Components

Mechanical Component Cut Sheets

Series 2"

To handle single 1-1/2" or 2" I.D. hose.

- Gear-driven crank rewind or chain and sprocket drive powered by an electric, hydraulic or compressed air motor.
- Optional auxiliary crank rewind for power rewind reels.
- Strap brake on power rewind without auxiliary crank.
- Standard inlet: 90° ball bearing swivel joint, 2" Victaulic® groove.
- Standard outlet: 2" female NPT threads.
- Other sizes and/or threads can be furnished and must be specified.
- Standard: inlet, outlet riser, and hub assembly are steel. Options: also available in aluminum or stainless steel.
- Rollers and roller mounting brackets are accessories. Specify roller position.
- Standard pressures to 600 psi (41 bar).
- Standard fluid temperatures from -40° F to +400 °F (-40° C to +204° C). Optional temperature ratings available - consult factory.
- Consult factory for other pressures and temperatures.

Standard configuration shown with Electric Rewind (EPJ) option

Chain Clutch - Reduction Units

- Recommended on reels with 39" diameter or larger discs, or when increased torque and slower rewind speeds are required.
- Factory installed.

PARTS DRAWING – ISO 35

Model Number For Power Rewind see Notes 3 & 4	Hose Capacity of Reel feet m		Approx. Weight Crank Rewind lb. kg See Note 3		Reel Dimensions*** in. mm									
I.D. in. mm / O.D. in. mm	1-1/2 38 / 2.06 52	2 51 / 2.67 68	NET	SHIP	A	B	D	E	F CRANK	F POWER	G	H	X	Y
232-26-27-15.5	70 / 21	50 / 15	104 / 47	154 / 70	23.75 / 603	17.5 / 445	27 / 686	25.75 / 654	31 / 787	32.75 / 832	26.62 / 676	13.75 / 349	16.25 / 413	23.25 / 591
238-26-27-15.5	100 / 30	75 / 23	145 / 66	195 / 88	30.25 / 768	24 / 610	27 / 686	25.75 / 654	37.5 / 953	39.25 / 997	26.62 / 676	13.75 / 349	22.75 / 578	23.25 / 591
246-26-27-15.5	140 / 43	100 / 30	196 / 89	246 / 112	38.25 / 972	32 / 813	27 / 686	25.75 / 654	45.5 / 1156	47.25 / 1200	26.62 / 676	13.75 / 349	30.75 / 781	23.25 / 591
224-33-34-15.5	60 / 18	50 / 15	70 / 32	140 / 64	15.75 / 400	9.5 / 241	31.5 / 800	31.75 / 806	23 / 584	24.75 / 629	33.38 / 848	17.5 / 445	8.25 / 210	27.75 / 705
228-33-34-15.5	100 / 30	75 / 23	92 / 42	162 / 73	19.75 / 502	13.5 / 343	31.5 / 800	31.75 / 806	27 / 686	28.75 / 730	33.38 / 848	17.5 / 445	12.25 / 311	27.75 / 705
234-33-34-15.5	140 / 43	100 / 30	133 / 60	203 / 92	26.25 / 667	20 / 508	31.5 / 800	31.75 / 806	33.5 / 851	35.25 / 895	33.38 / 848	17.5 / 445	18.75 / 476	27.75 / 705
232-39-40-15.5	250 / 76	150 / 46	180 / 82	250 / 113	23.75 / 603	17.5 / 445	40 / 1016	39 / 991	31 / 787	32.75 / 832	39.88 / 1013	20.38 / 518	16.25 / 413	37 / 940
240-39-40-15.5	350 / 107	200 / 61	218 / 99	288 / 131	32.25 / 819	26 / 660	40 / 1016	39 / 991	39.5 / 1003	41.25 / 1048	39.88 / 1013	20.38 / 518	22.75 / 578	37 / 940

Notes:

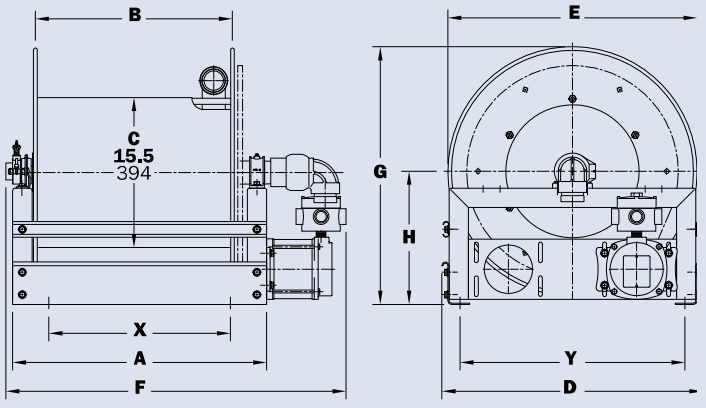
1. Specifications subject to change.
2. Upon request, reels can be supplied with drum lengths other than shown and with disc sizes in other diameters.
3. Weights shown in chart are for crank rewind models. ADD these amounts for power rewind models:

	Net lbs/kg	Ship lbs/kg
Electric	40/18.1	40/18.1
Hydraulic	20/9.1	20/9.1
Air	20/9.1	20/9.1

4. When ordering power rewind models, prefix model number with:
   - **A** = Air Rewind – Supplied with control valve and 18" air hose.
   - **EP** = Electric Rewind (1/2 HP) – 12v and 24v DC rewind supplied with non-explosion-proof switch and solenoid; 115v AC rewind is not supplied with switch but it can be ordered separately.
   - **EPJ** = Explosion-Proof Electric Rewind (1/2 HP) – supplied with explosion-proof switch, solenoid, and junction box.
   - **HD** = Hydraulic Rewind – Not supplied with control valve.
5. **Be sure to check dimensions and weights prior to ordering.**

NOTICE: A flexible connector must be used between the inlet pipe and the inlet swivel joint.

***X, Y indicate mounting holes.



Phone: 518-797-3791 | Toll Free: 1-877-467-3357 | FAX: 518-797-3259 | Email: reels@hannay.com | hannay.com

MAX SEAL® Valves & Controls

RESILIENT SEATED BUTTERFLY VALVES

Performance Series

Available in Wafer and Lug Styles

Max-Seal Performance Series valves are designed and manufactured in accordance with the requirements of USCG CFR 46 Category A.

MODELS:
Wafer 51
Lug 52

SIZE RANGE:
2" – 36"

PRESSURE RATING:
2" – 12" 225 WOG / Bidirectional Flow 14 – 24" 200 WOG / Bidirectional Flow 250 WOG – Optional – Unidirectional Flow

DI Nylon Coated Disc

UNIQUE DESIGN FEATURES:
- Ductile Iron Body
- Rugged Heavy Duty Construction
- High Quality Epoxy Coating for Excellent Corrosion Resistance
- 2-Piece Stem Design Allows for Easy Assembly and Maintenance with Higher Flow Capacity
- ISO Actuator Mounting

AVAILABLE DISC
- 316 Stainless Steel, DI/Nylon coated, Aluminum Bronze
- Special Alloys Available

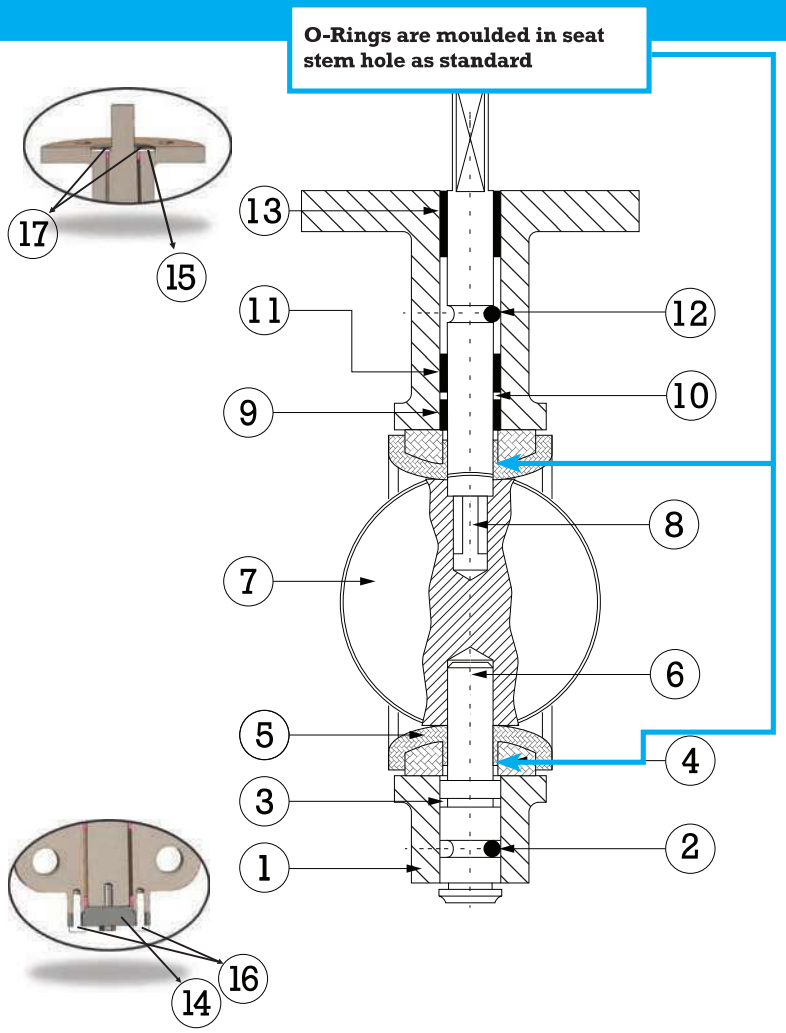
Max-Seal Concentric Butterfly Valves are backed by the resources and experience of over thirty five years of process valve and automation knowledge.

BUTTERFLY VALVE — COMPONENTS / DESIGN FEATURES

Standard parts list

No.	Part	Q'ty	Material	Code
1	Valve Body	1	*Ductile Iron A536* Cast Iron Stainless Steel CF8M Bronze ASTM B62	DI CI SS BZ
2	Pin	1	*Alloy Steel*	
3	O-Ring	1	Buna-N	B
4	Seat Back Up	1	Phenolic	~
5	Seat	1	*EPDM* Buna-N (Food Grade) Vitron	E B V
6	Lower Shaft	1	*Stainless 416* Stainless 316 17-4Ph	S6 SS S7
7	Disc	1	*Nylon Coated Ductile Iron* Stainless 316 CF8M Stainless 304 CF8 Aluminum Bronze	D1 SS S4 AB
8	Upper Shaft	1	*Stainless 416* Stainless 316 17-4Ph	S6 SS S7
9	Bushing	1	Fiberglass Reinforced PTFE	T
10	O-Ring	1	*Buna-N*	B
11	Bushing	1	Fiberglass Reinforced PTFE	T
12	Pin	1	Alloy Steel	
13	Bushing	1	PTFE	T
14	Lower Retainer**	1	Ductile Iron	
15	Upper Retainer**	1	Carbon Steel	
16	Bolts**	4	Carbon Steel	
17	Screw**	4	Carbon Steel	

** For 14"-24" valves



One piece body with extended neck allows clearance for flanges and up to 2½" of insulation.

Primary stem seals are formed by preloaded contact between the disc and seat. A secondary seal is effected by having a stem diameter greater than the stem hole in resilient seat. These seals provide a non-wetted body and stem, eliminating the need for corrosion resistant body material.

Field replaceable, phenolic bonded cartridge is blowout proof, stretch resistant, and non-collapsible, making it an ideal seat design for high velocity or vacuum service. Our resilient seat design eliminates the need for flange gaskets.

Valve sizes 16" & above are supplied with metal seat back up rings.

- **High strength, square drive (2"–14") ensures a positive shaft to disc connection.**
- **Square drive offers direct ISO mounting of gear operator and automation equipment.**
- **Disc floats inside the seat for positive sealing and extended seat life.**
- **No pins or bolts exposed to flow.**
- **Offset shaft retainers mechanically retain the shaft in the body ensuring a blow out proof stem design.**

Max-Seal performance series butterfly valve model number codes

Model	Body Material		Disc Material		Stem Material		Seat Material		Operator		Size inch	Size mm
Wafer-51 Lug-52	Ductile Iron	DI	Nylon Coated Ductile Iron	DI	Stainless 416	S6	EPDM	E	Level	L	2"	50
	Cast Iron	CI	Stainless 316	SS	Stainless 316	SS	BUNA	B	Gear	G	3"	80
	Stainless Steel	SS	Stainless 304	S4	Stainless 410	S0	VITON	V	Bare Stem	N	4"	100
					17-4Ph	S7	TEFLON	T	Actuator	A	6"	150
					Monel	MO					8"	200

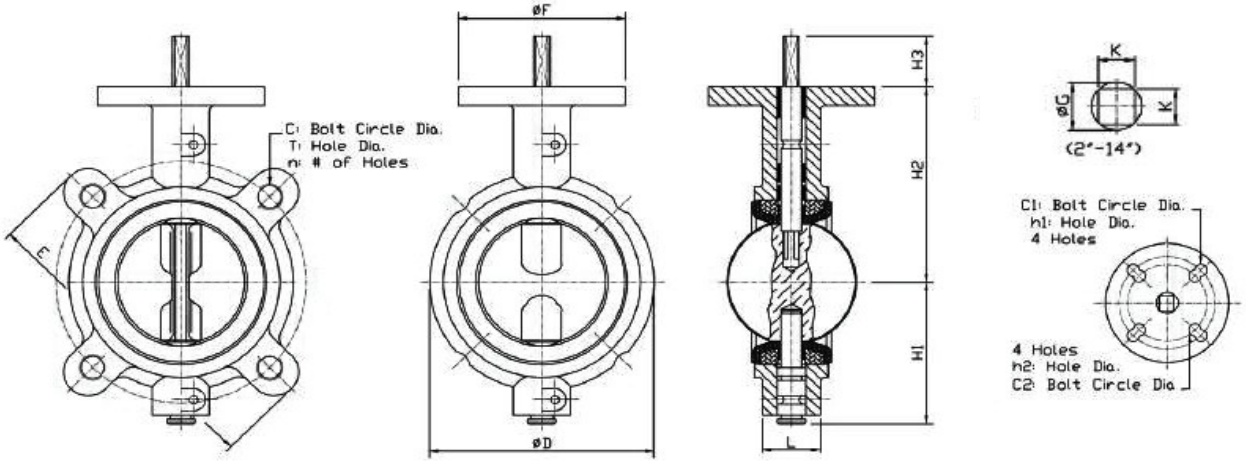
Accurate and smooth machined profile of disc edge requires minimal deformation of the resilient elastomer liner to achieve a positive seal. The low deformation results in low torque, less wear of the seat liner, and increased operational life.

Ordering Example by Part Number

Wafer	Ductile Iron	Stainless 316	Stainless 316	BUNA	Level	4"
Model	Body	Disc	Stem	Seat	Operator	Size
51 -	DI -	SS -	SS -	B -	L -	100

Max-Seal Performance Series Valves Are Bidirectionally Bubble Tight. They Are Marked With An Arrow Indicating The Preferred High Pressure Side.

