.4*	2 *50.8*	-	4	1 *25.4*	4 *101.6*	1.26 *32*	+16.03	+24.33	+5.17	3.2
HO	AISI 316/ 316L	1	2500	6.25 *158.8*	1.38 *35.1*	2 *50.8*	-	4	1 *25.4*	4.25 *108*	1.26 *32*	+16.03	+24.33	+5.17	4.6
AE	AISI 316/ 316L	1 1/2	150	5 *127*	0.69 *17.5*	2.88 *73.2*	0.52 *6.6* [3]	4	0.62 *15.7*	3.88 *96.6*	1.89 *48*	+8.14	+12.39	+1.90	1.5
AQ	AISI 316/ 316L	1 1/2	300	6.12 *155.4*	0.81 *20.6*	2.88 *73.2*	0.52 *6.6* [3]	4	0.88 *22.4*	4.5 *114.3*	1.89 *48*	+8.14	+12.39	+2.59	2.6
AF	AISI 316/ 316L	2	150	6 *152.4*	0.75 *19.1*	3.62 *91.9*	-	4	0.75 *19.1*	4.75 *120.7*	2.32 *59*	+2.21	+3.02	+1.60	2.2
J3 [4]	AISI 316/ 316L	2	150	6 *152.4*	0.75 *19.1*	3.62 *91.9*	-	4	0.75 *19.1*	4.75 *120.7*	1.85 *47*	+3.45	+4.81	+1.67	[4]
AR	AISI 316/ 316L	2	300	6.5 *165.1*	0.88 *22.4*	3.62 *91.9*	-	8	0.75 *19.1*	5 *127*	2.32 *59*	+2.21	+3.02	+0.85	3.4
HF	AISI 316/ 316L	2	400/ 600	6.5 *165.1*	1 *25.4*	3.62 *91.9*	-	8	0.75 *19.1*	5 *127*	2.32 *59*	+2.21	+3.02	+0.85	4.3

	Flange [1]							Boltholes			Diaphragm seal				
Version	Material [2]	Nominal diameter	Class	Diameter	Thickness	Raised face		Quantity	Diameter	Hole circle	max. Diaphragm diameter	T_K Ambient ≤ 40 bar	T_K Ambient > 40 bar	T_K Process	Diaphragm seal weight
				D	b	g	(m)		g_2	k	d_M				
		[in]	[lb./sq.in]	[in] *[mm]*	[in] *[mm]*	[in] *[mm]*	[in] *[mm]*		[in] *[mm]*	[in] *[mm]*	[in] *[mm]*	[mbar/10 K]			[kg]
HR	AISI 316/ 316L	2	900/ 1500	8.5 *215.9*	1.5 *38.1*	3.62 *91.9*	-	8	1 *25.4*	6.5 *165.1*	2.32 *59*	+2.21	+3.02	+0.75	10.3
H3	AISI 316/ 316L	2	2500	9.25 *235*	2 *50.8*	3.62 *91.9*	-	8	1.12 *28.4*	6.75 *171.5*	2.32 *59*	+2.21	+3.02	+0.75	15.8
AG	AISI 316/ 316L	3	150	7.5 *190.5*	0.94 *23.9*	5 *127*	-	4	0.75 *19.1*	6 *152.4*	3.50 *89*	+0.19	+0.25	+0.18	5.1
AS	AISI 316/ 316L	3	300	8.25 *209.5*	1.12 *28.4*	5 *127*	-	8	0.75 *19.1*	6 *152.4*	3.5 *89*	+0.19	+0.25	+0.11	7.0
J4 [4]	AISI 316/ 316L	3	150	7.5 *190.5*	0.94 *23.9*	5 *127*	-	4	0.75 *19.1*	6 *152.4*	2.83 *72*	+0.19	+0.25	+0.70	[4]
J7 [4]	AISI 316/ 316L	3	300	8.25 *209.5*	1.12 *28.4*	5 *127*	-	8	0.88 *22.4*	6.62 *168.1*	2.83 *72*	+0.19	+0.25	+0.70	[4]
AH	AISI 316/ 316L	4	150	9 *228.6*	0.94 *23.9*	6.19 *157.2*	-	8	0.75 *19.1*	7.5 *190.5*	3.50 *89*	+0.19	+0.25	+0.33	7.2
AT	AISI 316/ 316L	4	300	10 *254*	1.25 *31.8*	6.19 *157.2*	-	8	0.88 *22.4*	7.88 *200.2*	3.50 *89*	+0.19	+0.25	+0.11	11.7
J5 [4]	AISI 316/ 316L	4	150	9 *228.6*	0.94 *23.9*	6.19 *157.2*	-	8	0.75 *19.1*	7.5 *190.5*	3.50 *89*	+0.19	+0.25	+0.11	[4]
J8 [4]	AISI 316/ 316L	4	300	10 *254*	1.25 *31.8*	6.19 *157.2*	-	8	0.88 *22.4*	7.88 *200.2*	3.50 *89*	+0.19	+0.25	+0.11	[4]

1) The roughness of the surface in contact with the medium, including the raised face of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 μm. Lower surface roughness on request.

2) Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)

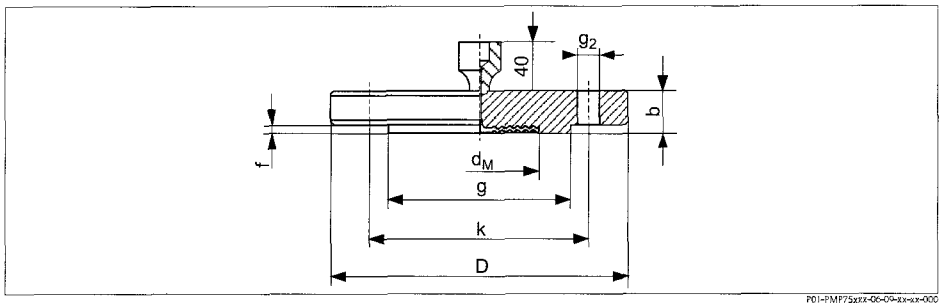
3) With these process connections the width of the raised face is smaller than described in the standard. Due to a smaller width of the raised face a special seal must be used. Refer to a manufacturer of seals or your local Endress+Hauser Sales Center.

4) 2", 4", 6" or 8" extension selectable, for extension diameter and weight see the following table

Version	Nominal diameter	Class	Extension length (L)	Extension diameter	Diaphragm seal weight
	[in]	[lb./sq.in]	[in] *[(mm)]*	[in] *[(mm)]*	[kg]
J3	2	150	– 2 *(50.8)* – 4 (101.6) – 6 *(152.4)* – 8 *(203.2)*	1.9 *(48.3)*	– 3.0 – 3.4 – 3.9 – 4.4
J4	3	150	– 2 *(50.8)* – 4 (101.6) – 6 *(152.4)* – 8 *(203.2)*	2.99 *(75.9)*	– 6.0 – 6.6 – 7.1 – 7.8
J7	3	300	– 2 *(50.8)* – 4 (101.6) – 6 *(152.4)* – 8 *(203.2)*	2.99 *(75.9)*	– 7.9 – 8.5 – 9.0 – 9.6
J5	4	150	– 2 *(50.8)* – 4 (101.6) – 6 *(152.4)* – 8 *(203.2)*	3.7 *(94)*	– 8.6 – 9.9 – 11.2 – 12.4

Version	Nominal diameter	Class	Extension length (L)	Extension diameter	Diaphragm seal weight
J8	4	300	– 2 *(50.8)* – 4 (101.6) – 6 *(152.4)* – 8 *(203.2)*	3.7 *(94)*	– 13.1 – 14.4 – 15.7 – 16.9

JIS flanges, connection dimensions as per JIS B 2220 BL, raised face RF



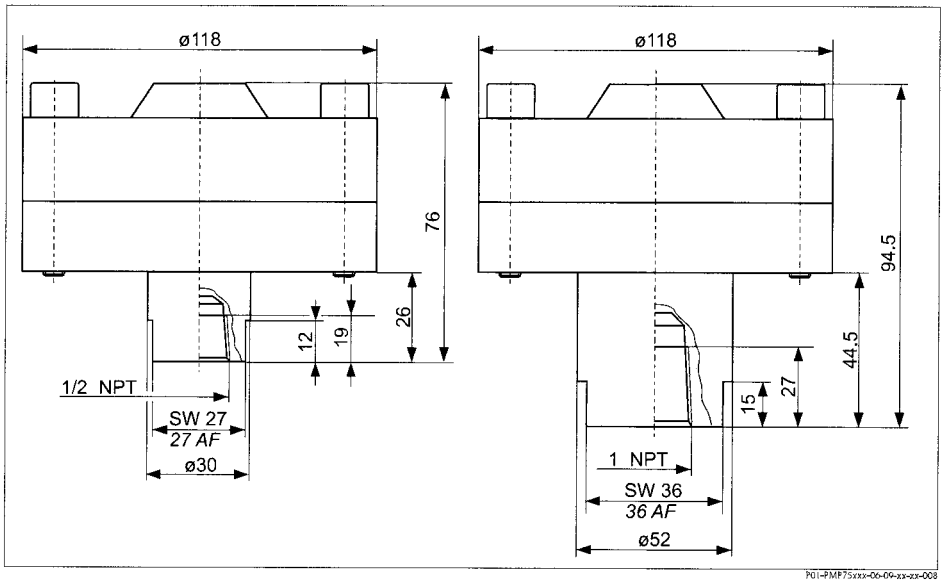
Process connection PMP75, JIS flange with raised face RF, material AISI 316L

	Flange [1]						Boltholes			Diaphragm seal				
Version	Nominal diameter	Nominal pressure	Diameter D [mm]	Thickness b [mm]	Diameter raised face g [mm]	Height raised face f [mm]	Quantity	Diameter g_2 [mm]	Hole circle k [mm]	max. Diaphragm diameter d_M [mm]	T_K Ambient ≤ 40 bar [mbar/10 K]	T_K Ambient > 40 bar [mbar/10 K]	T_K Process [mbar/10 K]	Diaphragm seal weight [2] [kg]
KC	25 A	10 K	125	14	67	1	4	19	90	32	+16.03	+24.33	+5.17	1.5
KF	50 A	10 K	155	16	96	2	4	19	120	59	+2.21	+3.02	+1.00	2.3
KL	80 A	10 K	185	18	127	2	8	19	150	89	+0.19	+0.25	+0.11	3.3
KH	100 A	10 K	210	18	151	2	8	19	175	89	+0.19	+0.25	+0.11	4.4

1) The roughness of the surface in contact with the medium, including the raised face of the flanges (all standards), made of Hastelloy C, Monel or Tantalum is Ra 0.8 µm. Lower surface roughness on request.

2) Housing weight → 🖹 61

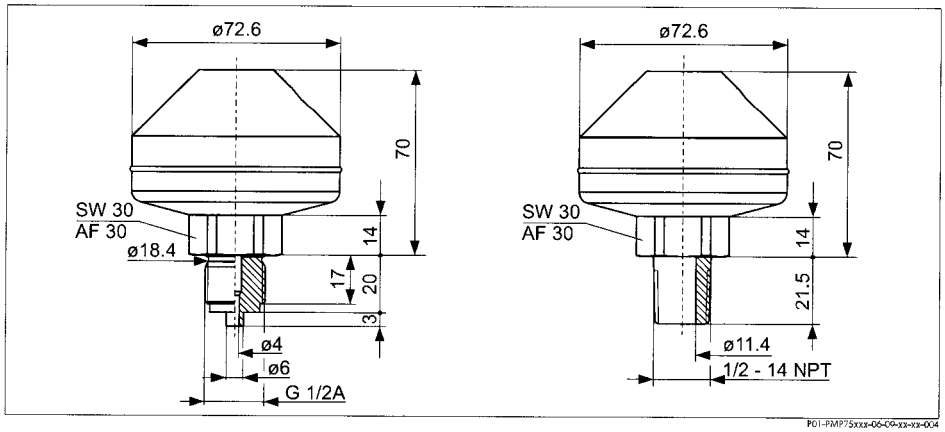
Thread 1/2 NPT und 1 NPT, seperator



Process connection PMP75, versions "UG" and "UH", screwed, material AISI 316L , seal Viton

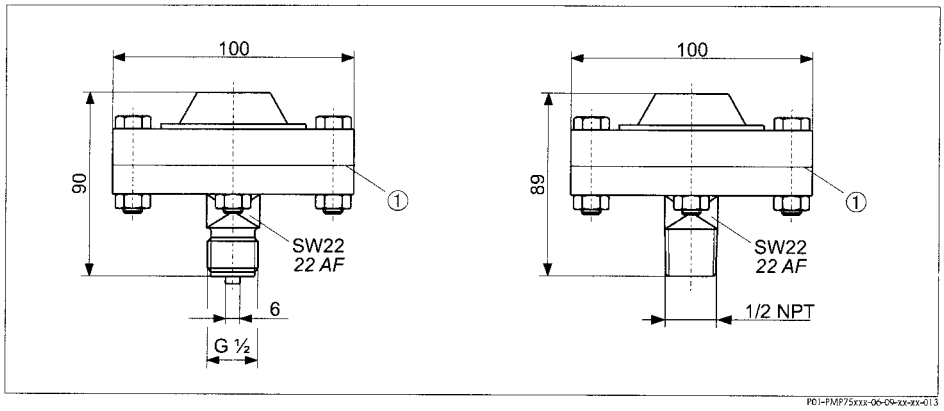
Version	Description	Nominal pressure	T_K Ambient	T_K Process	Diaphragm seal weight
			[mbar/10 K]		[kg]
UG	1/2 NPT	PN 250	+3.45	+1.28	4.75
UH	1 NPT	PN 250	+3.45	+1.28	5.0

Thread ISO 228 G 1/2 A and ANSI 1/2 MNPT, seperator



Process connection PMP75, versions "UA" and "UB", welded, material AISI 316L

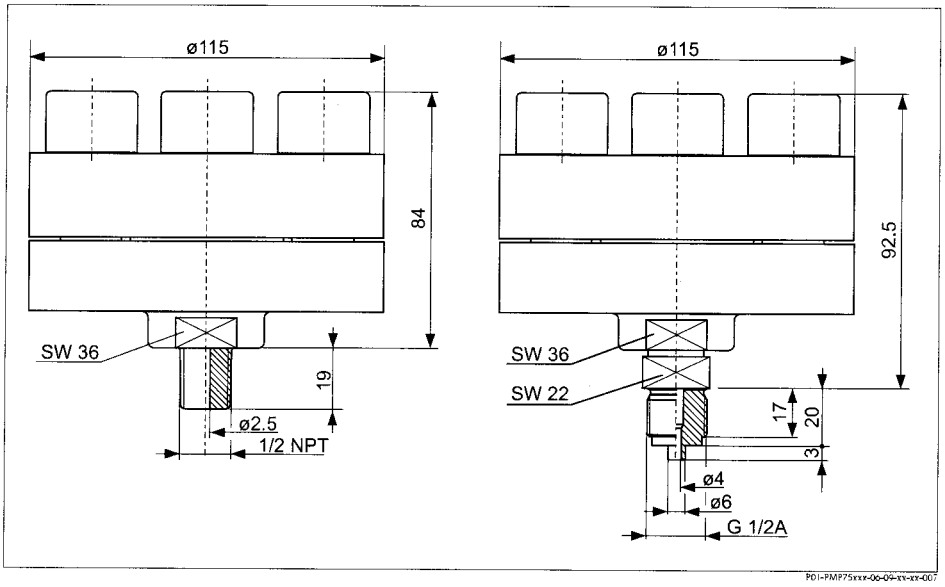
Version	Description	Nominal pressure	T_K Ambient	T_K Process	Diaphragm seal weight
			[mbar/10 K]		[kg]
UA	ISO 228 G 1/2 A	PN 160	+0.9	+0.30	1.43
UB	ANSI 1/2 MNPT	PN 160	+0.9	+0.30	1.43



Process connection PMP75, left: version "UC" with threaded connection ISO 228 G 1/2 B, right: version "UD" with threaded connection ANSI 1/2 MNPT

1 PTFE seal as standard max. 260 °C/500 °F (higher temperatures on request)

Version	Measuring range	Description	Nominal pressure	T_K Process [mbar/10 K]	Diaphragm seal weight [kg]
UC	≤ 40 bar	ISO 228 G 1/2 B	PN 40	+0.75	1.43
UD	≤ 40 bar	ANSI 1/2 MNPT	PN 40	+0.55	1.43

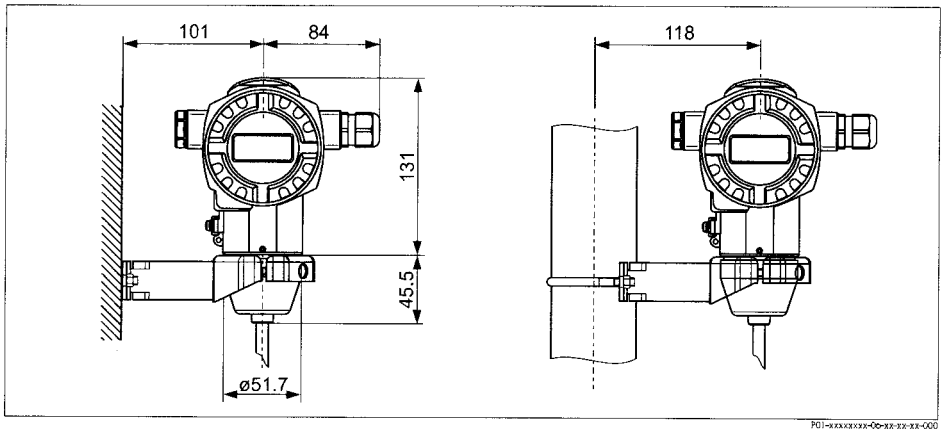


Process connection PMP75, versions "UC" and "UD", screwed, with integrated sealing lip, material AISI 316L

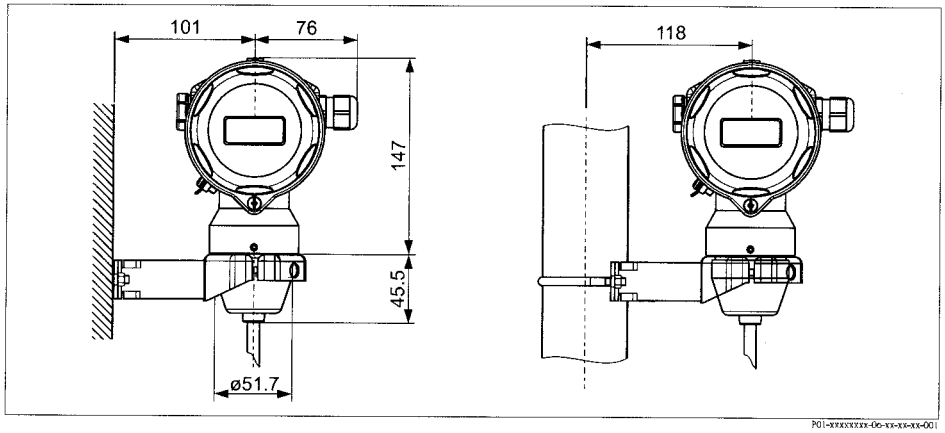
Version	Measuring range	Description	Nominal pressure	T_K Ambient [mbar/10 K]	T_K Process	Diaphragm seal weight [kg]
UC	> 40 bar	ISO 228 G 1/2 A	PN 400	+3.45	+1.28	1.43
UD	> 40 bar	ANSI 1/2 MNPT	PN 400	+3.45	+1.28	4.75

Note!
With the use of high temperature oils the design can deviate strongly.
For further information please contact your local Endress+Hauser Sales Center.

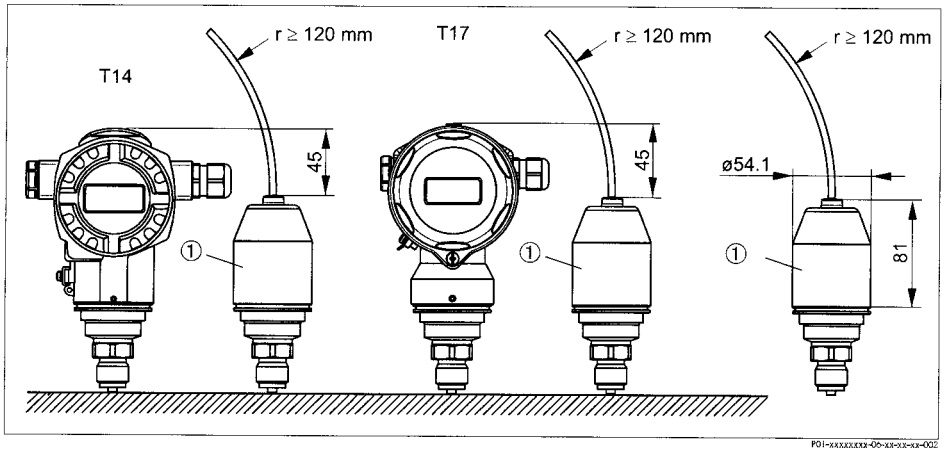
"Separate housing" version



Dimensions T14 housing, optional display on the side. Housing weight see → 61.



Dimensions T17 housing, optional display on the side. Housing weight see → 61.



Reduction of the mounting height of the process connection, for application of the separate housing.
1 Process connection adapter.

If the separate housing is used, the mounting height of the process connection is reduced by approx. 45 mm as compared to the dimensions of the standard version.
The minimum bending radius (r) for the cable is 120 mm (4.7").

Weight

Housing

	T14		T17	Separate housing
	Aluminium	AISI 316L	AISI 316L	
With electronic insert and on-site display	1.2 kg	2.1 kg	1.2 kg	Weight of housing T14 or T17 + 0.5 kg. Weight of sensor + 0.5 kg.
With electronic insert without on-site display	1.1 kg	2.0 kg	1.1 kg	

Process connections

- Process connections PMC71 (with ceramic process isolating diaphragm): → 33 ff
- Process connections PMP71 (with metallic process isolating diaphragm): → 40 ff
- Process connections PMP75 (with metallic process isolating diaphragm): → 47 ff

Material

T14 housing:

- T14 housing, selectable:
  - Die-cast aluminium with protective powder-coating on polyester basis: RAL 5012 (blue), cover: RAL 7035 (grey)
  - Precision cast stainless steel AISI 316L (1.4435)
- External operation (keys and key covering): Polycarbonate PC-FR, RAL 7035 (grey)
- Sight glass: Mineral glass
- Cable gland: Polyamid (PA)
- Pressure compensation filter: PA6 GF10
- Blind plug: PBT-GF30 FR, for Dust Ex, Ex d, FM XP and CSA XP: AISI 316L (1.4435)
- Seals:
  - Cable and blind plug seal: Silicone (VMQ)
  - Pressure compensation filter o-ring: Silicone (VMQ)
  - Cover: EPDM
  - Sight glass: Silicone (VMQ)
- Nameplates: AISI 304 (1.4301)

T17 housing:

- Housing: Stainless steel AISI 316L (1.4404)
- Sight glass:
  - Version for non-hazardous area, ATEX Ex ia, NEPSI Zone 0/1 Ex ia, IECEx Zone 0/1 Ex ia, FM NI, FM IS, CSA IS: Polycarbonate (PC)
  - ATEX 1/2 D, ATEX 1/3 D, ATEX 1 GD, ATEX 1/2 GD, ATEX 3 G, FM DIP, CSA Dust Ex: Mineral glass
- Cable gland: Polyamid PA, for Dust-Ex: CuZn nickel-plated
- Blind plug: PBT-GF30 FR, for Dust-Ex: AISI 316L (1.4435)
- Pressure compensation filter: PA6 GF10
- Seals:
  - Cable and blind plug seal: Silicone (VMQ)
  - Pressure compensation filter o-ring: Silicone (VMQ)
  - Cover: EPDM
  - Sight glass: EPDM
- Nameplates: lasered

Process connection

- "Clamp connections" and "Hygienic connections" (see also Chapter "Ordering information"): AISI 316L/ 1.4435
- "Threaded connection" and "DIN/EN flanges" (see also Chapter "Ordering information"): stainless steel AISI 316L with the material number 1.4435 or 1.4404
- With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13E0 in EN 1092-1 Tab.18. The chemical composition of the two materials can be identical.

Cable for separate housing:

- PE cable:
  Slip-resistant cable with strain-relief members made of Dynemo; shielded using aluminium-coated film; insulated with polyethylene (PE-LD), black; copper wires, twisted, UV resistant
- FEP cable:
  Slip-resistant cable; shielded using galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted, UV resistant

TSE Certificate of Suitability

The following applies to all process wetted device components:
- They do not contain any materials derived from animals.
- No auxiliaries or operating materials derived from animals are used in production or processing.

Note!
Process wetted device components are listed in the "Mechanical construction" (→ 🖹 32) and "Ordering information" (→ 🖹 77) sections.

Miscellaneous:

- Process isolating diaphragm PMC71: Al_2O_3 Aluminium-oxide-ceramic (FDA 21CFR186.1256, USP Class VI), ultrapure 99.9% (→ www.endress.com/ceraphire)
- Mounting accessories: Mounting kit with screws AISI 304 (1.4301)
- Capillary: AISI 316 Ti (1.4571)
- Protective hose for capillary: AISI 304 (1.4301)
- External earth terminal: AISI 304 (1.4301)

→ For process connections, process diaphragms, seals and filling oils see ordering information, → 🖹 77 ff.

Human interface

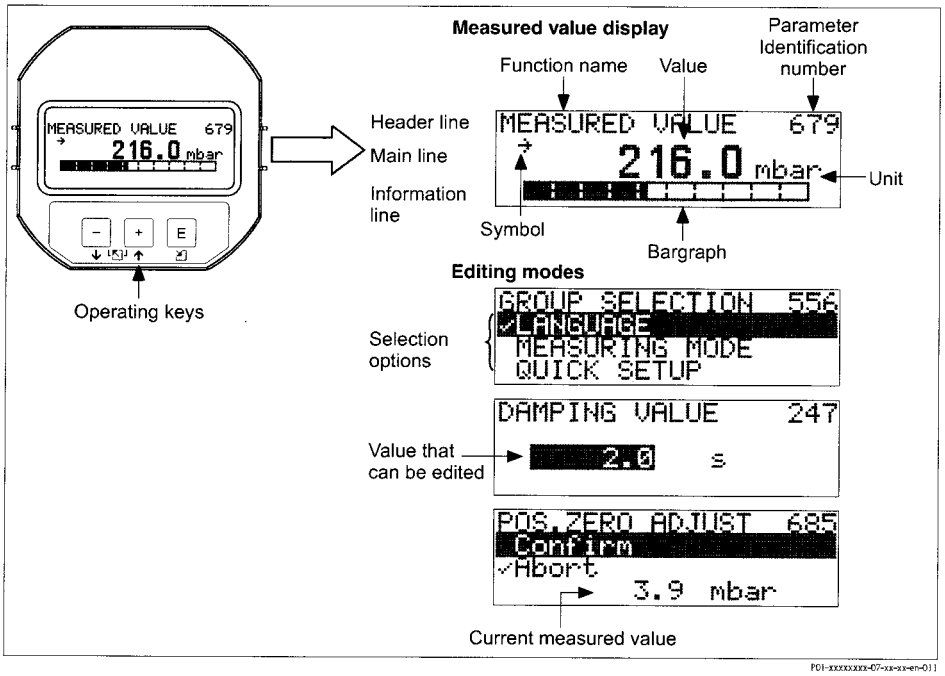
Operating elements

On-site display (optional)

A 4-line liquid crystal display (LCD) is used for display and operation. The on-site display shows measured values, dialog text as well as fault and notice messages in plain text, thereby supporting the user in every stage of operation. The liquid crystal display of the device can be turned in 90° steps.
Depending on the installation position of the device, this makes it easy to operate the device and read the measured value.

Functions:

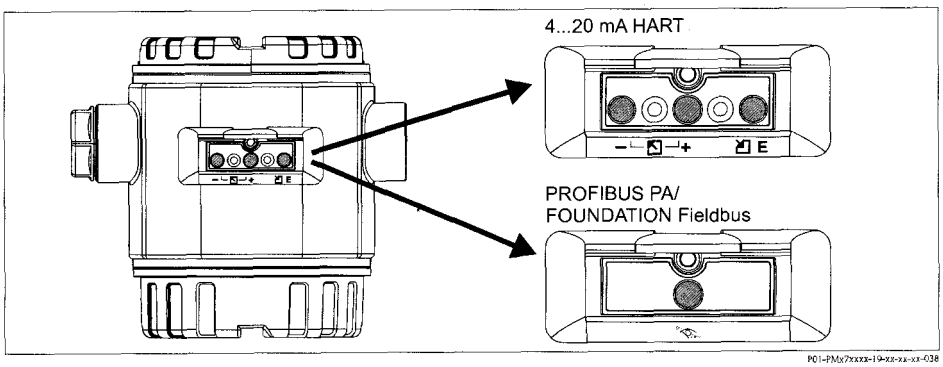
- 8-digit measured value display including sign and decimal point, bar graph for 4 to 20 mA HART as current display or for PROFIBUS PA as graphical display of the scaled value of the AI Block
- Simple and complete menu guidance thanks to seperation of the parameters into three levels
- Ech parameter is given as 3-digit ID number for easy navigation
- Option for configuring the display according to individual requirements and desires, such as language, alternating display, display of other measured values such as sensor temperature, contrast setting
- Comprehensive diagnostic functions (fault and warning message, peak-hold indicators, etc.)
- Rapid and safe commissioning with the Quick Setup menus



Operating elements

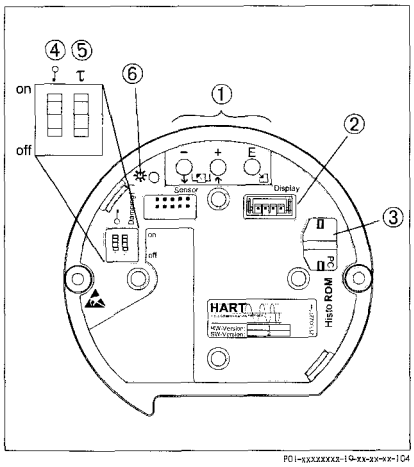
Operating keys on the exterior of the device

The operating keys of the housing T14 (aluminium or stainless steel) are located either outside of the housing, under the protection cap or upon the electronic insert. The operating keys of the housing T17 (ironing stainless steel) are located inside the housing upon the electronic insert



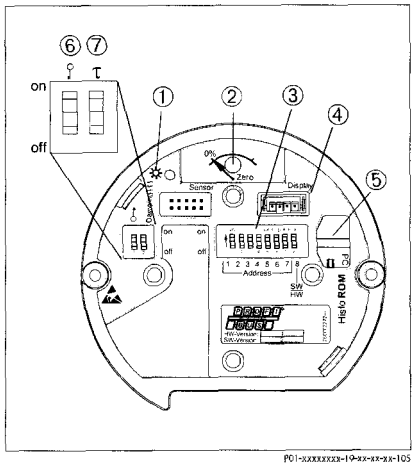
The operating keys located externally on the device work on the Hall sensor principle. As a result, no additional openings are required in the device. This guarantees:
- Complete protection against environmental influences such as moisture and contamination
- Simple operation without any tools
- No wear.

Operating keys and elements located internally on the electronic insert



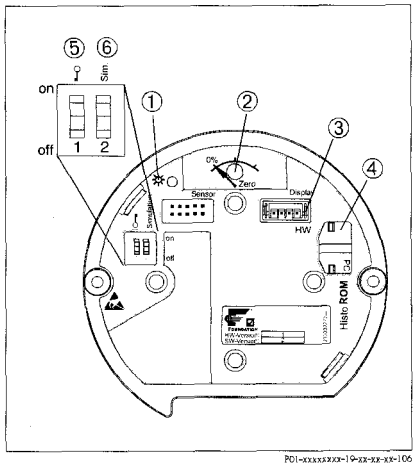
Electronic insert HART

1 *Operating keys*
2 *Slot for optional display*
3 *Slot for optional HistoROM®/M-DAT*
4 *DIP-switch for locking/unlocking measured-value-relevant parameters*
5 *DIP-switch for damping on/off*
6 *Green LED to indicate value being accepted*



Electronic insert PROFIBUS PA

1 *Green LED to indicate value being accepted*
2 *Key for position calibration and device reset*
3 *DIP-switch for bus address*
4 *Slot for optional display*
5 *Slot for optional HistoROM®/M-DAT*
6 *DIP-switch for locking/unlocking measured-value-relevant parameters*
7 *DIP-switch for damping on/off*



Electronic insert FOUNDATION Fieldbus

1 *Green LED to indicate value being accepted*
2 *Key for position calibration and device reset*
3 *Slot for optional display*
4 *Slot for optional HistoROM®/M-DAT*
5 *DIP-switch for locking/unlocking measured-value-relevant parameters*
6 *DIP-switch for simulation mode on/off*

Local operation

Function	External operation (operation keys, optional, not T17 housing)	Internal operation (electronic insert)	Display (optional)
Position calibration (zero point correction)	X	X	X
Setting lower-range value and upper-range value - reference pressure present at the device	X (HART only)	X (HART only)	X
Device Reset	X	X	X
Locking and unlocking measured-value-relevant parameters	—	X	X
Value acceptance indicated by green LED	X	X	X
Switching damping on and off	—	X (HART and PA only)	X
Setting bus address (PA)	—	X	X
Switching simulation mode on and off (FOUNDATION Fieldbus)	—	X	X

Remote operation

Depending on the position of the write protection switch at the device, all software parameters are accessible.

HART

Remote operation via:
- Handheld terminal Field Communicator 375 (see Chapter "Hard- und Software for on-site and remote operation" → 66)
- FieldCare (see Chapter "Hard- und Software for on-site and remote operation" → 66 ff) with
  - Commubox FXA191 (see Chapter "Hard- und Software for on-site and remote operation" → 66 ff)
  - Commubox FXA195 (see Chapter "Hard- und Software for on-site and remote operation" → 66 ff)
- Field Xpert:
  Field Xpert is an industrial PDA with integrated 3.5" touchscreen from Endress+Hauser based on Windows Mobile. It communicates via wireless with the optional VIATOR Bluetooth modem connected to a HART device point-to-point or wireless via WiFi and Endress+Hauser's Fieldgate FXA520. Field Xpert also works as a stand-alone device for asset management applications. For details refer to BA060S/00/en.

PROFIBUS PA

Remote operation via:
- FieldCare (see Chapter "Hard- und Software for on-site and remote operation" → 66 ff)
  - Profiboard: For the Connection of a Personal Computer to PROFIBUS
  - Proficard: For the Connection of a Laptop to PROFIBUS

FOUNDATION Fieldbus

Remote operation via:
- Handheld terminal Field Communicator 375 (see Chapter "Hard- und Software for on-site and remote operation" → 66 ff)
- Use an FF-configuration program for e.g. NI-FBUS configurator, to
  - connect devices with "FOUNDATION Fieldbus signal" into an FF-network
  - set FF-specific parameter

  Operation with NI-FBUS Configurator:
  The NI-FBUS Configurator is an easy-to-use graphical environment for creating linkages, loops and a schedule based on the fieldbus concept.
  You can use the NI-FBUS Configurator to configure a fieldbus network as follows:
  - Set block and device tags
  - Set device addresses
  - Create and edit function block control strategies (function block applications)
  - Configure vendor -defined function and transducer blocks
  - Create and edit schedules
  - Read and write to function block control strategies (function block applications)
  - Invoke Device Description (DD) methods

- Display DD menus
- Download a configuration
- Verify a configuration and compare it to a saved configuration
- Monitor a downloaded configuration
- Replace a virual device by a real device
- Save and print a configuration

Note!
For further information please contact your local Endress+Hauser Sales Center.

Hard- und Software for on-site and remote operation

Commubox FXA191

For intrinsically safe communication with FieldCare via the RS232C interface. For details refer to TI237F700/en.

Commubox FXA195

For intrinsically safe communication with FieldCare via the USB interface. For details TI404F/00/en.

Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field instruent with CDI interface (=Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook.
For details TI405C/07/en.

Note!
For the following Endress+Hauser instruments you need the "ToF Adapter FXA291" as an additional accessory:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70

ToF Adapter FXA291

The ToF Adapter FXA291 connects the Commubox FXA291 with instruments of the ToF platform, pressure instruments and Gammapilot via the USB interface of a personal computer or a notebook. For details refer to KA271F.

Field Communicator 375

With a handheld terminal, all the parameters can be configured anywhere along the 4 to 20 mA line via menu operation.

HistoROM®/M-DAT (optional)

HistoROM®/M-DAT is a memory module, which is attached to the electronic insert. The HistoROM®/M-DAT can be retrofitted at any stage (Order number: 52027785).

Your benefits

- Quick and safe commissioning of the same measuring points by copying the configuration data of one transmitter to another transmitter
- Reliable process monitoring thanks to cyclical recording of pressure and sensor temperature measured values
- Simple dagnosis by recording diverse events such as alarms, configuration changes, counters for measuring range undershoot and overshoot for pressure and temperature as well as user limit overshoot and undershoot for pressure and temperature etc.
- Analysis and graphic evaluation of the events and process parameters via software (contained in scope of supply).

HistoROM®/M-DAT can be ordered via feature 100 "Additional options 1" or feature 110 "Additional options 2" or as spare parts. → 77 ff. A CD with Endress+Hauser operating program is also included in the scope of delivery.
You can copy data from one transmitter to another transmitter when operating a FOUNDATION Fieldbus device via an FF configuration program. You need the Endress+Hauser FieldCare operating program and the Commubox FXA291 service interface and the ToF Adapter FXA291 to be able to access the data and events saved in the HistoROM®/M-DAT.

FieldCare

FieldCare is an Endress+Hauser asset management tool based on FDT technology. With FieldCare, you can configure all Endress+Hauser devices as wella s devices from other manufacturers that support the FDT standard.

FieldCare supports the following functions:
- Configuration of transmitter in offline and online operation
- Loading and saving device data (upload/download)
- HistoROM®/M-DAT analysis
- Documentation of the measuring point

Connection options:
- HART via Commubox FXA191 and the RS232C serial interface of a computer
- HART via Commubox FXA195 and the USB port on a computer
- PROFIBUS PA via segment coupler and PROFIBUS interface card
- FOUNDATION Fieldbus via Commubox FXA193 and the RS232C serial interface of a computer
- Service interface with adapter Commubox FXA291 and ToF Adapter FXA291 (USB).

For further information → www.endress.com

Planning instructions, diaphragm seal systems

With the Endress Hauser selection tool "Applicator" you will find the optimum diaphragm seal for your application. Online on "www.endress.com/applicator" or offline on CD.
For further information please contact your local Endress+Hauser Sales Center.

Applications

Diaphragm seal systems should be used if the process media and the device should be separated. Diaphragm seal systems offer clear advantages in the following instances:
- In the case of high process temperatures (→ 🖹 30, section "Process temperature limits".)
- For aggressive media
- If good and rapid measuring point cleaning is necessary
- If the measuring point is exposed to vibrations
- For mounting locations that are difficult to access
- For very humid mounting locations

Planning instructions

Diaphragm seals are separating equipment between the measuring system and the process medium.

A diaphragm seal system consists of:
- A diaphragm seal in a one-sided system
- Capillary tube
- Fill fluid and
- A pressure transmitter.

The process pressure acts via the process isolating diaphragm of a diaphragm seal on the liquid-filled system, which transfers the process pressure via the capillary tube onto the sensor of the pressure transmitter. Endress+Hauser delivers all diaphragm seal systems as welded versions. The system is hermetically sealed, which ensures the highest reliability.

Note!
The correlations between the individual diaphragm seal components are presented in the following section. For further information and comprehensive diaphragm seal system designs, please contact your local Endress+Hauser Sales Center.

Diaphragm seal

The diaphragm seal determines the application range of the system by
- the process isolating diaphragm diameter
- the diaphragms: stiffness and material
- the design (oil volume).

Process isolating diaphragm diameter

The larger the process isolating diaphragm diameter (less stiffness), the smaller the temperature effect on the measurement result.
Note: To keep the temperature effect in practice-oriented limits, you should select diaphragm seals with a nominal diameter of ≥ DN 80, in as far as the process connection allows for it.

Process isolating diaphragm stiffness

The stiffness is dependent on the process isolating diaphragm diameter, the material, any available coating and on the process isolating diaphragm thickness and shape. The process isolating diaphragm thickness and the shape are defined constructively. The stiffness of a process isolating diaphragm of a diaphragm seal influences the temperature operating range and the measuring error caused by temperature effects.

Capillary

Capillaries with an internal diameter of 1 mm are used as standard.
The capillary tube influences the T_K zero point, the ambient temperature operating range and the response time of a diaphragm seal system as a result of its length and internal diameter.
→ 🖹 69 ff, sections "Influence of the temperature on the zero point" and "Ambient temperature range".
→ Observe the installation instructions regarding capillary tubes. → 🖹 74 ff, section "Installation instructions".

Filling oil

When selecting the filling oil, fluid and ambient temperature as well as the operating pressure are of crucial importance. Observe the temperatures and pressures during commissioning and cleaning. A further selection criterion is the compatibility of the filling oil with the requirements of the process medium. For this reason, only filling oils that are harmless to health are used in the food industry, such as vegetable oil or silicone oil → See also the following section "Diaphragm seal filling oils" section.
The filling oil used influences the T_K zero point and the temperature operating range of a diaphragm seal system and the response time. → 69 ff, section "Influence of the temperature on the zero point".

Pressure transmitter

The pressure transmitter influences the temperature operating range, the T_K zero point and the response time as a result of its volume change. The volume change is the volume that has to be shifted to pass through the complete measuring range.
Pressure transmitters from Endress+Hauser are optimised with regard to minimum volume change.

Diaphragm seal filling oils

Version [1]	Filling oil	Permissible temperature range [2] at 0.05 bar ≤ p_{abs} ≤ 1 bar	Permissible temperature [2] range at p_{abs} ≥ 1 bar	Density [g/cm³]	Viscosity [cSt at 25°C (77°F)]	Coefficient of thermal expansion [1/K]	T_K correction factor	Note
A, H, 1 or 2	Silicone oil	–40...+180°C (–40...+356°F)	–40...+250°C (–40...+482°F)	0.96	100	0.00096	1	suitable for foods FDA 21 CFR 175.105
G, 3 or 4	High temperature oil	–10...+200°C (+14...+392°F)	–10...+400°C (+14...+752°F)	1.07	37	0.0007	0.72	high temperatures
F or N	Inert oil	–40...+80°C (–40...+176°F)	–40...+175°C (–40...+347°F)	1.87	27	0.000876	0.91	for ultra pure gas and oxygen applications
D, 5 or 6	Vegetable oil	–10...+120°C (+14...+248°F)	–10...+200°C (+14...+392°F)	0.94	9.5	0.00101	1.05	suitable for foods FDA 21 CFR 172.856
7 or 8	Low temperature oil	–70...+80°C –94...+176°F	–70...+180°C –94...+356°F	0.92	4.4	0.00108	1.12	low temperatures

1) Version for feature 90 in the order code

2) Observe temperature limits of the device (→ 28 and → 30).

Influence of the temperature on the zero point

A temperature change results in a volume change of the filling oil. The volume change is dependent on the coefficient of thermal expansion of the filling oil and on the volume of the filling oil at calibration temperature (constant in the range: +21 to +33°C (+69.8 to 91.4°F)). → 69, "Filling oil" section.
For example, the filling oil expands in the event of a temperature increase. The additional volume presses against the process isolating diaphragm of a diaphragm seal. The stiffer a process isolating diaphragm is, the greater its return force, which counteracts a volume change and acts on the measuring cell together with the operating pressure, thus shifting the zero point. For the "T_K Process" and "T_K Ambient (for devices without capillary)", see → 47 ff, section "Process connections PMP75".

The following diagrams display the temperature coefficient "T_K Ambient" dependent on the capillary length. The following application is displayed: capillary temperature and transmitter temperature (ambient temperature) change, the process temperature corresponds to the calibration temperature.
The temperature coefficients obtained from the diagrams apply to silicone oil and the process isolating diaphragm material AISI 316L/1.4435. For other filling oils, these temperature coefficients must be multiplied by the T_K correction factor of the corresponding filling oil. For the T_K correction factors, see → 69, section "Diaphragm seal filling oils".
With regard to the temperature coefficient "T_K Ambient", devices with temperature isolator behave like devices with the same process connection and 0.1 m capillary.

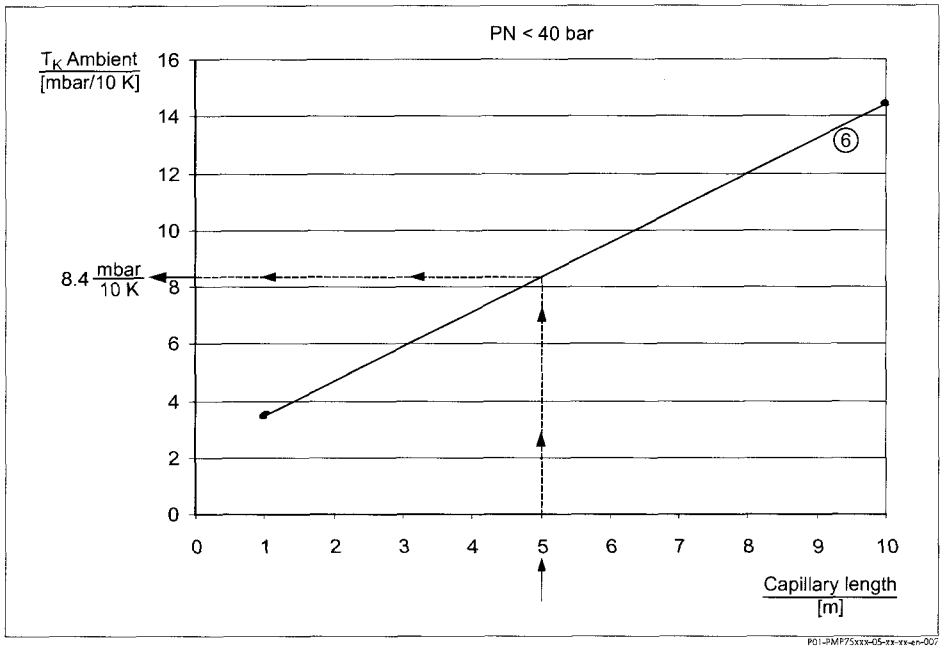


Diagram T_K Ambient dependent on the capillary length for PMP75, PN < 40 bar

Example for:
- Diaphragm seal versions "B3, EN/DIN flange DN 50 PN 10-40 B1, AISI 316L"
- Capillary length: 5 m
- Ambient temperature, capillary/transmitter: 45°C
- Filling oil: silicone oil

1. Select characteristic curve type for the diaphragm seal versions "B3" in accordance with the following table.
   Result: characteristic curve type 6
2. Obtain value for T_K Ambient from the diagram.
   Result: 8.4 mbar/10 K
3. $T_{Ambient} - T_{Calibration} = 45°C - 25°C = 20°C \Rightarrow 8.4$ mbar/10 K x 20 K = 16.8 mbar

Result: In this application, the zero point is shifted by 16.8 mbar.

Note!
- The influence of temperature on the zero point can be corrected with position calibration.
- The temperature influence can be minimised by using a filling oil with a smaller coefficient of thermal expansion, shorter capillary, diaphragm seal with larger process isolating diaphragm diameter or by using a smaller capillary internal diameter.

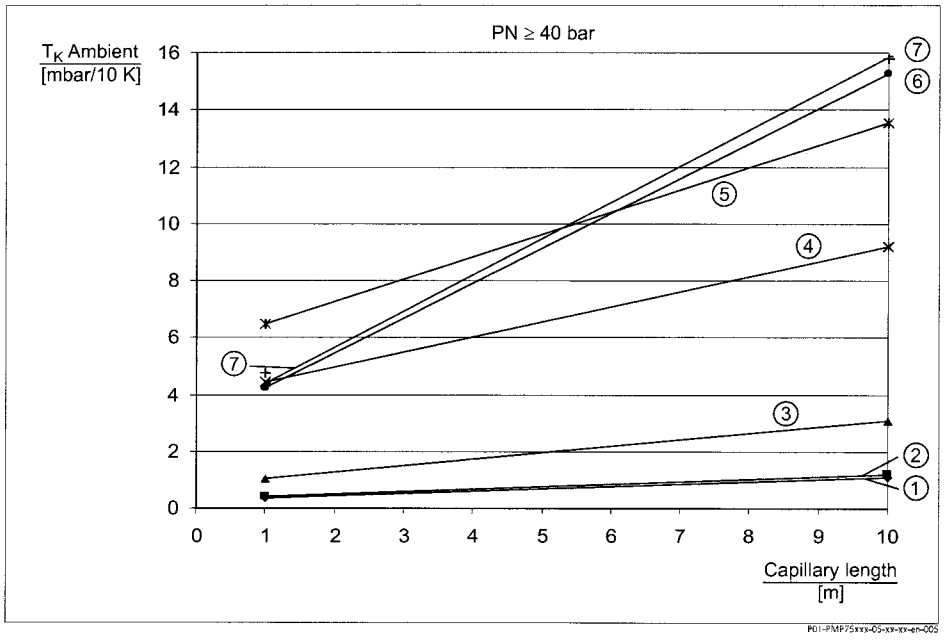


Diagram T_K Ambient dependent on the capillary length for PMP75, PN ≥ 40 bar

Characteristic curve type	Version	Diaphragm seal
1	B4	EN/DIN flange DN 80 PN 10-40 B1, AISI 316L
	C4	EN/DIN flange DN 80 PN 100 B2, AISI 316L
	C5	EN/DIN flange DN 100 PN 100 B2, AISI 316L
	KL	JIS flange 10K 80A RF, AISI 316L
	KH	JIS flange 10K 100A RF, AISI 316L
	D4	EN/DIN flange DN 80, PN 10-40 B1, Extensions: 50 mm/100 mm/200 mm, AISI 316L
	AG	ANSI flange 3" 150 lbs RF, AISI 316/316L
	AS	ANSI flange 3" 300 lbs RF, AISI 316/316L
	AH	ANSI flange 4" 150 lbs RF, AISI 316/316L
	AT	ANSI flange 4" 300 lbs RF, AISI 316/316L
	J4	ANSI flange 3" 150 lbs RF, Extensions: 2"/4"/6"/8", AISI 316/316L
	J7	ANSI flange 3" 300 lbs RF, Extensions: 2"/4"/6"/8", AISI 316/316L
	J5	ANSI flange 4" 150 lbs RF, Extensions: 2"/4"/6"/8", AISI 316/316L
	J8	ANSI flange 4" 300 lbs RF, Extensions: 2"/4"/6"/8", AISI 316/316L
2	TF	Tri-Clamp, ISO 2852 DN 76.1 (3"), AISI 316L/1.4435
3	MT	DIN 11851 DN 80 PN 25, AISI 316L/1.4435
	M5	DIN 11851 DN 80 PN 25 socket, AISI 316L/1.4435
4	SD	Pipe diaphragm seal Tri-Clamp, ISO 2852 DN 51 (2"), AISI 316L
5	SC	Pipe diaphragm seal Tri-Clamp, ISO 2852 DN 38 (1 1/2"), AISI 316L
6	B3	EN/DIN flange DN 50 PN 1040 B1, AISI 316L
	C3	EN/DIN flange DN 50 PN 63 B2, AISI 316L
	EF	EN/DIN flange DN 50 PN 100-160 E, AISI 316L
	ER	EN/DIN flange DN 50 PN 250 E, AISI 316L
	E3	EN/DIN flange DN 50 PN 400 E, AISI 316L
	AF	ANSI flange 2" 150 lbs RF, AISI 316/316L
	AR	ANSI flange 2" 300 lbs RF, AISI 316/316L
	HF	ANSI flange 2" 400/600 lbs RF, AISI 316/316L
	HR	ANSI flange 2" 900/1500 lbs RF, AISI 316/316L
	H3	ANSI flange 2" 2500 lbs RF, AISI 316/316L
	KF	JIS 10K 50A RF, AISI 316L
	MR	DIN 11851 DN 50 PN 25, AISI 316L/1.4435
	MS	DIN 11851 DN 65 PN 25, AISI 316L/1.4435
	M3	DIN 11851 DN 50 PN 25 socket, AISI 316L/1.4435
	M4	DIN 11851 DN 65 PN 25 socket, AISI 316L/1.4435
7	TR	Varivent Type N for tubes DN 40 – DN 162, PN 40, AISI 316L/1.4435
	TK	DRD DN50 (65 mm), PN 25, AISI 316L/1.4435

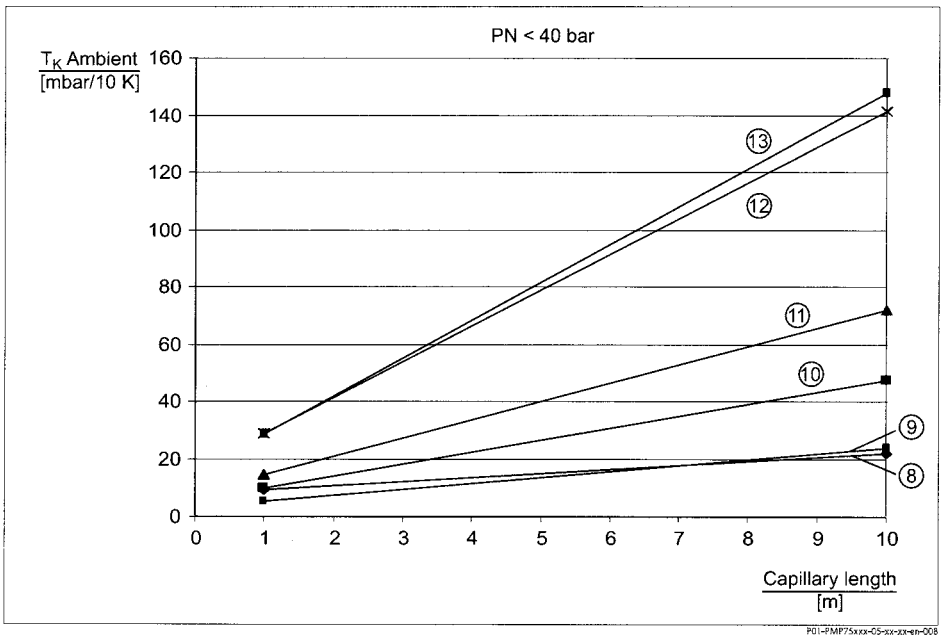


Diagram T_K Ambient dependent on the capillary length for PMP75, PN < 40 bar

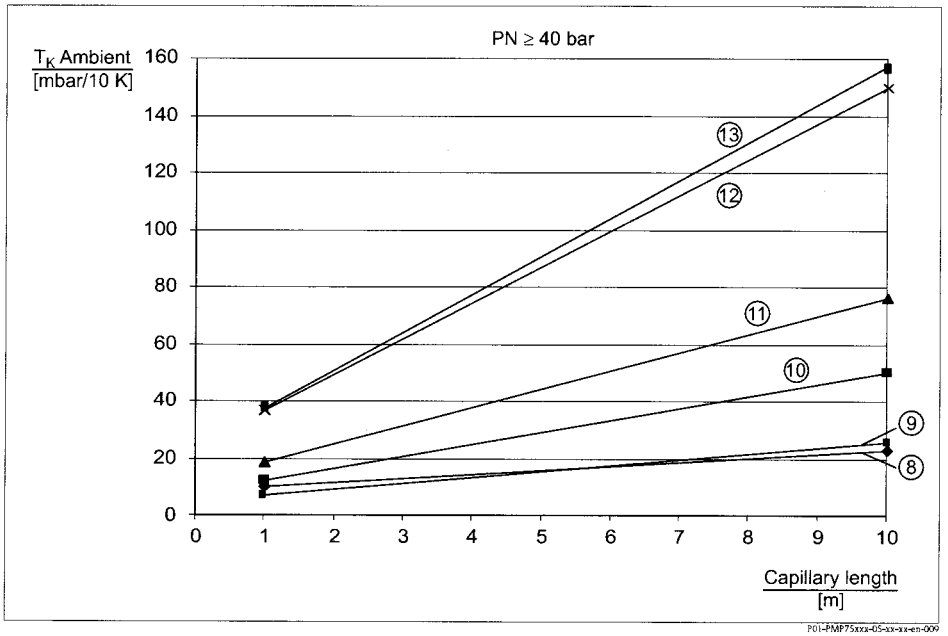
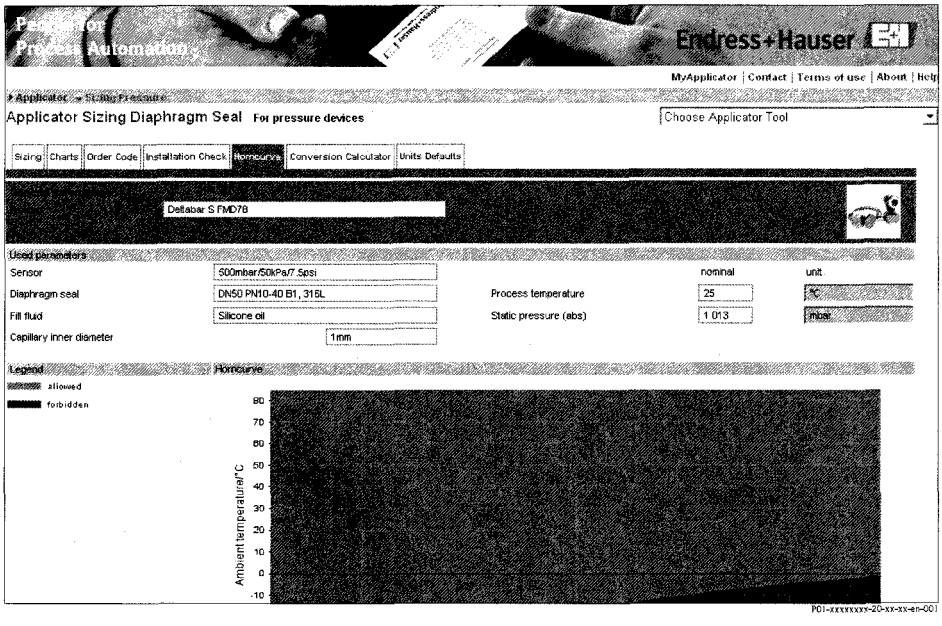


Diagram T_K Ambient dependent on the capillary length for PMP75, PN ≥ 40 bar

Characteristic curve type	Version	Diaphragm seal
8	SB	Pipe diaphragm seal Tri-Clamp, ISO 2852 DN 25 (1"), AISI 316L
9	D3	EN/DIN flange PN10-40 B1, Extensions: 50 mm/100 mm/200 mm, AISI 316L
	J3	ANSI flange 2" 150 lbs, Extensions: 2"/4"/6"/8", AISI 316/316L
	TD	Tri-Clamp, ISO 2852 DN 51 (2"), AISI 316L/1.4435
10	CQ	EN/DIN flange DN 40 PN 10-40 B1, AISI 316L
	TI	SMS 2" PN 25, AISI 316L/1.4435
	TN	APV-RJT 2" PN 40, AISI 316L/1.4435
	TS	APV-ISS 2" PN 40, AISI 316L/1.4435
11	CP	EN/DIN flange DN32 PN 10-40 B1, AISI 316L
	AE	ANSI flange 1 1/2" 150 lbs RF, AISI 316/316L
	AQ	ANSI flange 1 1/2" 300 lbs RF, AISI 316/316L
	TC	Tri-Clamp, ISO 2852 DN 38 (1 1/2"), DIN 32676 DN 40, AISI 316L/1.4435
	TH	SMS 1 1/2" PN 25, AISI 316L/1.4435
	TM	APV-RJT 1 1/2" PN 40, AISI 316L/1.4435
	TS	APV-ISS 1 1/2" PN 40, AISI 316L/1.4435
12	CN	EN/DIN flange PN 10-40 B1, AISI 316L
	DN	EN/DIN flange PN 64-160 E, AISI 316L
	EN	EN/DIN flange PN 250 E, AISI 316L
	E1	EN/DIN flange PN 400 E, AISI 316L
	AC	ANSI flange 1" 150 lbs RF, AISI 316/316L
	AN	ANSI flange 1" 300 lbs RF, AISI 316/316L
	HC	ANSI flange 1" 400/600 lbs RF, AISI 316/316L
	HN	ANSI flange 1" 900/1500 lbs RF, AISI 316/316L
	HO	ANSI flange 1" 2500 lbs RF, AISI 316/316L
	KC	JIS flange 10K 25 A RF, AISI 316L
13	TB	Tri-Clamp, ISO 2852 DN 25 (1"), DIN 32676 DN 25, AISI 316L/1.4435

Ambient temperature range

The operating temperature range of a diaphragm seal system depends on Fill fluid, "Capillary length and internal diameter, Process temperature and Diaphragm seal oil volume.
The range of application can be extended by using a fill fluid with a smaller expansion coefficient and a shorter capillary. The permitted operating temperature ranges in relation to the capillary length can be calculated online at "Applicator Sizing Diaphragm Seal":
http://www.endress.com/applicator -> Applicator Sizing Diaphragm Seal -> Horncurve



Note!

- Endress+Hauser recommends you use a low temperature oil for applications that require short response times or are close to the lower temperature limit (see "diaphragm seal fill fluid").
- Please contact your Endress+Hauser sales office for further information, comprehensive diaphragm seal system designs and measuring technology solutions that are close to the application limits.

Installation instructions

Instructions for diaphragm seal systems

- Endress+Hauser offer flushing rings as accessory to clean process isolating diaphragms without taking the transmitters out of process.
  For further information please contact your local Endress+Hauser Sales Center.
- The diaphragm seal together with the transmitter form a closed, calibrated system, which is filled through ports in the diaphragm seal and in the measurement system of the transmitter. These ports are sealed and must not be opened.
- In the case of devices with diaphragm seals and capillaries, the zero point shift caused by the hydrostatic pressure of the filling liquid column in the capillaries must be taken into account when selecting the measuring cell. If a measuring cell with a small measuring range is selected, a position adjustment can cause an overdrive. See the following diagram and the following example.
- For devices with temperature isolator or capillary a suitable fastening device (mounting bracket) is recommended.
- When using a mounting bracket, sufficient strain relief must be allowed for in order to prevent the capillary bending down (bending radius ≥ 100 mm).

Installation instructions for capillaries

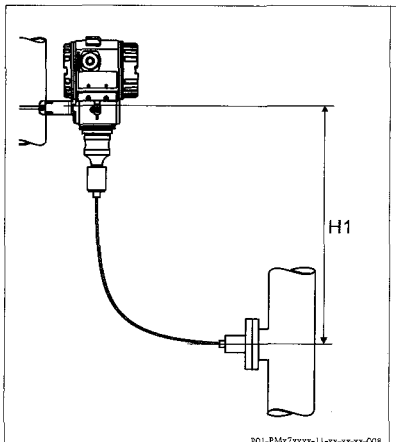
In order to obtain more precise measurement results and to avoid a defect in the device, mount the capillaries as follows:

- vibration-free (in order to avoid additional pressure fluctuations)
- not in the vicinity of heating or cooling lines
- insulate if the ambient temperature is below ore above the reference temperature
- with a bending radius of ≥ 100 mm.

Vacuum applications

For applications under vacuum, Endress+Hauser recommends mounting the pressure transmitter below the diaphragm seal. A vacuum load of the diaphragm seal caused by the presence of fill fluid in the capillary prevents is hereby prevented.

When the pressure transmitter is mounted above the diaphragm seal, the maximum height difference H1 in accordance with the following illustration on the left must not be exceeded. The maximum height difference is dependent on the density of the filling oil and the smallest ever pressure that is permitted to occur at the diaphragm seal (empty tank), see the following illustration, on the right.



Installation above the diaphragm seal

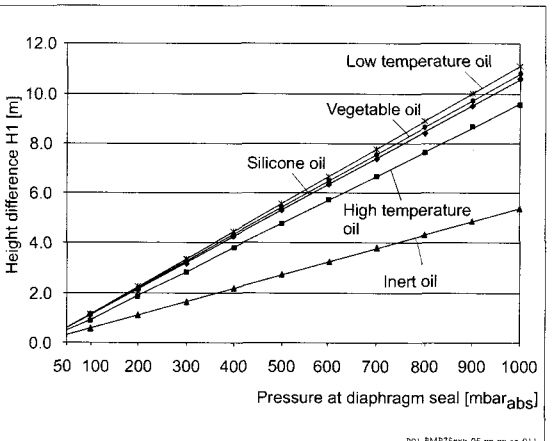


Diagram of maximum installation height above the diaphragm seal for vacuum applications

Certificates and approvals

CE mark

The device meets the legal requirements of the relevant EC directives.
Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

Ex approvals

- ATEX
- FM
- CSA
- NEPSI
- IECEx
- GOST
- also combinations of different approvals

All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.
→ 🖹 90 ff, sections "Safety Instructions" and "Installation/Control Drawings".

Suitability for hygenic processes

The Cerabar S is suitable for the employment in hygenic processes.
Overview of permitted process connections from page 32.
Many versions meet the requirements of 3A-Sanitary Standard No. 74 and are certified by the EHEDG.

Note!
The gap-free connections can be cleaned without residue using the usual cleaning methods.

Marine certificate

- GL
- ABS

Functional Safety SIL / IEC 61508 Declaration of conformity (optional)

The Cerabar S with 4 to 20 mA output signal have been developed to IEC 61508 standard. These devices can be used for process pressure and level measurement monitoring up to SIL 3.
For a detailed description of the safety functions with Cerabar S, settings and characteristic quantities for functional safety, please refer to the "Manual for Functional Safety- Cerabar S" SD190.
For devices with SIL / IEC 61508 declaration of conformity see → 🖹 77 ff, Feature 100 "Additional option 1" and Feature 110 "Additional option 2" version E "SIL / IEC 61508, declaration of Conformity".

Overspill protection

WHG

CRN approvals

Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection (→ 🖹 78, feature 70 "Process connection") has to be ordered with a CSA approval (→ 🖹 77, feature 10 "Approval"). PMP75 devices with capillary are not CRN-approved. These devices are fitted with a separate plate bearing the registration number 0F10525.5C.

Pressure Equipment Directive (PED)

The devices PMC71, PMP71 and PMP75 correspond to Article 3 (3) of the EC directive 97/23/EC (Pressure Equipment Directive) and has been designed and manufactured according to good engineering practice.

Additionally applies:
- PMP71 with threaded connection and internal process isolating diaphragm PN > 200 as well as oval flange adapter PN > 200:
  Suitable for stable gases in group 1, category I
- PMP75 with pipe diaphragm seal ≥ 1.5"/PN 40:
  Suitable for stable gases in group 1, category II
- PMP75 with separator PN > 200:
  Suitable for stable gases in group 1, category 1
- PMP75 with threaded connection PN > 200

Standards and guidelines

DIN EN 60770 (IEC 60770):
Transmitters for use in industrial-process control systems
Part 1: Methods for inspection and routine testing

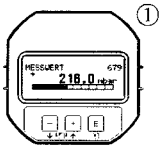
DIN 16086:
Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications in data sheets

EN 61326-X:
EMC product family standard for electrical equipment for measurement, control and laboratory use.

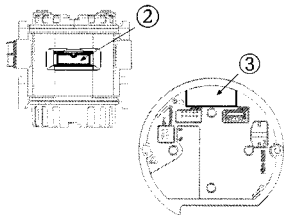
Ordering information

PMC71

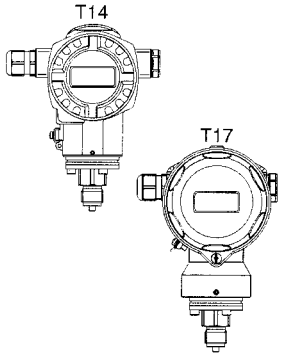
This overview does not mark options which are mutually exclusive.



10	Approval:
A	For non-hazardous areas
E	Combi-certification ATEX II Ex ia + FM IS + CSA IS ATEX II 1/2G Ex ia IIC T6 + FM/CSA IS Class I, II, III Division 1 Group A - G
1	ATEX II 1/2 G Ex ia IIC T6
6	ATEX II 1/2 G Ex ia IIC T6, overspill protection WHG
2	ATEX II 1/2 D Ex ia IIC T6
8	ATEX II 1 GD Ex ia IIC T6
3	ATEX II 1/2 GD Ex ia IIC T6
5	ATEX II 2 G Ex d[ia] IIC T6
7	ATEX II 3 G Ex nA II T6
S	FM IS, Class I, II, III Division 1, Groups A – G; NI Class I Division 2, Groups A – D; AEx ia
T	FM XP, Class I Division 1, Groups A – D; AEx d
R	FM NI, Class I, Division 2, Groups A – D
U	CSA IS, Class I, II, III Division 1, Groups A – G; Class I Division 2, Groups A – D, Ex ia
V	CSA XP, Class I Division 1, Groups B – D; Ex d
G	NEPSI Ex d[ia] IIC T4/T6
H	NEPSI Ex ia IIC T6
L	TIIS Ex d (ia) IIC T6
M	TIIS Ex d (ia) IIC T4
I	IECEx Zone 0/1 Ex ia IIC T6



20	Output; Operation:
A	4...20 mA HART, operation outside, LCD (→ see Fig. ①, ②)
B	4...20 mA HART, operation inside, LCD (→ see Fig. ①, ③)
C	4...20 mA HART, operation inside (→ see Fig.③)
M	PROFIBUS PA, operation outside, LCD (→ see Fig. ①, ②)
N	PROFIBUS PA, operation inside, LCD (→ see Fig. ①, ③)
O	PROFIBUS PA, operation inside (→ see Fig. ③)
P	FOUNDATION Fieldbus, operation outside, LCD (→ see Fig. ①, ③)
Q	FOUNDATION Fieldbus, operation inside, LCD (→ see Fig. ①, ③)
R	FOUNDATION Fieldbus, operation inside (→ see Fig. ③)



30	Housing; Cable entry; Protection:
A	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
B	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
C	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
D	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
E	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
F	Aluminium T14 housing, optional display on the side, IP 65/NEMA 4X, Hand 7D plug 90°
1	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
2	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
3	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
4	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
5	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
6	AISI 316L T14 housing, optional display on the side, IP 65/NEMA 4X, Hand 7D plug 90°
R	T17 316L Hygiene IP66/68 NEMA6P; M20 gland, T17 = side cover
S	T17 316L Hygiene IP66/68 NEMA6P; G1/2 thread, T17 = side cover
T	T17 316L Hygiene IP66/68 NEMA6P; NPT1/2 thread, T17 = side cover
U	T17 316L Hygiene IP66/68 NEMA6P; M12 plug, T17 = side cover
V	T17 316L Hygiene IP66/68 NEMA6P; 7/8" plug, T17 = side cover

40	Sensor range; Sensor overload limit (= OPL):	
	Sensors for gauge pressure	
	Measurement limits: –100 % (–1 bar)...+100 % of sensor nominal range	
	Sensor nominal value (URL)	**OPL (Over pressure limit)**
1C	100 mbar/10 kPa/1.5 psi g	4 bar/400 kPa/60 psi g
1E	250 mbar/25 kPa/3.75 psi g	5 bar/500 kPa/75 psi g
1F	400 mbar/40 kPa/6 psi g	8 bar/800 kPa/120 psi g
1H	1 bar/100 kPa/15 psi g	10 bar/1 MPa/150 psi g
1K	2 bar/200 kPa/30 psi g	18 bar/1.8 MPa/270 psi g
1M	4 bar/400 kPa/60 psi g	25 bar/2.5 MPa/375 psi g
1P	10 bar/1 MPa/150 psi g	40 bar/4 MPa/600 psi g
1S	40 bar/4 MPa/600 psi g	60 bar/6 MPa/900 psi g

40	Sensor range; Sensor overload limit (= OPL):		
		Sensors for absolute pressure	
		Sensor nominal value (URL)	**OPL (Over pressure limit)**
	2C	100 mbar/10 kPa/1.5 psi abs	4 bar/400 kPa/60 psi abs
	2E	250 mbar/25 kPa/3.75 psi abs	5 bar/500 kPa/75 psi abs
	2F	400 mbar/40 kPa/6 psi abs	8 bar/800 kPa/120 psi abs
	2H	1 bar/100 kPa/15 psi abs	10 bar/1 MPa/150 psi abs
	2K	2 bar/200 kPa/30 psi abs	18 bar/1.8 MPa/270 psi abs
	2M	4 bar/400 kPa/60 psi abs	25 bar/2.5 MPa/375 psi abs
	2P	10 bar/1 MPa/150 psi abs	40 bar/4 MPa/600 psi abs
	2S	40 bar/4 MPa/600 psi abs	60 bar/6 MPa/900 psi abs

50	Calibration; Unit:
	1 Sensor range; mbar/bar
	2 Sensor range; kPa/MPa
	3 Sensor range; mmH_2O/mH_2O
	4 Sensor range; inH_2O/ftH_2O
	6 Sensor range; psi
	B Customised; see additional specification
	C Factory certificate 5-point; see additional specification
	D DKD certificate; see additional specification
	K Platinum; see additional specification
	L Platinum and factory certificate 5-point; see additional specification
	M Platinum and DKD certificate; see additional specification

70	Process connection; Material:
	Thread, internal process isolating diaphragm
	GA Thread ISO 228 G 1/2 A EN 837, AISI 316L (CRN)
	GB Thread ISO 228 G 1/2 A EN 837, Alloy C (CRN)
	GC Thread ISO 228 G 1/2 A EN 837, Monel
	GD Thread ISO 228 G 1/2 A EN 837, PVDF (max. 15 bar/225 psi, –10...+60°C/+14...+140°F)
	GE Thread ISO 228 G 1/2 A G 1/4 (female), AISI 316L (CRN)
	GF Thread ISO 228 G 1/2 A G 1/4 (female), Alloy C (CRN)
	GG Thread ISO 228 G 1/2 A G 1/4 (female), Monel
	GH Thread ISO 228 G 1/2 A hole 11.4 mm, AISI 316L (CRN)
	GJ Thread ISO 228 G 1/2 A hole 11.4 mm, Alloy C (CRN)
	GK Thread ISO 228 G 1/2 A hole 11.4 mm, Monel
	RA Thread ANSI 1/2 MNPT 1/4 FNPT, AISI 316L (CRN)
	RB Thread ANSI 1/2 MNPT 1/4 FNPT, Alloy C (CRN)
	RC Thread ANSI 1/2 MNPT 1/4 FNPT, Monel
	RD Thread ANSI 1/2 MNPT, hole 11.4 mm, AISI 316L (CRN)
	RE Thread ANSI 1/2 MNPT, hole 11.4 mm, Alloy C (CRN)
	RF Thread ANSI 1/2 MNPT, hole 11.4 mm, Monel
	RG Thread ANSI 1/2 MNPT hole 3 mm, PVDF (max. 15 bar/225 psi, –10...+60°C/+14...+140°F)
	RH Thread ANSI 1/2 FNPT, AISI 316L (CRN)
	RJ Thread ANSI 1/2 FNPT, Alloy C (CRN)
	RK Thread ANSI 1/2 FNPT, Monel
	GL Thread JIS B0202 G 1/2 (male), AISI 316L
	RL Thread JIS B0203 R 1/2 (male), AISI 316L
	GP Thread DIN 13 M 20x1.5 EN 837 hole 3 mm, AISI 316L
	GQ Thread DIN 13 M 20x1.5 EN 837 hole 3 mm, Alloy C
	For continuation "Process connection, Material" see next page.
	Thread, flush-mounted process isolating diaphragm
	1G Thread ISO 228 G 1 1/2 A, AISI 316L
	1H Thread ISO 228 G 1 1/2 A, Alloy C
	1J Thread ISO 228 G 1 1/2 A, Monel
	1K Thread ISO 228 G 2 A, AISI 316L
	1L Thread ISO 228 G 2 A, Alloy C
	1M Thread ISO 228 G 2 A, Monel
	2D Thread ANSI 1 1/2 MNPT, AISI 316L (CRN)
	2E Thread ANSI 1 1/2 MNPT, Alloy C (CRN)
	2F Thread ANSI 1 1/2 MNPT, Monel (CRN)
	2G Thread ANSI 2 MNPT, AISI 316L (CRN)
	2H Thread ANSI 2 MNPT, Alloy C
	2J Thread ANSI 2 MNPT, Monel
	1R Thread DIN 13 M 44x1.25, AISI 316L
	1S Thread DIN 13 M 44x1.25, Alloy C
	EN/DIN flanges, flush-mounted process isolating diaphragm

70	Process connection; Material:
CP	DN 32 PN 10-40 B1, AISI 316L
CQ	DN 40 PN 10-40 B1, AISI 316L
BR	DN 50 PN 10-16 A, PVDF (max. 15 bar/150 psi, –10...+60°C/+14...+140°F)
B3	DN 50 PN 10-40 B1, AISI 316L
C3	DN 50 PN 63 B2, AISI 316L
BS	DN 80 PN 10-16 A, PVDF (max. 15 bar/150 psi, –10...+60°C/+14...+140°F)
B4	DN 80 PN 10-40 B1, AISI 316L
	ANSI flanges, flush-mounted process isolating diaphragm
AE	1 1/2" 150 lbs RF, AISI 316/316L (CRN)
AQ	1 1/2" 300 lbs RF, AISI 316/316L (CRN)
AF	2" 150 lbs RF, AISI 316/316L (CRN)
JR	2" 150 lbs RF, AISI 316L with ECTFE-coating
A3	2" 150 lbs RF, PVDF (max. 15 bar/225 psi, –10...+60°C/+14...+140°F)
AR	2" 300 lbs RF, AISI 316/316L (CRN)
AG	3" 150 lbs RF, AISI 316/316L (CRN)
JS	3" 150 lbs RF, AISI 316L with ECTFE-coating
A4	3" 150 lbs RF, PVDF (max. 15 bar/225 psi, –10...+60°C/+14...+140°F)
AS	3" 300 lbs RF, AISI 316/316L (CRN)
AH	4" 150 lbs RF, AISI 316/316L (CRN)
JT	4" 150 lbs RF, AISI 316L with ECTFE-coating
AT	4" 300 lbs RF, AISI 316/316L (CRN)
	JIS flanges, flush-mounted process isolating diaphragm
KF	10K 50A RF, AISI 316L
KL	10K 80A RF, AISI 316L
KH	10K 100A RF, AISI 316L
	Hygienic connections, flush-mounted process isolating diaphragm
MP	DIN 11851 DN 40 PN 25, AISI 316L, EHEDG, 3A with HNBR/EPDM seal (CRN)
MR	DIN 11851 DN 50 PN 25, AISI 316L, EHEDG, 3A with HNBR/EPDM seal (CRN)
TD	Tri-Clamp ISO 2852 DN 51 (2"), AISI 316L, EHEDG, 3A with HNBR/EPDM seal (CRN)
TF	Tri-Clamp ISO 2852 DN 76.1 (3"), AISI 316L, EHEDG, 3A with HNBR/EPDM seal (CRN)
TK	DRD DN50 (65 mm), PN 25, AISI 316L, EHEDG, 3A with HNBR/EPDM seal
TR	Varivent type N for tubes DN 40 – DN 162, PN 40, AISI 316L, EHEDG, 3A with HNBR/EPDM seal (CRN)

80	Seal:
A	FKM Viton
B	EPDM
D	Kalrez
E	Chemraz
F	NBR/3A: HNBR (FDA)
L	FKM Viton, cleaned for silicone-free service
M	Kalrez, cleaned for silicone-free service
1	FKM Viton, cleaned from oil and greace
2	FKM Viton, oxygen service Note application limits pressure/temp.