DIMENSIONS / TECHNICAL DATA



Note:
Verify mounting dimensions before manufacturing mounting hardware

ANSI Class 125 Concentric Butterfly Valves

Size		D	E	L	H1	H2	H3	H4	F	G	K	Flange Dimension			Mounting Base					Weight, lb	
inch	mm											C	T	n	C1	h1	C2	h2	ISO	wafer	lug
2	50	4.125	6.00	1.656	3.11	3.94	1.25	1.14	4.0	0.50	0.354	4.75	5/8-11unc	4	3.25	0.41	2.76	0.39	F07	5	7
2.5	65	4.875	7.00	1.75	3.46	4.59	1.25	1.37	4.0	0.50	0.433	5.50	5/8-11unc	4	3.25	0.41	2.76	0.39	F07	6.5	9
3	80	5.375	7.50	1.78	3.81	5.32	1.25	2.00	4.0	0.50	0.433	6.00	5/8-11unc	4	3.25	0.41	2.76	0.39	F07	7	9
4	100	6.875	9.00	2.05	4.49	6.61	1.25	2.00	4.0	0.625	0.433	7.50	5/8-11unc	8	3.25	0.41	2.76	0.39	F07	10.5	15.5
5	125	7.75	10.0	2.12	5.00	7.17	1.25	2.00	4.0	0.75	0.55	8.50	3/4-10unc	8	3.25	0.41	2.76	0.39	F07	13.5	19.5
6	150	8.75	11.0	2.19	5.51	7.68	1.25	2.00	4.0	0.75	0.55	9.50	3/4-10unc	8	3.25	0.41	2.76	0.39	F07	16.5	23.5
8	200	11.00	13.5	2.38	6.77	9.44	1.75	2.57	6.0	0.875	0.67	11.75	3/4-10unc	8	5.00	0.53	4.01	0.47	F10	31	38.5
10	250	13.38	16.0	2.58	8.03	11.22	1.75	2.88	6.0	1.125	0.87	14.25	7/8-9unc	12	5.00	0.53	4.01	0.47	F10	42.5	59.5
12	300	16.13	19.0	3.03	9.66	12.1	1.75	2.00	6.0	1.25	0.87	17.00	7/8-9unc	12	5.00	0.53	4.01	0.47	F10	65	93.5
14	350	17.16	20.9	3.07	10.7	14.49	1.77	3.6	6.0	1.24	0.87	18.75	1-8unc	12	5.00	0.53	4.01	0.47	F10	99	148
16	400	19.21	23.43	4.02	12.9	15.75	2.01	3.55	7.76	1.49	1.063	21.25	1-8unc	16	n/a	n/a	5.51	0.71	F14	147	215.5
18	450	21.22	25.16	4.49	13.5	16.61	2.01	3.55	7.76	1.69	1.063	22.75	1 1/8-7unc	16	n/a	n/a	5.51	0.71	F14	189	260
20	500	23.35	27.83	5.00	15.1	18.9	2.52	4.3	7.76	1.80	1.417	25.00	1 1/8-7unc	20	n/a	n/a	5.51	0.71	F14	276	384.5
24	600	32.44	32.76	6.06	18.79	22.12	2.76	5.4	10.87	2.13	1.417	29.50	1 1/4-7unc	20	n/a	n/a	6.50	0.87	F16	474	576.5

Larger sizes available through 120", consult factory

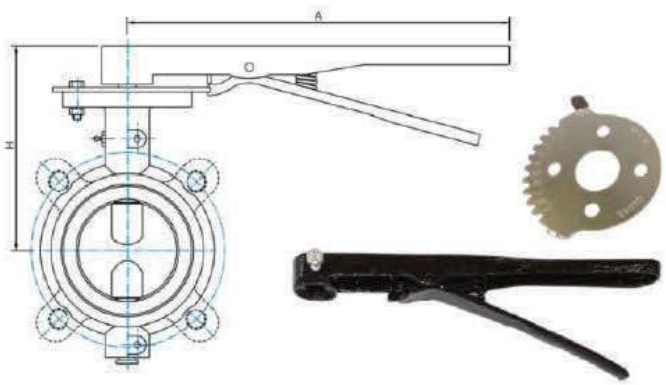
- **Pressure Ratings:**
  2"-12" 200 psi; 14"-24" 175 psi
- **Lug Body for Dead End Service:**
  2"-12" 150 psi; 14"-24" 125 psi
- **Higher Pressure Option:**
  250 WOG, Sizes 2"-18"; 220 WOG, Size 20"-24" with 17-4Ph stem & seat modification in lug body
  Step Machined in Body Helps Retain Seat Under High Pressure
  Max-Seal valves are designed for bubble tight shutoff in either direction of flow. Each valve is factory tested to 110% of their pressure rating

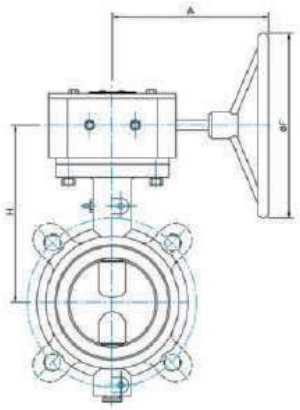
Blowout-proof stem design
A heavy duty butterfly valve, designed for ANSI Class 125/150 flanges. These comply with MSS-SP25, MSS-SP67, & the requirements of MIL-V-22133C (ship) Type 1, Class A-D
Valve sizes up to 16" meet API 609 standard;
Sizes 18"-24" with fine thread drilling meet API 609 standard

- **Positive Valve Position:**
  When the handle is parallel to the pipe, the valve is fully open. The orientation of the disc is indicated by a groove at the shaft end that is in line with the disc.
  See Tech Bulletin 608-19 for bolting information

Vacuum Service up to 28" Hg

HANDLE AND GEAR OPERATOR DIMENSIONS





Level-Lock 10 Position Type Handle

Size	2”	2.5”	3”	4”	5”	6”	8”	10”	12”
H	5.19	5.84	6.16	7.25	7.38	7.94	11.19	12.97	13.56
A	10.5	10.5	10.5	10.5	10.5	10.5	14	14	20

Gear Operator

Size	2”	2.5”	3”	4”	5”	6”	8”	10”	12”	14”	16”	18”	20”	24”
H	5.41	6.07	6.38	7.48	7.60	8.16	11.13	12.91	13.45	16.13	18.27	21.42	21.42	24.92
F	5.9	5.9	5.9	5.9	5.9	5.9	11.8	11.8	11.8	11.8	11.8	11.8	11.8	15.35
A	6	6	6	6	6	6	9.84	9.84	9.84	10.94	10.94	10.94	10.49	12.05

VALVE FLOW COEFFICIENTS & TECHNICAL DATA

Max-Seal Valves are ideally suited for actuated applications

Seat Temperature Range

Material	Temperature Range
Buna-N (NBR)	0° to 200° F
EPDM	-40° to 275° F
VITON	0° to 300° F
Neoprene	-60° to 200° F
Hypalon	-40° to 250° F

Different seat and seat backing available consult factory

ACTUATOR MOUNTING

Max-Seal Offers a broad line of automation systems for precise proportioning of on-off control in either pneumatic or electronically powered units.

Cast Mounting Flange Accommodates all types of operators, offering two sets of slotted bolted circles ISO 5211 and industry popular type. It is designed to accept direct actuator mounting, some sizes may require a spacer plate.

Max-Seal Models 51, 51 Cv Value

Size		Angle of Opening								
INCH	MM	10°	20°	30°	40°	50°	60°	70°	80°	90°
2	50	0.1	5	12	24	45	64	90	125	135
2½	65	0.2	8	20	37	65	98	144	204	220
3	80	0.3	12	22	39	70	116	183	275	302
4	100	0.5	17	36	78	139	230	364	546	600
5	125	0.8	29	61	133	237	392	620	930	1022
6	150	2	45	95	205	366	605	958	1437	1579
8	200	3	89	188	408	727	1202	1903	2854	3136
10	250	4	151	320	694	1237	2047	3240	4859	5340
12	300	5	234	495	1072	1911	3162	5005	7505	8250

Streamlined Disc Design Reduces Pressure Drop and Maximizes Cv

Performance Series Torque Value

Size		Pressure Differential		
INCH	MM	50 psi	100 psi	200 psi
2	50	127	147	170
2½	65	135	168	193
3	80	206	225	259
4	100	350	387	445
5	125	525	605	646
6	150	825	997	1147
8	200	1495	1864	2144
10	250	2420	3140	3611
12	300	3612	4767	5482

All torques shown in the above chart can be used for both seating and unseating. Figured for wet service defined as lubricated clean and non abrasive line media.

MAX SEAL® Valves & Controls

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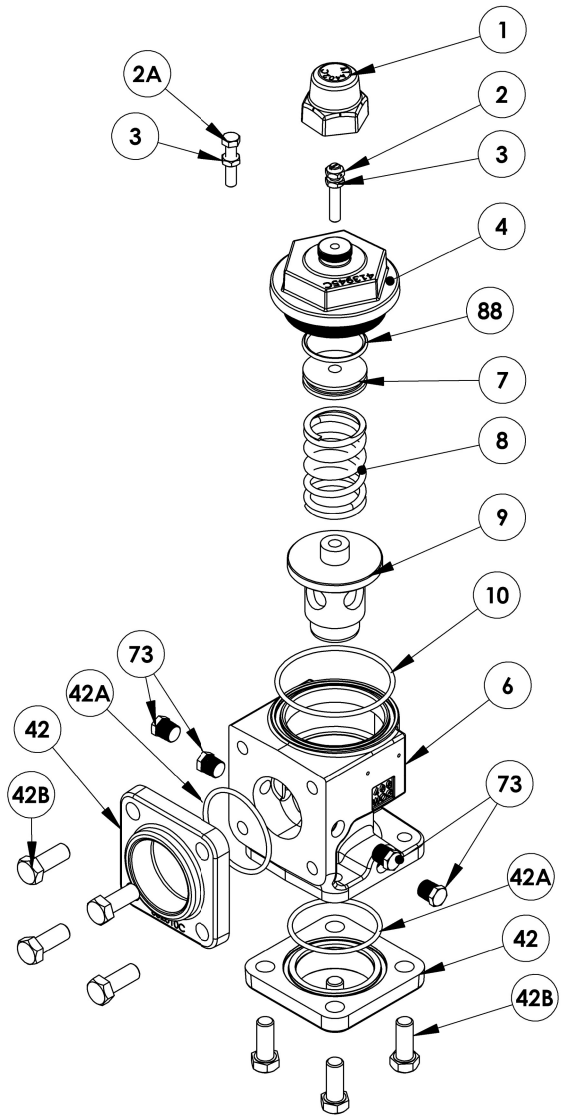
BLACKMER DIFFERENTIAL BYPASS VALVES

MODEL: BV2A

DISCONTINUED MODEL BV2

PARTS LIST WITH INSTALLATION AND OPERATION INSTRUCTIONS



PARTS LIST

Ref. No.	Description	Parts Per Unit	Part No.
1	Cap	1	414402
2	Adjusting Stud & Nut Asy. (91-125 psi) (std)	1	*
2A	Adjusting Screw (20 - 40 psi)	1	437803
	Adjusting Screw (41 - 70 psi)		437803
	Adjusting Screw (71 - 90 psi)		437803
	Adjusting Screw (126 - 150 psi)		433905
3	Locknut	1	922923
4	Cover	1	413945
6	Body	1	403945
7	Spring Guide	1	423953
8	Spring (20 - 40 psi)	1	471803
	Spring (41 - 70 psi)		471805
	SS Spring (41 - 70 psi)[1,3]		471815
	Spring (71 - 90 psi)		471811
	Spring (91 - 125 psi) (Std.)		471806
	Spring (126 - 150 psi)		471810
9	Valve (with pressure equalizing hole)	1	453942
10	O-Ring - Cover (Buna-N) (Std.)	1	701916
	O-Ring - Cover (FKM)[1,3]		711959
42	Flange - 2" NPT (Std.)	2	652010
	Flange - 2" Slip-on Weld **		652024
	Flange - 2" Socket Weld EI		655109
	Flange – 1.25" NPT		652029
	Flange – 1.5" NPT		652028
	Flange – 1.25" Slip-on Weld		652027
	Flange – 1.5" Slip-on Weld		652026
42A	O-Ring – Flange (Buna-N) (Std.) **	2	702004
	O-Ring – Flange (FKM)[1,3]		702086
42B	Capscrews – Flange	8	920491
73	Pipe Plug – ¼" NPT	4	908198
88	O-Ring Spring Guide (Buna-N)	1	711916
	O-Ring - Spring Guide (FKM)[1,3]		711908

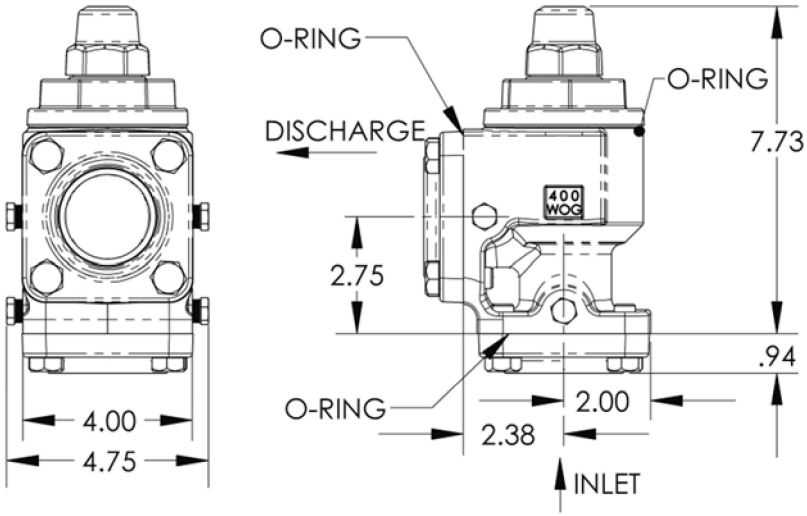
* Assembly is not a saleable part; preset at factory.

** Weld Flange O-rings before Nov 2002: 701919 Buna-N, 711929 FKM[1]

[1] Not-U.L. Listed.

[3] For MAPP Gas; use FKM O-rings and SS spring together.

DIMENSIONS



CAUTION

Bypass valve with welded connections

The bypass valve contains three O-ring seals that will be damaged if welding is done with these O-rings installed.

Prior to welding the piping, remove the O-rings from the inlet and outlet flanges and the bypass cover (see Figure 1). Reinstall the inlet and outlet flanges and weld the piping. Then reinstall the three O-rings.

INSTALLATION AND OPERATION

NOTICE

Blackmer bypass valves **must** only be installed in LPG & NH_3 systems that have been designed by qualified engineering personnel and operated and maintained by qualified technicians. The system **must** conform to all applicable local and national regulations and safety standards (specifically, LPG systems **must** conform to NFPA 58). This manual **must** be kept with the bypass valve and be reviewed **before** installation, putting into operation or performing any maintenance work.

Do not attempt to open the pump or external bypass valve until you have bled off the pressure. On systems with meters, the differential valve will keep liquid under pressure in the pump, meter and piping even when the hose is emptied.

FLOW RATING - BV2A

	*Normal Maximum Rated Flow - GPM (LPM)			
Liquid Viscosity	**at 20 psi** (1.38 bar)	**at 50 psi** (3.45 bar)	**at 80 psi** (5.52 bar)	**at 120 psi** (8.27 bar)
100 SSU (22 Cs) - Propane, Gasoline	150 (568)	180 (681)	220 (833)	250 (946)
500 SSU (105 Cs)	120 (454)	150 (568)	180 (681)	210 (795)
1000 SSU (220 Cs)	100 (379)	135 (511)	165 (625)	195 (738)
3000 SSU (630 Cs)	80 (303)	120 (454)	150 (568)	180 (681)
5000 SSU (1050 Cs)	60 (227)	100 (379)	130 (492)	160 (606)

* This is the maximum flow that will pass through the external bypass valve without an increase in pressure over the valve differential pressure setting.

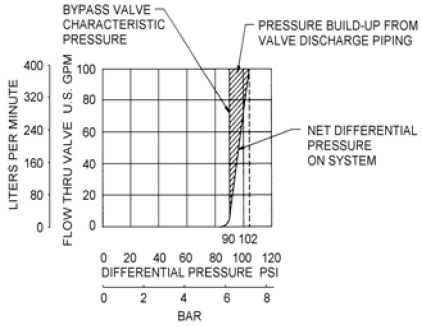
INSTALLATION

On liquefied gas systems, an external bypass valve, piped back to the supply tank, is necessary for maximum pump performance and longer pump life. The bypass valve must be installed in the correct position on the discharge side of the pump. (An arrow cast on the valve body indicates intake and discharge.) The bypass valve will automatically prevent excessive pressure resulting from accidental pump overspeeding, discharge shut-off, or highly restrictive receiving systems.

Size the external bypass valve and its piping to accommodate the full flow from the pump when the pump's discharge line is closed and the pump is running at its rated maximum speed.

When installing the external bypass valve, it is essential that the pipe and fittings from the discharge port of the bypass valve be sized properly. Excessive back pressure resulting from friction loss in the bypass valve discharge piping will cause a higher pressure than the actual bypass valve setting.

For example, a BV2A bypass valve has a characteristic pressure when set at 90 psi (6.21 bar) as shown on the following curve. If the friction loss through the bypass valve, discharge pipe and fittings (pipe, elbows, tees, shut-off valve, check valve, etc.) is 12 psi (.84 bar) at 100 gpm (379 lpm) flow rate, then the actual differential pressure in the system will rise under bypass conditions, as illustrated on the curve.



For more information on sizing and friction loss, refer to the Blackmer Liquefied Gas Handbook - Bulletin 500-001 (or Bulletin 33 for other liquids) for pipe friction tables.

On liquefied gas systems, the external bypass valve discharge must be piped back to the liquid or vapor section of the supply tank never to the pump inlet. This method of piping should also be used when pumping volatile liquids from an underground tank or at high vacuum.

OPERATION

Unless otherwise specified, the standard BV2A external bypass valves are factory set at 125 psi (8.62 bar) differential pressure for LP-Gas and NH_3 service, per Underwriters Laboratories. Optional spring ranges are available.

Pressure Equipment Directive design life expectancy is 10 years.

NOTICE:

At temperatures below -20° F (-28.9° C) materials have reduced impact strength. Provisions should be made to prevent tools and other objects from impacting any pressure containing components of the pumping system.

Annual inspection and testing of the internal relief valve (if applicable) and the external bypass valve operation and setting is recommended.

To check the pump's internal relief valve setting and the external bypass valve setting, follow these steps:

1. Install a pressure gauge equipped with a needle valve or snubber in the pump discharge gauge port. Install a pressure gauge on the tank and record the tank pressure.
2. Connect the delivery hose to the receiving tank.
3. Check all valves. The shut-off valve in the pump's discharge line, and the shut-off valve in the external bypass return line should be open.
4. Start pumping at the normal rate. Make sure the supply tank outlet valve is wide open and check the direction of shaft rotation to be sure it matches the direction of the arrow on the pump.
5. Check the pressure setting of the pump's internal relief valve (when applicable) with the following procedure:

   First gradually close the shut-off valve in the external bypass return line.

   Then slowly close the shut-off valve in the pump's discharge line while watching the gauge pressure on the discharge side of the pump. Record the peak differential pressure (the difference between the discharge and inlet pressure) when the internal relief valve begins to open. NOTE: It is important to read the peak pressure just before the pump relief valve opens. Once recirculation starts through the internal relief valve, vaporization will cause the pressure to fall quickly. For more information on the relief valve settings and adjustments, refer to the installation instructions for the specific pump.
6. After the internal relief valve setting has been determined, reopen the shut-off valve in the pump's discharge line and the shut-off valve in the external bypass return line. Continue pumping at the normal rate.
7. To check the external bypass valve setting, gradually close the shut-off valve in the pump's discharge line and record the gauge pressure. The difference between this reading and the tank pressure (before pumping) is the external bypass valve setting.