100	Additional option 1:
A	not selected
E	SIL/IEC 61508 Declaration of conformity
T	High temperature version
B	Material test certificate for wetted parts, inspection certificate as per EN 10204 3.1 acc. to specification 52005759
M	Overvoltage protection
J	Software adjustment, see additional spec.
N	HistoROM/M-DAT
S	GL (German Lloyd)/ABS marine certificate
V	Mounting on shut-off valve from above
2	Test report acc. to EN 10204 2.2
3	Routine test with certificate, inspection certificate as per EN 10204 3.1
4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1

110	Additional option 2:
A	not selected
E	SIL/IEC 61508 Declaration of conformity
G	Separate housing, cable length see additional spec. + mounting bracket, wall/pipe, 316L
T	High temperature version
M	Overvoltage protection
J	Software adjustment, see additional spec.

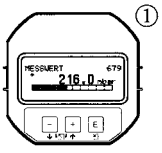
110	Additional option 2:
	N HistoROM/M-DAT
	S GL (German Lloyd)/ABS marine certificate
	U Mounting bracket for wall/pipe, AISI 304
	2 Test report acc. to EN 10204 2.2
	3 Routine test with certificate, inspection certificate as per EN 10204 3.1
	4 Overpressure test with certificate, inspection certificate as per EN 10204 3.1
	5 Helium leak test EN 1518 with test certificate, inspection certificate as per EN 10204 3.1

995	Marking:
	1 Tagging (TAG), see additional spec.
	2 Bus adress, see additional spec.

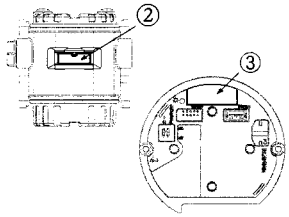
PMC71	order code

PMP71

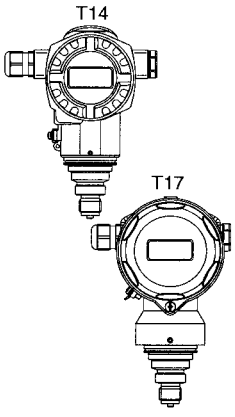
This overview does not mark options which are mutually exclusive.



10	Approval:
A	For non-hazardous areas
1	ATEX II 1/2 G Ex ia IIC T6
6	ATEX II 1/2 G Ex ia IIC T6, overspill protection WHG
2	ATEX II 1/2 D
4	ATEX II 1/3 D
8	ATEX II 1 GD Ex ia IIC T6
3	ATEX II 1/2 GD Ex ia IIC T6
5	ATEX II 2 G Ex d IIC T6
7	ATEX II 3 G Ex nA II T6
S	FM IS, Class I, II, III Division 1, Groups A – G; NI Class I Division 2, Groups A – D; AEx ia
T	FM XP, Class I Division 1, Groups A – D; AEx d
Q	FM DIP, Class II, III Division 1, Groups E – G
R	FM NI, Class I, Division 2, Groups A – D
U	CSA IS, Class I, II, III Division 1, Groups A – G; Class I Division 2, Groups A – D, Ex ia
V	CSA XP, Class I Division 1, Groups B – D; Ex d
W	CSA Class II, III Division 1, Groups E – G (Dust Ex)
G	NEPSI Ex d IIC T6
H	NEPSI Ex ia IIC T6
L	TIIS Ex d IIC T6
I	IECEx Zone 0/1 Ex ia IIC T6
B	Combined certificates: ATEX II 1/2 G Ex ia IIC T6 + II 2 G Ex d IIC T6
C	Combined certificates: FM IS and XP Class I Division 1, Groups A – D
D	Combined certificates: CSA IS and XP Class I Division 1, Groups A – D
E	Combined certificates: FM/CSA IS and XP Class I Division 1, Groups A – D
F	Combined certificates: ATEX II Ex ia / Ex d + FM/CSA IS + XP ATEX II 1/2G Ex ia IIC T6+ ATEX II 2G Ex d IIC T6+ FM/CSA IS + XP Cl.I Div.1 Gr.A-D



20	Output; Operation:
A	4...20 mA HART, operation outside, LCD (→ see Fig. ①, ②)
B	4...20 mA HART, operation inside, LCD (→ see Fig. ①, ③)
C	4...20 mA HART, operation inside (→ see Fig. ③)
M	PROFIBUS PA, operation outside, LCD (→ see Fig. ①, ②)
N	PROFIBUS PA, operation inside, LCD (→ see Fig. ①, ③)
O	PROFIBUS PA, operation inside (→ see Fig. ③)
P	FOUNDATION Fieldbus, operation outside, LCD (→ see Fig. ①, ③)
Q	FOUNDATION Fieldbus, operation inside, LCD (→ see Fig. ①, ③)
R	FOUNDATION Fieldbus, operation inside (→ see Fig. ③)



30	Housing; Cable entry; Protection:
A	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
B	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
C	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
D	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
E	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
F	Aluminium T14 housing, optional display on the side, IP 65/NEMA 4X, Hand 7D plug 90°
1	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
2	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
3	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
4	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
5	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
6	AISI 316L T14 housing, optional display on the side, IP 65/NEMA 4X, Hand 7D plug 90°
R	T17 316L Hygiene IP66/68 NEMA6P; M20 gland, T17 = side cover
S	T17 316L Hygiene IP66/68 NEMA6P; G1/2 thread, T17 = side cover
T	T17 316L Hygiene IP66/68 NEMA6P; NPT1/2 thread, T17 = side cover
U	T17 316L Hygiene IP66/68 NEMA6P; M12 plug, T17 = side cover
V	T17 316L Hygiene IP66/68 NEMA6P; 7/8" plug, T17 = side cover

40	Sensor range; Sensor overload limit (= OPL):	
	Sensors for gauge pressure	
	Measurement limits: –100 % (–1 bar)...+100 % of sensor nominal range	
	Sensor nominal value (URL)	**OPL (Over pressure limit)**
1F	400 mbar/40 kPa/6 psi g	6 bar/600 kPa/90 psi g
1H	1 bar/100 kPa/15 psi g	10 bar/1 MPa/150 psi g
1K	2 bar/200 kPa/30 psi g	20 bar/2 MPa/300 psi g

40	Sensor range; Sensor overload limit (= OPL):	
1M	4 bar/400 kPa/60 psi g	28 bar/2.8 MPa/420 psi g
1P	10 bar/1 MPa/150 psi g	40 bar/4 MPa/600 psi g
1S	40 bar/4 MPa/600 psi g	160 bar/16 MPa/2400 psi g
1U	100 bar/10 MPa/1500 psi g	400 bar/40 MPa/6000 psi g
1W	400 bar/40 MPa/6000 psi g	600 bar/60 MPa/9000 psi g
1X	700 bar/70 MPa/10500 psi g	1050 bar/105 MPa/15700 psi g
Sensors for absolute pressure		
	Sensor nominal value (URL)	**OPL (Over pressure limit)**
2F	400 mbar/40 kPa/6 psi abs	6 bar/600 kPa/90 psi abs
2H	1 bar/100 kPa/15 psi abs	10 bar/1 MPa/150 psi abs
2K	2 bar/200 kPa/30 psi abs	20 bar/2 MPa/300 psi abs
2M	4 bar/400 kPa/60 psi abs	28 bar/2.8 MPa/420 psi abs
2P	10 bar/1 MPa/150 psi abs	40 bar/4 MPa/600 psi abs
2S	40 bar/4 MPa/600 psi abs	160 bar/16 MPa/2400 psi abs
2U	100 bar/10 MPa/1500 psi g	400 bar/40 MPa/6000 psi g
2W	400 bar/40 MPa/6000 psi g	600 bar/60 MPa/9000 psi g
2X	700 bar/70 MPa/10500 psi g	1050 bar/105 MPa/15700 psi g

50	Calibration; Unit:
1	Sensor range; mbar/bar
2	Sensor range; kPa/MPa
3	Sensor range; mmH_2O/mH_2O
4	Sensor range; inH_2O/ftH_2O
6	Sensor range; psi
B	Customised; see additional specification
C	Factory certificate 5-point; see additional specification
D	DKD certificate; see additional specification
K	Platinum; see additional specification
L	Platinum and factory certificate 5-point; see additional specification
M	Platinum and DKD certificate; see additional specification

60	Membrane material:
1	AISI 316L
2	Alloy C276
6	AISI 316L with Gold-Rhodium coating

70	Process connection; Material:
	Thread, internal process isolating diaphragm
GA	Thread ISO 228 G 1/2 A EN 837, AISI 316L
GB	Thread ISO 228 G 1/2 A EN 837, Alloy C
GE	Thread ISO 228 G 1/2 A G 1/4 (female), AISI 316L
GF	Thread ISO 228 G 1/2 A G 1/4 (female), Alloy C
GH	Thread ISO 228 G 1/2 A hole 11.4 mm, AISI 316L
GJ	Thread ISO 228 G 1/2 A hole 11.4 mm, Alloy C
RA	Thread ANSI 1/2 MNPT 1/4 FNPT, AISI 316L (CRN)
RB	Thread ANSI 1/2 MNPT 1/4 FNPT, Alloy C (CRN)
RD	Thread ANSI 1/2 MNPT hole, AISI 316L (CRN)
RE	Thread ANSI 1/2 MNPT hole, Alloy C (CRN)
RH	Thread ANSI 1/2 FNPT, AISI 316L
RJ	Thread ANSI 1/2 FNPT, Alloy C
GL	Thread JIS B0202 G 1/2 (male), AISI 316L
RL	Thread JIS B0203 R 1/2 (male), AISI 316L
	For continuation "Process connection; Material", see next page.
	Thread, internal process isolating diaphragm (continued)
GP	Thread DIN 13 M 20x1.5 EN 837 hole 11.4 mm, AISI 316L
GQ	Thread DIN 13 M 20x1.5 EN 837 hole 11.4 mm, Alloy C
	Thread, flush-mounted process isolating diaphragm
1A	Thread ISO 228 G 1/2 A, DIN 3852, AISI 316L
1B	Thread ISO 228 G 1/2 A, DIN 3852, Alloy C
1D	Thread ISO 228 G 1 A, AISI 316L
1E	Thread ISO 228 G 1 A, Alloy C
1G	Thread ISO 228 G 1 1/2 A, AISI 316L
1H	Thread ISO 228 G 1 1/2 A, Alloy C
1K	Thread ISO 228 G 2 A, AISI 316L
1L	Thread ISO 228 G 2 A, Alloy C
2A	Thread ANSI 1 MNPT, AISI 316L (CRN)
2B	Thread ANSI 1 MNPT, Alloy C (CRN)
2D	Thread ANSI 1 1/2 MNPT, AISI 316L (CRN)
2E	Thread ANSI 1 1/2 MNPT, Alloy C (CRN)

70	Process connection; Material:
2G	Thread ANSI 2 MNPT, AISI 316L (CRN)
2H	Thread ANSI 2 MNPT, Alloy C
1N	Thread DIN 16288 M 20x1.5, AISI 316L
1P	Thread DIN 16288 M 20x1.5, Alloy C
1R	Thread DIN 13 M 44x1.25, AISI 316L
1S	Thread DIN 13 M 44x1.25, Alloy C
	EN/DIN flanges, flush-mounted process isolating diaphragm
CN	DN 25 PN 10-40 B1, AISI 316L
CP	DN 32 PN 10-40 B1, AISI 316L
CQ	DN 40 PN 10-40 B1, AISI 316L
B3	DN 50 PN 10-40 B1, AISI 316L
B4	DN 80 PN 10-40 B1, AISI 316L
	ANSI flanges, flush-mounted process isolating diaphragm
AN	1" 300 lbs RF, AISI 316/316L (CRN)
AE	1 1/2" 150 lbs RF, AISI 316/316L (CRN)
AQ	1 1/2" 300 lbs RF, AISI 316/316L (CRN)
AF	2" 150 lbs RF, AISI 316/316L (CRN)
AR	2" 300 lbs RF, AISI 316/316L (CRN)
AG	3" 150 lbs RF, AISI 316/316L (CRN)
AS	3" 300 lbs RF, AISI 316/316L (CRN)
AH	4" 150 lbs RF, AISI 316/316L (CRN)
AT	4" 300 lbs RF, AISI 316/316L (CRN)
	JIS flanges, flush-mounted process isolating diaphragm
KA	20K 25A RF, AISI 316L
KF	10K 50A RF, AISI 316L
KL	10K 80A RF, AISI 316L
KH	10K 100A RF, AISI 316L
	Other
UR	Ovalflange adapter 1/4-18 NPT, mounting: 7/16-20 UNF, AISI 316L (CRN)
U1	Prepared for diaphragm seal mount, AISI 316L (CRN)

90	Fill fluid:
A	Silicone oil fill
F	Inert oil fill
K	Inert oil fill, cleaned from oil and greace
N	Inert oil fill, cleaned for oxygen services (Note application limits pressure/temperature)

100	Additional option 1:
A	not selected
E	SIL/IEC 61508 Declaration of conformity
B	Material test certificate for wetted parts, inspection certificate as per EN 10204 3.1 acc. to specification 52005759
C	NACE MR0175 (wetted parts)
D	Material test certificate for wetted parts as per EN 10204 3.1 and NACE MR0175 material, inspection certificate as per EN 10204 acc. to specification 52010806
M	Overvoltage protection
J	Software adjustment, see additional spec.
N	HistoROM/M-DAT
S	GL (German Lloyd)/ABS marine certificate
2	Test report acc. to EN10204 2.2
3	Routine test with certificate, inspection certificate as per EN 10204 3.1
4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1

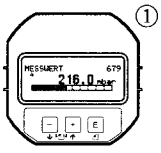
110	Additional option 2:
A	not selected
E	SIL/IEC 61508 Declaration of conformity
G	Separate housing, cable length see additional spec. + mounting bracket, wall/pipe, 316L
M	Overvoltage protection
J	Software adjustment, see additional spec.
N	HistoROM/M-DAT
S	GL (German Lloyd)/ABS marine certificate
U	Mounting bracket for wall/pipe, AISI 304
2	Test report acc. to EN10204 2.2
3	Routine test with certificate, inspection certificate as per EN 10204 3.1
4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1
5	Helium leak test EN 1528 with test certificate, inspection certificate as per EN 10204 3.1

995											Marking:	
											1	Tagging (TAG), see additional spec.
											2	Bus adress, see additional spec.

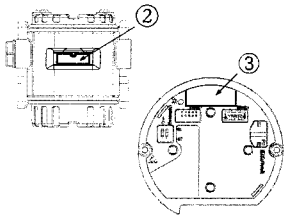
PMP71											order code

PMP75

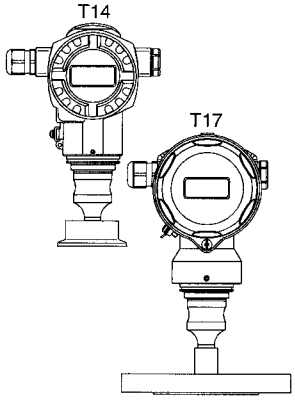
This overview does not mark options which are mutually exclusive.



10	Approval:
A	For non-hazardous areas
1	ATEX II 1/2 G Ex ia IIC T6
6	ATEX II 1/2 G Ex ia IIC T6, overspill protection WHG
2	ATEX II 1/2 D
4	ATEX II 1/3 D
8	ATEX II 1 GD Ex ia IIC T6
3	ATEX II 1/2 GD Ex ia IIC T6
5	ATEX II 2 G Ex d IIC T6
7	ATEX II 3 G Ex nA II T6
S	FM IS, Class I, II, III Division 1, Groups A – G; NI Class I Division 2, Groups A – D; AEx ia
T	FM XP, Class I Division 1, Groups A – D; AEx d
Q	FM DIP, Class II, III Division 1, Groups E – G
R	FM NI, Class I, Division 2, Groups A – D
U	CSA IS, Class I, II, III Division 1, Groups A – G; Class I Division 2, Groups A – D, Ex ia
V	CSA XP, Class I Division 1, Groups B – D; Ex d
W	CSA Class II, III Division 1, Groups E – G (Dust Ex)
G	NEPSI Ex d IIC T6
H	NEPSI Ex ia IIC T6
L	TIIS Ex d IIC T6
I	IECEx Zone 0/1 Ex ia IIC T6
B	Combined certificates: ATEX II 1/2 G Ex ia IIC T6 + II 2 G Ex d IIC T6
C	Combined certificates: FM IS and XP Class I Division 1, Groups A – D
D	Combined certificates: CSA IS and XP Class I Division 1, Groups A – D
E	Combined certificates: FM/CSA IS and XP Class I Division 1, Groups A – D
F	Combined certificates: ATEX II Ex ia / Ex d + FM/CSA IS + XP ATEX II 1/2G Ex ia IIC T6+ ATEX II 2G Ex d IIC T6+ FM/CSA IS + XP Cl.I Div.1 Gr.A-D



20	Output; Operation:
A	4...20 mA HART, operation outside, LCD (→ see Fig. ①, ②)
B	4...20 mA HART, operation inside, LCD (→ see Fig. ①, ③)
C	4...20 mA HART, operation inside (→ see Fig. ③)
M	PROFIBUS PA, operation outside, LCD (→ see Fig. ①, ②)
N	PROFIBUS PA, operation inside, LCD (→ see Fig. ①, ③)
O	PROFIBUS PA, operation inside (→ see Fig. ③)
P	FOUNDATION Fieldbus, operation outside, LCD (→ see Fig. ①, ③)
Q	FOUNDATION Fieldbus, operation inside, LCD (→ see Fig. ①, ③)
R	FOUNDATION Fieldbus, operation inside (→ see Fig. ③)



30	Housing; Cable entry; Protection:
A	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
B	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
C	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
D	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug,
E	Aluminium T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
F	Aluminium T14 housing, optional display on the side, IP 65/NEMA 4X, Hand 7D plug 90°
1	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Gland M 20x1.5
2	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread G 1/2
3	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, Thread 1/2 NPT
4	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, M 12x1 PA plug
5	AISI 316L T14 housing, optional display on the side, IP 66/67/NEMA 4X/ 6P, 7/8" FF plug
6	AISI 316L T14 housing, optional display on the side, IP 65/NEMA 4X, Hand 7D plug 90°
R	T17 316L Hygiene IP66/68 NEMA6P; M20 gland, T17 = side cover
S	T17 316L Hygiene IP66/68 NEMA6P; G1/2 thread, T17 = side cover
T	T17 316L Hygiene IP66/68 NEMA6P; NPT1/2 thread, T17 = side cover
U	T17 316L Hygiene IP66/68 NEMA6P; M12 plug, T17 = side cover
V	T17 316L Hygiene IP66/68 NEMA6P; 7/8" plug, T17 = side cover

40	Sensor range; Sensor overload (= OPL):	
	Sensors for gauge pressure	
	Measurement limits: –100 % (–1 bar)...+100 % of sensor nominal range	
	Sensor nominal value (URL)	**OPL (Over pressure limit)**
1F	400 mbar/40 kPa/6 psi	6 bar/600 kPa/90 psi
1H	1 bar/100 kPa/15 psi	10 bar/1 MPa/150 psi
1K	2 bar/200 kPa/30 psi	20 bar/2 MPa/300 psi

40							Sensor range; Sensor overload (= OPL):	
				1M			4 bar/400 kPa/60 psi	28 bar/2.8 MPa/420 psi
				1P			10 bar/1 MPa/150 psi	40 bar/4 MPa/600 psi
				1S			40 bar/4 MPa/600 psi	160 bar/16 MPa/2400 psi
				1U			100 bar/10 MPa/1500 psi	400 bar/40 MPa/6000 psi
				1W			400 bar/40 MPa/6000 psi	600 bar/60 MPa/9000 psi
							Sensors for absolute pressure	
							Sensor nominal value (URL)	**OPL (Over pressure limit)**
				2F			400 mbar/40 kPa/6 psi abs	6 bar/600 kPa/90 psi abs
				2H			1 bar/100 kPa/15 psi abs	10 bar/1 MPa/150 psi abs
				2K			2 bar/200 kPa/30 psi abs	20 bar/2 MPa/300 psi abs
				2M			4 bar/400 kPa/60 psi abs	28 bar/2.8 MPa/420 psi abs
				2P			10 bar/1 MPa/150 psi abs	40 bar/4 MPa/600 psi abs
				2S			40 bar/4 MPa/600 psi abs	160 bar/16 MPa/2400 psi abs
				2U			100 bar/10 MPa/1500 psi abs	400 bar/40 MPa/6000 psi abs
				2W			400 bar/40 MPa/6000 psi abs	600 bar/60 MPa/9000 psi abs

50							Calibration; Unit:
						1	Sensor range; mbar/bar
						2	Sensor range; kPa/MPa
						3	Sensor range; mmH_2O/mH_2O
						4	Sensor range; inH_2O/ftH_2O
						6	Sensor range; psi
						B	Customised; see additional specification
						C	Factory certificate 5-point; see additional specification
						D	DKD calibration: see additional specification

60							Membrane material:
						1	AISI 316L
						2	Alloy C276
						3	Monel
						5	Tantal
						6	AISI 316L with Gold-Rhodium coating
						7	AISI 316L with 0.09 mm PTFE foil (not for vacuum applications)
						8	AISI 316L with 0.25 mm PTFE foil (not for vacuum applications, only for non-hazardous areas)

70							Process connection, Material:
							Thread, flush-mounted process isolating diaphragm
						1D	Thread ISO 228 G 1 A, AISI 316L
						1E	Thread ISO 228 G 1 A, Alloy C
						1G	Thread ISO 228 G 1 1/2 A, AISI 316L
						1H	Thread ISO 228 G 1 1/2 A, Alloy C
						1K	Thread ISO 228 G 2 A, AISI 316L
						1L	Thread ISO 228 G 2 A, Alloy C
						2A	Thread ANSI 1 MNPT, AISI 316L
						2B	Thread ANSI 1 MNPT, Alloy C (CRN)
						2D	Thread ANSI 1 1/2 MNPT, AISI 316L
						2E	Thread ANSI 1 1/2 MNPT, Alloy C (CRN)
						2G	Thread ANSI 2 MNPT, AISI 316L
						2H	Thread ANSI 2 MNPT, Alloy C (CRN)
							Clamp connections
						TB	Tri-Clamp, ISO 2852 DN 25 (1"), DIN 32676 DN 25, AISI 316L (CRN), EHEDG
						TC	Tri-Clamp, ISO 2852 DN 38 (1 1/2"), DIN 32676 DN 40, AISI 316L (CRN), EHEDG
						TD	Tri-Clamp, ISO 2852 DN 40 – DN 51 (2")/DN 50, AISI 316L (CRN), EHEDG
						TF	Tri-Clamp, ISO 2852 DN 70 – DN 76.1 (3"), AISI 316L (CRN), EHEDG
							Pipe diaphragm seal, Clamp
						SB	Tri-Clamp, ISO 2852 DN 25 (1"), AISI 316L (CRN)
						SC	Tri-Clamp, ISO 2852 DN 38 (1 1/2"), AISI 316L, 3.1 + Pressure test acc. to PED Cat.II (CRN)
						SD	Tri-Clamp, ISO 2852 DN 51 (2"), AISI 316L, 3.1 + Pressure test acc. to PED Cat.II (CRN)
							Hygienic connections
						MR	DIN 11851 DN 50 PN 25, AISI 316L, EHEDG
						MS	DIN 11851 DN 65 PN 25, AISI 316L, EHEDG
						MT	DIN 11851 DN 80 PN 25, AISI 316L, EHEDG
						M3	DIN 11851 DN 50 PN 25 thread, AISI 316L, EHEDG
						M4	DIN 11851 DN 65 PN 25 thread, AISI 316L, EHEDG
						M5	DIN 11851 DN 80 PN 25 thread, AISI 316L, EHEDG
						TG	SMS 1" PN 25, AISI 316L, EHEDG
						TH	SMS 1 1/2" PN 25, AISI 316L, EHEDG
						TI	SMS 2" PN 25, AISI 316L, EHEDG

70	Process connection, Material:
TL	APV-RJT 1" PN 40, AISI 316L
TM	APV-RJT 1 1/2" PN 40, AISI 316L
TN	APV-RJT 2" PN 40, AISI 316L
TP	APV-ISS 1" PN 40, AISI 316L
TQ	APV-ISS 1 1/2" PN 40, AISI 316L
TS	APV-ISS 2" PN 40, AISI 316L
TK	DRD DN50 (65 mm) PN 25, AISI 316L
TR	Varivent Type N for pipes DN 40 – DN 162 PN 40, AISI 316L, EHEDG
	EN/DIN flanges, flush-mounted process isolating diaphragm
CN	DN 25 PN 10-40 B1, AISI 316L
DN	DN 25 PN 63-160 E, AISI 316L
EN	DN 25 PN 250 E, AISI 316L
E1	DN 25 PN 400 E, AISI 316L
CP	DN 32 PN 10-40 B1, AISI 316L
CQ	DN 40 PN 10-40 B1, AISI 316L
B3	DN 50 PN 10-40 B1, AISI 316L
C3	DN 50 PN 63 B2, AISI 316L 2
EF	DN 50 PN 100-160 E, AISI 316L
ER	DN 50 PN 250 E, AISI 316L
E3	DN 50 PN 400 E, AISI 316L
B4	DN 80 PN 10-40 B1, AISI 316L
C4	DN 80 PN 100 B2, AISI 316L
C5	DN 100 PN 100 B2, AISI 316L
	EN/DIN flanges with extended diaphragm seal, flush-mounted process isolating diaphragm
D3	DN 50 PN 10-40 B1, Tubus 50 mm/100 mm/200 mm, AISI 316L
D4	DN 80 PN 10-40 B1, Tubus 50 mm/100 mm/200 mm, AISI 316L
	ANSI flanges, flush-mounted process isolating diaphragm
AC	1" 150 lbs RF, AISI 316/316L (CRN)
AN	1" 300 lbs RF, AISI 316/316L (CRN)
HC	1" 400/600 lbs RF, AISI 316/316L (CRN)
HN	1" 900/1500 lbs RF, AISI 316/316L (CRN)
H0	1" 2500 lbs RF, AISI 316/316L (CRN)
AE	1 1/2" 150 lbs RF, AISI 316/316L (CRN)
AQ	1 1/2" 300 lbs RF, AISI 316/316L (CRN)
AF	2" 150 lbs RF, AISI 316/316L (CRN)
AR	2" 300 lbs RF, AISI 316/316L (CRN)
HF	2" 400/600 lbs RF, AISI 316/316L (CRN)
HR	2" 900/1500 lbs RF, AISI 316/316L (CRN)
H3	2" 2500 lbs RF, AISI 316/316L
AG	3" 150 lbs RF, AISI 316/316L (CRN)
AS	3" 300 lbs RF, AISI 316/316L (CRN)
AH	4" 150 lbs RF, AISI 316/316L (CRN)
AT	4" 300 lbs RF, AISI 316/316L (CRN)
	ANSI flanges with extended diaphragm seal
J3	2" 150 lbs RF, Tubus 2"/4"/6"/8", AISI 316/316L (CRN)
J4	3" 150 lbs RF, Tubus 2"/4"/6"/8", AISI 316/316L (CRN)
J7	3" 300 lbs RF, Tubus 2"/4"/6"/8", AISI 316/316L (CRN)
J5	4" 150 lbs RF, Tubus 2"/4"/6"/8", AISI 316/316L (CRN)
J8	4" 300 lbs RF, Tubus 2"/4"/6"/8", AISI 316/316L (CRN)
	JIS flanges, flush-mounted process isolating diaphragm
KC	10K 25A RF, AISI 316L
KF	10K 50A RF, AISI 316L
KL	10K 80A RF, AISI 316L
KH	10K 100A RF, AISI 316L
	Other
UA	Thread ISO 228 G 1/2 A PN 160, seperator, EN 837, welded, AISI 316L
UB	Thread ANSI 1/2 MNPT PN 160, seperator, welded, AISI 316L (CRN)
UC	Thread ISO 228 G 1/2 B, seperator, EN 837, threaded, AISI 316L
UD	Thread ANSI 1/2 MNPT, seperator, threaded, AISI 316L
UG	Thread 1/2 NPT PN 250, seperator, threaded, AISI 316L
UH	Thread 1 NPT PN 250, seperator, threaded, AISI 316L

90	Fill fluid:
A	Silicone oil
B	...m capillary, inert oil
C	...ft capillary, inert oil
D	Vegetable oil
F	Inert oil

90	Fill fluid:
G	High temperature oil, Temp. isolator 100 mm
H	Silicone oil, Temp. isolator 100 mm
K	Inert oil, cleaned from oil and greace
N	Inert oil, cleaned for oxygen services
1	... m capillary, silicone oil
2	... ft capillary, silicone oil
3	... m capillary, high temperature oil
4	... ft capillary, high temperature oil
5	... m capillary, vegetable oil
6	... ft capillary, vegetable oil
7	... m capillary, Low temperature oil
8	... ft capillary, Low temperature oil

100	Additional option 1:
A	not selected
E	SIL/IEC 61508 Declaration of conformity
B	Material test certificate for wetted parts, inspection certificate as per EN 10204 3.1 acc. to specification 52005759
C	NACE MR0175 (wetted parts)
D	Material test certificate for wetted parts, inspection certificate as per EN 10204 3.1 and NACE MR0175 material, inspection certificate as per EN 10204 acc. to specification 52010806
M	Overvoltage protection
J	Software adjustment, see additional spec.
N	HistoROM/M-DAT
S	GL (German Lloyd)/ABS marine certificate
2	Test report acc. to EN 10204 2.2
3	Routine test with certificate, inspection certificate as per EN 10204 3.1
4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1

110	Additional option 2:
A	not selected
E	SIL/IEC 61508 Declaration of conformity
G	Separate housing, cable length see additional spec. + mounting bracket, wall/pipe, 316L
M	Overvoltage protection
J	Software adjustment, see additional spec.
N	HistoROM/M-DAT
P	Ra < 0.38 µm/15.75 µin, electropolished + EN10204-3.1 material (wetted) inspection certificate; in conjunction with process connection versions "TC", "TD" and "TR" please order roughness test separetely
S	GL (German Lloyd)/ABS marine certificate
U	Mounting bracket for wall/pipe, AISI 304
2	Test report acc. to EN 10204 2.2
3	Routine test with certificate, inspection certificate as per EN 10204 3.1
4	Overpressure test with certificate, inspection certificate as per EN 10204 3.1

995	Marking:
1	Tagging (TAG), see additional spec.
2	Bus adress, see additional spec.

PMP75	order code

Additional documentation

Field of Activities

- Pressure measurement, Powerful instruments for process pressure, differential pressure, level and flow: FA004P/00/en

Technical Information

- Deltabar S: TI382P/00/en
- Deltapilot S: TI416P/00/en
- EMC test basic principles TI241F/00/en

Operating Instructions

4...20 mA HART:
- Cerabar S: BA271P/00/de
- Description of device functions Cerabar S/Deltabar S/Deltapilot S: BA274P/00/en

PROFIBUS PA:
- Cerabar S: BA295P/00/de
- Description of device functions Cerabar S/Deltabar S/Deltapilot S: BA296P/00/en

FOUNDATION Fieldbus:
- Cerabar S: BA302P/00/de
- Description of device functions Cerabar S/Deltabar S: BA303P/00/en

Brief operating instructions

- 4...20 mA HART, Cerabar S: KA1019P/00/en
- PROFIBUS PA, Cerabar S: KA1022P/00/en
- FOUNDATION Fieldbus, Cerabar S: KA1025P/00/en

Manual for Functional Safety (SIL)

- Cerabar S (4...20 mA): SD190P/00/en

Safety Instructions

Certificate/Type of Protection	Device	Electronic insert	Documentation	Version in the order code
ATEX II 1/2 G Ex ia IIC T6	PMC71, PMP71, PMP75	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA244P	1
ATEX II 1/2 D	PMP71, PMP75	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA246P – XA289P	2
ATEX II 1/2 D Ex ia IIC	PMC71	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA247P – XA290P	2
ATEX II 1/3 D	PMP71, PMP75	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– XA248P – XA291P	4
ATEX II 2 G Ex d IIC T6	PMP71, PMP75	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA249P	5
ATEX II 2 G Ex d[ia] IIC T6	PMC71	– 4...20 mA HART, PROFIBUS PA., FOUNDATION Fieldbus	– XA250P	5
ATEX II 3 G Ex nA II T6	PMC71, PMP71, PMP75	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA251P	7
ATEX II 1/2 GD Ex ia IIC T6	PMC71, PMP71, PMP75	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA253P	3
ATEX II 1 GD Ex ia IIC T6	PMC71, PMP71, PMP75	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA276P	8
ATEX II 1/2 G Ex ia IIC T6 + ATEX II 2 G Ex d IIC T6	PMP71, PMP75	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA252P	B

Certificate/Type of Protection	Device	Electronic insert	Documentation	Version in the order code
IECEx Zone 0/1 Ex ia IIC T6	PMC71, PMP71, PMP75	– 4...20 mA HART	– XB005P	I

Certificate/Type of Protection	Device	Electronic insert	Documentation	Version in the order code
NEPSI Ex ia IIC T6	PMC71, PMP71, PMP75	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XC003P	H
NEPSI Ex d IIC T6	PMP71, PMP75	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XC005P	G
NEPSI Ex d[ia] IIC T6	PMC71	– 4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XC005P	G

Installation/Control Drawings

Certificate/Type of Protection	Device	Electronic Insert	Documentation	Version in the order code
FM IS Class I, II, III, Division 1, Groups A – G; NI, Class I Division 2, Groups A – D; AEx ia	PMC71, PMP71, PMP75	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD147P – ZD188P	S
CSA IS Class I, II, III, Division 1, Groups A – G; Class I Division 2, Groups A – G	PMC71, PMP71, PMP75	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD148P – ZD189P	U
FM IS + XP Class , Division 1, Groups A – D	PMP71, PMP75	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD187P – ZD190P	C
CSA IS + XP Class I Division 1, Groups A – D	PMP71, PMP75	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD154P – ZD191P	D
FM/CSA IS + XP Class I Division 1, Groups A – D	PMP71, PMP75	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD154P + ZD187P – ZD190P + ZD191P	E
CSA +XP Class I Division 1, Groups B - D, Class II Division 1, Groups E - G, Class III	PMP71, PMP75	– 4...20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– in Vorbereitung	-

Overspill protection

- WHG: ZE260P/00/de

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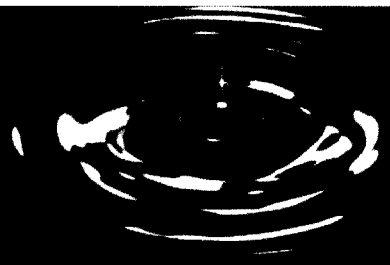
TI383P/00/EN/06.09
No. 71095447
CCS/FM+SGML 6.0

Arizona Water Company
Valley Farms Arsenic Removal
Facility



Float Switch

Contractor:
Felix Construction Company
1326 W Industrial Dr
Coolidge, AZ 85142
Ph: (480) 464-0011
Fx: (480) 464-0078
www.felixconstruction.com

Water Technologies

9G-EF (Mercury Free) Direct Acting Float Switch (B100)

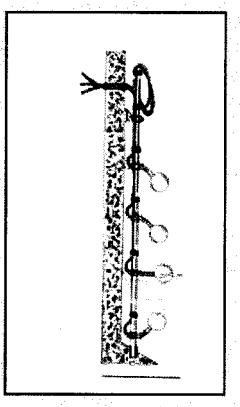
SIEMENS

Arguably the best non-mercury float switch available, this Teflon®-coated non-differential float of Type 316 stainless steel measures 5.5" in diameter. It is appropriate for a variety of applications, including sewage wet wells, storm water basins, water reservoirs, sludge tanks, irrigation canals and process sumps. The float operates reliably in even the most difficult environments. The 9G-EF can be used singly to sense an alarm level, but typically two or more switches are used in conjunction with our controllers to provide a float-based control system. The 9G-EF can be used as the redundant control sensor in larger automation installations.

TYPICAL SPECIFICATIONS

Float switch body shall be constructed of Teflon®-coated, 20 gauge, 316 stainless steel housing measuring not less than 51/2" in diameter. A long life, high reliability, potted SPST magnetic reed switch rated for not less than 100 VA at up to 250 Volts shall be mounted inside the float and connected to a multi-stranded, 2 conductor plus ground, 16 gauge, CPE jacketed cable. The cord shall have fine strand conductors (not more than 34 gauge) made especially for heavy flexing service. The cable connection point shall be potted in epoxy providing a strong bond to the float and reed switch forming a water/moisture tight connection. A flexible Neoprene sleeve, not less than 1/8" thick, shall be provided over the CPE jacketed cable extending not less than 5" from the top of the mounting bracket extending down through the cable mounting bracket hinge point to the top of the float switch body, providing cable stress point relief and extended operational life.

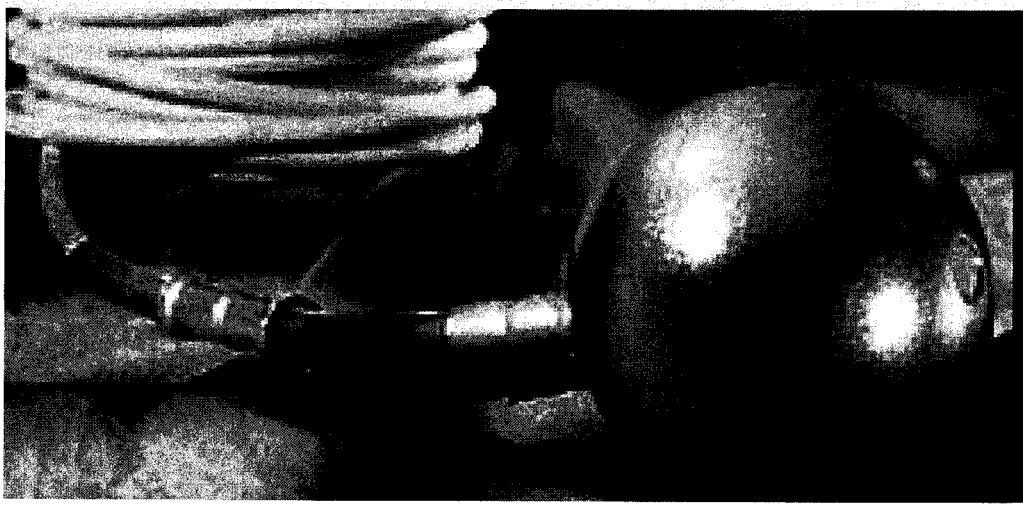
A 316 stainless steel flanged cable mounting clamp assembly shall be supplied allowing pipe or cable mounting as specified below. The float cable-mounting bracket shall be flared on both sides providing hinge point stress relief to both sides of the cable.



9G EF Floats provide reliable performance in "unbelievable surroundings."

The float switch assembly shall provide a minimum of two pounds of buoyancy in solutions with a specific gravity of 1.0 (water) and shall have an operating temperature rating of -35 to +90 degrees C.

The float switches shall be Model 9G-EF floats as manufactured by Siemens Water Technologies, Control Systems Products.

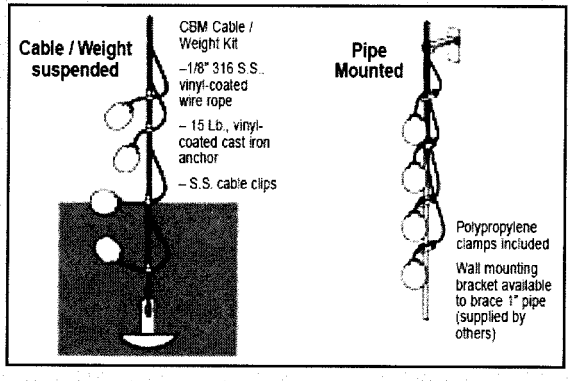


FEATURES

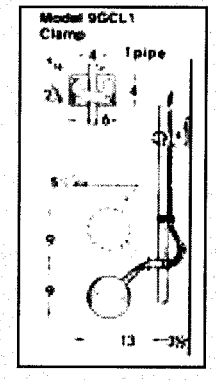
- Mercury Free – Magnetic Reed Switch
- Long life and reliable operation
- Non-oxidizing contacts allow low DC voltage signals for use with intrinsic safety devices
- Non-stick surface
- High buoyancy
- Pipe or suspension mounting
- 3 year factory warranty

DESCRIPTION	PART NO.
9G-EF (Mercury Free) NOTP Float Switch	
Teflon coated 316 SS Float Switch w/1 N.O. Contact & 30' Cable	6013520030
Teflon coated 316 SS Float Switch w/1 N.O. Contact & 60' Cable	6013520060
9G-EF (Mercury Free) NCTP Float Switch	
Teflon coated 316 SS Float Switch w/1 N.C. Contact & 30' Cable	6013530030
Teflon coated 316 SS Float Switch w/1 N.C. Contact & 60' Cable	6013530060
Mounting Hardware & Accessories	
9G Float Cable Clamp Assembly	6012120001
9G Float 1" Pipe Clamp Assembly	6011840001
316 SS cable suspension kit, 21'	6014400020
316 SS cable suspension kit, 31'	6014400030
316 SS cable suspension kit, 41'	6014400040
316 SS cable suspension kit, 61'	6014400060
316 SS cable suspension kit, 81'	6014400080
316 SS cable suspension kit, 101'	6014400100
5 Float Suspension Mount, 2 piece bracket w/strain reliefs	8031340001
9G CL3 1" stainless steel pipe mount clamps (transducer or float mount)	6011340001
15# Anchor	xx-333-100
Float Cable/Anchor kit 30' (w/15lb anchor, 30' SS cable, wall bracket, 5 cable clamp)	8032110003
Float Cable/Anchor kit 60' (w/15lb anchor, 60' SS cable, wall bracket, 5 cable clamp)	8032110006
IS6 Six Circuit Intrinsically Safe (Switch Circuit) Barrier: 12-24V DC powered	6013160002
9G JCTF fiberglass junction box (supports up to XXXX floats)	6011020001

Typical Mounting



Pipe Mounting Dimensions



COMPLETE CONTROL CAPABILITIES

Siemens Water Technologies, Control Systems Products, offers a single, high-quality source for everything from simple level sensors to telemetry systems to complex system control engineering and software. Based in St. Paul, Minnesota, Control Systems is part of the leading global provider of industrial, municipal and residential water and wastewater treatment systems, products and services. As a major manufacturer/integrator with an extensive selection of specialized product lines in the areas of SCADA and telemetry, power equipment integration, automation and measurement, Control Systems is uniquely positioned to provide cost effective, comprehensive solutions for water, wastewater, and process control and telemetry applications.

Siemens
Water Technologies
1239 Willow Lake Boulevard
Vadnais Heights, MN 55110
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651.766.2700 phone
651.766.2701 fax

Printed in U.S.A.
CS-9GEF-DS-1006

Chemical Feeding Technologies, Inc.
Quality Products for Environmental Quality®

Prepared: February 18, 2015 Revision: 1

Engineering Re-Submittal
Valley Farms Arsenic System
Disinfection System

Prepared by Chemical Feeding Technologies, Inc.

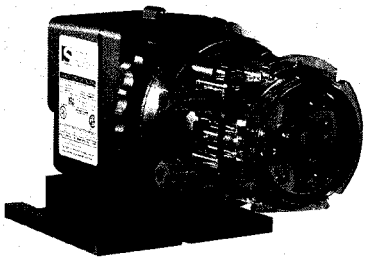
for

Felix Construction Co.

Phone: 602/650-1557 Fax: 602/277-2270 E-mail: rick@chemfeedtech.com

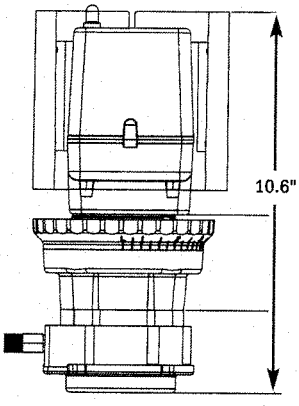
SPECIFICATION SHEET: 85 PUMP SERIES — STENNER PUMPS

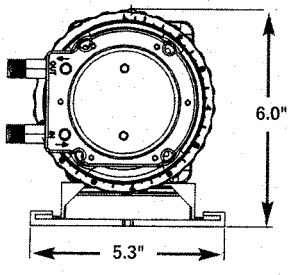
SINGLE HEAD ADJUSTABLE OUTPUT



MODELS

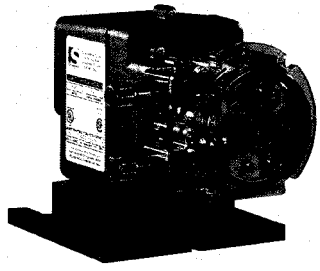
- 85MHP5
- 85MHP17
- 85MHP40
- 85M1
- 85M2
- 85M3
- 85M4
- 85M5





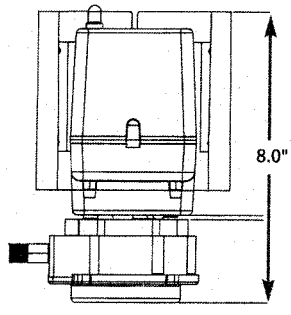
SHIPPING WEIGHT 8 lbs (3.6 kg)

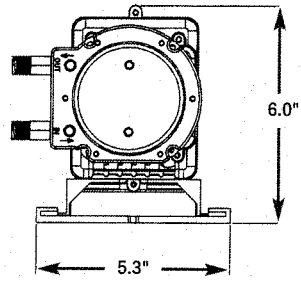
SINGLE HEAD FIXED OUTPUT



MODELS

- 85MPHP5
- 85MPHP17
- 85MPHP40
- 85MP1
- 85MP2
- 85MP3
- 85MP4
- 85MP5





SHIPPING WEIGHT 6 lbs (2.7 kg)

METERING PUMP
UL LISTED
96F0

METERING PUMP
LR79585
NRTL /C

CE

IPX4

94247
SANITATION LISTED
CONFORMS TO STD. NSF-50
CIRCULATION SYSTEM COMPONENTS FOR SWIMMING POOLS, SPAS, OR HOT TUBS

THIS PRODUCT HAS BEEN TESTED AND CERTIFIED BY THE WATER QUALITY ASSOCIATION ACCORDING TO NSF/ANSI 61 FOR MATERIALS SAFETY ONLY.

PRODUCT LISTINGS VARY BY MODEL. CONTACT FACTORY FOR DETAILS.

FEATURES

- Positive displacement pump
- 3-point roller design assists in anti-siphon protection.
- Pump head requires no valves, allows for easy maintenance.
- Self-priming against maximum working pressure, foot valve not required.
- Pump does not lose prime or vapor lock.
- Pumps off-gassing solutions and can run dry.
- Output volume is not affected by back pressure.
- Injection check valve included w/85MHP & 85MPHP models.
- Easy to change pump tube; lubrication is not required.
- Pump tubes and pump heads interchange between models.
- Models tested by WQA to conform to ANSI/NSF STD 61.
- Models tested by ETL to conform to ANSI/NSF STD 50.
- All pump accessories included allow a fast and easy installation.

STENNER

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Jacksonville, Florida 32246
Phone 904.641.1666
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Fax 904.642.1012

www.stenner.com
sales@stenner.com

Hours of Operation (EST)
Mon. - Fri. 7:00 am - 5:30 pm

SPECIFICATION SHEET: 85 PUMP SERIES

STENNER PUMPS

SPECIFICATIONS

OUTPUT RANGE
adjustable models only, 5%-100%,
2.5% increments

MAXIMUM WORKING PRESSURE
100psi (1.7 bar) for the following models
85MHP5, 85MHP17, 85MHP40,
85MPHP5, 85MPHP17, 85MPHP40
25 psi (6.9 bar) for the following models
85M1, 85M2, 85M3, 85M4, 85M5,
85MP1, 85MP2, 85MP3, 85MP4, 85MP5

MAXIMUM AMBIENT and FLUID TEMPERATURE
125°F (52° C)

MAXIMUM SUCTION LIFT
25' vertical lift

MOTOR TYPE
1/30 HP, shaded pole, class B

FINAL MOTOR RPM
44

DUTY CYCLE
Continuous

MOTOR VOLTAGE (AMP DRAW)
120V 60Hz 1PH (1.7)
220V 60Hz 1PH (0.9)
230V 50Hz 1PH (0.9) International
250V 50Hz 1PH (0.9) International

POWER CORD PLUG END
120V 60Hz - NEMA 5/15, 230V 50Hz - CEE 7/VII
220V 60Hz - NEMA 6/15, 250V 50Hz - CEE 7/VII

WET END COMPONENTS

PERISTALTIC TUBE
Santoprene® *FDA approved
optional Tygothane®** FDA approved

TUBE FITTINGS, COMPRESSION NUTS
Type 1 rigid PVC-NSF listed

SUCTION STRAINER & WEIGHT
Type 1 rigid PVC body, ceramic weight - NSF listed

SUCTION/DISCHARGE TUBING & FERRULES
LDPE polyethylene, NSF and FDA approved

CHECK VALVE (injection fitting & body)
Type 1 rigid PVC-NSF listed

CHECK VALVE DUCKBILL
Santoprene®* FDA Approved
Pellathane®† (w/Tygothane® tube)

OTHER COMPONENTS

ALL PUMP HOUSINGS
GE Lexan®†† Polycarbonate

PUMP HEAD ROLLERS
LDPE

ROLLER BUSHINGS
Bronze Oilite

ALL FASTENERS
Stainless Steel

POWER CORD TYPE
SJTOW

*Santoprene® is a registered trademark of Advanced Elastomer System.
**Tygothane® is a registered trademark of Saint-Gobain Performance Plastics.
†Pellathane® is a registered trademark of The Dow Company, Midland, MI.
††Lexan® is a registered trademark of General Electric. Consult General Electric for chemical resistance of Lexan®.

ACCESSORY KIT SHIPPED WITH EACH PUMP

- 3 connecting nuts (1/4" or 3/8")
- 3 ferrules w/1/4" & 6mm OR 2 ferrules w/3/8"
- 1 injection check valve (100 psi) OR (1) injection fitting (25 psi)
- 1 weighted suction line strainer
- 1 20' roll of suction/discharge tubing 1/4" or 3/8" in white or UV black 6 mm Europe tubing in white only
- 1 spare pump tube
- 1 mounting bracket
- 1 manual

85 SERIES PUMP ADJUSTABLE OUTPUT

			Approximate Outputs @ 60 Hz						Approximate Outputs @ 50 Hz		
Single Head Model	Maximum Pressure	Pump Tube Number	gallons per day	liters per day	gallons per hour	liters per hour	ounces per minute	milliliters per minute	liters per day	liters per hour	milliliters per minute
85MHP5* 85M1	100 psi (6.9 bar) 25 psi (1.7 bar)	#1 #1	0.3 to 5.0	1.1 to 18.9	0.01 to 0.21	0.05 to 0.79	0.03 to 0.44	0.76 to 13.13	0.9 to 15.1	0.04 to 0.63	0.52 to 10.49
85MHP17* 85M2	100 psi (6.9 bar) 25 psi (1.7 bar)	#2 #2	0.8 to 17.0	3.0 to 64.4	0.03 to 0.71	0.13 to 2.68	0.07 to 1.51	2.08 to 44.65	2.4 to 51.5	0.10 to 2.15	1.67 to 35.76
85MHP40* 85M3	100 psi (6.9 bar) 25 psi (1.7 bar)	#7 #3	2.0 to 40.0	7.6 to 151.4	0.08 to 1.67	0.32 to 6.31	0.18 to 3.55	5.27 to 105.14	6.1 to 121.1	0.25 to 5.05	4.24 to 84.10
85M4	25 psi (1.7 bar)	#4	3.0 to 60.0	11.4 to 227.1	0.13 to 2.50	0.48 to 9.46	0.27 to 5.33	7.92 to 157.71	9.1 to 181.7	0.38 to 7.57	6.32 to 126.18
85M5	25 psi (1.7 bar)	#5	4.3 to 85.0	16.3 to 321.8	0.18 to 3.54	0.68 to 13.40	0.38 to 7.55	11.32 to 223.40	13.0 to 257.4	0.54 to 10.73	9.03 to 178.75

The dial ring for adjustable pumps is marked L-10; L=5%, 1-10 indicates 10% increments of maximum output.

85 SERIES PUMP FIXED OUTPUT

			Approximate Outputs @ 60 Hz						Approximate Outputs @ 50 Hz		
Single Head Model	Maximum Pressure	Pump Tube Number	gallons per day	liters per day	gallons per hour	liters per hour	ounces per minute	milliliters per minute	liters per day	liters per hour	milliliters per minute
85MPHP5* 85MP1	100 psi (6.9 bar) 25 psi (1.7 bar)	#1 #1	5.0	18.9	0.21	0.79	0.44	13.13	15.1	0.63	10.49
85MPHP17* 85MP2	100 psi (6.9 bar) 25 psi (1.7 bar)	#2 #2	17.0	64.4	0.71	2.68	1.51	44.65	51.5	2.15	35.76
85MPHP40* 85MP3	100 psi (6.9 bar) 25 psi (1.7 bar)	#7 #3	40.0	151.4	1.67	6.31	3.55	105.14	121.1	5.05	84.10
85MP4	25 psi (1.7 bar)	#4	60.0	227.1	2.50	9.46	5.33	157.71	181.7	7.57	126.18
85MP5	25 psi (1.7 bar)	#5	85.0	321.8	3.54	13.40	7.55	223.40	257.4	10.73	178.75

*pump supplied with injection check valve for 26-100 psi applications

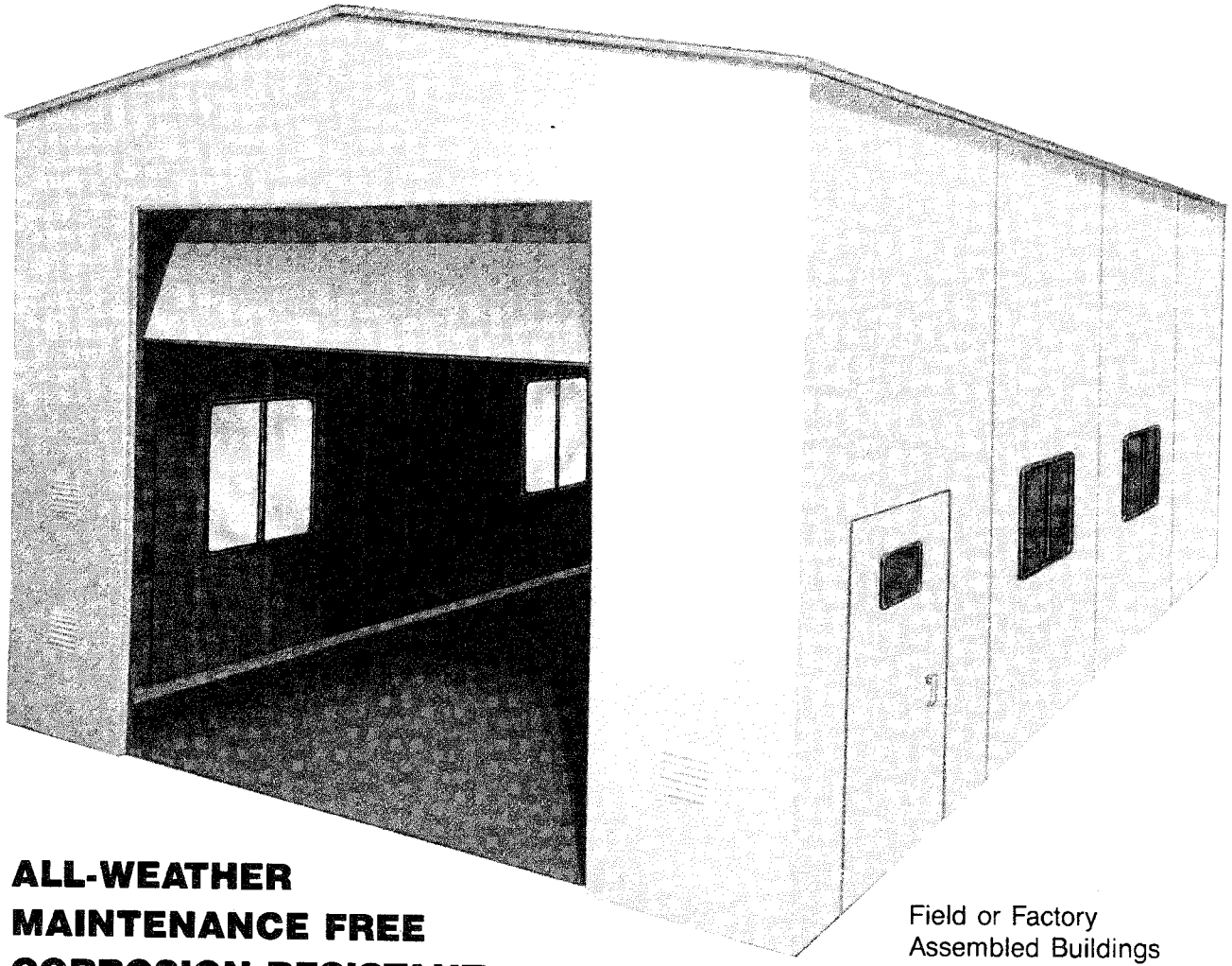
NOTICE: The information within this chart is solely intended for use as a guide. The output data is an approximation based on pumping water under a controlled testing environment. Many variables can affect the output of the pump. Stenner Pump Company recommends that all metering pumps undergo field calibration by means of analytical testing to confirm their outputs.

www.warminsterfiberglass.com
sales@warminsterfiberglass.com

WARMINSTER FIBERGLASS

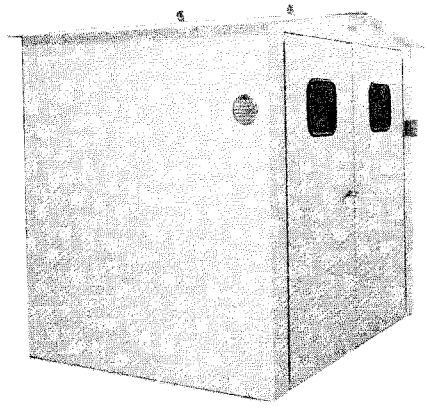
WFS1000 SPECIFICATION

Fiberglass Reinforced Plastic Buildings, Shelters and Enclosures

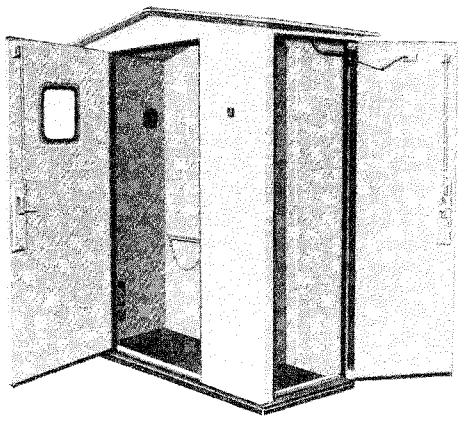


- **ALL-WEATHER**
- **MAINTENANCE FREE**
- **CORROSION RESISTANT**
- **INDUSTRIAL QUALITY**

Field or Factory Assembled Buildings



One-Piece Molded Shelters



Two Compartment Shelters

WFS1000 SPECIFICATION

APPLICATIONS

Warminster Fiberglass Company multi-purpose all-weather buildings and shelters are tough, shock resistant, non-conductive, light weight, corrosion resistant, maintenance free and easy to install. The insulated fiberglass reinforced, composite construction provides a unique thermal barrier which greatly minimizes heating and cooling requirements.

These structures meet a wide variety of applications.

Environmental Protection
Generating and Transmission Equipment
Pollution Monitoring Equipment
Analyzers and Field-Mounted Instruments
Laboratories
Security and Service Personnel
Fire Fighting Equipment
Micro-Wave Stations and Pump Stations
Chemical and Polymer Feed Systems
Safety Showers
Chlorination equipment for well fields and water and wastewater treatment plants
Containment of hazardous or toxic chemicals

STANDARD DESIGN FEATURES

- ALL WEATHER
  Wind load 125 MPH
  Snow load 30 lbs/ft²
  Seizmic loads
  Thermal resistance of R-7
  Temperatures from –150° F to 175°F
  Resistant to ultra-violet degradation
  Resistant to salt-spray, rain, ice, sandstorms
- MAINTENANCE FREE
  Never needs painting - color molded-in
  Smooth non-porous exterior surface
- CORROSION RESISTANT
  Polyester resin reinforced interior and exterior laminates
- INDUSTRIAL QUALITY
  Structures are designed and engineered using materials of fiberglass reinforced plastic composite construction

STANDARD CONSTRUCTION AND EQUIPMENT

- Walls and Roof - fiberglass composite of:
  White gelcoated exterior fiberglass laminate
  Rigid polyisocyanurate insulated core 1″ thick
  White pigmented interior fiberglass laminate
  Encapsulated steel and aluminum reinforcements as required
- Door typical to fiberglass composite
- Door latch - stainless steel
- Door hinge - stainless steel
- Door gasket - neoprene rubber
- Door stop chain - cadmium plated
- Lifting eyes - cadmium plated - removable
- Louver - Two - 6″ aluminum, with manual damper and insect screen
- Floor gasket - neoprene rubber

OPTIONAL EQUIPMENT

- ☐ Fiberglass Floor, with insulation value of R-14, 100 P.S.F. load rating
- ☐ Fiberglass Containment Floor
- ☐ Self-extinguishing construction - Class A - flame spread 20-25 per ASTM E-84
- ☐ Self-extinguishing construction - Class B - flame spread 70-75 per ASTM E-84
- ☐ Chemical resistant gel-coat
- ☐ Color selection (other than standard white)
- ☐ Additional wall height
- ☐ Partition walls
- ☐ Increased insulation to 2″ thickness, R-14
- ☐ Double door assembly (in place of single door)
- ☐ Double door assembly (in addition to single door)
- ☐ Second single door assembly
- ☐ Door window - 12″ x 12″ safety glass
- ☐ Door latch, two point, padlockable, stainless steel exterior
- ☐ Door panic hardware - aluminum
- ☐ Fixed or sliding wall windows
- ☐ Hatches, bulkheads and cutouts
- ☐ Mounting channel - galvanized 1-5/8 x 13/16
- ☐ Mounting channel - galvanized 1-5/8 x 1-5/8
- ☐ Lifting eyes - stainless steel (in place of plated)
- ☐ Exhaust fan - with gravity shutter and including fiber - glass canopy with insect screen. 7″ 135 CFM; 10″ 520 CFM; 12″ 650 CFM or as required
- ☐ Fiberglass louver - 6″ diameter with manual damper and insect screen (in place of aluminum)
- ☐ Fiberglass intake louver - 12″ square, with gravity shutter and insect screen
- ☐ Lamp - incandescent - vaportite
- ☐ Lamp - fluorescent - 48″ 2-bulb fixture with acrylic lens
- ☐ Duplex switch box - 2 toggle (inside)
- ☐ Duplex switch box - 2 toggle weatherproof (outside)
- ☐ Door actuated switch and manual/automatic selector switch
- ☐ Heater 1500 watt with thermostat and tip-over switch, or wattage as required
- ☐ Heater mounting - includes mounting channel, outlet & brackets
- ☐ Duplex outlet
- ☐ Air conditioner - BTU as required
- ☐ Heat pump - BTU heating & cooling as required
- ☐ Duplex fuse box 30 amp
- ☐ Circuit breaker panel 125 amp, MLO - including 4 - 1 pole breakers (total spaces - 8)
- ☐ Electrical wiring in flexible, liquid tight, PVC jacketed galvanized steel Anaconda conduit Type EF:
  - ☐ Fan and switch
  - ☐ Lamp and switch
  - ☐ Duplex outlet
- ☐ Explosion proof equipment
- ☐ Stainless steel expansion anchors
- ☐ Other special equipment per customer requirements

NOTE: Specifications are subject to change without notice.

Revised December, 1998

WARMINSTER FIBERGLASS

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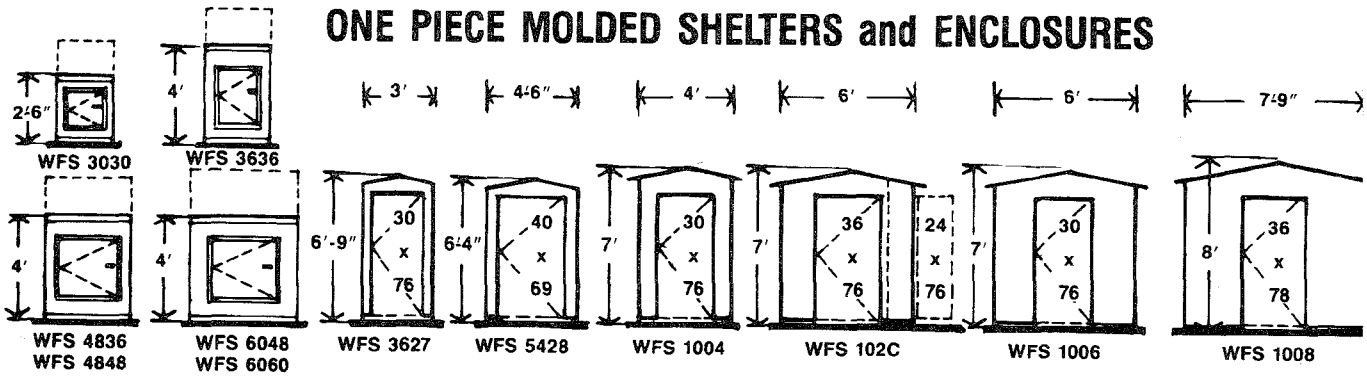
SOUTHAMPTON, PA 18966
PHONE: (215) 953-1260
FAX: (215) 357-7893
VISIT OUR WEBSITE: www.warminsterfiberglass.com

ONE PIECE MOLDED SHELTERS and ENCLOSURES



WFS 1004	DEPTHS	2'-6"	4'	6'
AREA	FT²	10	16	24
VOLUME	FT³	67	109	164
WEIGHT	LBS	250	315	400

WFS 1006	DEPTHS	4'	6'	8'	10'	12'	14'	16'
AREA	FT²	24	36	48	60	72	84	96
VOLUME	FT³	162	243	324	405	485	567	648
WEIGHT	LBS	400	490	580	670	760	850	940

WFS 1008	DEPTHS	6'	8'	10'	12'	14'	16'	18'	20'
AREA	FT²	48	64	80	93	108	124	140	155
VOLUME	FT³	356	475	600	710	830	950	1069	1188
WEIGHT	LBS	710	830	950	1070	1190	1310	143(	1550

	WFS 3627	WFS 5428	WFS 102C
DEPTH IN	27	28	30
VOLUME FT³	45	66	101
WEIGHT LBS.	180	240	380

SECTION 13121 — SPECIFICATION FOR ONE PIECE MOLDED SHELTER OR ENCLOSURE

MANUFACTURER

A) One piece molded shelter shall be manufactured by Warminster Fiberglass Company, Southampton, PA., Model No. WFS _____.

B) Options including lighting, heating, ventilating, air conditioning and other accessories shall be the standard equipment of the manufacturer or as specified by engineer in the plans and listed under optional equipment.

ONE-PIECE MOLDED SHELTER

A) The one piece molded shelter shall be _____ feet wide by _____ feet deep by standard eave height.
Shelters shall withstand 125 miles per hour wind load and 30 pounds per square foot snow load.
Fiberglass reinforced plastic shelter shall be of one piece molded construction with composite walls and roof. The exterior surface shall be white gelcoat with a low luster finish which is smooth and free from fiber pattern, roughness or other irregularities.
The exterior laminate which chemically bonds with the gelcoat shall be a minimum of 1/8" thick. The laminate consisting of polyester resin and chopped strand fiberglass shall have a minimum glass content of 25%.
The center core shall be 1" thick with a minimum insulating value of R-7.
The core material shall be rigid closed cell, self extinguishing polyisocyanurate foam with a density of 1.9 pounds per cubic foot.
The white interior laminate shall encapsulate the core in place.
The molding shall be continuous forming a one piece molded composite shelter with an integral 4" wide internal mounting flange around the perimeter.
The flange shall be pre-drilled on 12" centers with 7/16" diameter holes for bolting to a structural fiberglass floor or a concrete pad.

EQUIPMENT

A) The one piece molded fiberglass composite door shall be 1 3/8" thick and typical to materials of construction of the walls. The door shall be mounted using a continuous stainless steel hinge. The door shall be provided with a one point keyed stainless steel latch and cadimum plated door stop with chain.

B) The door gasket shall be extruded closed cell neoprene sponge rubber and provide a weather tight seal.

C) The base mounting flange gasket shall be 1/4" thick by 4" wide closed cell neoprene sponge rubber, and provide a weather tight seal around the shelter perimeter.

D) Two 6" diameter aluminum wall louvers shall be provided with manually adjustable damper and an insect screen.

E) Lifting eye bolts in the roof shall be cadmium plated and removable after installation.

OPTIONAL EQUIPMENT

A) Additional equipment for lighting, heating, ventilating, air conditioning and other accessories shall be from a list of the manufacturers pre-selected equipment.

STRUCTURAL FIBERGLASS FLOOR

A) The one piece molded fiberglass floor shall be _____ feet wide by _____ feet deep. The floor shall be 3" thick with a 2" thick polyisocyanurate foam core. The floor shall have an insulation value of R-14. Bolts for attaching the structure to the fiberglass floor shall be 3/8" diameter stainless steel. The floor load rating shall be 100 pounds per square foot. The floor shall have a skid resistant surface.

CONCRETE PAD

A) The concrete pad shall be supplied by owner in accordance with contract plans and specifications.

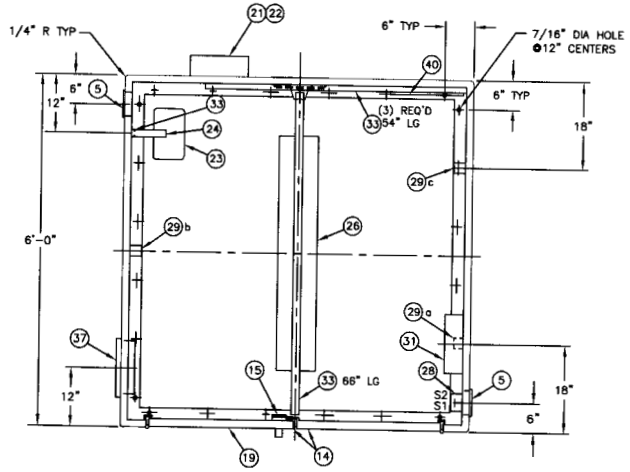
B) Anchor bolts for attaching the shelter to the concrete pad shall be 3/8" diameter stainless steel expansion anchors, supplied by the contractor.

SOURCE QUALITY CONTROL

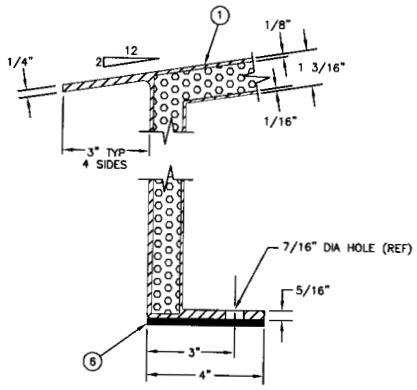
A) The manufacturer shall maintain a continuous quality control program and upon request, shall furnish to the engineer certified test results of the physical properties. Test results shall meet or exceed those listed in the specification.

LAMINATE PROPERTIES	VALUE	TEST METHOD
Tensile Strength	11,000 PSI	ASTM D638
Flexural Strength	18,000 PSI	ASTM D790
Shear Strength	12,000 PSI	ASTM D732
Barcol Hardness	40	ASTM D2583
Impact	12 ft lbs/inch	ASTM D256
Heat Distortion Point	175 °F	ASTM D384
Density/Specific Gravity	93.6 PCF/1.5	ASTM D792
Burning Characteristics	<150 Flame spread <1000 Smoke Density	ASTM E84
CORE PROPERTIES		
Thermal Conductivity	$.13 \frac{BTU \cdot IN}{HR \cdot FT^2 \cdot °F}$	ASTM C-518
Density/Specific Gravity	1.9 PCF/.03	ASTM D1622
Burning Characteristic	35 Flame Spread 240 Smoke Density	ASTM E-84

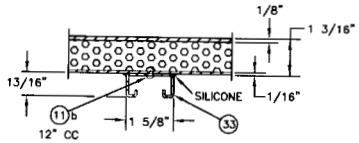
The procedure used in determining the minimum properties shall be in accordance with ASTM Standards, using the method designated. Test coupons shall be prepared in accordance with ASTM D618 test method.



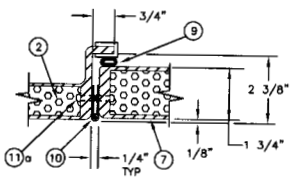
PLAN VIEW BELOW ROOF



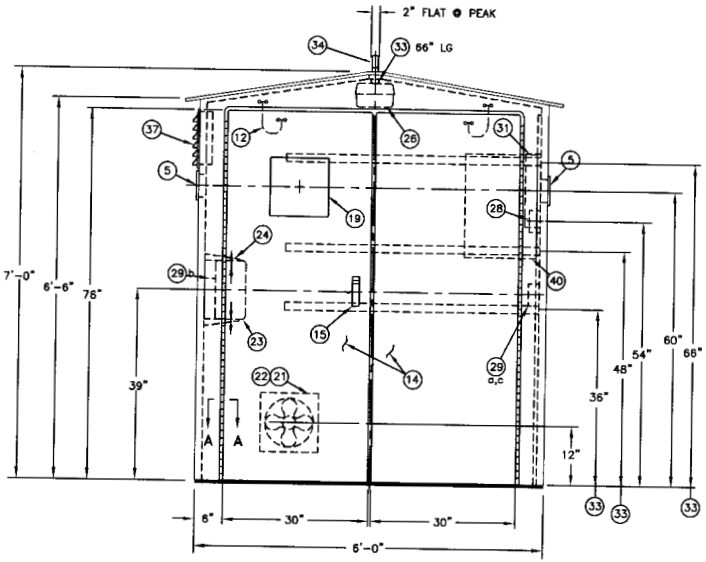
SECTION
ROOF, SIDE WALL & FLANGE
SCALE: 1/2" = 1"



SECTION – POWER STRUT MTG
SCALE: 1/2" = 1"



SECTION A–A
SCALE: 1/2" = 1"



FRONT ELEVATION

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION
1	1	SHELTER– ONE PIECE MOLDED FIBERGLASS CONSTRUCTION– WHITE
2	AR	INSULATION – 1" THK RIGID POLYISOCYANURATE FOAM
3	–	LIFTING EYE BOLT – 3/4–10 NC CADMIUM PLATED
4	–	LIFTING EYE BOLT SUPPORT – STL. 6" X 2" X 1" ENCAPSULATED
5	2	LOUVRE – 6" DIA PVC W/SCREEN MANUALLY ADJUSTABLE
6	AR	FLOOR GASKET– 4" X 1/2" NEOPRENE SPONGE
7	–	DOOR – FIBERGLASS 36" W X 78" H X 1 3/4" THK
8	–	DOOR ENTRANCE LOCKSET– PDQ # SR–CO–US32D–SS–W/KEYS
9	AR	DOOR GASKET NEOPRENE HOLLOW BULB TRIM SEAL # 4100–1/4 OR =
10	1	DOOR HINGE – S.S. 2 1/2" OPEN PIANO TYPE 6' LG
11	AR	FASTENER – POP RIVET #AD610BS (11)a #AD66BS (11)b
12	1	DOOR STOP– CHAIN & SPRING ASSY, PLATED
13	AR	DOOR & FRAME REINFORCEMENT– ENCAPSULATED
14	1	DOUBLE DOOR ASSEMBLY – FIBERGLASS EACH LEAF 30" W X 76" H
15	1	DOOR LATCH– 2 POINT EBERHARD #5647 W/PADLOCKABLE S.S. HANDLE
16	YES	SELF EXTINGUISHING CONSTRUCTION – CLASS A FLAME SPREAD 21
17		CHEMICAL RESISTANT GEL–COAT
18		SPECIAL COLOR
19	1	DOOR WINDOW – SAFETY GLASS 12" X 12" X 1/4" W/GASKET
20		PANIC HARDWARE, STAINLESS STEEL– CAL ROYAL #9800E036 WITH LEVER #NESC9800
21	1	EXHAUST FAN 10" 585 CFM – DAYTON #1HLA1 W/GRAVITY SHUTTER
22	1	EXHAUST FAN CANOPY– PVC W/INSECT SCREEN
23	1	HEATER– DAYTON #3VU33 – 1300/1500 WATTS W/THERMOSTAT
24	1	HEATER MTG BRACKETS– POWER STRUT #PS–840 R&L
25		LAMP INCANDESCENT VAPORTIGHT W/GLOBE & GUARD, RAB #VX100DG OR =
26	1	FLUORESCENT FIXTURE– 2 BULB, 48" VAPORTITE NON–CORROSIVE FRP GASKETED W/LENS LITHONIA #DMW232MVOLTGEB101SWWGR (3YA23)
27		SINGLE SWITCHBOX– 1 TOGGLE IN PVC BOX W/GASKETED FLIP COVER
28	1	DUPLEX SWITCHBOX, WEATHERPROOF, 2 TOGGLE IN PVC BOX W/GASKETED FLIP COVER
29	3	DUPLEX OUTLET– IN PVC BOX W/GASKETED FLIP COVERS
30		DUPLEX FUSE BOX– 2 POLE 30 AMP–SQUARE D #D221N W/FUSES OR =
31	1	CIRCUIT BREAKER LOAD CENTER–1 PH, 3 WIRE,120/240V, 125 AMP MAIN LUGS ONLY, W/ –15 AMP, 1P & 4–20 AMP, 1P BREAKERS– TOTAL SPACES 12, SQUARE D #QO112L125G (5F649) OR = W/DOOR 1D428
32	YES	WIRING IN RIGID SCHEDULE 40 PVC CONDUIT W/FLEXIBLE CONNECTIONS AS REQ'D AND NON–METALLIC FITTINGS & CLIPS – ALL WIRE #12
	1	FAN & SWITCH (21) THRU (28) S2 } TO (31) CIRC#1
	1	LIGHT & SWITCH (26) THRU (28) S1 } TO (31) CIRC#1
	2	DUPLEX OUTLET (29)a,b TO (31) CIRC#2
	1	HEATER OUTLET (29)c TO (31) CIRC#3 CIRC#4 SPARE
33	5	MTG CHANNEL, GALV. STL. POWER–STRUT #PS–500, W/(2) 3/8" CLAMPING NUT & SPRING ASS'Y, POWER–STRUT #PS–BSS
34	2	LIFTING EYE BOLT 3/4"–10 NC STAINLESS STEEL BOLTED THRU 5'–0" CC
35		FLOOR– FIBERGLASS, INSULATED & REINFORCED
36		LOUVRE – 6" DIA ALUM. W/SCREEN MANUALLY ADJUSTABLE
37	1	LOUVRE– 12" X 12" PVC FIXED OPEN W/SCREEN & FRP GRAVITY SHUTTER DAYTON #5C211
38	–	MICROSWITCH AUTO/LIGHT & FAN, OPERATED BY OPENING DOOR
39	–	SELECTOR SWITCH – 2 POSITION, AUTO/MANUAL– LIGHT & FAN OPERATION
40	1	SUB–PANEL, FIBERGLASS 21" X 15" X 1/4" THICK

NOTES:
1. EXTERIOR SURFACE – SMOOTH GEL–COATED FINISH W/COLOR MOLDED IN
2. THERMAL RESISTANCE RATING R=7
3. WIND LOADING RESISTANCE 125 MPH
4. GROUND SNOW LOAD RESISTANCE 30 LBS PER SQ FT
5. FLOOR GASKET – ITEM #6, SHIPPED WITH SHELTER, FIELD INSTALLED
6. APPROX TOTAL NET WEIGHT – 495 LBS

REF: VALLEY FARMS ARSENIC SYSTEM

QTY: ONE
SIZE: 6'–0"W X 6'–0"D
COLOR: WHITE
PO#: 26031

REV	REVISION DESCRIPTION	DATE	BY
1	ENGINEERING UPDATED	10FEB15	J. Loring
		18DEC14	J. LORING

REV: W.O., ECN, ECP, AUTHORIZATION
MODEL NO.
SCALE 13/16"=1'–0"
REF. DWG.