   The external bypass valve must be set at least 25 psi (1.72 bar) less than the pump's internal relief valve setting. This pressure setting will ensure that the liquid does not recirculate through the relief valve, and thus cause excessive pump wear and noise.

   Reopen the shut-off valve in the pump's discharge line and resume normal pumping operation. Record the discharge gauge pressure. The difference between this reading and the tank pressure (before pumping) is the normal system operating pressure.

   If possible*, the external bypass valve setting should also be at least 15 psi (1.03 bar) higher than the normal system operating pressure. Operating pressures nearing the external bypass valve setting may mean liquid is being recirculated unnecessarily. *A lower external bypass valve setting may be necessary with smaller motors.

   If necessary, adjustment to the external bypass valve can be made by removing the valve cap and loosening the locknut. **WARNING: Do not remove the valve cap on the external bypass valve until you have bled off the pressure.** To increase the pressure setting, turn the adjusting stud and nut assembly (or adjusting screw) inward, or clockwise. To reduce the pressure setting, turn the adjusting stud and nut assembly (or adjusting screw) outward, or counterclockwise.

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BLACKMER POWER PUMPS

961224
INSTRUCTIONS NO. 101-C00

INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS
MODELS: GNX(H)2A, GNX(H)2.5A, GNX(H)3A, GNX(H)4A

Section	101
Effective	June 2024
Replaces	June 2023

TABLE OF CONTENTS Page

NOTE: Numbers in parentheses following individual parts indicate reference numbers on Blackmer Parts Lists.

Blackmer pump manuals and parts lists may be obtained from Blackmer's website (www.blackmer.com) or by contacting Blackmer Customer Service.

PUMP	PUMP PARTS LIST			
MODEL	2”	2.5”	3”	4”
GNX(H)	101-C01	101-C02	101-C03	101-C04

SAFETY DATA

This is a SAFETY ALERT SYMBOL.
When you see this symbol on the product, or in the manual, look for one of the following signal words and be alert to the potential for personal injury, death or major property damage

DANGER
Warns of hazards that WILL cause serious personal injury, death or major property damage.

WARNING
Warns of hazards that CAN cause serious personal injury, death or major property damage.

CAUTION
Warns of hazards that CAN cause personal injury or property damage.

NOTICE:
Indicates special instructions which are very important and must be followed.

NOTICE:

Blackmer Pumps **MUST** only be installed in systems, which have been designed by qualified engineering personnel. The system **MUST** conform to all applicable local and national regulations and safety standards.

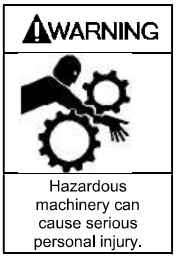
This manual is intended to assist in the installation and operation of the Blackmer power pumps, and **MUST** be kept with the pump.

Pump service shall be performed by qualified technicians **ONLY**. Service shall conform to all applicable local and national regulations and safety standards.

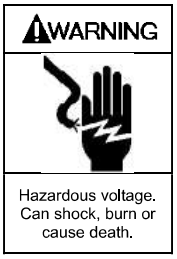
Thoroughly review this manual, all instructions and hazard warnings, **BEFORE** performing any work on the pump.

Maintain **ALL** system and pump operation and hazard warning decals.

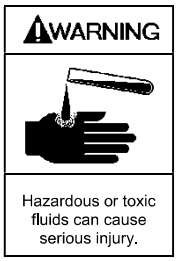
SAFETY DATA



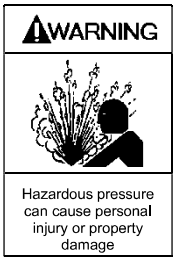
Failure to disconnect and lockout electrical power or engine drive before attempting maintenance can cause severe personal injury or death



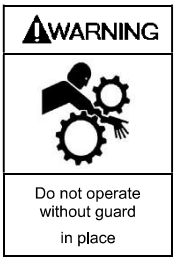
Failure to disconnect and lockout electrical power before attempting maintenance can cause shock, burns or death



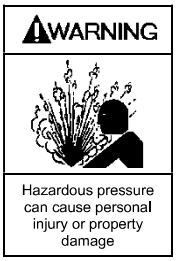
If pumping hazardous or toxic fluids, system must be flushed and decontaminated, inside and out, prior to performing service or maintenance



Disconnecting fluid or pressure containment components during pump operation can cause serious personal injury, death or major property damage



Operation without guards in place can cause serious personal injury, major property damage, or death.



Failure to relieve system pressure prior to performing pump service or maintenance can cause personal injury or property damage.

PUMP DATA

PUMP IDENTIFICATION

A pump Identification tag, containing the pump serial number, I.D. number, and model designation, is attached to each pump. It is recommended that the data from this tag be recorded and filed for future reference. If replacement parts are needed, or if information pertaining to the pump is required, this data must be furnished to a Blackmer representative.

TECHNICAL DATA

	2", 2.5"	3"	4"
Maximum Pump Speed	815 RPM	700 RPM	563 RPM
Maximum Viscosity	20,000 SSU (4,250 cP)		
Maximum Operating Temperature *	240 – 300°F (115 – 149°C)		
Maximum Differential Pressure	125 psi (8.6 Bar)		
Maximum Working Pressure	175 psi (12.1 Bar)		

* Maximum operating limits are dependent on the materials of construction. See Blackmer Material Specs 101-096.

INITIAL PUMP START UP INFORMATION

Model No.: _____

Serial No.: _____

ID No.: _____

Date of Installation: _____

Inlet Gauge Reading: _____

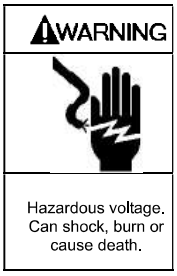
Discharge Gauge Reading: _____

Flow Rate: _____

INSTALLATION

NOTICE:

Blackmer pumps must only be installed in systems designed by qualified engineering personnel. System design must conform with all applicable regulations and codes and provide warning of all system hazards.



Install, ground and wire to local and National Electrical Code requirements.

Install an all-leg disconnect switch near the unit motor.

Disconnect and lockout electrical power before installation or service

Electrical supply MUST match motor nameplate specifications.

Motors equipped with thermal protection automatically disconnect motor electrical circuit when overload exists. Motor can start unexpectedly and without warning.

PRE-INSTALLATION CLEANING

NOTICE:

New pumps contain residual test fluid and rust inhibitor. If necessary, flush pump prior to use.

Foreign matter entering the pump WILL cause extensive damage. The supply tank and intake piping MUST be cleaned and flushed prior to pump installation and operation.

LOCATION AND PIPING

Pump life and performance can be significantly reduced when installed in an improperly designed system. Before starting the layout and installation of the piping system, review the following:

1. Locate the pump as near as possible to the source of supply to avoid excessive inlet pipe friction.
2. The inlet line MUST be at least as large as the intake port on the pump. The inlet piping should slope downward to the pump without any upward loops. Eliminate restrictions such as sharp bends; globe valves, unnecessary elbows, and undersized strainers.
3. It is recommended a strainer be installed in the inlet line to protect the pump from foreign matter. The strainer should be located at least 24" (0.6m) from the pump, and have a net open area of at least four times the area of the intake piping. For viscosities greater than 1000 SSU, consult the strainer manufacture instructions. Strainers must be cleaned regularly to avoid pump starvation.
4. The intake system must be free of air leaks.
5. Expansion joints, placed at least 36" (0.9m) from the pump, will compensate for expansion and contraction of the pipes. Contact the flexible connector/hose manufacturer for required maintenance/care and design assistance in their use.
6. Install pressure gauges in the NPT ports provided in the pump casing to check pump at start up.
7. ALL piping and fittings MUST be properly supported to prevent any piping loads from being placed on the pump.
8. Check alignment of pipes to pump to avoid strains which might later cause misalignment. See Figure 1. Unbolt flanges or break union joints. Pipes should not spring away or drop down. After pump has been in operation for a week or two, completely recheck alignment.

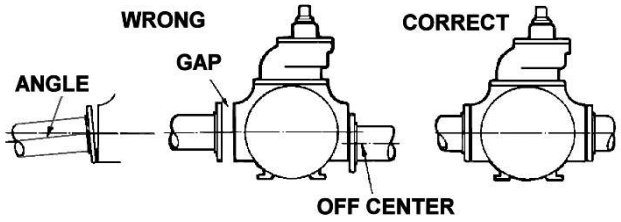


Figure 1

9. When pumping liquids at elevated temperature, provisions should be made to compensate for expansion and contraction of the pipes, especially when long pipe lines are necessary. Steel pipe expands approximately 3/4" (1.9 cm) per 100 feet (30.49 m) per 100°F (37.8°C) rise in temperature.

PUMP MOUNTING

A solid foundation reduces noise and vibration, and will improve pump performance. On permanent installations it is recommended the pumping unit be secured by anchor bolts as shown in Figure 2. This arrangement allows for slight shifting of position to accommodate alignment with the mounting holes in the base plate.

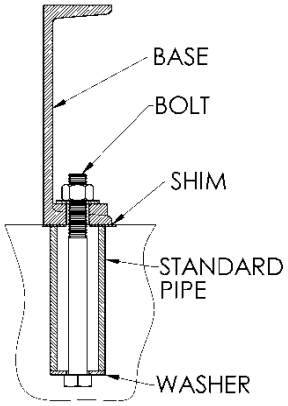


Figure 2 - Pipe Type Anchor Bolt Box

For new foundations, it is suggested that the anchor bolts be set in concrete. When pumps are to be located on existing concrete floors, holes should be drilled into the concrete to hold the anchor bolts.

When installing units built on channel or structural steel type bases, use care to avoid twisting the base out of shape when anchor bolts are tightened. Shims should be used under the edges of the base prior to tightening of the anchor bolts to prevent distortion.

COUPLING ALIGNMENT – FOOTED GEARBOX

The following pertains to units with non-standard, footed gearboxes only. Standard GNX(H) units will not require manual alignment.

The pump must be directly coupled to a gear and/or driver with a flexible coupling. Verify coupling alignment after installation of new or rebuilt pumps. Both angular and parallel coupling alignment MUST be maintained between the pump, gear, motor, etc. in accordance with manufacturer's instructions. See Figure 3.

1. Parallel alignment: The use of a laser alignment tool or dial indicator is preferred. If a laser alignment tool or dial indicator is not available, use a straightedge. Turn both shafts by hand, checking the reading through one complete revolution. Maximum offset should be less than .005" (.127 mm).
2. Angular alignment: Insert a feeler gauge between the coupling halves. Check the spacing at 90° increments around the coupling (four checkpoints). Maximum variation should not exceed .005" (.127 mm). Some laser alignment tools will check angular alignment as well.
3. Replace the coupling guards after setting alignment.

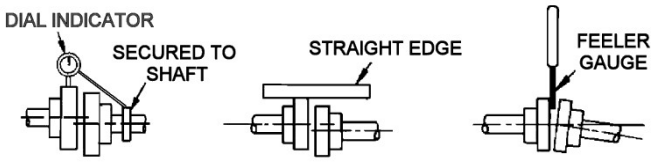
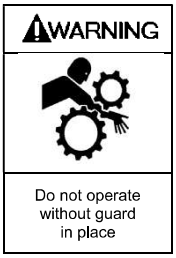


Figure 3 – Alignment Check

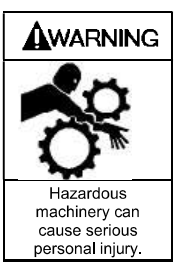


Operation without guards in place can cause serious personal injury, major property damage, or death.

ALIGNMENT – GNX(H) MODELS

The motor, gearbox, and pump are rigidly connected with bolted, flange connections. These flanges ensure the motor shaft, gearbox shafts, and pump shaft are aligned correctly, without the need for manual alignment. However, due to variations in base and foundation geometry the unit will require shimming to reduce stress on the gearbox and pump adapter. See *PRESTART CHECKLIST* section for details.

NEMA MOTOR COUPLING ADAPTER



Failure to disconnect and lockout electrical power or engine drive before attempting maintenance can cause severe personal injury or death

Motor adapters allow for easy installation and removal of industry standard motors. Motor adapters consist of a coupling and an adapter housing that connects the motor to the gear reducer.

NORD Gear supplies a coupling that is to be mounted on the motor shaft. It is important that the coupling is properly positioned.

• For NEMA Input Adapters, follow the Motor Installation Instructions on page 5.
• For IEC Input Adapters, the supplied coupling will mount directly against the motor shaft shoulder. No locating measurements need to be taken.

Couplings

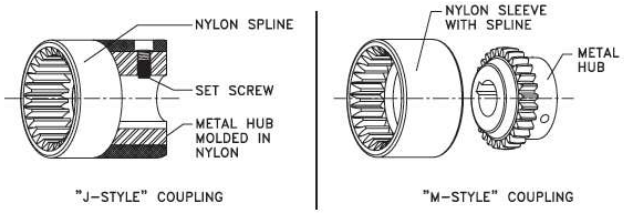
Couplings are made with tough abrasion resistant materials, which resist most chemicals and petroleum products. They are electrically isolated (prevent metal to metal contact) and require no lubrication or maintenance. Depending upon the size of the C-face input, NORD provides either a gear or a jaw type coupling.

NORD supplies three different types of couplings depending on the size of input: "J" style, "M" style and "Jaw" style coupling.

Following are instructions on how to properly mount each type of coupling onto the motor.

BoWex® Couplings

NORD C-face adapter input shafts have a machined spline on the end. NORD incorporates two styles of BoWex® couplings, the "J" and "M" styles. The "J" style is a one-piece coupling with a metal hub and nylon spline. The "M" style is a two-piece coupling – the metal hub and a nylon sleeve. Nylon and steel components allow them to operate in high ambient temperatures without lubrication or maintenance.
• Nylon sleeves resist dirt, moisture, most chemicals and petroleum products
• No lubrication required
• Operating Conditions: -22ºF - 212ºF (-30ºC - 100ºC)
• Higher temperature coupling sleeve available up to 250ºF (120ºC)
• Special bore available



NEMA Motor Coupling Styles

BoWex® Couplings Mechanical Ratings "J" Style (NEMA & IEC)

Coupling Type	Rated Torque Cont. (Lb-in) (N-m)	Peak (Lb-in) (N-m)	Input Adapter Sizes	Bore Size
BoWex® J14	44.3 5	88.5 10	N56C	5/8"
BoWex® J24	106 12	212 24	N140TC	7/8"
BoWex® J28	398 45	1,195 135	N180TC N180TC1	1-1/8"

BoWex® Couplings Mechanical Ratings "M" Style (NEMA & IEC)

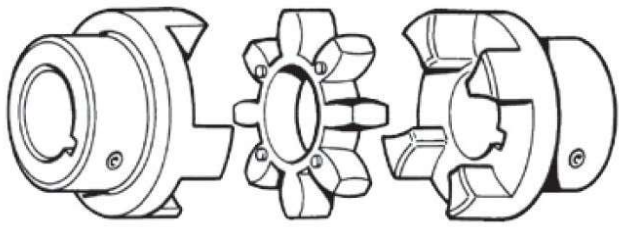
Coupling Type	Rated Torque Cont. (Lb-in) (N-m)	Peak (Lb-in) (N-m)	Input Adapter Sizes	Bore Size
BoWex® M38	708 80	2,124 240	N180TC, N210TC, N250TC*	1-1/8", 1-3/8"
BoWex® M42	885 100	2,655 300	N250TC*	1-5/8"
BoWex® M48	1,239 140	3,717 420	N280TC	1-7/8"

*GNX(H)2/2.5 N250TC Frame size uses BoWex® M38
*GNX(H)3/4 N250TC Frame size uses BoWex® M42

Rotex® Couplings

The cast iron jaw type couplings have an integral urethane "spider" that provides smooth transmission of the motor torque. A set screw on the coupling prohibits axial movement along the motor shaft.

- Excellent shock and vibration dampening
- Excellent resistance to oils and most chemicals
- No metal-to-metal contact
- Operating Conditions: -22ºF - 195ºF (-30ºC - 90ºC)
- Higher temperature material (Hytrel) spider available up to 230ºF (110ºC)
- Low temperature materials available upon request
- Special bores available

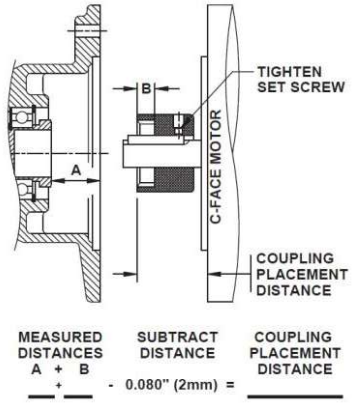


Rotex® Couplings Mechanical Ratings "R" Style (NEMA & IEC)

Coupling Type	Rated Torque Cont. (Lb-in) (N-m)	Peak (Lb-in) (N-m)	Input Adapter Sizes	Bore Size
Rotex® R65	5,532 625	11,063 1,250	N320TC	2-3/8"
Rotex® R90	21,242 2400	42,484 4800	N360TC	1-5/8"

"J" Style Coupling NEMA C-face Motor Installation

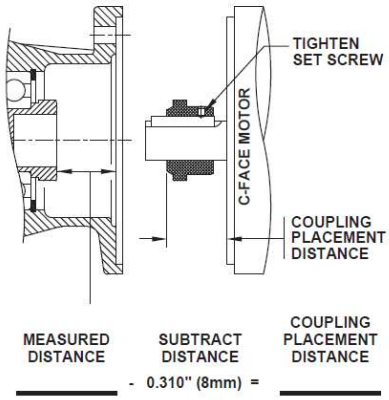
1. Measure the distance from the face of the input adapter to the face of the splined shaft and record that measurement as A in the equation below.
2. Measure depth of coupling engagement zone and record the measurement as "B" in the equation below.
3. Add "A" + "B" and subtract 0.08" (~2mm) from the distance. This needs to be done so that the coupling will not be preloaded after installation!
4. Use that measurement to locate the coupling from the face of the motor onto the shaft.
5. Once in place, tighten the set screw to lock the coupling in place. It is recommended that the key is staked or bonded (Loctite® 262) in place to prohibit the key from vibrating out.
6. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



"J" Style NEMA Motor Coupling Installation

"M" Style Coupling NEMA C-face Motor Installation

1. Measure the distance from the face of the input adapter to the face of the splined shaft & record that measurement.
2. Subtract 0.31" (~8mm) from the distance. This needs to be done so that the coupling will not be preloaded after installation!
3. Use that measurement to locate the coupling from the face of the motor onto the shaft.
4. Apply Loctite® 7471 (primer) to the key, keyway, set screws, and threaded holes in the hub. Wait 60 seconds to dry.
5. Apply Loctite® 262 to key and install into shaft. Apply Loctite® 262 to setscrews.
6. Once in place, tighten the set screws to 156 in-lbf to lock the coupling in place.
7. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



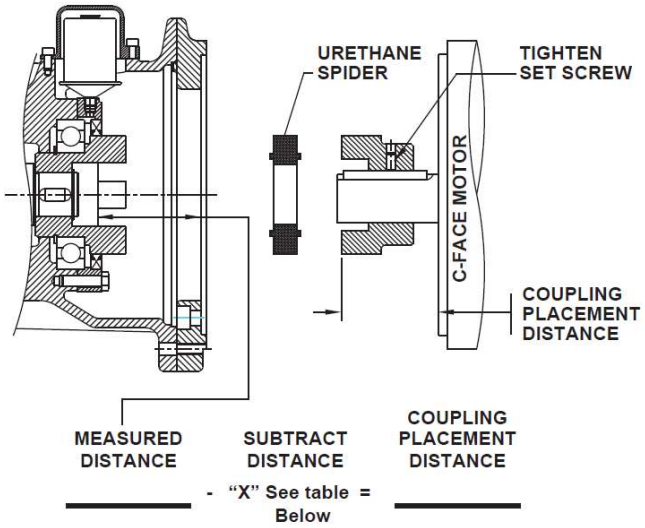
"M" Style NEMA Motor Coupling Installation

"Jaw" Style Coupling NEMA C-face Installation

1. Measure the distance from the face of the input adapter to the face of the coupling as shown and record that measurement.
2. Subtract the "X" dimension from the measured distance. This needs to be done so that the coupling will not be preloaded after installation!
3. Use that measurement to locate the coupling from the face of the motor onto the shaft.
4. The metal portion of the coupling should be heated up prior to assembly, generally 250ºF to 300ºF (120ºC to 150ºC).

Notice: DO NOT HEAT URETHANE SPIDER

5. Once in place, tighten the setscrew to lock coupling in place. Let the coupling cool down before placing the spider into the jaws. It is recommended that the key is staked or bonded (Loctite) in place to prohibit the key from vibrating out.
6. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit bolts from becoming loose from vibration.



Jaw Style NEMA Motor Coupling Installation

Coupling Size	"X" (Subtract this value from measured distance)
R14	0.06" (1.5 mm)
R19 & 24	0.08" (2.0 mm)
R28	0.10" (2.5 mm)
R38 & 42	0.12" (3.0 mm)
R48	0.14" (3.5 mm)
R65	0.18" (4.5 mm)
R90	0.22" (5.5 mm)

PUMP ROTATION

A right-hand pump rotates clockwise with the intake and relief valve on the right side, when viewed from the driven end.

A left-hand pump rotates counterclockwise with the intake and relief valve on the left side, when viewed from the driven end.

NOTICE:

On GNX(H) models, the gear reducer input shaft will rotate in the opposite direction of the pump shaft. For example, on a right-hand GNX(H) pump, the gear reducer shaft will rotate counterclockwise. The motor fan can be used to ensure proper rotation.

NOTICE:

Confirm correct pump rotation by checking the pump rotation arrows respective to pump driver rotation.

TO CHANGE PUMP ROTATION

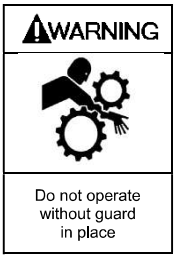
To reverse rotation, the pump must be disassembled then reassembled with the shaft on the opposite side of the pump. See the 'Maintenance' section for instructions.

CHECK VALVES

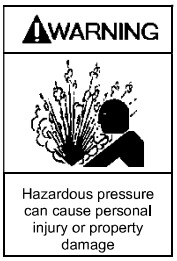
The use of check valves or foot valves in the supply tank is not recommended with self-priming, positive displacement pumps.

If the possibility of liquid backflow exists when the pump is off, a check valve in the pump discharge piping is recommended because the pump can motor in the reverse rotation and create undue stress on all attached components. Never start a pump when it is rotating in the reverse rotation as the added starting torque can damage the pump and related equipment.

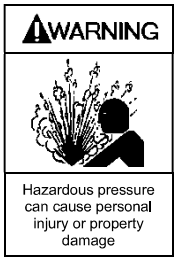
OPERATION



Operation without guards in place can cause serious personal injury, major property damage, or death.



Disconnecting fluid or pressure containment components during pump operation can cause serious personal injury, death or major property damage



Failure to relieve system pressure prior to performing pump service or maintenance can cause personal injury or property damage.

Pumps operating against a closed valve can cause system failure, personal injury and property damage

PRE-START UP CHECK LIST

1. Check the alignment of the pipes to the pump. Pipes should be supported so that they do not spring away or drop down when pump flanges or union joints are disconnected.
2. Verify proper coupling alignment on long coupled units.
3. For GNX(H) models:
   - 3a. Bolt down the pump foot, while supporting the motor with an appropriate lifting device (e.g. crane)
   - 3b. Place a .125" thick shim under each of the motor mounting holes
   - 3c. Slowly lower the motor until it is unsupported
   - 3d. Try pulling out each of the shims, while noticing the the pull tension
   - 3e. If the shims closest to the motor shaft easily pull out, increase the shim thickness the same at all locations and recheck
   - 3f. If the shims furthest from the motor shaft easily pull out, decrease the shim thickness the same at all locations and recheck
   - 3g. The unit is properly shimmed when all 4 motor shims have the same amount of tension when pulled
   - 3h. Bolt down the motor with the appropriate fastener.
4. The GNX(H)2 and GNX(H)2.5 gearbox will be shipped with Mobil SHC630 synthetic oil. The GNX(H)3 and GNX(H)4 will be shipped with Mobil SHC Gear 220 synthetic oil. If replacing the oil, refer to the **GEAR REDUCER MAINTENANCE** section.

NOTICE:

The GNX(H) Gear Reducer is shipped with the correct amount of synthetic oil. If the unit will be orientated in a non-standard way, please consult the factory for lubrication information

5. **On GNX(H) models shipped without the gear reducer attached, the inboard bearings are NOT greased at the factory. The inboard bearing MUST be greased after installation of the gear reducer and prior to initial pump start up.** See "Pump Lubrication" in the Maintenance section of this manual.
6. Check the entire pumping system to verify that the proper inlet and discharge valves are fully open, and that the drain valves and other auxiliary valves are closed.
7. Install vacuum and pressure gauges on the pump in the 1/4" NPT connections provided to check suction and discharge conditions after pump start-up.
8. Check the wiring of the motor, and briefly turn on the power to make sure that the pump rotates in the direction of the rotation arrow.

START UP PROCEDURES

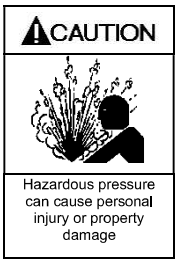
NOTICE:

Consult the "General Pump Troubleshooting" section of this manual if difficulties during start up are experienced.

1. Start the motor. Priming should occur within one minute.
2. Check the suction and discharge pressure to see if the pump is operating within the expected conditions. Record pressures in the 'Initial Start Up Information' section.
3. Check for leakage from the piping and equipment.
4. Check for overheating, excessive noise or vibration of the pump, reducer, and motor.
5. Check the flow rate to ensure the pump is operating within the expected parameters. Record flow rate in the 'Initial Start Up Information' section.
6. Check the pressure setting of the relief valve by briefly closing a valve in the discharge line and reading the pressure gauge. This pressure should be 20 psi (1.4 bar) higher than the maximum operating pressure.

   Do not run the pump for more than 15 seconds with the discharge valve completely closed.

   If adjustments need to be made, refer to "Relief Valve Setting & Adjustment."



Incorrect settings of the pressure relief valve can cause pump component failure, personal injury, and property damage.

RUNNING THE PUMP IN REVERSE ROTATION

NOTICE:

Pump should be operated in reverse rotation for no more than 10 minutes and only when a separate pressure relief valve is installed to protect the pump from excessive pressure.

It may be desirable to run the pump in reverse rotation for system maintenance. The pump will operate satisfactorily in reverse rotation for a LIMITED time, **at a reduced performance level.**

FLUSHING THE PUMP

NOTICE:

If flushing fluid is to be left in the pump for an extended time, it must be a lubricating, non-corrosive fluid. If a corrosive or non-lubricating fluid is used, it must be flushed from the pump immediately.

1. To flush the pump, run the pump with the discharge valve open and the intake valve closed. Bleed air into the pump through the intake gauge plug hole or through a larger auxiliary fitting in the intake piping. Pump air for 30 second intervals to clean out most of the pumpage.
2. Run a system compatible flushing fluid through the pump for one minute to clear out the remainder of the original pumpage.
3. To remove the flushing fluid, follow step 1 above.

NOTICE:

After flushing the pump some residual fluid will remain in the pump and piping.

NOTICE:

Properly dispose of all waste fluids in accordance with the appropriate codes and regulations.

PUMP RELIEF VALVE

NOTICE:

The pump internal relief valve is designed to protect the pump from excessive pressure and must not be used as a system pressure control valve.

GNX(H) series pumps are fitted with an internal pressure relief valve that bypasses back to the suction side of the pump.

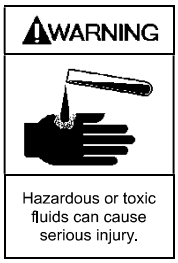
Pumping volatile liquids under suction lift may cause cavitation. Partial closing of the discharge valve WILL result in internal relief valve chatter and is NOT recommended. For these applications, install an external system pressure control valve, and any necessary bypass piping, back to the storage tank.

A system pressure control valve is also recommended when operating for extended periods (more than 1 minute) against a closed discharge valve.

RELIEF VALVE SETTING AND ADJUSTMENT

The relief valve pressure setting is marked on a metal tag attached to the valve cover. Generally, the relief valve should be set at least 15 - 20 psi (1.0 - 1.4 Bar) higher than the operating pressure, or the external bypass valve setting (if equipped).

Incorrect settings of the pressure relief valve can cause pump component failure, personal injury, and property damage.



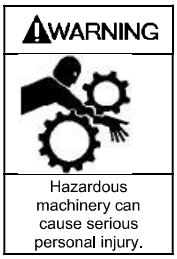
Relief valve cap is exposed to pumpage and will contain some fluid

DO NOT remove the R /V Cap OR adjust the relief valve pressure setting while the pump is in operation.

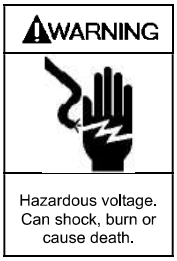
1. **To INCREASE the pressure setting,** remove the relief valve cap (1) and gasket (88). Loosen the locknut(3), if equipped. Turn the adjusting screw (2) *inward*, or clockwise. Inspect the R/V cap gasket (88) and replace as required. Reattach the R/V cap gasket and cap.
2. **To DECREASE the pressure setting**, remove the relief valve cap (1) and gasket (88). Loosen the locknut(3), if equipped. Turn the adjusting screw (2) out*ward*, or counterclockwise. Inspect the R/V cap gasket (88) and replace as required. Reattach the R/V cap gasket and cap.

Refer to the individual Blackmer pump parts lists for various spring pressure ranges. Unless specified otherwise, pumps are supplied from the factory with the relief valve adjusted to the mid-point of the spring range.

MAINTENANCE

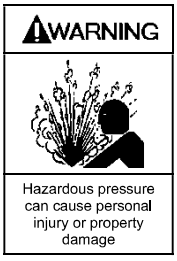


Failure to disconnect and lockout electrical power or engine drive before attempting maintenance can cause severe personal injury or death

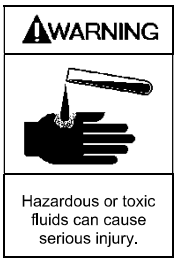


Failure to disconnect and lockout electrical power before attempting maintenance can cause shock, burns or death

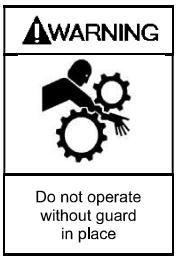
Failure to relieve system pressure prior to performing pump service or maintenance can cause personal injury or property damage.



Disconnecting fluid or pressure containment components during pump operation can cause serious personal injury, death or major property damage



If pumping hazardous or toxic fluids, system must be flushed and decontaminated, inside and out, prior to performing service or maintenance



Operation without guards in place can cause serious personal injury, major property damage, or death.

NOTICE:
Maintenance shall be performed by qualified technicians only. Follow the appropriate procedures and warnings as presented in this manual.

SCHEDULED MAINTENANCE

LUBRICATION

NOTICE:
To avoid possible entanglement in moving parts do not lubricate pump bearings, gear reducer or any other parts while the pump is running.

NOTICE:
The inboard bearings of GNX(H) models shipped without the gear reducer attached are NOT greased at the factory. The inboard bearing MUST be greased after installation of the gear reducer and prior to initial pump start up.

NOTICE:
If pumps are repainted in the field, ensure that the grease relief fittings (76A) are functioning properly after painting. Do NOT paint them closed. Remove any excess paint from the fittings.

Pump bearings should be lubricated every three months at minimum. More frequent lubrication may be required, depending on the application and operating conditions.

Recommended Grease:
Mobil® - Mobilgrease XHP222,
Exxon® - RONNEX MP Grease,
or equivalent Lithium grease..

Greasing Procedure:

1. Remove the grease relief fittings (76A) from the bearing covers (27, 27A).
2. **SLOWLY** apply grease with a hand gun until grease begins to escape from the grease relief fitting port. (76)
3. Replace the grease relief fittings (76A).

DO NOT overgrease pump bearings. While it is normal for some grease to escape from the grease tell-tale hole after lubrication, excessive grease on pumps equipped with mechanical seals can cause seal failure.

If equipped with a Blackmer gear reducer, refer to the 'Gear Reducer Lubrication' section of this manual.

STRAINERS

Strainers must be cleaned regularly to avoid pump starvation. Schedule will depend upon the application and conditions.

VANE REPLACEMENT

NOTICE:

Maintenance shall be performed by qualified technicians only. Follow the appropriate procedures and warnings as presented in manual.

1. Flush the pump per instructions in this manual. Drain and relieve pressure from the pump and system as required.
2. Remove the head assembly from the **outboard** (nondriven) side of the pump according to steps 5 - 8 in the "Pump Disassembly" section of this manual.
3. Turn the shaft by hand until a vane comes to the top (12 o'clock) position of the rotor. Remove the vane.
4. Install a new vane, ensuring that the rounded edge is UP, and the relief grooves are facing towards the direction of rotation. See Figure 4.
5. Repeat steps 3 and 4 until all vanes have been replaced.
6. Reassemble the pump according to the "Pump Assembly." section of this manual.

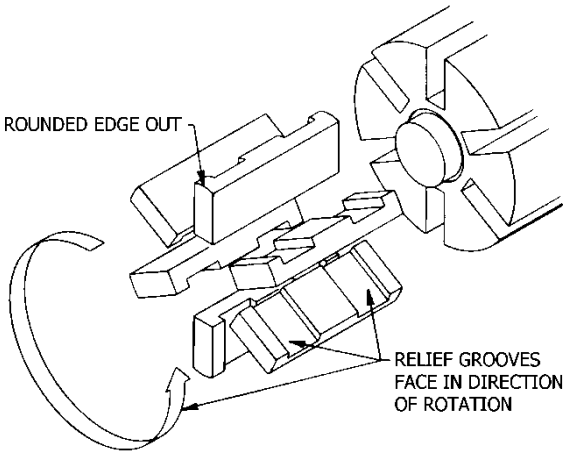


Figure 4 – Vane Replacement

PUMP DISASSEMBLY

NOTICE:

Follow all hazard warnings and instructions provided in the "Pump Maintenance" section of this manual.