6'–0" W ONE PIECE MOLDED FIBERGLASS SHELTER FOR CHEMICAL FEEDING TECHNOLOGIES

WARMINSTER FIBERGLASS
P.O. BOX 188, BOLTHWAITE, PA 18966

WFS1006–06–SD REV
45469–1 1

PHOENIX PUMPS, INC.

EQUIPMENT SUBMITTAL

ARIZONA WATER COMPANY

VALLEY FARMS ARSENIC REMOVAL FACILITY

BAG FILTER

CONTRACTOR
Felix Construction
1326 West Industrial Drive
Coolidge, AZ 85128
Phone:(480) 464-0011
www.felixconstruction.com

ENGINEER
GHD USA
7600 North 16th Street, Suite 205
Phoenix, AZ 85020
Phone: Phoenix, AZ 85020
www.ghd.com/usa/

MANUFACTURER
Pall Filter Specialists, Inc.
100 Anchor Road
Michigan City, IN 46360
Phone: (800) 348-3205
www.fsifilters.com

MANUFACTURER'S REPRESENTATIVE
Phoenix Pumps, Inc.
5100 S. 36th Street
Phoenix, AZ 85040
Phone: 602.232.2994
Fax: 602.232.2995
www.phoenixpumps.com

Submitted By: Tom Daniels
tdaniels@phoenixpumps.com

EQUIPMENT SUBMITTAL

ARIZONA WATER COMPANY

VALLEY FARMS ARSENIC REMOVAL FACILITY

BAG FILTER

Phoenix Pumps, Inc.
5100 S. 36th Street
Phoenix, AZ 85040
p.602.232.2994
f.602.232.2995
www.phoenixpumps.com

Submitted By:
Tom Daniels
tdaniels@phoenixpumps.com

TAB #1

SCOPE OF SUPPLY

SCOPE OF SUPPLY

BAG FILTER

Qty-1 Pall / Filter Specialists, Inc. Model CBFP-14 single bag vessel in 304SS construction, 2" NPT Connections, Style 2 (side in, bottom out). Includes perforated basket assembly. **Note; no bags included.**

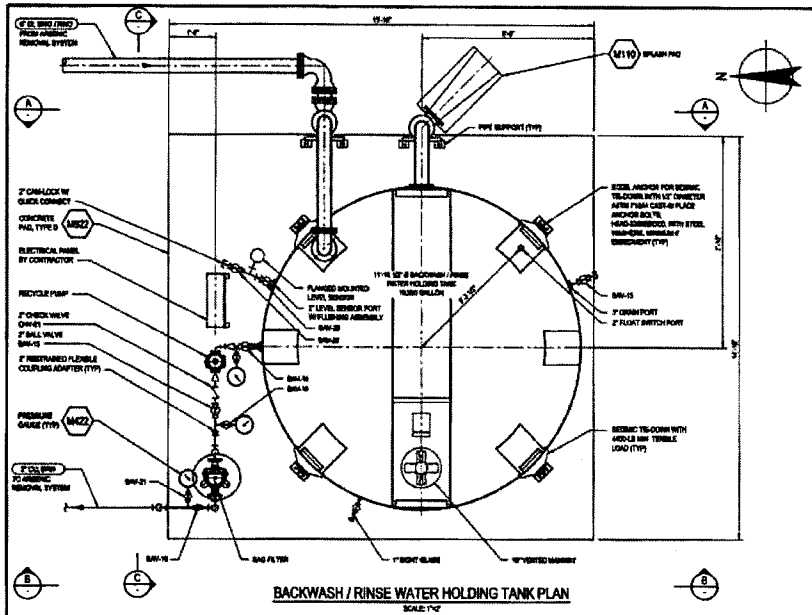
Qty-1 Filter Leg Kit

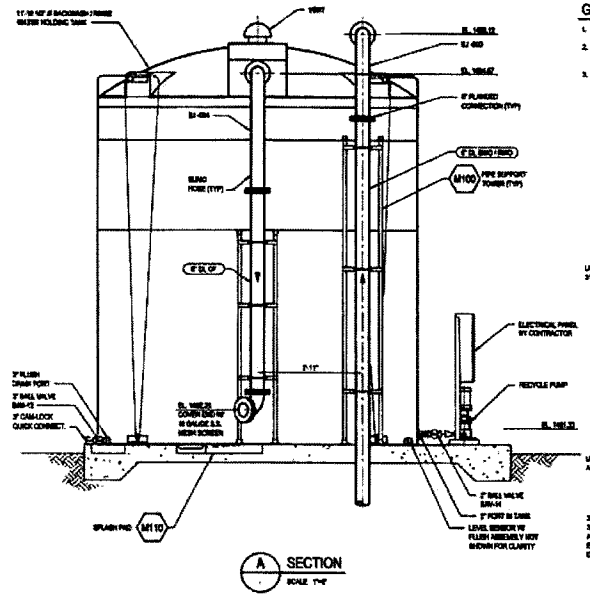
Qty-1 Spare O-Ring

Includes freight to jobsite and startup services.

TAB #2

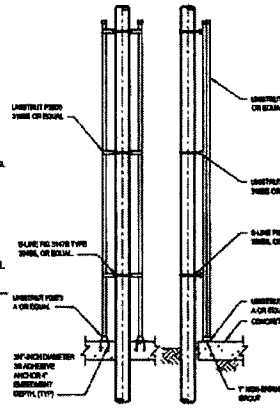
CONTRACT DRAWING



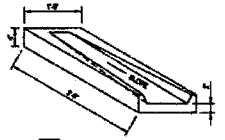


GENERAL NOTES

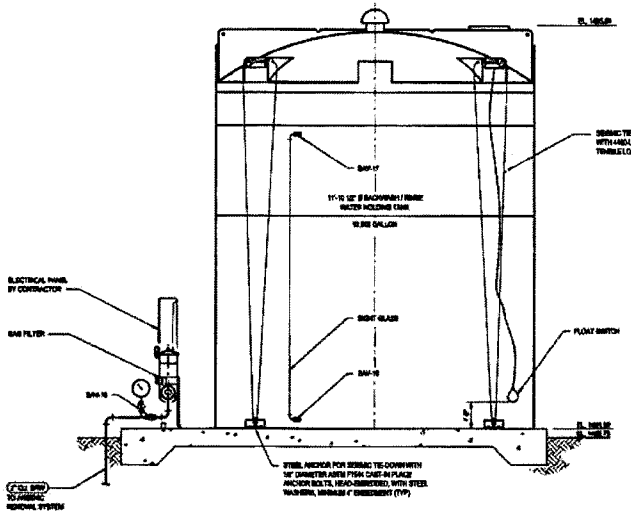
1. PROVIDE INSULATING COUPLINGS BETWEEN DISSIMILAR METALS.
2. EQUIPMENT, VALVE, VESSEL, FLOWMETER, AND GAUGE MANUFACTURERS AND MODELS PER BTR SPECIFICATIONS U.N.O.
3. ALL ABOVE GROUND PIPING SHALL BE D.I.P., CLASS 350 WITH FLANGED JOINTS. ABOVE GROUND PIPING SHALL INCLUDE EPOXY COATING IN ADDITION TO ITS FACTORY COATING. THE EPOXY COATING SHALL BE TNEMEC AND AS FOLLOWS:
   - 3.1. SURFACE PREP: PER MANUFACTURER
   - 3.2. PRIMER: TNEMEC 66 OF 1600 HI-BUILD EPOXOLINE @ 4-6 DFT.
   - 3.3. INTERMEDIATE: TNEMEC 66 OR 1600 HI-BUILD EPOXOLINE @ 3-5 DFT.
   - 3.4. FINISH: SERIES 73, 1072, OR 1029 ENDURA SHIELD
   - 3.5. COLOR: DESERT SPANDI

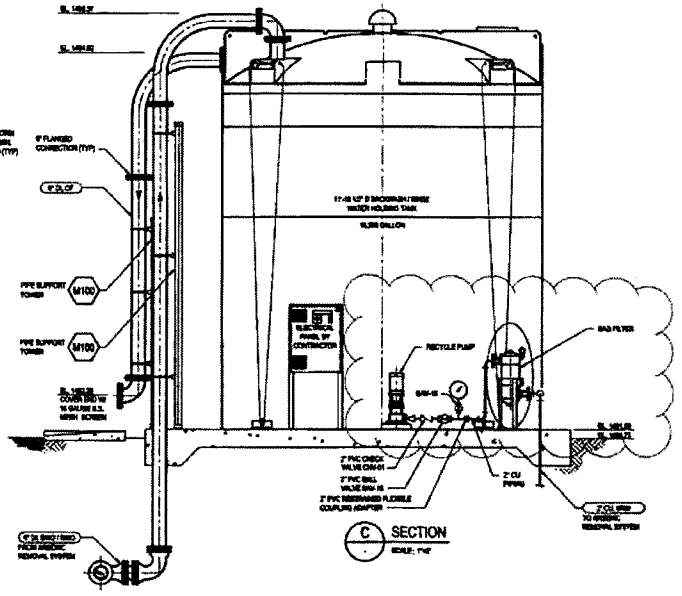


M100 PIPE SUPPORT RACK
SCALE: NTS



M110 SPLASH PAD
SCALE: NTS





EQUIPMENT TABLE

RECYCLE PUMP	
1	QUANTITY
SUBMERSIBLE (VERTICAL IN-LINE)	MAKE
GPM	MODEL
FEET	FLUID
HP	PUMP
1,750 RPM	ENERGY
3 PH	SPEED
60 HZ	FRAME

BAG FILTER	
1	QUANTITY
PSI	MAKE
GPM	MODEL
2	BAG SIZE
MAX	SHELL MATERIAL
8	SHELL DIAMETER
	SHELL HEIGHT
10,000	FLUID CAPACITY
10	NUMBER OF BAGS

BAG TYPE	
PSI BACKWASH/RINSE	MODEL
10	INLET SIZE
10	INLET TYPE
10	OUTLET SIZE
2	OUTLET TYPE
65	MODULE CONTROL
5	EXTERNAL VALVE
1	TOP DRAINAGE DETAIL
N	GASKET TYPE

SCALE: 1"=2" AT ORIGINAL SIZE

ARIZONA WATER COMPANY
3805 N. BLACK CANYON HWY., PORT OFFICE BOX 29080
PHOENIX, ARIZONA 85038-9080
(602) 240-6860

VALLEY FARMS ARSENIC REMOVAL FACILITY
10904 E. VAH 80 MM ROAD - VALLEY FARMS, AZ 85181

BACKWASH / RINSE WATER HOLDING TANK PLAN, SECTIONS, AND DETAILS

7600 North 15th Street Suite 205, Phoenix, Arizona 85020 USA
T 1 602 216 7200 F 1 602 216 7221
E phoenix@ghd.com W www.ghd.com

"Blue Stake, Inc." 263-1100 1-800-STAKE-IT (782-5348) arizona811.com

The installation shown is to be installed in accordance with the Arizona Water Company Standard Specifications or as noted by Arizona Department of Environmental Quality

DESIGN: SEC 17 - T1S - R5E
DRAWN: AG SHOWN
CHECKED: PMT
DATE: 12/17/2014
SCALE: AS SHOWN
PROJECT NO.: 8-35

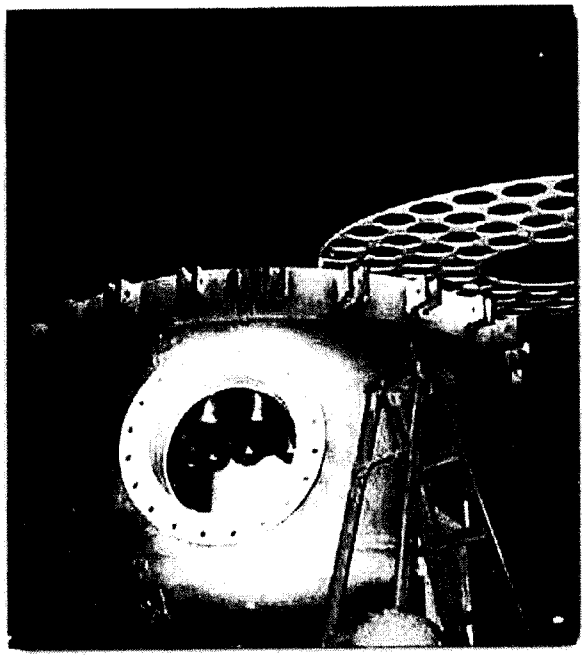
M4

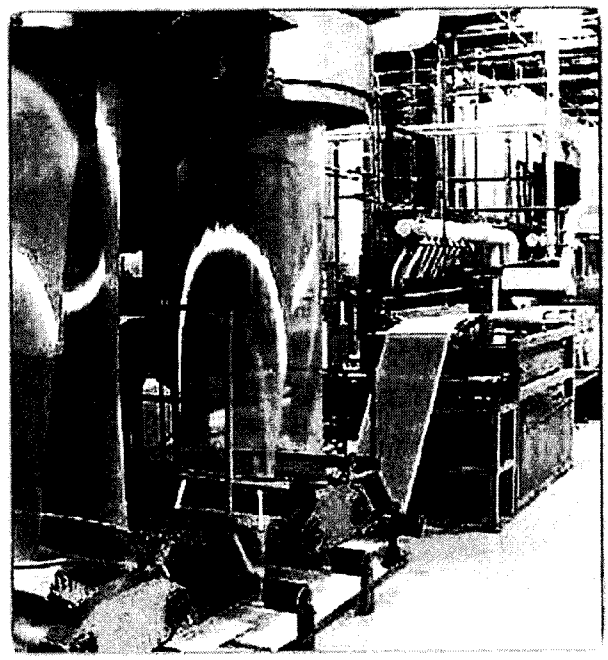
SHEET 10 OF 25

TAB #3

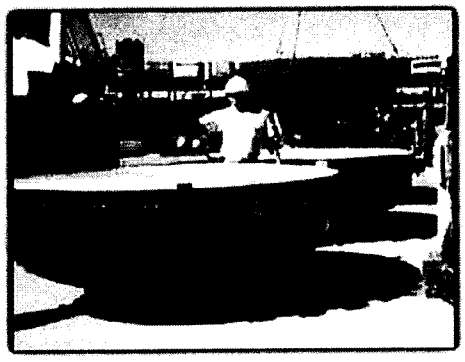
FILTER HOUSING DATA

Company Profile





Creating Filtration Solutions



FSI is the industry leader when it comes to manufacturing innovative, state-of-the-art filtration products. As a fully-integrated operation, we maintain complete control over the entire manufacturing process. No matter how large or small the project, FSI achieves the highest levels of quality for all of our filters and vessels!

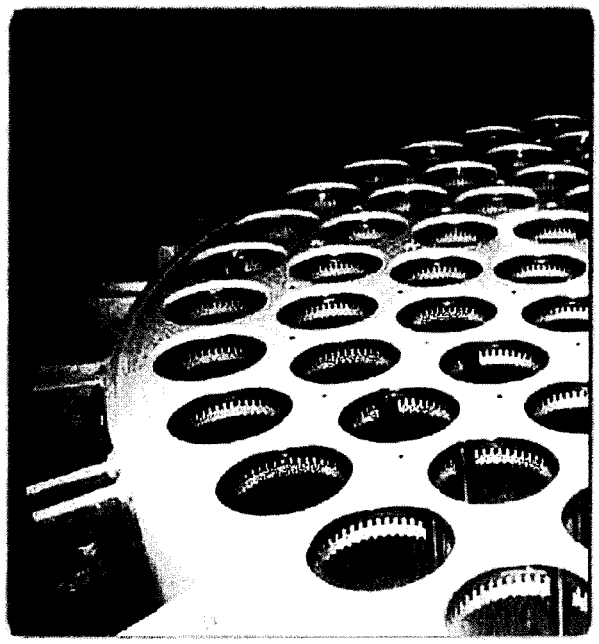
From our beginnings in 1972 in Michigan City, Indiana, FSI has grown into a worldwide supplier of both high quality and economical filtration products. We now serve customers from our production facilities in Europe, South America, China, and throughout North America.

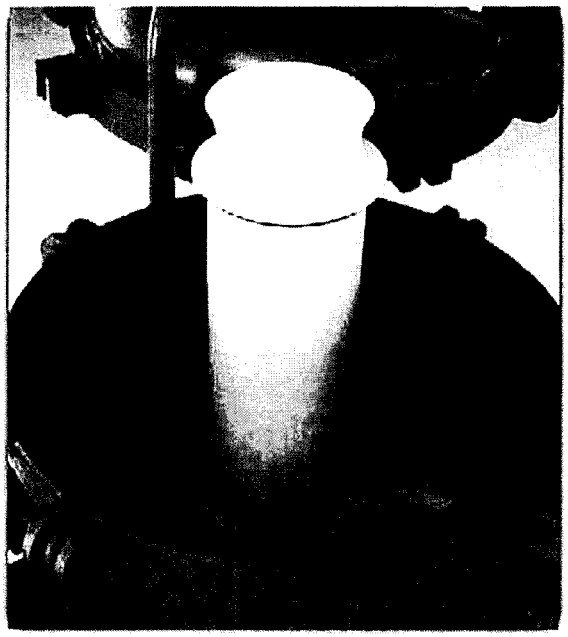
To maintain the highest quality standards for workmanship and materials in the industry, we have established advanced laboratory facilities in Soddy Daisy, Tennessee. All of our materials and processes are submitted for regular, comprehensive microscopic and chemical analysis to confirm they are completely contaminant free.

FSI is committed to remaining at the leading edge of innovation, as we continue to develop filtration products that revolutionize the industry. We were the first to introduce the Polyloc® bag ring, which completely eliminates the need for under-basket gaskets, as it hermetically seals to prevent liquid bypass. Our groundbreaking Polyweld® welded seam filter bag removes the risk of unfiltered bypass that needle holes on traditional filter bags allow through.

Our determination to lead rather than follow is one reason behind our vertically-integrated manufacturing process. Our emphasis on innovation and engineering expertise has helped us develop world-class filtration systems. The reason we do all this is simple – so that our customers can achieve the highest levels of product quality.

COMPANY PROFILE





Our Experience Enables Us to:

- Assess the processing requirements of customer systems and fulfill them to our customers' complete satisfaction.
- Provide the highest quality filtration products, filter bags and cartridge filters, and a wide range of filter vessels.
- Design and manufacture custom products to nearly any customer specification.
- Offer advanced filtration products, like the FSI BOS Polymicro® seamless design, and our Extended Life filter bags, which provide at least twice the dirt holding capacity of a standard felt bag, and which feature our no-bypass, welded seam design.
- Maintain a completely ISO 9000 certified North American network of manufacturing sources, where we create all elements of our filter and cartridge products, including the fiber for our in-house produced felts.
- Manufacture ASME code-compliant vessels designed to meet the needs and requirements of our clients' most demanding liquid flows.
- Manufacture API compliant and NSF certified vessels.
- Meet custom filtration requirements by designing and manufacturing products to your particular specifications.

The FSI Quality Process at Work

Our worldwide FSI sales and distribution offices work with clients to determine the best product for their particular fluid application. Our experienced engineers and R&D staff then set out to create the best filters available on the market.

Next, our manufacturing locations in the United States, Mexico, Brazil, China and the U.K. take that data and create the perfect filtration solution to fit your needs.

Even after the sale, we continue to work with our clients. We continually check on how our products are performing, taking the feedback and data from those uses and applying them to update and improve our complete line of products. You can rely on FSI to work with you on your specific application requirements.

www.fsifilters.com
1-800-348-3205

FILTER VESSELS

Bag Filter Housings

FSPN Vessels | FSPN E-Z Open | CBFP 11, 12 Vessels | **CBFP 13, 14 Vessels** | QX4 Filter Vessel | SBF Compact Bag Vessels | FMC Drum Filters

Cartridge Filter Housings

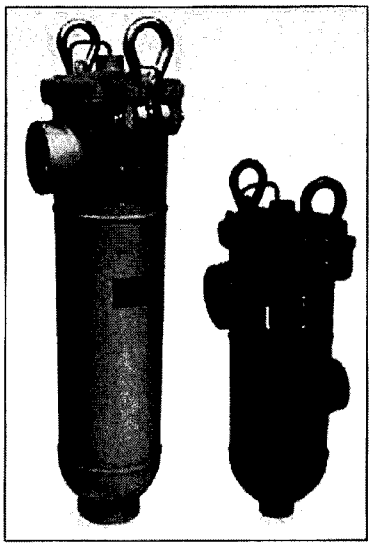
FSMC Cartridge Filter Vessels

Plastic Filter Housings

X100 Convertible Filter Housing | XL234 Modular Filter Housings

Specialty Filter Housings

Basket Strainers



BAG FILTER HOUSINGS
CBFP 13, 14 Vessels

Introduction

The CBFP 13 & 14 are cost effective bag filter vessels that are durable and reliable for low flow applications using a size 3 or 4 filter bag.

Features

- Offset, Side Inlet with Side Outlet (same side or opposite), or Side Inlet with Bottom Outlet configuration available
- Positive bag seating without the use of a manual hold-down device
- Single gasket cover seal
- Connections sizes available in either 1" or 2" NPT

TABLE OF CONTENTS

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FSI
FILTER SPECIALISTS INC

FILTER VESSELS

Bag Filter Housings

FSPN Vessels | FSPN E-Z Open | CBFP 11, 12 Vessels | **CBFP 13, 14 Vessels** | QX4 Filter Vessel | SBF Compact Bag Vessels | FMC Drum Filters

Cartridge Filter Housings

FSMC Cartridge Filter Vessels

Plastic Filter Housings

X100 Convertible Filter Housing | XL234 Modular Filter Housings

Specialty Filter Housings

Basket Strainers

BAG FILTER HOUSINGS

Options

- **Mesh lined and heavy duty rimmed basket available**
- **Flange, Sanitary and Victaulic connections**
  (available upon request)
- **Adjustable clamp-on legs in Carbon Steel or 304 Stainless Steel**

CBFP 13, 14 Vessels

Specifications

Number of Bags	1
Filter Bag Size	3, 4
Maximum Operating Pressure	150 PSI (10.34 Bar)
Design Temperature Range	Carbon Steel: 20 to 500°F (-6 to 260°C) Stainless Steel: -20 to 250°F (-28 to 121°C)
Materials of Construction	Carbon Steel, 304 & 316 Stainless Steel
Non-Wetted Parts	Carbon Steel: Carbon Steel Stainless Steel: May contain some plated Carbon Steel materials
Number of Gaskets	1
Connections	NPT
Surface Finish	Carbon Steel: Acrylic enamel painted exterior Stainless Steel: Light sand blast
Code Stamp	None
Gasket Material	Buna, EPR, Viton, Buna White FDA
PolyLoc® Bag Seal	Positive Bag Seal without manual hold down
Lid Opening	Swing bolt

Locate Your Sales Representative

TABLE OF CONTENTS

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1-800-348-3205

FILTER VESSELS

Bag Filter Housings

FSPN Vessels | FSPN E-Z Open | CBFP 11, 12 Vessels | **CBFP 13, 14 Vessels** | QX4 Filter Vessel | SBF Compact Bag Vessels | FMC Drum Filters

Cartridge Filter Housings

FSMC Cartridge Filter Vessels

Plastic Filter Housings

X100 Convertible Filter Housing | XL234 Modular Filter Housings

Specialty Filter Housings

Basket Strainers

CBFP 13, 14 Vessels ~ HOW TO ORDER

CBF	P	0013	A	0150	N	02	F	02	F	06	A	1	N
1	2	3	4	5	6	7	8	9	10	11	12	13	14

1 Model Number
CBF

2 Bag Style
P = PolyLoc®

3 Number of Bags
0013 = (1) #3 bag
0014 = (1) #4 bag

4 Vessel Material
A = Carbon Steel
B = 304 Stainless Steel
C = 316 Stainless Steel

5 Vessel Pressure Rating (PSI)
0150

6 Coating/Lining Material
A = Electropolish
F = Paint finish/prep
N = None
S = Special
X = Passivation

7 Inlet Size
Use basic pipe size with the folowing exceptions:
01 = 1"
02 = 2"

8 Inlet Type
C = Sanitary fitting
D = Flange, din
E = European EN Flange
F = Flange, slip-on, raised face, std.
N = Female NPT
P = Plain pipe
S = Special
T = Plain OD Tube
W = Socket weld

9 Outlet Size
See Inlet Size for codes

10 Outlet Type
See Inlet Type for code letter

11 Nozzle Configuration
02 = Side In/Bottom Out
06 = Side In/Side Out, Offset
08 = Side In/Side Out, Same Side
See the nozzle configuration chart

12 Internal Usage
A = Standard

13 Lid Opening Type
1 = Hinge, std.

14 Jacket Type
N = None

MODEL # CBF P 0014 B 0150 N 02 N 02 N 02 A 1 N

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FILTER VESSELS

Bag Filter Housings

FSPN Vessels | FSPN E-Z Open | CBFP 11, 12 Vessels | **CBFP 13, 14 Vessels** | QX4 Filter Vessel | SBF Compact Bag Vessels | FMC Drum Filters

Cartridge Filter Housings

FSMC Cartridge Filter Vessels

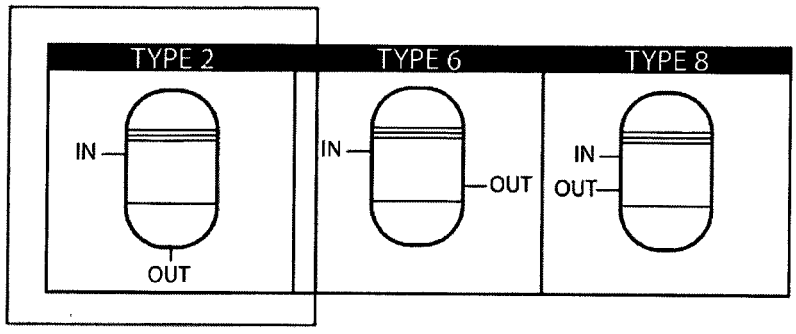
Plastic Filter Housings

X100 Convertible Filter Housing | XL234 Modular Filter Housings

Specialty Filter Housings

Basket Strainers

CBFP Inlet-Outlet Configurations



CBFP 13, 14 Flow Rate Chart

Model Number	CBFP 13	CBFP 14
No. of Bags	1	1
Bag Size No.	3	4
Surface Area per Bag, Ft.	0.5	1.0
Surface Area per Vessel, Ft2	0.5	1.0
Inlet and Outlet Size	1"	1"
Max Flow Rate, GPM	15	30

NOTE: The maximum flow rate GPM is the MAXIMUM FLOW RATE recommended through the vessel using a 10 micron felt filter bag (PONG10) filtering water. Any increase in fluid viscosity will reduce the maximum GPM figures significantly. Please consult your FSI representative when sizing these vessels.

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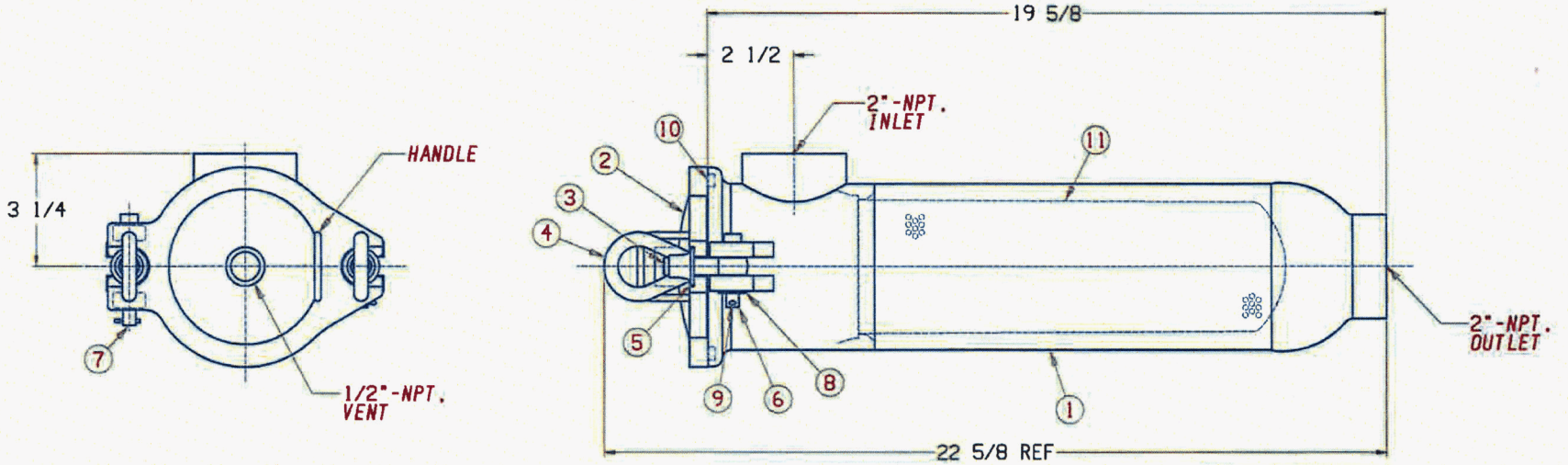
ITEM	QTY	DESCRIPTION	CARBON STEEL	304 S.S.		316 S.S.	
				MATERIAL	PART NO.		
1	1	HOUSING WELD ASS'Y		304 S.S.	436755B		
2	1	COVER LID ASS'Y		316 S.S.	PCA436763C		
3	2	EYE BOLT (1/2-13 UNC X 1 7/8"L)		SA-193-B8	PHB25037A24		
4	2	EYE NUT (1/2-13 UNC)		SA-194-1 NI. PLATED	PHE25000A10E		
5	2	WASHER (1/2" SAE)		S.S.	EHWS08S0B		
6	1	CLEVIS PIN (3/8 DIA. X 1 3/4"L)		SA-193-B8	PHP25141A24		
7	1	CLEVIS PIN (3/8 DIA. X 2 3/4"L)		SA-193-B8	PHP25356A24		
8	2	WASHER (3/8" SAE)		S.S.	EHWS06S0B		
9	2	COTTER PIN		S.S.	EHCP03X160B		
10	1	GASKET		CUST. SPEC.	EGR30087_		
11	1	BASKET ASS'Y		CUST. SPEC.	EBA27058_		



316 S.S.	VB436756CS
304 S.S.	VB436756BS
CARBON STEEL	VB436756AS
MATERIAL	PART NO.

DESIGN-
CARBON STEEL: 150 PSI @ 500°F MAX. / 20°F MIN.
STAINLESS STEEL: 150 PSI @ 250°F MAX. / -20°F MIN.

HYDROSTATIC TEST PRESSURE: 195 PSI.

CHG	REVISION	BY	DATE

FSI FILTER SPECIALISTS INC. MICHIGAN CITY, IND. 46360

FILTER ASS'Y
CBFP-14 #2 - 2"NPT - STD
PART NO. VB436756_S

DATE 3/26/12 DWN BY LVL
APP'D LVL SCALE 1-2.5
MATERIAL CS/304SS/316SS
DRAWING NO. 1910494

TAB #4

FILTER BAG CATALOG

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FILTER BAGS

Innovative Solutions. Clear Results.

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FSI
FILTER SPECIALISTS, INC

FILTER BAGS

Felt Filter Bags

Standard Felt Filter Bags | Polyweld® Filter Bags |
Extended Life Filter Bags (POEX/PEEX) | MAX PONG Filter Bags

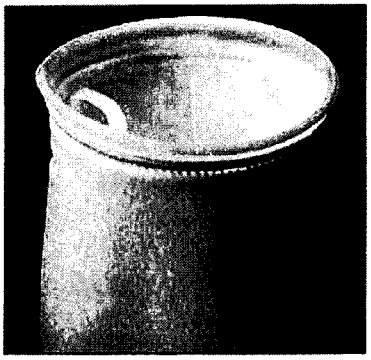
Polymicro Microfiber Filter Bags

POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | BOS MAX Filter Bags

Mesh Filter Bags



FELT FILTER BAGS
Standard Felt Filter Bags

FSI Felt Bags are the Answer

When it comes to felt filter bags, FSI has the answer. Our years of experience give us an advantage over our competitors, and our felt filter bags show it. Our felt bags are designed to withstand higher solid loading, and are suitable for applications using vessel or open filtration systems.

FSI's "Comprehensive Manufacturing Control" philosophy insures that we will maintain our status as the industry leader in all phases of the filter business. Our integrated technology, control over our manufacturing and quality leads to consistent performance. With FSI filter bags, you can count on a quality product every time.

We start with the finest material possible. FSI makes its own fiber to produce the felt material used in our felt filter bags inhouse, guaranteeing the highest quality. Our Extended Life filter bag provides superior filtration of all sized particles, as well as up to twice the dirt holding capacity of a standard filter bag.

Our no-bypass welded seams eliminate the possibility of fluid bypass through needle holes. We provide a variety of glazed and singed finishes to inhibit fiber migration. FSI also offers polyester inserted felts. These inserted felts include a reinforcing scrim needled inside the felt material, to provide added strength and durability, when a restrainer basket is not being used.

Features

- We offer a full line of felt materials and micron ratings
- Conventional sewn bags or the PolyWeld® welded seam bags available
- FSI PolyLoc® ring or other common bag rings available on most bags
- Heavy Duty and Extended Life designs available to suit your filtration needs

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Felt Filter Bags

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Polymicro Microfiber Filter Bags

POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | BOS MAX Filter Bags

Mesh Filter Bags

Specifications

- **Available Materials**
  PO = Felt, Polypropylene
  PE = Felt, Polyester
  N = Felt, Nylon
  HT = Felt, High Temperature
  TFE = Felt, Teflon
- **Maximum Operating Temperature**
  Polypropylene: 200-220° F (93-104° C)
  Polyester: 275-325° F (135-162° C)
  Nylon: 275-300° F (135-149° C)
  High Temperature: 400-450° F (204-232° C)
  Teflon: 450-500° F (232-260° C)
- **Suggested Differential Pressure**
  35 PSIG maximum — dirty
  10-15 PSIG optimum change out
- **Micron Rating**
  PO = 1, 3, 5, 10, 25, 50, 100
  PE = 1, 3, 5, 10, 25, 50, 75, 100, 200
  N = 5, 10, 25, 50, 100
  HT = 5, 10, 25, 50, 100, 200
  TFE = 1, 5, 10, 25
- **Sizes**
  #1: 7" x 16" (17.78 cm x 40.65 cm)
  #2: 7" x 32" (17.78 cm x 81.28 cm)
  #3: 4" x 8.25" (10.16 cm x 20.96 cm)
  #4: 4" x 14" (10.16 cm x 35.56 cm)
  #5: 6 7/8" x 34" (17.46 cm x 86.36 cm)
  #6: 6 7/8" x 16" 1/2" (17.46 cm x 41.91 cm)
  #7: 5 1/2" x 16" (13.97 cm x 40.64 cm)
  #8: 5 1/2" x 22" (13.97 cm x 55.88 cm)
  #9: 5 1/2" x 33" (13.97 cm x 83.82 cm)
- **Rings**
  P = Polypropylene PolyLoc®
  PE = Polyester PolyLoc®
  N = Nylon PolyLoc®
  C = Cuno
  S = Snap ring metal
  SSS = Stainless steel snap ring
  CO = Commercial steel ring
  COP = Commercial plastic ring
  RP = Ronningen-Petter snap ring
  RPP = Ronningen-Petter plastic ring
  RPF = Ronningen-Petter flange

FELT FILTER BAGS

Standard Felt Filter Bags

Item # **BPONG10P2PC**

Type of Filter	B = Filter Bag	
Material	See specifications	N = Non-Inserted felt I = Inserted felt *(polyester only)* G = Glazed finish F = Fuzzy finish *(polyester only)*
Micron Rating	See specifications	
Cover	P = Plain PEM = Polyester multifilament NMO = Nylon monofilament	
Size	1, 2, 3, 4, 5*, 6*, 7, 8, 9	
Ring	See specifications	
Suffix	WE** = Welded Seam Construction A = Auto Construction *(seam inside bag)* C = Cotton Handle N = Nylon Handle LOOPS = Loops	

* SIZES 5, 6, AVAILABLE WITH S RING ONLY
** AVAILABLE IN SIZES 1 AND 2, POLYPROPYLENE AND POLYESTER NON-INSERTED ONLY

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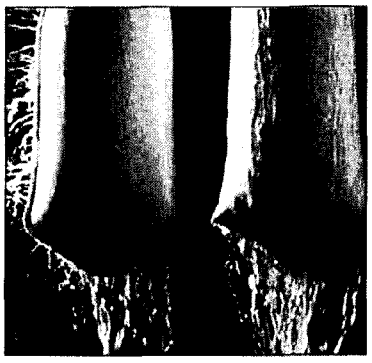
Polymicro Microfiber Filter Bags

POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | BOS MAX Filter Bags

Mesh Filter Bags



FELT FILTER BAGS
Polyweld® Filter Bags

FSI's PolyWeld® filter bags hold a distinct advantage over all types of needle-sewn bags. The welded seams completely eliminate the possibility of unfiltered liquid bypass occurring due to needle holes. The result is a tighter seam, higher bag efficiencies and improved finish product yields. In addition, the fused edges of our PolyWeld bag provide a fiber-free finish and virtually eliminate unwanted fiber migration. Since the PolyWeld bag is not constructed with thread, the possibility of silicone contamination from this source is also removed. FSI's PolyWeld filter bags are available in standard and extended life polypropylene felt, and standard and extended life polyester felt.

Features

- Welded construction of bags completely eliminates unfiltered liquid bypass from occurring due to needle holes
- Available in standard polypropylene, polyester and extended life felt for broad range of product compatibility
- Glazed finish eliminates fiber migration for clearer results
- PolyLoc® ring creates a hermetic seal that prevents liquid bypass and produces clearer results
- Polypropylene is FDA food grade compliant to government standards
- FDA Compliant Polyester felt is available (non-standard)
- Silicone free to eliminate cratering for improved surface results
- Available from stock for quick delivery

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Polymicro Microfiber Filter Bags

POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | BOS MAX Filter Bags

Mesh Filter Bags

FELT FILTER BAGS

Specifications

- **Available Materials**
  Polypropylene, Polyester Standard and FDA Compliant Polyester

  Polypropylene and Polyester Extended Life
- **Maximum Operating Temperature**
  Polypropylene: 200-220° F (93-104° C)
  Polyester: 275-325° F (135-162° C)
- **Suggested Differential Pressure**
  35 PSIG maximum — dirty
  10-15 PSIG optimum change out
- **Micron Rating**
  BPONG = 1, 3, 5, 10, 25, 50, 100
  BPENG = 1, 3, 5, 10, 25, 75, 100, 200
  BPOEX = 5, 10, 25, 50 100
  BPEEX = 1, 5, 10, 25, 50, 100
- **Sizes**
  #1: 7" x 16" (17.78 cm x 40.65 cm)
  #2: 7" x 32" (17.8 cm x 81.3 cm)
- **Plastic PolyLoc® Rings**
- **Welded Seam Construction**

Polyweld® Filter Bags

Item # **BPONG100P2PWE**

Type of Filter	**B = Filter Bag**	
Material	Standard: PONG = Polypropylene PENG = Polyester	Extended Life: POEX = Polypropylene PEEX = Polyester
Micron Rating	See specifications	See specifications
Cover	P = Plain (no cover)	
Size	1, 2	
Ring	P = Polypropylene PolyLoc® PE = Polyester PolyLoc®	
Suffix	WE = Welded Seam Construction F = FDA Compliant Polyester	

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FILTER BAGS

Slides: • POEX Filter Bags
• POEX Felt *(close up)*

FELT FILTER BAGS
Extended Life Filter Bags (POEX/PEEX)

The Extended Life filter bags (POEX and PEEX) provide outstanding performance on many types of contaminants such as gels, particles with wide ranges of sizes, and particles with various irregular shapes. The coarse, pre-filtering layer is designed to provide long service life, capturing a large amount of contaminants without excess surface loading. The POEX has been field-proven to hold up to twice the amount of contaminants as a standard felt bag, reducing waste volume and bag changes. The Extended Life filter bag is ideal for automotive coatings, chemicals, resins, edible oils and other fluid applications.

Features

- Excellent filtration on many contaminants - gels, particles with wide range of sizes and particles with irregular shapes
- A coarse inner layer, graded pore structure, greater depth than standard bags provides excellent filtration performance
- Available in polyester (PEEX) and polypropylene (POEX)
- Twice the standard dirt-holding capacity of traditional felt bags to provide longer service life, fewer change-outs and reduced waste
- Polypropylene bags are FDA compliant
- Micron rating for polypropylene 5-100; polyester 1-100
- PolyWeld® seam construction with hermetically sealing PolyLoc® ring eliminates liquid bypass
- Glazed finish eliminates unwanted fiber migration

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FILTER BAGS

Felt Filter Bags

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Extended Life Filter Bags (POEX/PEEX) | MAX PONG Filter Bags

Polymicro Microfiber Filter Bags

POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | BOS MAX Filter Bags

Mesh Filter Bags

FELT FILTER BAGS

Specifications

- **Available Materials**
  Polypropylene
  Polyester
- **Maximum Operating Temperature**
  Polypropylene: 200-220° F (93-104° C)
  Polyester: 275-325° F (135-162° C)
- **Suggested Differential Pressure**
  35 PSIG maximum — dirty
  10-15 PSIG optimum change out
- **Micron Rating**
  PEEX= 1, 5, 10, 25, 50, 100
  POEX= 5, 10, 25, 50, 100
- **Sizes**
  #1: 7" x 16" (17.78 cm x 40.65 cm)
  #2: 7" x 32" (17.8 cm x 81.3 cm)
- **Plastic PolyLoc® Rings**
- **Welded Seam Construction**

Extended Life Filter Bags (POEX/PEEX)

Item # **BPOEX10P2PWE**

Type of Filter	B = Filter Bag		
Material	PEEX = Polyester extended life felt	POEX = Polypropylene extended life felt	
Micron Rating	See specifications	See specifications	
Cover	P = Plain		
Size	1, 2		
Ring	P = Polypropylene PolyLoc®	PE = Polyester PolyLoc®	S = Steel Ring*
Suffix	WE = Welded Seam Construction		

* AVAILABLE WITH SEWN SEAMS ONLY

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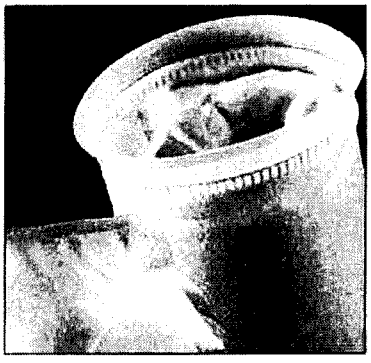
FILTER BAGS



FELT FILTER BAGS
MAX PONG

The PONG Heavy Duty Extended Life filter bag (MAX PONG) is the leader in high-efficiency, low-cost filtration. Its seamless micro-fiber graded density cartridge insert removes trace oils that frequently occur in process fluids, and provides up to four times the dirt-holding capacity of conventional polypropylene bags. Combined with its welded seam felt cover and PolyLoc® ring for elimination of unfiltered bypass, it becomes the perfect choice for uses where longer-lasting, high-efficiency filter bags are needed. The MAX PONG Heavy Duty Extended Life filter bag is ideal for continuous flow applications such as e-coat and phosphate baths, and batch applications including oils, edible oils and syrups, or any final or polishing filter requirements.

Features

- High-efficiency, low-cost filtration is ideal for continuous flow applications
- Welded seam construction eliminates unfiltered bypass due to needle holes
- Large dirt-holding capacity and lower pressure drop provide long service life
- Adsorbs smaller particles and filters wide range of particle sizes
- Pure polypropylene microfiber insert contains no sizing, bonding adhesive, resin, lubricant, silicone or antistatic chemicals
- FDA compliant to meet food grade government standards
- PolyLoc® ring creates hermetic seal to prevent liquid bypass

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Felt Filter Bags

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Extended Life Filter Bags (POEX/PEEX) | **MAX PONG Filter Bags**

Polymicro Microfiber Filter Bags

POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | BOS MAX Filter Bags

Mesh Filter Bags

FELT FILTER BAGS

Specifications

- **Available Materials**
  Polypropylene filter bag with
  100% polypropylene rigid insert
- **Maximum Operating Temperature**
  Polypropylene: 200-220° F (93-104° C)
- **Suggested Differential Pressure**
  35 PSIG maximum — dirty
  10-15 PSIG optimum change out
- **Micron Rating**
  1, 5, 10, 25, 50, 100
- **Sizes**
  #1: 7" x 16" (17.78 cm x 40.64 cm)
  #2: 7" x 32" (17.78 cm x 80 cm)
- **Plastic PolyLoc® Rings**
- **Welded Seam Construction**

MAX PONG Filter Bags

Item # **BMAXPONG52PWE**

Type of Filter	B = Filter Bag
Prefix	MAX = Maximum Life
Material	PONG = Polypropylene non-inserted felt
Micron Rating	See specifications
Size	1, 2
Ring	P = PolyLoc®
Suffix	WE = Welded Seam Construction

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FILTER BAGS

POLYMICRO MICROFIBER FILTER BAGS
POMF Filter Bags

The Polymicro microfiber filter bag (POMF) provides outstanding performance for applications requiring higher filtration efficiency. The POMF contains three layers: a pre-filtering layer that removes coarse debris; the primary layer, composed of micro pores (for efficient particle retention); and an outer cover that prevents fiber migration. The finish-free fibers are non-foaming, which is ideal for food, beverage, water, chemical and coating applications.

Features

- Proprietary polypropylene, triple-layer construction adsorbs hydrocarbons from air, gas and aqueous streams for clearer results
- Outer cover prevents fiber migration to reduce waste
- Non-foaming microfiber offers product cleanliness, high performance and longer service life
- High void volume means longer service life, higher contaminant loading and reduced waste loads
- Easy change-out reduces down time
- PolyLoc® ring creates a hermetic seal within a vessel housing to prevent liquid bypass
- POMF 1A, 2A, 10A and 25A bags are made from FDA-compliant materials
- POMF1A, 2A, 10A & 25A are available with NSF Standard 61 Certification
- Available in stock for quick, one-week delivery

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Felt Filter Bags

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Extended Life Filter Bags (POEX/PEEX) | MAX PONG Filter Bags

Polymicro Microfiber Filter Bags

POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | BOS MAX Filter Bags

Mesh Filter Bags

Specifications

- **POMF1A, 2A, 10A & 25A**
  Available with NSF Standard 61 Certification
- **POMF 1A, 2A, 10A and 25A**
  Bags are made from FDA-compliant materials (OA bags also include an additional layer of oil removing material)
- **Auto Construction**
  (Seams on Inside)
- **Available Materials**
  Polypropylene microfiber
- **Maximum Operating Temperature**
  160° F (93° C)
- **Suggested Differential Pressure**
  35 PSIG maximum — dirty
  10-15 PSIG optimum change out
- **Micron Rating**
  1A: 1 micron
  2A: 2 micron
  10A: 10 micron
  25A: 25 micron
  50A: 50 micron
  90A: 90 micron
  120A: 120 micron
  OA: Special purpose 25 micron
  (includes an additional layer of oil removing material)
- **Sizes**
  #1: 7" dia. x 16" long, 65 GPM
  #2: 7" dia. x 32" long, 125 GPM
  #3: 4" dia. x 8.25" long, 20 GPM
  #4: 4" dia. x 14" long, 35 GPM
- **Available Rings**
  (See chart on right for all available rings)

POLYMICRO MICROFIBER FILTER BAGS

POMF Filter Bags

Item # **BPOMF1AP2P**

Type of Filter	B= Filter Bag
Material	POMF = Polypropylene microfiber
Micron Rating	See specifications
Cover	Plain
Size	1, 2, 3, 4
Ring	P = PolyLoc® S = Snap fit metal RPP = Ronningen-Petter plastic ring CO = Commercial steel ring COP = Commercial plastic ring RP = Ronningen-Petter snap fit

Item # **BPOMF1APP2P61**

Type of Filter, Material, Micron Rating, Size and Ring nomenclature same for NSF 61 Certified bags. *See Above.*

Cover	PP = Special NSF Construction
Suffix	61 = NSF 61 Certified

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Extended Life Filter Bags (POEX/PEEX) | MAX PONG Filter Bags

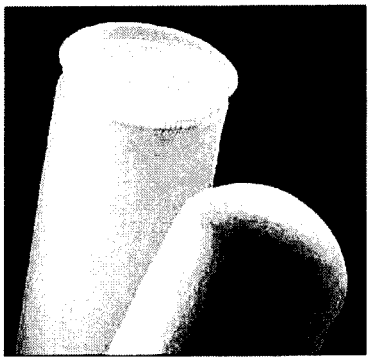
Polymicro Microfiber Filter Bags

POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | BOS MAX Filter Bags

Mesh Filter Bags



SEAMLESS-ABSOLUTE RATED
BOS Filter Bags

The BOS filter bag is a Polymicro® seamless filter bag, constructed entirely without seams. This unique material composition allows for a higher efficiency, with graded pore-size distribution creating absolute filtration. Thermally bonded microfibers create a seamless filter bag that has high tensile strength, providing superior resistance to channeling, unloading, bypass and other forms of traditional leakage that result from pulsating water.

The benefit of using this advanced filter bag is precise particle retention. The BOS filter bag is an ideal product for use in a wide variety of high-purity applications, where absolute filtration is required.

Features

- Seamless construction offers unequalled benefit of eliminating fluid bypass
- Absolute rated (98%) 3-100 microns for highest efficiency and consistent quality
- Microfiber-graded pore design provides lower initial pressure drop
- Thermally-bonded microfibers contain no sizing, bonding adhesive, resin or silicone
- FDA compliant
- Can be incinerated for easy disposal
- Available with NSF Standard 61 Certification

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Polymicro Microfiber Filter Bags

POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | BOS MAX Filter Bags

Mesh Filter Bags

SEAMLESS-ABSOLUTE RATED

Specifications

- **Available Materials**
  Polypropylene
- **Seamless Construction**
- **Maximum Operating Temperature**
  160° F (71° C)
- **Suggested Differential Pressure**
  35 PSIG maximum – dirty
  10-15 PSIG optimum change out
- **Absolute (98%) Micron Rating**
  3, 5, 10, 25, 35, 50, 75, 100
- **Sizes**
  #1: 7" x 16" (17.8 cm x 40.65 cm)
  #2: 7" x 32" (17.8 cm x 81.3 cm)
- **Plastic PolyLoc® Rings**
- **Available with NSF Standard 61 Certification**

BOS Filter Bags

Item # **BOS5PM2P**	
Code	BOS = Polymicro seamless
Micron Rating	See specifications
Cover	PM = Polypropylene
Size	1, 2
Ring	P = Polypropylene PolyLoc®

Item # **BOS5PP2P61**	
Code	BOS = Polymicro seamless
Micron Rating	See specifications
Cover	PP = Special NSF Construction
Size	2
Ring	P = Polypropylene PolyLoc®
Suffix	61 = NSF 61 Certified

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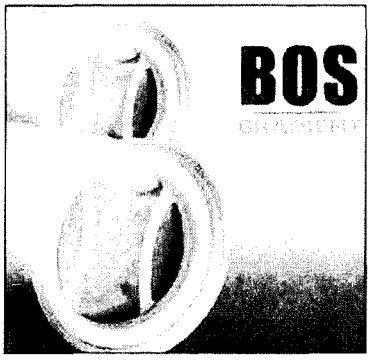
Polymicro Microfiber Filter Bags

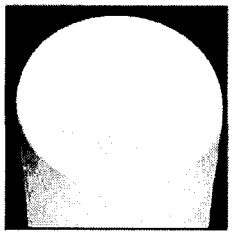
POMF Filter Bags

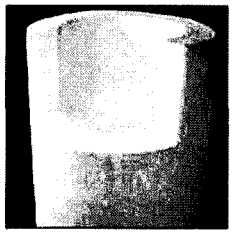
Seamless-Absolute Rated

BOS Filter Bags | **BOS Gradient Filter Element** | BOS MAX Filter Bags

Mesh Filter Bags







SEAMLESS-ABSOLUTE RATED
BOS Gradient Filter Elements

BOS Gradient Filter element is the first of its kind, with seamless design and true gradient density. This absolute rated element provides users with the depth of a cartridge and the convenience of a bag. This 100% polypropylene microfiber product adsorbs up to 16 times its own weight in hydrocarbons (oils) and will last up to 18 times the life of other products (depending on particle distribution and application).

Features/Benefits

Gradient Density provides:

- Up to 18 times extended life compared to other products, dependent upon particle distribution and application
- Longer life means fewer bag changes which results in lower labor costs and less loss of product
- Not compressible in operation providing greater dirt holding capacity
- Designed for typical broad particle distribution applications.
- Will allow more efficient filtration (lower micron) without sacrificing product life

Polypropylene Microfiber Material

- Adsorbs up to 16 times its own weight in hydrocarbons (oils)
- Inventory reduction. Eliminates need for stocking "oil" bags
- Thermally bonded, with no lubricants or surface active agents
- Available with NSF Standard 61 Certification

Fits existing FSI standard basket

- No retrofit costs

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FILTER BAGS

Felt Filter Bags

Standard Felt Filter Bags | Polyweld® Filter Bags |

Extended Life Filter Bags (POEX/PEEX) | MAX PONG Filter Bags

Polymicro Microfiber Filter Bags

POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | **BOS Gradient Filter Element** | BOS MAX Filter Bags

Mesh Filter Bags

SEAMLESS-ABSOLUTE RATED

Specifications

- **Available Materials**
  Polypropylene Microfiber
- **Seamless Construction**
- **Maximum Operating Temperature**
  160° F (71° C)
- **Suggested Differential Pressure**
  20 PSIG maximum – dirty
  10-15 PSIG optimum change out
- **Absolute (98%) Micron Rating**
  3, 5, 10, 25, 50, 75, 100, 125
- **Sizes**
  #2: 7" X 32" (17.8 cm X 81.32 cm)
- **Thermally Bonded Ring**
- **Available with NSF Standard 61 Certification**

BOS Gradient Filter Elements

Item # **BOSG50PM2P**

Code	BOS = Seamless Polypropylene
Type of Filter	G = Gradient
Micron Rating	See specifications
Cover	PM = Polypropylene
Size	2
Ring	P = Polypropylene

Item # **BOSG50PP2PG61**

Code	BOS = Seamless Polypropylene
Type of Filter	G = Gradient
Micron Rating	See specifications
Cover	PP = Special NSF Construction
Size	2
Ring	P = Polypropylene
Suffix	G61 = NSF 61 Certified

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SEAMLESS-ABSOLUTE RATED BOS MAX Filter

The innovative BOS MAX heavy duty seamless filter bags have an advanced design that provides extended life and increased efficiency with a greater depth filtration than conventional filter bags. It provides all of the benefits of the standard BOS filter bag with a semi-rigid microfiber insert that increases the dirt holding capacity of the filter while providing the absolute filtration of the BOS filter bag.

Features

- BOS MAX Heavy Duty Extended Life Bags contain a semi-rigid, microfiber cartridge insert for up to four times the life of standard BOS bags and are ideal for high-purity applications
- Absolute rated 3-100 microns for high efficiency and consistent quality
- Thermally-bonded microfibers contain no sizing, bonding adhesive, resin or silicone
- Contaminant free to eliminate craters providing better surface results
- PolyLoc® ring creates hermetic seal within a vessel housing to prevent liquid bypass

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POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | **BOS MAX Filter Bags**

Mesh Filter Bags

SEAMLESS-ABSOLUTE RATED

Specifications

- **Available Materials**
  Polypropylene
- **Seamless Construction**
- **Maximum Operating Temperature**
  160° F (71° C)
- **Suggested Differential Pressure**
  35 PSIG maximum – dirty
  10-15 PSIG optimum change out
- **Absolute (98%) Micron Rating**
  3, 5, 10, 25, 35, 50, 75, 100
- **Sizes**
  #1: 7" x 16" (17.8 cm x 40.65 cm)
  #2: 7" x 32" (17.8 cm x 81.3 cm)
- **Plastic PolyLoc® Rings**

BOS MAX Filter Bags

Item # **BOS5PM2PMAX**

Code	BOS = Polymicro seamless
Micron Rating	See specifications
Cover	PM = Polypropylene
Size	1, 2
Ring	P = Polypropylene PolyLoc®
Suffix	MAX = Maximum life

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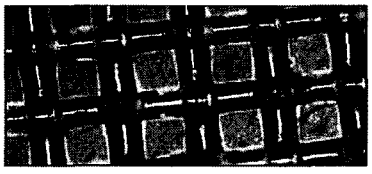
FILTER BAGS

MESH FILTER BAGS

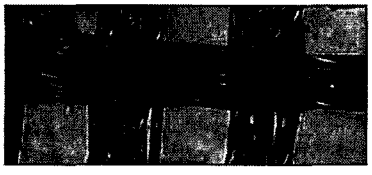
All FSI mesh bags are constructed using a woven or knitted fabric. Whether your particular environment requires a single filament mesh that provides excellent strength with no fiber migration, or a woven multi-strand mesh designed for economical filtration bags, we have your needs covered. The yarn in all of our mesh filter bags is abrasion resistant, compatible with a broad range of chemicals, unaffected by metal fatigue or corrosion, and boasts high tensile strength.

Features

- Available in nylon monofilament, polyester multifilament and polypropylene monofilament offering broad range of chemical compatibility and price ranges
- Monofilament mesh bags provide extra strength and abrasion resistance
- Precision mesh materials produce predictable results for consistent performance
- Offered in standard and custom sizes to provide a perfect fit for standard and unique applications
- Offered in micron ratings 1-1500 with plastic and metal rings for versatility
- Silicone free to prevent cratering for a better surface finish



Monofilament Mesh is a woven fabric where each thread is a single filament, boasting excellent strength with no fiber migration.



Mutifilament Mesh is a woven fabric where each strand consists of many smaller diameter threads.

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FILTER BAGS

FILTER BAGS

Specifications

- **Available Materials**
  Nylon Monofilament
  Polyester Multifilament
  Polypropylene Monofilament
- **Micron Rating**
  NMO = 1, 5, 10, 25, 35, 45, 55, 65, 75, 100, 125, 150, 175, 200, 250, 400, 600, 800, 1200

  PEM = 75, 100, 125, 150, 200, 250, 400, 800, 1500

  PMO = 100, 150, 200, 250, 300, 600, 800
- **Sizes**
  #1: 7" x 16" (17.78 cm x 40.65 cm)
  #2: 7" x 32" (17.78 cm x 80 cm)
  #3: 4" x 8 1/4" (10.16 cm x 20.96 cm)
  #4: 4" x 14" (10.16 cm x 35 cm)
  #5: 6 7/8" x 34" (17.46 cm x 86.36 cm)
  #6: 6 7/8" x 16 1/2" (17.46 cm x 41.91 cm)
  #7: 5 1/2" x 16" (13.97 cm x 40.64 cm)
  #8: 5 1/2" x 22" (13.97 cm x 55.88 cm)
  #9: 5 1/2" x 33" (13.97 cm x 83.82 cm)

  5GP: 5 Gallon Pail (19L)
  12X18D: 12" x 18" Drawstring (30.48 cm x 43.2 cm)

  18X24D: 18" x 24" Drawstring (45 cm x 60.96 cm)

  18X28D: 18" x 28" Drawstring (45 cm x 71.12 cm)

MESH FILTER BAGS

Item # **BPEM100P1PA**

Type of Filter	B = Filter Bag
Material	NMO = Mesh, Nylon monofilament PEM = Mesh, Polyester multifilament PMO = Mesh, Polypropylene monofilament
Micron Rating	See specifications
Cover	P = Plain (no cover)
Size	1, 2, 3, 4, 5, 6, 7, 8, 9 5GP (5 Gallon Pail) 12x18D, 18x24D, 18x28D (D = Draw-string)
Ring	P = Polypropylene PolyLoc® PE = Polyester PolyLoc® C = Cuno N = Nylon PolyLoc® S = Snap fit metal SSS = Stainless steel snap fit CO = Commercial steel ring COP = Commercial plastic ring
Suffix	WE = Welded Seam Construction *(available on sizes 3 & 4 NMO only)* A = Auto Construction LOOPS = Loops C = Cotton Handle N = Nylon Handle

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POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | BOS MAX Filter Bags

Mesh Filter Bags

Filter Fabric Qualities

Fabric	Cotton	Polyester	Glass	Nylon	Nomex	Polypropylene
Specific Gravity	1.55	1.38	2.56	1.14	1.14	0.9
Tensile Strength	44 - 109	64 - 124	200 - 215	58 - 128	58 - 128	50 - 85
Abrasion & Flex	Fair	Very Good	Poor	Excellent	Very Good	Very Good
Weak Acids	Poor	Very Good	Excellent	Fair	Fair	Excellent
Strong Acids	Poor	Good	Good	Poor	Poor	Excellent
Weak Alkali	Excellent	Good	Fair	Excellent	Excellent	Excellent
Strong Alkali	Excellent	Poor	Poor	Excellent	Excellent	Excellent
Solvents	Good	Good	Excellent	Good	Good	Fair
Temperature (F°)	200 - 240°	275 - 325°	500 - 600°	275 - 300°	400 - 450°	200 - 220°

Filter Bag Data

Bag Size	1	2	3	4	X01	XL
Surface Area Per Bag (ft2/m2)	2.0/0.19	4.4/0.41	0.5/0.05	1.0/0.9	2.0/0.19	5.3/0.49
Volume Per Bag (gal*/liter)	2.1/7.9	4.6/17.3	0.37/1.4	0.67/2.5	2.1/7.9	5.5/0.51
Bag Diameter (inch/cm)	7.0/17.8	7.0/17.8	4.0/10.2	4.0/10.2	6.0/15.2	9.25/23.5
Bag Length (inch/cm)	16/40.65	32.0/81.3	8.25/20.9	14.0/35.5	22/55.9	32/81.3
FSI Filter Vessel Model Number	FSPN-40 CBFP-11	FSPN-85 FSPN-250 CBFP-12 and all multi-hole vessels	FSPN-20 BFN-13	FSPN-35 BFN-14	X100B	XL234

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POMF Filter Bags

Seamless-Absolute Rated

BOS Filter Bags | BOS Gradient Filter Elements | BOS MAX Filter Bags

Mesh Filter Bags

Flow Rates of Filter Bags

In most filtration applications, fluid viscosities do not exceed 50cps. Using the following Flow Rates Per #2 Size Bag as a guide, the suggested flow rates should result in a CLEAN Pressure Drop under 2 PSID.

Material Used	Micron Rating	Flow Rate (GPM)
Felt	1 & 3	80 GPM/#2 BAG
Felt	5 THRU 200	120 GPM/#2 BAG
Mesh	1, 3, 5 & 100	100 GPM/#2 BAG
Mesh	25 THRU 100	125 GPM/#2 BAG
Mesh	150 THRU 800	150 GPM/#2 BAG
Microfiber	1A and 2A	60 GPM/#2 BAG
Microfiber	10A, 25A, 90A & 0A	80 GPM/#2 BAG

Micron Rating & Availability

Micron Availability		Micron Rating																								
Fiber	Material	1	3	5	10	25	35	50	65	75	90	100	120	125	150	175	200	250	300	400	600	700	800	1200	1500
Polyester Felt	Felt	■	■	■	■	■		■		■		■					■								
Nylon	Felt			■	■	■		■				■													
Polypropylene	Felt	■	■	■	■	■		■				■													
Teflon®	Felt	■		■	■	■																			
High Temperature	Felt			■	■	■		■				■					■								
Polypropylene	Microfiber	■	■		■	■		■			■		■												
Nylon	Monofilament Mesh	■		■	■	■	■	■	■	■		■		■	■	■	■	■	■	■	■		■	■	
Polypropylene	Monofilament Mesh											■			■		■	■	■		■		■		
Polyester	Multifilament Mesh									■		■		■	■		■	■	■	■	■		■		■

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TAB #5

INSTALLATION, OPERATION & MAINTENANCE MANUAL

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

FSI

FILTER VESSELS

IMPORTANT! READ AND UNDERSTAND ENTIRE MANUAL BEFORE OPERATING THIS VESSEL

This manual contains important revised information and supersedes all prior publications.

SAFETY

This manual has been prepared for the safe installation, operation, and maintenance of FSI pressure vessels. Warning labels have been reprinted in this manual. The application of warning labels to vessels is based upon vessel type and adequate space to affix labels. **Warning labels are not a substitute for reading and understanding this manual.**

LABEL FORMAT

A. Hazard Alert Word
B. Hazard and Consequence Statement
C. Instruction Statement

A. → ⚠ WARNING!

B. → Improper use of this vessel can cause serious injury, blindness or death.

Read the vessel ASME code plate, warning labels and this instruction manual for the installation, operation

C. → and maintenance of filter vessels before installation and operation.

All labels must be replaced when legibility is lost or visibility is blocked. Labels have a part number in the lower right hand corner for reordering.

PROTECTIVE CLOTHING

Before operating this vessel, operator should wear protective clothing including protective gloves and face shield. If handling hot liquids, operator should wear heat-resistant clothing such as Nomex garments to prevent possible burning or scalding. Refer to Material Safety Data Sheet (MSDS) for specific instructions for handling the liquid as supplied by the manufacturer of the material.

INSTALLATION

MOVING VESSEL

A. Mount vessel securely to a skid and move skid with fork lift.

B. Vessel can be lifted by means of a multi-legged sling chain with a safety hook attached to the end of each leg. Attach the hook of each leg to an eyenut and space legs around vessel equally. (See Figure 1)

PLACEMENT OF MANUAL FOR THE INSTALLATION, OPERATION AND MAINTENANCE OF FILTER VESSELS

The end user is to locate one manual for the installation, operation, and maintenance of filter vessels on each vessel at final installation so it is visible and accessible to an operator.

MOUNTING

All vessels must be properly bolted to the floor before moving the lid. This will assure vessel stability and prevent tipping.

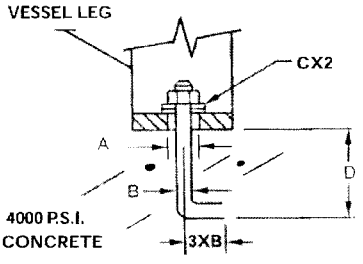
EXISTING CONCRETE FLOOR

For vessels placed on existing floors, use the following or an equivalent:
Red 1 – Chem-threaded anchor rod
Red 1 – Chem capsules

Refer to manufacturer's literature for part number and installation instructions.
ITW Ramset/Red Head
U.S. 12 & Liberty Trail
Michigan City, IN 46360
Phone Number: (219) 874-4217
Fax Number: (219) 874-7035

For vessel weight, check the bill of lading.

NEW FLOOR CONSTRUCTION

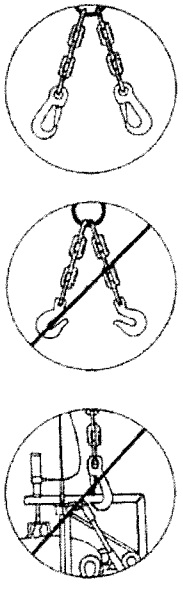


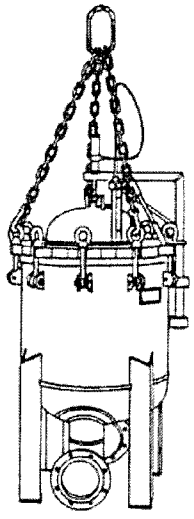
⚠ WARNINGS

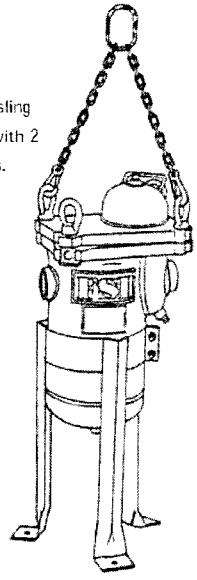
Never use the lid support arm to lift vessel.

Damage to lift assembly will result.

Vessel may drop.







Two-legged sling for vessels with 2 or 4 eyenuts.

FIGURE 1

Three-legged sling equally spaced for vessels with 3 eyenuts, and 5 or more eyenuts. **Never use lid support (Davit) arm to lift vessel.**

A	B	C			D	
Mounting Plt. Hole Diameter	Anchor Thread Diameter	American Standard Plane Washer			Embed-ment	Minimum Pullout
		ID	OD	THK		
17/32 in 13.4 mm	3/8 9.5	7/16 11	1 25.4	.10 2.5	3 76	4000 lb 1814 kg
1 in 25.4 mm	1/2 12.7	9/16 14.3	1-3/8 34.9	.13 3.3	4 101	7500 lb 3402 kg

INSTALLATION

PIPING

The piping material used should be the same as the base material of the vessel. It should have a rating equal to or greater than the pressure and temperature rating of the vessel.

RELIEF VALVE

It is the responsibility of the end user to protect system components, such as the FSI Filter, from being over pressurized. This can be achieved by installing a system relief valve.

PRESSURE GAUGE, TEMPERATURE GAUGE, AND VENT VALVE

FSI does not supply the vessel pressure gauge, temperature gauge, or the vent valve. It is the responsibility of the end user to obtain, install and maintain the proper gauge, indicating vessel temperature and internal vessel pressure. (Refer to Figure 2, Page 5)

GASKET

Note: The operating temperature of a gasket material changes with respect to the fluid temperature and chemical concentration.

Each FSI gasket is labeled to show the vessel type it will fit and the gasket material.

LABEL FORMAT

EXAMPLE:

VESSEL TYPE → FS 3500, 3000, 2500, 30021
FSP 4000

GASKET MATERIAL → Viton®

SPECIAL INSTRUCTION LABELS

Gasket installed with lips toward center of vessel.

Use only FSI approved gaskets.

SYSTEM CHECK

It is advisable to hydro-statically test this vessel with water to determine if there are any leaks in the system.

Should there be any questions or if assistance is needed in the installation, operation or maintenance of this vessel, please contact the Engineering Department, Filter Specialists, Inc., P.O. Box 735, Michigan City, IN 46360.
Phone: 800-348-3205
Fax: (219) 877-0639

⚠ WARNINGS

Gaskets can fail, causing serious injury and/or blindness.

Gasket material must be chemically and temperature compatible with fluid being filtered.

Viton® is a registered trademark of Dupont Dow Elastomers

MANUAL LIFTING DEVICE:
Refer to Figure 2

This device consists of a threaded stud (Item 16) welded to the lid and an internally threaded crank handle (Item 15).

A. Keep threads clean and well lubricated with a lubricant acceptable for the customer's application.

B. Threads should be inspected periodically for wear and tear. Should the wear become excessive, parts should be replaced with authorized FSI parts.

CRANK HANDLE – P/N 26004
Specify carbon steel OR stainless steel vessel
*THREAD STUD – P/N 20521
Specify carbon steel OR stainless steel vessel

C. Lubricate the support and swivel blocks (Item 14) of the Davit Arm which supports the lid when opened.

HYDRAULIC LIFTING DEVICE:
Refer to Figure 2

FSI offers three basic lid lifting cylinder assemblies. See Table 1 for replacement parts.

A. Maintain the hydraulic reservoir in the dump (Item 12) with hydraulic fluid. Refer to the manufacturer's maintenance literature (See Pages 6-7). The pump relief valve is factory set to prevent excess pressure (1800 PSI).

B. Check the hydraulic hoses (Item 13) periodically for tears, abrasion and kinks. Replace if needed.

C. There are two (2) nuts attached to the end of the cylinder rod. The first is a jam nut (GR5) (Item 10) and the second is a lock nut with a nylon insert (Item 11). If item 11 is removed, it must be replaced with a new one to keep it from vibrating loose.

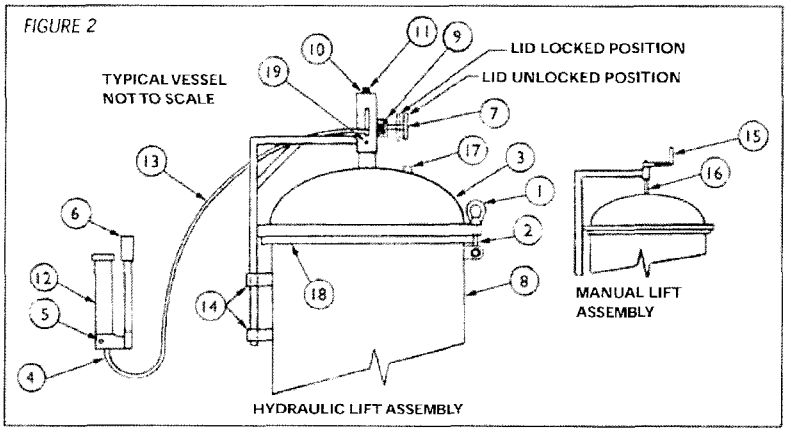
D. On the lift cylinder assemblies, the lid lowering rate can be set by adjusting the flow control valve mounted in the cylinder end cap. Adjust speed so that the lid comes down slowly. (Item 19, Figure 2)

*Threaded stud must be welded by an authorized ASME code weld facility. The vessel must be re-inspected after welding by an authorized inspector.

TABLE 1 **REPLACEMENT PART LIST FOR LID-LIFTING DEVICE**

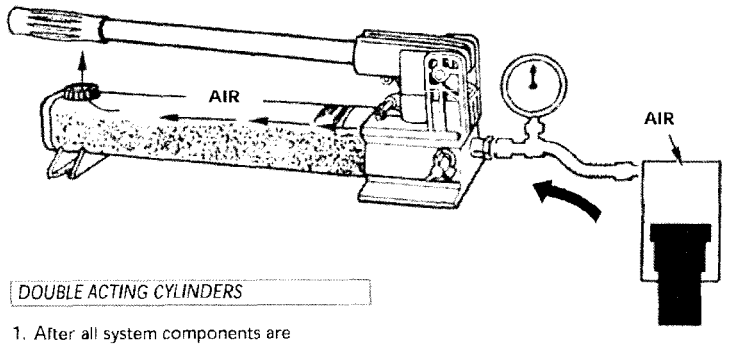
General application for vessels rated at 150 PSI or less and NO corrosion allowance. Please have FSI verify the actual lift cylinder assembly by matching it with the vessel serial number for all other vessels.					**Grade #5**	
MODEL NO.	LIFT CYLINDER ASSEMBLY PART NO.	HYDRAULIC PUMP PART NO.	HYDRAULIC HOSE PART NO.	HYDRAULIC CYLINDER PART NO.	LOCK NUT	LOCK NUT WITH NYLON INSERT
252-3500	19987	26220	26222	3/4 BORE X 3 STK # 26010	1/4-28 # 25115	1/4-28 # 25116
4000-5000	402184	26221	26222	1-1/8 BORE X 3 STK # 26218	3/8-24 # 25117	3/8-24 # 25118
5500 and up	404342	26221	26222	1-3/8 BORE X 3 STK # 26209	# 25117	# 25118

FIGURE 2



ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Eye Nut	11	Lock Nut
2	Lid Restraining Bolts	12	Hand Pump
3	Lid	13	Hose
4	Pump Hose End	14	Support Blocks Davit Arm
5	Pump Release Valve	15	Handle
6	Pump Handle	16	Stud
7	Safety Pin	17	Vent
8	Vessel Body	18	Collar Plate
9	Spring	19	Flow Control Valve in Cylinder End Cap
10	Jam Nut		

OPERATION



REMOVAL OF AIR

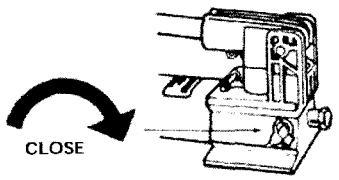
When hoses, cylinders and other components are connected to build a system, air will be trapped in the system. To function properly, the air in the system must be removed. However, the hand pump does require air in the reservoir to prevent a vacuum. If the pump reservoir is totally filled and the vent cap is closed tight, the vacuum created will prevent oil flow out of the pump. Fill reservoirs only to level indicated on the pump end cap.

SINGLE ACTING CYLINDER SYSTEMS

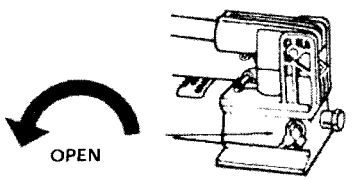
1. After all system components are connected to the hand pump, check reservoir oil level. Fill to indicator mark on the end cap. Replace the fill cap and be sure it is closed (not in vent position).
2. Turn pump release valve to closed position. Operate hand pump until cylinder plunger is completely extended.
3. Invert cylinder (plunger end down). Open the pump release valve; as the plunger retracts, the air in the system will be forced into the pump reservoir and replaced by oil. Close the release valve.
4. Turn the cylinder upright. Operate the pump to cycle the cylinder plunger. If air is out of the system, the plunger will advance and retract smoothly. If the plunger is erratic, repeat steps 1 through 4.
5. Open the pump fill cap and check the oil level. Fill to the indicator mark on the end cap.

DOUBLE ACTING CYLINDERS

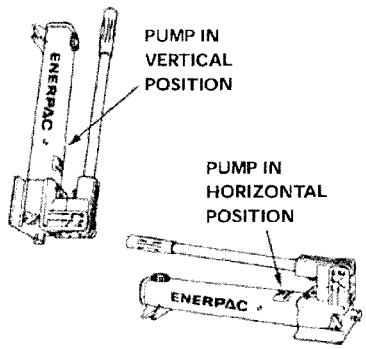
1. After all system components are connected to the hand pump, check pump reservoir oil level. Fill to the indicator mark on the pump end cap. Replace end cap and tighten (not in vent position).
2. Place hand pump in a place where it will be higher than the hydraulic cylinder. Lay the hydraulic cylinder on its side with the couplers facing up.
3. Close the pump release valve (finger tight). Operate the pump to advance and retract the cylinder plunger three or four times.
4. Open pump release valve to retract the cylinder plunger. Check pump oil level. Add oil as necessary to restore correct level in the reservoir.



1. **To advance cylinder plunger, turn pump release valve clockwise as illustrated and close fingertight.** CAUTION: To avoid release valve damage, do not use tools to tighten valve.
2. Operate pump handle.



3. To retract cylinder plunger, turn release valve counterclockwise as illustrated.
4. Pump can be operated from horizontal or vertical (as long as hose end is down).



MAINTENANCE

To check oil level in pump, open pump release valve to allow cylinder (if connected) to return to pump. Remove fill cap. Add ENERPAC hydraulic oil until level with mark on rear cap. **DO NOT** overfill. To function properly, all hand pumps require air in the reservoir. If oil level is too high, the pump will not operate. If hydraulic system is used under extremely dirty conditions, frequently drain pump completely. Refill with clean ENERPAC hydraulic oil. Install fill cap and close it.