1. Flush the pump per instructions in this manual. Drain and relieve pressure from the pump and system as required.
2. Remove the four adapter capscrews (20C) to release the adapter (135). Remove the motor mounting bolts. With the aid of a lifting device, slide the motor and gearbox away from the pump. Refer to "Gear Reducer Maintenance" for reducer disassembly instructions.
3. Starting on the **inboard** (driven) end of the pump, clean the pump shaft thoroughly, making sure the shaft is free of nicks and burrs. This will prevent damage to the mechanical seal when the inboard head assembly is removed.
4. Remove the outboard bearing cover capscrews (28) and the outboard bearing cover (27) and bearing cover gasket (26). Discard the bearing cover gasket.
5. **The GNX(H)2 and GNX(H)2.5** are equipped with locknuts (24A) and lockwashers (24B). To remove:
   a. Bend up the engaged lockwasher tang and rotate the locknut counterclockwise to remove it from the shaft.
   b. Slide the lockwasher off the shaft. Inspect the lockwasher for damage and replace as required.
   c. Repeat steps a and b on the opposite shaft end.
6. Remove the head capscrews (21). Gently pry the head away from the cylinder.
7. Slide the head off the shaft. The head O-ring (72), bearing (24), and mechanical seal (153) will come off with the head assembly. Remove and discard the head O-ring.
   a. Pull the bearing (24) from the housing in the head.
   b. To remove the mechanical seal, use two screw drivers against the backside of the seal jacket to gently push the seal from the head (see Figure 5. Use care when placing the screw drivers to prevent damage to the seal faces. Remove and discard the seal O-rings.

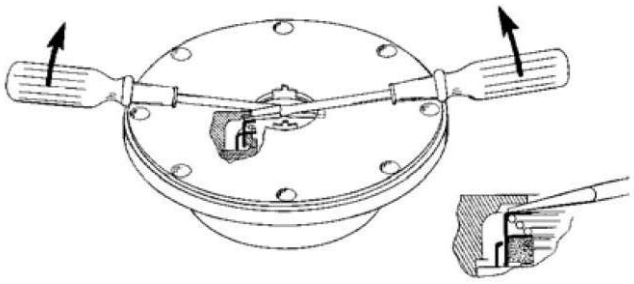


Figure 5 – Mechanical Seal Removal

8. Pull the rotor and shaft (13) from the cylinder. While one hand is pulling the shaft, the other hand should be cupped underneath the rotor to prevent the vanes (14) and push rods (77) from falling out. Carefully set the rotor and shaft aside for future vane replacement and reassembly.
9. Remove the remaining components from the outboard side of the pump, as instructed in steps 7 and 8 above.

PARTS REPLACEMENT

1. If any of the O-rings have been removed or disturbed during disassembly, they should be replaced with new O-rings.
   NOTE: PTFE O-rings should be heated in hot water to aid installation.
2. Excessive or continuous leakage from the tell-tale hole in the bearing cover may be an indication of a damaged mechanical seal. If a mechanical seal has been leaking, it is recommended the entire seal be replaced. Refer to "General Pump Troubleshooting" for possible causes of seal leakage.

PUMP ASSEMBLY

Before reassembling the pump, inspect all component parts for wear or damage, and replace as required. Wash out the bearing/seal recess of the head and remove any burrs or nicks from the rotor and shaft.

1. **Reassemble the OUTBOARD side of the pump first:** For a CLOCKWISE rotation pump, position the pump cylinder with the INTAKE port to the **left**.

   For a COUNTERCLOCKWISE rotation pump, position the pump cylinder with the INTAKE port to the **right**.
2. Apply a small amount of quality O-ring lubricant in the head recess. With new O-rings installed, push the mechanical seal assembly (153) into the recess of the head with the seal jacket drive tangs inward. The pin in the seal stationary seat MUST be between the lugs in the back of the head recess.
3. Apply a small amount of O-ring lubricant to the O-ring groove on the inside face of the head to facilitate installation. Install a new head O-ring (72) in the groove by laying the O-ring flat and starting in on one side of the groove, stretching ahead with the fingers, as shown in Figure 8.

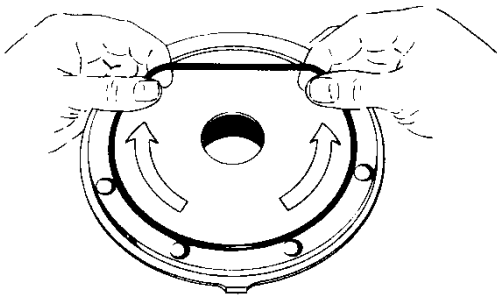


Figure 8 – Head O-Ring Installation

4. Install the head (20) on the outboard side of the cylinder. Install and snug up four head capscrews (21) 90° apart.
5. Hand pack the ball bearing (24) with grease. Refer to "Lubrication" in the Pump Maintenance Section for the recommended grease.
6. Install the bearing into the head recess. The bearing balls should face outward, with the grease shield inward. Ensure the bearing is fully and squarely seated against the mechanical seal.
7. Turn the pump cylinder around and begin assembly on the opposite, inboard end.
8. Remove the vanes (14) and push rods (77) from the rotor and shaft assembly. Inspect for wear and damage, and replace as follows:
   a. Partially install the non-driven end of the rotor and shaft (13) into the open side of the pump cylinder.
   b. Leave part of the rotor outside of the cylinder so that the bottom vanes can be installed and held in place as the push rods are installed in the push rod holes of the rotor. Insert the new vanes into the rotor slots with the rounded edges outward, and the vane relief grooves facing TOWARDS the direction of rotation. Refer to Figure 4 in “Vane Replacement.”
   c. After the bottom vanes and push rods are installed, insert the rotor and shaft fully into the cylinder.
   d. Install the remaining vanes into the top positions of the rotor. **Rotate the shaft by hand to engage the drive tangs of the mechanical seal jacket in the rotor slots.**
9. Apply a thin coating of quality O-ring lubricant on the inboard shaft to aid installation. Install the inboard head, mechanical seal, and bearing as instructed in steps 2 through 6.
10. Rotate the shaft by hand to engage the seal drive tangs, and to test for binding or tight spots. If the rotor does not turn freely, lightly tap the rims of the heads with a soft faced mallet until the correct position is found. Install all of the remaining head capscrews for each head and uniformly tighten, then torque to 25 lbs ft (34 Nm).

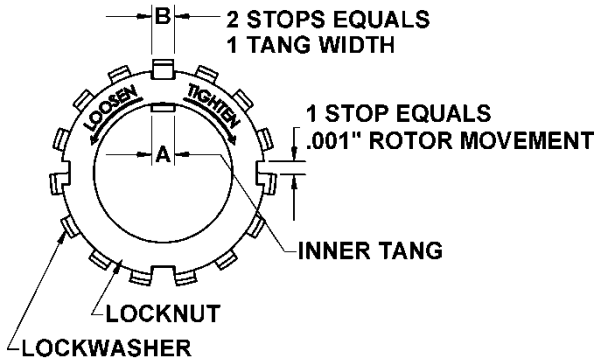


Figure 9 – Locknut Assembly

11. **LOCKNUT ADJUSTMENT – 2”, 2.5”, 3” Models**
    It is important that the bearing locknuts (24A) and lockwashers (24B) be installed and adjusted properly. Overtightening locknuts can cause bearing failure or a broken lockwasher tang. Loose locknuts will allow the rotor to shift against the heads, causing wear. See Figure
    a. On both ends of the pump shaft, install a lockwasher (24B) with the tangs facing outward, followed by a locknut (24A) with the tapered end inward. Ensure the inner tang "A" of the lockwasher is located in the slot in the shaft threads, bending it slightly, if necessary.
    b. Tighten both locknuts to ensure that the bearings are bottomed in the head recess. **DO NOT overtighten and bend or shear the lockwasher inner tang.**
    c. Loosen both locknuts one complete turn.
    d. Tighten one locknut until a slight rotor drag is felt when turning the shaft by hand.
    e. Back off the nut the width of one lockwasher tang "B". Secure the nut by bending the closest aligned lockwasher tang into the slot in the locknut. The pump should turn freely when rotated by hand.
    f. Tighten the opposite locknut by hand until it is snug against the bearing. Then, using a spanner wrench, tighten the nut the width of one lockwasher tang “B”. Tighten just past the desired tang, then back off the nut to align the tang with the locknut slot. Secure the nut by bending the aligned lockwasher tang into the slot in the locknut. The pump should continue to turn freely when rotated by hand.
    g. To check adjustment, grasp the nut and washer with fingers and rotate back and forth. If this cannot be done, one or both locknuts are too tight and should be alternately loosened one stop at a time 0.001" (0.025mm). Begin by loosening the locknut adjusted last.

12. LOCK COLLAR ADJUSTMENT – 4" Models

It is important that the bearing Lock Collar (24A) be installed and adjusted properly. Overtightening the Lock Collar Adjustment Tool Screws during installation can cause bearing failure or excessive pump power draw. Loose Lock Collar Adjustment Tool Screws will allow the rotor to shift against the heads, causing wear.

a. On both ends of the pump shaft, install a Lock Collar (24A) with the socket head cap screws facing upward.

b. Starting with the Outboard side of the pump, attach the Lock Collar Adjustment Tool to the Outboard Head (23). See Figure 10. Align the inner hole pattern of the tool with the corresponding tapped holes in the head. Ensure that the large center hole of the tool is centered on the shaft.

c. Slowly turn the Lock Collar Adjustment Tool screws, which will move the Lock Collar and Bearing towards the Outboard Head (23). Alternate between each screw so that even pressure is applied to the Lock Collar. Once the Bearing (24) stops moving into the head, is slightly recessed in the head bore, and the force required to turn the screws increases stop turning the screws.

d. Tighten 5/16" screws on lock collar to 20 ft-lbf. Make sure that the 3/8" set screws are loosened, so they do not contact the shaft. Ensure an even gap on each split of the collar.

e. Remove Lock Collar Adjustment Tool.

f. Tighten 3/8" set screws on Lock Collar to 20 ft-lbf.

g. Move Lock Collar Adjustment Tool to Inboard side and repeat steps 12a through 12f. See figure 11 for Inboard Side tool assembly.

h. Spin shaft to make sure it turns smoothly.

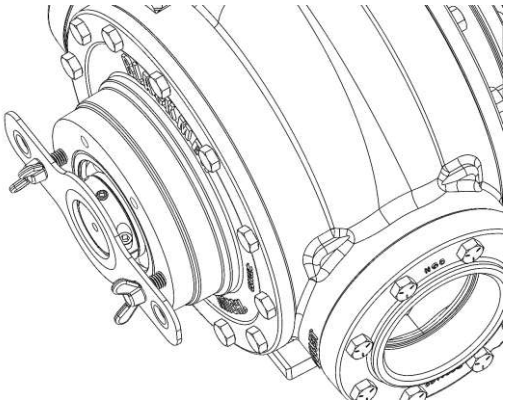


Figure 10 – Lock Collar Assembly, Outboard

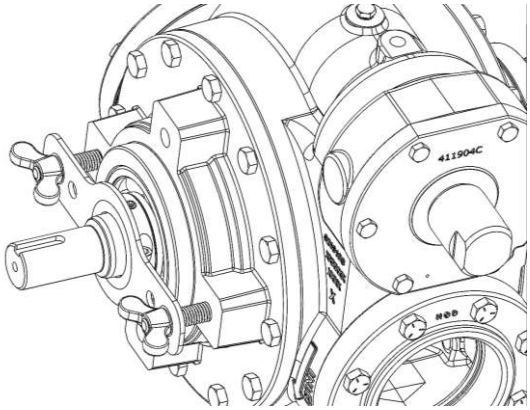


Figure 11 – Lock Collar Assembly, Inboard

13. Attach a new bearing cover gasket (26) and the outboard bearing cover (27) to the outboard head. Install and torque the bearing cover capscrews (28) to 15 ft-lbf (20 Nm).

14. Lightly oil Adapter O-ring (135B) and install on inboard head.

15. Ensure the key (35) is installed on the pump shaft. With the aid of a lifting device, slide the motor and gearbox assembly towards the pump engaging gearbox shaft receiver with the pump shaft.

16. Install the Adapter screws (20C) into the inboard head and torque to 23 ft-lbf.

17. RELIEF VALVE ASSEMBLY

a. Insert the valve (9) into the relief valve bore of the casing with the fluted end inward.

b. Install the relief valve spring (8) and spring guide (7) against the valve.

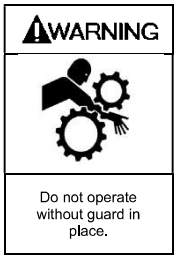
c. Attach a new relief valve O-ring (10) and the valve cover (4) on the cylinder.

d. Screw the relief valve adjusting screw (2) with locknut (3) into the valve cover (4) until it makes contact with the spring guide (7).

e. After the relief valve has been adjusted, tighten the Locknut (3) and install the relief valve cap (1) and O-ring (88).

NOTICE:

The relief valve setting MUST be tested and adjusted more precisely before putting the pump into service. Refer to "Relief Valve Setting and Adjustment"



Operation without guards in place can cause serious personal injury, major property damage, or death.

18. Reinstall coupling, shaft key, and coupling guards.

19. Refer to "Pre-Start Up Check List" and "Start Up Procedures" sections of this manual prior to restarting pump operation.

GEAR REDUCER MAINTENANCE

NOTICE:

Detailed maintenance instructions for the gearbox can be found at www.nord.com/docs. The following are excerpts from those documents and should be treated as reference only.

STORAGE

NOTICE:

For storage periods longer than 9 months, or for storage in less than desirable conditions, please consult NORD for recommendations.

- Storage for up to 9 months is possible, so long as the following conditions are observed:
- Store the gear unit in its actual mounting position in accordance with the specified oil fill-level, in a clean and dry temperature controlled area. Avoid temperature fluctuations within the range of 0°C and 40°C (32°F to 104°F) and avoid relative humidity conditions in excess of 60%.
- Protect all exposed or unpainted shaft and flange surfaces with an anti-corrosion agent or grease.
- Store in a location free from shock and vibration, to avoid false brinelling of bearing elements and raceways.
- Whenever possible, rotate the shafts periodically, by hand if necessary, to help prevent brinelling (bearing damage) and to help keep the shaft seals pliable.
- Avoid direct exposure to the sun or UV light and aggressive or corrosive materials in the environment (ozone, gases, solvents, acids, caustic solutions, salts, radioactivity, etc.

Commissioning

Prior to gear unit start-up, complete the following:

- Please check your gear unit for a vent and if applicable to your product, remove the sealing plug to activate

NOTICE:

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal gearbox components and leakage.

- Check the lubricant and be sure the gear unit is filled with the proper oil type, to the proper level, as determined by the mounting position.
- Check the condition of all shaft seals and all assembled flange gasket areas. If any change is detected in the shape, color, hardness or permeability, or if any leaks are detected, the corresponding shaft seals and/or gaskets must be replaced.
- Remove all anti-corrosive metal protectant from otherwise bare metal surfaces. Follow product manufacturer's directions and warnings during surface protection removal.
- Check the resistance of all motor and brake windings to verify the integrity of the winding insulation and inspect all terminal box openings and wire connection areas to verify that all components are dry and free of corrosion.

Long Term Storage

By taking special precautions, problems such as seal leakage and reducer failure due to the lack of lubrication, improper lubrication quantity, or contamination can be avoided. The following precautions will protect gear reducers during periods of extended storage:

- Store the gear unit in its actual mounting position in accordance with the specified oil fill-level, in a clean and dry temperature controlled area. Avoid temperature fluctuations within the range of 0°C and 40°C (32°F to 104°F) and avoid relative humidity conditions in excess of 60%.
- Fill the reducer full with oil that is compatible with the product normally used or recommended during service.
- Apply grease to all unpainted or unprotected shafts, bores, keyways, flange surfaces, tapped holes, and to the exterior of all oil seals.
- Store in a location free from shock and vibration, to avoid false brinelling of bearing elements and raceways.
- Once every few months rotate the input shaft approximately 10-20 revolutions to redistribute the weight of gears and shafts and to prevent brinnelling of the bearings and drying of the seal track.
- Avoid direct exposure to the sun or UV light and aggressive or corrosive materials in the environment (ozone, gases, solvents, acids, caustic solutions, salts, radioactivity, etc.)

Commissioning After Long-Term Storage

- Please check your gear unit for a vent and if applicable to your product, remove the sealing plug to activate.

NOTICE:

To prevent build-up of excessive pressure, sealed vents must be activated as shown prior to gear unit start up. Excessive pressure may cause damage to internal gearbox components and leakage.

- Remove all anti-corrosive metal protectant from otherwise bare metal surfaces. Follow product manufacturer's directions and warnings during surface protection removal.
- Drain the reducer and refill it with the proper type and amount of lubricant.
- Observe start-up and initial operation to make sure there are no seal or gasket leaks, or unusual sounds, vibration or heat rise during operation.
- Check the resistance of all motor and brake windings to verify the integrity of the winding insulation and inspect all terminal box openings and wire connection areas to verify that all components are dry and free of corrosion.

Lubrication

Proper gearbox lubrication is essential in order to reduce friction, heat, and component wear. Lubricants reduce heat and wear by inserting a protective "fluid boundary" between mating parts and preventing direct metal to metal contact. Lubricants also help prevent corrosion and oxidation, minimize foam, improve heat transfer, optimize reducer efficiency, absorb shock loads and reduce noise. Most NORD reducers are shipped from the factory with a pre-determined oil fill level in accordance to the specified reducer size and mounting position.

The standard orientation for the gearbox is shown in Figure 12. The gearbox is filled with the correct amount of oil and is the correct configuration for this orientation. For any other orientation, please consult the factory.