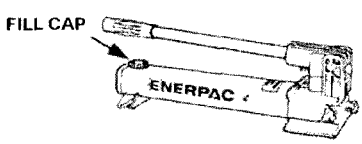
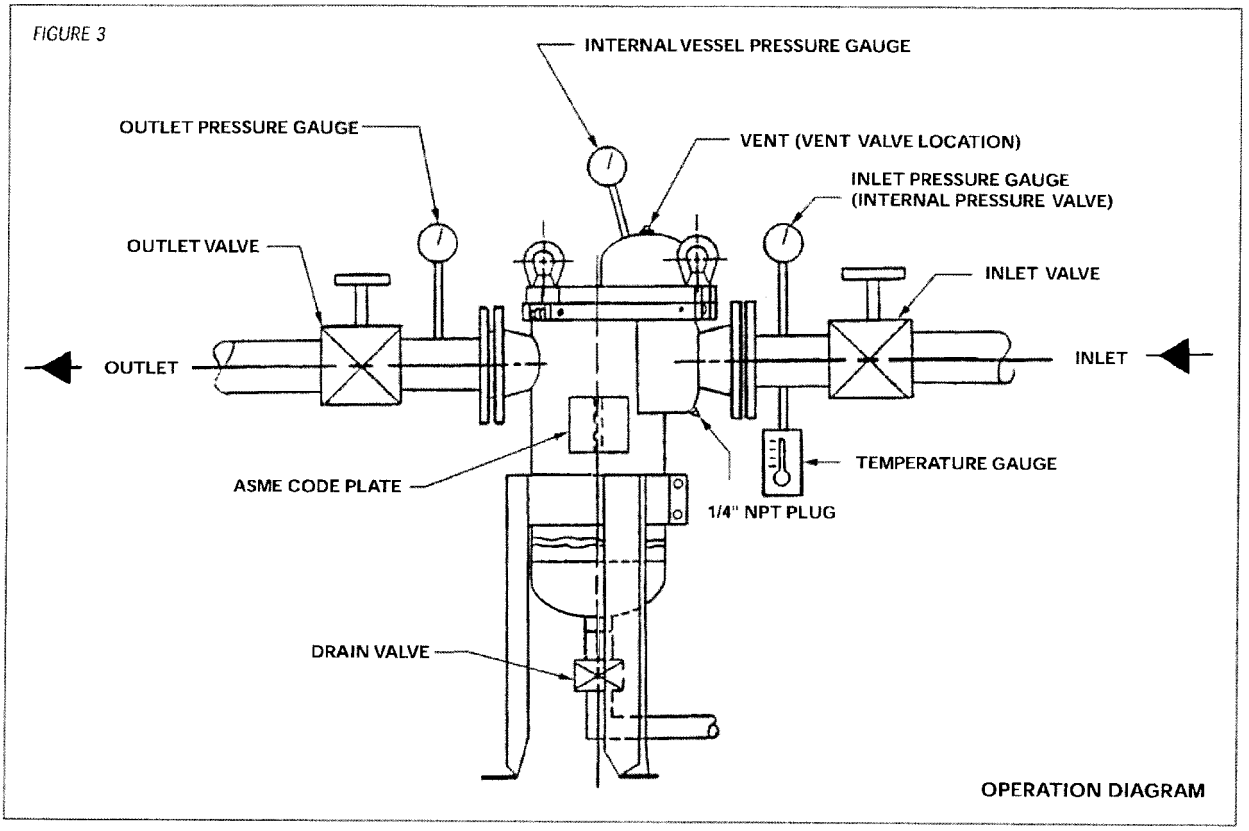


FIGURE 3

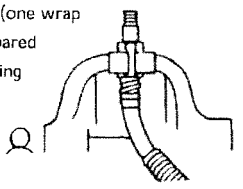


OPERATION DIAGRAM

REPLACING COUPLER

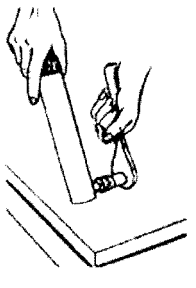
ASSEMBLING TO HOSE

Clamp the hexagon nut of the hose fitting in a vise as illustrated. Remove the old coupler or rigid adaptor. Install new coupler clockwise on to hose fitting to a firm fit. Use high quality thread sealer on threads (one wrap only). A kit has been prepared for the purpose of replacing a worn out seal and may be obtained at your nearest authorized technical service center.



ASSEMBLING SPEED-D-COUPLERS TO CYLINDER

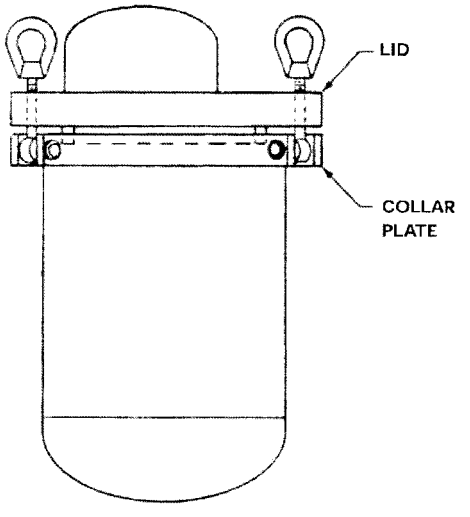
Use wrench to unscrew old coupler half from cylinder. Thread new coupler to cylinder and tighten firmly. Use a high quality thread sealant on coupler thread (one wrap only).



LIDS WITH NO LIFT MECHANISM — lid nuts should be unscrewed far enough to allow the lid to rest on the gasket freely and parallel to the vessel collar plate.

FIGURE 4

NOTE: POSITION OF EYE NUTS PRIOR TO TIGHTENING



⚠ WARNING

Hot and/or chemically active liquids can cause serious injury and blindness.

Before operating this vessel, operator should wear protective clothing, including protective gloves and face shield. If handling hot liquids, operators should wear heat resistant clothing such as Nomex garments, to prevent possible burns.

⚠ WARNINGS

Do not exceed the operating limits of this vessel and gasket.

Serious injury or death can result if limits are exceeded.

Refer to the Material Safety Data Sheet (MSDS) for specific information on material. The MSDS is supplied by the manufacturer of the material.

For maximum pressure, check ASME code plate of vessel.

For maximum temperature of vessel, check ASME code plate.

For maximum operating temperature of gasket, call FSI, (219) 879-3307. The maximum gasket operating temperature can change with changes in fluid, chemical composition, temperature and pressure.

Note: Do not exceed the lesser of the two maximum temperatures.

I. INITIAL CLOSING OF THE VESSEL

Vessel must be isolated from system – pump turned off and locked out; inlet and outlet valves closed. Refer to Figure 3, Page 7.

A. Insert basket into seat. The basket rim flange must cover entire opening. If not, the basket may cock and be forced through the opening under pressure. Refer to Figure 5, Page 9.

B. Insert new filter elements, making sure that all bags or cartridges are properly seated. Snap ring bags must have the selvage on the inside of the bag to prevent bypass. Refer to Figure 5, Page 9.

C. Inspect gasket groove and gasket. Refer to Figure 6, Page 10. If gasket is nicked or worn, replace only with FSI replacement parts. For ordering replacements, refer to vessel model number and serial number.

D. Insert gasket, making sure gasket is not twisted, and if a lip-type gasket is used, the lips must point inward as shown in Figure 6, Page 10. If gasket wants to roll out of groove, stretch gasket slightly by hand, inspect gasket seam, and refit into groove.

E. Position lid for closing.

1. Lids with no lift mechanism — lid nuts must be unscrewed far enough to allow the lid to rest on the gasket freely and parallel to the vessel collar plate. Refer to Figure 4, Page 7.

2. Lids with a crank—Refer to Figure 3, Page 7.

   a. Rotate lid over vessel so the eye nut and bolt bracket are in line.

   b. Turn crank to lower lid.

   c. Realign brackets, if necessary, before lid sets down on vessel body.

3. Lids with hydraulic lifts—Refer to Figure 2, Page 5.

   a. Refer to steps E2a, E2b, E2c.

   b. Hold hand pump in vertical position with hose end down and raise lid slightly.

   c. With one hand, pull safety pin out to disengage it. Hold in this position.

   d. With other hand, crack open the pump release valve.

   e. Lower lid until it almost touches gasket, release safety pin, align eyebolt and eyenut brackets, and continue to lower lid until it rests freely on the gasket.

⚠ WARNINGS

A falling lid can cause serious injury and loss of limb.

Never place hands, fingers, or limbs between lid and vessel.

F. Engage all bolts. Hand tighten nuts. Refer to Figure 7, Page 10.

G. Moderately torque nuts at 180° to each other, rotating around the vessel until tight. Refer to Figure 7, Page 10.

H. Close vent valve. Refer to Figure 3, Page 7.

I. Turn pump on.

J. Open inlet valve slowly and observe for leaks. Should any leaks appear, close valve immediately and continue with part II. Refer to Figure 2, Page 5.

K. If necessary, fill vessel with product by evacuating the air via the vent valve.

L. Open outlet valve. Refer to Figure 3, Page 7.

II. OPENING AND CLOSING OF THE VESSEL LID

Adhere to the following sequence. Refer to Figure 2, Page 5.

⚠ WARNING

Do not open a vessel under pressure.

Escaping fluid can cause serious injury and blindness.

A. Before opening vessel:

1. Turn off pump and lock it out.
2. Close inlet and outlet valve.

B. Open vent valve. Make sure that the valve outlet is so piped that escaping fluids are so directed to prevent personal injury of the operator and surrounding area.

C. Check pressure gauge to make sure that the isolated vessel's internal pressure is zero PSI gauge. Refer to Figure 3, Page 7.

D. Drain fluid from vessel by gravity flow through drain valve. Close drain valve. Evacuation can be assisted with pressurization. Refer to "Blow Down Procedure," Page 11.

E. Loosen lid nuts and swing nuts and bolts free of lid.

F. Lift lid.

Lids with hydraulic lifts:
Hold hand pump vertically with hose end down. Close pump release valve and pump until lid lifts high enough to engage spring loaded safety pin.

⚠ WARNING

Safety pin must be engaged when lid is open.

A falling lid can cause serious injury and loss of limb.

G. Rotate lid off of vessel.

H. Remove filter bag or cartridges with caution.

I. Inspect basket for roundness and flange condition.

J. Verify that basket and bag-bearing surfaces are clean and free of nicks.

K. Insert new filter elements, making sure that all bags or cartridges are properly seated. Snap ring bags must have selvage on inside of bag. Refer to Figure 5.

L. Remove gasket; clean gasket groove. If gasket is worn or nicked, replace only with FSI replacement parts. For correct replacements, refer to the vessel model number and serial number. Use only FSI authorized gaskets.

M. Rotate lid over vessel and align bolt and nut brackets.

N. Close lid. Same as E1, E2, and E3, Page 8.

O. Same as I.F.

P. Same as I.G.

Q. Same as I.H.

R. Same as I.L.

S. Same as I.J.

T. Same as I.K.

U. Same as I.L.

If a vessel still leaks, depressurize vessel and retorque bolts according to step I.G., Page 8. If vessel leakage continues, call FSI.

FIGURE 5

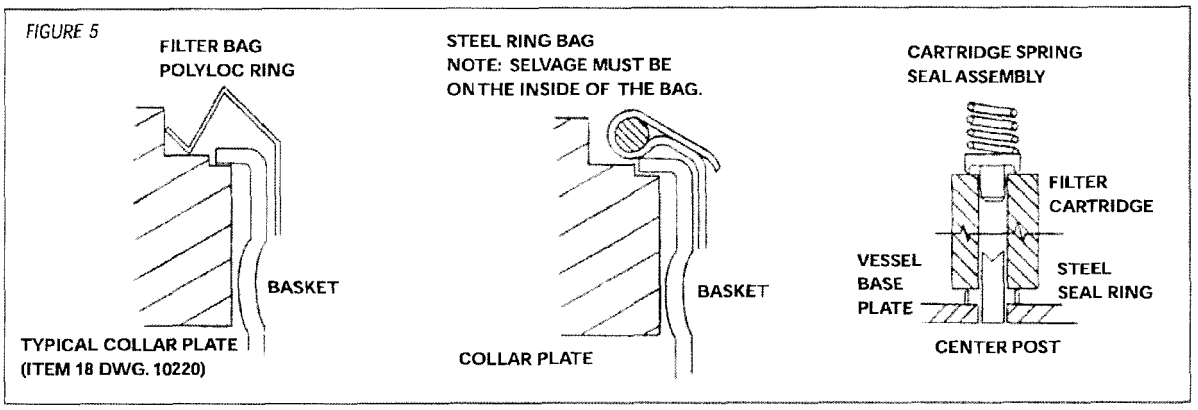
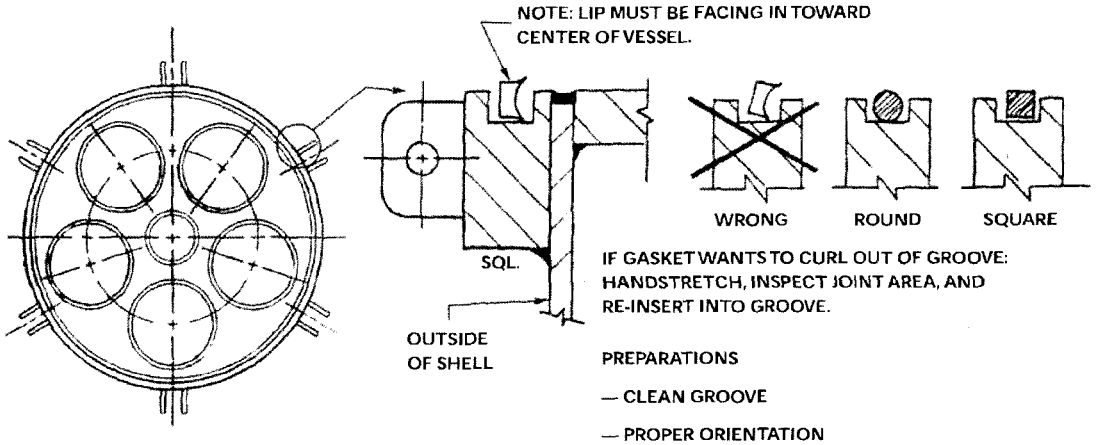
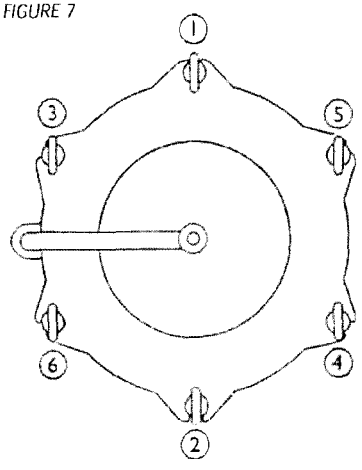


FIGURE 6



GASKET INSTALLATION

FIGURE 7



NOTE: EXCESSIVE TORQUE SHOULD NOT BE NECESSARY WHEN USING FSI SELF-ENERGIZING GASKETS.

BOLT TIGHTENING SEQUENCE

Standard FSI vessels are designed to use gaskets made of self-energizing material, such as BUNA, EPR, or Viton®. The torque requirements to seal a vessel with such gaskets is minimal. It is, therefore, not necessary to use extensions or cheater bars when torquing eyenuts. FSI does not recommend the use of gaskets made of non-energizing material or rope-type gaskets. They may require excessive tightening torque. Due to the many variables that influence torque, exact values are not given herein. For general torque values applicable to your particular vessel, call FSI at 1-800-348-3205.

BLOW DOWN PROCEDURE

To aid filter element changes, the liquid in the vessel can be evacuated prior to the change.

1. Close inlet valve. Refer to Figure 3, Page 7.
2. Close outlet valve.
3. Open vent valve.
4. Check gauge — internal pressure must be zero.
5. Open drain valve.
6. Close vent.
7. Connect gas to vessel via vent valve. Use only if gravity evacuation does not yield desired results.
8. Open vent valve slowly.
9. Close vent valve metering out fluid.
10. Disconnect gas.
11. Close drain valve.
12. Make sure internal pressure is zero and continue with opening instructions.

FILTER IN OPERATION

Once the filter is operational and in use, the differential pressure should be checked regularly. It is suggested that when the differential pressure across the filter elements reaches a predetermined amount, the elements be changed. If the differential pressure suddenly drops, stop filtration immediately and check bags for proper seal or rupture.

⚠ WARNINGS

The gas used for blow down must be stable in the environment of the fluid being evacuated.

⚠ WARNINGS

- **PRESSURE GAUGE AND VENT VALVE MUST BE INSTALLED IN ACCESS HOLE.**
- **FAILURE TO INSTALL PRESSURE GAUGE AND VENT CAN RESULT IN SERIOUS INJURY WHEN OPENING THE LID.**
- **DIRECT VENT VALVE EXHAUST TO A SAFE PLACE.**

1289 **PT. NO. 35001**

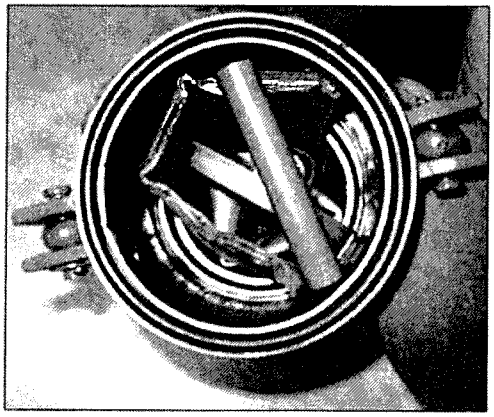
⚠ WARNINGS

- **VESSEL MAY TIP IF NOT PROPERLY BOLTED TO FLOOR.**
- **A TIPPING VESSEL CAN CAUSE SERIOUS INJURY.**
- **PROPERLY BOLT VESSEL TO FLOOR BEFORE ROTATING LID.**
- **REFER TO MANUAL FOR THE INSTALLATION, OPERATION, AND MAINTENANCE OF FILTER VESSELS.**

1289 **PT. NO. 35002**

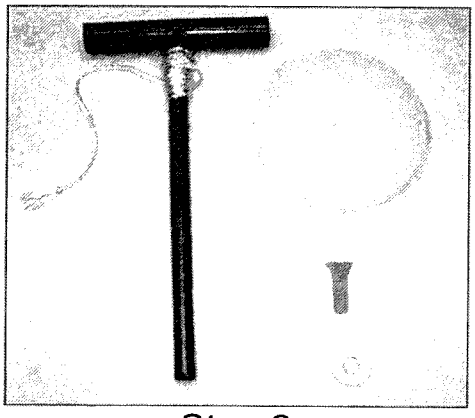
T-HANDLE POLYLOC® INSERT TOOL

ASSEMBLY INSTRUCTIONS



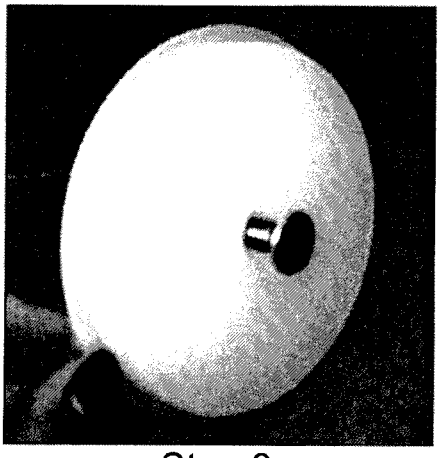
Step 1

Open filter.



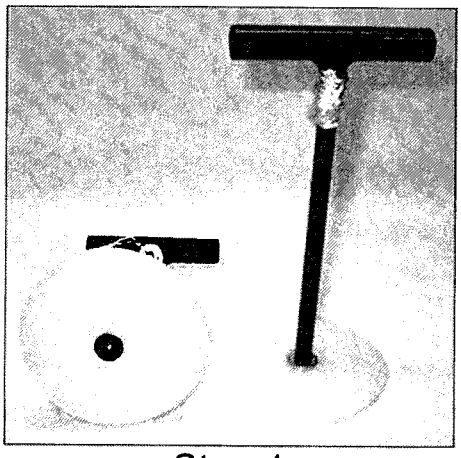
Step 2

Pull out T-handle, Polyloc® tool, instructions, and any cardboard inside filter. Remove the socket cap screw and washer from the bottom of the T-handle.



Step 3

Place socket cap screw into the Polyloc® tool through the chamfered side so that the socket cap screw sits flush with the Polyloc® tool.



Step 4

Slide washer over end of socket cap screw. Tighten socket cap screw to T-handle.

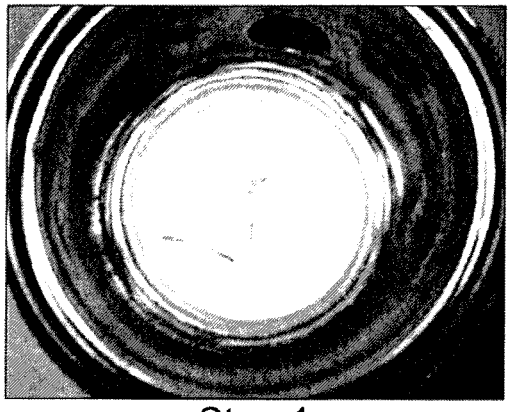
Note: The string tied to the T-handle may be used to attach the T-handle Polyloc® insert tool to a convenient location near the filter.

06/00

filter specialists, inc. michigan city, in 46360 1-800-348-3205

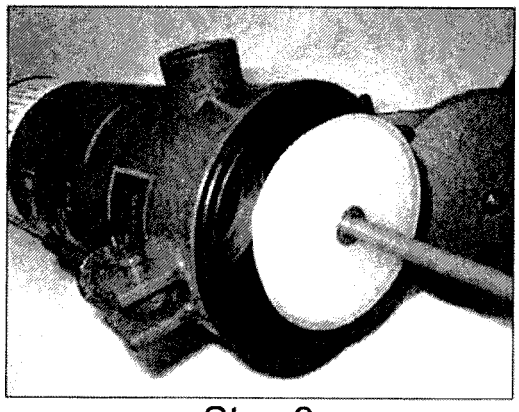
T-HANDLE POLYLOC® INSERT TOOL

INSTRUCTIONS FOR USE



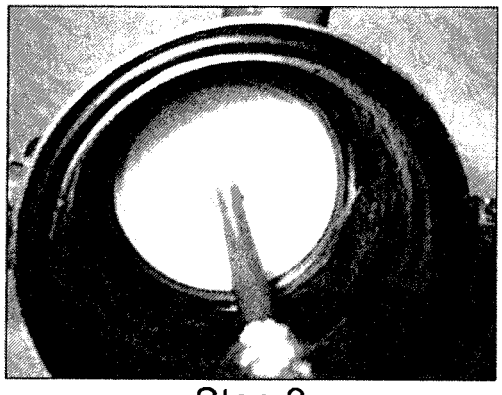
Step 1

Place bag into filter.



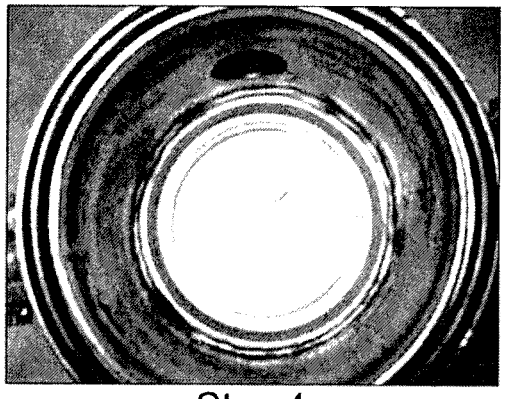
Step 2

Place T-handle Polyloc® insert tool over bag.



Step 3

Press T-handle Polyloc® insert tool down until bag 'snaps' into place.



Step 4

Remove T-handle Polyloc® insert tool from filter.

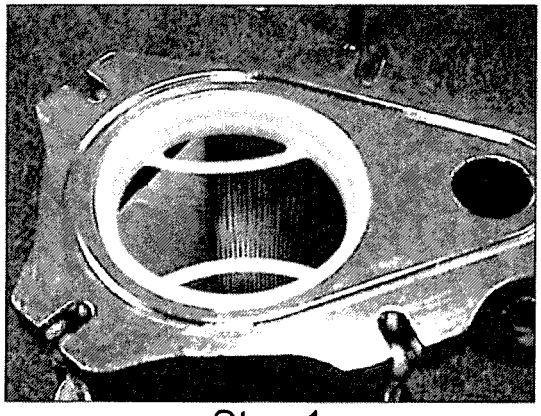
CAUTION

Do NOT operate the filter with any part of the T-handle Polyloc® insert tool inside.

06/00

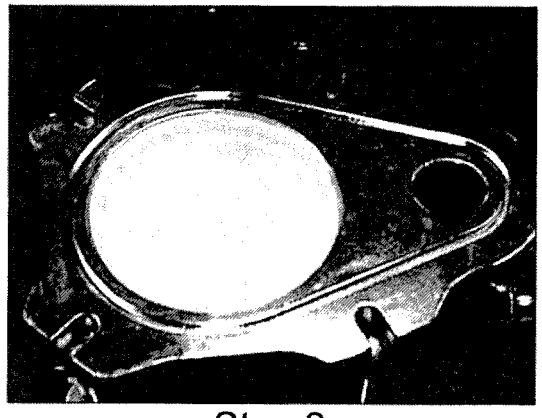
filter specialists, inc. michigan city, in 46360 1-800-348-3205

POLYLOC® INSERT TOOL



Step 1

Open filter. Remove instructions and any packing material.

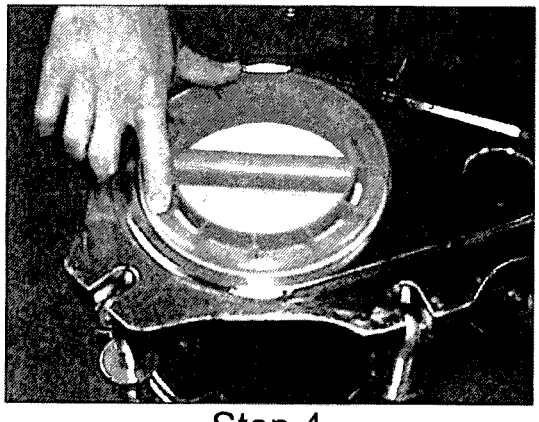


Step 2

Place Polyloc® bag into filter.

Step 3

Place Polyloc® insert tool over bag. With both hands, firmly push down on the Polyloc® insert tool. An audible snap will be heard indicating that the Polyloc® bag ring is locked in place.



Step 4

To ensure complete engagement, press down firmly with thumb and forefinger around the outside of the Polyloc® insert tool.

Step 5

Make a visual check and *lightly* pull on the Polyloc® bag ring handles to ensure the Polyloc®
bag ring is completely seated.

08/00

filter specialists, inc. michigan city, in 46360 1-800-348-3205

⚠ WARNING!

- VESSEL AND/OR GASKET CAN FAIL IF OPERATING LIMITS ARE EXCEEDED.
- A FAILURE CAN CAUSE SERIOUS INJURY, BLINDNESS OR DEATH.
- DO NOT EXCEED MAXIMUM OPERATING PRESSURE PER VESSEL CODE PLATE.
- CHECK TEMPERATURE RANGE ON VESSEL CODE PLATE.
- CHECK TEMPERATURE RANGE OF GASKET MATERIAL WITH RESPECT TO FLUID BEING FILTERED.
- DO NOT EXCEED THE LESSER OF THE TWO OPERATING TEMPERATURES.
- SECURE LID BY TIGHTENING LID EYENUTS.
- READ THE MANUAL FOR THE INSTALLATION, OPERATION, AND MAINTENANCE OF FILTER VESSELS.

1289 PT. NO. 35000

⚠ WARNING!

- RAISED LID MAY FALL IN THE EVENT OF A HYDRAULIC OR MECHANICAL FAILURE.
- A FALLING LID CAN SERIOUSLY INJURE OR CAUSE LOSS OF LIMB.
- REFER TO FSI OPERATING AND MAINTENANCE INSTRUCTIONS.
- READ AND UNDERSTAND THE FOLLOWING INSTRUCTIONS:
  - — NO BODY PARTS UNDER THE LID AT ANY TIME
  - — WEAR EYE PROTECTION IN CASE OF HYDRAULIC COMPONENT RUPTURE.
  - — ENGAGE LID SAFETY LATCH WHERE APPLICABLE.

1289 PT. NO. 35003

⚠ WARNING!

- IF IMPROPERLY USED, THIS VESSEL CAN CAUSE SERIOUS INJURY, BLINDNESS OR DEATH.
- READ ALL WARNING LABELS AND MANUAL FOR THE INSTALLATION, OPERATION, AND MAINTENANCE OF FILTER VESSELS BEFORE USE.
- FOR ADDITIONAL MANUALS, CALL FSI AT 1-800-348-3205.

PT. NO. 35005

⚠ WARNING!

- GASKET SEAL MAY LEAK OR SQUIRT FLUID UNDER PRESSURE IF THE LID OPENING AND CLOSING INSTRUCTIONS ARE NOT FOLLOWED.
- SQUIRTING FLUID CAN CAUSE SERIOUS INJURY OR BLINDNESS.
- READ THE MANUAL FOR INSTALLATION, OPERATION, AND MAINTENANCE OF FILTER VESSELS.
- WEAR PROTECTIVE CLOTHING.
- WEAR FACE SHIELD.
- BEFORE OPENING, TURN PUMP OFF AND LOCK IT OUT.
- CLOSE INLET AND OUTLET VALVE.
- OPEN VENT SLOWLY — DIRECT EXHAUST TO SAFE PLACE.
- INTERNAL PRESSURE SHOULD BE ZERO PSI GAUGE.
- DRAIN FLUID VIA DRAIN VALVE.
- CLOSE DRAIN VALVE.
- UNBOLT LID LUGS.
- LIFT LID.
- ENGAGE LID SAFETY PIN (IF APPLICABLE).
- ROTATE LID, UNCOVERING VESSEL.
- CHANGE FILTER ELEMENT.
- REMOVE GASKET, CLEAN GASKET GROOVE AND GASKET.
- INSPECT GASKET GROOVE AND LID SEALING AREA FOR DAMAGE.
- REPLACE DAMAGED PARTS WITH FSI REPLACEMENT PARTS ONLY.
- REPOSITION LID, DISENGAGE SAFETY PIN AND LOWER LID ONTO VESSEL SLOWLY.
- REPLACE WASHERS UNDER NUTS IF NECESSARY.
- ENGAGE ALL BOLTS, HAND TIGHTEN NUTS.
- NUT AND BOLT THREADS MUST BE FREE OF RUST AND FOREIGN MATTER.
- MODERATELY TORQUE NUTS AT 180° TO EACH OTHER, ROTATING AROUND VESSEL.
- CLOSE VENT VALVE.
- ACTIVATE PUMP.
- OPEN INLET VALVE SLOWLY. OBSERVE FOR LEAKS. IF LEAK APPEARS, CLOSE VALVE AND START OVER.
- IF THERE ARE NO LEAKS, OPEN OUTLET VALVES SLOWLY.

1289 PT. NO. 35004

TO LEARN MORE ABOUT FILTER SPECIALISTS, INC. PRODUCTS, CONTACT OUR OFFICE BELOW OR VISIT OUR WEB PAGE: http://www.fsifilters.com.

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Michigan City, IN 46361
(219) 879-3307
(219) 877-0632 FAX
Filter Specialists, Inc. 800-348-3205

MANUFACTURED IN THE USA
PRINTED IN USA
OPMAN-002-302
Part No. RMLOPMAN

Appendix G - Mechanical Equipment and Instruments

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 5 **MECHANICAL EQUIPMENT**

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 5 MECHANICAL EQUIPMENT

A. MANUAL BUTTERFLY VALVES

MARK	QTY	SIZE	SERVICE
V-121A	1	6"	TREATED INFLUENT WATER
V-122A	1	6"	TREATED EFFLUENT WATER
V-123A	1	6"	BACKWASH WATER SUPPLY
V-124A	1	6"	BACKWASH WATER OUT WASTE
V-125A	1	6"	RINSE WATER OUT WASTE

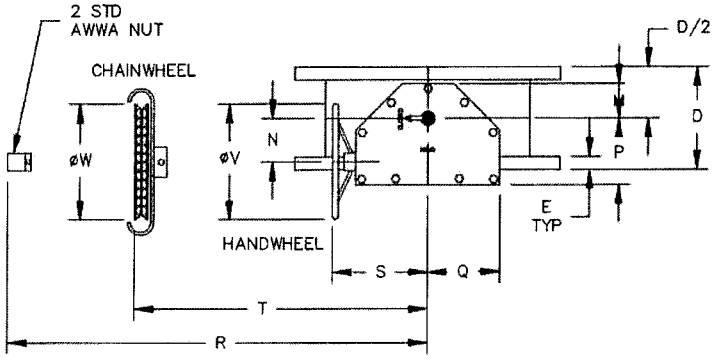
TTE F E WW

Project	ARSENIC REMOVAL SYSTEM	Tetra Cont. No.	22643	Rev.	1	By	AS	Date	25-Sep-14
Customer	AZ WATER	Cost Code		Date	11/17/2014	Ckd.		Date	
Location	VALLEY FARMS					Sheet	1 of		1

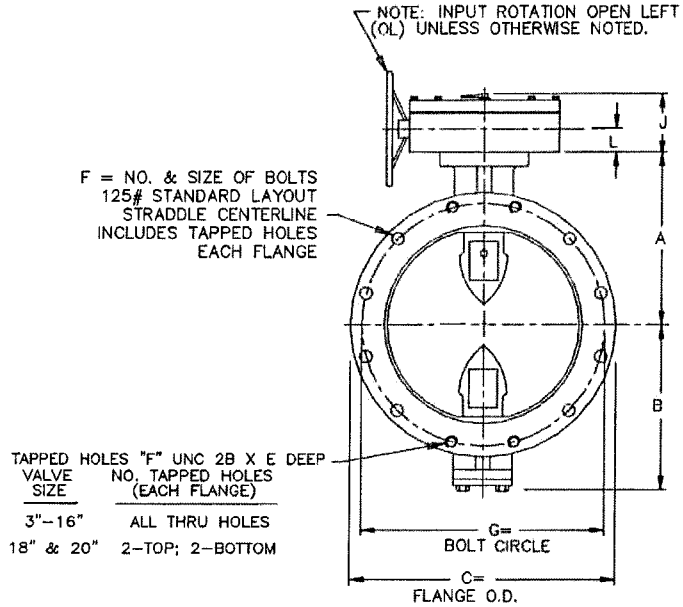
Qty	Mark	Materials Description	Ref. Dwg No.	Item Code
		WW M TTE F E W TE E		
		DESIGN PRESSURE 100 PSIG 125 ° F		
		E E T		
1	V-121A	6" FEED INFLUENT WATER HANDWHEEL		
1	V-122A	6" TREATED EFFLUENT HANDWHEEL		
1	V-123A	6" BACKWASH WATER IN HANDWHEEL		
1	V-124A	6" BACKWASH WATER OUT WASTE HANDWHEEL		
1	V-125A	6" RINSE WATER OUT WASTE HANDWHEEL		
5		MARK NOS REPRESENTS : VESSEL "A"		
		WW F d rd		
		Ed		
	Rev. 1	r M d F		
		ACTUATOR TO BE HANDWHEEL OR CHAINWHEEL AS SPECIFIED ABOVE. CHAIN TO BE HOT DIPPED GALVANIZED.		
		CHAINWHEEL SHALL BE EQUIPPED WITH GUIDE TO ALLOW RAPID HANDLING OF CHAIN WITHOUT "GAUGING" OF THE WHEEL.		
		MANUAL OPERATOR OF WORM GEAR OR LEAD SCREW TYPE, SELF-LOCKING, DESIGNED TO HAVE VALVE IN		
		INTERMIDIATE POSITION .		
		OPERATOR TO INCLUDE POSITION INDICATORS AND MECHANICAL STOPS LIMITING DEVICES TO PREVENT OVER		
		TRAVEL OF DISC IN OPEN AND CLOSED POSITION.		

ACTUATOR SIZE	J	L	M	N	P	Q	R	S	T	V	W	NUMBER OF TURNS
MDT-2S	4-11/16	2	2-1/8	2	4-1/2	4-1/4	8-1/4	7-7/8	7-7/8	8	9-1/8	32
MDT-3S	5-5/8	2-7/16	3-1/4	3-5/32	5-5/8	5-3/8	10-3/8	10-1/2	10-1/8	12	9-1/8	30
MDT-4S	6-3/8	2-27/32	3-3/8	4	7-5/16	6-3/4	11-5/16	11-1/2	11	12	9-1/8	40
MDT-5	7-9/16	3-15/32	4-1/2	5-1/2	8-3/4	10	17	17 3/16	17-3/16	18	16-7/16	44

VALVE SIZE	A	B	C	D	E ⚠	F	G
3	4-3/4	3-1/4⚠	7-1/2	5	13/16	4--5/8	6
4	5-1/2	3-1/2⚠	9	5	1	8--5/8	7-1/2
6	6-1/2	5-1/8	11	5	1-1/16	8--3/4	9-1/2
8	7-3/4	6-1/2	13-1/2	6	1-3/16	8--3/4	11-3/4
10	9	9-7/8	16	8	1-3/16	12--7/8	14-1/4
12	10-1/2	11-3/8	19	8	1-5/16	12--7/8	17
14	11-7/8	12-3/4	21	8	1-3/8	12--1	18-3/4
16	13-1/2	14-3/8	23-1/2	8	1-7/16	16--1	21-1/4
18	14-3/8	15-1/4	25	8	1-9/16	16--1-1/8	22-3/4
20	16	16-7/8	27-1/2	8	1-11/16	20--1-1/8	25



ACTUATOR POSITION 1



VALVE SIZE	NO. TAPPED HOLES (EACH FLANGE)
3"-16"	ALL THRU HOLES
18" & 20"	2-TOP; 2-BOTTOM

NOTES:

1. ALL DIMENSIONS SHOWN IN INCHES.
2. "D" DIMENSION ±1/16" FOR 3" THRU 10" VALVES.
   "D" DIMENSION ±1/8" FOR 12" THRU 20" VALVES.
3. FOR BOLTS SMALLER THAN ø1-3/4, BOLT HOLES WILL BE 1/8" LARGER THAN DIAMETER OF BOLT.
   FOR BOLTS ø1-3/4 OR LARGER , BOLT HOLES WILL BE 1/4" LARGER THAN DIAMETER OF BOLT.
4. DIMENSIONS AND DRILLING OF END FLANGES CONFORM TO THE AMERICAN CAST IRON FLANGE STANDARDS, CLASS 125 (B16.1).
5. VALVES MANUFACTURED & TESTED IN ACCORDANCE WITH AWWA SPECIFICATION C-504 LATEST REVISION, CLASS 150B.
6. RECOMMENDATION FOR MATING FLANGES: WHERE INSULATING BUSHINGS ARE USED, IT IS NECESSARY THAT BOLT HOLES BE DRILLED OVERSIZE BY AN AMOUNT EQUAL TO TWO TIMES THE INSULATING SLEEVE THICKNESS TO MAINTAIN THE SAME MINIMUM CLEARANCE FOR BOLTS.

⚠

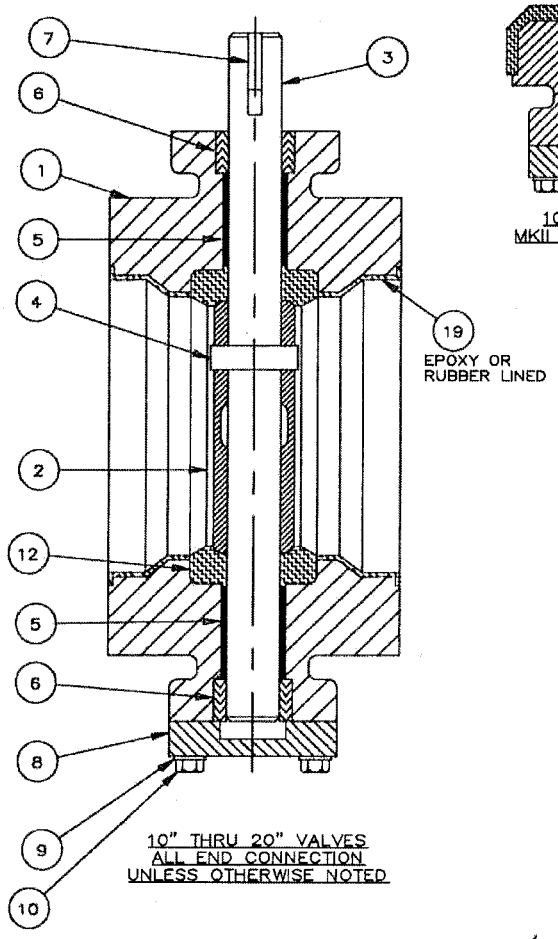
TOLERANCES	
FLANGE THICKNESS "E":	+1/8" -0
LAYING LENGTH "D":	
3" THRU 10"	±1/16"
12" THRU 20"	±1/8"
BOLT CIRCLE "G":	±1/64"
FLANGE O.D."C":	
3" THRU 10"	±1/8"
12" THRU 20"	±3/16"

REV	DATE	BY	DESCRIPTION	APP
1	5-5-11	JLM	REV COL B & E ADD TOLERANCES	

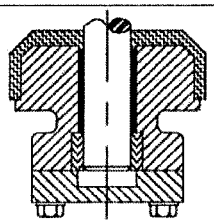
PRATT© HENRY PRATT COMPANY AURORA, ILL.

3" - 20" FLG BUTTERFLY VALVE
MDT MANUAL ACTUATOR

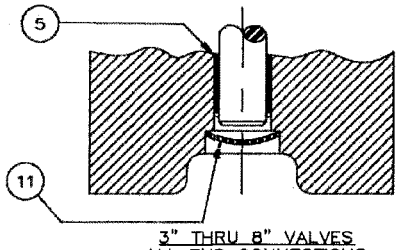
SCALE NONE DATE 1-20-09
DRAWN BY CEM CHECKED BY JR
APPROVED GA=BORDER
DRWG. NO. GA-11864 REV 1 A/C



10" THRU 20" VALVES
ALL END CONNECTION
UNLESS OTHERWISE NOTED



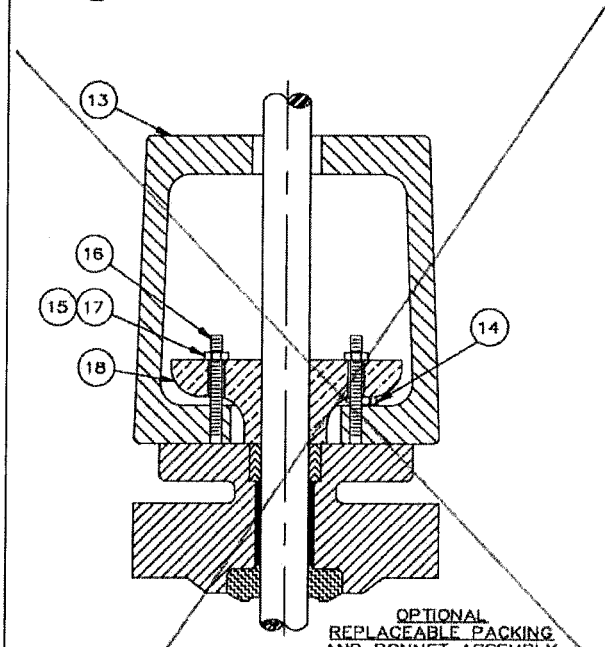
10" THRU 20"
MKII WAFER VALVES



3" THRU 8" VALVES
ALL END CONNECTIONS
UNLESS OTHERWISE NOTED

MATERIAL OPTIONS AS CHECKED

ITEM NO.	DESCRIPTION	MATERIALS	✓
1	BODY	CAST IRON ASTM A-48 CLASS 40 (MKII ONLY)	
		CAST IRON ASTM A-126 CLASS B *	✓
		DUCTILE IRON ASTM A-536 (65-45-12)	
2	DISC	CAST IRON ASTM A-126 CLASS B STAINLESS STEEL EDGE TYPE 316 (DUCTILE IRON MAY BE SUBSTITUTED)	
		DUCTILE IRON ASTM A-536 (65-45-12) STAINLESS STEEL EDGE TYPE 316	
		STAINLESS STEEL ASTM A-351 GRADE CF8M	✓
3	SHAFT	STAINLESS STEEL ASTM A-276 TYPE 304	✓
		STAINLESS STEEL ASTM A-276 TYPE 316	
		STN. STL. A-564 TYPE 630 COND. H-1150	
4	SQUEEZE PIN	STAINLESS STEEL ASTM A-276 TYPE 304	✓
		STAINLESS STEEL ASTM A-276 TYPE 316	
		STN. STL. A-564 TYPE 630 COND. H-1150	
5	BEARING	NYLATRON GS	✓
		RULON LR (HIGH TEMPERATURE ONLY)	
		FLUOMETAL (PTFE IMPREGNATED w/ EXPANDED 317L METAL SHEET)	
6	PACKING	RUBBER BUNA-N	✓
		RUBBER (EPDM)	
7	KEY	AISI C1045 COLD DRAWN STEEL	
8	COVER	CAST IRON ASTM A-48 CLASS 40	
		CAST IRON ASTM A-126 CLASS B	✓
9	LOCKWASHER	STAINLESS STEEL TYPE 304	✓
		STAINLESS STEEL TYPE 316	
10	CAP SCREW	STAINLESS STEEL TYPE 304	✓
		STAINLESS STEEL TYPE 316	
11	EXP. PLUG	STAINLESS STEEL TYPE 304	✓
		STAINLESS STEEL TYPE 316	
12	SEAT	RUBBER BUNA-N	✓
		RUBBER (EPDM)	
13	BONNET	CAST IRON ASTM A-48 CLASS 40 FOR 3"-10" & 12" W/ MDT2S	
		DUCTILE IRON ASTM A-536 65-45-12 FOR 10" W/ MDT3S & 12" -20"	
14	CAP SCREW	ALLOY STEEL SAE GRADE 8	
15	LOCKWASHER	STAINLESS STEEL TYPE 304	
16	THD. STUD	STAINLESS STEEL TYPE 304	
17	HEX NUT	STAINLESS STEEL TYPE 304	
18	GLAND	BRONZE ASTM B-584 ALLOY C86400	
19	LINING	EPOXY	
		RUBBER (SAME AS 12)	



OPTIONAL
REPLACEABLE PACKING
AND BONNET ASSEMBLY

* DUCTILE IRON MAY BE SUBSTITUTED
FOR 3" & 4" BODIES

REV	DATE	BY	DESCRIPTION	APP.
A	5/28/14	DSL	UPDATED TITLE BLOCK	

PRATT® HENRY PRATT COMPANY AURORA, ILL.

CROSS SECTION
PARTS AND MATERIALS LIST
3"-20" BONDED SEAT VALVES
150B & 250B

SCALE NONE DATE 10-27-05
DRAWN BY ES CHECKED BY RCB
APPROVED GA-BORDER
DRWG. NO. GA-11486 REV 19 A/C

SYSTEM PART NO.	A069636A	A069636B	A069636C	A069636D	A069636E
PART NO.	2308405	2308406	2308407		
ALTERNATE SYSTEM	NO	NO	NO	NO	NO
MULTIPLE COLOR SYSTEM	NO	NO	NO	NO	NO
MANUFACTURER	PPG PROTECTIVE & MARINE COATINGS	PPG PROTECTIVE & MARINE COATINGS	PPG PROTECTIVE & MARINE COATINGS	PPG PROTECTIVE & MARINE COATINGS	PPG PROTECTIVE & MARINE COATINGS
MANUFACTURER'S DESIGNATION	AMERCOAT 370	AMERCOAT 370	AMERCOAT 370	AMERCOAT 370	AMERCOAT 370
USE CATEGORY	ALL	ALL	ALL	ALL	ALL
SUBMERSIBLE[4]	YES	YES	YES	YES	YES
MIN. TOTAL DRY MIL THICKNESS	SEE NOTE 1	SEE NOTE 1	SEE NOTE 1	SEE NOTES 1 AND 2	SEE NOTE 1
MAXIMUM TOTAL DRY MIL THICKNESS	24	24	24	24	24
NSF/UL RECOAT TIME	1 HOUR @ 70° F	1 HOUR @ 70° F	1 HOUR @ 70° F	1 HOUR @ 70° F	1 HOUR @ 70° F
NSF/UL CURING TIME	7 DAYS @ 70° F	7 DAYS @ 70° F	7 DAYS @ 70° F	7 DAYS @ 70° F	7 DAYS @ 70° F
SURFACE PREPARATION	SSPC-SP10	SSPC-SP10	SSPC-SP10	SSPC-SP10	SSPC-SP5
COLOR (IF SPECIFIED)	OXIDE RED	WHITE	PEARL GRAY	WHITE	OXIDE RED
CLASS I INSPECTION	NO	NO	NO	NO	NO
MAT'L CATEGORY	PE	PE	PE	PE	PE
MIN. TOTAL DRY MIL THICKNESS	8	8	8	8	8
THEORETICAL COVERAGE SQ FT / GAL / MIL	1011	1011	1011	1011	1011
OTHER	2.50-3.0 LBS/GAL F STD 61 63% +/- 3% TEM E T E E E 250°F DRY CONTINUOUS	2.50-3.0 LBS/GAL F STD 61 63% +/- 3% TEM E T E E E 250°F DRY CONTINUOUS	2.50-3.0 LBS/GAL F STD 61 63% +/- 3% TEM E T E E E 250°F DRY CONTINUOUS	2.50-3.0 LBS/GAL F STD 61 63% +/- 3% TEM E T E E E 250°F DRY CONTINUOUS	2.50-3.0 LBS/GAL F STD 61 63% +/- 3% TEM E T E E E 250°F DRY CONTINUOUS
AWWA C-550 NSF 61 USDA NFPA CLASS 1 TEMP: 200◇F	NSF – YES	NSF – YES	NSF – NO	NSF – YES	NSF - YES

8 mils coating

NOTES:

1) MINIMUM THICKNESS SHALL BE PER THE SHOP ORDER JDE SCREEN AND GENERAL ARRANGEMENT DRAWING WHICH MUST INDICATE THE SAME MINIMUM NUMBER OF MILS.
2) FOR MULTIPLE COLOR SYSTEMS, FIRST COLOR LISTED SHALL BE APPLIED FIRST TO A THICKNESS OF 1/2 THE TOTAL REQUIRED MIL THICKNESS, FOLLOWED BY THE SECOND COLOR MAKING UP THE SECOND 1/2 OF REQUIRED MIL THICKNESS.
3) AWWA C-550 APPROVED.
4) NSF-61 APPROVED VALVES ARE NOT TO BE USED SUBMERGED IN POTABLE WATER SYSTEMS.
5) MAY BE THINNED WITH THINNER #65 UP TO 12% BY VOLUME.
6) FOR NSF61 APPLICATIONS, ONLY 4" AND LARGE VALVES ARE ALLOWED.

UL/FM

PRATT Henry Pratt Company

HENRY PRATT COMPANY

PPG
AMERCOAT 370
(FACTORY ACCELERATED)

MATERIAL SPECIFICATIONS

REV	DATE	BY	APP	REV	DATE	BY	APP
3	4/9/08	SD	SS	6			
2	7/1/05	SD	SS	5	3/23/11 Dry Mil Thickness to 8	Tim Fallon	RCB
1	10/29/03	SJR	SS	4	3/11/10 Per ECO 1502150	RCB	JHW

DRAWN	SD	CHKD BY	SS
SCALE		DATE	4/9/08

APPROVED

LAST MODIFIED

PPG Amercoat

Amercoat® 370

370 Series — *Fast-dry multi-purpose epoxy*

Product Data/ Application Instructions

- High performance, corrosion resistance
- Fast drying, fast curing epoxy composition
- Application over wide range of surface temperatures from 20°F (-7°C) to 120°F (60°C)
- Self-priming, high-build coating
- Primer for wide range of topcoats
- Excellent shop primer for corrosion resistance
- Compatible with inorganic zinc silicate primers
- No lead pigments added
- VOC compliant
- Suitable for immersion in fresh and salt water
- Compatible with compromised surface preparation

Amercoat 370 forms an excellent corrosion barrier and is suitable for most industrial and marine new construction, repair, and field maintenance applications.

The fast curing properties of Amercoat 370 make it especially beneficial as a shop-applied coating where fast-drying and handling of coated parts are required.

Amercoat 370 is user-friendly and can be applied by a variety of spray application methods.

Typical Uses

Tank exteriors, structural steel, and piping in chemical plants, refineries, pulp and paper mills, offshore platforms, ship hulls, ballast tank service, anticorrosive under antifoulings and other structures exposed to severe weathering or salt spray.

Typical Properties

Physical

Abrasion (ASTM D4060) 1 kg load/1000 cycles CS-17 wheel	250 mg weight loss
Adhesion, Elcometer (ASTM D4541)	>1000 psi

Performance

Salt spray – 1 coat @ 6 mils 3000 hours exposure	
face corrosion (ASTM B117)	None
face blistering (ASTM B117)	None
Humidity (condensation) (ASTM D4585) 3000 hours exposure	
face corrosion	None
Steam cleanable	Yes
Chemical resistance – Condition after 1 year immersion	
salt water	Excellent
fresh water	Excellent

Qualifications

AWWA C550

NSF Standard 61* - For use in drinking water.

**For NSF application information, please visit our website at www.ameroncoatings.com/usa/nsf*

Physical Data

Finish	Flat	
Color	Pearl gray, light buff, white, oxide red	
Components	2	
Curing mechanism	Solvent release and chemical reaction between components	
Volume solids (ISO 3233)	66% ± 3%	
Dry film thickness per coat	4-6 mils (100 - 150 microns)	
Coats	1 or 2	
Coverage	ft²/gal	m²/L
1 mil (25 microns)	1059	25.4
5 mils (125 microns)	212	5.1
VOC	lb/gal	g/L
mixed	2.5	300
mixed/thinned (½ pt/gal)	2.8	335
mixed/thinned (1pt/gal)	3.0	359
Temperature limit	°F	°C
continuous (dry)	200	93
intermittent (dry)	250	121
Flash point (SFTA)	°F	°C
cure	82	28
resin	82	28
Amercoat 65	81	27
Amercoat 12	2	-17
Amercoat 101	145	63

Application Data

Applied over	Primed or prepared steel	
Surface preparation		
new steel	SSP-SP6	
primed steel	See specific primer	
previously painted or pitted steel	SSPC-SP10	
Primer	Dimetcote*	
Method	Airless or conventional spray	
Mixing ratio (by volume)	4 parts resin to 1 part cure	
Environmental conditions		
Temperature	°F	°C
air and surface	20 to 120	-7 to 49
material (mininum)	40	4

Surface temperatures must be at least 5°F (3°C) above dew point to prevent condensation.

Thinner	
below 60°F	Amercoat 65
over Dimetcote or above 60°F	Amercoat 101
Equipment cleaner	Thinner or Amercoat 12

NSF

UL/FM

PRATT Henry Pratt Company	HENRY PRATT COMPANY	MATERIAL SPECIFICATIONS								
		3	4/9/08	SD	SS	6				
PPG AMERCOAT 370 (FACTORY ACCELERATED)		2	7/1/05	SD	SS	5	3/23/11 Dry Mil Thickness to 8	Tim Fallon	RCB	
		1	10/29/03	SJR	SS	4	3/11/10 Per ECO 1502150	RCB	JHW	

DRAWN	SD	CHKD BY	SS	REV	DATE	BY	APP	REV	DATE	BY	APP
SCALE		DATE	4/9/08	APPROVED				LAST MODIFIED			

Amercoat 370 Chemical Resistance Guide

Environment	Splash and Spillage	Fumes and Weather
Acidic	F	G
Alkaline	E	E
Solvents	E	E
Salt solutions		
Acidic	G	VG
Neutral	E	E
Alkaline	E	E
Water	E	E

F-Fair G-Good E-Excellent VG-Very Good

This chart shows typical resistance of Amercoat 370. Contact your PPG representative for your specific requirements.

Systems Using Amercoat 370

1st Coat	2nd Coat	3rd Coat
Amercoat 370	–	–
Amercoat 370	Amershield™	–
Amercoat 370	450H	–
Dimetcote 9 Series, 21-5	370	Amershield, 450H
Amercoat 68HS	370	Amershield, 450H
Amercoat 370	370	ABC 3, ABC 4

Confirm compliance with VOC regulations before using coating systems. For immersion service, apply 2 coats at a minimum of 8 mils total DFT.

Over Dimetcote or Amercoat 68HS primer, a mist coat and thinning with Amercoat 101 may be required to prevent application bubbling.

Surface Preparation

Coating performance is, in general, proportional to the degree of surface preparation. Surface must be clean, dry, undamaged and free of all contaminants prior to coating.

Welds should be continuous with no overlapping steel surfaces or rough edges. Remove all weld spatter.

Steel, non-immersion – Remove all loose rust, dirt, grease or other contaminants by one of the following depending on the degree of cleanliness required: SSPC-SP2, 3, 6, 7 or 11. UHP waterjetting per SSPC-SP-12 WJ2 is also acceptable.

Steel, immersion – For more severe service and immersion, clean to SSPC-SP10. The choice of surface preparation will depend on the system selected and end-use service conditions.

Blast to achieve a surface profile not to exceed 3 mils (75 microns) as indicated by a Keane-Tator Surface Profile Comparator Testex Tape. Increase coating thickness if profile greater than 3 mils.

Primed steel – Prepare surface in accordance with application instructions for the specific primer being used. Be sure primer is clean and dry when Amercoat 370 is applied. Remove all loose rust, dirt, moisture, grease or contaminants.

Repair – Prepare damaged areas to original surface preparation specifications, feathering edges of intact coating. Thoroughly remove dust or abrasive residue before touch up.

Application Equipment

The following is a guide; suitable equipment from other manufacturers may be used. Changes in pressure, hose and tip size may be needed for proper spray characteristics.

Airless spray – Standard equipment such as Graco Bulldog Hydra-Spray or larger with a 0.015- to 0.021-inch (0.38 mm to 0.53 mm) fluid tip.

Conventional spray – Industrial equipment, such as DeVilbiss, MBC or JGA gun with 78 or 765 air cap and "E" fluid tip, or Binks No. 18 or 62 gun with a 66x63PB nozzle set up. Separate air and fluid pressure regulators, mechanical pot agitator, and a moisture and oil trap in the main air supply line are recommended.

Environmental Conditions

Temperature	°F	°C
air and surface	20 to 120	-7 to 49
material	40	4

Surface temperatures must be at least 5°F (3°C) above dew point to prevent condensation.

Application Procedure

Amercoat 370 is packaged in two components in the proper proportions which must be mixed together before use.

1. Flush equipment with thinner or Amercoat 12 before use.
2. Stir each component thoroughly, then combine and mix until uniform.
3. For general use, if thinning is necessary for workability, add Amercoat 65 below 60°F or Amercoat 101 at 60°F and above. Thin in quantities up to 1 pint per gallon of Amercoat 370. For potable water tanklining applications, see current NSF listing at www.nsf.org for approved thinner and thinning restrictions.
4. Do not mix more material than will be used within 4 hours at 70°F (21°C). Pot life is shortened by higher temperatures. Thinning may be necessary for workability periodically throughout pot life.

Pot Life and Dry Times

Temperature (°F/°C)	Pot-Life (Hours)	Touch Dry (Min.)	Through Dry (Hours)	Recoat (Hours)
20/-7	—	90	20	2½
32/0	—	60	9	2
40/4	7	45	7	2
50/10	6	30	4½	1½
60/16	5	22	2⅞	1
70/21	4	15	1⅝	½
80/27	3	12	1⅜	½
90/32	2	10	1	½

Topcoat or recoat time (days) (maximum)

	°F/°C 90/32	70/21	50/10	20/-7
Amercoat 450H, Amershield™	14	30	45	60
Amercoat 370				
non-immersion	6 months – Clean surface required *(clean and roughen if exceeded)*			
immersion	1 month – Clean surface			
ABC 3, ABC4	Apply while 370 is soft to thumb pressure*			

** Failure to apply antifoulings while coating is still soft to thumb pressure may result in poor adhesion and eventual delamination*

Drying times are dependent on air and surface temperatures as well as film thickness, ventilation and relative humidity. Maximum recoating time is highly dependent upon actual surface temperatures - not simply ambient air temperatures. Surface temperatures should be monitored, especially with sun-exposed or otherwise heated surfaces. Higher surface tempertures shorten the maximum recoat window.

If maximum topcoat time is exceeded, either clean and roughen the Amercoat 370 surface or clean and apply a tack coat of Amercoat 370 before topcoating with Amercoat 450H, Amershield or antifouling.

Time before service @ 8 mils (hours)

Amercoat 370	°F/°C 90/32	70/21	50/10	32/0	20/-7
non-immersion**	6	12	24	96	120
immersion	12	24	48	168	NR

NR=Not recommended

Cure to full physical properties.

5. When applying by conventional spray, use adequate air pressure and volume to ensure proper atomization.
6. When applying over inorganic zinc or zinc rich primers, a "mist coat" 1-1½ mils wet./full coat technique may be required to minimize bubbling. This will depend on the age of the Dimetcote, surface roughness and conditions during curing. When applying Amercoat 370 over Dimetcote at 60°F and above, use Amercoat 101 thinner up to 1 pint per gallon. For potable water tanks, use only Amercoat 65 thinner.
7. Normal recommended dry film thickness is 5 mils (125 microns). Total dry film thickness must not exceed 15 mils (375 microns).

UL/FM

PRATT Henry Pratt Company	HENRY PRATT COMPANY	MATERIAL SPECIFICATIONS								
		3	4/9/08	SD	SS	6				
	PPG AMERCOAT 370 (FACTORY ACCELERATED)	2	7/1/05	SD	SS	5	3/23/11 Dry Mil Thickness to 8	Tim Fallon	RCB	
		1	10/29/03	SJR	SS	4	3/11/10 Per ECO 1502150	RCB	JHW	
DRAWN	SD	CHKD BY	SS	REV	DATE	BY	APP	REV	DATE	BY	APP
SCALE		DATE	4/9/08	APPROVED				LAST MODIFIED			

8. The application of a wet film thickness of 7 to 8 mils (175 to 200 microns) will normally provide 5 mils (125 microns) of dry film.
9. Clean all equipment with thinner or Amercoat 12 immediately after use.

Safety Precautions

Read each component's material safety data sheet before use. Mixed material has hazards of each component. Safety precautions must be strictly followed during storage, handling and use.

CAUTION – Improper use and handling of this product can be hazardous to health and cause fire or explosion.

Do not use this product without first taking all appropriate safety measures to prevent property damage and injuries. These measures may include, without limitation: implementation of proper ventilation, use of proper lamps, wearing of proper protective clothing and masks, tenting and proper separation of application areas. Consult your supervisor. Proper ventilation and protective measures must be provided during application and drying to keep spray mists and vapor concentrations within safe limits and to protect against toxic hazards. Necessary safety equipment must be used and ventilation requirements carefully observed, especially in confined or enclosed spaces, such as tank interiors and buildings.

This product is to be used by those knowledgeable about proper application methods. PPG makes no recommendation about the types of safety measures that may need to be adopted because these depend on application environment and space, of which PPG is unaware and over which it has no control.

If you do not fully understand these warnings and instructions or if you cannot strictly comply with them, do not use the product.

Note: Consult Code of Federal Regulations Title 29, Labor, parts 1910 and 1915 concerning occupational safety and health standards and regulations, as well as any other applicable federal, state and local regulations on safe practices in coating operations.

This product is for professional use only. Not for residential use.

Shipping Data

Packaging units	1 gal	5 gal
cure	0.2 gal in 1-qt can	1 gal in 1-gal can
resin	0.8 gal in 1-gal can	4 gal in 5-gal can
Shipping weight (approx)	lb	kg
1-gal unit		
cure	1.9	0.9
resin	14.2	6.5
5-gal can		
cure	8.6	3.9
resin	70.4	32

Shelf life when stored indoors at 40 to 100°F (4 to 38°C)
cure and resin 1 year from shipment date

Numerical values are subject to normal manufacturing tolerances, colors and testing variances. Allow for application losses and surface irregularities.

This product is photochemically reactive as defined by the South Coast Air Quality Management District's Rule 102 or equivalent regulations.

UL/FM

PRATT Henry Pratt Company	HENRY PRATT COMPANY	MATERIAL SPECIFICATIONS								
		3	4/9/08	SD	SS	6				
PPG AMERCOAT 370 (FACTORY ACCELERATED)		2	7/1/05	SD	SS	5	3/23/11 Dry Mil Thickness to 8	Tim Fallon	RCB	
		1	10/29/03	SJR	SS	4	3/11/10 Per ECO 1502150	RCB	JHW	

DRAWN	SD	CHKD BY	SS	REV	DATE	BY	APP	REV	DATE	BY	APP
SCALE		DATE	4/9/08	APPROVED				LAST MODIFIED			

UL/FM

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PRATT Henry Pratt Company	HENRY PRATT COMPANY	MATERIAL SPECIFICATIONS									
		3	4/9/08	SD	SS	6					
PPG AMERCOAT 370 (FACTORY ACCELERATED)		2	7/1/05	SD	SS	5	3/23/11 Dry Mil Thickness to 8	Tim Fallon	RCB		
		1	10/29/03	SJR	SS	4	3/11/10 Per ECO 1502150	RCB	JHW		
DRAWN	SD	CHKD BY	SS	REV	DATE	BY	APP	REV	DATE	BY	APP
SCALE		DATE	4/9/08	APPROVED				LAST MODIFIED			

PRATT

Henry Pratt Company

AWWA Butterfly Valves
3" – 20"

Engineering Creative Solutions
for Fluid Systems Since 1901

A Tradition of Excellence

With the development of the first rubber seated butterfly valve more than 70 years ago, the Henry Pratt Company became a trusted name in the flow control industry, setting the standard for product quality and customer service. Today Pratt provides the following range of superior products to the water, wastewater and power generation industries.

Butterfly Valves: from 3" to 162"

Rectangular Valves: 1' x 1' to 14' x 16'

Ball Valves –
Rubber Seated: from 4" to 60"
Metal Seated: from 6" to 48"

Plug Valves: from 1/2" to 72", 100% port available up to 48", 3 ways

Air Valves for Water and Wastewater: from 1/2" to 20"

Hydraulic Control Systems

Valve Controls

Energy Dissipating Valves and Fixed Energy Dissipaters

Cone Valves

Check Valves

Plunger Valves

A Commitment to Meeting The Customers' Needs

Henry Pratt valves represent a long-term commitment to both the customer and to a tradition of product excellence. This commitment is evident in the number of innovations we have brought to the industries we serve. In fact, the Henry Pratt Company was the first to introduce many of the flow control products in use today, including the first rubber seated butterfly valve, one of the first nuclear N-Stamp valves, and the bonded seat butterfly valve.

Innovative Products For Unique Applications

Though many of the standard valves we produce are used in water filtration and distribution applications, Pratt has built a reputation on the ability to develop specialized products that help customers to meet their individual operational challenges.

Creative Engineering for Fluid Systems

Pratt's ability to provide practical solutions to complex issues is demonstrated by the following case histories.

Earthquake Proof Valves

Pratt designed and manufactured hydraulically actuated valves for a water storage application so that the valves would automatically operate in the event of earthquakes. This led to the development of a valve that will withstand acceleration forces of up to 6gs.

Custom Actuation/Isolation Valves

Pratt has designed and manufactured nuclear quality quarter-turn valves and parts since the first nuclear-powered generating plants were built. Our custom valves are able to close in a millisecond, using specially designed Pratt electro-pneumatic actuators.

Valves Designed for Harsh Environments

Pratt designed and manufactured a 144" diameter butterfly valve for the emergency cooling system at a jet engine test facility. The valve was designed to supply water to help dissipate the tremendous heat generated by the engines during testing.

PRATT
Henry Pratt Company

Through experience, commitment and creative engineering, Pratt is uniquely suited to provide superior products for our customers' special needs.
For more information, contact our corporate headquarters in Aurora, Illinois.

PRATT
Henry Pratt Company

401 South Highland Avenue
Aurora, Illinois 60506-5563
www.henrypratt.com
phone: 630.844.4000
fax: 630.844.4160

Table of Contents

AWWA Butterfly Valve 3 through 20 inches:

Scope of Line:
AWWA In-Plant Rubber Seated Butterfly Valves

Model 2FII Butterfly Valve

Model 2FII Flanged Butterfly Valve

Sizes: 3 through 20 inches

Body Style: Flanged x flanged ends

Other Body Style Options:
- Mechanical joint
- Victaulic
- Flanged & mechanical joint
- Push-on
- Push-on & flanged

Pressure Class:
- Class 150B per AWWA Standard C504

Working Pressure: 150 psig

Flanges:
- Flat faced and drilled in accordance with ANSI B16.1, Class 125 standards.

Rubber Seat: Bonded seat-in-body

Actuation Options:
- Pratt hand lever
- MDT manual actuator with AWWA nut, handwheel or ~~chainwheel~~
- Pratt Dura-Cyl hydraulic or pneumatic cylinder
- Pratt Positron electric actuator

Monoflange MKII Wafer Butterfly Valve

Sizes: 3 through 20 inches

Body Style: Wafer-type

Pressure Class:
- Class 150B per AWWA Standard C504

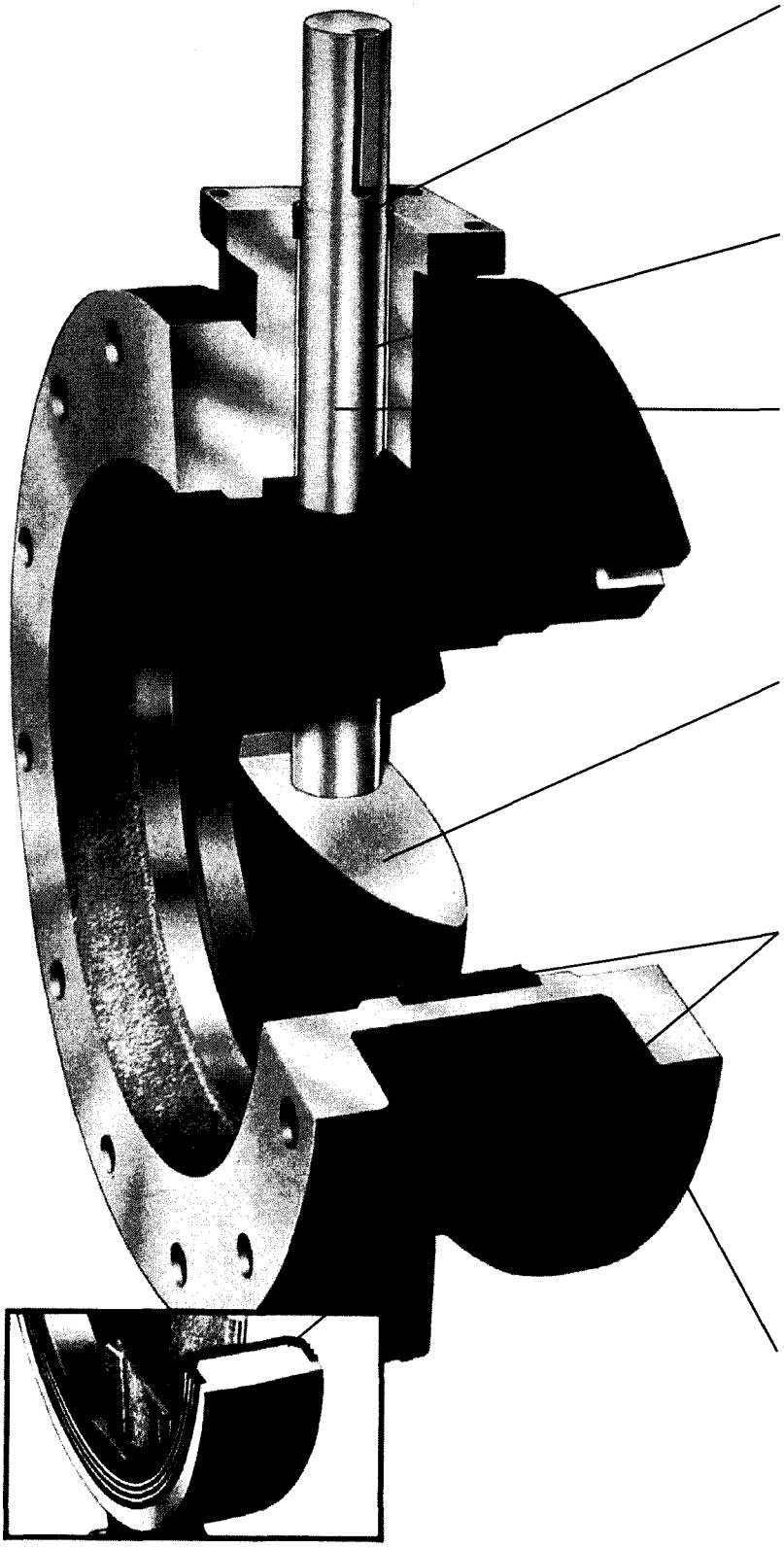
Working Pressure: 150 psig

Rubber Seat:
- Bonded seat-in-body extends over inner surface to form self-gasketing feature

Actuation Options:
- Pratt hand lever
- MDT manual actuator with AWWA nut, handwheel or chainwheel
- Pratt Dura-Cyl hydraulic or pneumatic cylinder
- Pratt Positron electric actuator

Monoflange MKII Butterfly Valve

Design Details: Models 2FII and MKII



Self Adjusting Permanent Packing

Chevron type packing increases sealing force as line pressure increases. The self adjusting packing bears on turned, ground and polished stainless steel, minimizing wear and assuring long life. Packing is accessible for replacement without dismantling the valve per AWWA Standard C504.

Lifetime Bearings

Pratt's chemically inert nylon bearings are sized to meet or exceed AWWA specification pressure loads. They are self-lubricating, require no periodic maintenance and are designed to outlast the life of the pipeline.

Corrosion Resistant Shafts

The shafts in Pratt's rubber seated butterfly valves, 3" through 20", are constructed of centerless, ground ASTM A276 type 304 or type 316 stainless steel bar and thus are not susceptible to corrosion as are carbon steel or other similar materials. Shafts are one-piece, through-shaft construction, sized to meet or exceed the requirements of AWWA Standard C504 for Class 150B butterfly valves.

Streamlined Discs

Pratt's lens-shaped discs are designed to minimize pressure drop and turbulence. In the full open position, the disc creates no more friction loss than a 45° elbow. Discs are secured to shafts by stainless steel pins to transmit required torques and withstand stresses imposed under a variety of operating conditions.

Body Seat

Our standard seats are constructed of Buna N rubber and bonded to the valve body in Pratt's manufacturing facility using a unique thermal process. This molding process ensures that the disc-to-seat interference will not cause excessive wear or abrasion under normal operating conditions. On the wafer type MKII bodies, the rubber seat covers the entire inner surface plus the outside face of the valve body to provide a self-gasketing feature. Pratt's seat-in-body design minimizes the effects of corrosive buildup on the inside of the valve because deposits are swept away by the hard sealing edge of the disc each time the valve is exercised.

Heavy Duty Bodies

Both Monoflange MKII and Model 2FII bodies are heavy duty cast iron. Model 2FII flanges are fully faced and drilled in accordance with ANSI B16.1, Class 125 standard for cast iron flanges. Monoflange MKII bodies incorporate an overlapping seat which also forms a gasket for the flange face. The actuator mounting trunnion is machined and drilled for a 4-bolt connection.

Features and Benefits: of Pratt Models 2FII and MKII

Feature	Benefit
Seat-in-body design **Seat molded in recessed body cavity, protected by metal on 3 sides**	▪ Reduces seat failure due to corrosive buildup in the valve and pipeline. No hardware to loosen. No periodic maintenance required. Rubber protected from flow media to increase seat life.
Valve withstood proof-of-design testing of 100,000 cycles – AWWA only requires 10,000 cycle proof-of-design testing	▪ Proven reliability over the life of the valve
Through-disc pinning	▪ Provides a tight disc-to-shaft pin connection, greatly reducing the possibility of loosening through vibration
Symmetrical lens-shaped disc	▪ Higher C_V : lower head loss results in energy savings for customer's system
Nonmetallic bearings	▪ Prevents galvanic corrosion and provides lower coefficient of friction
Chevron V-type packing	▪ Self-adjusting, lasts the life of the valve

Valve Size	C_V	Valve Size	C_V	Valve Size	C_V
3"	323	10"	4458	16"	11413
4"	575	12"	6420	18"	14444
6"	1294	14"	8738	20"	17832
8"	2300	C_V values for the 2FII and MKII in the full open position			

Valve Model	Body	Seat	Disc	Shaft
2FII	ASTM A126, Class B Cast Iron*	Buna-N**	Cast Iron/316 Edge	Stainless Steel, Type 304
MKII 3"-6"	ASTM A536, (65-45-12) Ductile Iron	Buna-N**	CF8M	Stainless Steel, Type 304
MKII 8" +	ASTM A536, (65-45-12) Ductile Iron	Buna-N**	Cast Iron/316 Edge	Stainless Steel, Type 304

* Model 2FII valves also available with optional ASTM A536 (65-45-12) ductile iron body for all sizes and ductile iron disc on sizes 8"-20"

**Also available with optional EPDM seat

Suggested Specification for the Pratt Rubber Seated Butterfly Valve, Sizes 3 through 20 inches

General

Butterfly valves shall be manufactured in accordance with the latest revision of AWWA C504, Class 150B and conform to NSF Standard 61. The manufacturer shall have produced AWWA butterfly valves for a minimum of five years. All valves shall be either Henry Pratt Model 2FII or Monoflange MKII and comply with the following details.

Valve Bodies

Valve bodies shall be constructed of ASTM A126, Class B cast iron for flanged valves or ASTM A536 (65-45-12) for wafer style. Flanged valves shall be fully faced and drilled in accordance with ANSI Standard B16.1, Class 125.

Valve Seats

Rubber body seats shall be of one piece construction, simultaneously molded and bonded into a recessed cavity in the valve body. Seats may not be located on the disc or be retained by segments and/or screws. For wafer style valves, the seat shall cover the entire inner surface of the valve body and extend over the outside face of the valve body to form a flange gasket.

Valve Bearings

Valve bearings shall be of a self-lubricating, nonmetallic material to effectively isolate the disc-shaft assembly from the valve body. Metal-to-metal thrust bearings in the flow stream are not allowed.

Valve Disc

The disc shall be a lens-shaped design to afford minimal pressure drop and line turbulence. Materials of construction shall be:

- 3"-6" – ASTM A351 Gr. CF8M stainless steel disc
- 8"-20" – ASTM A126, Class B cast iron disc with a stainless steel type 316 edge

Discs shall be retained by stainless steel pins which should extend through the full diameter of the shaft to withstand the specified line pressure up to valve rating and the torque required to operate the valve. Disc stops located in the flow stream are not allowed.

Valve Shafts

Valve shafts shall be of stainless steel type 304. At the operator end of the valve shaft, a packing gland utilizing "V" type chevron packing shall be utilized. "O" ring and/or "U" cup packing is not allowed.

Painting

All surfaces of the valve interior shall be clean, dry and free from grease before painting. The valve interior and exterior, except for disc edge, rubber seat and finished portions shall be evenly coated with an NSF61 approved 2-part liquid epoxy. Minimum dry film thickness shall be 8 Mils.

Testing

Hydrostatic and seat leakage tests shall be conducted in strict accordance with AWWA Standard C504.

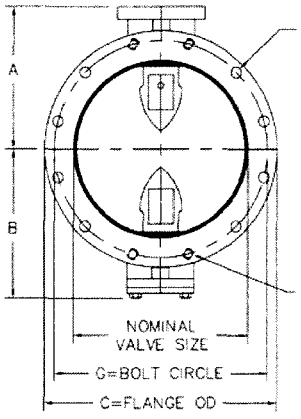
Proof of Design

The manufacturer furnishing valves under the specification shall be prepared to provide Proof of Design Test reports to illustrate that the valves supplied meet the design requirements of AWWA C504.

Manual Actuators: Manual actuators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Actuators shall be equipped with mechanical stop-limiting devices to prevent overtravel of the disc in the open and closed positions. Actuators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 lb. on the handwheel or chainwheel. Actuator components shall withstand an input torque of 450 Lb. Ft. at extreme operator position without damage. Manual actuators shall conform to AWWA C504 and shall be Pratt MDT or an approved equal.