Lubrication Table

ISO Viscosity	Oil Type	Ambient Temp Range (°F)	Brand	Pump Model: Standard Oil Shipped with Gearbox
VG220	**PAO-EP**	**-31 to 140**	**Mobil SHC Gear 220***	**GNX(H)3, GNX(H)4**
VG220	**PAO**	**-31 to 140**	**Mobil SHC630***	**GNX(H)2, GNX(H)2.5**
VG220	MIN-EP	32 to 104	Mobilgear 600XP220	
VG220	FG	23 to 104	Fuchs FM220	
VG460	PAO	-31 to 176	Mobil SHC 634	

*Standard Oil Shipped with Gearbox

Oil Formulation Codes:
MIN-EP - Mineral Oil with EP Additive
PAO - Synthetic Polyalphaolefin Oil
PAO-EP – Synthetic Polyaphoalefin Oil with EP Additive
FG - Food-Grade Oil

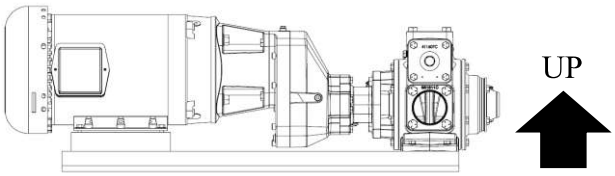


Figure 12 - Standard Gearbox Orientation

NOTICE:

The "Ambient Temperature" is intended to be an operation guideline based upon the typical properties of all the lubricant. The viscosity and other properties of the lubricant change based upon load, speed, ambient conditions, and reducer operating temperatures. The user should consult with their lubrication supplier & NORD gear before considering changes in oil type or viscosity.

- To prevent reducer overheating, observe the maximum operating oil temperature limits:
  Mineral Oil: 176 – 180 °F
  Synthetic Oil: 225 °F
- In the following instances, please consult NORD for specific recommendations:
  - Gear units will operate in high ambient temperature conditions exceeding 40 oC (104 oF).
  - Gear units will operate in cold ambient temperature conditions approaching 0 oC (32 oF) or lower.
  - Lower than an ISO VG100 viscosity oil is being considered for a cold-temperature service.
  - Fluid grease is required for lubricating the gear unit.
- Observe the general lubrication guidelines outlined in user manual U10750.
- Lubrication Replacement: In general, it is recommended that the lubricant be replaced after 20,000 hours of operation or 4 years, whichever occurs first. For more details on lubrication replacement, reference Nord document, U10750 (B1000, page 32)

NOTICE:

Do not mix different oils with different additive packages or different base oil formulation types. Polyglycol (PG) oils are not miscible with other oil types and should never be mixed with mineral oil or polyalphaolefin (PAO) synthetic oil.

PUMP TROUBLESHOOTING

NOTICE:
Maintenance shall be performed by qualified technicians only,
following the appropriate procedures and warnings as presented in this manual.

Symptom	Probable Cause
Pump Not Priming	1. Pump not wetted. 2. Worn vanes 3. Suction valve closed. 4. Air leaks in the suction line. 5. Strainer clogged. 6. Suction line or valves clogged or too restrictive. 7. Pump vapor-locked. 8. Pump speed too low for priming. 9. Relief valve partially open, worn or not seating properly.
Reduced Capacity	1. Pump speed too low. 2. Suction valves not fully open. 3. Air leaks in the suction line. 4. Excessive restriction in the suction line (undersized piping, too many elbows & fittings, clogged strainer, etc.). 5. Damaged or worn parts. 6. Excessive restriction in discharge line causing partial flow through the relief valve. 7. Relief Valve worn, set too low, or not seating properly. 8. Vanes installed incorrectly (see "Vane Replacement").
Noise	1. Excessive vacuum on the pump due to: a. Undersized or restricted fittings in the suction line. b. Pump speed too fast for the viscosity or volatility of the liquid. c. Pump too far from fluid source. 2. Running the pump for extended periods with a closed discharge line. 3. Pump not securely mounted. 4. Bearings worn or damaged. 5. Vibration from improperly anchored piping. 6. Bent shaft, or drive coupling misaligned. 7. Excessively worn rotor. 8. Malfunctioning valve in the system. 9. Relief valve setting too low. 10. Damaged vanes (see following category). 11. Vanes installed incorrectly (see "Vane Replacement").
Damaged Vanes	1. Foreign objects entering the pump. 2. Running the pump dry for extended periods of time. 3. Cavitation. 4. Viscosity too high for the vanes and/or the pump speed. 5. Incompatibility with the liquids pumped. 6. Excessive heat. 7. Worn or bent push rods, or worn push rod holes. 8. Settled or solidified material in the pump at start-up. 9. Hydraulic hammer - pressure spikes. 10. Vanes installed incorrectly (see "Vane Replacement").
Broken Shaft	1. Foreign objects entering the pump. 2. Viscosity too high for the pump speed - EC Rotor & Shaft required for fluid viscosities over 20,000 SSU. 3. Relief valve not opening. 4. Hydraulic hammer - pressure spikes. 5. Pump/driver misalignment. 6. Excessively worn vanes or vane slots. 7. Settled or solidified material in the pump at start-up.
Mechanical Seal Leakage	1. O-rings not compatible with the liquids pumped. 2. O-rings nicked, cut or twisted 3. Shaft at seal area damaged, worn or dirty. 4. Ball bearings overgreased. 5. Excessive cavitation.

	6. Mechanical seal faces cracked, scratched, pitted or dirty.

GEAR REDUCER TROUBLESHOOTING

NOTICE:
Maintenance shall be performed by qualified technicians only,
following the appropriate procedures and warnings as presented in this manual.

This section identifies some of the most common issues involved with NORD Gear speed reducers , and provides recommendations to assist you in defining and answering your questions as you work with our products. You may also contact our Engineering/Application departments if your questions are not answered in the table below.

Problem With the Reducer		Possible Causes	Suggested Remedy
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce the load.
	Improper lubrication	Insufficient lubrication	Check lubricant level and adjust up to recommended levels
		Excessive lubrication	Check lubricant level and adjust down to recommended levels.
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
Runs Noisy	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/or reinforce mounting and structure.
		Loose hold down bolts	Tighten bolts
	Failure of bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer.
	Insufficient lubricant	Level of lubricant in reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.
Output shaft does not turn	Internal parts are broken or missing	Overloading of reducer can cause damage	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected	Properly allign reducer and coupling. Tighten coupling.
Oil Leakage	Worn seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.
	Unit runs hot or leaks	Overfilled reducer	Check lubricant level and adjust to recommended level.
		Vent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.
	Incorrect fill level	Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position on the name tag & verify with mounting chart in manual.

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TSB 2013.08.006

Installation Instructions for DC and AC Electric Rewind Reels

Date Issued: October-2013

NOTE: FAILURE TO FOLLOW THESE INSTRUCTIONS WILL VOID THE WARRANTY.

UPACKING AND MOUNTING THE REEL

1. Inspect the reel for shipping damage.
2. Check the wiring kit against the parts list.
3. Fasten the reel frame securely to a level surface.
4. Turn the reel discs by hand. The spool should turn freely. If it binds, adjust the self-aligning bearings.
5. Check motor voltage matches the supply voltage.

CONNECTING THE INLET

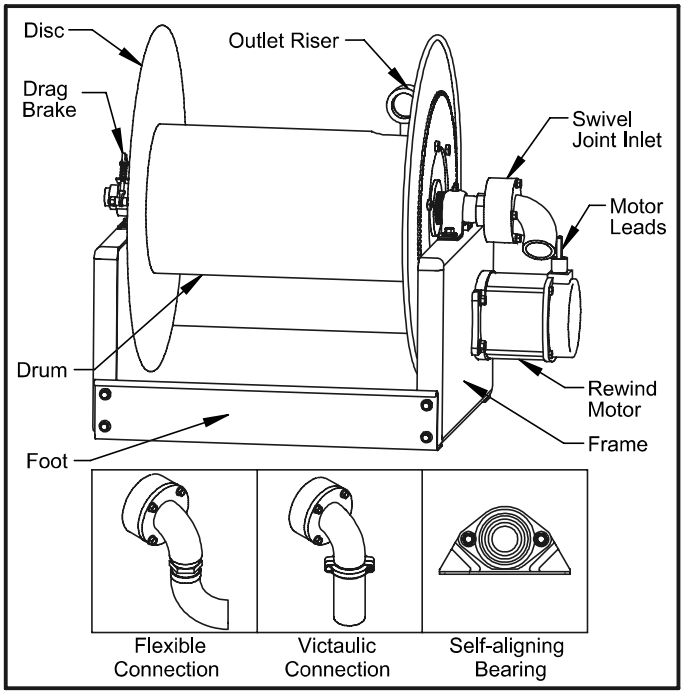
1. Threaded-type swivel joint inlets must be connected to the fluid supply by a **flexible connector** or the Hannay Warranty will be void.
2. Victaulic-type inlet connections must be carefully aligned. Two victaulic connections, correctly installed, will normally allow adequate flexibility for smooth rotation.
3. Install a union fitting as near as possible to the swivel joint so the joint can be easily removed for servicing.

WIRING THE REEL

1. Certain accessories have been provided to wire your reel (see following pages). You will, however, need to provide a few additional materials:
   - Insulated Cable (see motor nameplate for amperage)
   - Various Insulated Ring Terminal and Wire Nut Connectors (installation specific)
   - Circuit Breaker (see chart for amperage ratings)
   - Ground Strap for Reel - Vapor-proof Conduit (optional)
2. Follow the appropriate wiring diagram on the following pages to make the necessary connections. Check all ground connections before using motor.
   NOTE: #6 AWG wire should be sufficient in most installations to prevent significant voltage drop. However, you may choose to use heavier #4 AWG if the total circuit length is unusually long.
3. The solenoid (12V DC or 24V DC motors only) should be mounted as close as possible to the battery and/or starter and grounded securely. A circuit breaker MUST be wired into the circuit between the solenoid and battery.
4. The motor rotation can be reversed by interchanging the motor leads.
5. If you choose to use vapor-proof conduit between the solenoid and motor, then seal the open end of the conduit with a sealing compound and wrap with electrical tape.
6. A ground strap must be securely fastened between the reel frame and a grounded part of the vehicle body. The motor ground lead must be directly bonded to the chassis. Do NOT rely on the reel structure for grounding. For explosion proof applications, the ground lead must be run to, and bonded to, the chassis in a non hazardous location such as the engine compartment of the vehicle.
7. Tape all connections and check each one to make sure they are secure.

CONNECTING THE HOSE

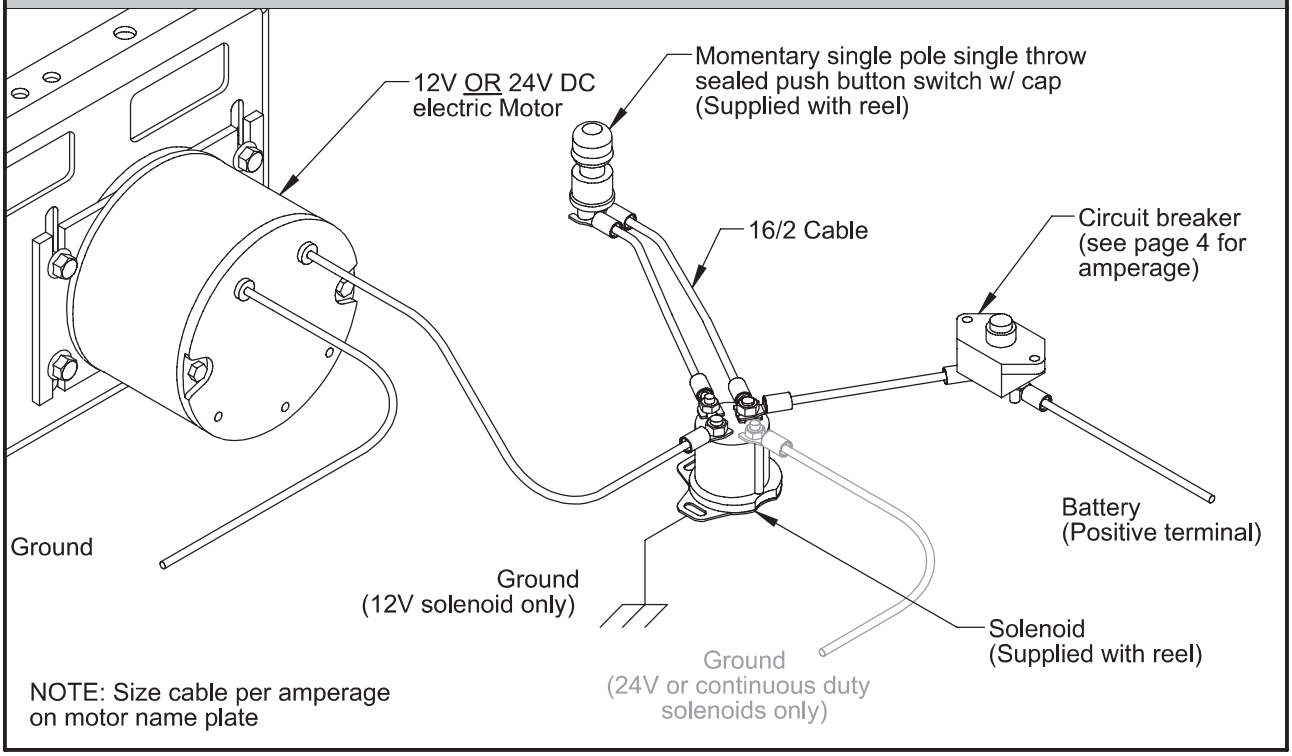
1. Do NOT attach the hose until the reel has been installed and wired.
2. Charge the hose before winding it on the reel. This will protect the drum from excessive pressure.
3. If reel has flanged outlet riser: Remove the entire riser from the hub. Be careful not to damage the gasket/o-ring. Apply thread compound to all threads and bushings. Thread the hose onto the outlet riser. Replace the riser and tighten securely, making sure the gasket/o-ring is seated properly. If reel does NOT have flanged riser: The riser can't be removed, so you will need to thread the hose directly onto the riser.
4. Wind the hose onto the reel (either electrically or with the hand crank).



WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

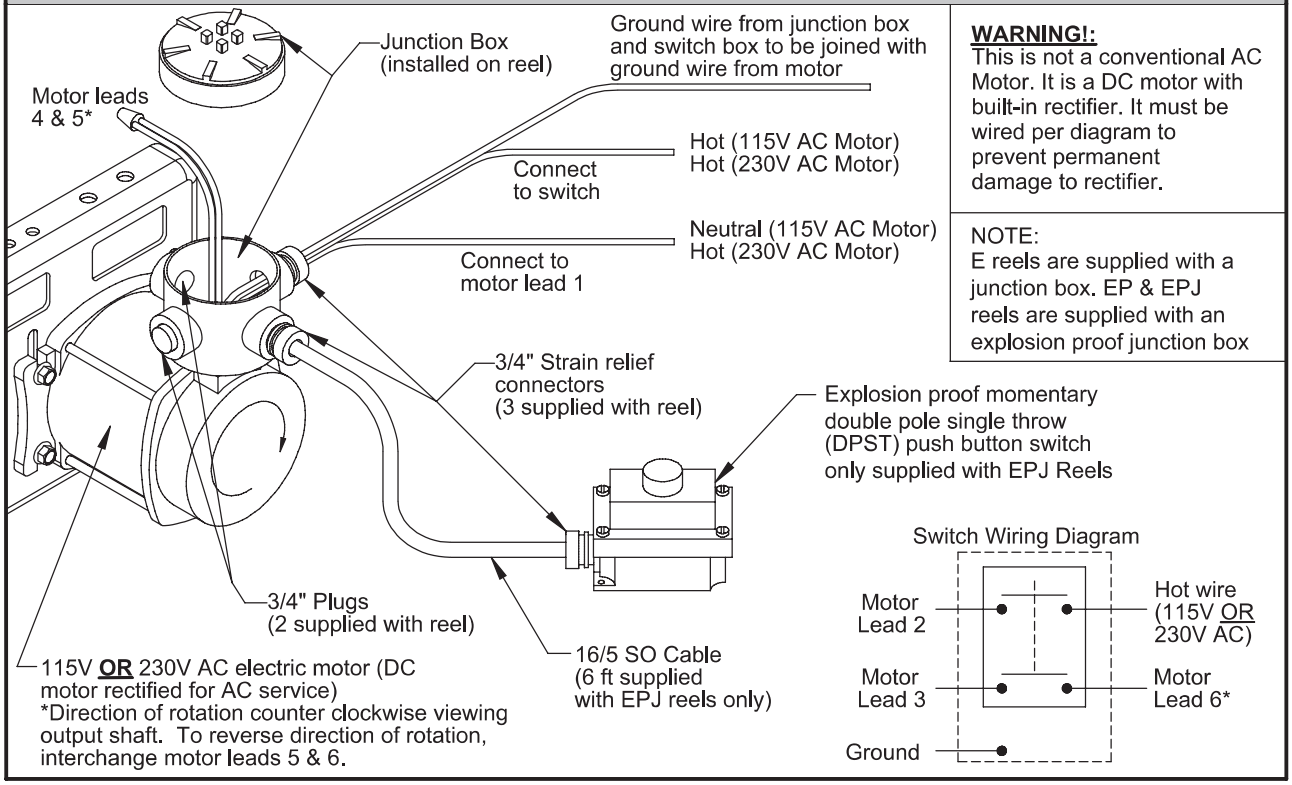
WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