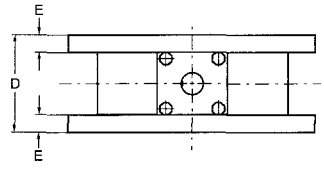
Powered Actuators: Refer to Pratt's Butterfly Valve Actuator brochure for suggested specifications and detailed information regarding cylinder actuators and electric actuators.

Dimensional Data:
Model 2FII, Flanged Butterfly Valve



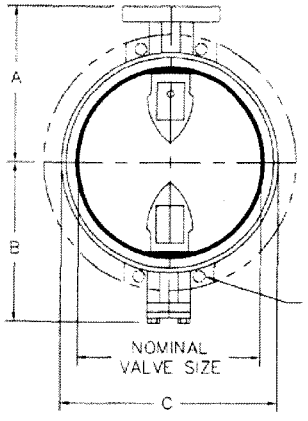
Nominal Valve Size	A	B	C	D	E	F	G
3	4 3/4	31/4	7 1/2	5	3/4	4 – 5/8	6
4	5 1/2	3 1/2	9	5	15/16	8 – 5/8	7 1/2
6	6 1/2	51/8	11	5	1	8 – 3/4	9 1/2
8	7 3/4	6 1/2	13 1/2	6	1 1/8	8 – 3/4	11 3/4
10	9	9 7/8	16	8	1 3/16	12 – 7/8	14 1/4
12	10 1/2	11 3/8	19	8	1 1/4	12 – 7/8	17
14	11 7/8	12 3/4	21	8	1 3/8	12 – 1	18 3/4
16	13 1/2	14 3/8	23 1/2	8	1 7/16	16 – 1	21 1/4
18	14 3/8	15 1/4	25	8	1 9/16	16 – 1 1/8	22 3/4
20	16	16 7/8	27 1/2	8	1 11/16	20 – 1 1/8	25

All dimensions shown in inches.



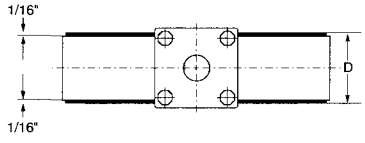
– Available in sizes 3 through 20 inches

Dimensional Data:
Monoflange MKII Wafer Butterfly Valve



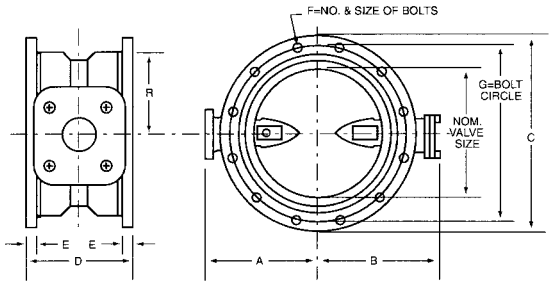
Nominal Valve Size	A	B	C	D
3	4 3/4	3 1/4	5 1/4	2 1/16
4	5 1/2	3 1/2	6 3/4	2 5/16
6	6 1/2	5 1/8	8 5/8	2 15/16
8	7 3/4	6 1/2	10 7/8	3 1/16
10	9	9 7/8	13 1/4	3 3/16
12	10 1/2	11 5/16	16	3 7/16
14	11 7/8	12 3/4	17 5/8	3 11/16
16	13 1/2	14 3/8	20 1/8	4 3/16
18	14 3/8	15 1/4	21 1/2	4 11/16
20	16	16 13/16	23 3/4	5 3/16

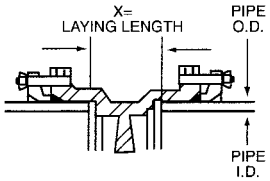
All dimensions shown in inches.



VALVE SIZE (in.)	DISC O.D. (in.)	MINIMUM MATING PIPE I.D. (in.)*
3	3.089	2.41
4	4.074	3.44
6	6.070	5.38
8	8.078	7.53
10	10.098	9.62
12	12.108	11.64
14	13.339	12.86
16	15.336	14.79
18	17.370	16.75
20	19.380	18.71

Dimensional Data:
Model 2MII Mechanical Joint End Butterfly Valve





Installation Diagram
Note: The following items to be furnished by others unless otherwise specified in contract: **Bolts, Glands, Nuts, Gaskets**

See Note 1.

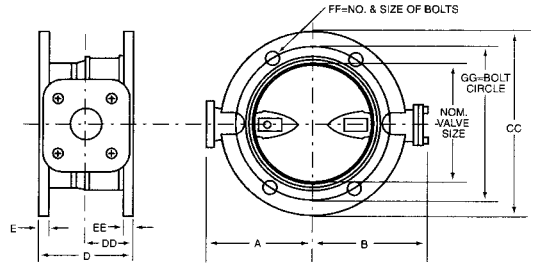
PIPE SIZE	PIPE O.D.	PIPE I.D. MIN.
4	4.80	3.10
6	6.90	5.69
8	9.05	7.65
10	11.10	9.93
12	13.20	11.70
14	15.30	12.91
16	17.40	14.91
18	19.50	16.95
20	21.60	18.96

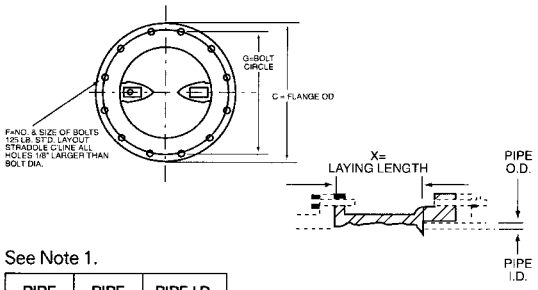
– Available in sizes 4 through 20 inches

Nominal Valve Size	A	B	C	D	E	F	G	X
4	5 1/2	3 1/2	9	8 1/8	1	4 – 3/4	7 1/2	3 1/8
6	6 1/2	5 1/8	11	8 1/2	1 1/16	6 – 3/4	9 1/2	3 1/2
8	7 3/4	6 1/2	13 1/4	8 5/8	1 1/8	6 – 3/4	11 3/4	3 5/8
10	9	9 3/4	15 9/16	9 1/4	1 3/16	8 – 3/4	14	4 1/4
12	10 1/2	11 3/8	17 15/16	9 1/4	1 1/4	8 – 3/4	16 1/4	4 1/4
14	11 7/8	12 3/4	20 5/16	11 1/2	1 5/16	10 – 3/4	18 3/4	4 1/2
16	13 1/2	14 5/16	22 9/16	12	1 3/8	12 – 3/4	21	5
18	14 3/8	15 3/8	24 11/16	12 1/4	1 3/8	12 – 3/4	23 1/4	5 1/4
20	16	17	27 3/32	12 1/2	1 1/2	14 – 3/4	25 1/2	5 1/2

All dimensions shown in inches.
Mechanical joint end is in compliance with ANSI 21.11.

Dimensional Data: Model 2MFII
Mechanical Joint and Flange End Butterfly Valve





See Note 1.

PIPE SIZE	PIPE O.D.	PIPE I.D. MIN.
4	4.80	3.10
6	6.90	5.69
8	9.05	7.65
10	11.10	9.93
12	13.20	11.70
14	15.30	12.91
16	17.40	14.91
18	19.50	16.95
20	21.60	18.96

Installation Diagram
Note: **Bolts, Nuts, Glands and Gaskets** furnished by others unless otherwise specified in contract.

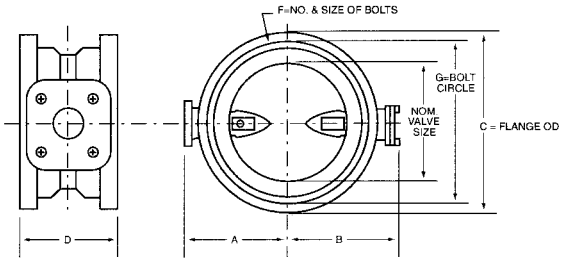
– Available in sizes 6 through 20 inches.

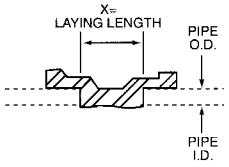
Nominal Valve Size	A	B	C	CC	D	DD	E	EE	F	FF	G	GG	X
6	6 1/2	5 1/8	11	11	6 3/4	4 1/4	1 1/16	1 1/16	8 – 3/4	6 – 3/4	9 1/2	9 1/2	4 1/4
8	7 3/4	6 1/2	13 1/2	13 1/4	7 5/16	4 5/16	1 1/8	1 1/8	8 – 3/4	6 – 3/4	11 3/4	11 3/4	4 13/16
10	9	9 7/8	16	15 9/16	8 5/8	4 5/8	1 1/4	1 3/16	12 – 7/8	8 – 3/4	14 1/4	14	6 1/8
12	10 1/2	11 3/8	19	17 15/16	8 5/8	4 5/8	1 1/4	1 1/4	12 – 7/8	8 – 3/4	17	16 1/4	6 1/8
14	11 7/8	12 3/4	21	20 5/16	9 3/4	5 3/4	1 3/8	1 5/16	12 – 1	10 – 3/4	18 3/4	18 3/4	6 1/4
16	13 1/2	14 3/8	23 1/2	22 9/16	10	6	1 7/16	1 3/8	16 – 1	12 – 3/4	21 1/4	21	6 1/2
18	14 3/8	15 1/4	25	24 11/16	10 1/8	6 1/8	1 9/16	1 7/16	16 – 1 1/8	12 – 3/4	22 3/4	23 1/4	6 5/8
20	16	16 7/8	27 1/2	27 3/32	10 1/4	6 1/4	1 11/16	1 1/2	20 – 1 1/8	14 – 3/4	25	25 1/2	6 3/4

All dimensions shown in inches.

Note 1: Min. Pipe I.D. value has zero clearance between mating pipe and valve disc. Properly sized piping must include appropriate clearance.

Dimensional Data:
Model 2PII Push-On Joint End Butterfly Valve





Installation Diagram
Note: **Rubber ring gaskets** furnished by others unless otherwise specified in contract.

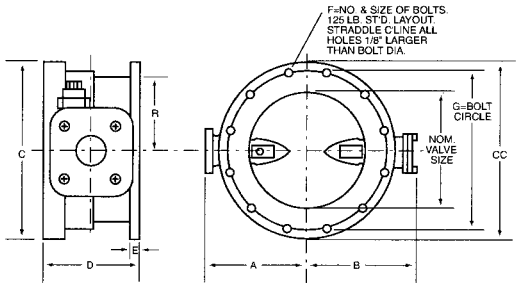
See Note 1.

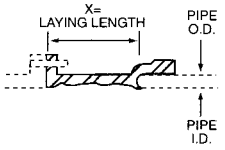
Pipe Size	Pipe O.D.	Min. Pipe I.D.
4	4.80	2.61
6	6.90	4.96
8	9.05	7.22
10	11.10	9.22
12	13.20	10.97
14	15.30	12.56
16	17.40	14.59

Nominal Valve Size	A	B	C	D	X
4	5 1/2	3 1/2	6 7/8	10 3/8	3 1/8
6	6 1/2	5 1/8	9	10 3/4	3 1/2
8	7 3/4	6 1/2	11 1/4	12	3 5/8
10	9	9 7/8	14	12 5/8	4 1/8
12	10 1/2	11 3/8	16 3/8	15	5 1/8
14	11 7/8	12 3/4	18 7/8	14 3/4	4 1/2
16	13 1/2	14 3/8	21 1/4	15	4 3/4

- All dimensions shown in inches.
- Available in sizes 4 through 16 inches.
- D ± 1/16" through 10" valves, ± 1/8" for 12" and larger valves.
- The valve end is designed for iron or PVC pipe with cast iron equivalent O.D.s (not for use with IPS O.D. pipe.)
- Use with "Tyton" (Reg. T.M. or U.S. Pipe & Foundry Co.) rubber ring gasket.

Dimensional Data:
Model 2FPII Push-On X Flange End Butterfly Valve





Installation Diagram
Note: **Bolts, Nuts, and Rubber Gaskets** furnished by others unless otherwise specified in contract.

See Note 1.

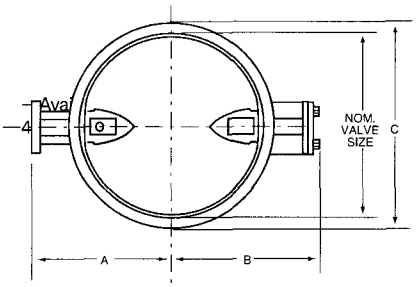
Pipe Size	Pipe O.D.	Min. Pipe I.D.
4	4.80	2.61
6	6.90	4.96
8	9.05	7.22
10	11.10	9.22
12	13.20	10.97
14	15.30	12.56
16	17.40	14.59

Note 1: Min. Pipe I.D. value has zero clearance between mating pipe and valve disc. Properly sized piping must include appropriate clearance.

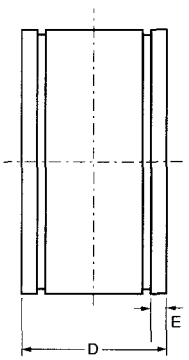
Nominal Valve Size	A	B	C	CC	D	E	F	G
4	5 1/2	3 1/2	6 7/8	9	7 11/16	1 5/16	8 – 5/8	7 1/2
6	6 1/2	5 1/8	9	11	7 7/8	1	8 – 3/4	9 1/2
8	7 3/4	6 1/2	11 1/4	13 1/2	8 15/16	1 1/8	8 – 3/4	11 3/4
10	9	9 7/8	14	16	10 5/16	1 3/16	12 – 7/8	14 1/2
12	10 1/2	11 3/8	16 3/8	19	11 1/2	1 1/4	12 – 7/8	17
14	11 7/8	12 11/16	18 7/8	21	11 3/8	1 3/8	12 – 1	18 3/4
16	13 1/2	14 5/16	21 1/4	23 1/2	11 1/2	1 7/16	16 – 1	21 1/4

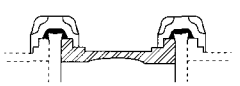
- All dimensions shown in inches.
- Available in sizes 4 through 12 inches.
- D ± 1/16" through 10" valves, ± 1/8" for 12" and larger valves.
- The valve end is designed for iron or PVC pipe with cast iron equivalent O.D.s (not for use with IPS O.D. pipe.)
- Use with "Tyton" (Reg. T.M. or U.S. Pipe & Foundry Co.) rubber ring gasket.

Dimensional Data:
Model 2VII Victaulic End Butterfly Valve



– Available in sizes
4 through 20 inches.





INSTALLATION DETAIL
NOTE: VICTAULIC COUPLINGS, GLANDS, AND GASKETS FURNISHED BY OTHERS

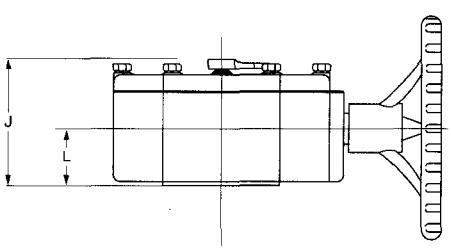
Nominal Valve Size	A	B	C	D	E
4	5 1/2	3 1/2	5 5/16	8 1/8	3/4
6	6 1/2	5 1/8	7 1/2	8 1/2	3/4
8	7 3/4	6 1/2	9 3/4	8 5/8	7/8
10	9	9 7/8	12	8	15/16
12	10 1/2	11 5/16	14 1/4	8	15/16
14	11 7/8	12 11/16	16 7/16	8	15/16
16	13 1/2	14 5/16	18 1/2	8	1 3/16
18	14 3/8	15 3/16	20 15/16	8	1 1/4
20	16	16 13/16	22 7/8	8	1 3/16

All dimensions shown in inches.

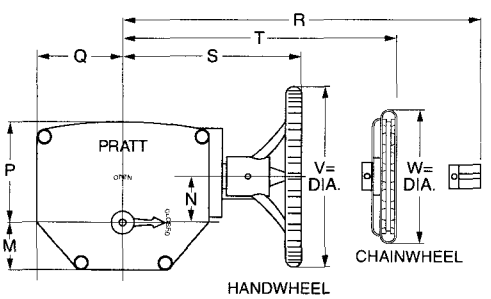
"D" dimension ± 1/16" for 4" thru 10" valves.
"D" dimension ± 1/8" for 12" thru 20" valves.

Victaulic groove profile style 44

Actuator Dimensional Data for Models 2FII and MKII Pratt MDT Manual Actuator



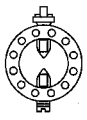
All dimensions shown in inches



Valve Size	MDT Size	J	L	M	N	P	Q	R	S	T	V	W	# Turns to Close
3 to 12"	MDT-2	4 11/16	2	2 1/8	2	4 1/2	4 1/4	7 5/8	7 7/8	7 7/8	8	9 1/8	32
14, 16"	MDT-3	5 5/8	2 7/16	3 1/4	3 5/32	5 5/8	5 3/8	9 1/4	10 1/2	10	12	9 1/8	30
18, 20"	MDT-4	6 3/8	2 27/32	3 3/8	4	7 5/16	63/4	10 1/2	11 1/2	11	12	9 1/8	40

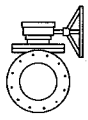
For further information regarding manual actuators, refer to Pratt's Butterfly Valve Actuator brochure.

PRATT PRODUCT GUIDE

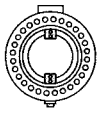


Model 2FII

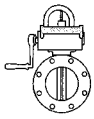
Monoflange MKII



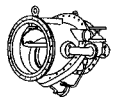
Plug Valve



Triton® XR70



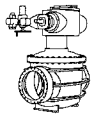
Indicating Butterfly Valve UL & FM approved



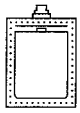
Tilting Disc Check Valve

Triton® XL

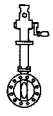
N-Stamp Nuclear Butterfly Valve



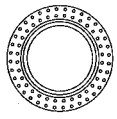
Cone Valve



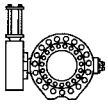
Rectangular



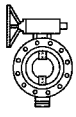
PIVA Post Indicating Valve Assembly UL & FM approved



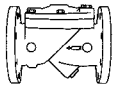
Sleeve Valve



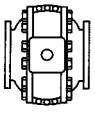
Rubber Seated Ball Valve



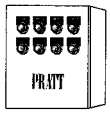
Triton® HP250



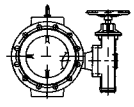
Check Valve



Metal Seated Ball Valve

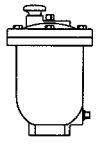


Control Systems



Plunger Valve

PRATT



Air Valve

Henry Pratt Company
401 South Highland Avenue
Aurora, Illinois 60506-5563 - US
P: 630-844-4000 F: 630-844-4160
www.henrypratt.com
ISO 9001: 2000 Certified

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 5 **MECHANICAL EQUIPMENT**
B. MANUAL BALL VALVES

Project	ARSENIC REMOVAL SYSTEM	Tetra Cont. No.	22643	Rev.	0	By	Date
Customer	AZ WATER	Cost Code		Date	12/17/2014	Ckd.	Date
Location	VALLEY FARMS					Sheet 1	of 1

Qty	Mark	Materials Description		Drawing No.	Code Letter
		DESIGN PRESSURE	100 PSIG 125 ° F		
		Threaded, 2-Piece, Standard Port, Stainless Steel Ball Valve			
		Blow-out-proof stem design, Reinforced TFE Seals and TFE Seals			
2	V-402	2" DIAMETER	AIR IN / VENT & DRAIN		
1	V-402	1" DIAMETER	AIR RELEASE SHUT OFF		
1	V-402	3/4" DIAMETER	VESSEL MEDIA SAMPLE		
7	V-402	1/2" DIAMETER	INSTRUMENT / SAMPLE		
2	V-402	1/4" DIAMETER	SAMPLE SCREEN		
		TAG EACH ITEM WITH "MARK NO." USING CORROSION RESISTANT			
		TAG ATTACHED WITH SS WIRE.			

P.O. No.

76F-100-A SERIES

Stainless Steel Full Port Ball Valve

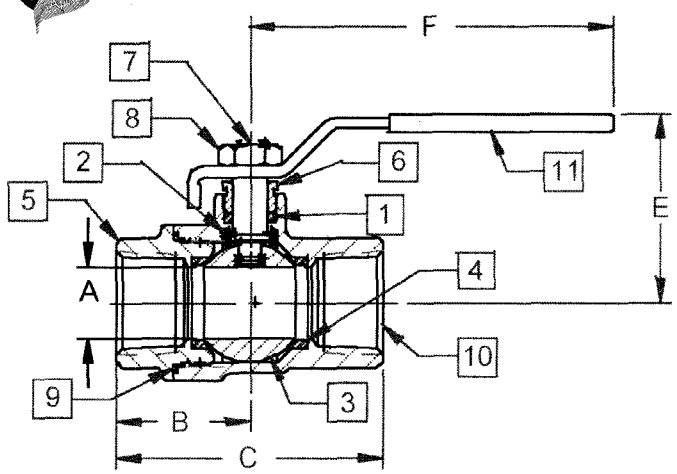
Female NPT Thread, 1/4"-3" 1000 CWP (psig), Cold Non-Shock. (See referenced P/T chart)
150 psig Saturated Steam.
Vacuum Service to 29 inches Hg.
MSS SP-110 compliant.

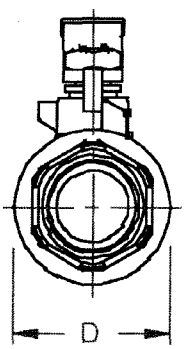
FEATURES

- Investment cast components
- Reinforced seats
- Blow-out-proof stem design
- Adjustable packing gland
- Stainless Steel lever and nut
- Fire tested API 607, 6th edition (Requires "24" suffix)
- Meets NACE MR0175 (2000) & MR0103 (2012)
- CSA/CAN 3.16-M88 (2009) (Requires "01" suffix)
- NSF/ANSI 61 (2010) Section 8, Annex F & G
- NSF-372, Drinking Water System Components - Lead Content

OPTIONS AVAILABLE: (More information in Section J)

(SUFFIX)	OPTION	SIZES
-01	Standard Configuration	All
-P -01-	BSPP (Parallel) Thread Connection	1/2" to 2"
-T -01-	BSPT (Tapered) Thread Connection	1/2" to 3"
-02-	Stem Grounded	1/2" to 3"
-04-	2.25" Stem Extension	1/2" to 2"
-08-	90° Reversed Stem	1/2" to 2"
-11-	Therma-Seal™ Insulating Tee Handle	1/4" to 2"
-14-	Side Vented Ball (Uni-Directional)	3/8" to 3"
-24-	Graphite Packing	1/2" to 3"
-27-	SS Latch-Lock Lever & Nut	1/4" to 3"
-30-	Cam-Lock and Grounded	1/2" to 2"
-32-	SS Tee Handle & Nut	1/2" to 2"
-39-	SS Hi-Rise Locking Wheel Handle, SS Nut	1/2" to 2"
-40-	Cyl-Loc and Grounded	1/2" to 2"
-44-	Seal Welded	1/4" to 3"
-45-	Less Lever & Nut	1/2" to 3"
-46-	Latch Lock Lever - Lock in Closed Position Only	1/2" to 2"
-47-	SS Latch Lock Oval Handle	1/2" to 2"
-48-	SS Oval Handle (No Latch) & Nut	1/4" to 2"
-49-	No Lubrication. Assembled Dry.	1/2" to 3"
-56-	Multifill Seats & Packing	1/2" to 3"
-60-	Static Grounded Ball & Stem	1/2" to 3"





STANDARD MATERIAL LIST

	PART	MATERIAL
1	Stem packing	MPTFE
2	Stem bearing	RPTFE
3	Ball	A276-316 Stainless Steel
4	Seat (2)	RPTFE
5	Retainer	A351-CF8M Stainless Steel
6	Gland	A276-316 Stainless Steel
7	Stem	A276-316 Stainless Steel
8	Lever nut	304 Stainless Steel
9	Body Seal	RPTFE (1/2" to 2")
10	Body	A351-CF8M
11	Lever and grip	SS w/vinyl

PRODUCT NUMBER	SIZE	A	B	C	D	E	F	WT.
76F-101-01	1/4"	0.37	0.95	1.91	1.12	1.60	3.85	0.47
76F-102-01	3/8"	0.37	0.95	1.91	1.12	1.60	3.85	0.44
76F-103-01A	1/2"	0.50	1.21	2.35	1.27	1.73	3.85	0.57
76F-104-01A	3/4"	0.81	1.39	2.77	1.62	1.96	3.85	0.91
76F-105-01A	1"	1.00	1.67	3.34	2.00	2.27	4.75	1.38
76F-106-01A	1.25"	1.25	1.96	3.92	2.73	3.21	7.77	4.17
76F-107-01A	1.5"	1.50	2.05	4.10	2.92	3.31	7.77	4.69
76F-108-01A	2"	2.00	2.37	4.74	3.75	3.69	7.77	6.90
76F-100-01A	3"	3.00	3.70	7.40	5.68	5.23	10.00	22.40

** LEAD FREE: The wetted surfaces of this product shall contain no more than 0.25% lead by weighted average. Complies with CA AB1953, VT Act 193, MD HB372, LA HB471 and Federal Public Law 111-380. ANSI 3rd party approved and listed.*

FOR PRESSURE/TEMPERATURE RATINGS, REFER TO PAGE M-12, GRAPH NO. 8

FLOW DATA

For Apollo® Ball Valves

The listed Cv "factors" are derived from actual flow testing, in the Apollo® Ball Valve Division, Conbraco Industries, Inc., Pageland, South Carolina. These tests were completed using standard "off the shelf" valves with no special preparation and utilizing standard schedule 40 pipe. It should be understood that these factors are for the valve only and also include the connection configuration. The flow testing is done utilizing water as a fluid media and is a direct statement of the gallons of water flowed per minute with a 1 psig pressure differential across the valve/connection unit. Line pressure is not a factor. Because the Cv is a factor, the formula can be used to estimate flow of most media for valve sizing.

FLOW OF LIQUID

$$Q = C_V \sqrt{\frac{\Delta P}{SpGr}}$$

$$\text{or } \Delta P = \frac{(Q)^2 (SpGr)}{(Cv)^2}$$

Where:

Q = flow in US gpm
ΔP = pressure drop (psig)
SpGr = specific gravity at flowing temperature
Cv = valve constant

FLOW OF GAS

$$Q = 1360\, C_V \sqrt{\frac{(\Delta P)\,(P_2)}{(SpGr)\,(T)}}$$

$$\text{or } \Delta P = \frac{5.4 \times 10^{-7} (SpGr)\,(T)\,(Q)^2}{(Cv)^2\,(P_2)}$$

Where:

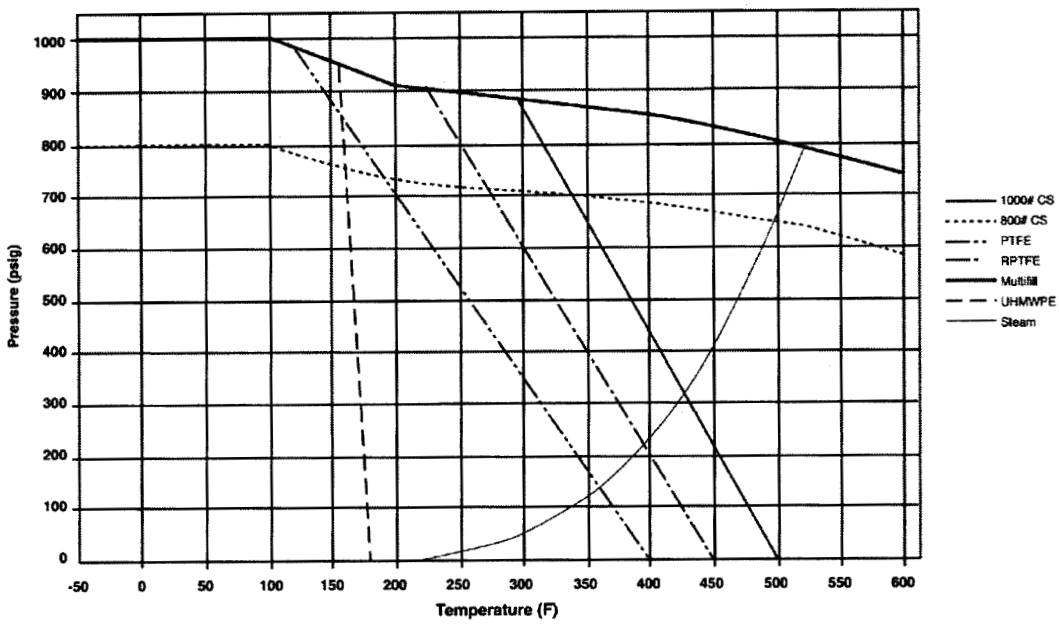
Q = flow in SCFH
ΔP = pressure drop (psig)
SpGr = specific gravity (based on air = 1.0)
P_2 = outlet pressure–psia (psig + 14.7)
T = (temp. °F + 460)
Cv = valve constant

Cv FACTORS FOR APOLLO VALVES

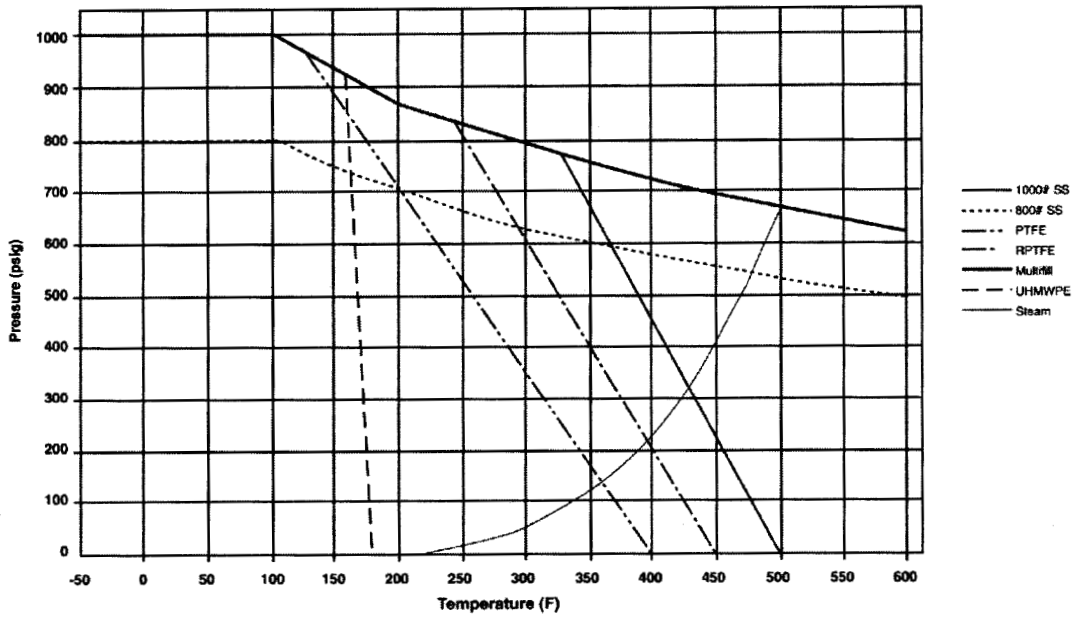
SIZE (IN.) VALVE	1/4	3/8	1/2	3/4	1	1.25	1.5	2	2.5	3	4	6	8	10	12
32-100/200 Series	5.1	6.6	8	24	30	45	55	95	--	--	--	--	--	--	--
64-100/200 Series	6	7	19	34	50	104	268	309	629	1018	1622	--	--	--	--
64W Series	--	--	--	--	--	--	--	--	629	1018	1622	--	--	--	--
70B-140 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
70-100/200 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	---
70-300/400 Series	--	--	15	30	43	48	84	108	--	--	--	--	--	--	--
70-600 Series	2.3	4.5	5.4	12	14	21	34	47	--	--	--	--	--	--	--
70-800 Series	8.4	7.2	15	30	43	48	84	--	--	--	--	--	--	--	--
71AR Series	--	--	--	30	43	48	84	108	190	370	--	--	--	--	--
71-100/200 Series	--	--	--	30	43	48	84	108	190	370	--	--	--	--	--
72-100/900 Series	--	--	26	48	65	125	170	216	--	--	--	--	--	--	--
73A-100 Series	8.4	7.2	15	30	43	48	84	108	--	--	--	--	--	--	--
73-300/400 Series	--	--	26	48	65	125	170	216	--	--	--	--	--	--	--
74-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
75-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
76AR Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
76F-100 Series	8.1	15	15	51	68	125	177	389	--	--	--	--	--	--	--
76-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	--	--	--	--	--
76-300/400 Series	--	--	26	48	65	125	170	216	--	--	--	--	--	--	--
76-600 Series	2.3	4.5	5.4	12	14	21	34	47	--	--	--	--	--	--	--
7K-100 Series	--	--	15	51	68	125	177	389	503	--	--	--	--	--	--
77AR Series	8.1	15	15	51	68	125	177	389	--	--	--	--	--	--	--
77C-100/200 Series	4.5	7.2	16	36	68	125	177	389	503	--	--	--	--	--	--
77D-140 Series	4.5	7.2	16	36	68	125	177	389	--	--	--	--	--	--	--
77D-640 Series	--	--	--	11	24	35	--	--	--	--	--	--	--	--	--
77G-UL Series	4.5	7.2	16	36	68	125	177	389	503	--	--	--	--	--	--
77W Series	--	--	16	36	68	125	177	389	--	--	--	--	--	--	--
77X Series	--	--	16	36	68	--	--	--	--	--	--	--	--	--	--
77-100/200 Series	8.1	15	15	51	68	125	177	389	503	--	--	--	--	--	--
79 Series	8.5	8.5	9.8	32	44	66	148	218	440	390	--	--	--	--	--

continued on next page

1000# CS (GRAPH 7)



1000# SS (GRAPH 8)



VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 5 **MECHANICAL EQUIPMENT**

C. AIR RELEASE VALVES

MARK	QTY	SIZE	SERVICE
AV-001	2	1"	POTABLE WATER

Project	ARSENIC REMOVAL SYSTEM	Tetra Cont. No.	22643	Rev.	0	By		Date	25-Sep-14
Customer	AZ WATER	Cost Code		Date	9/25/2014	Ckd.		Date	
Location	VALLEY FARMS					Sheet	1 of		1

Qty	Mark	Materials Description	Drawing No.	Code Letter
1	AV-001	SERVICE: POTABLE WATER		
		PURPOSE:		
		FILLING AND PREVENT FORMATION OF EXCESSIVE VACUUM CONDITION S DURING DRAINING OPEARATIONS		
		VESSEL RATING 100 PSIG 125 ° F		
		SIZE: 1" DIAMETER		
		END CONNECTIONS THREADED		
		BODY AND COVER CAST IRON		
		FLOAT 316 STAILESS STEEL		
		SEAT BUNA N (NSF)		
		ACCEPTABLE APCO SERIES 140C		
		MANUFACTURERS: GA INDUSTRIES FIG. 945		
		CRISPIN SERIES C		
		PRATT		
		TAG EACH VALVE WITH "MARK NO." USING CORROSION RESISTANT		
		TAG ATTACHED WITH SS WIRE.		
		SUBMIT CATALOGUE CUTS MARKED WITH		
		TAG NUMBER		
		SIZE		
		QUANTITY		
		FEATURES		

P.O. No.

KINETIC COMPACT COMBINATION AIR VALVE

1/2" through 1" NPT Inlet and Outlet

FIG. 945

COMBINETIC

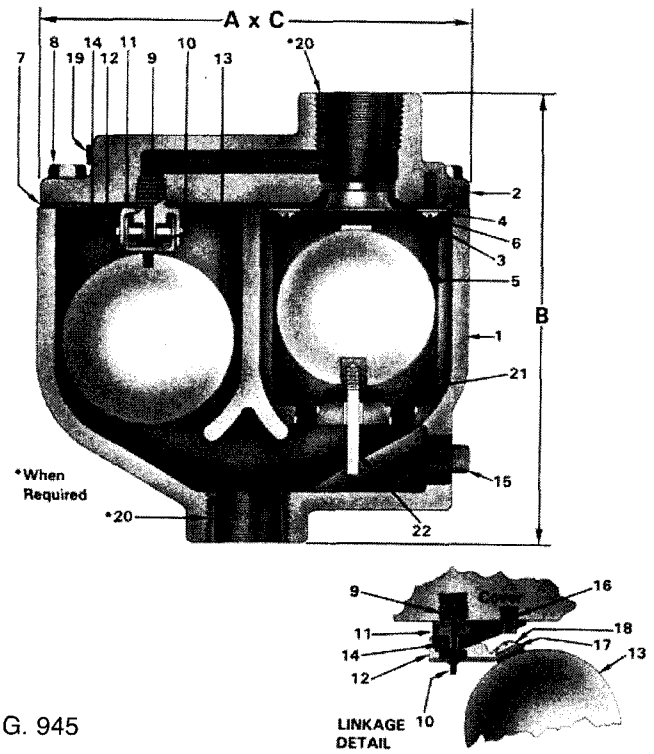


FIG. 945

GENERAL DIMENSIONS

VALVE SIZE	A (SQUARE)	B (HEIGHT)	C (WIDTH)	WEIGHT (LBS.)
1/2" NPT	6-1/4"	7-1/4"	3-7/8"	16
3/4" NPT	6-1/4"	7-1/4"	3-7/8"	16
1" NPT	6-1/4"	7-1/4"	3-7/8"	16

ENGINEERING SPECIFICATION

The Combination Air Valve shall consist of a KINETIC Air & Vacuum Valve and an Air Release Valve contained in a single body housing. The valve shall be designed to exhaust large amounts of air during filling, to release small amounts of accumulated air during operation and to admit large amounts of air upon impending vacuum during draining.

The inlet shall be the nominal size of the valve and the outlet shall be the same size as the inlet. Body and cover shall be of cast iron conforming to ASTM A126, Class B. The Air & Vacuum portion of the valve shall be designed to exhaust air at up to sonic velocity without blowing shut. The floats shall be spherical and shall be capable of withstanding a test pressure of 1000 psi. The Air Release portion shall have a stainless steel leverage mechanism and float. The small orifice shall be stainless steel and have a rubber seat.

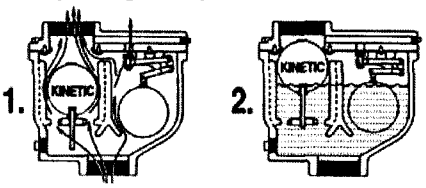
KINETIC Compact Combination Air Valves shall be as manufactured by GA Industries, Inc., their Figure 945.

PARTS LIST

1. BODY - Cast Iron A126 Class B
2. COVER - Cast Iron A126 Class B
3. SEAT (Air Vacuum) - Buna-N
4. SUPPORT RING - 316 Stainless Steel
5. FLOAT BALL (Air Vacuum) - 316 Stainless Steel
6. SEAT SCREWS - 18-8 Stainless Steel
7. COVER GASKET - Composition
8. COVER BOLTS - Steel Grade 2
9. ORIFICE - 316 Stainless Steel
10. ORIFICE BUTTON - Buna-N
11. LEVERAGE BRACKET - 316 Stainless Steel
12. FLOAT ARM - 316 Stainless Steel
13. FLOAT BALL (Air Release) - 316 Stainless Steel
14. COILED SPRING PIN - 302 Stainless Steel
15. PIPE PLUG - Steel (Commercial)
16. SLOTTED SPRING PIN - 410/420 Stainless Steel
17. LOCKWASHER - 18-8 Stainless Steel
18. FLOAT SCREW - 18-8 Stainless Steel
19. COUNTERSUNK PLUG - Steel (Commercial)
20. REDUCING BUSHING - Steel (Commercial)
21. CUSHION - Buna-N
21. BALL GUIDE - UHMW-PE

ENGINEERING DATA

Kinetic Operating Principle of the Combinetic Valve:



1. During the exhausting sequence, the air flowing around the large orifice buoy ball produces a resultant downward force which maintains the ball in the open position.
2. The buoyant force of the balls will seal both orifices when water reaches the balls.

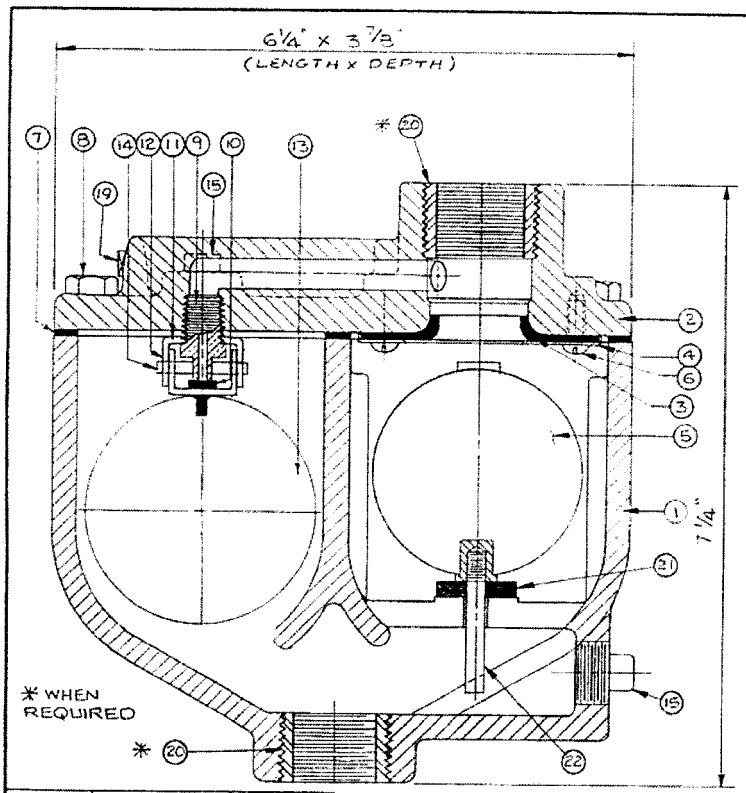
Pressure Rating:
NPT Inlet Body rated to 300 psi WOG; tested to 450 psi
Float tested to 1000 psi.

Working Pressure:
10-150 psi with 3/32" orifice (Standard - Fig. 945)
10-300 psi with 1/16" orifice (Optional - Fig. 945H)
CONSULT FACTORY IF OPERATING PRESSURE IS LESS THAN 10 PSI.

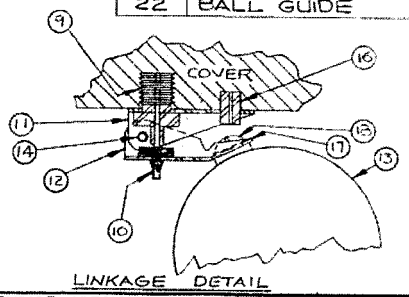
Small Orifice (Air Release) Maximum Venting Rate:
Figure 945@ 150 psi with 3/32" orifice = 14.7 SCFM
Figure 945-H@ 300 psi with 1/16" orifice = 8.5 SCFM
FOR SIZING AND LOCATING SEE PAGES 16-17, 36-37.

Connections:
Inlet - NPT, Standard
Outlet - NPT, Standard

Options:
For Optional Cowl, specify 945-C.
For Optional Throttling Device, specify 945-P
see pages 41 and 35.



PART NO.	DESCRIPTION	MATERIAL
1	BODY	CAST IRON A126 CL B
2	COVER	CAST IRON A126 CL B
3	SEAT (AIR VACUUM)	BUNA-N
4	SUPPORT RING	304 STN. STL.
5	FLOAT BALL (AIR VACUUM)	304 STN. STL.
6	SEAT SCREWS	18-8 STN. STL.
7	COVER GASKET	ARMSTRONG CS-301
8	COVER BOLTS	STEEL GRADE 2
9	ORIFICE	303 STN. STL.
10	ORIFICE BUTTON	BUNA-N
11	LEVERAGE BRACKET	302/304 STN. STL.
12	FLOAT ARM	302/304 STN. STL.
13	FLOAT BALL (AIR RELEASE)	304 STN. STL.
14	SPIROL PIN	302 STN. STL.
15	PIPE PLUG	STEEL (COMM.)
16	SPRING PIN	18-8 STN. STL.
17	LOCKWASHER	18-8 STN. STL.
18	FLOAT SCREW	18-8 STN. STL.
19	COUNTERSUNK PLUG	STEEL (COMM.)
20	REDUCING BUSHING	STEEL (COMM.)
21	CUSHION	BUNA-N
22	BALL GUIDE	UHMW



LINKAGE DETAIL

VALVE SIZE	SIZE INLET & OUTLET	WEIGHT
½"	½" N.P.T.	15 LBS.
¾"	¾" N.P.T.	15 LBS.
1"	1" N.P.T.	15 LBS.

ORIFICE SIZE:
3/32" FOR 0-150 PSI (STANDARD)
1/16" FOR 151-300 PSI (OPTIONAL)

EMPIRE SPECIALTY COMPANY PITTSBURGH, PA.

½", ¾", 1" FIG. #945
COMBINATION AIR VALVE (NEW STYLE)

DWG. N.T.S.
FIG. # 945
ACT
DRAWN RRS
DATE 3-12-91
DWG. NO. ECAV-7136

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 5 **MECHANICAL EQUIPMENT**
D. EXPANSION JOINTS

E T

F M TE		MM			E T		
Project	ARSENIC REMOVAL SYSTEM	Tetra Cont. No.	22643	Rev.	0	By	Date 25-Sep-14
Customer	AZ WATER	Cost Code		Date	9/25/2014	Ckd.	Date
Location	VALLEY FARMS					Sheet 1 of 1	

Qty	Mark	Materials Description	Drawing No.	Code Letter
		E T		
		Single Arch, Flanged, EPDM - NSF listed rubber, Galvanized CS back up rings,		
		Drilled per ANSI Class 125 Flanges, rated for 100 PSIG @ 125 ° F		
		Include Galvanized Carbon Steel Control Rods designed for Maximum Design Pressure.		
		Face to face dimension 6"		
		MANUFACTURER E		
2	EJ-001	SIZE 6.0 IN DIAMETER		
		TAG EACH ITEM WITH "MARK NO." USING CORROSION RESISTANT		
		TAG ATTACHED WITH SS WIRE.		
		SUBMIT CATALOGUE CUTS MARKED W/		
		TAG NUMBER		
		SIZE		
		QUANTITY		
		FEATURES		

E E T E TW TE F T F T T P.O. No.

Proco Style 240/242 Molded Spherical Joints

Proco Style 240/242 Spherical Molded Expansion Joints are designed for piping systems to absorb pipe movements, relieve stress, reduce system noise/vibration, compensate for misalignment/offset and to protect rotating mechanical equipment against start-up surge forces.

The molded style 240 single sphere and 242 twin sphere designed bellows are inherently stronger than the conventional hand-built style spool arch type. Internal pressure within a "sphere" is exerted in all directions, distributing forces evenly over a larger area. The spherical design "flowing arch" reduces turbulence and sediment buildup.

Features and Benefits:

Absorbs Directional Movement

Thermal movements appear in any rigid pipe system due to temperature changes. The Style 240 and Style 242 spherical arch expansion joints allow for axial compression or axial extension, lateral deflection as well as angular movement. (Note: Rated movements in this publication are based on single plane movements. Multiple movement conditions are based on a multiple movement calculation. Contact Proco for information when designing multiple pipe movements.)

Easy Installation with Rotating Metallic Flanges

The floating metallic flanges freely rotate on the bellows, compensating for mating flange misalignment, thus speeding up installation time. Gaskets are not required with the Style 240 or Style 242, provided the expansion joints are mated against a flat face flange as required in the installation instructions.

Flange Materials/Drilling

The Proco Style 240 and Style 242 molded expansion joints are furnished complete with plated carbon steel flanges for corrosion protection. 304 or 316 stainless steel flanges are available upon request as well as ANSI 250/300 lb., BS-10, DIN PN10 & PN16 and JIS-10K drilling.

Absorbs Vibration, Noise and Shock

The Proco Style 240 and Style 242 molded expansion joints effectively dampen and insulate downstream piping against the transmission of noise and vibration generated by mechanical equipment. Noise and vibration caused by equipment can cause stress in pipe, pipe guides, anchors and other equipment downstream. Water hammer and pumping impulses can also cause strain, stress or shock to a piping system. Install the Style 240 or Style 242 molded expansion joints to help compensate for these system pressure spikes.

Wide Service Range with Low Cost

Engineered to operate up to 300 PSIG or 265°F, the Proco Style 240 and Style 242 can be specified for a wide range of piping requirements. Compared to conventional hand-built spool type joints, you will invest less money when specifying the mass-produced, consistent high quality, molded single or twin sphere expansion joints.

Material Identification

All Style 240 or Style 242 molded expansion joints have branded elastomer designations. Neoprene Tube/Neoprene Cover (NN) and Nitrile Tube/Neoprene Cover (NP) elastomer designated joints meet the Coast Guard Requirements and conform to ASTM F1123-87. 240C/NP-9 joints have ABS certification.

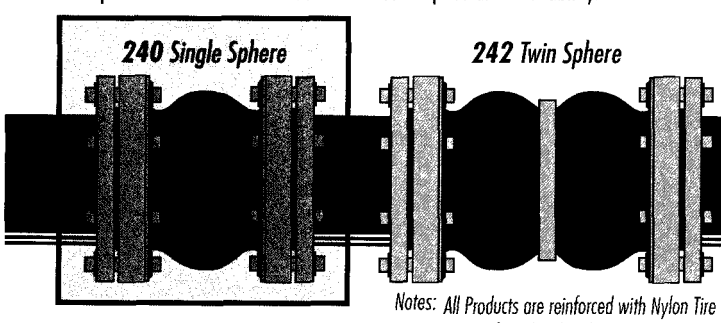
Large Inventory

Proco Products, Inc. maintains one of the largest inventories of rubber expansion joints in the world. Please contact us for price and availability.

Table 1: Available Styles • Materials

For Specific Elastomer Recommendations, See: **PROCO "Chemical To Elastomer Guide"**

240-A	240-C	240-A/D,E,M	242-A,B,C	PROCO Material Code	Cover Elastomer [1]	Tube Elastomer [2]	Maximum Operating Temp. °F	Identifying Color Band/Label
		X	X	/BB[3]	Chlorobutyl	Chlorobutyl	250°	Black
		X	X	/EE[3]	EPDM	EPDM	250°	Red
X	X			/EE[3,4]	EPDM	FDA-EPDM	250°	Red
		X		/EQ[3]	EPDM	FDA-EPDM	250°	Red
X	X			/EE-9[3,5]	EPDM	EPDM	265°	DBL Red
	X			/HH	CSM	CSM	212°	Green
		X	X	/NH	Neoprene	CSM	212°	Green
	X			/NJ	Neoprene	FDA-Nitrile	212°	White
	X	X	X	/NN	Neoprene	Neoprene	225°	Blue
X	X	X	X	/NP	Neoprene	Nitrile	212°	Yellow
X	X			/NP-9[6]	Neoprene	Nitrile-ABS	212°	DBL Yellow



Protecting Piping and Equipment Systems from Stress/Motion

Notes: All Products are reinforced with Nylon Tire Cord, except 240-A and 240-C which are reinforced with Polyester.

1. *All NN & NP elastomer designated joints meet the Coast Guard Requirements and conform to ASTM F 1123-87 and are marked accordingly.*
2. *Branding Label will be marked as "Food Grade".*
3. *BB, EE or EE-9 are good for 300°F blower service at 20 PSI or less.*
4. *240-A & 240-C expansion joints have black EPDM tube, but are FDA compliant.*
5. *EE-9 joints are peroxide cured.*
6. *NP-9 joints have ABS certification.*
7. *All elastomers above are not intended for steam service.*
8. *Only available up to 12" I.D.*
9. *For PTFE lined single sphere see www.procoproducts.com/ptfelined.html*

Information subject to change without notice.

Style 240 Single Sphere Performance Data

Table 2: Sizes • Movements • Pressures • Flange Standards • Weights

NOMINAL Pipe Size I.D.	Neutral Length	PROCO Style Number [1]	240 Movement Capability: From Neutral Position [2]					Pressure [4]		Standard Flange Drilling Dimensions [8]					Weight in lbs	
			Axial Compression Inches	Axial Extension Inches	Lateral Deflection Inches	Angular Deflection Degrees	Thrust Factor [3]	Positive PSIG [5]	Vacuum [6] Inches of Hg	Flange O.D. Inches	Bolt Circle Inches	Number of Holes	Size of Holes Inches	Bolt Hole [7] Thread	Exp. Joint & Flanges	Control Unit Set (2 Rod)
6 (150)	5.00	240-C	1.063	1.250	1.188	23		225	8	11.0	9.5	8	0.875	—	22.6	10.4
	5.00	240-E	0.750	0.500	0.500	9		225	26	11.0	9.5	8	0.875	—	26.0	10.4
	6.00	240-A	1.188	1.188	1.188	21		235	10	11.0	9.5	8	0.875	—	24.0	10.4
	6.00	**240-AV**	0.750	0.500	0.500	9	41.28	225	26	11.0	9.5	8	0.875	3/4-10 UNC	26.8	10.4
	7.09	240-D	0.750	0.500	0.500	9		225	26	11.0	9.5	8	0.875	—	29.0	10.6
	8.00	**240-AV**	0.750	0.500	0.500	9		225	26	11.0	9.5	8	0.875	3/4-10 UNC	29.1	10.8
	6.00	Q-240-HW	0.750	0.500	0.500	9		300	26	12.5	10.62	12	0.875	—	39.0	10.4
8 (200)	5.00	240-C	1.063	1.188	1.188	17		235	8	13.5	11.75	8	0.875	—	35.5	13.4
	5.00	240-E	0.750	0.500	0.500	7		225	26	13.5	11.75	8	0.875	—	40.0	13.4
	6.00	240-A	1.188	1.188	1.188	16	63.62	235	8	13.5	11.75	8	0.875	—	38.5	13.4
	6.00	**240-AV**	0.750	0.500	0.500	7		225	26	13.5	11.75	8	0.875	3/4-10 UNC	40.6	13.4
	8.07	240-D	1.000	0.563	0.875	8		225	26	13.5	11.75	8	0.875	—	41.3	14.0
	6.00	Q-240-HW	0.750	0.500	0.500	7		300	26	15.0	13.00	12	1.000	—	70.0	13.4
10 (250)	5.00	240-C	1.063	1.188	1.188	14		235	6	16.0	14.25	12	1.000	—	49.3	21.0
	5.00	240-E	1.000	0.625	0.750	7		225	26	16.0	14.25	12	1.000	—	56.0	21.0
	8.00	240-A	1.188	1.188	1.188	13		235	6	16.0	14.25	12	1.000	—	53.6	21.3
	8.00	**240-AV**	1.000	0.625	0.750	7	103.87	225	26	16.0	14.25	12	1.000	7/8-9 UNC	56.6	21.3
	9.00	**240-AV**	1.000	0.625	0.750	7		225	26	16.0	14.25	12	1.000	7/8-9 UNC	57.0	22.0
	9.45	240-D	1.000	0.625	0.750	7		225	26	16.0	14.25	12	1.000	—	58.5	22.0
	10.00	**240-AV**	1.000	0.625	0.875	7		225	26	16.0	14.25	12	1.000	7/8-9 UNC	60.5	26.5
	8.00	Q-240-HW	1.000	0.625	0.750	7		275	26	17.5	15.25	16	1.125	—	56.0	22.0
12 (300)	5.00	240-C	1.063	1.250	1.188	12		235	6	19.0	17.0	12	1.000	—	73.4	26.5
	5.00	240-E	1.000	0.625	0.750	6		225	26	19.0	17.0	12	1.000	—	74.0	26.5
	8.00	240-A	1.188	1.188	1.188	11		235	6	19.0	17.0	12	1.000	—	80.0	27.0
	8.00	**240-AV**	1.000	0.625	0.750	6	137.89	225	26	19.0	17.0	12	1.000	7/8-9 UNC	83.0	27.0
	9.00	**240-AV**	1.000	0.625	0.750	6		225	26	19.0	17.0	12	1.000	7/8-9 UNC	88.0	27.0
	10.24	240-D	1.000	0.625	0.875	6		225	26	19.0	17.0	12	1.000	—	89.0	28.0
	8.00	Q-240-HW	1.000	0.625	0.750	6		275	26	20.5	17.75	16	1.250	—	100.0	27.0
14 (350)	8.00	240-C	1.000	1.063	1.188	8	182.65	200	6	21.0	18.75	12	1.125	—	162.0	28.0
	8.00	**240-AV**	1.000	0.625	0.750	6		150	26				1.125	—	115.0	28.0
16 (400)	8.00	240-C	1.000	1.063	1.188	8		145	6				1.125	—	136.0	26.8
	8.00	240-HW	1.000	0.625	0.750	4		175	26				1.125	—	186.0	26.8
	8.00	**240-AV**	1.000	0.625	0.750	4	240.53	125	26	23.5	21.25	16	1.125	—	165.0	26.8
	9.00	240-M	1.000	0.625	0.750	4		125	26				1.125	—	168.0	27.0
	10.43	240-D	1.000	0.625	0.875	4		125	26				1.125	—	170.0	27.0
18 (450)	8.00	240-HW	1.000	0.625	0.750			175	26				1.250	—	209.0	31.4
	8.00	**240-AV**	1.000	0.625	0.750	4	298.65	125	26	25.0	22.75	16	1.250	—	168.0	31.4
	9.00	240-M	1.000	0.625	0.750			125	26				1.250	—	169.0	33.1
	10.43	240-D	1.000	0.625	0.875			125	26				1.250	—	170.0	33.1
20 (500)	8.00	240-C	1.000	1.063	1.188	6		145	6				1.250	—	154.0	32.4
	8.00	240-HW	1.000	0.625	0.750	3		175	26				1.250	—	234.0	32.4
	8.00	**240-AV**	1.000	0.625	0.750	3	363.05	125	26	27.5	25.00	20	1.250	—	170.0	32.4
	9.00	240-M	1.000	0.625	0.750	3		125	26				1.250	—	173.0	34.1
	10.43	240-D	1.000	0.625	0.875	3		125	26				1.250	—	175.0	34.1

See Notes Page 4

Style 240/242 Drilling Chart

Table 4: Flange Drilling

NOMINAL Pipe Size Inch (mm)	American 125/150# Conforms to ANSI B16.1 and B16.5						American 250/300# Conforms to ANSI B16.1 and B16.5					British Standard 10:1962 Conforms to BS 10 Table E				
	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Drilled Hole Size	Threaded Hole Size	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Hole Size	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Hole Size
1 (25)	0.55 (14.0)	4.25 (108.0)	3.13 (79.4)	4	0.62 (15.9)	1/2 - 13 UNC	0.63 (16.0)	4.88 (124.0)	3.5 (88.9)	4	0.75 (19.1)	0.59 (15.0)	4.5 (114.0)	3.25 (82.6)	4	0.62 (15.9)
1.25 (32)	0.55 (14.0)	4.63 (118.0)	3.5 (88.9)	4	0.62 (15.9)	1/2 - 13 UNC	0.63 (16.0)	5.25 (133.0)	3.88 (98.4)	4	0.75 (19.1)	0.59 (15.0)	4.75 (121.0)	3.44 (87.3)	4	0.62 (15.9)
1.5 (40)	0.55 (14.0)	5.0 (127.0)	3.88 (98.4)	4	0.62 (15.9)	1/2 - 13 UNC	0.63 (16.0)	6.12 (156.0)	4.50 (114.3)	4	0.88 (22.2)	0.59 (15.0)	5.25 (133.0)	3.88 (98.4)	4	0.62 (15.9)
2 (50)	0.63 (16.0)	6.0 (152.0)	4.75 (120.7)	4	0.75 (19.1)	5/8 - 11 UNC	0.71 (18.0)	6.50 (165.0)	5.00 (127.0)	8	0.75 (19.1)	0.63 (16.0)	6.0 (152.0)	4.5 (114.3)	4	0.75 (19.1)
2.5 (65)	0.71 (18.0)	7.0 (178.0)	5.5 (139.7)	4	0.75 (19.1)	5/8 - 11 UNC	0.71 (18.0)	7.5 (191.0)	5.88 (149.2)	8	0.88 (22.2)	0.71 (18.0)	6.5 (165.0)	5.0 (127.0)	4	0.75 (19.1)
3 (80)	0.71 (18.0)	7.5 (191.0)	6.0 (152.4)	4	0.75 (19.1)	5/8 - 11 UNC	0.79 (20.0)	8.25 (210.0)	6.62 (168.2)	8	0.88 (22.2)	0.71 (18.0)	7.25 (184.0)	5.75 (146.1)	4	0.75 (19.1)
3.5 (90)	0.71 (18.0)	8.5 (216.0)	7.0 (177.8)	8	0.75 (19.1)	5/8 - 11 UNC	0.79 (20.0)	9.0 (229.0)	7.25 (184.2)	8	0.88 (22.2)	0.71 (18.0)	8.0 (203.0)	6.5 (165.1)	8	0.75 (19.1)
4 (100)	0.71 (18.0)	9.0 (229.0)	7.5 (190.5)	8	0.75 (19.1)	5/8 - 11 UNC	0.79 (20.0)	10.0 (254.0)	7.88 (200.0)	8	0.88 (22.2)	0.71 (18.0)	8.5 (216.0)	7.0 (177.8)	8	0.75 (19.1)
5 (125)	0.79 (20.0)	10.0 (254.0)	8.5 (215.9)	8	0.88 (22.2)	3/4 - 10 UNC	0.87 (22.0)	11.0 (279.0)	9.25 (235.0)	8	0.88 (22.2)	0.79 (20.0)	10.0 (254.0)	8.25 (209.6)	8	0.75 (19.1)
6 (150)	0.87 (22.0)	11.0 (279.0)	9.5 (241.3)	8	0.88 (22.2)	3/4 - 10 UNC	0.87 (22.2)	12.5 (318.0)	10.62 (269.9)	12	0.88 (22.2)	0.87 (22.2)	11.0 (279.0)	9.25 (235.0)	8	0.88 (22.2)
8 (200)	0.87 (22.0)	13.5 (343.0)	11.75 (298.5)	8	0.88 (22.2)	3/4 - 10 UNC	0.95 (24.0)	15.0 (381.0)	13.0 (330.2)	12	1.00 (25.4)	0.87 1 (22.2)	3.25 (337.0)	11.5 (292.1)	8	0.88 (22.2)
10 (250)	0.95 (24.0)	16.0 (406.0)	14.25 (362.0)	12	1.00 (25.4)	7/8 - 9 UNC	1.02 (26.0)	17.5 (445.0)	15.25 (387.4)	16	1.13 (28.6)	0.95 (24.0)	116.0 (406.0)	14.0 (355.6)	12	0.88 (22.2)
12 (300)	0.95 (24.0)	19.0 (483.0)	17.0 (431.8)	12	1.00 (25.4)	7/8 - 9 UNC	1.02 (26.0)	20.5 (521.0)	17.75 (450.9)	16	1.25 (31.8)	0.95 (24.0)	18.0 (457.0)	16.0 (406.4)	12	1.00 (25.4)
14 (350)	1.02 (26.0)	21.0 (533.0)	18.75 (476.3)	12	1.13 (28.6)	1 - 8 UNC	1.10 (28.0)	23.0 (584.0)	20.25 (514.4)	20	1.25 (31.8)	1.02 (26.0)	20.75 (527.0)	18.5 (469.9)	12	1.00 (25.4)
16 (400)	1.10 (28.0)	23.5 (597.0)	21.25 (539.8)	16	1.13 (28.6)	1 - 8 UNC	1.18 (30.0)	25.5 (648.0)	22.5 (571.5)	20	1.38 (34.9)	1.10 (28.0)	22.75 (578.0)	20.5 (520.7)	12	1.00 (25.4)
18 (450)	1.18 (30.0)	25.0 (635.0)	22.75 (577.9)	16	1.25 (31.8)	1 1/8 - 7 UNC	1.18 (30.0)	28.0 (711.0)	24.75 (628.7)	24	1.38 (34.9)	1.18 (30.0)	25.25 (641.0)	23.0 (584.2)	16	1.00 (25.4)
20 (500)	1.18 (30.0)	27.5 (699.0)	25.0 (635.0)	20	1.25 (31.8)	1 1/8 - 7 UNC	1.18 (30.0)	30.5 (775.0)	27.0 (685.8)	24	1.38 (34.9)	1.18 (30.0)	27.75 (705.0)	25.25 (641.4)	16	1.00 (25.4)
24 (600)	1.18 (30.0)	32.06 (813.0)	29.5 (749.3)	20	1.38 (34.9)	1 1/4 - 7 UNC	1.18 (30.0)	36.0 (914.0)	32.0 (812.8)	24	1.62 (41.3)	1.18 (30.0)	32.5 (826.0)	29.75 (755.7)	16	1.25 (31.8)
30 (750)	1.26 (32.0)	38.75 (984.0)	36.0 (914.4)	28	1.38 (34.9)	1 1/4 - 7 UNC	1.26 (32.0)	43.0 (1092.0)	39.25 (997.0)	28	2.00 (50.8)	1.26 (32.0)	39.25 (997.0)	36.5 (927.1)	20	1.38 (34.9)

Drilling Chart for Bolting Requirements

Table 5: Standard Drilling for PROCO Rubber Expansion Joints | Thickness of Materials for PROCO Rubber Expansion Joints | Control Unit Plate Detail

Nominal Pipe Size Expansion Joint I.D. Inch /(mm)	Flange Dimensions [2]					Material Thickness [1] for Bolt Length Requirements			Control Unit Plate Detail	
	Flange O.D. Inch / (mm)	Bolt Circle Inch / (mm)	Number Of Holes	Size Of Holes Inch / (mm)	Bolt Hole Thread	Nominal Flange/ Beaded End Thickness Inch / (mm) (Approx. Value)	Adjacent Mating [3] Flange Thickness	Max. Control [4] Rod Plate Thickness Inch / (mm)	Control Rod [6] Plate O.D. Inch / (mm)	Maximum [7] Rod Diameter Inch / (mm)
1 (25)	4.25 (108.0)	3.13 (79.50)	4	0.625 (15.87)	1/2-13 UNC	1.25 (31.75)	CUSTOMER TO SPECIFY MATING FLANGE THICKNESS	0.375 (9.53)	8.375 (215.9)	0.625 (15.9)
1.25 (32)	4.63 (118.0)	3.5 (88.90)	4	0.625 (15.87)	1/2-13 UNC	1.25 (31.75)		0.375 (9.53)	8.750 (222.3)	0.625 (15.9)
1.5 (40)	5.0 (127.0)	3.88 (98.55)	4	0.625 (15.87)	1/2-13 UNC	1.25 (31.75)		0.375 (9.53)	9.125 (231.8)	0.625 (15.9)
2 (50)	6.00 (152.00)	4.75 (120.65)	4	0.750 (19.05)	5/8-11 UNC	1.25 (31.75)		0.375 (9.53)	10.125 (257.2)	0.625 (15.9)
2.5 (65)	7.00 (178.00)	5.50 (139.70)	4	0.750 (19.05)	5/8-11 UNC	1.25 (31.75)		0.375 (9.53)	11.125 (282.6)	0.625 (15.9)
3 (80)	7.50 (191.00)	6.00 (152.40)	4	0.750 (19.05)	5/8-11 UNC	1.25 (31.75)		0.375 (9.53)	11.625 (295.3)	0.625 (15.9)
3.5 (90)	8.5 (216.0)	7.0 (177.80)	8	0.750 (19.05)	5/8-11 UNC	1.25 (31.75)		0.375 (9.53)	12.625 (320.7)	0.625 (15.9)
4 (100)	9.00 (229.00)	7.50 (190.50)	8	0.750 (19.05)	5/8-11 UNC	1.25 (31.75)		0.375 (9.53)	13.125 (333.4)	0.625 (15.9)
5 (125)	10.00 (254.00)	8.50 (215.90)	8	0.875 (22.23)	3/4-10 UNC	1.50 (38.10)		0.500 (12.70)	14.125 (358.8)	0.625 (15.9)
6 (150)	11.00 (279.00)	9.50 (241.30)	8	0.875 (22.23)	3/4-10 UNC	1.50 (38.10)		0.500 (12.70)	15.125 (384.2)	0.625 (15.9)
8 (200)	13.50 (343.00)	11.75 (298.45)	8	0.875 (22.23)	3/4-10 UNC	1.50 (38.10)		0.750 (19.05)	19.125 (485.8)	1.000 (25.4)
10 (250)	16.00 (406.00)	14.25 (361.95)	12	1.000 (25.40)	7/8-9 UNC	1.50 (38.10)		0.750 (19.05)	21.625 (549.3)	1.000 (25.4)
12 (300)	19.00 (483.00)	17.00 (431.80)	12	1.000 (25.40)	7/8-9 UNC	1.50 (38.10)		0.750 (19.05)	24.625 (625.5)	1.000 (25.4)
14 (350)	21.00 (533.00)	18.75 (476.25)	12	1.125 (28.58)	—	1.75 (44.45)		0.750 (19.05)	26.625 (676.3)	1.000 (25.4)
16 (400)	23.50 (597.00)	21.25 (539.75)	16	1.125 (28.58)	—	1.75 (44.45)		0.750 (19.05)	30.125 (765.2)	1.250 (31.8)
18 (450)	25.00 (635.00)	22.75 (577.85)	16	1.250 (31.75)	—	2.00 (50.80)		0.750 (19.05)	31.625 (803.3)	1.250 (31.8)
20 (500)	27.50 (699.00)	25.00 (635.00)	20	1.250 (31.75)	—	2.00 (50.80)		0.750 (19.05)	34.125 (866.8)	1.250 (31.8)
24 (600)	32.00 (813.00)	29.50 (749.30)	20	1.375 (34.93)	—	2.00 (50.80)		1.000 (25.40)	38.625 (981.1)	1.250 (31.8)
30 (750)	38.75 (984.00)	36.00 (914.40)	28	1.375 (34.93)	—	2.00 (50.80)		1.250 (31.75)	46.375 (1177.9)	1.500 (38.1)

Metric Conversion Formula: Nominal I.D.: in. x 25 = mm; Dimensions/ Thickness': in. x 25.4 = mm.

Notes:

1. *Limit/Control Rod length is determined by neutral length of rubber expansion joint, rated extension, control rod plate thickness, mating flange thickness and number of nuts. Consult PROCO for rod lengths.*
2. *Flange Dimensions shown are in accordance with ANSI B16.1 and ANSI B16.5 Class 125/150, AWWA C-207-07, Tbl 2 and 3 - Class D, Table 4 - Class E. Hole size shown is 1/8" larger than AWWA Standard.*
3. *Adjacent mating flange thickness is required to determine overall rod length and compression sleeve length (if required).*
4. *Plate thickness is based on a maximum width PROCO would use to design a Limit/Control Rod plate.*
5. *Flat Washers required at ring splits and are supplied by others.*
6. *Control rod plate O.D. installed dimension is based on a maximum O.D. Proco would supply.*
7. *Control rod diameter is based on a maximum diameter Proco would use to design a control rod.*

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 5 **MECHANICAL EQUIPMENT**
E. PRESSURE RELIEF VALVE

PRESSURE RELIEF VALVES

Project	ARSENIC REMOVAL SYSTEM	Tetra Cont. No.	22643	Rev.	0	By	Date
Customer	AZ WATER	Cost Code		Date	11/25/2014	Ckd.	Date
Location	VALLEY FARMS					Sheet	1 of 1

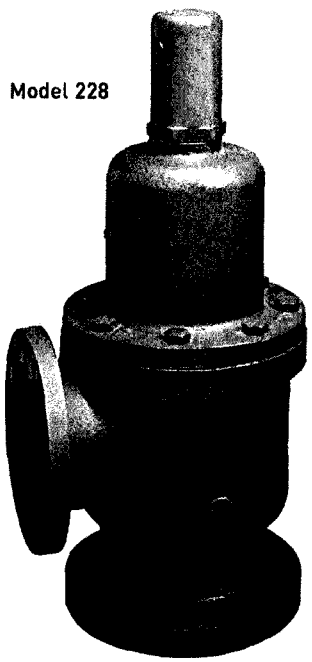
Qty	Mark	Materials Description				Drawing No.	Code Letter
1		PRESSURE RELIEF VALVE FOR LIQUID SERVICE					
		VESSEL RATING:	100	PSIG	125 ° F		
		LIQUID:	WATER				
		INLET PRESSURE RANGE:	30-35	PSIG			
		OUTLET PRESSURE RANGE:	ATM	PSIG			
		SET PRESSURE:	100	PSIG			
		BODY:					
		TRIM:					
		INLET CONNECTION:					
		OUTLET CONNECTION:					
		MANUFACTURER:					
		Documentation:	Five (5) Copies of Installation, O & M Manuals				

P.O. No.

PENTAIR VALVES & CONTROLS

KUNKLE SAFETY AND RELIEF PRODUCTS
MODELS 91, 218 AND 228

Cast Iron Liquid Relief Valves



Model 228

Model descriptions

Model 91: Bronze trim, with pressuretight cap. Suitable for maximum back pressure of 60 psig1. Variation "03" for field adjustability.

Model 218: Bronze trim, UL and FM approved for fire pump installations. Special design offers minimum set pressure of 60 psig[1]. Easily adjustable with handwheel to 200 psig (175 psig with optional 125# inlet flange).

Model 228: Bronze trim, with pressuretight cap. UL and FM approved for fire pump installations. Suitable for maximum back pressure of 60 psig[1]. Supplied with handwheel.

Features

- Bolted bonnet permits easy inspection and servicing without removal from system.
- Quality cast iron body and bonnet, insert and disc are available in either bronze or Stainless Steel (SS) and lapped for optimum performance.
- Springs are steel with plating for corrosion protection.
- High lift, wing-guided disc offers high relieving capacity. Pivot between disc and spring corrects misalignment and compensates for spring side thrust.
- Each Kunkle valve is tested and inspected for pressure setting and leakage.

Technical data

Pressure and Temperature Limits[2]

Model 91:
5 to 400 psig;
-20° to 406°F

Models 218, 228:
60 to 200 psig;
-20° to 406°F

Furnished standard with ANSI rated B16.1 - 250# inlet flange and ANSI rated B16.1 - 125# outlet flange.

Applications

- Fire Pump Service, UL1478 listed and FM approved. (models 218, 228)
- Overpressure relief and protection of pumps, tanks, lines and hydraulic systems.
- Pressure regulation.

Options

- SS trim. (insert and disc) (variation 02)
- Female x Female NPT connections. (1 1/2" to 4" sizes)
- Inlet and outlet flanges per ANSI B16.1 - 125#. Limited to 175 psig maximum set pressure.
- Epoxy-coated internal body and bonnet for corrosive environments. Temperature limit 125°F (52°C).

Notes:

1. Back pressure increases set pressure on a one to one basis, and reduces capacity. Back pressure in excess of 10% of set pressure is not recommended.
2. For other pressure and temperature limits, consult ANSI B16 cast iron flange standards.

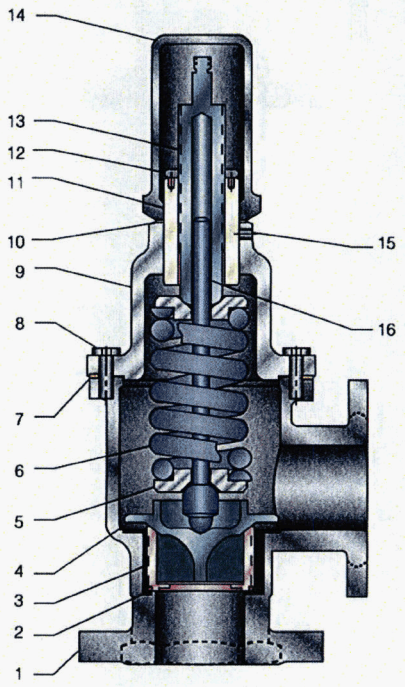
Parts and Materials

Model 91[3, 6] - Non-code, Liquid Relief Valve

No.	Part Name	Materials
1	Body	Iron, A126 Class A or B
2	O-ring	BUNA-N
3	Insert	[1]
4	Disc	[1]
5	Spring Step	[2]
6	Spring	Steel, Aluminum Coated
7	Bonnet Gasket	Fiber and Nitrile, Klinger C-4400 or C-4401
8	Hex Head Cap Screw[3]	Steel, SAE Gr. 5
9	Bonnet	Iron, A126 Class A or B
10	Cap Gasket[5]	Fiber and Nitrile, Klinger C-4400 or C-4401
11	Compression Screw Bushing	Iron, A536 80-55-06
12	Jam Nut	[4]
13	Compression Screw	[4]
14	Cap[5]	Iron, A126 Class A or B
15	Socket Set Screw	Steel, Commercial
16	Stem	[2]

Items Not Shown

	Handwheel[5]	Iron, A126 Class A or B
	Handwheel Jam Nut[5]	Steel Plated, Commercial

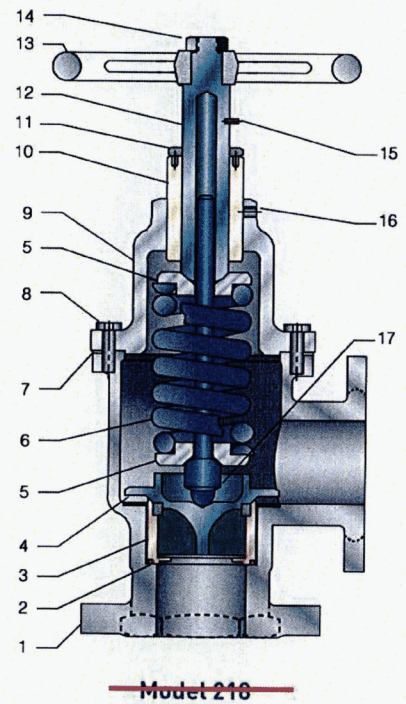


Model 91

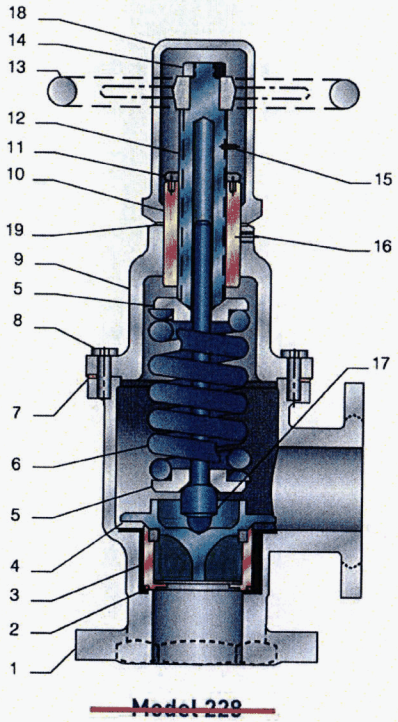
Notes:

1. Disc (item 4) and insert (item 3) material Bronze, B-584 Alloy 84400 or B62, also available in SS, A743 Gr. CF-8, as a package option.
2. Material CS with anti-corrosion coating, commercial Gr. or Brass, B16.
3. 6 bolts required for 3" and 4" sizes, and 8 bolts required for 6" size.
4. Material Brass, B16 or Bronze, B584 casting.
5. Handwheel option available, delete cap (item 14) and gasket (item 10).
6. Inlet and outlet flanges per ANSI B16.1 250#, inlet flange standard and 125# inlet flange optional. Outlet flange 125#.

Parts and Materials



Model 218



Model 228

Models 218 and 228 - Non-code		
No.	**Part Name**	**Materials**
1	Body[1]	Iron, A126 Class A or B
2	O-ring	BUNA-N
3	Insert	[2]
4	Disc	[2]
5	Spring Step	[3]
6	Spring	Steel, Aluminum Coated
7	Bonnet Gasket	Fiber and Nitrile, Klinger C-4400 or C-4401
8	Hex Head Cap Screw[4]	Steel, SAE Gr.[5]
9	Bonnet	Iron, A126 Class A or B
10	Compression Screw Bushing	Brass, B16
11	Jam Nut	Brass, B16
12	Compression Screw	[5]
13	Handwheel	Iron, A126 Class A or B
14	Handwheel Locknut	Steel Plated, Commercial Gr.
15	Spring Pin	Steel, Commercial Gr.
16	Socket Set Screw	Steel, Commercial Gr.
17	Stem	[3]
	Compression Screw Locknut Wrench[6]	Steel, A366
	Installation Instruction[6]	Paper, Commercial Gr.

Model 228 Only		
18	Cap[7]	Iron, A126 Class A or B
19	Cap Gasket[7]	Gasket, Klinger Silicone C-4400

Notes:

1. Inlet and outlet flanges per ANSI B16.1 250#, inlet flange standard and 125# inlet flange optional. Outlet flange 125#.
2. Disc (item 4) and insert (item 3) material Bronze, B-584 Alloy 84400 or B62, also available in SS, A743 Gr. CF-8, as a package option.
3. Material CS with anti-corrosion coating, commercial Gr., Brass, B16 or SS, A582 TY 416.
4. 6 bolts required for 3" and 4" sizes, and 8 bolts required for 6" size.
5. Material Brass, B16 or Bronze, B584 casting (Model 218 only), B584 Alloy 84400 (Model 228 only).
6. Not shown on assembly.
7. Cap (item 18), Gasket (item 19) and Locknut (item 11) factory installed. Handwheel (item 13) shipped unassembled (Models 218 and 228).

Specifications

Model 91

Model Number	Valve Size (in)	Connections ANSI Standard Inlet	Connections ANSI Standard Outlet	Valve Dimensions in A	Valve Dimensions in B	Valve Dimensions in C	Min/Max Approx. Set Pressure (psig)	Min/Max Approx. Weight (lb)
091A-G	1½ x 1½	Female NPT	Female NPT	4¾	4¼	11⅞	5/400	27
091H-G	1½ x 1½	125# Flange	125# Flange	4¾	4¼	11¼	5/175	36
091K-G	1½ x 1½	250# Flange	125# Flange	5	4¾	11¼	5/400	36
091A-H	2 x 2	Female NPT	Female NPT	4⅛	4⅛	12¾	5/400	35
091H-H	2 x 2	125# Flange	125# Flange	4¾	4⅝	12¾	5/175	47
091K-H	2 x 2	250# Flange	125# Flange	5	4⅝	12¾	5/400	47
091A-J	2½ x 2½	Female NPT	Female NPT	4½	4½	14¼	5/400	48
091H-J	2½ x 2½	125# Flange	125# Flange	5¼	4¾	14¼	5/175	65
091K-J	2½ x 2½	250# Flange	125# Flange	5¼	4¾	14¼	5/400	65
091A-K	3 x 3	Female NPT	Female NPT	5⅞	5⅞	21	5/400	81
091H-K	3 x 3	125# Flange	125# Flange	5⅞	5⅞	21¾	5/175	98
091K-K	3 x 3	250# Flange	125# Flange	6¼	5⅞	21¾	5/400	98
091A-M	4 x 4	Female NPT	Female NPT	6⅝	6½	26	5/400	132
091H-M	4 x 4	125# Flange	125# Flange	6⅝	6½	26	5/175	170
091K-M	4 x 4	250# Flange	125# Flange	6⅝	6½	26	5/400	170
091H-P	6 x 6	125# Flange	125# Flange	9⅜	8½	31	5/175	340
091K-P	6 x 6	250# Flange	125# Flange	9⅜	8½	31	5/300	340

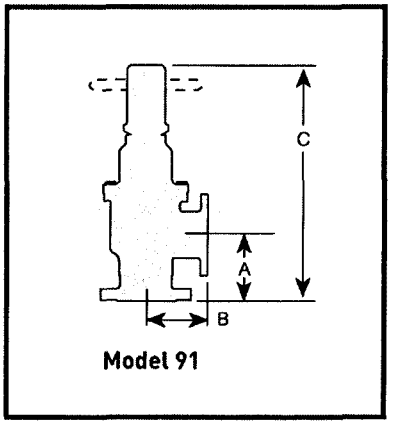
Models 218 and 228[1]

Model Number	Valve Size	Connections ANSI Standard Inlet	Connections ANSI Standard Outlet	Valve Dimensions in A	Valve Dimensions in B	Valve Dimensions in C (218)	Valve Dimensions in C (228)	Min/Max Set Pressure (psig)	Approx. Weight (lb)
2*8A-K[2]	3 x 3	Female NPT	Female NPT	6⅛	5⅞	20⅝	21⅝	60/200	85
2*8H-K[2]	3 x 3	125# Flange	125# Flange	6⅛	5⅞	20⅝	21⅝	60/175	110
2*8K-K[2]	3 x 3	250# Flange	125# Flange	6⅛	5⅞	20⅝	21⅝	60/200	110
2*8A-M[2]	4 x 4	Female NPT	Female NPT	6⅝	6½	25	26	60/200	143
2*8H-M[2]	4 x 4	125# Flange	125# Flange	6⅝	6½	25	26	60/175	185
2*8K-M[2]	4 x 4	250# Flange	125# Flange	6⅝	6½	25	26	60/200	185
2*8H-P[2]	6 x 6	125# Flange	125# Flange	9⅜	8½	30	31	60/175	350
2*8K-P[2]	6 x 6	250# Flange	125# Flange	9⅜	8½	30	31	60/200	350

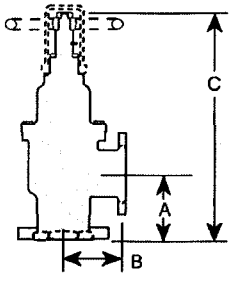
Dimensions are for reference only.

Notes:

1. Temperature limits -20°F to 406°F.
2. Replace asterisk with desired model number. Data applicable to models 218, 228.



Model 91



Models 218, 228

Capacities

Liquid Overpressure Factors

To determine capacities at other than 25% overpressure/accumulation, multiply capacity shown by:

10% Acc. = 0.6
15% Acc. = 0.8
20% Acc. = 0.9

Models 218, 228 Capacities

UL/FM Size, in	Certified Capacities1 GPM
3 x 3	500
4 x 4	1000
6 x 6	2000

Note:

1. Rated at 100 psig set pressure and 25% accumulation 125 psig.

Non-code Liquid - 25% Accumulation (GPM) - Model 91 Only

Set Pressure (psig)	Inlet Size 1 1/2"	2"	2 1/2"	3"	4"	6"
5	31	56	87	125	224	447
10	44	79	123	177	316	632
20	63	111	174	250	447	894
30	77	136	213	307	548	1095
40	88	157	246	354	633	1265
50	99	176	275	396	707	1414
60	108	193	301	434	775	1549
70	117	208	325	468	837	1673
80	125	223	348	501	895	1789
90	133	236	369	531	949	1897
100	140	249	389	560	1000	2000
110	147	261	408	587	1049	2097
120	153	273	426	613	1096	2191
130	159	284	443	638	1140	2280
140	165	295	460	663	1183	2366
150	171	305	476	686	1225	2449
160	177	315	492	708	1265	2530
170	182	325	507	730	1304	2607
180	188	334	522	751	1342	2683
190	193	343	536	772	1379	2757
200	198	352	550	792	1414	2828
210	203	361	563	811	1449	2898
220	207	369	577	831	1483	2966
230	212	378	590	849	1517	3033
240	217	386	602	867	1549	3098
250	221	394	615	885	1581	3162
260	225	401	627	903	1613	3225
270	230	409	639	920	1643	3286
280	234	417	650	937	1673	3346
290	238	424	662	954	1703	3406
300	242	431	673	970	1732	3464
310	246	438	684	986	1761	—
320	250	445	695	1002	1789	—
330	254	452	706	1017	1817	—
340	258	459	717	1033	1844	—
350	261	466	727	1048	1871	—
360	265	472	738	1062	1898	—
370	269	479	748	1077	1924	—
380	272	485	758	1092	1950	—
390	276	492	768	1106	1975	—
400	280	498	777	1120	2000	—

Model Number/Order Guide

Model Number Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Example	0	9	1	K	—	M	0	1	A	M	S	0	4	0	0

Model

091
218
228

Connection Type

A - Female x Female NPT
H - 125# Flange x 125# Flange
K - 250# Flange x 125# Flange

Inlet Size

G - 1½"
H - 2"
J - 2½"
K - 3"
M - 4"
P - 6"

Variation

01 - Catalog standard
02 - SS seat and disc
03 - Model 91 w/handwheel (K, M and P inlet only)
03 - SST Seat, Disc and Stem (Model 218K-P only)
03 - Epoxy coated body and bonnet internal surfaces (all Models except Model 218K-P)
04 - Epoxy coated body and bonnet internal surfaces (Model 218K-P only)

Design Revision

Indicates non-interchangeable revision.
Current Design at Revision "A".

Valve Service

M - Liquid

Spring Material

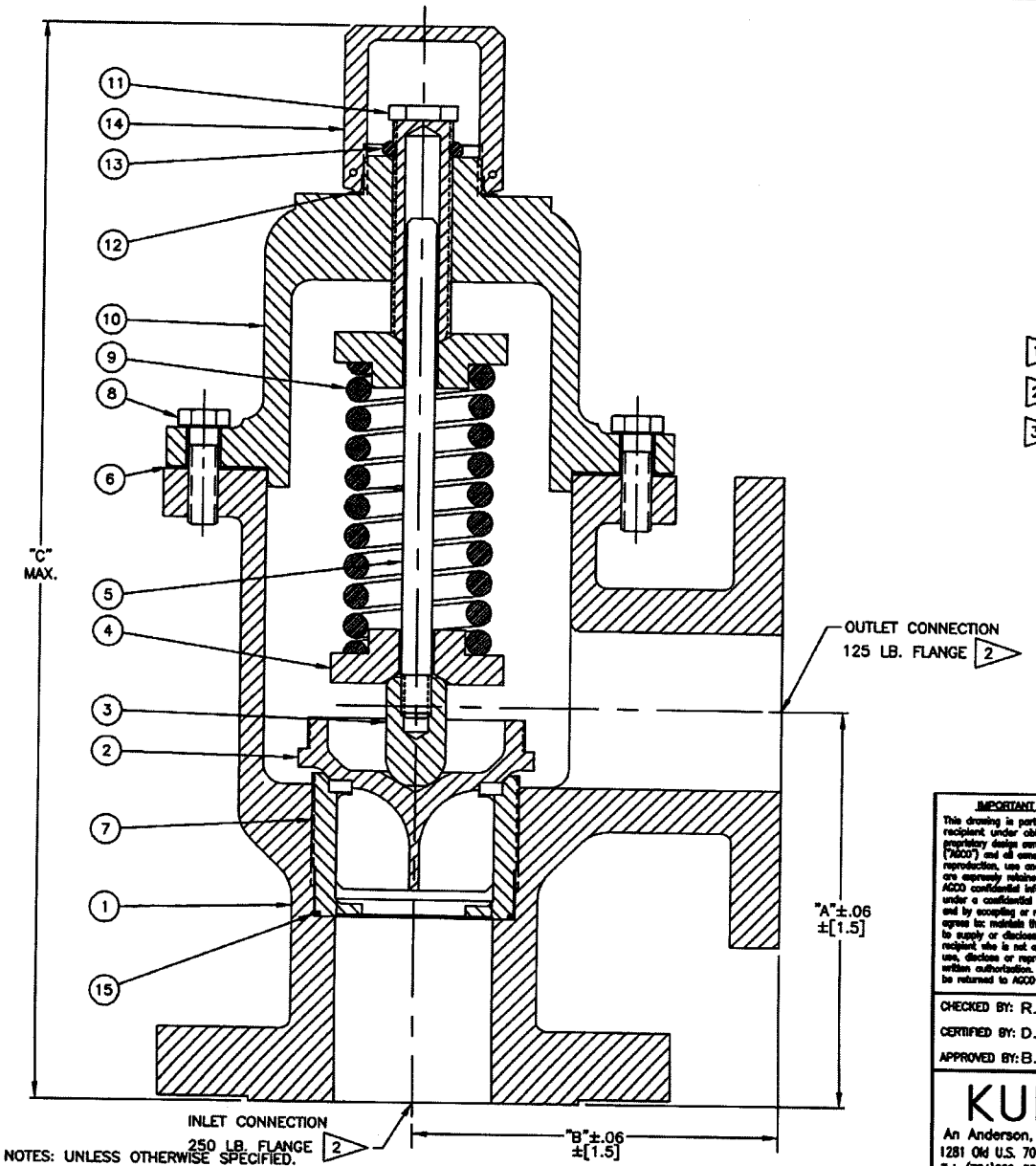
C - Aluminum Coated, ASTM A231 Steel (G, H, J inlet sizes only)
S - Aluminum Coated, ASTM A229 Steel (K, M, P inlet sizes only)

Set Pressure

0005 - 5 psig
0400 - 400 psig

PENTAIR VALVES & CONTROLS

5500 WAYZATA BLVD # 800, MINNEAPOLIS, MN 55416 WWW.PENTAIR.COM/VALVES
KUNKLE FACILITY PHONE: 1-828-669-3700 • WWW.KUNKLEVALVE.COM



ITEM NO	DESCRIPTION	MATERIAL
1	BODY	IRON A126 CLASS A OR B
2	DISC	BRONZE B584 ALY 84400
3	RETAINER–STEM	SST A582–416 COND A
4	STEP–SPRING	STL A108–1018/ZNCO
5	STEM	STL A108–1018/ZNCO
6	GASKET–BONNET	FIBER AND NITRILE
7	INSERT	BRONZE B584 ALY 84400
8	BOLT	STL A193–B7/BK OX
9	SPRING	STL A231
10	BONNET	IRON A126 CLASS A OR B
11	SCREW–PRESSURE	SST A582–416 COND A
12	GASKET–CAP	TEFLON
13	NUT–HEX	SST A582–416 COND A
14	CAP	STL A108–1018/ZNCO
15	SEAL–INSERT	BUNA–N
16	NAMEPLATE	ALUMINUM COMMERCIAL
17	SCREW–DRIVE	SST 18–8

NOTE:

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE MILLIMETERS.
2. FLANGES PER ANSI B16.1, 125 LB. INLET OPTIONAL.
3. THESE PARTS NOT SHOWN.

PRESSURE RATING PSIG [BARS]	TEMPERATURE RATING F° [C°]
400 [27.6]	-20/150 [-29/66]

INLET & OULET SIZE (NPT)	DIMENSIONS 1			WEIGHT LBS [Kg]
	A	B	C	
1–1/2"	5.00 [127.0]	4.62 [117.3]	12.50 [317.5]	35 [15.8]
2"	5.00 [127.0]	4.62 [117.3]	14.00 [355.6]	50 [22.6]
2–1/2"	5.12 [130.0]	4.81 [122.2]	15.13 [384.3]	70 [31.7]

CHECKED BY: R.D.P. 11–14–74

CERTIFIED BY: D.A.N. 11–14–74

APPROVED BY: B.A.R. 11–14–74

KUNKLE
An Anderson, Greenwood Company
1281 Old U.S. 70, Black Mountain, NC 28711
Tel: (704)669–5515 Fax: (704)669–4017

CUSTOMER:

ORDER NO.:

CATALOG NO.:

SERIAL NO.:

TAG NO.:

SET PRESSURE:

TITLE:
MODEL 91
1–1/2", 2–1/2" FLANGED

DWG. NO. 3180 REV. 13

SCALE: NONE SHEET 1 OF 1

FILENAME: KUNKLE\3180.DWG

PLOT SCALE: 1/1

NOTES: UNLESS OTHERWISE SPECIFIED.

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 6 INSTRUMENTS

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 6 INSTRUMENTS

A. MAGNETIC FLOWMETERS

MARK	QTY	SIZE	SERVICE
FE/FIT-101A	1	6"	ADSORBER A INFLUENT
FE/FIT-108	1	3"	TREATMENT BYPASS

□□T□□ME□T □□T□ □□EET

□E□E□ T E T E □□E□			M□□ ET□ F□ W METE□			Sheet : 1 OF 1 Spec: 624-1	
			No.	By	Date	Revision	Contract: 22643
Park West One, Suite 600 Pittsburgh, PA 15275 (412) 788-8300			A	JWS	10/02/14		P. O. # By: JWS Chk:
	1	Meter Tag Number				FE-101A	
	2	Service				ADSORBER EAS-A INFLUENT / FEED FLOWMETER	
	3	Location				6"	
M	4	CONN'S.	Line Size /Schedule / Material			6"	
E	5		Connection Type / Material			FLANGED	
T	6		Tube Material | Liner Material			304 SS POLYURETHANE	DRINKING WATER
E	7		Electrode Type | Material			FLUSH HAST C	
R	8	METER	Meter Casing			MFG. STD. STEEL	
I	9		Power Supply | Elect. Code			FROM TRANSMITTER	
N	10		Grounding : Type | Material			REQD. 316 SS.	
G	11		Enclosure Class			NEMA 4X	
	12		Fluid			CLEAN WATER DRINKING WATER	
E	13		Max. Flow | Max. Velocity			550 GPM	
L	14		Normal Flow | Minimum Flow			190 GPM 0 GPM	
E	15	FLUID	Max. Temp. | Minimum Temp.			95 F 85 F	
M	16		Max. Pressure | Min. Pressure			100 PSIG	
E	17		Min. Fluid Condyctivity			DRINKING WATER	
N	18		Vacuum Possibility			NONE	
T							
A	19	Instrument Tag Number				FIT-101A	
S	20	Function				TRANSMITT INDICATE	
S	21	Mounting				2" PIPE MOUNT / WALL MOUNT	
O	22	Enclosure Class				NEMA 4X	
C	23	length Signal cable				25'-0	
I	24	Type Scan adjustment				N/A	
A	25	Power Supply				120 VAC 60 HZ	
T	26	XMITTER	TOTALIZER		OUTPUT	4-20 MA LOCAL DISPLAY WITH TRANSMITTER	
E	27		Scale Size		Range	CALB. 4-20 MA = 0-800 GPM	
	28	DISPLAY				TOTALYZER	
I	29					MUST READ FWD. AND REV. FLOW	
N	30		Integrator			N/A	
S	31	CONTR.	Modes		Output	EMPTY PIPE DETECTION	
T	32		Action		Auto- Man		
R	33		Contact No.		Form		
U	34	ALARM	Rating		Elec. Code		
M	35		Action				
E	36	Manufacturer				ENDRESS HAUSER	
N	37	Meter Model Number				PROMAG 53W SERIES	
T	38	Instrument Model Number				PROMAG 53W SERIES WITH GROUND RINGS	
Notes:		NOTE. 1 ENDRESS HAUSER SHALL SUPPLY S.S. TAG BEARING INSTRUMENT TAG NUMBER. DRINKING WATER SERVICE SUPPLY 25'-0 CABLE FOR REMOTE TRANSMITTER					

□□T□□ME□T □□T□ □□EET

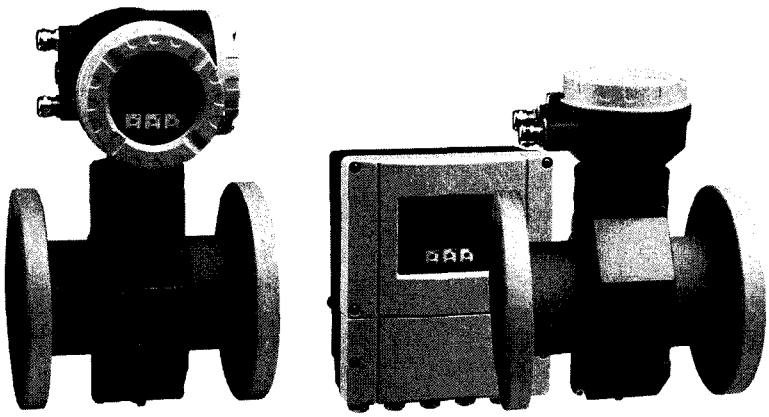
□E□E □ T□E□T □E□ □ E□				M □ □ET□ F □W METE□		Sheet :	1 OF 1
						Spec:	624-2
				No.	By	Date	Revision
Park West One, Suite 600 Pittsburgh, PA 15275 (412) 788-8300				A B	JWS JWS	10/02/14 11/17/14	
						Contract:	22643
						P. O. #	
						By:	JWS
						Chk:	
	1	Meter Tag Number				FE-108	
	2	Service				BY-PASS FLOWMETER	
	3	Location				3"	
M	4	CONN'S.	Line Size /Schedule / Material			3"	
E	5		Connection Type / Material			FLANGED	
T	6		Tube Material | Liner Material			304 SS POLYURETHANE	DRINKING WATER
E	7		Electrode Type | Material			FLUSH HAST C	
R	8	METER	Meter Casing			MFG. STD. STEEL	
I	9		Power Supply | Elect. Code			FROM TRANSMITTER	
N	10		Grounding : Type | Material			REQD. 316 SS.	
G	11		Enclosure Class			NEMA 4X	
	12		Fluid			CLEAN WATER DRINKING WATER	
E	13		Max. Flow | Max. Velocity			133 GPM	
L	14		Normal Flow | Minimum Flow			60 GPM 30 GPM	
E	15	FLUID	Max. Temp. | Minimum Temp.			95 F 85 F	
M	16		Max. Pressure | Min. Pressure			100 PSIG	
E	17		Min. Fluid Condyctivity			DRINKING WATER	
N	18		Vacuum Possibility			NONE	
T							
A	19	Instrument Tag Number				FIT-108	
S	20	Function				TRANSMITT INDICATE	
S	21	Mounting				2" PIPE MOUNT / WALL MOUNT	
O	22	Enclosure Class				NEMA 4X	
C	23	length Signal cable				25'-0	
I	24	Type Scan adjustment				N/A	
A	25	Power Supply				120 VAC 60 HZ	
T	26	XMITTER	TOTALIZER	OUTPUT		4-20 MA LOCAL DISPLAY WITH TRANSMITTER	
E	27		Scale Size	Range		CALB. 4-20 MA = 0-200 GPM	
	28	DISPLAY				TOTALYZER	
I	29						
N	30		Integrator			N/A	
S	31	CONTR.	Modes	Output		EMPTY PIPE DETECTION	
T	32		Action	Auto- Man			
R	33		Contact No.	Form			
U	34	ALARM	Rating	Elec. Code			
M	35		Action				
E	36	Manufacturer				ENDRESS HAUSER	
N	37	Meter Model Number				PROMAG 53W SERIES	
T	38	Instrument Model Number				PROMAG 53W SERIES WITH GROUND RINGS	
Notes:		NOTE. 1 ENDRESS HAUSER SHALL SUPPLY S.S. TAG BEARING INSTRUMENT TAG NUMBER. DRINKING WATER SERVICE SUPPLY 25'-0 CABLE FOR REMOTE TRANSMITTER					

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Proline Promag 50W, 53W

Electromagnetic Flow Measuring System
Flow measurement of liquids in water or wastewater applications



Application

Electromagnetic flowmeter for bidirectional measurement of liquids with a minimum conductivity of ≥ 5 µS/cm:
- Drinking water
- Wastewater
- Sewage sludge

- Flow measurement up to 110000 m³/h (484315 gal/min)
- Fluid temperature up to +80 °C (+176 °F)
- Process pressures up to 40 bar (580 psi)
- Lengths in accordance with DVGW/ISO

Application-specific lining of the measuring pipe from polyurethane or hard rubber with the following drinking water permissions:
- KTW
- WRAS
- NSF
- ACS

Approvals for hazardous area:
- ATEX
- IECEx
- FM
- CSA
- NEPSI

Connection to process control system:
- HART
- PROFIBUS DP/PA
- FOUNDATION Fieldbus
- MODBUS RS485

Your benefits

Promag measuring devices offer you cost-effective flow measurement with a high degree of accuracy for a wide range of process conditions.

The uniform Proline transmitter concept comprises:
- Modular device and operating concept resulting in a higher degree of efficiency
- Software options for batching, electrode cleaning and for measuring pulsating flow
- High degree of reliability and measuring stability
- Uniform operating concept

The tried-and-tested Promag sensors offer:
- No pressure loss
- Not sensitive to vibrations
- Simple installation and commissioning

TI046D/24/en/07.10

Endress+Hauser

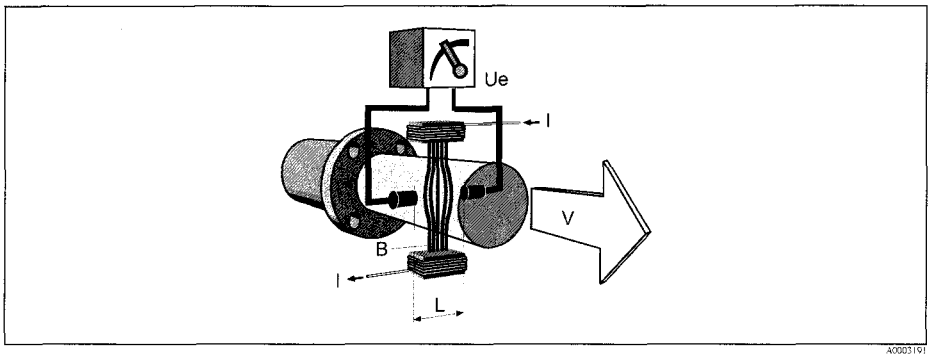
People for Process Automation

Table of contents

Function and system design

Measuring principle

Following Faraday's law of magnetic induction, a voltage is induced in a conductor moving through a magnetic field.
In the electromagnetic measuring principle, the flowing medium is the moving conductor.
The voltage induced is proportional to the flow velocity and is supplied to the amplifier by means of two measuring electrodes. The flow volume is calculated by means of the pipe cross-sectional area.
The DC magnetic field is created through a switched direct current of alternating polarity.



$Ue = B \cdot L \cdot v$
$Q = A \cdot v$

Ue	Induced voltage
B	Magnetic induction (magnetic field)
L	Electrode spacing
v	Flow velocity
Q	Volume flow
A	Pipe cross-section
I	Current strength

Measuring system

The measuring system consists of a transmitter and a sensor.
Two versions are available:
- Compact version: Transmitter and sensor form a mechanical unit.
- Remote version: Sensor is mounted separate from the transmitter.

Transmitter:
- Promag 50 (user interface with push buttons for operation, two-line display, illuminated)
- Promag 53 ("Touch Control" without opening the housing, four-line display, unilluminated)

Sensor:
- Promag W (DN 25 to 2000 / 1 to 78")

Input

Measured variable

Flow velocity (proportional to induced voltage)

Measuring ranges

Measuring ranges for liquids
Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Operable flow range

Over 1000 : 1

Input signal

Status input (auxiliary input)
- U = 3 to 30 V DC, R_i = 5 kΩ, galvanically isolated
- Configurable for: totalizer(s) reset, measured value suppression, error-message reset

Status input (auxiliary input) with PROFIBUS DP and MODBUS RS485
- U = 3 to 30 V DC, R_i = 3 kΩ, galvanically isolated
- Switching level: 3 to 30 V DC, independent of polarity
- Configurable for: totalizer(s) reset, measured value suppression, error-message reset, batching start/stop (optional), batch totalizer reset (optional)

Current input (only Promag 53)
- active/passive selectable, galvanically isolated, full scale value selectable, resolution: 3 µA, temperature coefficient: typ. 0.005% o.r./°C (o.r. = of reading)
- active: 4 to 20 mA, $R_i \leq 150\ \Omega$, max. 24 V DC, short-circuit-proof
- passive: 0/4 to 20 mA, $R_i < 150\ \Omega$, max. 30 V DC

Output

Output signal

Promag 50

Current output
active/passive selectable, galvanically isolated, time constant selectable (0.01 to 100 s), full scale value selectable, temperature coefficient: typ. 0.005% o.r./°C (o.r. = of reading), resolution: 0.5 µA
- active: 0/4 to 20 mA, $R_L < 700\ \Omega$ (HART: $R_L \geq 250\ \Omega$)
- passive: 4 to 20 mA, operating voltage V_S: 18 to 30 V DC, $R_i \geq 150\ \Omega$

Pulse/frequency output
passive, open collector, 30 V DC, 250 mA, galvanically isolated
- Frequency output: full scale frequency 2 to 1000 Hz (f_{max} = 1250 Hz), on/off ratio 1:1, pulse width max. 10s
- Pulse output: pulse value and pulse polarity selectable, max. pulse width configurable (0.5 to 2000 ms)

PROFIBUS DP interface
- Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated
- Profil version 3.0
- Data transmission rate: 9,6 kBaud to 12 MBaud
- Automatic data transmission rate recognition
- Function blocks: 1 × analog Input, 1 × totalizer
- Output data: volume flow, totalizer
- Input data: positive zero return (ON/OFF), totalizer control, value for local display
- Cyclic data transmission compatible with previous model Promag 33
- Bus address adjustable via miniature switches or local display (optional) at the measuring device

PROFIBUS PA interface
- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- Profil version 3.0
- Current consumption: 11 mA
- Permissible supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Function blocks: 1 × analog input, 2 × totalizer
- Output data: volume flow, totalizer
- Input data: positive zero return (ON/OFF), control totalizer, value for local display
- Cyclic data transmission compatible with previous model Promag 33
- Bus address adjustable via miniature switches or local display (optional) at the measuring device

Promag 53

Current output

active/passive selectable, galvanically isolated, time constant selectable (0.01 to 100 s),
full scale value selectable, temperature coefficient: typ. 0.005% o.r./°C (o.r. = of reading), resolution: 0.5 µA

- active: 0/4 to 20 mA, $R_L < 700\ \Omega$ (HART: $R_L \geq 250\ \Omega$)
- passive: 4 to 20 mA, operating voltage V_S: 18 to 30 V DC, $R_i \geq 150\ \Omega$

Pulse/frequency output

active/passive selectable, galvanically isolated (Ex i version: only passive)

- active: 24 V DC, 25 mA (max. 250 mA during 20 ms), $R_L > 100\ \Omega$
- passive: open collector, 30 V DC, 250 mA
- Frequency output: full scale frequency 2 to 10000 Hz (f_{max} = 12500 Hz), EEx-ia: 2 to 5000 Hz; on/off ratio 1:1, pulse width max. 10 s
- Pulse output: pulse value and pulse polarity selectable, max. pulse width configurable (0.05 to 2000 ms)

PROFIBUS DP interface

- Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated
- Profil version 3.0
- Data transmission rate: 9,6 kBaud to 12 MBaud
- Automatic data transmission rate recognition
- Function blocks: 2 × analog Input, 3 × totalizer
- Output data: volume flow, calculated mass flow, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), totalizer control, value for local display
- Cyclic data transmission compatible with previous model Promag 33
- Bus address adjustable via miniature switches or local display (optional) at the measuring device
- Available output combination → 8

PROFIBUS PA interface

- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- Profil version 3.0
- Current consumption: 11 mA
- Permissible supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Function blocks: 2 × analog input, 3 × totalizer
- Output data: volume flow, calculated mass flow, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), totalizer control, value for local display
- Cyclic data transmission compatible with previous model Promag 33
- Bus address adjustable via miniature switches or local display (optional) at the measuring device

MODBUS RS485 interface

- Transmission technology (Physical Layer): RS485 in accordance with ANSI/TIA/EIA-485-A: 1998, galvanically isolated
- MODBUS device type: Slave
- Adress range: 1 to 247
- Bus address adjustable via miniature switches or local display (optional) at the measuring device
- Supported MODBUS function codes: 03, 04, 06, 08, 16, 23
- Broadcast: supported with the function codes 06, 16, 23
- Übertragungsmodus: RTU oder ASCII
- Supported baudrate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
- Response time:
  - Direct data access = typically 25 to 50 ms
  - Auto-scan buffer (data range) = typically 3 to 5 ms
- Available output combination → 8

FOUNDATION Fieldbus interface
- FOUNDATION Fieldbus H1
- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- ITK version 5.01
- Current consumption: 12 mA
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Bus connection with integrated reverse polarity protection
- Function blocks:
  - 5 × Analog Input (execution time: 18 ms each)
  - 1 × PID (25 ms)
  - 1 × Digital Output (18 ms)
  - 1 × Signal Characterizer (20 ms)
  - 1 × Input Selector (20 ms)
  - 1 × Arithmetic (20 ms)
  - 1 × Integrator (18 ms)
- Output data: volume flow, calculated mass flow, temperature, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), reset totalizer
- Link Master (LM) functionality is supported

Signal on alarm
- Current output → failure response selectable (e.g. in accordance with NAMUR recommendation NE 43)
- Pulse/frequency output → failure response selectable
- Status output (Promag 50) → non-conductive by fault or power supply failure
- Relay output (Promag 53) → de-energized by fault or power supply failure

Load

see "Output signal"

Low flow cutoff

Switch points for low flow cutoff are selectable.

Galvanic isolation

All circuits for inputs, outputs and power supply are galvanically isolated from each other.

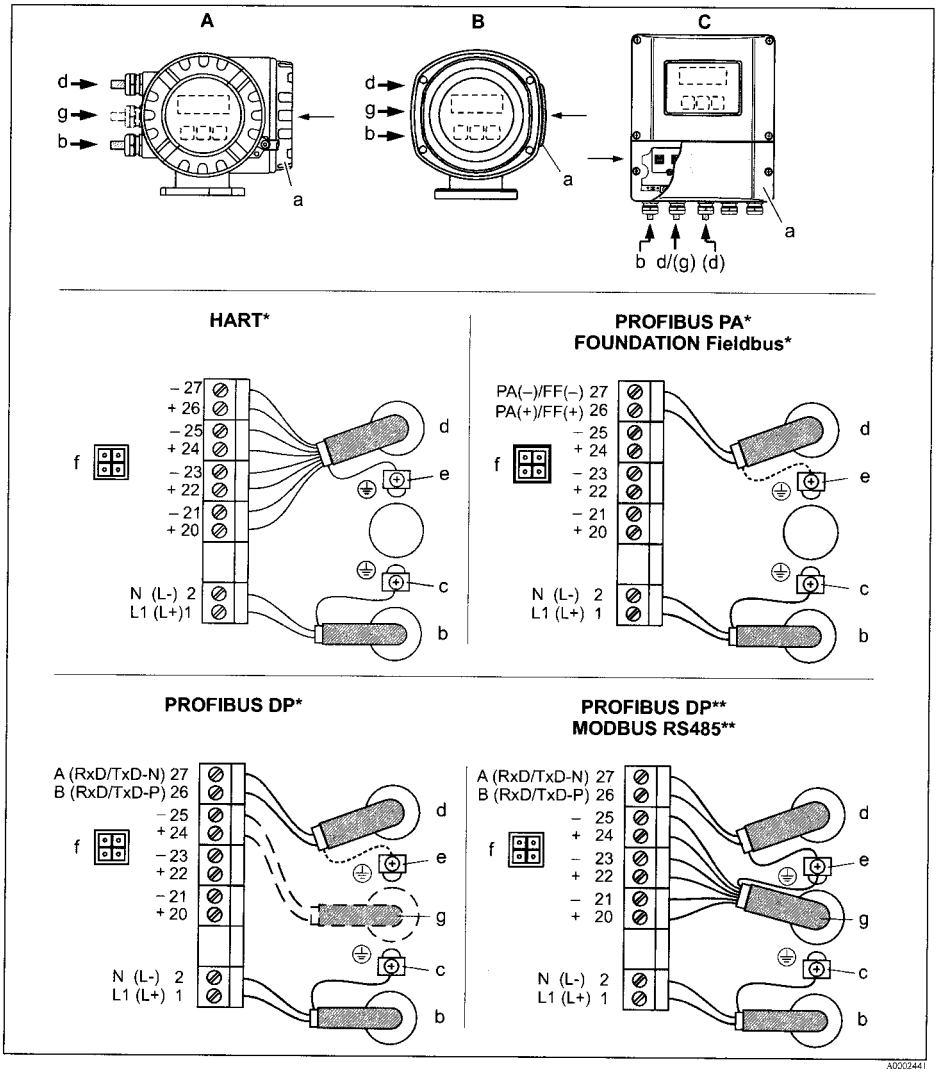
Switching output

Status output (Promag 50, Promag 53)
Open collector, max. 30 V DC / 250 mA, galvanically isolated.
Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values.

Relay outputs (Promag 53)
Normally closed (NC or break) or normally open (NO or make) contacts available
(default: relay 1 = NO, relay 2 = NC), max. 30 V / 0,5 A AC ; 60 V / 0,1 A DC, galvanically isolated.
Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values, batching contacts.

Power supply

Electrical connection, measuring unit



Connecting the transmitter, cable cross-section max. 2.5 mm² (14 AWG)

A View A (field housing)
B View B (stainless steel field housing)
C View C (wall-mount housing)

*) fixed communication boards
**) flexible communication boards
a Connection compartment cover
b Cable for power supply: 85 to 260 V AC / 20 to 55 V AC / 16 to 62 V DC
- Terminal No. 1: L1 for AC, L+ for DC
- Terminal No. 2: N for AC, L– for DC
c Ground terminal for protective conductor
d Signal cable: see "Electrical connection, terminal assignment" → 8
Fieldbus cable:
- Terminal No. 26: DP (B) / PA + / FF + / MODBUS RS485 (B) / (PA, FF: with polarity protection)
- Terminal No. 27: DP (A) / PA – / FF – / MODBUS RS485 (A) / (PA, FF: with polarity protection)
e Ground terminal for signal cable shield / Fieldbus cable / RS485 line
f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)
g Signal cable: see "Electrical connection, terminal assignment" → 8
Cable for external termination (only for PROFIBUS DP with fixed assignment communication board):
- Terminal No. 24: +5 V
- Terminal No. 25: DGND

Electrical connection, terminal assignment

Terminal assignment, Promag 50

Order variant	Terminal No. (inputs/outputs)			
	20 (+) / 21 (–)	22 (+) / 23 (–)	24 (+) / 25 (–)	26 (+) / 27 (–)
50***-**********W	–	–	–	Current output HART
50***-**********A	–	–	Frequency output	Current output HART
50***-**********D	Status input	Status output	Frequency output	Current output HART
50***-**********H	–	–	–	PROFIBUS PA
50***-**********J	–	–	+5 V (external termination)	PROFIBUS DP
50***-**********S	–	–	Frequency output, Ex i, passive	Current output, Ex i, passive, HART
50***-**********T	–	–	Frequency output, Ex i, passive	Current output, Ex i, passive, HART

Ground terminal → 7

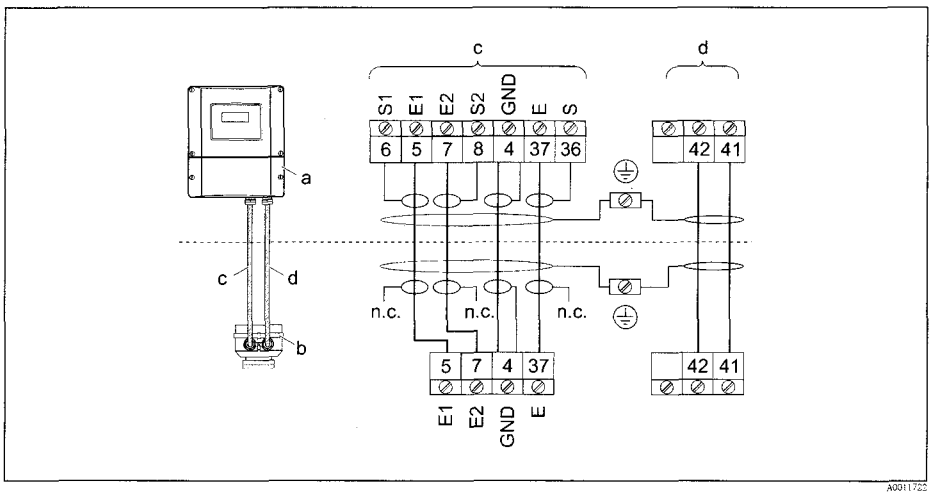
Terminal assignment, Promag 53

The inputs and outputs on the communication board can be either permanently assigned or variable, depending on the version ordered (see table). Replacements for modules which are defective or which have to be replaced can be ordered as accessories.

Order variant	Terminal No. (inputs/outputs)			
	20 (+) / 21 (–)	22 (+) / 23 (–)	24 (+) / 25 (–)	26 (+) / 27 (–)
Fixed communication boards (fixed assignment)				
53***-**********A	–	–	Frequency output	Current output HART
53***-**********B	Relay output 2	Relay output 1	Frequency output	Current output HART
53***-**********F	–	–	–	PROFIBUS PA, Ex i
53***-**********G	–	–	–	FOUNDATION Fieldbus, Ex i
53***-**********H	–	–	–	PROFIBUS PA
53***-**********J	–	–	–	PROFIBUS DP
53***-**********K	–	–	–	FOUNDATION Fieldbus
53***-**********O	–	–	Status input	MODBUS RS485
53***-**********S	–	–	Frequency output, Ex i	Current output, Ex i, passive, HART
53***-**********T	–	–	Frequency output, Ex i	Current output, Ex i, passive, HART
Flexible communication boards				
53***-**********C	Relay output 2	Relay output 1	Frequency output	Current output HART
53***-**********D	Status input	Relay output	Frequency output	Current output HART
53***-**********L	Status input	Relay output 2	Relay output 1	Current output HART
53***-**********M	Status input	Frequency output	Frequency output	Current output HART
53***-**********N	Current output	Frequency output	Status input	MODBUS RS485
53***-**********P	Current output	Frequency output	Status input	PROFIBUS DP
53***-**********V	Relay output 2	Relay output 1	Status input	PROFIBUS DP
53***-**********2	Relay output	Current output	Frequency output	Current output HART
53***-**********4	Current input	Relay output	Frequency output	Current output HART
53***-**********7	Relay output 2	Relay output 1	Status input	MODBUS RS485

Ground terminal → 7

Electrical connection, remote version



Connecting the remote version

a Wall-mount housing connection compartment
b Sensor connection housing cover
c Signal cable
d Coil current cable
n.c. Not connected, insulated cable shields
Terminal no. and cable colors: 6/5 = brown; 7/8 = white; 4 = green; 36/37 = yellow

Supply voltage (power supply)

- 85 to 260 V AC, 45 to 65 Hz
- 20 to 55 V AC, 45 to 65 Hz
- 16 to 62 V DC

PROFIBUS PA and FOUNDATION Fieldbus
- Non-Ex: 9 to 32 V DC
- Ex i: 9 to 24 V DC
- Ex d: 9 to 32 V DC

Cable entry

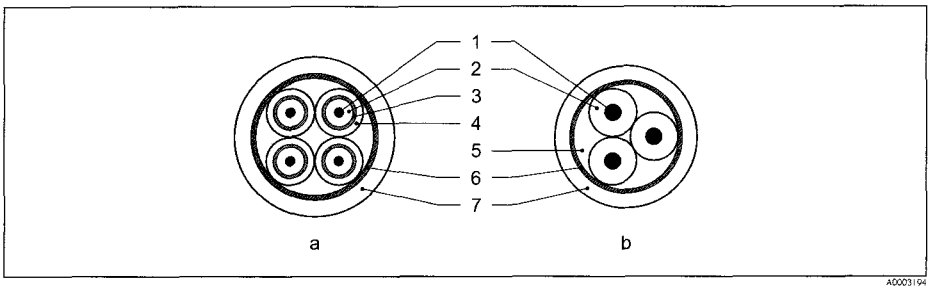
Power supply and signal cables (inputs/ outputs):
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Sensor cable entry for armoured cables M20 × 1.5 (9.5 to 16 mm / 0.37 to 0.63")
- Thread for cable entries, ½" NPT, G ½"

Connecting cable for remote version:
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Sensor cable entry for armoured cables M20 × 1.5 (9.5 to 16 mm / 0.37 to 0.63")
- Thread for cable entries, ½" NPT, G ½"

Remote version cable specifications

Coil cable
- 2 × 0.75 mm² (18 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28")
- Conductor resistance: ≤ 37 Ω/km (≤ 0.011 Ω/ft)
- Capacitance core/core, shield grounded: ≤ 120 pF/m (≤ 37 pF/ft)
- Operating temperature: –20 to +80 °C (–68 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 AWG)
- Test voltage for cable insulation: ≤ 1433 AC r.m.s. 50/60 Hz or ≥ 2026 V DC

Signal cable
- 3 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individual shielded cores
- With empty pipe detection (EPD): 4 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individual shielded cores
- Conductor resistance: ≤ 50 Ω/km (≤ 0.015 Ω/ft)
- Capacitance core/shield: ≤ 420 pF/m (≤ 128 pF/ft)
- Operating temperature: –20 to +80 °C (–68 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 AWG)



a Signal cable
b Coil current cable

1 Core
2 Core insulation
3 Core shield
4 Core jacket
5 Core reinforcement
6 Cable shield
7 Outer jacket

Operation in zones of severe electrical interference
The measuring device complies with the general safety requirements in accordance with EN 61010 and the EMC requirements of IEC/EN 61326 and NAMUR recommendation NE 21.

Caution!
Grounding is by means of the ground terminals provided for the purpose inside the connection housing. Ensure that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible.

Power consumption

- AC: < 15 VA (incl. sensor)
- DC: < 15 W (incl. sensor)

Switch-on current:
- Max. 3 A (< 5 ms) for 260 V AC
- Max. 13.5 A (< 50 ms) for 24 V DC

Power supply failure

Lasting min. ½ cycle frequency: EEPROM saves measuring system data
- EEPROM or T-DAT (Promag 53 only) retain the measuring system data in the event of a power supply failure
- S-DAT: exchangeable data storage chip which stores the data of the sensor (nominal diameter, serial number, calibration factor, zero point etc.)

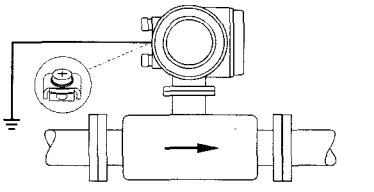
Potential equalization

Warning!
The measuring system must be included in the potential equalization.

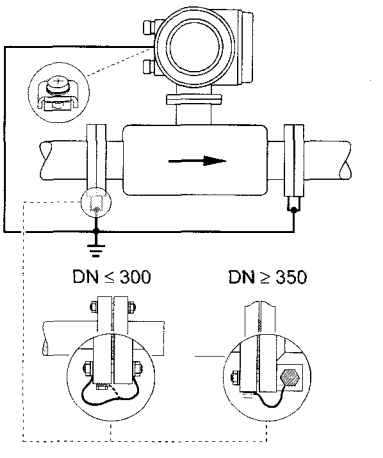
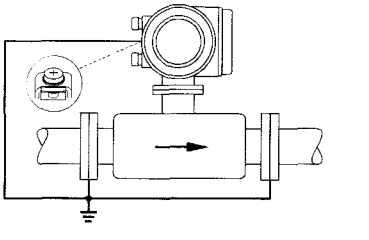
Perfect measurement is only ensured when the fluid and the sensor have the same electrical potential. This is ensured by the reference electrode integrated in the sensor as standard.

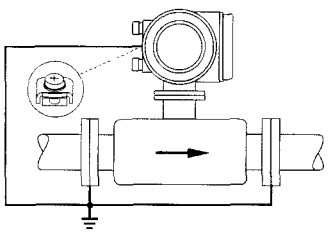
The following should also be taken into consideration for potential equalization:
- Internal grounding concepts in the company
- Operating conditions, such as the material/ grounding of the pipes (see table)

Standard situation

Operating conditions	Potential equalization
When using the measuring device in a: ■ Metal, grounded pipe Potential equalization takes place via the ground terminal of the transmitter. Note! When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.	 A0011802 Via the ground terminal of the transmitter

Special situations

Operating conditions	Potential equalization
When using the measuring device in a: ■ Metal pipe that is not grounded This connection method also applies in situations where: ■ Customary potential equalization cannot be ensured. ■ Excessively high equalizing currents can be expected. Both sensor flanges are connected to the pipe flange by means of a ground cable (copper wire, at least 6 mm² / 0.0093 in²) and grounded. Connect the transmitter or sensor connection housing, as applicable, to ground potential by means of the ground terminal provided for the purpose. ■ DN ≤ 300 (12"): the ground cable is mounted directly on the conductive flange coating with the flange screws. ■ DN ≥ 350 (14"): the ground cable is mounted directly on the transportation metal support. Note! The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser.	 A0011803 Via the ground terminal of the transmitter and the flanges of the pipe
When using the measuring device in a: ■ Plastic pipe ■ Pipe with insulating lining This connection method also applies in situations where: ■ Customary potential equalization cannot be ensured. ■ Excessively high equalizing currents can be expected. Potential equalization takes place using additional ground disks, which are connected to the ground terminal via a ground cable (copper wire, at least 6 mm² / 0.0093 in²). When installing the ground disks, please comply with the enclosed Installation Instructions.	 A0011805 Via the ground terminal of the transmitter and the optionally available ground disks

Operating conditions	Potential equalization
When using the measuring device in a: ■ Pipe with a cathodic protection unit The device is installed potential-free in the pipe. Only the two flanges of the pipe are connected with a ground cable (copper wire, at least 6 mm² / 0.0093 in²). Here, the ground cable is mounted directly on the conductive flange coating with flange screws. Note the following when installing: ■ The applicable regulations regarding potential-free installation must be observed. ■ There should be **no** electrically conductive connection between the pipe and the device. ■ The mounting material must withstand the applicable torques.	 A0011896 Potential equalization and cathodic protection 1 Power supply isolation transformer 2 Electrically isolated

Performance characteristics

Reference operating conditions

As per DIN EN 29104 and VDI/VDE 2641:
- Fluid temperature: +28 °C ± 2 K (+82 °F ± 2 K)
- Ambient temperature: +22 °C ±2 K (+72 °F ± 2 K)
- Warm-up period: 30 minutes

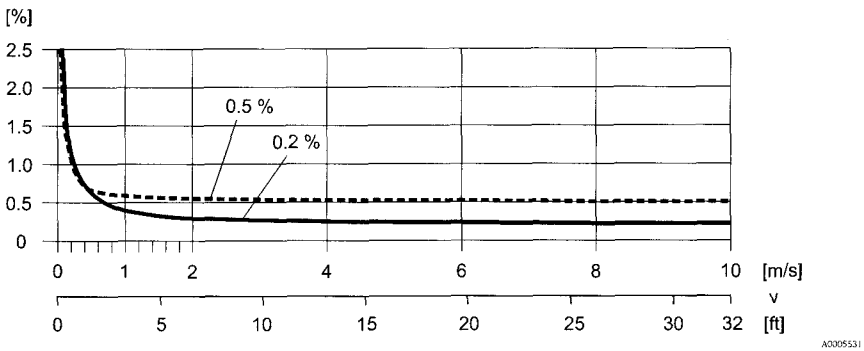
Installation conditions:
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

Maximum measured error

Promag 50:
- Current output: also typically ± 5 µA
- Pulse output: ±0.5% o.r. ± 1 mm/s (±0.5% o.r. ± 0.04 in/s)
  optional: ±0.2% o.r. ± 2 mm/s (±0.2% o.r. ± 0.08 in/s) (o.r. = of reading)

Promag 53:
- Current output: also typically ± 5 µA
- Pulse output: ±0.2% o.r. ± 2 mm/s (±0.2% o.r. ± 0.08 in/s) (o.r. = of reading)

Fluctuations in the supply voltage do not have any effect within the specified range.



Max. measured error in % of reading

Repeatability

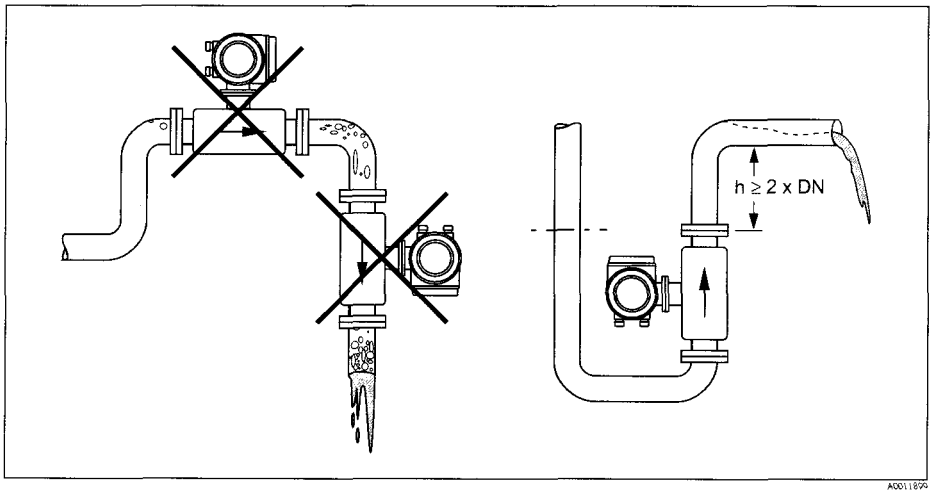
Max. ±0.1% o.r. ± 0.5 mm/s (±0.1% o.r. ± 0.02 in/s) (o.r. = of reading)

Operating conditions: Installations

Installation instructions

Mounting location

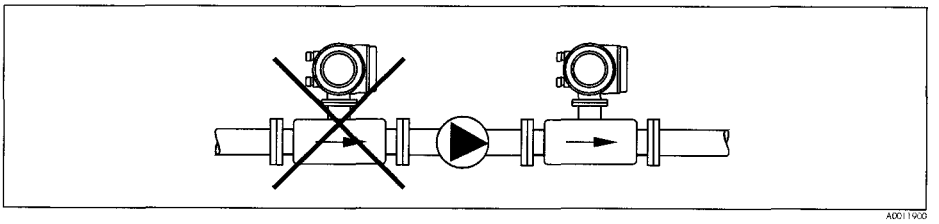
Entrained air or gas bubble formation in the measuring tube can result in an increase in measuring errors.
Avoid the following installation locations in the pipe:
- Highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a vertical pipeline.



Mounting location

Installation of pumps

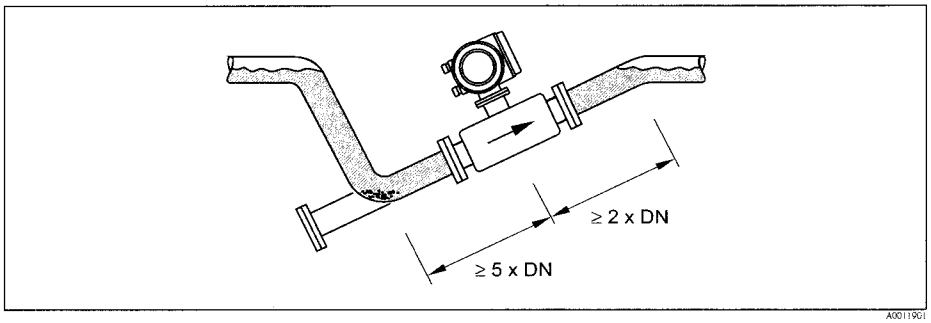
Sensors may not be installed on the pump suction side. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the pressure tightness of the measuring tube lining → 21, Section "Pressure tightness".
Pulsation dampers may be needed when using piston pumps, piston diaphragm pumps or hose pumps. Information on the shock and vibration resistance of the measuring system → 20, Section "Shock and vibration resistance".



Installation of pumps

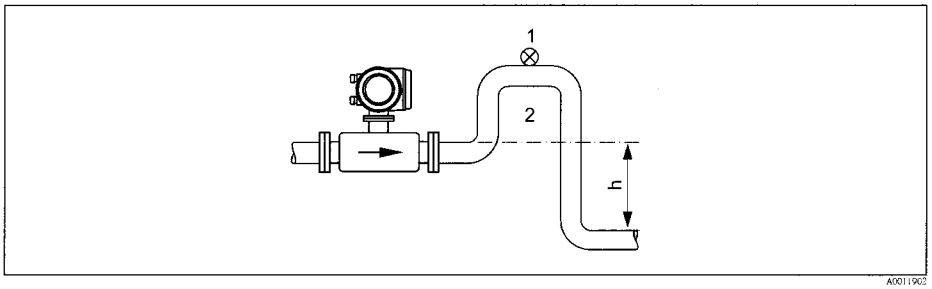
Partially filled pipes
Partially filled pipes with gradients necessitate a drain-type configuration.
The empty pipe detection function (EPD) provides additional security in detecting empty or partially filled pipes.

Caution!
Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.



Installation with partially filled pipes

Down pipes
Install a siphon or a vent valve downstream of the sensor in down pipes h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. This measure also prevents the liquid current stopping in the pipe which could cause air locks. Information on the pressure tightness of the measuring tube lining → 21, Section "Pressure tightness".



Installation measures for vertical pipes

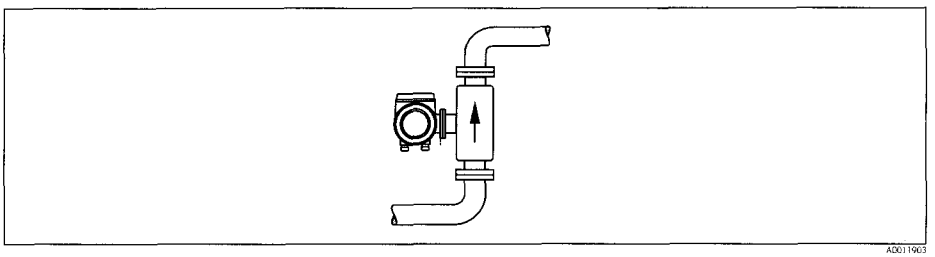
1 Vent valve
2 Pipe siphon
h Length of the down pipe

Orientation

An optimum orientation helps avoid gas and air accumulations and deposits in the measuring tube. However, the measuring device also offers the additional function of empty pipe detection (EPD) for detecting partially filled measuring tubes or if outgassing fluids or fluctuating operating pressures are present.

Vertical orientation

This is the ideal orientation for self-emptying piping systems and for use in conjunction with empty pipe detection.

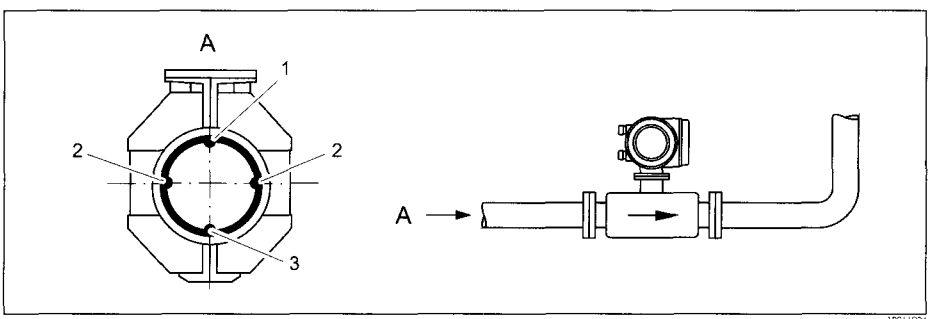


Vertical orientation

Horizontal orientation

The measuring electrode axis should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

Caution!
Empty pipe detection only works correctly with horizontal orientation if the transmitter housing is facing upwards. Otherwise there is no guarantee that empty pipe detection will respond if the measuring tube is only partially filled or empty.



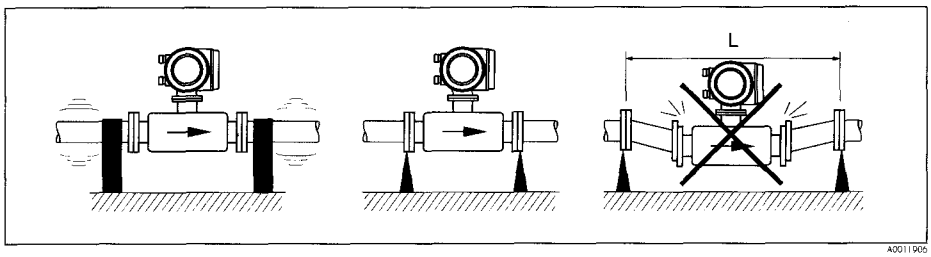
Horizontal orientation

1 EPD electrode for empty pipe detection
2 Measuring electrodes for signal detection
3 Reference electrode for potential equalization

Vibrations

Secure the piping and the sensor if vibration is severe.

Caution!
If vibrations are too severe, we recommend the sensor and transmitter be mounted separately. Information on the permitted shock and vibration resistance → 20, Section "Shock and vibration resistance".



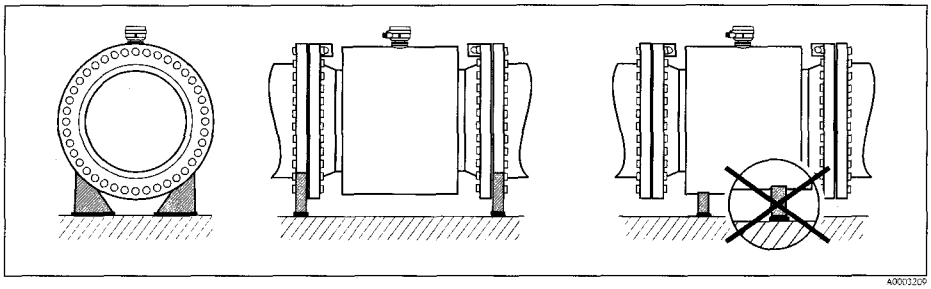
Measures to prevent vibration of the measuring device

L > 10 m (33 ft)

Foundations, supports

If the nominal diameter is DN ≥ 350, mount the transmitter on a foundation of adequate load-bearing strength.

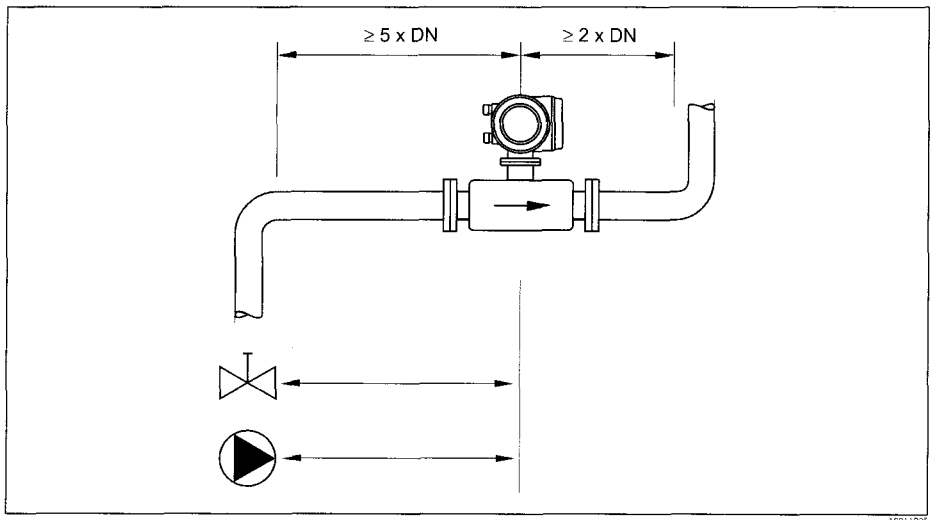
Caution!
Do not allow the casing to take the weight of the sensor. This would buckle the casing and damage the internal magnetic coils.



Inlet and outlet run

If possible, install the sensor well clear of assemblies such as valves, T-pieces, elbows etc.

Note the following inlet and outlet runs to comply with measuring accuracy specifications:
- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN



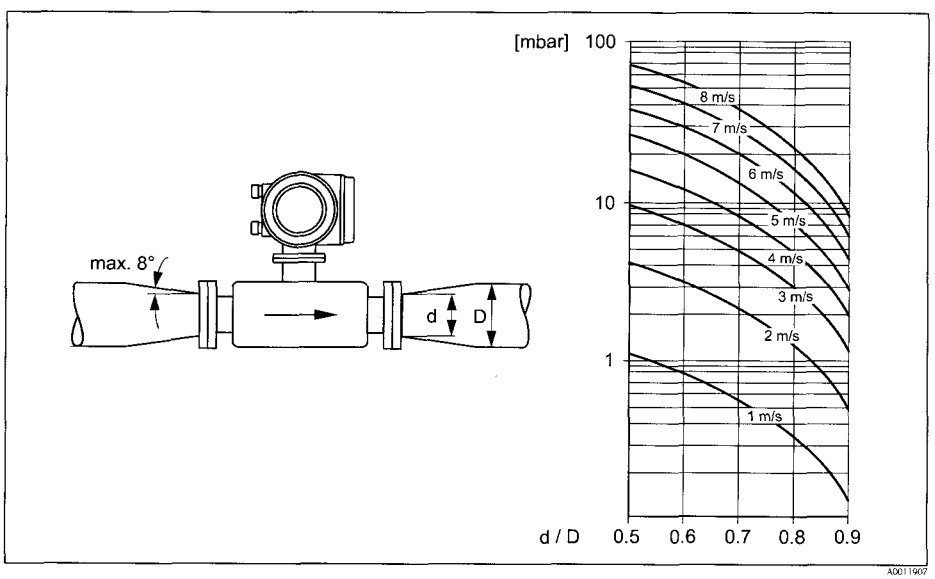
Inlet and outlet run

Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

Note!
The nomogram only applies to liquids of viscosity similar to water.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

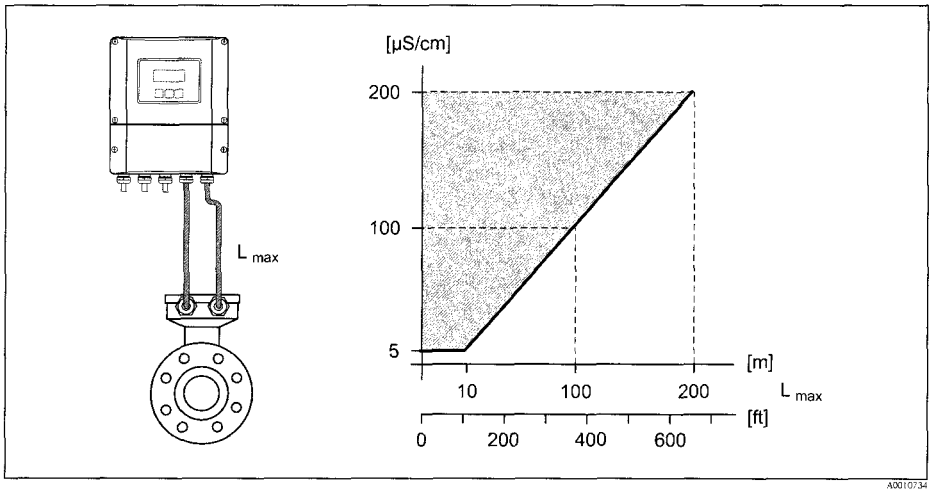


Pressure loss due to adapters

Length of connecting cable

When mounting the remote version, please note the following to achieve correct measuring results:

- Fix cable run or lay in armored conduit. Cable movements can falsify the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- If necessary, ensure potential equalization between sensor and transmitter.
- The permitted cable length L_{max} is determined by the fluid conductivity. A minimum conductivity of 20 µS/cm is required for measuring demineralized water.
- When the empty pipe detection function is switched on (EPD), the maximum connecting cable length is 10 m (33 ft).



Permitted length of connecting cable for remote version
Area marked in gray = permitted range; L_{max} = length of connecting cable in [m] ([ft]); fluid conductivity in [µS/cm]

Operating conditions: Environment

Ambient temperature range

Transmitter
- Standard: –20 to +60 °C (–4 to +140 °F)
- Optional: –40 to +60 °C (–40 to +140 °F)

Note!
At ambient temperatures below –20 °C (–4 °F)the readability of the display may be impaired.

Sensor
- Flange material carbon steel: –10 to +60 °C (14 to +140 °F)
- Flange material stainless steel: –40 to +60 °C (–40 to +140 °F)

Caution!
The permitted temperature range of the measuring tube lining may not be undershot or overshot
→ 21, Section "Medium temperature range".

Please note the following points:
- Install the device in a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- The transmitter must be mounted separate from the sensor if both the ambient and fluid temperatures are high.

Storage temperature

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.

Caution!
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- A storage location must be selected where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.
- Do not remove the protective plates or caps on the process connections until the device is ready to install.

Degree of protection

- Standard: IP 67 (NEMA 4X) for transmitter and sensor.
- Optional: IP 68 (NEMA 6P) for sensor for remote version.
- For information regarding applications where the device is buried directly in the soil or is installed in a flooded wastewater basin please contact your local Endress+Hauser Sales Center.

Shock and vibration resistance

Acceleration up to 2 g following IEC 600 68-2-6

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR recommendation NE 21.

Operating conditions: Process

Medium temperature range

The permitted temperature depends on the lining of the measuring tube:
- Polyurethane: –20 to +50 °C (–4 to +122 °F) (DN 25 to 1200 / 1 to 48")
- Hard rubber: ±0 to +80 °C (+32 to +176 °F) (DN 50 to 2000 / 2 to 78")

Conductivity

The minimum conductivity is:
- ≥ 5 µS/cm for fluids generally
- ≥ 20 µS/cm for demineralized water

Note!
In the remote version, the necessary minimum conductivity also depends on the cable length (→ 19, Section "Length of connecting cable").

Medium pressure range (nominal pressure)

- EN 1092-1 (DIN 2501)
  - PN 6 (DN 350 to 2000 / 14 to 78")
  - PN 10 (DN 200 to 2000 / 8 to 78")
  - PN 16 (DN 65 to 2000 / 3 to 78")
  - PN 25 (DN 200 to 1000 / 8 to 40")
  - PN 40 (DN 25 to 150 / 1 to 6")
- ANSI B 16.5
  - Class 150 (DN 1 to 24")
  - Class 300 (DN 1 to 6")
- AWWA
  - Class D (DN 28 to 78")
- JIS B2220
  - 10 K (DN 50 to 300 / 2 to 12")
  - 20 K (DN 25 to 300 / 1 to 12")
- AS 2129
  - Table E (DN 80, 100, 150 to 400, 500, 600 / 3", 4", 6 to 16", 20", 24")
- AS 4087
  - PN 16 (DN 80, 100, 150 to 400, 500, 600 / 3", 4", 6 to 16", 20", 24")

Pressure tightness

Measuring tube lining: Polyurethane

Nominal diameter		Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures:			
		25 °C (77 °F)		50 °C (122 °F)	
[mm]	[inch]	[mbar]	[psi]	[mbar]	[psi]
25 to 1200	1 to 48"	0	0	0	0

Measuring tube lining: Hard rubber

Nominal diameter		Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures:					
		25 °C (77 °F)		50 °C (122 °F)		80 °C (176 °F)	
[mm]	[inch]	[mbar]	[psi]	[mbar]	[psi]	[mbar]	[psi]
50 to 2000	2 to 78"	0	0	0	0	0	0

Limiting flow

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor.
The optimum flow velocity is between 2 to 3 m/s (6.5 to 9.8 ft/s). The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:

- v < 2 m/s (6.5 ft/s): for abrasive fluids such as potter's clay, lime milk, ore slurry etc.
- v > 2 m/s (6.5 ft/s): for fluids causing build-up such as wastewater sludges etc.

Flow characteristic values (SI units)

Diameter		Recommended flow	Factory settings		
		Min./max. full scale value	Full scale value Current output	Pulse value	Low flow
[mm]	[inch]	(v ~ 0.3 or 10 m/s)	(v ~ 2.5 m/s)	(~ 2 pulses/s)	(v ~ 0.04 m/s)
25	1"	9 to 300 dm³/min	75 dm³/min	0.50 dm³	1 dm³/min
32	–	15 to 500 dm³/min	125 dm³/min	1.00 dm³	2 dm³/min
40	1½"	25 to 700 dm³/min	200 dm³/min	1.50 dm³	3 dm³/min
50	2"	35 to 1100 dm³/min	300 dm³/min	2.50 dm³	5 dm³/min
65	–	60 to 2000 dm³/min	500 dm³/min	5.00 dm³	8 dm³/min
80	3"	90 to 3000 dm³/min	750 dm³/min	5.00 dm³	12 dm³/min
100	4"	145 to 4700 dm³/min	1200 dm³/min	10.00 dm³	20 dm³/min
125	–	220 to 7500 dm³/min	1850 dm³/min	15.00 dm³	30 dm³/min
150	6"	20 to 600 m³/h	150 m³/h	0.025 m³	2.5 m³/h
200	8"	35 to 1100 m³/h	300 m³/h	0.05 m³	5.0 m³/h
250	10"	55 to 1700 m³/h	500 m³/h	0.05 m³	7.5 m³/h
300	12"	80 to 2400 m³/h	750 m³/h	0.10 m³	10 m³/h
350	14"	110 to 3300 m³/h	1000 m³/h	0.10 m³	15 m³/h
375	15"	140 to 4200 m³/h	1200 m³/h	0.15 m³	20 m³/h
400	16"	140 to 4200 m³/h	1200 m³/h	0.15 m³	20 m³/h
450	18"	180 to 5400 m³/h	1500 m³/h	0.25 m³	25 m³/h
500	20"	220 to 6600 m³/h	2000 m³/h	0.25 m³	30 m³/h
600	24"	310 to 9600 m³/h	2500 m³/h	0.30 m³	40 m³/h
700	28"	420 to 13500 m³/h	3500 m³/h	0.50 m³	50 m³/h
–	30"	480 to 15000 m³/h	4000 m³/h	0.50 m³	60 m³/h
800	32"	550 to 18000 m³/h	4500 m³/h	0.75 m³	75 m³/h
900	36"	690 to 22500 m³/h	6000 m³/h	0.75 m³	100 m³/h
1000	40"	850 to 28000 m³/h	7000 m³/h	1.00 m³	125 m³/h
–	42"	950 to 30000 m³/h	8000 m³/h	1.00 m³	125 m³/h
1200	48"	1250 to 40000 m³/h	10000 m³/h	1.50 m³	150 m³/h
–	54"	1550 to 50000 m³/h	13000 m³/h	1.50 m³	200 m³/h
1400	–	1700 to 55000 m³/h	14000 m³/h	2.00 m³	225 m³/h
–	60"	1950 to 60000 m³/h	16000 m³/h	2.00 m³	250 m³/h
1600	–	2200 to 70000 m³/h	18000 m³/h	2.50 m³	300 m³/h
–	66"	2500 to 80000 m³/h	20500 m³/h	2.50 m³	325 m³/h
1800	72"	2800 to 90000 m³/h	23000 m³/h	3.00 m³	350 m³/h
–	78"	3300 to 100000 m³/h	28500 m³/h	3.50 m³	450 m³/h
2000	–	3400 to 110000 m³/h	28500 m³/h	3.50 m³	450 m³/h

Flow characteristic values (US units)					
Diameter		Recommended flow rate	Factory settings		
[inch]	[mm]	Min./max. full scale value (v ~ 0.3 or 10 m/s)	Full scale value Current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulses/s)	Low flow (v ~ 0.04 m/s)
1"	25	2.5 to 80 gal/min	18 gal/min	0.20 gal	0.25 gal/min
–	32	4 to 130 gal/min	30 gal/min	0.20 gal	0.50 gal/min
1½"	40	7 to 190 gal/min	50 gal/min	0.50 gal	0.75 gal/min
2"	50	10 to 300 gal/min	75 gal/min	0.50 gal	1.25 gal/min
–	65	16 to 500 gal/min	130 gal/min	1 gal	2.0 gal/min
3"	80	24 to 800 gal/min	200 gal/min	2 gal	2.5 gal/min
4"	100	40 to 1250 gal/min	300 gal/min	2 gal	4.0 gal/min
–	125	60 to 1950 gal/min	450 gal/min	5 gal	7.0 gal/min
6"	150	90 to 2650 gal/min	600 gal/min	5 gal	12 gal/min
8"	200	155 to 4850 gal/min	1200 gal/min	10 gal	15 gal/min
10"	250	250 to 7500 gal/min	1500 gal/min	15 gal	30 gal/min
12"	300	350 to 10600 gal/min	2400 gal/min	25 gal	45 gal/min
14"	350	500 to 15000 gal/min	3600 gal/min	30 gal	60 gal/min
15"	375	600 to 19000 gal/min	4800 gal/min	50 gal	60 gal/min
16"	400	600 to 19000 gal/min	4800 gal/min	50 gal	60 gal/min
18"	450	800 to 24000 gal/min	6000 gal/min	50 gal	90 gal/min
20"	500	1000 to 30000 gal/min	7500 gal/min	75 gal	120 gal/min
24"	600	1400 to 44000 gal/min	10500 gal/min	100 gal	180 gal/min
28"	700	1900 to 60000 gal/min	13500 gal/min	125 gal	210 gal/min
30"	–	2150 to 67000 gal/min	16500 gal/min	150 gal	270 gal/min
32"	800	2450 to 80000 gal/min	19500 gal/min	200 gal	300 gal/min
36"	900	3100 to 100000 gal/min	24000 gal/min	225 gal	360 gal/min
40"	1000	3800 to 125000 gal/min	30000 gal/min	250 gal	480 gal/min
42"	–	4200 to 135000 gal/min	33000 gal/min	250 gal	600 gal/min
48"	1200	5500 to 175000 gal/min	42000 gal/min	400 gal	600 gal/min
54"	–	9 to 300 Mgal/min	75 Mgal/min	0.0005 Mgal	1.3 Mgal/min
–	1400	10 to 340 Mgal/min	85 Mgal/min	0.0005 Mgal	1.3 Mgal/min
60"	–	12 to 380 Mgal/min	95 Mgal/min	0.0005 Mgal	1.3 Mgal/min
–	1600	13 to 450 Mgal/min	110 Mgal/min	0.0008 Mgal	1.7 Mgal/min
66"	–	14 to 500 Mgal/min	120 Mgal/min	0.0008 Mgal	2.2 Mgal/min
72"	1800	16 to 570 Mgal/min	140 Mgal/min	0.0008 Mgal	2.6 Mgal/min
78"	–	18 to 650 Mgal/min	175 Mgal/min	0.001 Mgal	3.0 Mgal/min
–	2000	20 to 700 Mgal/min	175 Mgal/min	0.001 Mgal	3.0 Mgal/min

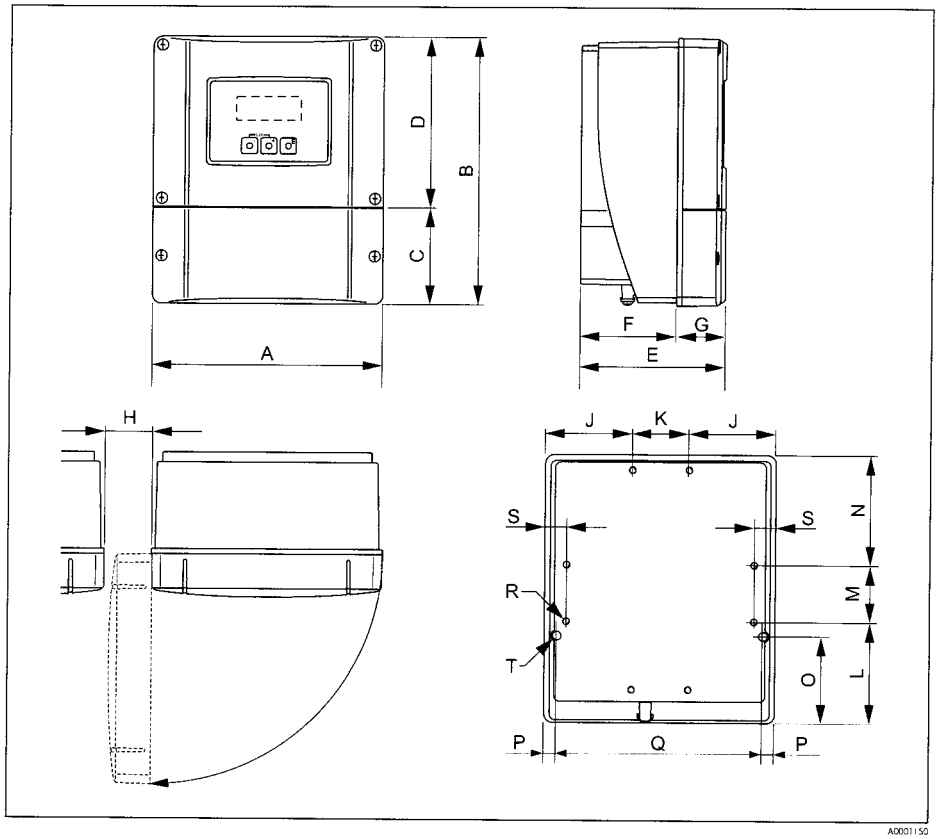
Pressure loss

- No pressure loss if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (→ 18, Section "Adapters").