E or EP Reels with either a 12V DC Motor OR a 24V DC Motor



WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

E, EP or EPJ Reels with either a 115V AC Motor OR a 230V AC Motor



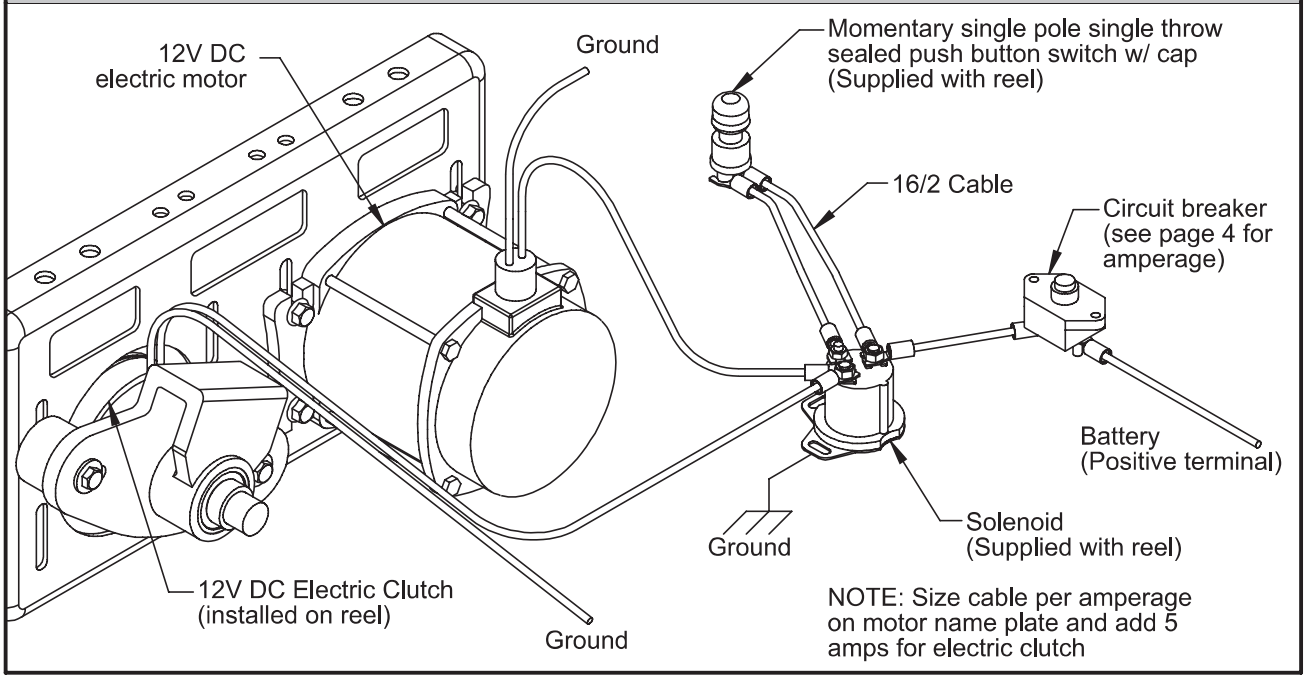
WARNING!:
This is not a conventional AC Motor. It is a DC motor with built-in rectifier. It must be wired per diagram to prevent permanent damage to rectifier.

NOTE:
E reels are supplied with a junction box. EP & EPJ reels are supplied with an explosion proof junction box

NOTE: USING A 115V MOTOR ON A 230V CIRCUIT WILL VOID WARRANTY. BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

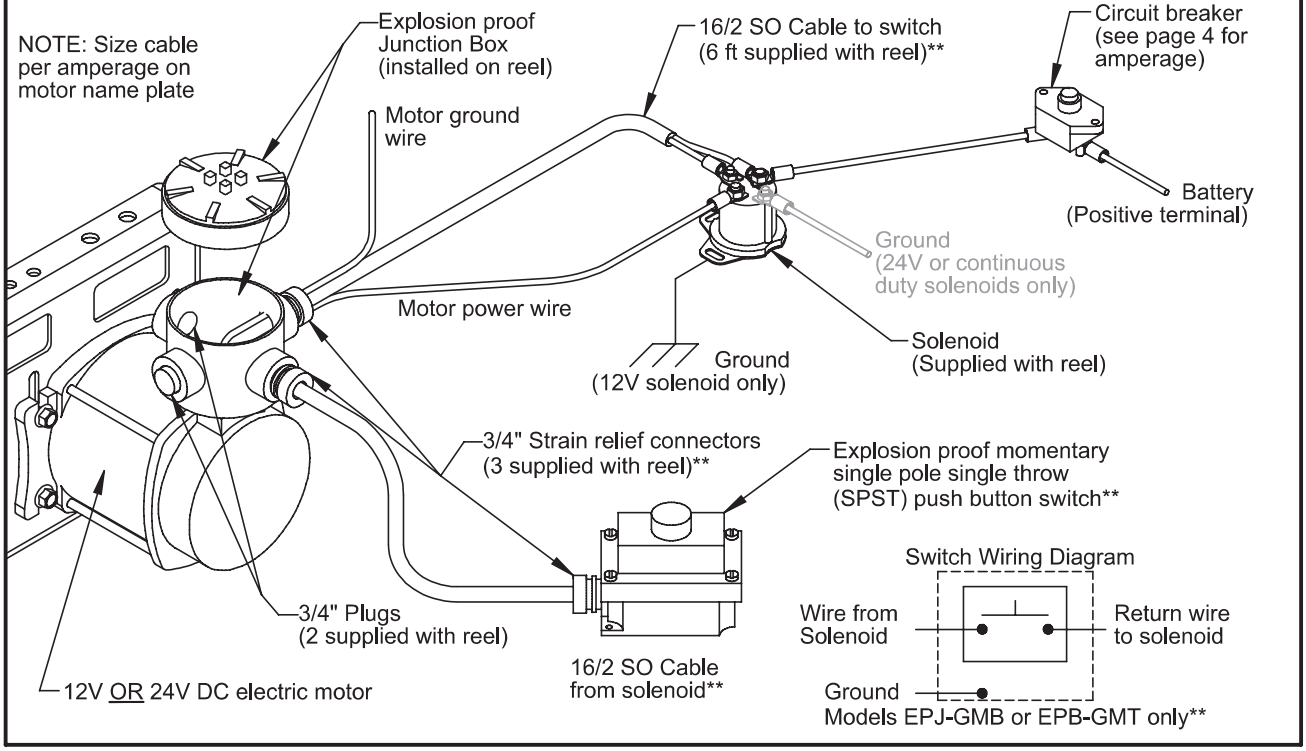
WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

EP Reels with 12 Volt DC Motor and Optional Electric Clutch



WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

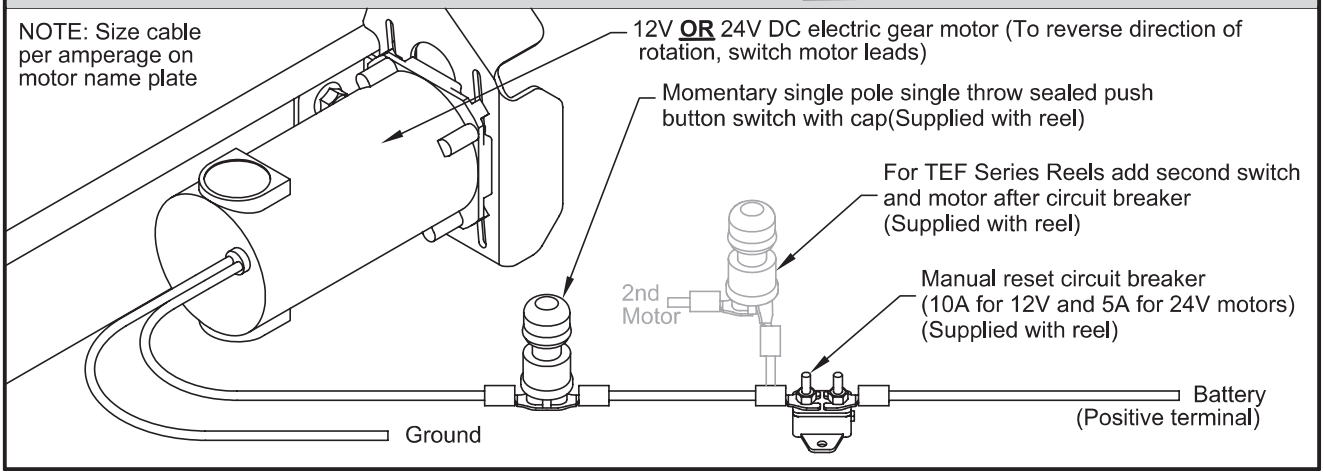
EPJ or EPB Reels with either a 12V DC Motor OR a 24V DC Motor**



** **NOTE:** If reel is equipped with Hannay Guidemaster (model prefix **EPB-GMB** or **EPB-GMT**), then switch and cord are replaced with Guidemaster switch and accompanying mounting hardware. Additionally, only 2 strain relief connectors are provided. See note on wiring diagram for installing Guidemaster switch.

WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

Reels with either a 12V DC Gear Motor OR a 24V DC Gear Motor

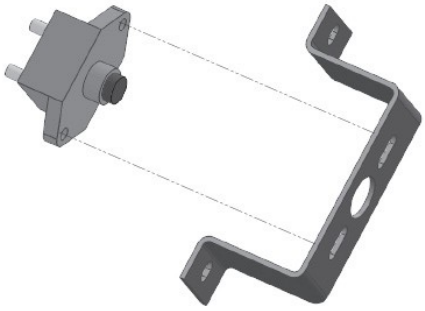


CIRCUIT BREAKER RECOMMENDATIONS

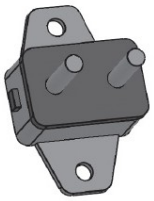
All electric rewind reels manufactured by Hannay Reels require a properly sized circuit breaker to protect the motor from a sustained overload condition. Type 3 manual reset circuit breakers are required in all Hannay motor applications.

Hannay Circuit Breakers

Circuit Breaker (50 or 70 Amp)



Circuit Breaker Mounting Bracket 9917.0024



Circuit Breaker (5 through 40 Amp)

MOUNTING – The larger-sized manual circuit breakers (50 and 70 Amp) sold by Hannay Reels can be purchased with a convenient mounting bracket. Mount the breaker away from any heat source such as an exhaust manifold or radiator. Since this style of breaker must be manually reset if tripped, it should also be mounted in a location convenient to the end user.

With the smaller manual reset circuit breakers (5 through 40 Amp), no mounting bracket is necessary since there are already mounting tabs provided on the circuit breaker itself.

AMPERAGE RATING – The goal in choosing an appropriately sized circuit breaker is to choose a breaker that will open the circuit in a short period of time (ideally in less than 30 seconds) when the reel motor is stalled, but not so quickly that 'nuisance trips' occur. Be aware that ambient temperature can cause trip times to vary.

The chart below shows recommended circuit breaker sizes to use with the motors used on Hannay-manufactured reels.

Hannay Motor Model	Wire Sizes	Circuit Breaker Size	Circuit Breaker Part Number	Mtg. Bracket Part Number
Bodine 550 Gear Motor (12V)	16 AWG	10 Amp	9917.0018	Included
TEF Series Gear Motor (12V)	16 AWG	10 Amp	9917.0018	Included
AN250 (12V)	10 AWG	15 Amp	9917.0019	Included
AN239 (12V)	10 AWG	25 Amp	9917.0171	Included
AN227 (12V)	10 AWG	35 or 40 Amp	9917.0172	Included
SX001, SX007 or SX102 (12V)	8 AWG	50 Amp	9917.0021	9917.0024
SX043, SX103, SX139, SX153 or SX743 (12V)	6 AWG	70 Amp	9917.0022	9917.0024
Bodine 990 Gear Motor (24V)	16 AWG	5 Amp	9917.0017	Included
AN248 or AN249 (24V)	10 AWG	15 Amp	9917.0019	Included
SX123, or SX145 (24V)	8 AWG	25 Amp	9917.0171	Included
AN351 or SX163 (115V AC)	16 AWG	5 Amp	----------	----------

Clean Fuel & Lubricant Solutions

Water Absorbing Filter

DBB0248

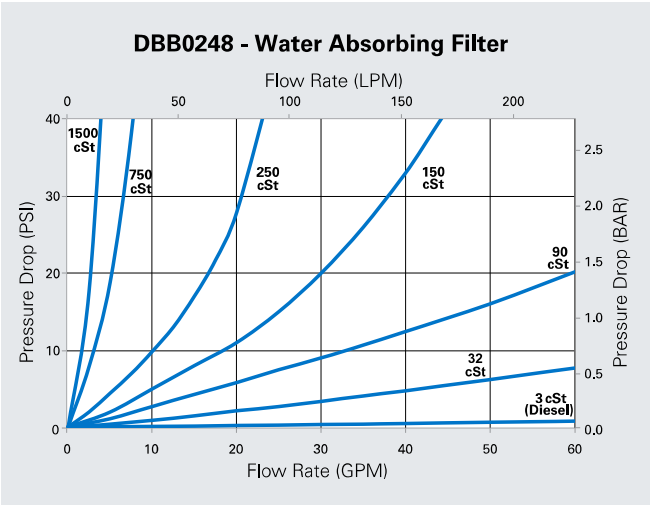
This water absorbing filter is constructed with super absorbent media to remove free and emulsified water at high flow rates and help guard ethanol fluids from free water. Its media will not migrate when saturated.

Donaldson Clean Solutions filters provide unsurpassed cleanliness in a single pass. Filters may be used individually or configured into high capacity systems using a variety of different head and manifold options. These filters incorporate our best technology and construction, including epoxy for increased fluid compatibility and e-coating for maximum epoxy adhesion and corrosion resistance.

SPECIFICATIONS

Efficiency	Not for particulate removal
Fluid Compatibility	#1 or #2 diesel, kerosene biodiesel up to B100, ethanol-free gasoline
Working Pressure	24.1 bar / 350 psi
Element Collapse Pressure	10.3 bar / 150 psi
Rated Static Burst	55.2 bar / 800 psi
Max. Flow Range**	246 lpm / 65 gpm
Operating Temperature	-40 to 118 °C / -40 to 245 °F
Recommended Viscosity Range	<1500 cSt

**Actual flow rate varies based on fluid viscosity, pumping pressure and filter loading.*



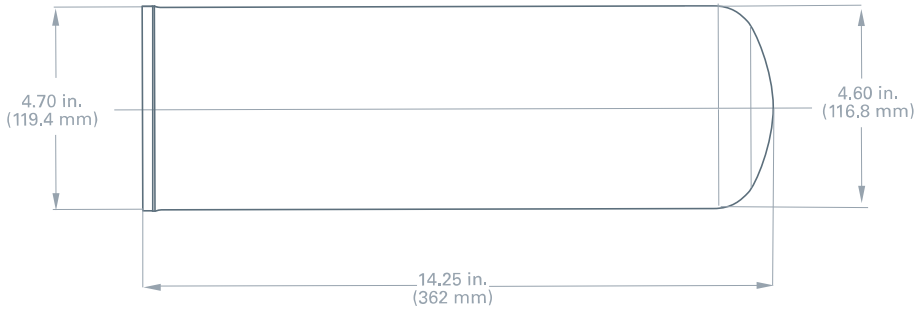
FEATURES

- Unsurpassed water absorption
- Spin-on design for fast, easy maintenance
- Use with Clean Solutions particulate filters to remove free and emulsified water

APPLICATIONS

- Single pass water removal
- Used in conjunction with particulate filters for clean, dry fluid transfers

DIMENSIONS



INSTALLATION

- Use with Clean Solutions single, dual filter head or manifolds


P568583


P561880


P568932

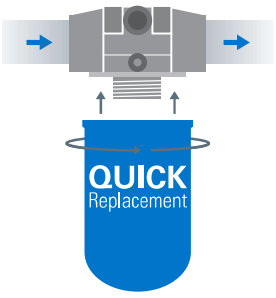

P568933


DFF1012

- Install on pressure side of pump with arrows pointing in direction of flow
- Allow 51 mm / 2" clearance for servicing filter
- Lubricate filter and head o-rings with clean oil or diesel
- Install filter on head by spinning clockwise
- Use strap-wrench to tighten
- Also available in Clean and Dry Kit X011449, which includes dual filter head P568563, pressure gauge P57368, port adapter P573862, T.R.A.P. Breather X920006 and particulate filter DBB8666

REPLACEMENT PARTS & MAINTENANCE SCHEDULE

- Service filter when flow slows or predetermined differential pressure is reached (varies based on pump spec, system dP and clean filter dP; maximum 20 psi dP increase)
- Isolate filter and relieve pressure prior to servicing
- Loosen filter by rotating counter clockwise using strap-wrench
- Install clean filter by rotating clockwise, tighten 1/2 turn after filter seats in gasket
- Dispose of used filter appropriately



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Japan

Korea
Australia
India

Brochure No. F111553 ENG (01/24)

Clean Fuel & Lubricant Solutions

Winter Fuel Filter

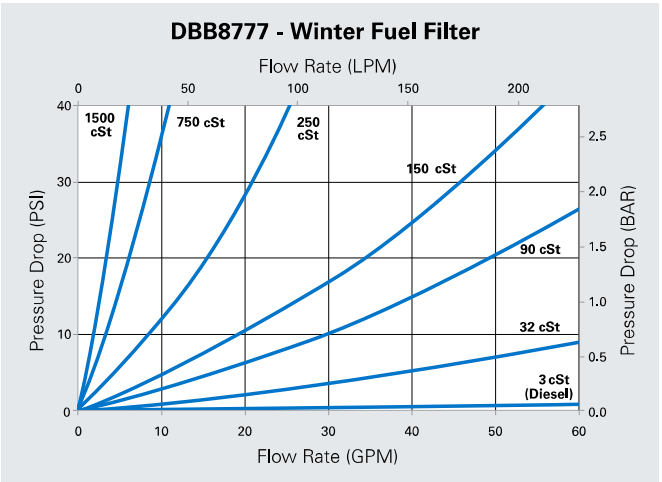
DBB8777

This 7 micron filter is designed for use in cold weather when gel or other soft substances can cause rapid filter plugging. Its specially formulated media provides an efficient ISO 16/14/11 cleanliness level while allowing the small crystals formed in cold weather additized fuel to pass, thus extending filter life.