Mechanical construction

Design, dimensions

Transmitter remote version, wall-mount housing (non Ex-zone and II3G/Zone 2)



Dimensions (SI units)

A	B	C	D	E	F	G	H	J
215	250	90.5	159.5	135	90	45	> 50	81
K	L	M	N	O	P	Q	R	S
53	95	53	102	81.5	11.5	192	8 × M5	20

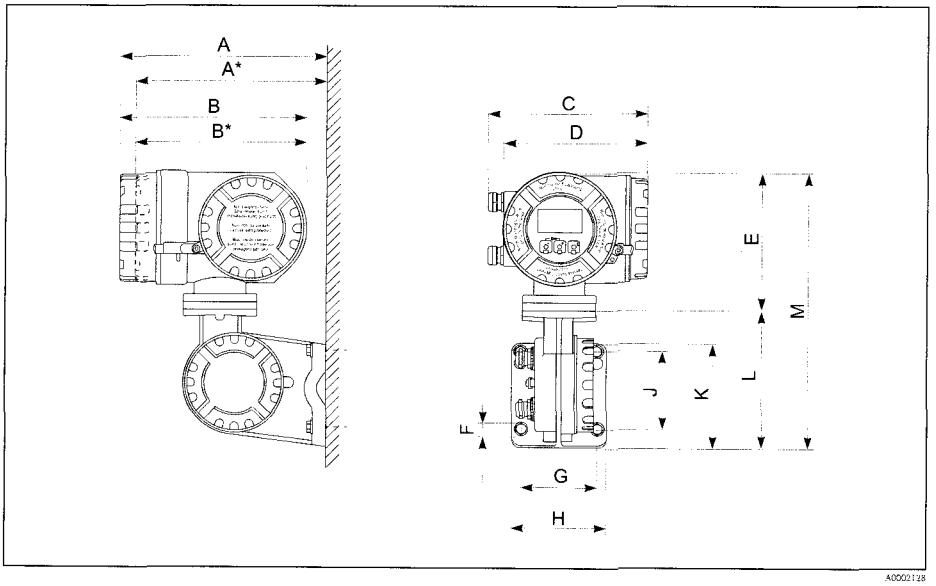
All dimensions in [mm]

Dimensions (US units)

A	B	C	D	E	F	G	H	J
8.46	9.84	3.56	6.27	5.31	3.54	1.77	> 1.97	3.18
K	L	M	N	O	P	Q	R	S
2.08	3.74	2.08	4.01	3.20	0.45	7.55	8 × M5	0.79

All dimensions in [inch]

Transmitter remote version, connection housing (II2GD/Zone 1)



Dimensions (SI units)

A	A*	B	B*	C	D	E	ØF	G	H	J	K	L	M
265	242	240	217	206	186	178	8.6 (M8)	100	130	100	144	170	355

All dimensions in [mm]

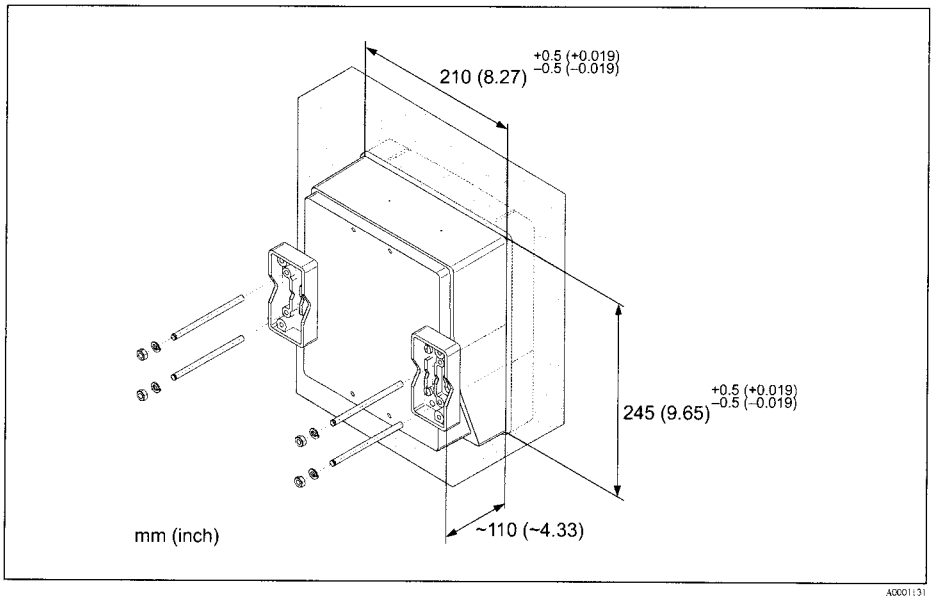
Dimensions (US units)

A	A*	B	B*	C	D	E	ØF	G	H	J	K	L	M
10.4	9.53	9.45	8.54	8.11	7.32	7.01	0.34 (M8)	3.94	5.12	3.94	5.67	6.69	14.0

All dimensions in [inch]

There is a separate mounting kit for the wall-mounted housing. It can be ordered from Endress+Hauser as an accessory. The following installation variants are possible:
- Panel-mounted installation
- Pipe mounting

Installation in control panel



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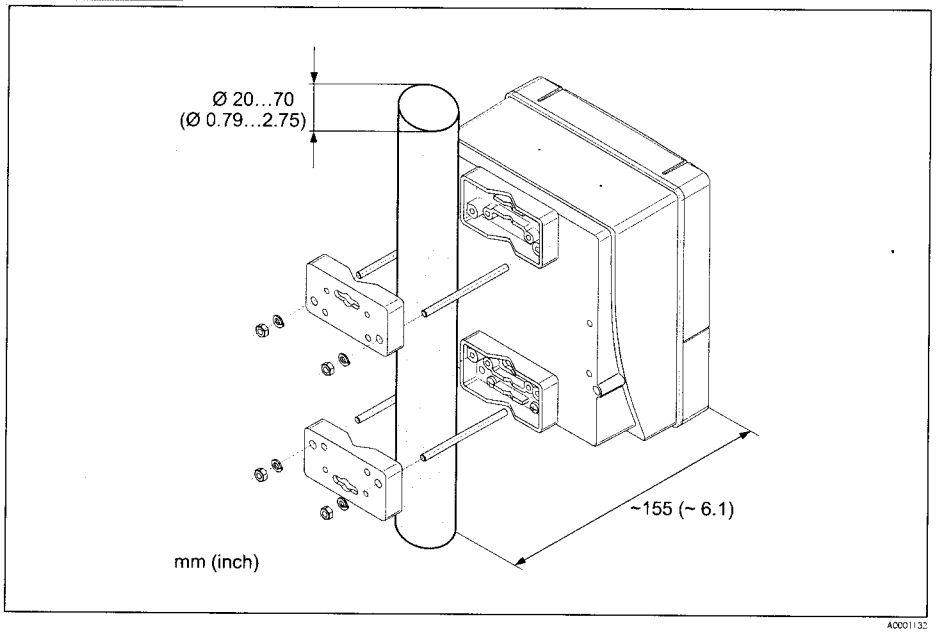
Pipe mounting



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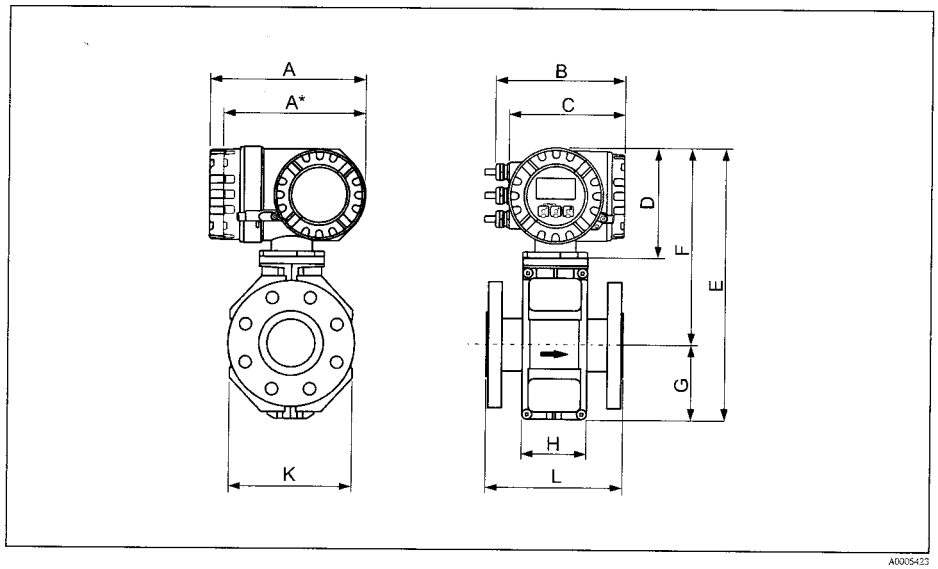
Compact version DN ≤ 300 (12")



Dimensions (SI units)

DN EN (DIN) / JIS / AS [2]	L [1]	A	A*	B	C	D	E	F	G	H	K
25	200	227	207	187	168	160	341	257	84	94	120
32	200						341	257	84	94	120
40	200						341	257	84	94	120
50	200						341	257	84	94	120
65	200						391	282	109	94	180
80	200						391	282	109	94	180
100	250						391	282	109	94	180
125	250						472	322	150	140	260
150	300						472	322	150	140	260
200	350						527	347	180	156	324
250	450						577	372	205	166	400
300	500						627	397	230	166	460

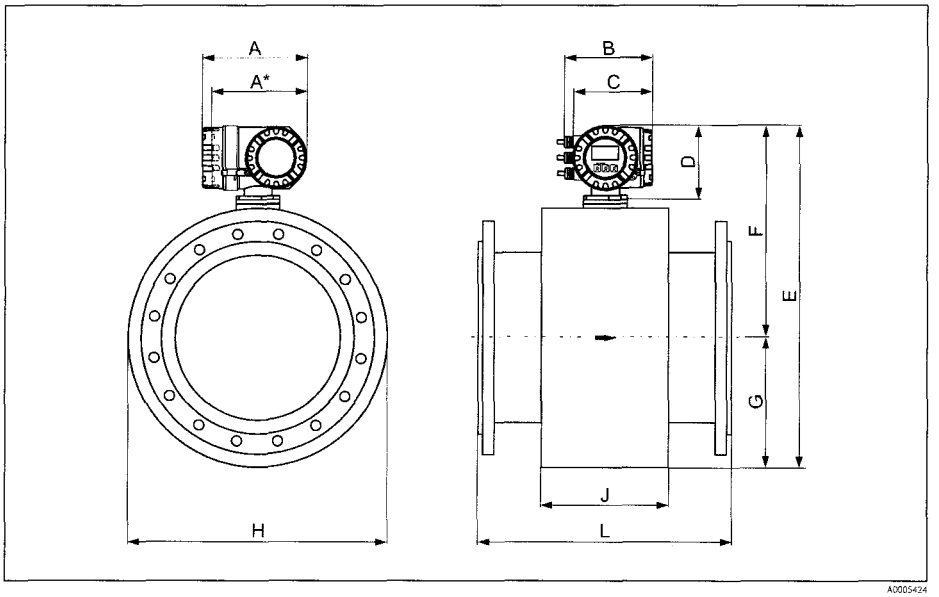
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only the nominal diameters DN 80, 100 and 150 to 300 are available.
All dimensions in [mm]

Dimensions (US units)

DN ANSI	L [1]	A	A*	B	C	D	E	F	G	H	K
1"	7.87						13.4	10.1	3.31	3.70	4.72
1½"	7.87						13.4	10.1	3.31	3.70	4.72
2"	7.87						13.4	10.1	3.31	3.70	4.72
3"	7.87						15.4	11.1	4.29	3.70	7.09
4"	9.84	8.94	8.15	7.36	6.61	6.30	15.4	11.1	4.29	3.70	7.09
6"	11.8						18.6	12.7	5.91	5.51	10.2
8"	13.8						20.8	13.7	7.09	6.14	12.8
10"	17.7						22.7	14.7	8.07	6.14	15.8
12"	19.7						24.7	15.6	9.06	6.54	18.1

[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
All dimensions in [inch]

Compact version DN ≥ 350 (14")



Dimensions (SI units)

DN EN (DIN) / AS [2]	L [1]	A	A*	B	C	D	E	F	G	H	J
350	550	227	207	187	168	160	738.5	456.5	282.0	276	564
375	600						790.5	482.5	308.0	276	616
400	600						790.5	482.5	308.0	276	616
450	650						840.5	507.5	333.0	292	666
500	650						891.5	533.0	358.5	292	717
600	780						995.5	585.0	410.5	402	821
700	910						1198.5	686.5	512.0	589	1024
750	975						1198.5	686.5	512.0	626	1024
800	1040						1241.5	708.5	533.5	647	1067
900	1170						1394.5	784.5	610.0	785	1220
1000	1300						1546.5	860.5	686.0	862	1372
1050	1365						1598.5	886.5	712.0	912	1424
1200	1560						1796.5	985.5	811.0	992	1622
1350	1755						1998.5	1086.5	912.0	1252	1824
1400	1820						2148.5	1161.5	987.0	1252	1974
1500	1950						2196.5	1185.5	1011.0	1392	2022
1600	2080						2286.5	1230.5	1056.0	1482	2112
1650	2145						2360.5	1267.5	1093.0	1482	2186
1800	2340						2550.5	1362.5	1188.0	1632	2376
2000	2600						2650.5	1412.5	1238.0	1732	2476

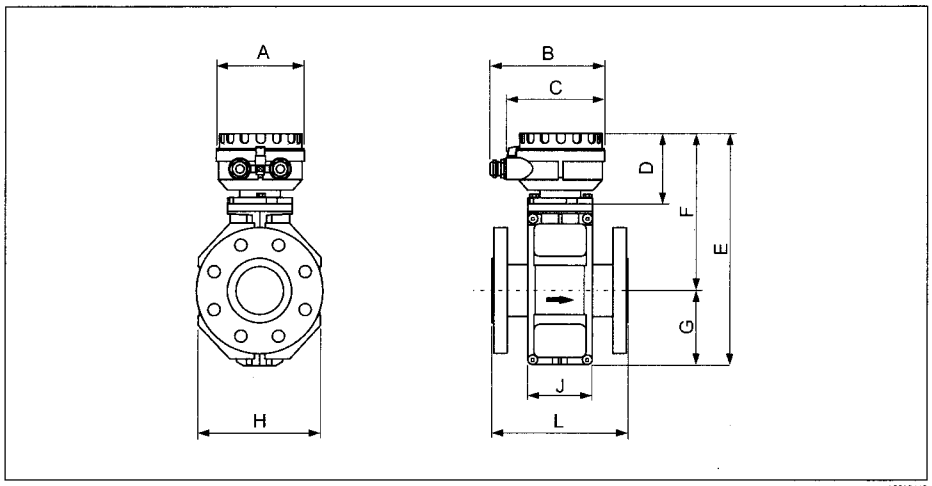
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only DN 350, 400, 500 and 600 are available.
All dimensions in [mm]

Dimensions (US units)

DN ANSI / AWWA [2]	L [1]	A	A*	B	C	D	E	F	G	H	J
14"	21.6	8.94	8.15	7.36	6.61	6.30	29.1	17.9	11.1	10.9	22.2
15"	23.6						31.1	18.9	12.1	10.9	24.2
16"	23.6						31.1	18.9	12.1	10.9	24.2
18"	25.6						33.1	19.9	13.1	11.5	26.2
20"	25.6						35.1	20.9	14.1	11.5	28.2
24"	30.7						39.2	23.0	16.2	15.8	32.3
28"	35.8						47.2	27.0	20.1	23.2	40.3
30"	38.4						47.2	27.0	20.1	24.6	40.3
32"	40.9						48.9	27.9	21.0	25.5	42.0
36"	46.0						54.9	30.9	24.0	30.9	48.0
40"	51.2						60.9	33.9	27.0	33.9	54.0
42"	53.7						62.9	34.9	28.0	35.9	56.0
48"	61.4						71.7	38.8	31.9	39.0	63.8
54"	69.1						78.7	42.8	35.9	42.3	71.8
56"	71.7						84.6	45.7	38.9	49.3	77.7
60"	76.8						86.5	46.7	39.8	54.8	79.6
64"	81.9						90.0	48.4	41.6	58.4	83.2
66"	84.4						92.9	49.9	43.0	58.4	86.0
72"	92.1						100.4	53.6	46.8	64.2	93.5
78"	102.3						104.3	55.6	48.7	68.2	97.5

[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] Flanges ≤ 24" only to ANSI available, ≥ 28" only to AWWA available.
All dimensions in [inch]

Sensor, remote version DN ≤ 300 (12")



Dimensions (SI units)

DN EN (DIN) / JIS / AS [2]	L [1]	A	B	C	D	E	F	G	H	J
25	200	129	163	143	102	286	202	84	120	94
32	200	129	163	143	102	286	202	84	120	94
40	200	129	163	143	102	286	202	84	120	94
50	200	129	163	143	102	286	202	84	120	94
65	200	129	163	143	102	336	227	109	180	94
80	200	129	163	143	102	336	227	109	180	94
100	250	129	163	143	102	336	227	109	180	94
125	250	129	163	143	102	417	267	150	260	140
150	300	129	163	143	102	417	267	150	260	140
200	350	129	163	143	102	472	292	180	324	156
250	450	129	163	143	102	522	317	205	400	166
300	500	129	163	143	102	572	342	230	460	166

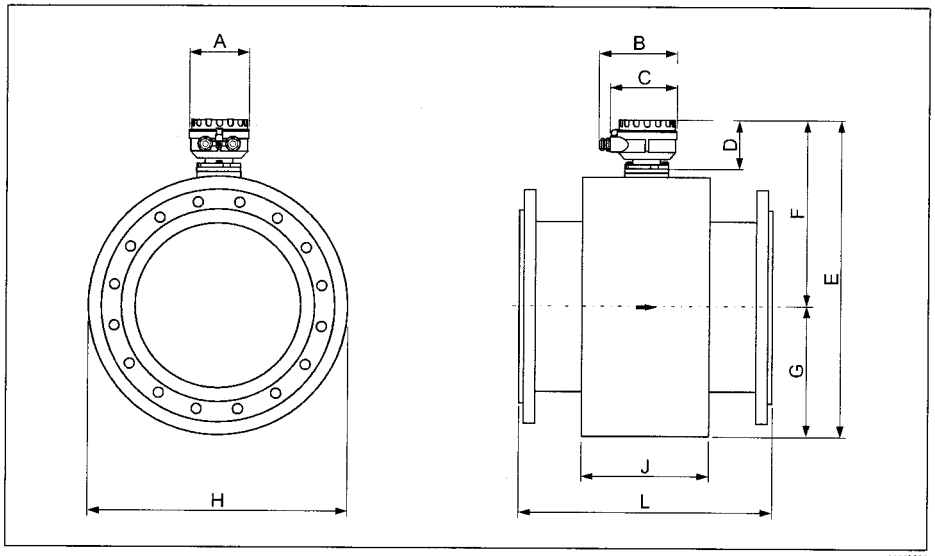
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only the nominal diameters DN 80, 100 and 150 to 300 are available.
All dimensions in [mm]

Dimensions (US units)

DN ANSI	L [1]	A	B	C	D	E	F	G	H	J
1"	7.87	5.08	6.42	5.63	4.02	11.3	7.95	3.32	4.72	3.70
1½"	7.87	5.08	6.42	5.63	4.02	11.3	7.95	3.32	4.72	3.70
2"	7.87	5.08	6.42	5.63	4.02	11.3	7.95	3.32	4.72	3.70
3"	7.87	5.08	6.42	5.63	4.02	13.2	8.94	4.30	7.10	3.70
4"	9.84	5.08	6.42	5.63	4.02	13.2	8.94	4.30	7.10	3.70
6"	11.8	5.08	6.42	5.63	4.02	16.4	10.5	5.91	10.2	5.51
8"	13.8	5.08	6.42	5.63	4.02	18.6	11.5	7.10	12.8	6.14
10"	17.7	5.08	6.42	5.63	4.02	20.6	12.5	8.08	15.8	6.14
12"	19.7	5.08	6.42	5.63	4.02	22.5	13.5	9.06	18.1	6.54

[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
All dimensions in [inch]

Sensor, remote version DN ≥ 350 (14")



Dimensions (SI units)

DN EN (DIN) / AS [2]	L [1]	A	B	C	D	E	F	G	H	J
350	550	129	163	143	102	683.5	401.5	282.0	564	276
375	600					735.5	427.5	308.0	616	276
400	600					735.5	427.5	308.0	616	276
450	650					785.5	452.5	333.0	666	292
500	650					836.5	478.0	358.5	717	292
600	780					940.5	530.0	410.5	821	402
700	910					1143.5	631.5	512.0	1024	589
750	975					1143.5	631.5	512.0	1024	626
800	1040					1186.5	653.0	533.5	1067	647
900	1170					1339.5	729.5	610.0	1220	785
1000	1300					1491.5	805.5	686.0	1372	862
1050	1365					1543.5	831.5	712.0	1424	912
1200	1560					1741.5	930.5	811.0	1622	992
1350	1755					1943.5	1031.5	912.0	1824	1252
1400	1820					2093.5	1106.5	987.0	1974	1252
1500	1950					2141.5	1130.5	1011.0	2022	1392
1600	2080					2231.5	1175.5	1056.0	2112	1482
1650	2145					2305.5	1212.5	1093.0	2186	1482
1800	2340					2495.5	1307.5	1188.0	2376	1632
2000	2600					2595.5	1357.5	1238.0	2476	1732

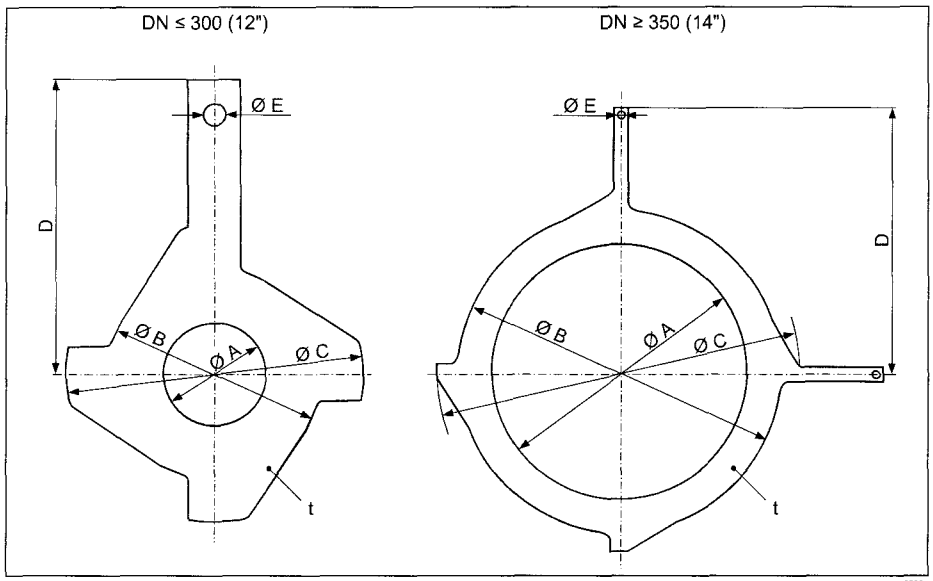
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only DN 350, 400, 500 and 600 are available.
All dimensions in [mm]

Dimensions (US units)

DN ANSI / AWWA [2]	L [1]	A	B	C	D	E	F	G	H	J
14"	21.6	5.08	6.42	5.63	4.02	29.1	15.8	11.1	22.2	10.9
15"	23.6					31.1	16.8	12.1	24.2	10.9
16"	23.6					31.1	16.8	12.1	24.2	10.9
18"	25.6					33.1	17.8	13.1	26.2	11.5
20"	25.6					35.1	18.8	14.1	28.2	11.5
24"	30.7					39.2	20.9	16.2	32.3	15.8
28"	35.8					45.0	24.9	20.1	40.3	23.2
30"	38.4					45.0	24.9	20.1	40.3	24.6
32"	40.9					46.7	25.7	21.0	42.0	25.5
36"	46.0					52.7	28.7	24.0	48.0	30.9
40"	51.2					58.7	31.7	27.0	54.0	33.9
42"	53.7					60.7	32.7	28.0	56.0	35.9
48"	61.4					68.5	36.6	31.9	63.8	39.0
54"	69.1					76.5	40.6	35.9	71.8	42.3
56"	71.7					82.4	43.6	38.9	77.7	49.3
60"	76.8					84.3	44.5	39.8	79.6	54.8
64"	81.9					87.9	46.3	41.6	83.2	58.4
66"	84.4					90.8	47.7	43.0	86.0	58.4
72"	92.1					98.2	51.5	46.8	93.5	64.2
78"	102.3					102.2	53.4	48.7	97.5	68.2

[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] Flanges ≤ 24" only to ANSI available, ≥ 28" only to AWWA available.
All dimensions in [inch]

Ground disk for flange connections



Dimensions (SI units)

DN [1] EN (DIN) / JIS / AS [2]	A	B	C	D	E	t
25	26	62	77.5	87.5	6.5	2
32	35	80	87.5	94.5		
40	41	82	101	103		
50	52	101	115.5	108		
65	68	121	131.5	118		
80	80	131	154.5	135		
100	104	156	186.5	153		
125	130	187	206.5	160		
150	158	217	256	184		
200	206	267	288	205		
250	260	328	359	240		
300 [3]	312	375	413	273		
300 [4]	310	375	404	268		
350 [3]	343	433	479	365	9.0	
375 [3]	393	480	542	395		
400 [3]	393	480	542	395		
450 [3]	439	538	583	417		
500 [3]	493	592	650	460		
600 [3]	593	693	766	522		

[1] Ground disks can be used for all flange standards/pressure ratings that can be delivered, except for DN ≥ 300.
[2] Only DN 32, 40, 65 and 125 are available for flanges according to AS.
[3] PN 10/16
[4] PN 25, JIS 10K/20K
All dimensions in [mm]

Dimensions (US units)

DN [1] ANSI	A	B	C	D	E	t
1"	1.02	2.44	3.05	3.44	0.26	0.08
1½"	1.61	3.23	3.98	4.06		
2"	2.05	3.98	4.55	4.25		
3"	3.15	5.16	6.08	5.31		
4"	4.09	6.14	7.34	6.02		
6"	6.22	8.54	10.08	7.24		
8"	8.11	10.5	11.3	8.07		
10"	10.2	12.9	14.1	9.45		
12"	12.3	14.8	16.3	10.8		
14"	13.5	17.1	18.9	14.4	0.35	
15"	15.45	18.9	21.3	15.6		
16"	15.45	18.9	21.3	15.6		
18"	17.3	21.2	23.0	16.4		
20"	19.4	23.3	25.6	18.1		
24"	23.4	27.3	30.1	20.6		

[1] Ground disks can be used for all flange standards/pressure ratings.
All dimensions in [inch]

Weight

Weight in SI units

Weight data in kg

Nominal diameter		Compact version			Remote version (without cable)			
					Sensor			Transmitter
[mm]	[inch]	EN (DIN) / AS [1]	JIS	ANSI / AWWA	EN (DIN) / AS [1]	JIS	ANSI / AWWA	Wall-mount housing
25	1"	PN 40: 7.3	10K: 7.3	Class 150: 7.3	PN 40: 5.3	10K: 5.3	Class 150: 5.3	6.0
32	–	PN 40: 8.0	10K: 7.3	Class 150: –	PN 40: 6.0	10K: 5.3	Class 150: –	6.0
40	1½"	PN 40: 9.4	10K: 8.3	Class 150: 9.4	PN 40: 7.4	10K: 6.3	Class 150: 7.4	6.0
50	2"	PN 40: 10.6	10K: 9.3	Class 150: 10.6	PN 40: 8.6	10K: 7.3	Class 150: 8.6	6.0
65	–	PN 16: 12	10K: 11.1	Class 150: –	PN 16: 10.0	10K: 9.1	Class 150: –	6.0
80	3"	PN 16: 14	10K: 112.5	Class 150: 14.0	PN 16: 12.0	10K: 10.5	Class 150: 12.0	6.0
100	4"	PN 16: 16	10K: 14.7	Class 150: 16.0	PN 16: 14.0	10K: 12.7	Class 150: 14.0	6.0
125	–	PN 16: 21.5	10K: 21.0	Class 150: –	PN 16: 19.5	10K: 19.0	Class 150: –	6.0
150	6"	PN 16: 25.5	10K: 24.5	Class 150: 25.5	PN 16: 23.5	10K: 22.5	Class 150: 23.5	6.0
200	8"	PN 10: 45	10K: 41.9	Class 150: 45	PN 10: 43	10K: 39.9	Class 150: 43	6.0
250	10"	PN 10: 65	10K: 69.4	Class 150: 75	PN 10: 63	10K: 67.4	Class 150: 73	6.0
300	12"	PN 10: 70	10K: 72.3	Class 150: 110	PN 10: 68	10K: 70.3	Class 150: 108	6.0
350	14"	PN 6: 105		Class 150: 175	PN 6: 103		Class 150: 173	6.0
375	15"	PN 6: 120		Class 150: –	PN 6: 118		Class 150: –	6.0
400	16"	PN 6: 120		Class 150: 205	PN 6: 118		Class 150: 203	6.0
450	18"	PN 6: 161		Class 150: 255	PN 6: 159		Class 150: 253	6.0
500	20"	PN 6: 156		Class 150: 285	PN 6: 154		Class 150: 283	6.0
600	24"	PN 6: 208		Class 150: 405	PN 6: 206		Class 150: 403	6.0
700	28"	PN 6: 304		Class D: 400	PN 6: 302		Class D: 398	6.0
–	30"	PN 6: –		Class D: 460	PN 6: –		Class D: 458	6.0
800	32"	PN 6: 357		Class D: 550	PN 6: 355		Class D: 548	6.0
900	36"	PN 6: 485		Class D: 800	PN 6: 483		Class D: 798	6.0
1000	40"	PN 6: 589		Class D: 900	PN 6: 587		Class D: 898	6.0
–	42"	PN 6: –		Class D: 1100	PN 6: –		Class D: 1098	6.0
1200	48"	PN 6: 850		Class D: 1400	PN 6: 848		Class D: 1398	6.0
–	54"	PN 6: –		Class D: 2200	PN 6: –		Class D: 2198	6.0
1400	–	PN 6: 1300		Class D: –	PN 6: 1298		Class D: –	6.0
–	60"	PN 6: –		Class D: 2700	PN 6: –		Class D: 2698	6.0
1600	–	PN 6: 1700		Class D: –	PN 6: 1698		Class D: –	6.0
–	66"	PN 6: –		Class D: 3700	PN 6: –		Class D: 3698	6.0
1800	72"	PN 6: 2200		Class D: 4100	PN 6: 2198		Class D: 4098	6.0
–	78"	PN 6: –		Class D: 4600	PN 6: –		Class D: 4598	6.0
2000	–	PN 6: 2800		Class D: –	PN 6: 2798		Class D: –	6.0

[1] For flanges to AS, only DN 80, 100, 150 to 400, 500 and 600 are available.

- Transmitter (compact version): 3.4 kg
- Weight data valid for standard pressure ratings and without packaging material.

Weight in US units (only ANSI / AWWA)

Weight data in lbs					
Nominal diameter		Compact version		Remote version (without cable)	
				Sensor	Transmitter
[mm]	[inch]		ANSI / AWWA	ANSI / AWWA	Wall-mount housing
25	1"	Class 150	16.1	Class 150	11.7	13.2
40	1½"		20.7		16.3	
50	2"		23.4		19.0	
80	3"		30.9		26.5	
100	4"		35.3		30.9	
150	6"		56.2		51.8	
200	8"		99.2		94.8	
250	10"		165.4		161.0	
300	12"		242.6		238.1	
350	14"		385.9		381.5	
400	16"		452.0		447.6	
450	18"		562.3		557.9	
500	20"		628.4		624.0	
600	24"		893.0		888.6	
700	28"	Class D	882.0	Class D	877.6	
–	30"		1014.3		1009.9	
800	32"		1212.8		1208.3	
900	36"		1764.0		1759.6	
1000	40"		1984.5		1980.1	
–	42"		2425.5		2421.1	
1200	48"		3087.0		3082.6	
–	54"		4851.0		4846.6	
–	60"		5953.5		5949.1	
–	66"		8158.5		8154.1	
1800	72"		9040.5		9036.1	
–	78"		10143.0		10138.6	

- Transmitter (compact version): 7.5 lbs
- Weight data valid for standard pressure ratings and without packaging material.

Measuring tube specifications

Diameter		Pressure rating						Internal diameter			
		EN (DIN)	AS 2129	AS 4087	ANSI	AWWA	JIS	Hard rubber		Polyurethane	
[mm]	[inch]	[bar]			[lbs]			[mm]	[inch]	[mm]	[inch]
25	1"	PN 40	–	–	Cl. 150	–	20 K	–	–	24	0.94
32	–	PN 40	–	–	–	–	20 K	–	–	32	1.26
40	1½"	PN 40	–	–	Cl. 150	–	20 K	–	–	38	1.50
50	2"	PN 40	Table E	PN 16	Cl. 150	–	10 K	50	1.97	50	1.97
65	–	PN 16	–	–	–	–	10 K	66	2.60	66	2.60
80	3"	PN 16	Table E	PN 16	Cl. 150	–	10 K	79	3.11	79	3.11
100	4"	PN 16	Table E	PN 16	Cl. 150	–	10 K	102	4.02	102	4.02
125	–	PN 16	–	–	–	–	10 K	127	5.00	127	5.00
150	6"	PN 16	Table E	PN 16	Cl. 150	–	10 K	156	6.14	156	6.14
200	8"	PN 10	Table E	PN 16	Cl. 150	–	10 K	204	8.03	204	8.03
250	10"	PN 10	Table E	PN 16	Cl. 150	–	10 K	258	10.2	258	10.2
300	12"	PN 10	Table E	PN 16	Cl. 150	–	10 K	309	12.2	309	12.2
350	14"	PN 6	Table E	PN 16	Cl. 150	–	–	342	13.5	342	13.5
375	15"	–	–	PN 16	–	–	–	392	15.4	–	–
400	16"	PN 6	Table E	PN 16	Cl. 150	–	–	392	15.4	392	15.4
450	18"	PN 6	–	–	Cl. 150	–	–	437	17.2	437	17.2
500	20"	PN 6	Table E	PN 16	Cl. 150	–	–	492	19.4	492	19.4
600	24"	PN 6	Table E	PN 16	Cl. 150	–	–	594	23.4	594	23.4
700	28"	PN 6	–	–	–	Class D	–	692	27.2	692	27.2
–	30"	–	–	–	–	Class D	–	742	29.2	742	29.2
800	32"	PN 6	–	–	–	Class D	–	794	31.3	794	31.3
900	36"	PN 6	–	–	–	Class D	–	891	35.1	891	35.1
1000	40"	PN 6	–	–	–	Class D	–	994	39.1	994	39.1
–	42"	–	–	–	–	Class D	–	1043	41.1	1043	41.1
1200	48"	PN 6	–	–	–	Class D	–	1197	47.1	1197	47.1
–	54"		–	–	–	Class D	–	1339	52.7	–	–
1400	–	PN 6	–	–	–	–	–	1402	55.2	–	–
–	60"	–	–	–	–	Class D	–	1492	58.7	–	–
1600	–	PN 6	–	–	–	–	–	1600	63.0	–	–
–	66"	–	–	–	–	Class D	–	1638	64.5	–	–
1800	72"	PN 6	–	–	–	Class D	–	1786	70.3	–	–
2000	78"	PN 6	–	–	–	Class D	–	1989	78.3	–	–

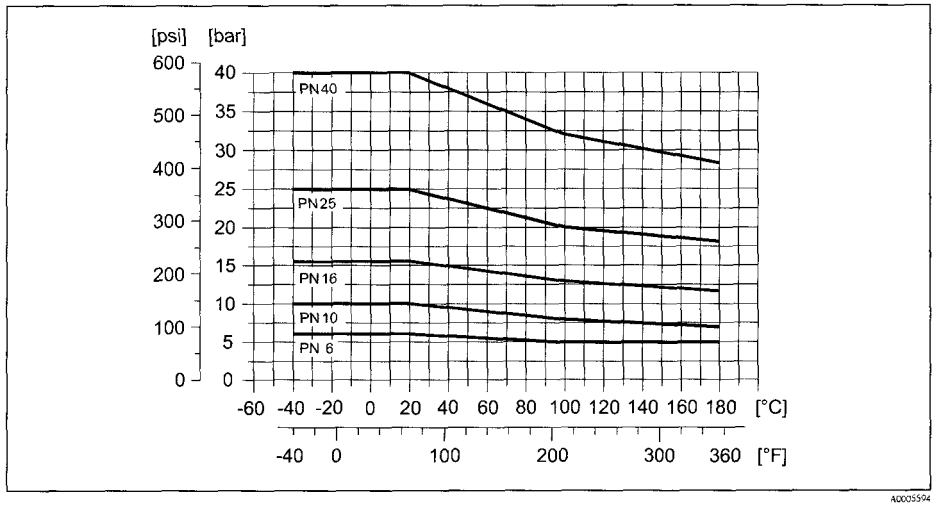
Material

- Transmitter housing
  - Compact housing: powder-coated die-cast aluminum
  - Wall-mount housing: powder-coated die-cast aluminum
- Sensor housing
  - DN 25 to 300 (1 to 12"): powder-coated die-cast aluminum
  - DN 350 to 2000 (14 to 78"): with protective lacquering
- Measuring tube
  - DN ≤ 300 (12"): stainless steel 1.4301 or 1.4306/304L; (for flanges made of carbon steel with Al/Zn protective coating)
  - DN ≥ 350 (14"): stainless steel 1.4301 or 1.4306/304L; (for flanges made of carbon steel with Al/Zn protective coating)
- Electrodes: 1.4435, Alloy C-22, Tantalum
- Flanges
  - EN 1092-1 (DIN 2501): 1.4571/316L; RSt37-2 (S235JRG2); C22; FE 410W B (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - ANSI: A105; F316L (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - AWWA: 1.0425
  - JIS: RSt37-2 (S235JRG2); HII; 1.0425/316L (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - AS 2129
    - DN 150 to 300, 600 (6 to 12", 24"): A105 or RSt37-2 (S235JRG2)
    - DN 50, 80, 100, 350, 400, 500 (2", 3", 4", 14", 16", 20"): A105 or St44-2 (S275JR)
  - AS 4087: A105 or St44-2 (S275JR)
- Seals: to DIN EN 1514-1
- Ground disks: 1.4435/316L, Alloy C-22, Tantalum

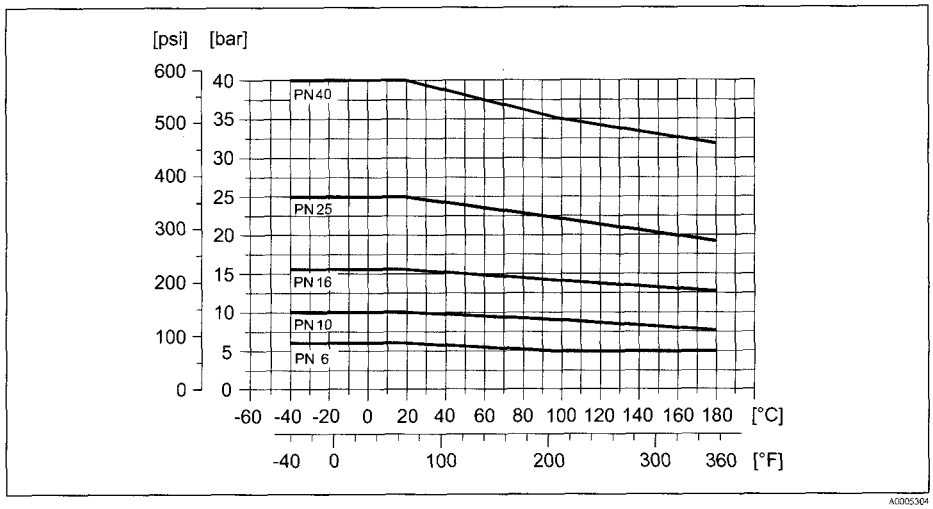
Material load diagram

Caution!
The following diagrams contain material load diagrams (reference curves) for flange materials with regard to the medium temperature. However, the maximum medium temperatures permitted always depend on the lining material of the sensor and/or the sealing material (→ 21).

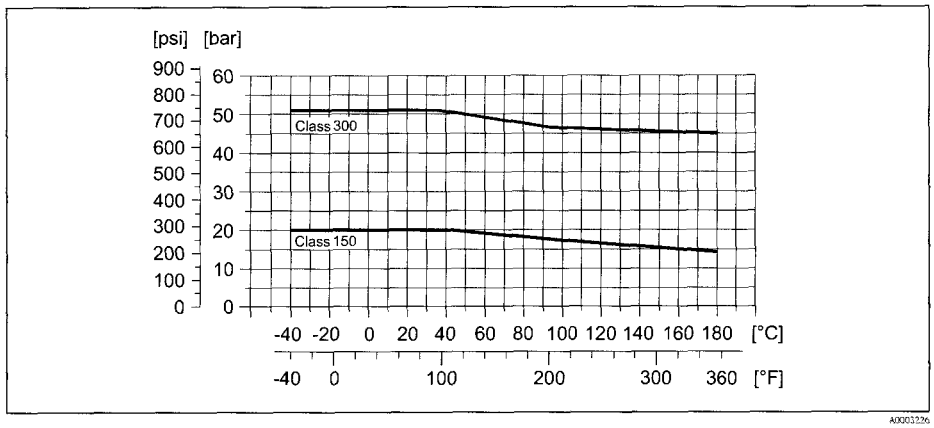
Flange connection to EN 1092-1 (DIN 2501)
Material: RSt37-2 (S235JRG2) / C22 / Fe 410W B



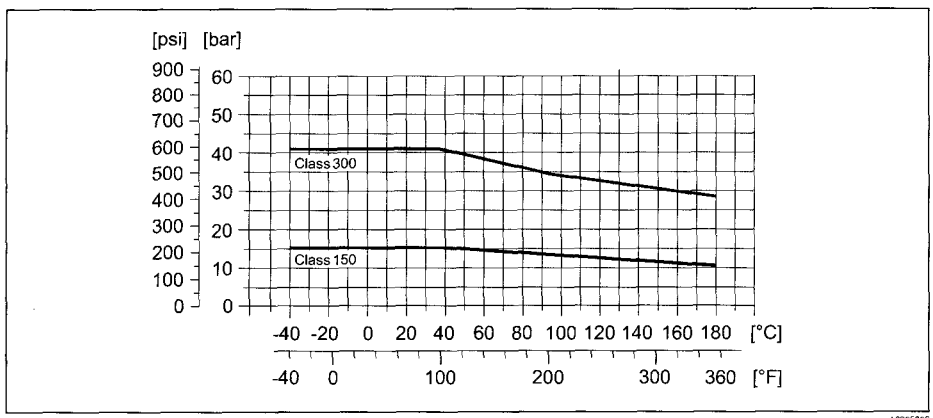
Flange connection to EN 1092-1 (DIN 2501)
Material: 316L / 1.4571



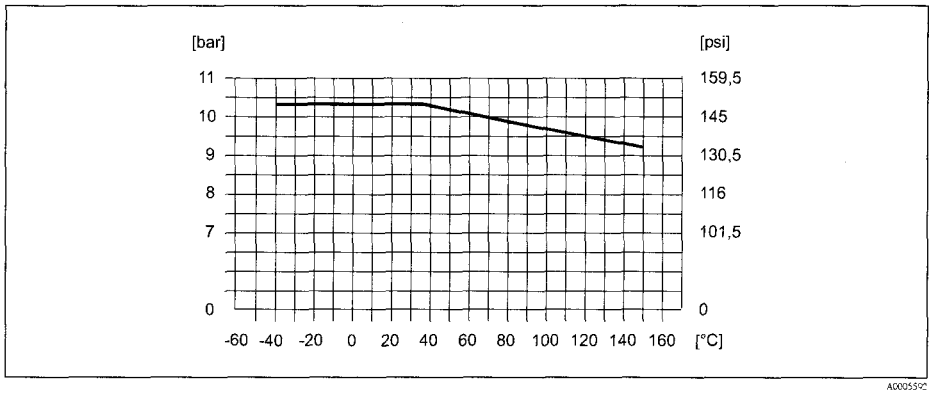
Flange connection to ANSI B16.5
Material: A 105



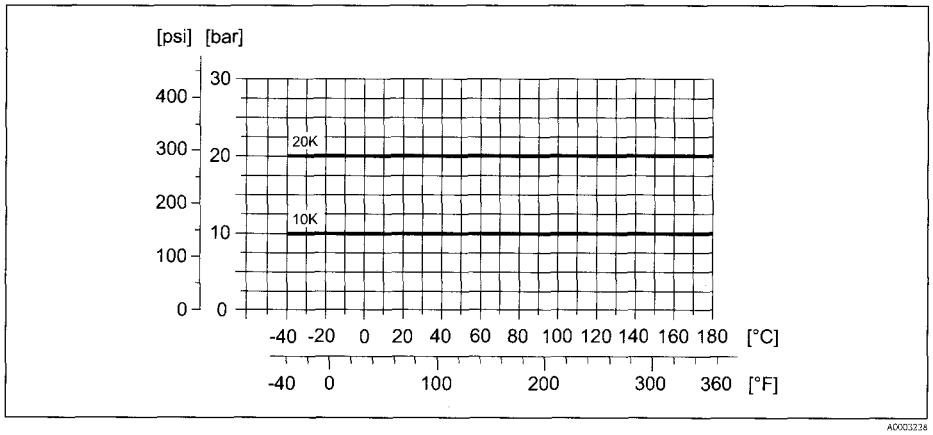
Flange connection to ANSI B16.5
Material: F316L



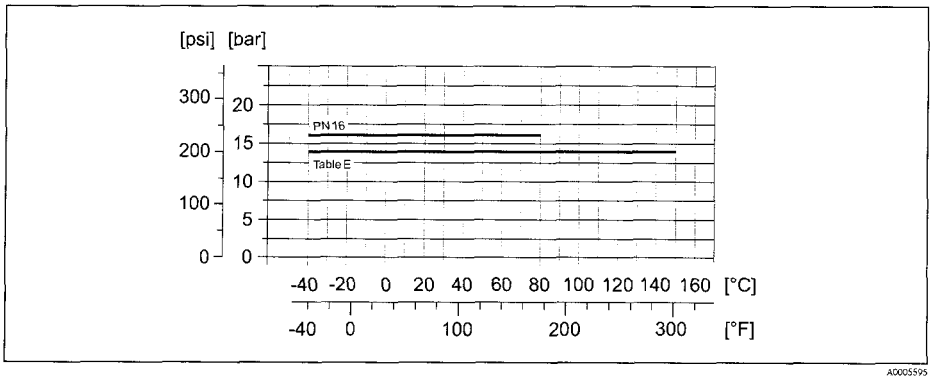
Flange connection to AWWA C 207, Class D
Material: 1.0425



Flange connection to JIS B2220
Material: RSt37-2 (S235JRG2) / HII / 1.0425 / 316L



Flange connection to AS 2129 Table E or AS 4087 PN 16
Material: A105 / RSt37-2 (S235JRG2) / St44-2 (S275JR)



Fitted electrodes

Measuring electrodes, reference electrodes and empty pipe detection electrodes:
- Standard available with 1.4435, Alloy C-22, tantalum
- Optional: exchangeable measuring electrodes made of 1.4435 (DN 350 to 2000 / 14 to 78")

Process connections

Flange connection:
- EN 1092-1 (DIN 2501), DN ≤ 300 (12") form A, DN ≥ 350 (14") form B
  (Dimensions to DIN 2501, DN 65 PN 16 and DN 600 (24") PN 16 exclusively to EN 1092-1)
- ANSI B16.5
- AWWA C 207, Class D
- JIS B2220
- AS 2129 Table E
- AS 4087 PN 16

Surface roughness

- Electrodes
  – 1.4435, Alloy C-22, tantal: ≤ 0.3 to 0.5 µm (≤ 11.8 to 19.7 µin)

(all data refer to parts in contact with medium)

Human interface

Display elements

- Liquid crystal display: backlit, two lines (Promag 50) or four lines (Promag 53) with 16 characters per line
- Custom configurations for presenting different measured-value and status variables
- Totalizer
  – Promag 50: 2 totalizers
  – Promag 53: 3 totalizers

Operating elements

Unified operation concept for both types of transmitter:

Promag 50:
- Local operation via three keys (−, +, E)
- Quick Setup menus for straightforward commissioning

Promag 53:
- Local operation via three keys (−, +, E)
- Application-specific Quick Setup menus for straightforward commissioning

Language groups

Language groups available for operation in different countries:

Promag 50, Promag 53:
- Western Europe and America (WEA):
  English, German, Spanish, Italian, French, Dutch, Portuguese
- Eastern Europe and Scandinavia (EES):
  English, Russian, Polish, Norwegian, Finnish, Swedish, Czech
- South and east Asia (SEA):
  English, Japanese, Indonesian

Promag 53:
- China (CN):
  English, Chinese

You can change the language group via the operating program "FieldCare".

Remote operation

- Promag 50: Remote control via HART, PROFIBUS DP/PA
- Promag 53: Remote control via HART, PROFIBUS DP/PA, MODBUS RS485, FOUNDATION Fieldbus

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-tick mark

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

Pressure measuring device approval

Measuring devices with a nominal diameter smaller than or equal to DN 25 correspond to Article 3(3) of the EC Directive 97/23/EC (Pressure Equipment Directive) and have been designed and manufactured according to good engineering practice. Where necessary (depending on the medium and process pressure), there are additional optional approvals to Category II/III for larger nominal diameters.

Ex approval

Information about currently available Ex versions (ATEX, IECEx, FM, CSA, NEPSI) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.

Other standards and guidelines

- EN 60529
  Degrees of protection by housing (IP code)
- EN 61010
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
- IEC/EN 61326
  "Emission in accordance with requirements for Class A".
  Electromagnetic compatibility (EMC requirements)
- NAMUR NE 21:
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NAMUR NE 43:
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53:
  Software of field devices and signal-processing devices with digital electronics.
- ANSI/ISA-S82.01
  Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment - General Requirements Pollution degree 2, Installation Category II.
- CAN/CSA-C22.2 No. 1010.1-92
  Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II

FOUNDATION Fieldbus certification

The flow device has successfully passed all the test procedures carried out and is certified and registered by the Fieldbus Foundation. The device thus meets all the requirements of the following specifications:

- Certified to FOUNDATION Fieldbus Specification
- The device meets all the specifications of the FOUNDATION Fieldbus H1.
- Interoperability Test Kit (ITK), revision status 5.01 (device certification number: on request)
- The device can also be operated with certified devices of other manufacturers
- Physical Layer Conformance Test of the Fieldbus Foundation

MODBUS RS485 certification

The measuring device meets all the requirements of the MODBUS/TCP conformity test and has the "MODBUS/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out and is certified by the "MODBUS/TCP Conformance Test Laboratory" of the University of Michigan.

PROFIBUS DP/PA certification

The flow device has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organisation). The device thus meets all the requirements of the following specifications:

- Certified to PROFIBUS PA, profile version 3.0 (device certification number: on request)
- The device can also be operated with certified devices of other manufacturers (interoperability)

Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Your Endress+Hauser service organization can provide detailed information on the order codes in question.

Documentation

- Flow Measurement (FA005D/06)
- Operating Instructions Promag Promag 50 (BA046D/06 and BA049D/06)
- Operating Instructions Promag Promag 50 PROFIBUS PA (BA055D/06 and BA056D/06)
- Operating Instructions Promag Promag 53 (BA047D/06 and BA048D/06)
- Operating Instructions Promag Promag 53 FOUNDATION Fieldbus (BA051D/06 and BA052D/06)
- Operating Instructions Promag Promag 53 MODBUS RS485 (BA117D/06 and BA118D/06)
- Operating Instructions Promag Promag 53 PROFIBUS DP/PA (BA053D/06 and BA054D/06)
- Supplementary documentation on Ex-ratings: ATEX, IECEx, FM, CSA, NEPSI

Registered trademarks

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

PROFIBUS®
Registered trademark of the PROFIBUS Nutzerorganisation e.V., Karlsruhe, D

FOUNDATION™ Fieldbus
Registered trademark of the Fieldbus Foundation, Austin, USA

MODBUS®
Registered trademark of the MODBUS Organisation

HistoROM™, S-DAT®, T-DAT™, F-CHIP®, FieldCare®, Fieldcheck®, FieldXpert™, Applicator®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

Order Codes

NOTE: Endress+Hauser reserves the right to change or modify product, specifications, and ordering information at any time without notice.
Please consult Endress+Hauser or your local representative for the most recent information.

Please note that the Promag 50W/53W is also available with:
Hard rubber and Polyurethane liners; ACS, KTW/W270 and WRAS B59620 approvals
PED Cat. II / III material certificates
ATEX and NEPSI hazardous area approvals
DIN2501 and JIS B2220 process connections

Consult factory for information.

Promag 50W, 1" to 24"

Promag 50W [ ][ ] - [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]
010 020 030 040 050 060 070 080 090 100 110 120

Nominal Diameter
- 25 1"
- 40 1-1/2"
- 50 2"
- 80 3"
- 1H 4"
- 1F 6"
- 2H 8"
- 2F 10"
- 3H 12"
- 3F 14"
- 4H 16"
- 4F 18"
- 5H 20"
- 6H 24"

010 Liner
- D Hard rubber, NSF61 drinking water approval (not available for 1", 1-1/2" or 2" sensors)
- H Hard rubber (not available for 1", 1-1/2" or 2" sensors)
- P Polyurethane, NSF61 drinking water approval
- S Hard rubber HR (not available for 1", 1-1/2" or 2" sensors)
- U Polyurethane
- 9 Special version, to be specified

020 Process connection
- L Class 150 ANSI B16.5 CS steel A105 flanges
- M Class 300 ANSI B16.5 CS steel A105 flanges (not for 8" and larger)
- R Class 150 ANSI B16.5 316L SS flanges
- S Class 300 ANSI B16.5 316L SS flanges (not for 8" and larger)
- 9 Special version, to be specified

030 Electrodes / material
- 0 Measuring, reference and EPD electrodes / 316L SS
- 1 Measuring, reference and EPD electrodes / Alloy C22
- 2 Measuring, reference and EPD electrodes / tantalum
- 7 Measuring electrode, exchangeable / 316L SS (for hard rubber liner only, 14" and larger sensors, no EPD or reference electrodes, for safe areas only)
- G Measuring, reference and EPD electrodes, bullet nose / 316L SS
- H Measuring, reference and EPD electrodes, bullet nose / Alloy C-22
- 9 Special version, to be specified

040 Calibration
- A 3-point calibration, 0.5%
- B 3-point calibration, 0.2%
- D SCS/A2LA 3-point 0.5% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)
- E SCS/A2LA 3-point 0.2% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)
- 9 Special version, to be specified

050 Certificates
- 1 Standard, no certificate
- 2 3.1B material certificate for pipe and flanges
- 3 2.3 pressure test certificate (1.5 x PN, 3 minutes) for sensors up to 12" only
- 4 3.1B material and 2.3 pressure test certificate for sensors up to 12" only
- 5 CRN approval
- 8 CRN approval + material certificate + pressure test
- 9 Special version, to be specified

060 Approvals
- A For use in non-hazardous areas
- N FM explosion proof Class I, Div. 1 / CSA Class I, Div. 1 (only for aluminum field housing, compact version, not for 14" and larger sensors)
- R FM non-incendive Class I, Div. 2 / CSA Class I, Div. 2

070 Housing
- A NEMA 4X (IP 67) compact aluminum housing
- C NEMA 4X (IP 67) remote wall-mounted (only for approvals A or R)
- G NEMA 4X (IP 67) remote aluminum field housing for non-hazardous areas
- K NEMA 6P sensor, wall-mounted housing (only for approvals A or R)
- N NEMA 6P sensor, aluminum field housing, non-hazardous
- P NEMA 4X (IP 67) compact aluminum housing, HE (harsh environment), compact and remote sensor sizes up to 12" only *
- S NEMA 4X (IP 67) remote wall-mounted housing, HE (harsh environment), remote sensor sizes 14" to 78" (only for approvals A and R) *
- 1 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact, aluminum field housing (only for approvals A and R)
- 3 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact (only for approvals A and R)
- 5 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67) wall mount housing, for NEMA 6P sensor (only for approvals A and R)
- 9 Special version, to be specified

080 Cable for remote
- 0 Without cable
- 1 15 foot coil and signal cable
- 2 30 foot coil and signal cable
- 5 Coil and signal cable, specify length (maximum 650 ft depending on conductivity of process material)
- 7 Coil and signal cable, flexible conduit, specify length (maximum 650 ft depending on conductivity of process material)
- 9 Special version, to be specified

090 Cable entries
- B 1/2" NPT
- L 1/2" NPT fieldbus connector (only for approval A and R)
- 9 Special version, to be specified

100 Power supply / display
- 7 85 to 260 VAC, without display, remote configuration only (not for wall mount or SS housing)
- 8 20 to 55 VAC / 16 to 62 VDC, without display, remote configuration only (not for wall mount or SS housing)
- A 85 to 260 VAC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- B 20 to 55 VAC / 16 to 62 VDC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- X Sensor only (without transmitter, only available up to 8")
- 9 Special version, to be specified

110 Software
- A Standard software
- X Sensor only (up to 8" only)
- 9 Special version, to be specified

120 Outputs / Inputs
- A Current HART, SIL, frequency
- D Current HART, SIL, frequency, status output, status input
- H PROFIBUS-PA (approvals A and R only)
- J PROFIBUS-DP (approvals A and R only)
- S Current HART, SIL, frequency; active I.S. (not for approvals A and R)
- T Current HART, SIL, frequency; passive I.S. (not for approvals A and R)
- W Current HART, SIL
- X Sensor only
- 9 Special version, to be specified

* Harsh environment (HE) option is available for process conditions where cool process temperatures in tropical (high humidity) environments or process fluids which undergo large cyclical temperature variations which can cause high amounts of moisture that could condense onto the measurement tube.

Promag 50W, 28" to 78"

Promag 50W [ ] - [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
010 020 030 040 050 060 070 080 090 100 110 120

Nominal Diameter
- 7H 28"
- 7F 30", AWWA
- 8H 32"
- 9H 36"
- TO 40"
- VO 42", AWWA
- T2 48"
- V3 54", AWWA
- V5 60", AWWA
- V6 66", AWWA
- T8 72"
- V9 78", AWWA

010 Liner
- D Hard rubber, NSF61 drinking water approval
- H Hard rubber
- P Polyurethane, NSF61 drinking water approval (not available for 42" up to 78")
- S Hard rubber HR
- U Polyurethane (not available for 42" up to 78")
- 9 Special version, to be specified

020 Process connection
- P Class D AWWA carbon steel A105 flanges
- 9 Special version, to be specified

030 Electrodes / material
- 0 Measuring, reference and EPD electrodes / 316L SS
- 1 Measuring, reference and EPD electrodes / Alloy C22
- 2 Measuring, reference and EPD electrodes / tantalum
- 7 Measuring electrode, exchangeable / 316L SS (for hard rubber liner only, 14" and larger sensors, no EPD or reference electrodes, for safe areas only)
- G Measuring, reference and EPD electrodes, bullet nose / 316L SS
- H Measuring, reference and EPD electrodes, bullet nose / Alloy C-22
- 9 Special version, to be specified

040 Calibration
- A 3-point calibration, 0.5%
- B 3-point calibration, 0.2%
- D SCS/A2LA 3-point 0.5% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)
- E SCS/A2LA 3-point 0.2% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)
- 9 Special version, to be specified

050 Certificates
- 1 Standard, no certificate
- 2 3.1B material certificate for pipe and flanges
- 9 Special version, to be specified

060 Approvals
- A For use in non-hazardous areas
- R FM non-incendive Class I, Div. 2 / CSA Class I, Div. 2

070 Housing
- A NEMA 4X (IP 67) compact aluminum housing
- C NEMA 4X (IP 67) remote wall-mounted (only for approvals A or R)
- G NEMA 4X (IP 67) remote aluminum field housing for non-hazardous areas
- K NEMA 6P sensor, wall-mounted housing (only for approvals A or R)
- S NEMA 4X (IP 67) remote wall-mounted housing, HE (harsh environment), remote sensor sizes 14" to 78" (only for approvals A and R) *
- 1 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact, aluminum field housing (only for approvals A and R)
- 3 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact (only for approvals A and R)
- 5 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67) wall mount housing, for NEMA 6P sensor (only for approvals A and R)
- 9 Special version, to be specified

080 Cable for remote
- 0 Without cable
- 1 15 foot coil and signal cable
- 2 30 foot coil and signal cable
- 5 Coil and signal cable, specify length (maximum 650 ft depending on conductivity of process material)
- 7 Coil and signal cable, flexible conduit, specify length (maximum 650 ft depending on conductivity of process material)
- 9 Special version, to be specified

090 Cable entries
- B 1/2" NPT
- L 1/2" NPT fieldbus connector (only for approval A and R)
- 9 Special version, to be specified

100 Power supply / display
- 7 85 to 260 VAC, without display, remote configuration only (not for wall mount or SS housing)
- 8 20 to 55 VAC / 16 to 62 VDC, without display, remote configuration only (not for wall mount or SS housing)
- A 85 to 260 VAC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- B 20 to 55 VAC / 16 to 62 VDC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- X Sensor only (without transmitter, only available up to 8")
- 9 Special version, to be specified

110 Software
- A Standard software
- 9 Special version, to be specified

120 Outputs / Inputs
- A Current HART, SIL, frequency
- D Current HART, SIL, frequency, status output, status input
- H PROFIBUS-PA (approvals A and R only)
- J PROFIBUS-DP (approvals A and R only)
- S Current HART, SIL, frequency; active I.S. (not for approvals A and R)
- T Current HART, SIL, frequency; passive I.S. (not for approvals A and R)
- W Current HART, SIL
- X Sensor only
- 9 Special version, to be specified

* Harsh environment (HE) option is available for process conditions where cool process temperatures in tropical (high humidity) environments or process fluids which undergo large cyclical temperature variations which can cause high amounts of moisture that could condense onto the measurement tube.

Promag 53W, 1" to 24"

Promag 53W [ ] - [010] [020] [030] [040] [050] [060] [070] [080] [090] [100] [110] [120]

Nominal Diameter
- 25 1"
- 40 1-1/2"
- 50 2"
- 80 3"
- 1H 4"
- 1F 6"
- 2H 8"
- 2F 10"
- 3H 12"
- 3F 14"
- 4H 16"
- 4F 18"
- 5H 20"
- 6H 24"

010 Liner
- D Hard rubber, NFS61 drinking water approval (not available for 1", 1-1/2" or 2" sensors)
- H Hard rubber (not available for 1", 1-1/2" or 2" sensors)
- P Polyurethane, NSF61 drinking water approval
- S Hard rubber HR (not available for 1", 1-1/2" or 2" sensors)
- U Polyurethane
- 9 Special version, to be specified

020 Process connection
- L Class 150 ANSI B16.5 CS steel A105 flanges
- M Class 300 ANSI B16.5 CS steel A105 flanges (not for 8" and larger)
- R Class 150 ANSI B16.5 316L SS flanges
- S Class 300 ANSI B16.5 316L SS flanges (not for 8" and larger)
- 9 Special version, to be specified

030 Electrodes / material
- 0 Measuring, reference and EPD electrodes / 316L SS
- 1 Measuring, reference and EPD electrodes / Alloy C22
- 2 Measuring, reference and EPD electrodes / tantalum
- 7 Measuring electrode, exchangeable / 316L SS (for hard rubber liner only, 14" and larger sensors, no EPD or reference electrodes, for safe areas only)
- G Measuring, reference and EPD electrodes, bullet nose / 316L SS
- H Measuring, reference and EPD electrodes, bullet nose / Alloy C-22
- 9 Special version, to be specified

040 Calibration
- B 3-point calibration, 0.2%
- E SCS/A2LA 3-point, 0.2% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)
- 9 Special version, to be specified

050 Certificates
- 1 Standard, no certificate
- 2 3.1B material certificate for pipe and flanges
- 3 2.3 pressure test certificate (1.5 x PN, 3 minutes) for sensors up to 12" only
- 4 3.1B material and 2.3 pressure test certificate for sensors up to 12" only
- 5 CRN approval
- 8 CRN approval + material certificate + pressure test
- 9 Special version, to be specified

060 Approvals
- A For use in non-hazardous areas
- N FM explosion proof Class I, Div. 1 / CSA Class I, Div. 1 (only for aluminum field housing, compact version, not for 14" and larger sensors)
- R FM non-incendive Class I, Div. 2 / CSA Class I, Div. 2

070 Housing
- A NEMA 4X (IP 67) compact aluminum housing
- C NEMA 4X (IP 67) remote wall-mounted (only for approvals A or R)
- G NEMA 4X (IP 67) remote aluminum field housing for non-hazardous areas
- K NEMA 6P sensor, wall-mounted housing (only for approvals A or R)
- N NEMA 6P sensor, aluminum field housing, non-hazardous
- P NEMA 4X (IP 67) compact aluminum housing, HE (harsh environment), compact and remote sensor sizes up to 12" only *
- S NEMA 4X (IP 67) remote wall-mounted housing, HE (harsh environment), remote sensor sizes 14" to 78" (only for approvals A and R) *
- 1 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact, aluminum field housing (only for approvals A and R)
- 3 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact (only for approvals A and R)
- 5 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67) wall mount housing, for NEMA 6P sensor (only for approvals A and R)
- 9 Special version, to be specified

080 Cable for remote
- 0 Without cable
- 1 15 foot coil and signal cable
- 2 30 foot coil and signal cable
- 5 Coil and signal cable, specify length (maximum 650 ft depending on conductivity of process material)
- 7 Coil and signal cable, flexible conduit, specify length (maximum 650 ft depending on conductivity of process material)
- 9 Special version, to be specified

090 Cable entries
- B 1/2" NPT
- L 1/2" NPT Fieldbus connector (only for approval A and R)
- 9 Special version, to be specified

100 Power supply / display
- 7 85 to 260 VAC, without display, remote configuration only (not for wall mount or SS housing)
- 8 20 to 55 VAC / 16 to 62 VDC, without display, remote configuration only (not for wall mount or SS housing)
- A 85 to 260 VAC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- B 20 to 55 VAC / 16 to 62 VDC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- X Sensor only (without transmitter, only available up to 8")
- 9 Special version, to be specified

110 Software
- A Standard software
- C ECC electrode cleaning circuit (only for approvals A and R)
- 9 Special version, to be specified

120 Outputs / Inputs
Fixed communication boards
- A Current HART, SIL, frequency
- B Current HART, SIL, frequency, 2 relays
- F PROFIBUS-PA, IS
- G Foundation Fieldbus, IS
- H PROFIBUS-PA
- J PROFIBUS-DP
- K Foundation Fieldbus
- Q Modbus RS485, status input
- S Current HART, SIL, frequency; active I.S
- T Current HART, SIL, frequency; passive I.S

Flexible communication boards
- C Current HART, SIL, frequency, 2 relays, flexible module
- D Current HART, SIL, frequency, relay, and status input, flexible module
- L Current HART, SIL, 2 relays and status input/output
- M Current HART, SIL, 2 frequency output, status input
- N Modbus RS 485, current and frequency output, status input
- P PROFIBUS-DP, current and frequency output, status input
- V PROFIBUS-DP, two relay outputs, status input
- 2 Current HART, SIL, relay, current, frequency ouputs
- 4 Current HART, SIL, relay, frequency outputs, current input
- 7 Modbus RS485, two relay outputs, status input
- X Sensor only
- 9 Special version, to be specified

* Harsh environment (HE) option is available for process conditions where cool process temperatures in tropical (high humidity) environments or process fluids which undergo large cyclical temperature variations which can cause high amounts of moisture that could condense onto the measurement tube.

Promag 53W, 28" to 78"

Promag 53W [ ] - [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
010 020 030 040 050 060 070 080 090 100 110 120

Nominal Diameter
- 7H 28"
- 7F 30", AWWA
- 8H 32"
- 9H 36"
- TO 40"
- VO 42", AWWA
- T2 48"
- V3 54", AWWA
- V5 60", AWWA
- V6 66", AWWA
- T8 72"
- V9 78", AWWA

010 Liner
- D Hard rubber, NSF61 drinking water approval
- H Hard rubber
- P Polyurethane, NSF61 drinking water approval (not available for 42" to 78" sensors)
- S Hard rubber HR
- U Polyurethane (not available for 42" to 78" sensors)
- 9 Special version, to be specified

020 Process connection
- P Class D AWWA carbon steel A105 flanges
- 9 Special version, to be specified

030 Electrodes / material
- 0 Measuring, reference and EPD electrodes / 316L SS
- 1 Measuring, reference and EPD electrodes / Alloy C22
- 2 Measuring, reference and EPD electrodes / tantalum
- 7 Measuring electrode, exchangeable / 316L SS (for hard rubber liner only, 14" and larger sensors, no EPD or reference electrodes, for safe areas only)
- G Measuring, reference and EPD electrodes, bullet nose / 316L SS
- H Measuring, reference and EPD electrodes, bullet nose / Alloy C-22
- 9 Special version, to be specified

040 Calibration
- B 3-point calibration, 0.2%
- E SCS/A2LA 3-point 0.2% calibration (ISO/IEC 17025) with certificate traceable according to ISO 9000 (specify range)
- 9 Special version, to be specified

050 Certificates
- 1 Standard, no certificate
- 2 3.1B material certificate for pipe and flanges
- 9 Special version, to be specified

060 Approvals
- A For use in non-hazardous areas
- R FM non-incendive Class I, Div. 2 / CSA Class I, Div. 2

070 Housing
- A NEMA 4X (IP 67) compact aluminum housing
- C NEMA 4X (IP 67) remote wall-mounted (only for approvals A or R)
- G NEMA 4X (IP 67) remote aluminum field housing for non-hazardous areas
- K NEMA 6P sensor, wall-mounted housing (only for approvals A or R)
- S NEMA 4X (IP 67) remote wall-mounted housing, HE (harsh environment), remote sensor sizes 14" to 78" (only for approvals A and R) *
- 1 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact, aluminum field housing (only for approvals A and R)
- 3 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67), compact (only for approvals A and R)
- 5 -40°F (-40°C) ambient temperature, NEMA 4X (IP 67) wall mount housing, for NEMA 6P sensor (only for approvals A and R)
- 9 Special version, to be specified

* Harsh environment (HE) option is available for process conditions where cool process temperatures in tropical (high humidity) environments or process fluids which undergo large cyclical temperature variations which can cause high amounts of moisture that could condense onto the measurement tube.

080 Cable for remote
- 0 Without cable
- 1 15 foot coil and signal cable
- 2 30 foot coil and signal cable
- 5 Coil and signal cable, specify length (maximum 650 ft depending on conductivity of process material)
- 7 Coil and signal cable, flexible conduit, specify length (maximum 650 ft depending on conductivity of process material)
- 9 Special version, to be specified

090 Cable entries
- B 1/2" NPT
- L 1/2" NPT Fieldbus connector (only for approval A and R)
- 9 Special version, to be specified

100 Power supply / display
- 7 85 to 260 VAC, without display, remote configuration only (not for wall mount or SS housing)
- 8 20 to 55 VAC / 16 to 62 VDC, without display, remote configuration only (not for wall mount or SS housing)
- A 85 to 260 VAC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- B 20 to 55 VAC / 16 to 62 VDC, with display, push button operation (language: EN, ES, FR, IT, NL, PT, DE)
- 9 Special version, to be specified

110 Software
- A Standard software
- C ECC electrode cleaning circuit (only for approvals A and R)
- 9 Special version, to be specified

120 Outputs / Inputs
Fixed communication boards
- A Current HART, SIL, frequency
- B Current HART, SIL, frequency, 2 relays
- F PROFIBUS-PA, IS
- G Foundation Fieldbus, IS
- H PROFIBUS-PA
- J PROFIBUS-DP
- K Foundation Fieldbus
- Q Modbus RS485, status input
- S Current HART, SIL, frequency; active I.S
- T Current HART, SIL, frequency; passive I.S

Flexible communication boards
- C Current HART, SIL, frequency, 2 relays, flexible module
- D Current HART, SIL, frequency, relay, and status input, flexible module
- L Current HART, SIL, 2 relays and status input/output
- M Current HART, SIL, 2 frequency output, status input
- N Modbus RS 485, current and frequency output, status input
- P PROFIBUS-DP, current and frequency output, status input
- V PROFIBUS-DP, two relay outputs, status input
- 2 Current HART, SIL, relay, current, frequency outputs
- 4 Current HART, SIL, relay, frequency outputs, current input
- 7 Modbus RS485, two relay outputs, status input
- X Sensor only
- 9 Special version, to be specified

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People for Process Automation

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 6 **INSTRUMENTS**

B. PRESSURE DIFFERENTIAL SWITCHES

MARK	QTY	SIZE	SERVICE
PDIS-102A	1		ADSORBER A – HIGH DIFF PRESSURE

□□T□□ME□T □□T□ □□EET

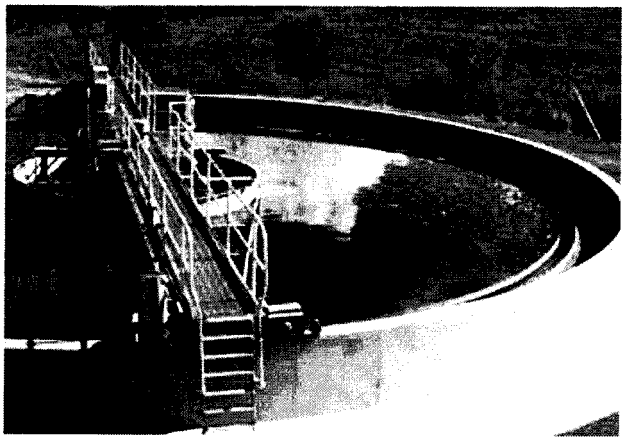
SEVERN TRENT SERVICES	FFE E T□ □E □□ E □□T ME T				Sheet : 1 OF 1
	No.	By	Date	Revision	Spec: 636-1
					Contract: 22643
Park West One, Suite 600	A	JWS	10/02/14		P. O. #
Pittsburgh, PA 15275					By: JWS
(412) 788-8300					Chk:

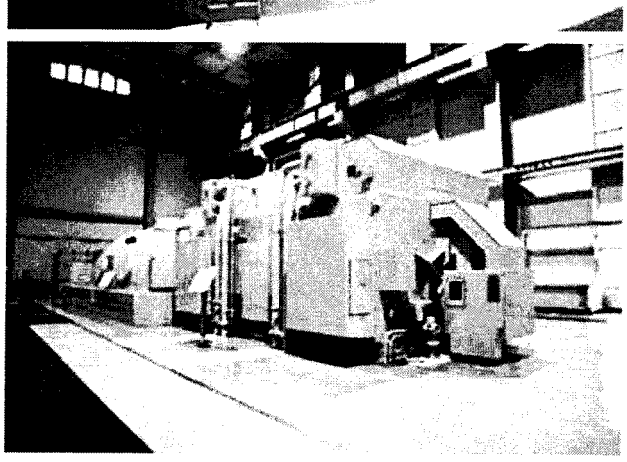
	1	TAG PDSH-102A	SERVICE: ADSORBER EAS-A HIGH DIFFERENTIAL PRESSURE
	2	Function	HIGH DIFF. PRESSURE SWITCH
	3	Case	CAST ALUMINUM
	4	Mounting	MFG. STD.
	5	Enclosure Class	NEMA 4X
			For Instrinsically Safe System ☐ Other:
	6	Power Supply	N/A
	7	Chart	N/A Range: No.:
	8	Chart Drive	N/A
	9	Scale	Type: Range:
X M T	10	Transmitter Output	NONE For Receiver Instrument, See Sheet :
C O N T R O L L E R	11	Control Modes	NONE P = Proportional (Gain), I = Integral (Auto Reset) D = Derivative(Rate), Sub: s= Slow, f = Fast
	12	Action	On Meas. Increase Output
	13	Auto - Manual Switch	N/A
	14	Setpoint Adjustment	N/A
	15	Manual regulator	N/A
	16	Output	N/A
	17		
	18		
U N I T	19	Service	DIFF.PRESSURE
	20	Element Type	DIFF BUNA-N DIAPHRAGM
	21	Material	Body: ALUMINUM Element:
	22	Rating	Overrange: MFG. STD. Body Rating: 225 PSID
	23	Differential Range	Range: 3-30 PSI Set At 10 PSI
	24		(SCALE) . (SWITCH)
	25	Process Data	Fluid: WATER
			Maximum Temp. 95 F Maximum Pressue: 250 PSI
	26	Process Connection	IMPULSE LINES TAPS (1/4" NPT)
	27	Alarm Switches	Quantity: 1 Form: SPDT Rating: 15A
	28	Function	Contacts To On Increase In Meas
	29	Options	Pressure Element ☐ Range: Material
			Temperature Element ☐ Range: Material
	30		
	31		
	32		Valve Manifold: N/A
	33		
	34		DISPLAY REQD. DIFFERENTIAL PRESSURE INDICATION
	35	Manufacturer & Model No.	UNITED ELECTRIC J400K-S147B-M210-M900

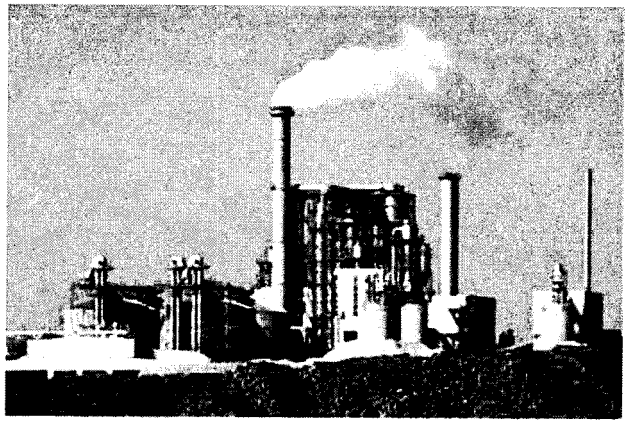
Notes: VENDOR SHALL SUPPLY S.S TAG BEARING INSTRUMENT TAG NO.
PROVIDE INTERNAL ADJ. PROVIDE DISPLAY

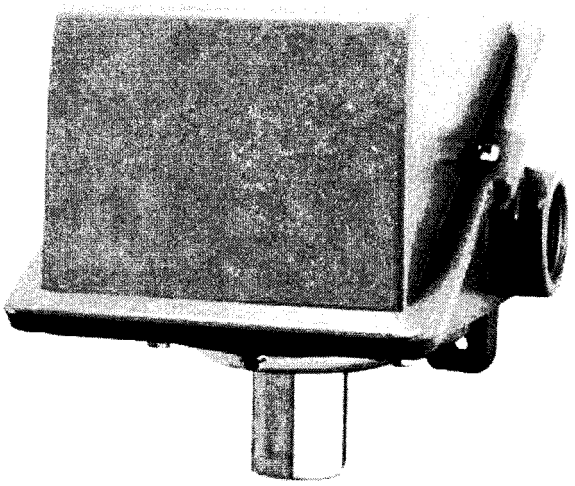
400 Series

PRESSURE, VACUUM, DIFFERENTIAL PRESSURE AND TEMPERATURE SWITCHES









FEATURES

- 1, 2 & 3 switch outputs
- Epoxy-coated enclosure designed to meet enclosure type 4X
- Wide variety of pressure sensors and materials
- Setting via reference dial or hex screw adjustment
- FM approved
- Adjustable Ranges:

  "WC ranges: 300 "wc vacuum to 250 "wc pressure (-746,7 to 622,3 mbar)

  Pressure: 30 "Hg Vac to 6000 psi (-1,0 to 413,7 bar)

  Differential pressure: 1"wcd to 200 psid (2.5 mbar to 13,8 bar)

  Temperature: -180 to 650 °F (-117.8 to 343.3 °C)

ISO 9001 CERTIFIED COMPANY

UE UNITED ELECTRIC CONTROLS

400 Series

OVERVIEW

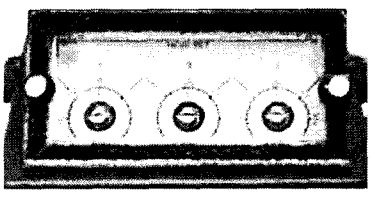
The 400 Series is a versatile family of vacuum, pressure, differential pressure and temperature switches for applications that require single or multiple switching capabilities. Dual and triple switch versions provide multi-output for alarm and shutdown, pre-alarm and alarm, high/low limit or level staging functions.

A wide variety of microswitch and process connection options, along with a weather-tight enclosure, make the 400 Series an ideal choice for most ordinary location applications. Its worldwide use is assured with approvals and certifications to agency standards.

Widely used throughout the process industries, the 400 Series provides threshold protection and control for many critical functions. Typical installations are found in industrial gas production, energy generation including pumps, turbines and compressors, pulp and paper, and water and wastewater treatment.

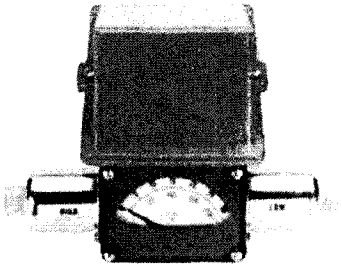
FEATURES

- UL listed and cUL certified. FM approved.
- CE compliant to low voltage directive and pressure equipment directive.
- Optional ATEX or GOST intrinsic safety compliance.
- One, two or three switch outputs may be separated up to 100% of range.
- Wide variety of available options and pressure sensor modules.
- Most models available for immediate delivery.

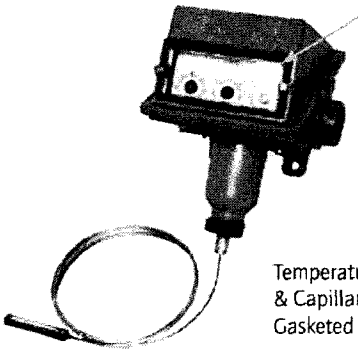


Reference scale, for types B, E & H with option M321

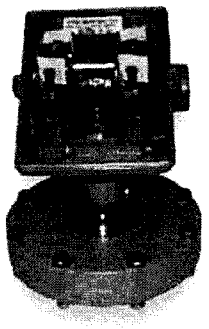
Enlarged View



Differential Pressure Model with M210 Option - Dial Indication



Temperature Model with Remote Bulb & Capillary and M321 option - Gasketed Lexan® Window



Dual Switch, Low Water Column Differential Pressure Model

Lexan® is a registered trademark of Sabic Innovative Plastics

SPECIFICATIONS

STORAGE TEMPERATURE	-65 to 160°F (-54 to 71°C)
AMBIENT TEMPERATURE LIMITS	-40 to 160°F (-40 to 71°C); set point typically shifts less than 1% of range for a 50°F (28°C) ambient temperature change
SET POINT REPEATABILITY	Temperature models: ± 2% of full scale range Pressure: models 126-376, 520-535, 540-547, 570-572, S126B-S164B: ± 2% of full scale range; models 440-457, 550-559: ± 1% of full scale range; models 610-614: ± 3% of full scale range
SHOCK	Set point repeats after 15 G, 10 millisecond duration
VIBRATION	Set point repeats after 2.5 G, 5-500 Hz
ENCLOSURE	Die cast aluminum, epoxy powder coated, gasketed, captive cover screws
ENCLOSURE CLASSIFICATION	Designed to meet enclosure type 4X requirements
SWITCH OUTPUT	One, two or three SPDT switches, may be separated up to 100% of range except models 521-524, 531-534: 50%; models 520, 525, 530, 535, 570-572: 30%; switches may be wired "normally open" or "normally closed"
ELECTRICAL RATING	15 A 125/250/480 VAC resistive. Electrical switches have limited DC capabilities. Consult factory for additional information.
WEIGHT	Approx. 3 to 7.5 lbs.; varies with model
ELECTRICAL CONNECTION	One 3/4" NPT and two 7/8" diameter knockouts
PRESSURE CONNECTION	All models 1/4" NPT (female) except models S126B-S164B, 520-535: 1/2" NPT (female); models 540-547: 1/8" NPT (female)
TEMPERATURE ASSEMBLY	'E' types use the same assemblies as 'F' types, however, range spans are limited due to use of reference dials Bulb and capillary: 6 feet 304 stainless steel Immersion stem: models 120 &121: nickel-plated brass; optional 316L stainless steel available
FILL	Temperature Models: Model 1BS: solvent filled; models 2-8: non-toxic oil filled
TEMPERATURE DEADBAND	Type F typically 1% and type E, B & C typically 2% of range under laboratory conditions (70°F ambient circulating bath at rate of 1/2°F per minute change)
DIFFERENTIAL PRESSURE INDICATOR (OPTION M210)	Differential pressure indication available J400K, J402K models 147-S157B; accuracy approximately 1-1/2% mid 50% of range, 3% at ends; window is plexiglass and gasketed; indicator may be field adjusted for approximately ±1% accuracy at any set point within range

APPROVALS

UNITED STATES AND CANADA
Type 400 & 402
UL Listed, cUL Certified
Pressure: UL 508; CSA C22.2 No. 14, file # E42272
Temperature: UL 873; CSA C22.2 No. 24, file # E10667

Type 403
UL Recognized, cUL Recognized
Pressure: UL 508; CSA C22.2 No. 14, file # E42272
Temperature: UL 873; CSA C22.2 No. 24, file # E10667

All Types
FM Approved
Pressure: Class 3510
Temperature: Class 3545

EUROPE
ATEX Directive (94/9/EC)
II 1 G EEx ia IIC T6 **(OPTIONAL – code M405)**
Tamb = -50°C to +60°C
UL International DEMKO A/S (N.B.# 0539)
Certificate # DEMKO 03 ATEX 0335063
EN 50014, 50020 & 50284

Low Voltage Directive (LVD) (73/23/EC & 93/68/EEC)
Compliant to LVD
Products rated lower than 50 VAC and 75 VDC are outside of the scope of the LVD

Pressure Equipment Directive (PED) (97/23/EC)
Compliant to PED
Products rated below 7.5 PSI are outside the scope of PED

RUSSIA
Gosgortechnadzor Permit **(OPTIONAL – code M406)**
0ExiaIICT6
Tamb = -50°C to +60°C
NANIO CCVE Certification Center
Certificate # ROSS US.GB05.Bo2933
GOST R 51330.0, 51330.1, 51330.10 & 51330.14

PRESSURE MODEL CHART

Type H400, single switch output with internal adjustment via reference dial
Type H402, dual switch output with internal adjustment via reference dial
Type H403, triple switch output with internal adjustment via reference dial

Model	Adjustable Set Point Range Low end of range on fall; High end of range on rise		Deadband Deadband doubles for 2 and 3 switch types		Proof Pressure**		Scale Division
	psi (unless noted)	bar (unless noted)	psi (unless notec)	bar (unless noted)	psi	bar	psi (unless noted)
Teflon® diaphragm and Viton® O-Ring with 316L stainless steel 1/4" NPT (female) pressure connection and cap							
550††	30 "Hg Vac to 0	-1 to 0	0.1 to 0.6 "Hg	3,4 to 20,3 mbar	225	15,5	2 "Hg
552††	30 "Hg Vac to 20 psi	-1 to 1,4	0.2 to 1 "Hg	6,8 to 33,9 mbar	225	15,5	2 "Hg & 2 psi
553††	0 to 20	0 to 1,4	0.05 to 0.3	3,4 to 20,7 mbar	225	15,5	1
554††	0 to 30	0 to 2,1	0.1 to 0.4	6,9 to 27,6 mbar	225	15,5	1
555††	0 to 100	0 to 6,9	0.25 to 0.75	17,2 to 51,7 mbar	225	15,5	5

****Proof pressure:** The maximum pressure to which a pressure sensor may be subjected, which causes no permanent damage. The unit may require calibration (e.g. start-up, testing).
† Model not available on types H402 and H403
†† Model not available on type H403

DIFFERENTIAL PRESSURE MODEL CHART

Type J400K, single switch output with internal hex screw adjustment
Type J402K, dual switch output with internal hex screw adjustment

Model	Adjustable Set Point Range Low end of range on fall: High end of range on rise		Deadband Deadband doubles for 2 and 3 switch types		Working Pressure***		Proof Pressure**	
	psid (unless noted)	bar (unless noted)	psi (unless noted)	mbar	psi	bar	psi	bar
Welded 316L stainless steel bellows and 1/2" NPT (female) pressure connections								
S147B	3 to 30	0,2 to 2,1	0.5 to 2	34,5 to 137,9	30 "Hg Vac to 100	-1 to 6,9	300	20,7
S157B	10 to 100	0,7 to 6,9	0.5 to 3	34,5 to 206,8	30 "Hg Vac to 180	-1 to 12,4	300	20,7
Brass bellows with nickel-plated brass 1/4" NPT (female) pressure connections								
147	3 to 30	0,2 to 2,1	0.5 to 2	34,5 to 137,9	30 "Hg Vac to 100	-1 to 6,9	180	12,4
157	10 to 100	0,7 to 6,9	0.5 to 3	34,5 to 206,8	30 "Hg Vac to 150	-1 to 10,3	180	12,4
Buna-N diaphragm and O-Ring with aluminum 1/4" NPT (female) pressure connections								
455	5 to 80 "wcd	12,4 to 199,1 mbar	1 to 4 "wc	2,5 to 10	30 "Hg Vac to 225	-1 to 15,5	225	15,5
456	2 to 20	0,1 to 1,4	0.1 to 0.3	6,9 to 20,7	30 "Hg Vac to 225	-1 to 15,5	225	15,5
457	3 to 30	0,2 to 2,1	0.1 to 0.4	6,9 to 27,6	30 "Hg Vac to 225	-1 to 15,5	225	15,5

***Working Pressure Range: The pressure range within which two opposing sensors can be safely operated and still maintain set point adjustability.

HOW TO ORDER

BUILDING A PART NUMBER

Select a **Type**

Refer to the "Type" section below.

Determine type number based on switch output, enclosure, adjustment and reference.

Fill in the type portion of your part number with the corresponding number.

Select a **Model**

Refer to the "Model Charts".

Determine model based on adjustable range, deadband and proof pressure.

Fill in the model portion of your part number with the corresponding number.

Select an **Option**

Refer to the "Options" section.

Determine option number based on switch output, optional materials or other product enhancements.

Fill in the option portion of your part number with the corresponding number.

Leave "option" portion blank if no options are needed.

FOR MULTIPLE OPTIONS: Call United Electric Controls.

TYPE	DESCRIPTION
PRESSURE	Type J400 - One SPDT output; internal hex screw adjustment
	Type J402 - Two SPDT outputs; internal hex screw adjustment
	Type J403 - Three SPDT outputs; internal hex screw adjustment
	Type H400 - One SPDT output; internal adjustment with reference dial
	Type H402 - Two SPDT outputs; internal adjustment with reference dial
	Type H403 - Three SPDT outputs; internal adjustment with reference dial
DIFFERENTIAL PRESSURE	Type J400K - One SPDT output; internal hex screw adjustment
	Type J402K - Two SPDT outputs; internal hex screw adjustment
	Type H400K - One SPDT output; internal adjustment with reference dial
	Type H402K - Two SPDT outputs; internal adjustment with reference dial
TEMPERATURE	Type B400 - Immersion stem; one SPDT output; internal adjustment with reference dial
	Type B402 - Immersion stem; two SPDT outputs; internal adjustment with reference dial
	Type B403 - Immersion stem; three SPDT outputs; internal adjustment with reference dial
	Type C400 - Immersion stem; one SPDT output; internal hex screw adjustment
	Type C402 - Immersion stem; two SPDT outputs; internal hex screw adjustment
	Type C403 - Immersion stem; three SPDT outputs; internal hex screw adjustment
	Type E400 - Bulb and capillary; one SPDT output; internal adjustment with reference dial
	Type E402 - Bulb and capillary; two SPDT outputs; internal adjustment with reference dial
	Type E403 - Bulb and capillary; three SPDT outputs; internal adjustment with reference dial
	Type F400 - Bulb and capillary; one SPDT output; internal hex screw adjustment
	Type F402 - Bulb and capillary; two SPDT outputs; internal hex screw adjustment
	Type F403 - Bulb and capillary; three SPDT outputs; internal hex screw adjustment

HOW TO ORDER OPTIONS

SWITCH OPTIONS*	DESCRIPTION
0140	Gold contacts, 1 A 125 VAC resistive. NOT AVAILABLE MODELS 440-443
0500	Close deadband, 5 A 125/250 VAC resistive. NOT AVAILABLE MODELS 440-443, 520-535 & 540-547
1010	DPDT switch, 10 A 125/250 VAC resistive; deadband and minimum set point will increase. NOT AVAILABLE TEMPERATURE VERSIONS, TYPE J403, TYPE H403 AND MODELS 440-449, 520-535, 540-547, 570-572
1070	10 A 125 VDC resistive; deadband and minimum set point will increase. NOT AVAILABLE TYPES B, E AND MODELS 440-449, 520-535, 540-547, 570-572
1520	Adjustable deadband, 15 A 125/250/480 VAC resistive. Adjustment wheel changes rise setting only if adjustment on fall setting is required, use primary adjustment (see product Installation & Maintenance instructions for additional information or consult UE). NOTE: NOT AVAILABLE ON MIDDLE SWITCH FOR TYPE J403, C403 AND F403. NOT AVAILABLE TYPES B, E, H, OR MODELS 440-443, 520-535, 540-547, 570-572, 610-614
1530	External manual reset, 15 A 125/250/480 VAC resistive, latches on rise only. NOT AVAILABLE TRIPLE SWITCH VERSIONS, OR MODELS 440-443, 520-535, 570-572
1535	High ambient, 15 A 125/250/480 VAC resistive; temperatures up to 250°F/145°C. NOT AVAILABLE MODELS 440-443, 520-535
1537	Vapor-sealed 15 A 125/250 VAC resistive. NOT AVAILABLE MODELS 440-443, 520-535
1539	Fungus resistant case, 15 A 125/250 VAC resistive. NOT AVAILABLE MODELS 440-443, 520-535
2000	20 A 125/250/480 VAC resistive. NOT AVAILABLE MODELS 440-443, 520-535, 540-547, 570-572
OTHER OPTIONS	
M020	Single red status light, 115 VAC only. Specify whether light goes on or off with increasing or decreasing pressure or temperature. NOT AVAILABLE J400K, H400K, J402K, H402K OR MODELS 440-443, 449
M201	Factory set one switch; specify set point on increasing or decreasing pressure, differential pressure or temperature. NOT AVAILABLE DUAL OR TRIPLE SWITCH VERSIONS
M202	Factory set two switches; specify set points on increasing or decreasing pressure, differential pressure or temperature. NOT AVAILABLE SINGLE OR TRIPLE SWITCH VERSIONS
M203	Factory set three switches; note: the third or middle switch must always be set to highest pressure or temperature when switches are set apart; specify set points on increasing or decreasing pressure, differential pressure or temperature. NOT AVAILABLE SINGLE OR DUAL SWITCH VERSIONS
M210	Differential pressure indication. AVAILABLE J400K AND J402K, MODELS 147, S147B, 157 & S157B
M277	Range indicated on nameplate in kPa or MPa, factory selected. NOT AVAILABLE TEMPERATURE VERSIONS
M278	Range indicated on nameplate in Kg/cm^2. NOT AVAILABLE TEMPERATURE VERSIONS
M321	Gasketed Lexan® window. NOT AVAILABLE ON J, C, F TYPES
M405	Intrinsic safety compliance for European Union per ATEX standards
M406	Intrinsic safety compliance for Russia per Gosgortechnadzor standards
M444	Paper ID tag
M446	Stainless steel ID tag & wire attachment
M449	Surface mounting hardware kit that is required for models 520-535 when surface mounting. Use option code only at time of ordering product, otherwise use surface and pipe mounting kit part number 6361-704 as a separate order or for other models.
M504	316L Stainless steel immersion temperature stem. AVAILABLE TEMPERATURE MODELS 120, 121 ONLY
M540	Viton® construction (deadband and low end range may increase slightly); wetted parts include Viton® with standard connection material. AVAILABLE MODELS 448-454 and 540-547. TYPES J400K & J402K MODELS 455-457 include Viton® sealing diaphragms and O-rings with Teflon® main diaphragm. TYPES H400K & H402K MODELS 456-457 include Viton® sealing diaphragms and O-rings with Teflon® main diaphragm. MODELS 610-614 (Viton® O-ring only).
M550	Oxygen service cleaning; alcohol cleaning to remove residue from the process connection. NOT AVAILABLE ON MODELS 440-443 OR H400K-455 AND H402K-455.
M900	Watertight conduit fitting; converts 7/8" hole to 1/2" NPT fitting. Required for product to meet NEMA 4X if using knockout holes for wiring
M913	1/4" NPT (female) stainless steel pressure connection. AVAILABLE MODELS S126B-S146B, S156B, S164B ONLY
M914	1/2" NPT (female) stainless steel pressure connection. AVAILABLE MODELS 358-376
M921	1/4" NPT (female) brass pressure connection. AVAILABLE MODELS 610-614, TYPE J402 ONLY
6361-704	Surface and pipe mount hardware kit for all models. Required for surface mounting needs 520-535, if not previously ordered with option M449.
SD6286-51	Watertight conduit fitting; connects 7/8" hole to 1/2" NPT (female) fitting, if not previously ordered with option M900

**All switches have limited DC capabilities. Consult factory for details.*

DIMENSIONAL DRAWINGS

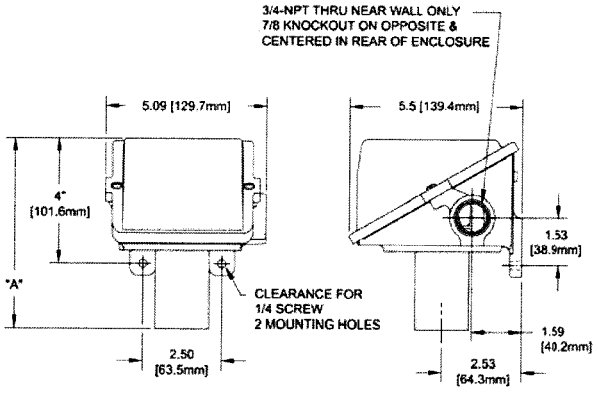
Dimensional drawings for all models may be found at www.ueonline.com

Internal Hex Screw Set Point Adjustment

Types J400, J402, J403, J400K, J402K, C400, C402, C403, F400, F402, F403

Set Point Adjustment via Reference Dial

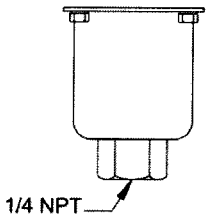
Types H400, H402, H403, H400K, H402K, B400, B402, B403, E400, E402, E403



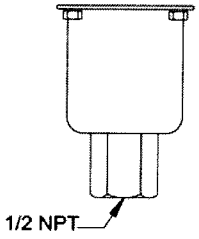
	Dimension A		
Models	**Inches**	**mm**	**NPT**
PRESSURE			
126-164	5.91	150.0	1/4
S126B-S164B	6.31	160.3	1/2
270-376	5.50	139.7	1/4
440-443, 449			
451, 453, 454	4.28	108.7	1/4
448, 450, 452	5.03	127.8	1/4
520-525	8.25	209.6	1/2
530-535	8.13	206.5	1/2
551, 553-555	4.56	115.8	1/4
550, 552	5.03	127.8	1/4
570-572	4.56	115.8	1/4
610-614	6.31	160.3	1/4
DIFFERENTIAL PRESSURE			
147-157	6.13	155.7	1/4
S147B-S157B	6.13	155.7	1/2
455-559	7.00	177.8	1/4
540-543	7.97	202.4	1/8
544-547	8.03	204.0	1/8
TEMPERATURE			
120, 121	7.38	187.3	Immersion Stem
1BS-8BS	6.72	170.7	Bulb & Capillary

Pressure Sensors *All dimensions stated in inches (millimeters)*

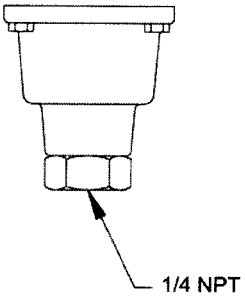
Models 126-164



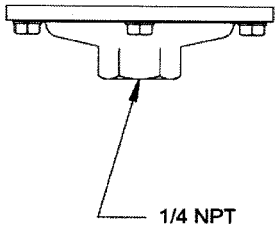
Models S126B-S164B



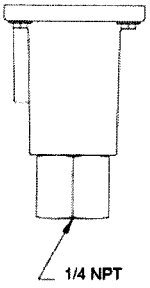
Models 270-376



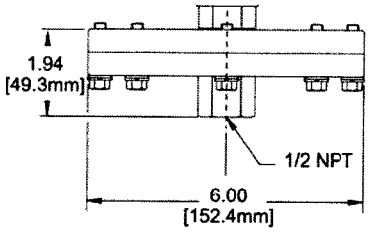
Models 440-454, 550-555, 570-572



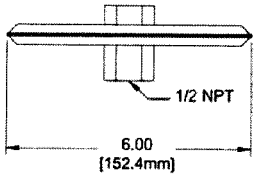
Models 610-614



Models 520-525



Models 530-535

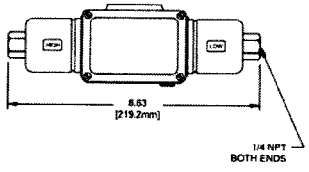


DIMENSIONAL DRAWINGS

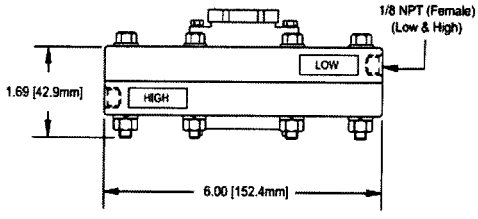
Dimensional drawings for all models may be found at www.ueonline.com

Differential Pressure Sensors

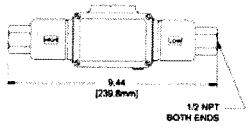
Models 147-157



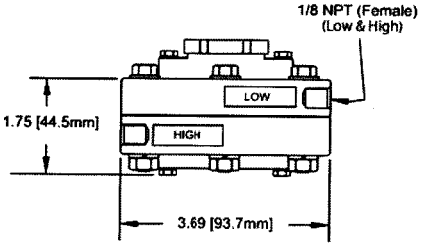
Models 540-543



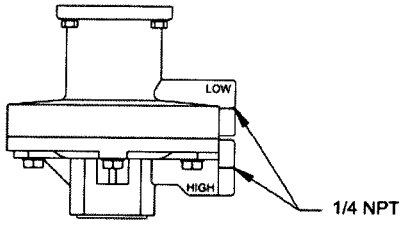
Models S147B-S157B



Models 544-547

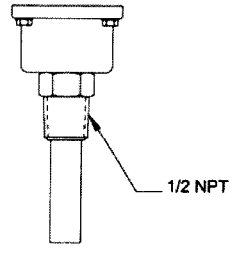


Models 455-457, 559



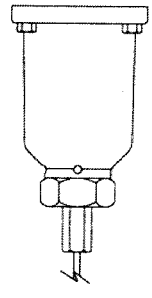
Temperature Sensors

Models 120-121



Local mount temperature version

Models 1BS-8BS



Remote mount temperature version

RECOMMENDED PRACTICES AND WARNINGS

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE pressure and temperature units. Before installing a unit, the Installation and Maintenance instructions provided with unit must be read and understood.

- To avoid damaging unit, proof pressure and maximum temperature limits stated in literature and on nameplates must never be exceeded, even by surges in the system. Operation of the unit up to maximum pressure or temperature is acceptable on a limited basis (e.g., start-up, testing) but continuous operation must be restricted to the designated adjustable range. Excessive cycling at maximum pressure or temperature limits could reduce sensor life.
- A back-up unit is necessary for applications where damage to a primary unit could endanger life, limb or property. A high or low limit switch is necessary for applications where a dangerous runaway condition could result.
- The adjustable range must be selected so that incorrect, inadvertent or malicious setting at any range point cannot result in an unsafe system condition.
- Install unit where shock, vibration and ambient temperature fluctuations will not damage unit or affect operation. When applicable, orient unit so that moisture does not enter the enclosure via the electrical connection. When appropriate, this entry point should be sealed to prevent moisture entry.
- Unit must not be altered or modified after shipment. Consult UE if modification is necessary.
- Monitor operation to observe warning signs of possible damage to unit, such as drift in set point or faulty display. Check unit immediately.
- Preventative maintenance and periodic testing is necessary for critical applications where damage could endanger property or personnel.
- Electrical ratings stated in literature and on nameplate must not be exceeded. Overload on a switch can cause damage, even on the first cycle. Wire unit according to local and national electrical codes, using wire size recommended in installation sheet.
- Do not mount unit in ambient temp. exceeding published limits.

LIMITED WARRANTY

Seller warrants that the product hereby purchased is, upon delivery, free from defects in material and workmanship and that any such product which is found to be defective in such workmanship or material will be repaired or replaced by Seller (Ex-works, Factory, Watertown, Massachusetts. INCOTERMS); provided, however, that this warranty applies only to equipment found to be so defective within a period of 24 months from the date of manufacture by the Seller. Seller shall not be obligated under this warranty for alleged defects which examination discloses are due to tampering, misuse, neglect, improper storage, and in any case where products are disassembled by anyone other than authorized Seller's representatives. EXCEPT FOR THE LIMITED WARRANTY OF REPAIR AND REPLACEMENT STATED ABOVE, SELLER DISCLAIMS ALL WARRANTIES WHATSOEVER WITH RESPECT TO THE PRODUCT, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

LIMITATION OF SELLER'S LIABILITY

SELLER'S LIABILITY TO BUYER FOR ANY LOSS OR CLAIM, INCLUDING LIABILITY INCURRED IN CONNECTION WITH (I) BREACH OF ANY WARRANTY WHATSOEVER, EXPRESSED OR IMPLIED, (II) A BREACH OF CONTRACT, (III) A NEGLIGENT ACT OR ACTS (OR NEGLIGENT FAILURE TO ACT) COMMITTED BY SELLER, OR (IV) AN ACT FOR WHICH STRICT LIABILITY WILL BE INPUTTED TO SELLER, IS LIMITED TO THE "LIMITED WARRANTY" OF REPAIR AND/OR REPLACEMENT AS SO STATED IN OUR WARRANTY OF PRODUCT. IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY SPECIAL, INDIRECT, CONSEQUENTIAL OR OTHER DAMAGES OF A LIKE GENERAL NATURE, INCLUDING, WITHOUT LIMITATION, LOSS OF PROFITS OR PRODUCTION, OR LOSS OR EXPENSES OF ANY NATURE INCURRED BY THE BUYER OR ANY THIRD PARTY.

UE specifications subject to change without notice.

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Kujawska 5, Poland
Phone: +48 22 499 4804
email: easterneuropesales@ueonline.com

INDIA

United Electric Controls
402, Aries Avenue - I, 58-United Colony
Sama, Baroda - 390008 India
Phone: (+91) 265 3191711
email: indiasales@ueonline.com

ASIA-PACIFIC

United Electric Controls, Far East
No. 1-2-2, 2nd Floor
Jalan 4/101C
Cheras Business Centre
Batu 5, Jalan Cheras
56100 Kuala Lumpur, Malaysia
Phone: 603-9133-4122
email: fareastsales@ueonline.com

MEXICO-LATIN AMERICA

United Electric Controls
Zacatecas #206 Suite 20
Col Guadalupe CP 89120
Tampico, Tamaulipas Mexico
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Elninskaya str., 15-140
Moscow, 121552, Russia
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UNITED ELECTRIC CONTROLS

180 Dexter Avenue, P.O. Box 9143
Watertown, MA 02471-9143 USA
Telephone: 617 926-1000 Fax: 617 926-2568
http://www.ueonline.com

CP11111000

VALLEY FARMS
ARSENIC REMOVAL FACILITY
SORB 33® ADSORBER SYSTEM

(1) ONE 8'0" DIA. ADSORBER

SEVERN TRENT SERVICES
PROJECT # 22643

SECTION 6 **INSTRUMENTS**
C. PRESSURE GAUGES

MARK	QTY	SIZE	SERVICE
PI-171	1	4-1/2"	HEADER PRESSURE
PI-172	1	4-1/2"	HEADER PRESSURE

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SEVERN TRENT SERVICES	□□E□ □□□E □□□E□				Sheet : 1 Of 1
					Spec: 646-1
	No.	By	Date	Revision	Contract: 22643
Park West One, Suite 600	A	JWS	10/02/14		P. O. #
Pittsburgh, PA 15275					By: JWS
(412) 788-8300					Chk:

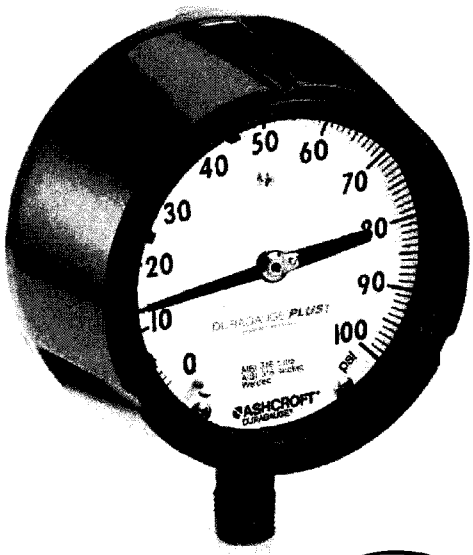
1	Type:	DIRECT READING	
2	Mounting:	STEM	
3	Dial Dia.:	4 1/2"	
	Color:	WHITE	
4	Case:	PHENOLIC	
5	Ring:	THREADED	
6	Blow-Out Protection:	SOLID FRONT	
7	Lens:	SAFTYGLASS (SHATTERPROOF)	
8	Option:	LIQUID FILL (SILICONE)	
9	Nominal Accuracy Reqired:	0.50%	
10	Manufacturer	ASHCROFT DURAGAUGE	
	Model No.:	1279S	
11	Pressure Element:	BOURDON	
12	Element:	316 S.S.	
13	Socket Material:	316 S.S.	
14	Connection:	1/2" BOTTOM	
15	Movement:	ROTARY-GEARED	
16	Diaphragm Seal:		

	Tag Number	Range	Operating Pressure	Service
1	PI-171	0-160 PSI	100 PSI	RAW WELL WATER INFLUENT
2	PI-172	0-160 PSI	100 PSI	BLENDED EFFLUENT WATER

Notes: VENDOR SHALL SUPPLY S.S. TAG BEARING INSTRUMENT TAG NO.

ASHCROFT®

Type 1279 Duragauge® Pressure Gauge Available With *PLUS!*™ Performance Option



- ***Solid front case design, field convertible to hermetically sealed or liquid filled style***
- ***Pressure ranges from vacuum — 30,000 psi***
- ***Select from various socket and Bourdon tube materials***
- ***Micrometer adjustable pointer***
- ***400 Series stainless steel movement wears better for longer life***
- ***Teflon-coated pinion for longer life***
- ***Patented Duratube™ with as-welded tube construction controls stresses for longer life***
- ***PLUS!™ Performance Option:***
  - ***Liquid-filled performance in a dry gauge***
  - ***Fights vibration and pulsations without liquid-filled headaches***
  - ***Order as option XLL***

The Ashcroft® Duragauge® pressure gauge is the finest production gauge on the market for industrial use where precise indications are required. The product line offers a wide variety of case styles, Bourdon tubes and pressure ranges to meet your application needs .

With the component combinations available in the Duragauge gauge line, over ten million variations are possible to serve the needs of all types of industries, including process, power, nuclear, aerospace and cryogenics.

TEMPERATURE LIMITS

	Ambient	Process	Storage
Dry	–20/200°F[1] (–29/93°C)	–20/250°F[1] (–29/121°C)	–40/250°F (–40/121°C)
LF (glycerin)	20/150°F (7/66°C)	20/200°F (7/93°C)	0/150°F (–18/66°C)
(silicone)	–40/150°F (–40/66°C)	–40/200°F (–40/93°C)	–40/150°F (–40/66°C)
(halocarbon)	–40/150°F (–40/66°C)	–40/200°F (–40/93°C)	–40/150°F (–40/66°C)

Note: Other than discoloration of the dial and hardening of the gasketing that may occur as ambient or process temperatures exceeds 150°F, non-liquid-filled gauges with standard glass windows, can withstand continuous operating temperatures up to 250°F (121°C). Liquid-filled gauges can withstand 200°F (93°C) but glycerin fill and acrylic window will tend to yellow. Accuracy at temperatures above or below the reference ambient temperature of 68°F (20°C) will be affected by approximately .4% per 25°F. Gauges with welded joints will withstand 750°F (450°F (232°C) with silver brazed joints) for short times without rupture, although other parts of the gauge will be destroyed and calibration will be lost. For continuous use and for process or ambient temperatures above 250°F (121°C), a diaphragm seal or capillary or siphon is recommended.

(1) Available for temperatures below –20°F, see Product Information page ASH/PI-21B for details.

PRODUCT SPECIFICATIONS

Model Number: 1279
Accuracy: ½% full scale (Grade 2A, ASME B40.100)
Ranges: Vac., compound to 30,000 psi
Dial Size: 4½″ diameter
Case Material: Black phenolic, solid front
Weather Protection: Dry Case: IP54
Liquid filled or hermetically sealed case: IP 65
Ring: Threaded reinforced black polypropylene
Window: Glass
Dial: Aluminum, white background, black figures and intervals
Pointer: Micrometer adjustable
Movement: Rotary, 400 SS, Teflon® coated pinion gear and segment
Bourdon Tube and Socket: C510 Phos. bronze/brass (A)[1]
316L SS/steel (R)[2]
316L SS/316L SS (S)[2]
K Monel/ Monel (P)[2]
Conn. Size: ¼″, ½″ NPT
Conn. Location: Lower or back

OPTIONAL FEATURES

Fill: L-Glycerin-Standard
XGV-Silicone-Optional
XGX-Halocarbon-Optional
PLUS!™ **Performance:** XLL
Hermetically Sealed, IP65: H
Flush Mounting Ring: X56
Receiver Gauge: XPR
Shatter Proof Glass Window: XSG
Acrylic Window: XPD
Red Set Hand: XSH
Maximum Pointer: XEP

[1] Joints silver brazed
[2] Joints welded

STANDARD RANGE TABLE*

Pressure – psi		
Range	**Figure interval**	**Minor Graduation**
0/15	1	0.1
0/30	5	0.2
0/60	5	0.5
0/100	10	1
0/160	20	2
0/200	20	2
0/300	50	2
0/400	50	5
0/600	50	5
0/800	100	10
0/1000	100	10
0/1500	200	20
0/2000	200	20
0/3000	500	20
0/5000	500	50
0/6000	500	50
0/10,000	1000	100
0/20,000	2000	200
0/30,000	5000	200

* Full standard and metric equivalent range table available on our web site.

ISO 9001
REGISTERED FIRM

BULLETIN DU-1 1279

Ashcroft Inc., 250 East Main Street, Stratford, CT 06614 USA
Tel: 203-378-8281 • Fax: 203-385-0408
email: info@ashcroft.com • www.ashcroft.com

ASHCROFT®

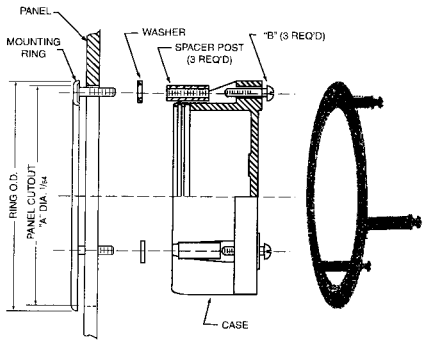
Type 1279 Duragauge® Pressure Gauge Available With *PLUS!*™ Performance Option

Compound				
Range	Figure Interval		Minor Grads	
	in Hg	psi	in Hg	psi
30″ Hg/15 psi	5	3	0.5	0.2
30″ Hg/30 psi	10	5	1	0.5
30″ Hg/60 psi	10	10	1	1
30″ Hg/100 psi	10	10	2	1
30″ Hg/150 psi	10	20	5	2
30″ Hg/200 psi	30	20	5	2
30″ Hg/300 psi	30	50	5	2

Vacuum		
Range	Figure Interval	Minor Grads
30/0 in. Hg	5 in	0.2 in
34/0 ft H_2O	5 ft	0.5 ft

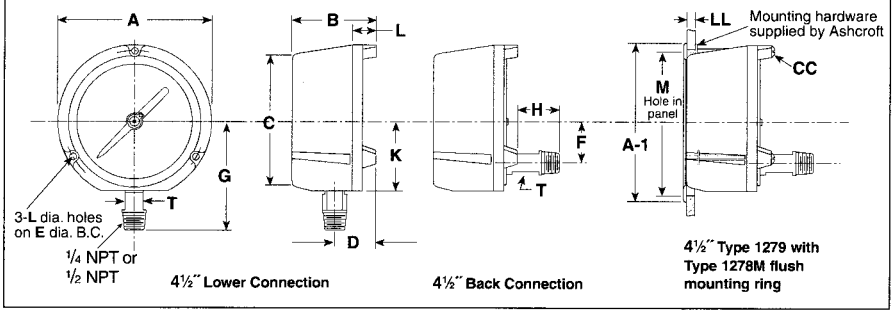
TYPE 1278M SERIES FLUSH MOUNTING RING

Used to flush mount gauge case Type 1279(*)S. Standard finish is black; optional polished stainless steel finish is available.



GAUGE SIZE	RING O.D.	"A" DIA.	"B" Size of 3 Screws	"C" Size of Washers
4½	6.000 (152)	5⅝ (148)	#10-24 x 1⅝	7/16 x 17/64 x ⅝

Dimensions



Dial Size Inches	A	B	C	D	E	F	G	H	K	L	T	V	Weight (lbs)
4½	5.81 (147.6)	3.36 (85.3)	5.07 (128.7)	1.06 (40.6)	5.375 (137)	1.62 (41.2)	4.08 (103.7)	.73 (18.4)	2.62 (66.6)	.22 (5.5)	.62 (15.7)	2.625 (67)	2.5 (Dry) 3.5 (L.F.)

Order Coding Example

45	1279	S	S	04	L	XEPNH	100	#

SIZE	TYPE	SYSTEM (TUBE & SOCKET)	CASE DESIGN SOLID FRONT	PROCESS CONNECTION SIZE	CONNECTION LOCATION	OPTIONS (X VARIATIONS)[1]	RANGE	ENGINEERING UNITS[1]
(45) 4½	1279	(A) Bronze tube, Brass socket[1] (P) K-Monel 500 tube, Monel 400 socket[2] (R) 316L st st tube, steel socket (S) 316L[2] [1] Max pressure 1000psi [2] Max pressure 30,000psi	(S) Dry(IP54) (SH) Dry, Hermetically Sealed, Field Fillable (IP65) (SL) Liquid filled (glycerin standard) (IP65)	(02) ¼ NPT male[1] (04) ½ NPT male[1] (09) 9/16-18 UNF-2B Aminco (standard for high pressure >20,000psi) [1] Max pressure 20,000psi	(B) Back (D) Side (3:00) (E) Side (9:00) (L) Lower (T) Top (12:00)	(GV) Silicone case fill (GX) Halocarbon case fill (NH) St. St. Wired Tag (TS) Throttle screw[2] (6B) Oxygen service (PD) Acrylic window[2] (SG) Safety glass (EP) Maximum pointer, adjustable (SH) Red set hand, stationary (LL) *PLUS!* Performance (56) Flush mounting ring (C4) Individual calibration chart [1] Others on request [2] Standard with hermetically sealed or liquid filled gauge	See website for most common ranges offered	(#) PSI (BR)) Bar (KG) Kilograms/CM2 (KP) Kilopascal (IMV) Inches of Mercury Vacuum [1] See website for more units of measure

ISO 9001
REGISTERED FIRM

BULLETIN DU-1 1279

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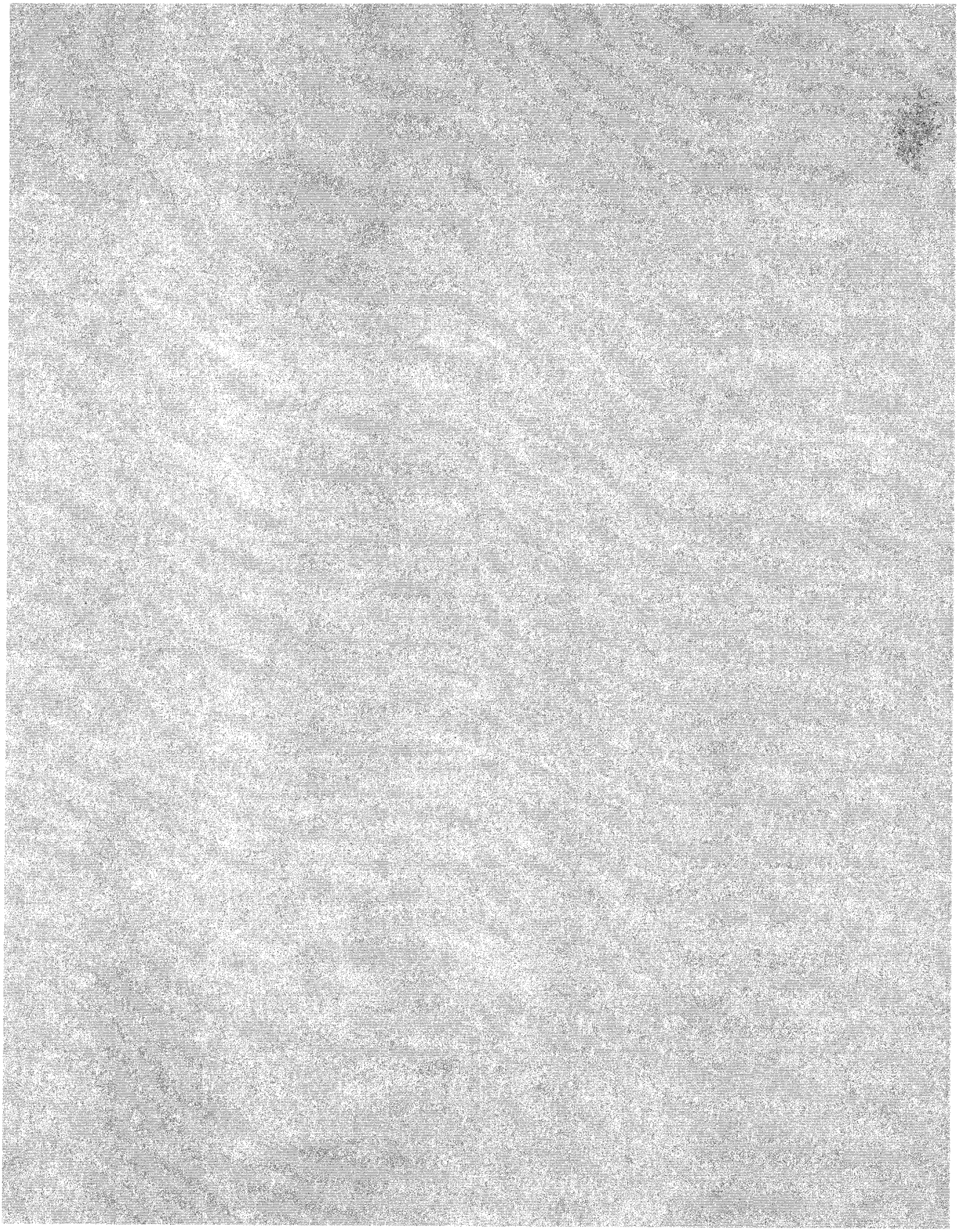
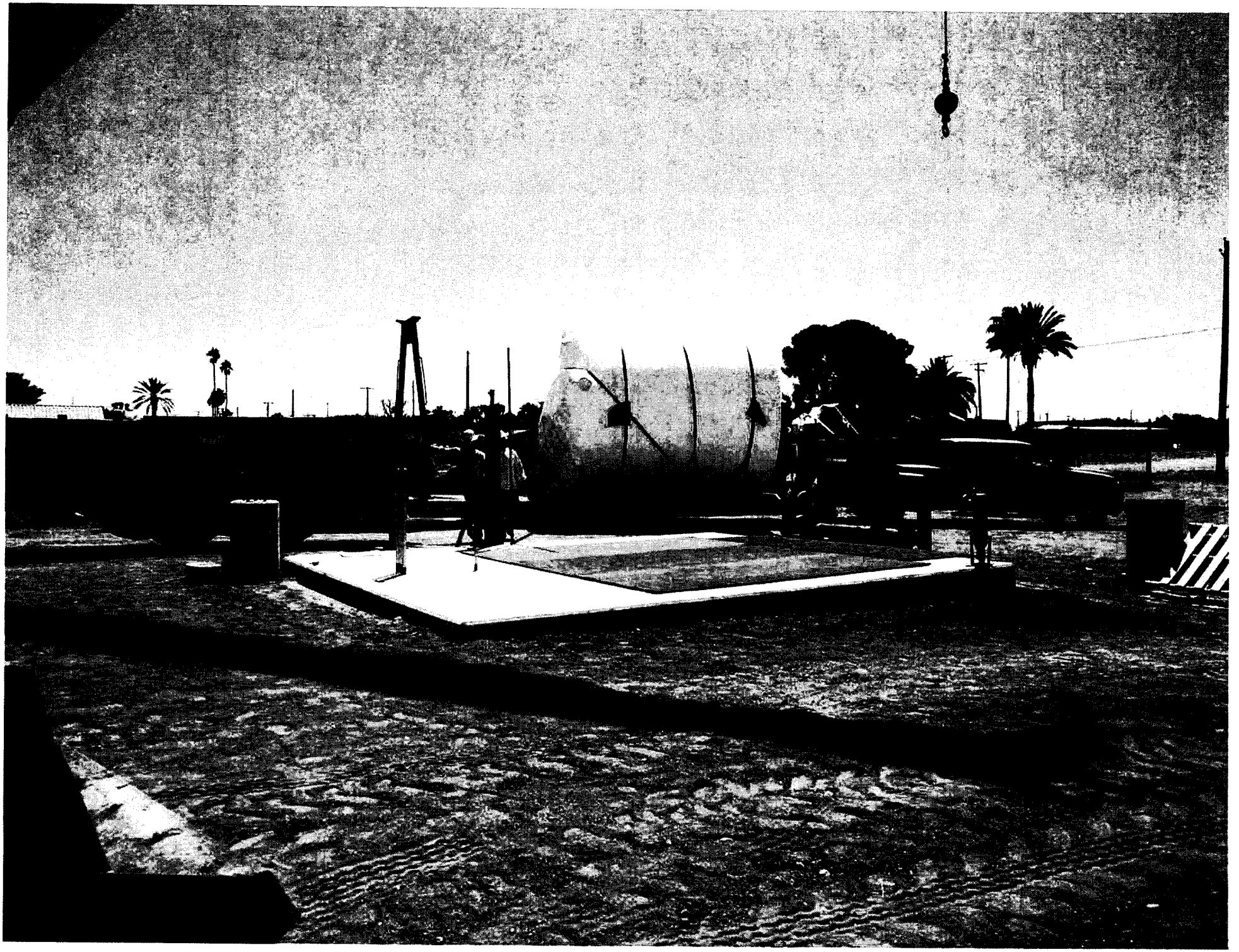
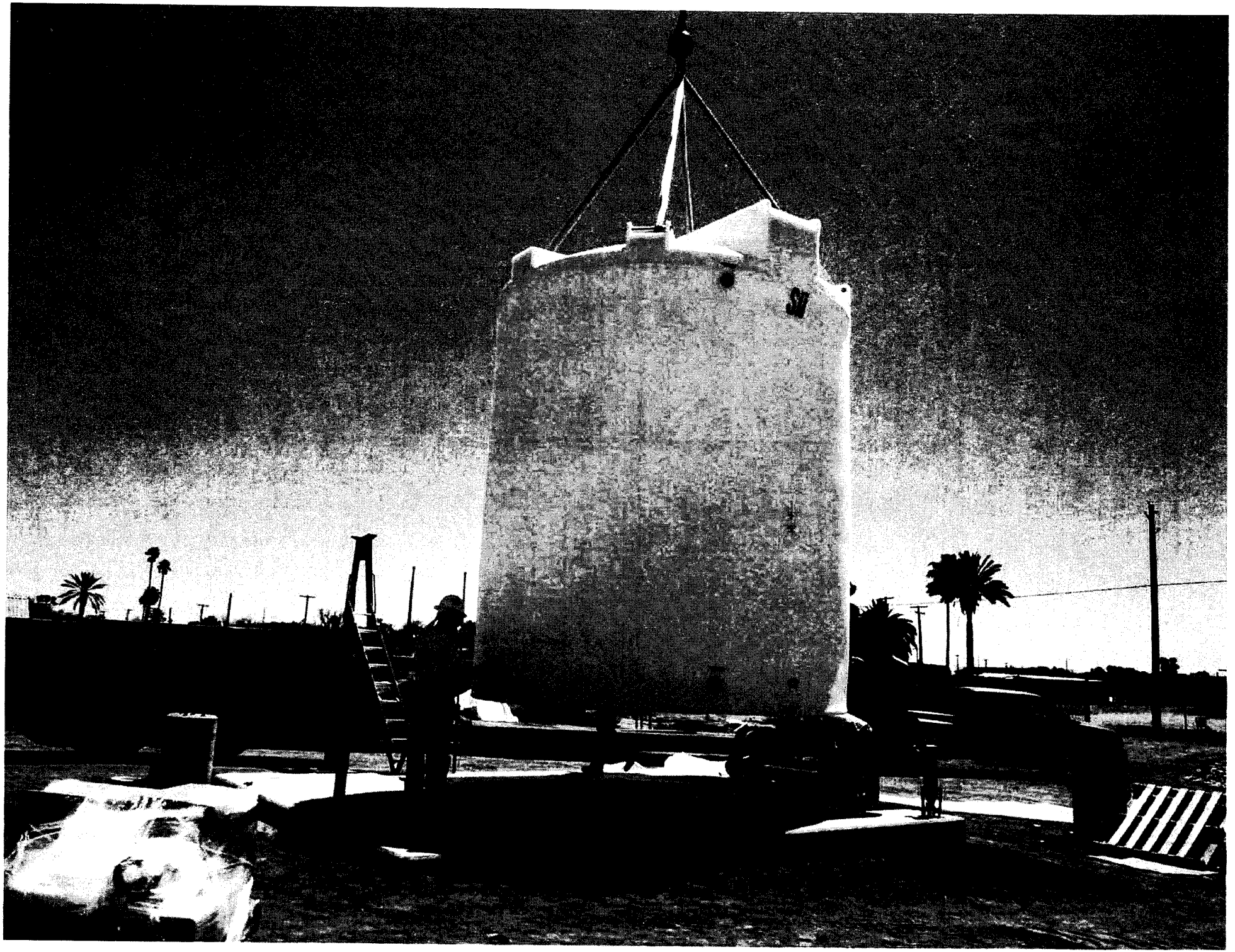
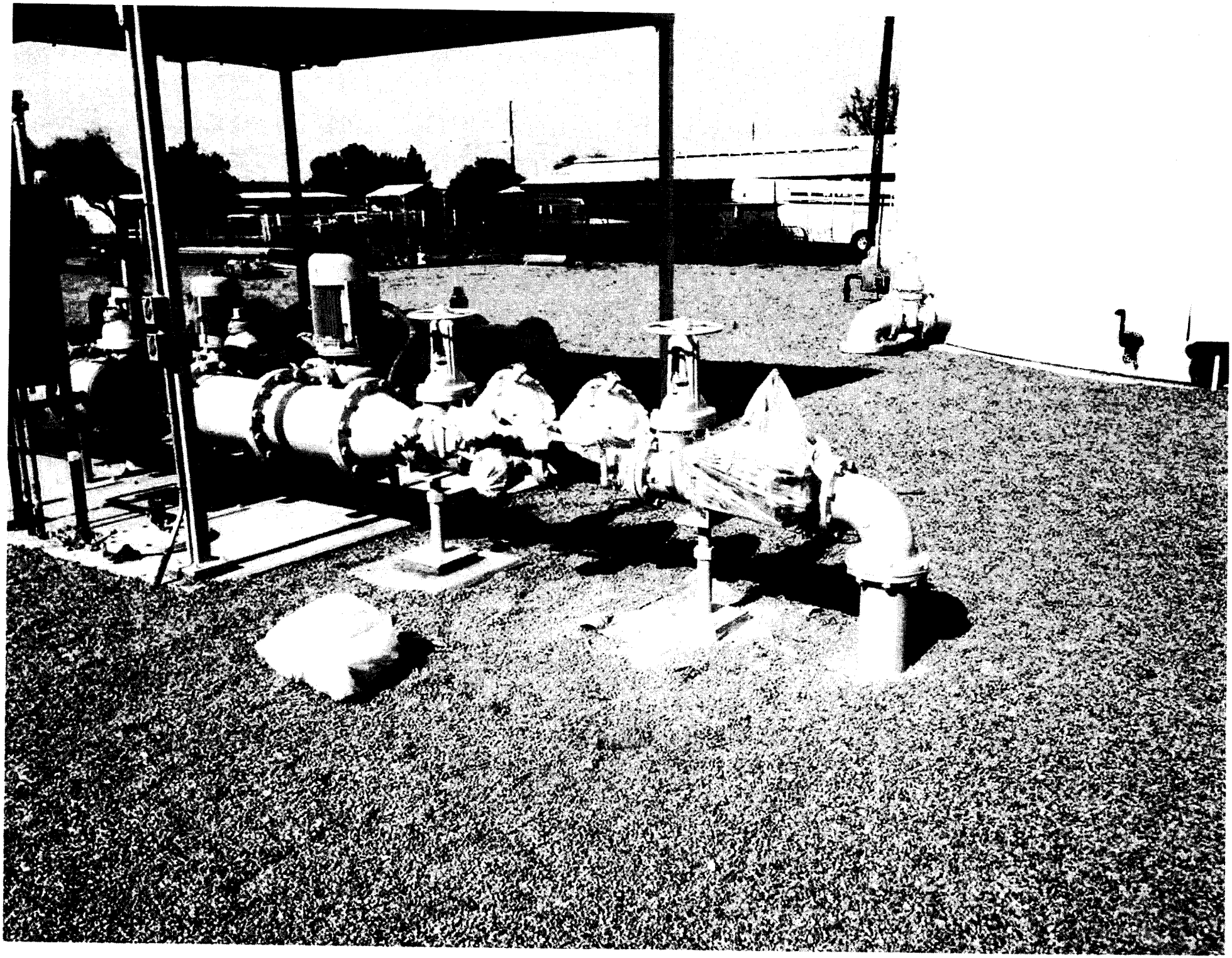
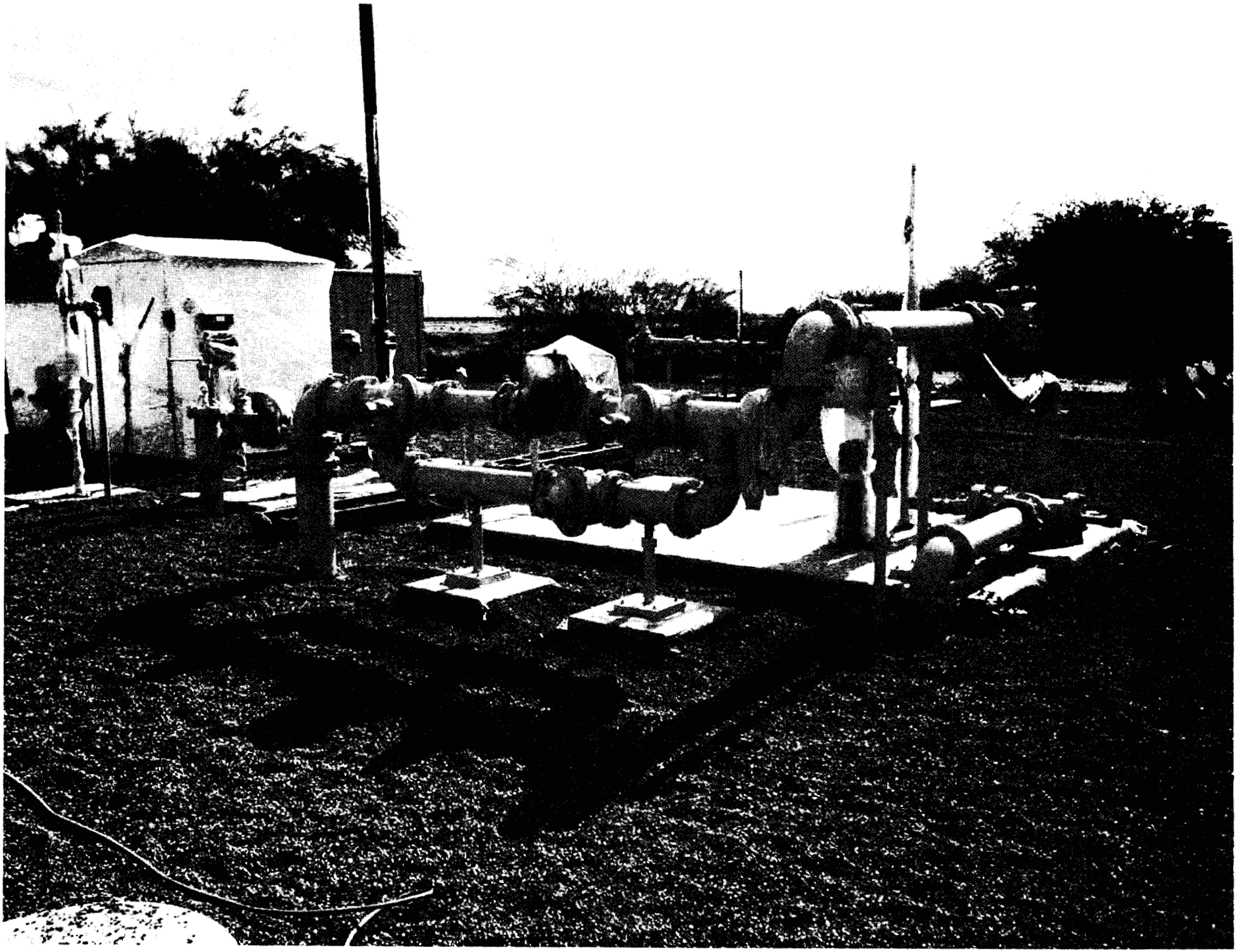
www.ghd.com

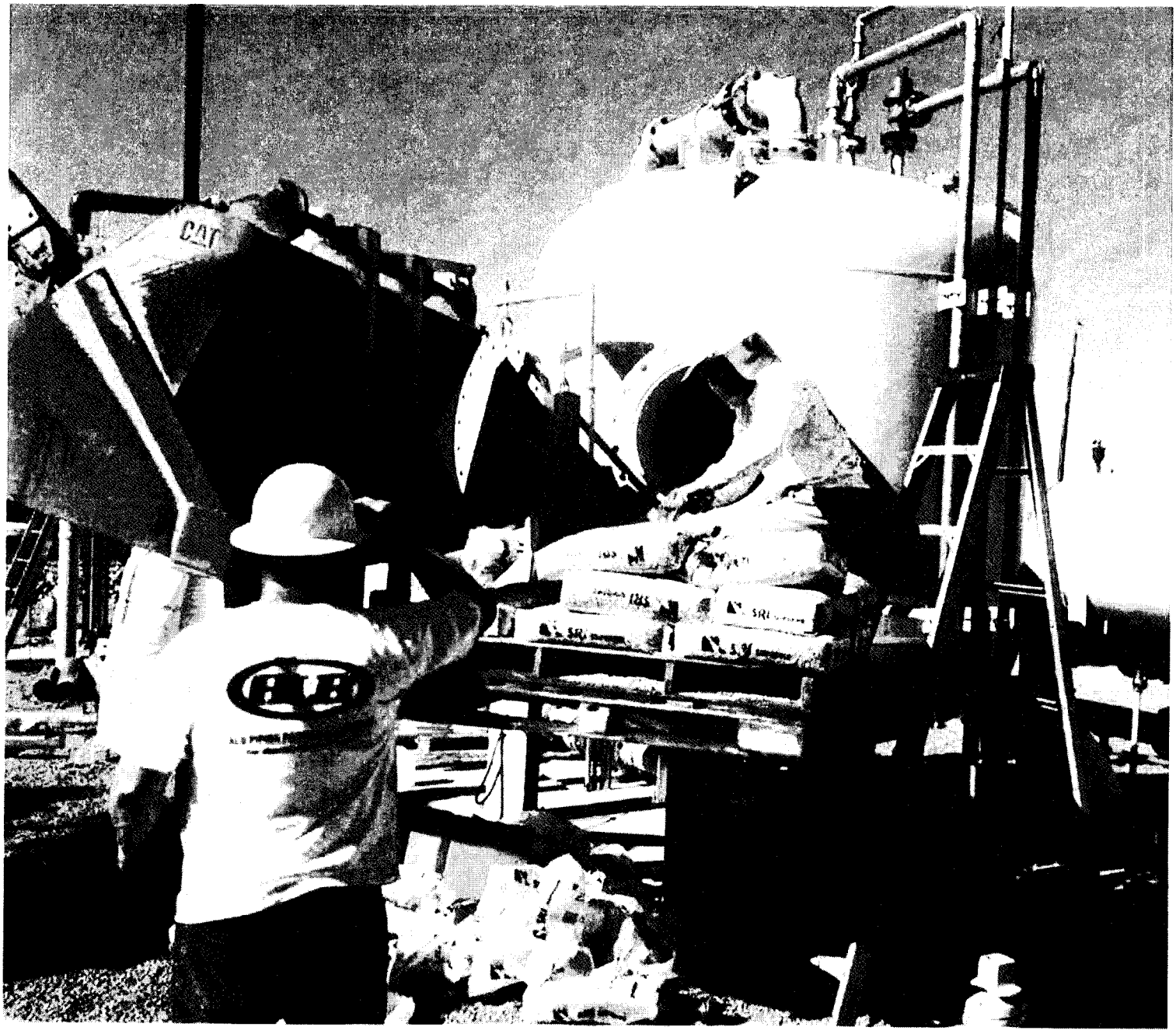




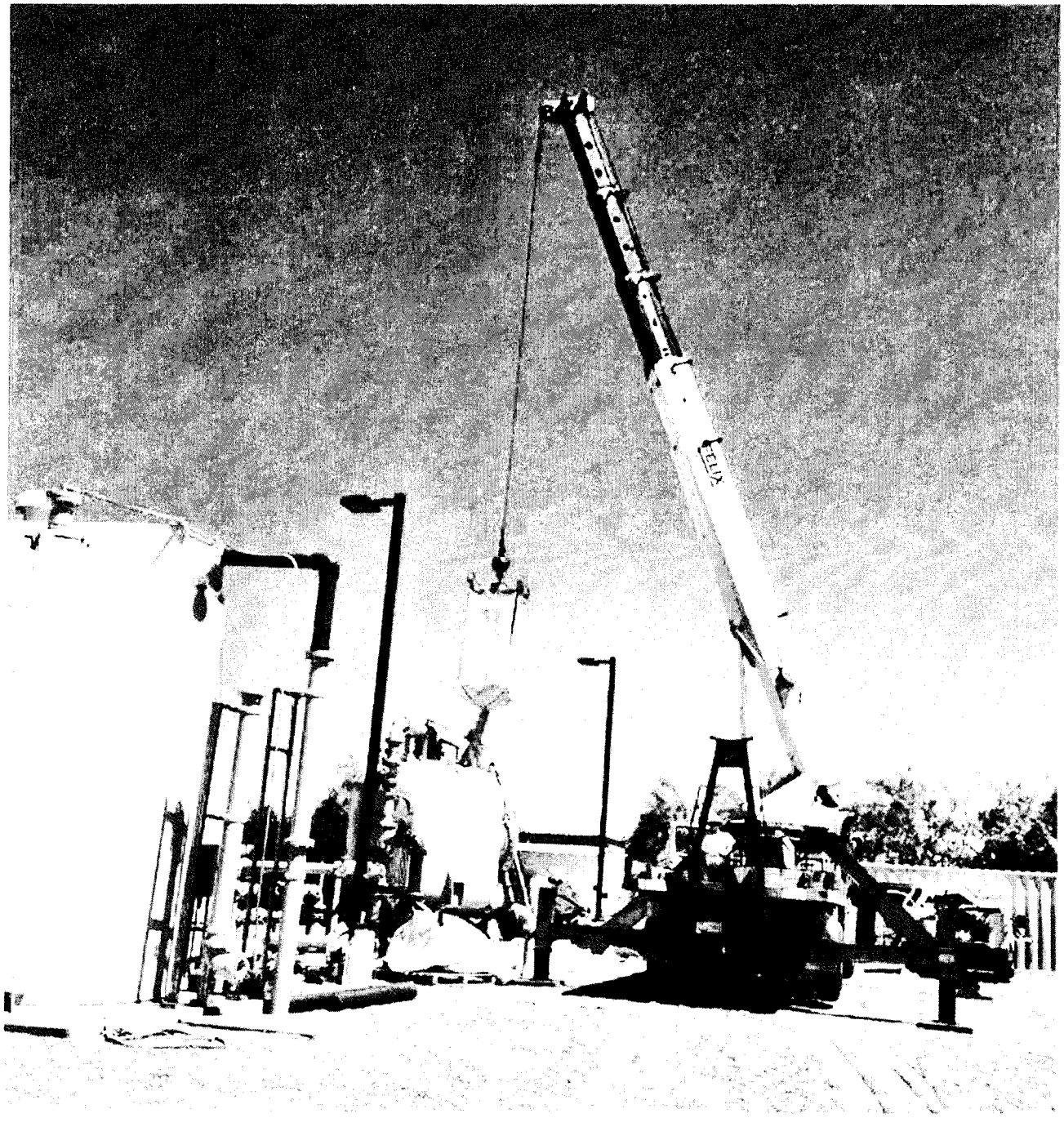




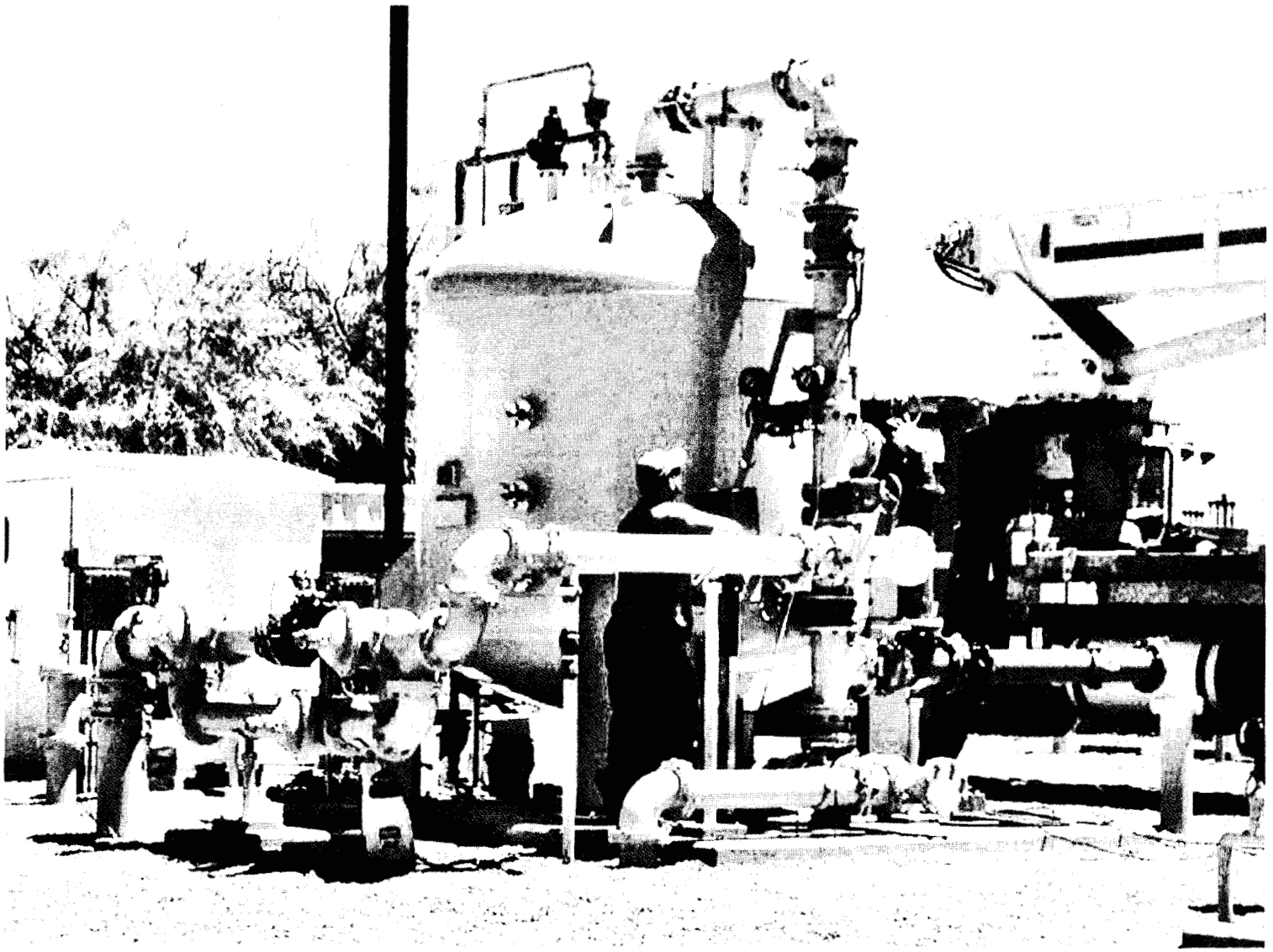




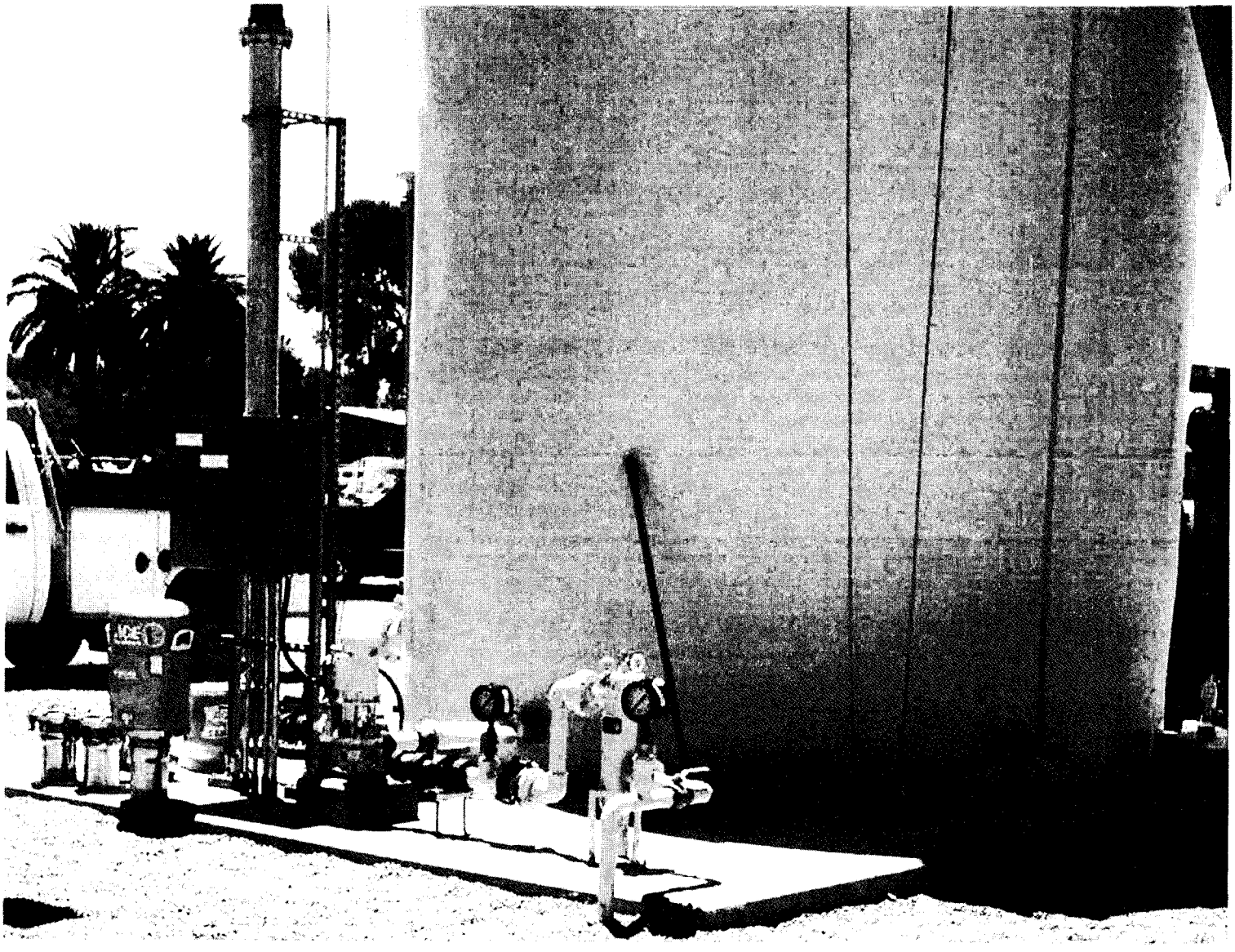
Valley Farms ARF - 6-2-15
Loading Gravel into the Arsenic Vessel



Valley Farms 6-2-15
Loading Arsenic Removal Media
Into Vessel
Looking North



Valley Farms 6-3-15
Severn Trent representative on site to supervise
Arsenic Vessel back washing



Valley Farms 6-3-15
Recycle pump and piping

ARIZONA DEPARTMENT
OF
ENVIRONMENTAL QUALITY

Douglas A. Ducey
Governor

Henry R. Darwin
Director

APPROVAL OF CONSTRUCTION

Project Description: Valley Farms Arsenic Removal Facility
Installation of ab Arsenic removal system (SORB 33 Engineered Arsenic System), blending plan, booster pumps, and related appurtenances.

Location: Valley Farms, AZ

Project Owner: Arizona Water Company
Address: PO Box 29006, Phoenix, AZ 85038

The Arizona Department of Environmental Quality (ADEQ) hereby issues an Approval of Construction for the above-described facility based on the following provisions of Arizona Administrative Code (A.A.C.) R18-5-507 et seq.

On 6/24/15 William Roberts, P.E., certified that the project was built according to the as-built plans and specifications and ADEQ's Certificate of Approval to Construct.

On 1/12/15, ADEQ issued a Certificate of Approval to Construct for the referenced project.

This Approval of Construction authorizes the owner to begin operating the above-described facilities as represented in the approved plan on file with the ADEQ. Be advised that A.A.C. R18-4-203 requires the owner of a public water system to maintain and operate all water production, treatment and distribution facilities in accordance with ADEQ Safe Drinking Water Rules.

RDR

PWS No.: 141-099
LTF No.: 62636

for 7-7-15

David Burchard
Manager

Date Approved

C: ADEQ File No.: 20140293
Pinal County Health Department
AZ Corporation Commission
Engineer

RIGHT TO APPEAL INFORMATION

The Arizona Department of Environmental Quality's review of this application was subject to the requirements of the licensing time frames ("LTF") statute under Arizona Revised Statutes ("A.R.S.") § 41-1072 through § 41-1079 and the LTF rules under Arizona Administrative Code ("A.A.C.") R18-1-501 through R18-1-525. This Notice is being issued within the overall time frame for your application.

ADEQ hereby approves your application for Approval of Construction Drinking Water Facilities under A.R.S. § 49-351. Your copy of the Approval of Construction Permit is on the reverse side of this Right to Appeal Information sheet.

This decision is an appealable agency action under A.R.S. § 41-1092. You have a right to request a hearing and file an appeal under A.R.S. § 41-1092.03(B). You must file a written Request for Hearing or Notice of Appeal within **30 days** of your receipt of this Notice. A Request for Hearing or Notice of Appeal is filed when it is received by ADEQ's Hearing Administrator as follows:

Office of Administrative Counsel
Arizona Department of Environmental Quality
1110 W. Washington Street
Phoenix, AZ 85007

The Request for Hearing or Notice of Appeal shall identify the party, the party's address, the agency and the action being appealed and shall contain a concise statement of the reasons for the appeal. Upon proper filing of a Request for Hearing or Notice of Appeal, ADEQ will serve a Notice of Hearing on all parties to the appeal. If you file a timely Request for Hearing or Notice of Appeal you have a right to request an informal settlement conference with ADEQ under A.R.S. § 41-1092.06. This request must be made in writing no later than **20 days** before a scheduled hearing and must be filed with the Hearing Administrator at the above address.

Please contact Ali Baadiyan at (602) 771-4127 or asb@azdeq.gov if you have questions regarding this Notice or the Certificate of Approved of Construction.

ARIZONA WATER COMPANY

CONSTRUCTION PLACED IN SERVICE NOTICE

WORK AUTHORIZATION NO.: 1-5167

DIVISION: PV/CG

DATE PLACED IN SERVICE: 7 | 8 | 2015

CONTRACT NO:

FOR PURPOSES OF *MODIFIED ACCELERATED COST RECOVERY SYSTEM*, AN ASSET IS "PLACED IN SERVICE" WHEN IT IS IN A CONDITION OR STATE OF READINESS AND AVAILABILITY FOR A SPECIFICALLY ASSIGNED FUNCTION, WHETHER IT BE FOR USE IN A TRADE OR BUSINESS, OR FOR THE PRODUCTION OF INCOME.

I CERTIFY THAT THE ASSET(S) CONSTRUCTED PURSUANT TO THE PROVISIONS OF THE ABOVE-REFERENCED WORK AUTHORIZATION ARE READY FOR SERVICE AS OF THE DATE SHOWN ABOVE.

Division Manager or Operations Superintendent
(signature)

7-31-15
Date

SUBMIT ORIGINAL TO ACCOUNTING DEPARTMENT

A-1-3-1
FKS 11/24/11