Donaldson Clean Solutions filters provide unsurpassed cleanliness in a single pass. Filters may be used individually or configured into high capacity systems using a variety of different head and manifold options. These filters incorporate our best technology and construction, including Donaldson Electrostatic Reduction Technology (D.E.R.T.™), epoxy for increased fluid compatibility and e-coating for maximum epoxy adhesion and corrosion resistance.

SPECIFICATIONS

Target ISO Cleanliness*	16/14/11
Efficiency	7 micron @ Beta 2000
Fluid Compatibility	#1 or #2 diesel, kerosene biodiesel up to B100, gasoline including ethanol
Working Pressure	24.1 bar / 350 psi
Element Collapse Pressure	10.3 bar / 150 psi
Rated Static Burst	55.2 bar / 800 psi
Max. Flow Range**	246 lpm / 65 gpm
D.E.R.T.***	Yes
Operating Temperature	-40 to 118 °C / -40 to 245 °F
Recommended Viscosity Range	<100 cSt



*Select the proper filter by fluid type and OE recommended ISO code. Do not over filter fluids. Doing so may result in the stripping of beneficial additive.
**Actual flow rate varies based on fluid viscosity, pumping pressure and filter loading.
***D.E.R.T™ Donaldson Electrostatic Reduction Technology prevents media damage during high flow fuel applications.

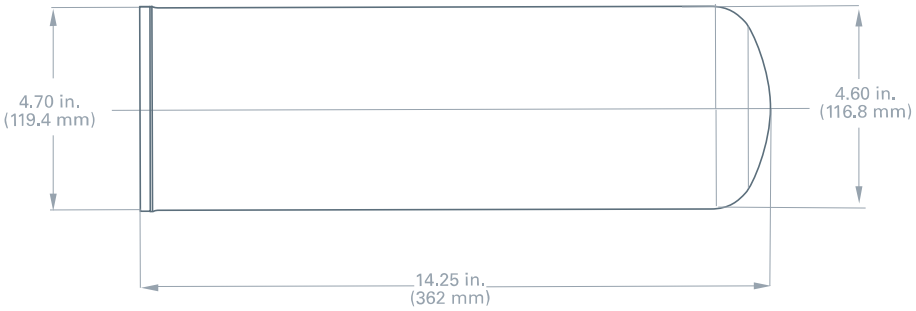
FEATURES

- Fast and easy to service
- Unsurpassed filter efficiency
- D.E.R.T. technology to prevent electrostatic discharge damage
- Cleans to target ISO cleanliness in a single pass
- Modular design can be configured for virtually any flow rate or usage level

APPLICATIONS

- Single pass filtration for clean fluid transfers
- Inlet and outlet filtration at bulk storage tanks
- Dispenser "polishing" filtration on fuel pumps and hose reels

DIMENSIONS



P561880 P568932 P568933 DFF1012

INSTALLATION

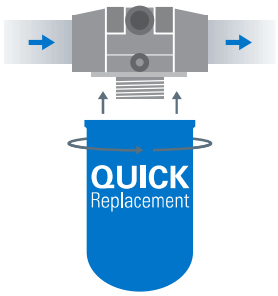
- Use with Clean Solutions single filter heads, dual filter head or manifolds

P570329 P570330 P568583 P561880 P568932 P568933 DFF1012

- Install on pressure side of pump with arrows pointing in direction of flow
- Allow 51 mm / 2" clearance for servicing filter
- Lubricate filter and head o-rings with clean oil or diesel
- Install filter on head by spinning clockwise
- Use strap-wrench to tighten

REPLACEMENT PARTS & MAINTENANCE SCHEDULE

- Service filter when flow slows or predetermined differential pressure is reached (varies based on pump spec, system dP and clean filter dP)
- Isolate filter and relieve pressure prior to servicing
- Loosen filter by rotating counter clockwise using strap-wrench
- Install clean filter by rotating clockwise, tighten ½ turn after filter seats in gasket
- Dispose of used filter appropriately



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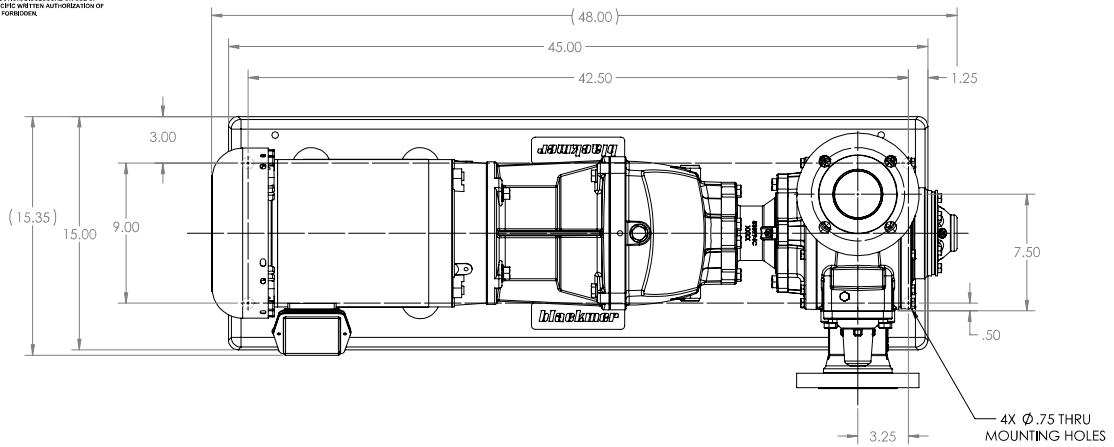
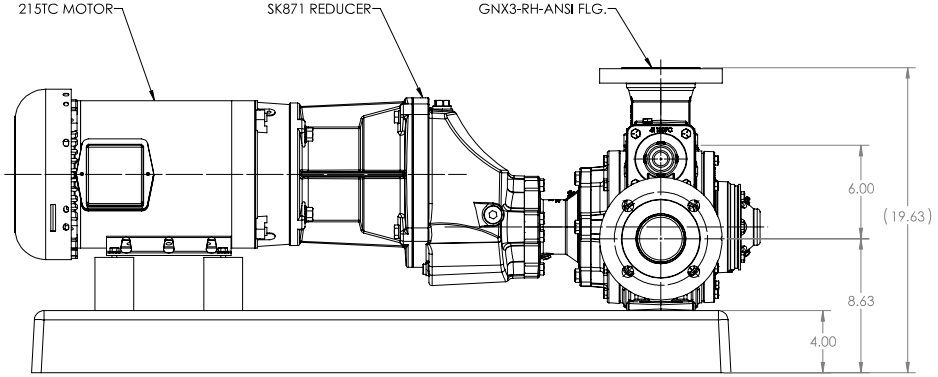
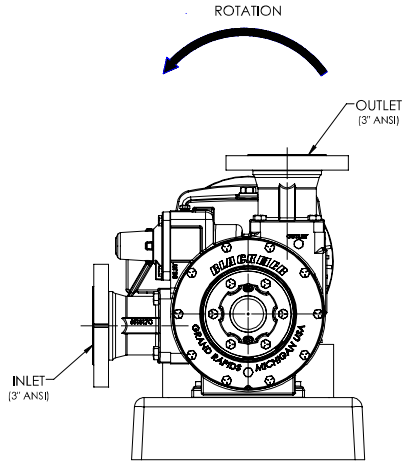
Brochure No. F111554 ENG (01/24)

REVISIONS					
EC NO.	REV.	DESCRIPTION	DATE	DESIGNER	APPROVED
DWG. REQ.	A	NEW ISSUE	12/3/25	SJY	--







UNLESS OTHERWISE SPECIFIED

1. MACHINED PART TO BE CLEAN AND FREE OF BURRS AND CHIPS.
2. RUN OUT .003 T.I.R.
3. TOLERANCE ON:
   2 PLACE DECIMALS ±.020
   3 PLACE DECIMALS ±.010
   ANGLES ±1°
4. MACHINED FINISHES 125 OR BETTER.
5. TOLERANCE DEFINED BY PRIMARY DIMENSION (DUAL DIMENSION FOR REFERENCE ONLY)

PRIMARY DIMENSIONS ARE IN INCHES, DUAL DIMENSIONS (X.XX) ARE IN MILLIMETERS

DRAFTSMAN: SJY 12/3/25
APPD./ENG.:
MATERIAL: PER ORDER

Blackmer
1809 Century Ave.
Grand Rapids, Michigan
49503-1530
U.S.A.
Telephone 616.241.1611
www.blackmer.com

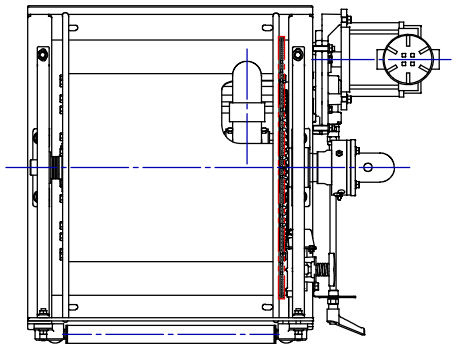
IDT: D | CODE/DOC. NO.: 07524

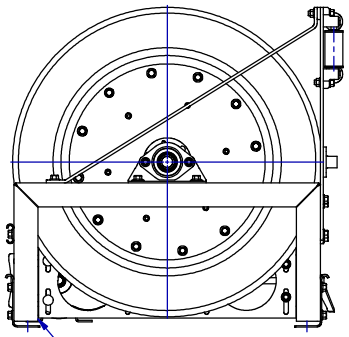
OUTLINE
GNX3-RH-ANSI-SK871-B215TC
DWG. REQ.

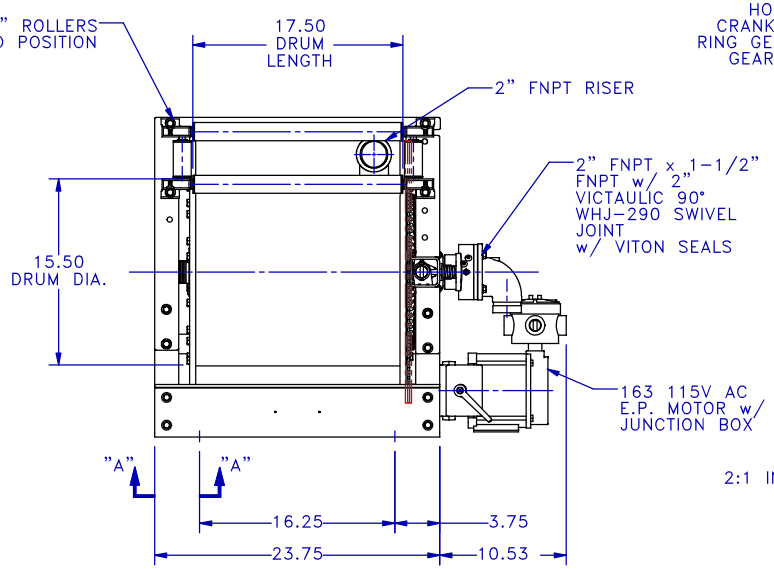
DWG NO.: DWG. REQ. | REV.: A

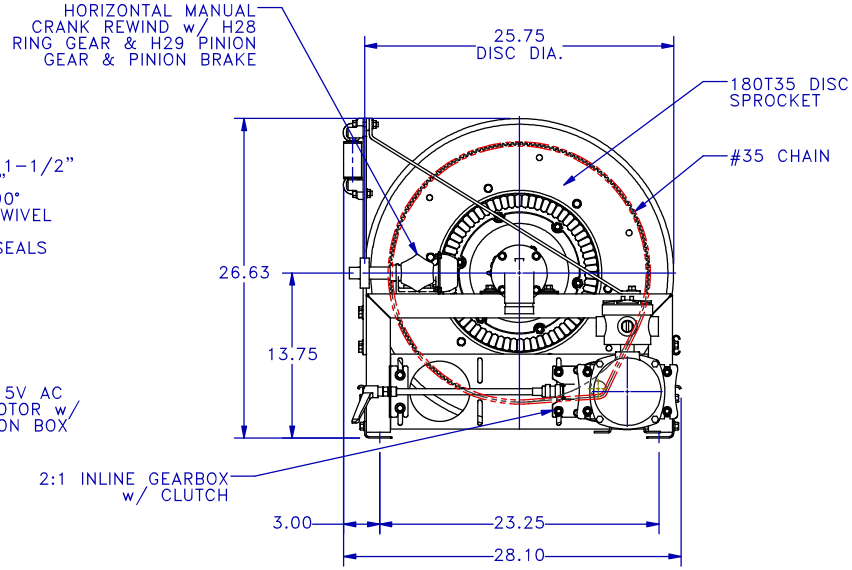
SCALE: 1:4 | CALCULATED PC: LBS | THIRD ANGLE PROJECTION | SHEET 1 OF 1

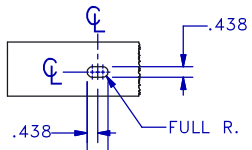
REVISIONS				
ZONE	REV.	DESCRIPTION	REV. BY	REV. DATE
	A	ORIGINAL ISSUE		











VIEW "A-A"
SCALE: 1:4

DO NOT SCALE DRAWING	BREAK SHARP CORNERS AND REMOVE BURRS
DRAWN ON: SOLIDWORKS 2024	THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL DECIMALS ± 0.13
3 PL DECIMALS ± 0.063
ANGLES ± N/A
FRACTIONS ± N/A

MATERIAL: STEEL

DR. BY: B. WESTFALL
DATE: 11/24/2025

CK. BY: C. GUETTLER
DATE: 11/24/2025

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The reel leader.
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WESTERLO, NY 12193 USA
PHONE: 877-467-3357
WWW.HANNAY.COM

TITLE: EPJ 232-26-27-15.5 RT

SIZE	DWG. NO.:	REV.
C	R9820-0358	A

SCALE: 1:8 | WEIGHT: N/A LBS. | SHEET 1 OF 1

Hannay Reels®
The reel leader.

Reel Product News

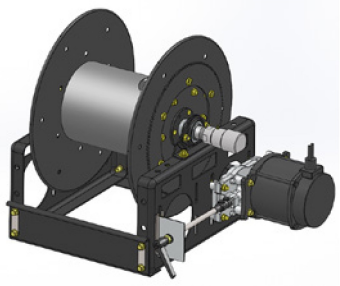
Hannay Offers New Inline Gearbox - Available in 3 Configurations

Hannay Reels announces the availability of a new family of inline gearboxes, with 3 different gear ratios to handle a wide variety of speed and power requirements. These gearboxes offer a superior, simpler and more cost effective option when compared to our legacy double clutch/reduction assemblies.

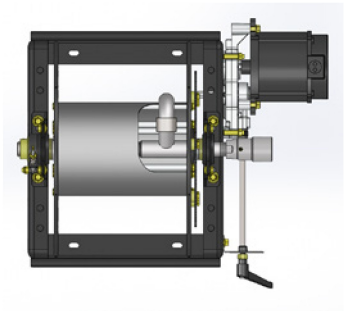
Inline Gearbox Features & Benefits:

- Available in 3 reduction ratios—2:1, 3:1 and 4:1, so that almost any desired motor speed reduction and pull force requirement can be met.
- Bolts directly on the face of existing Hannay motors, making installation very easy
- Field retrofittable on existing reels
- Eliminates the complexity and extra maintenance associated with a traditional Hannay clutch/reduction unit—including two fewer sprockets and one less piece of chain. Aesthetically, it also gives the reel a cleaner, more modern look.
- Better operator ergonomics – simple, low-force quarter turn of a knob to engage or disengage the clutch from the motor, compared to legacy clutch, which required 35 lbs of pull force to activate.
- Significant price savings compared to the traditional clutch/reduction unit (up to $360 List per reel).

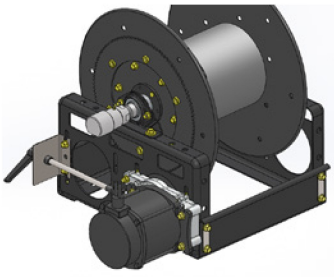
Inline Gearbox can be configured for the left (pictured above) or right side (pictured below) of a reel.



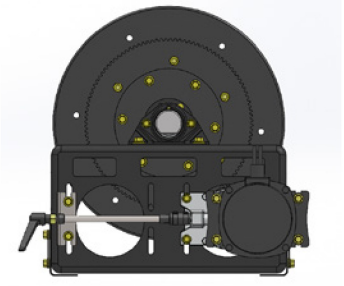
Side Front View: Inline Gearbox configured on right side of reel.



Top View: Inline Gearbox configured on right side of reel.



Rear View: Inline Gearbox configured on right side of reel.



Straight on Side View: Inline Gearbox configured on right side of reel.

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SINCE 1846

TABLE OF CONTENTS

THE WM. POWELL COMPANY - PROFILE

TThe Wm. Powell Company is very proud of our achievements and our evolution in the past 171 years. We like to refer to ourselves as 171 years young due to our flexibility in changing quickly to our customer's and the industry's needs. Our business strategy is to maintain excellent customer service. We will continue to focus on manufacturing the best of class products both in design features and quality, at competitive prices.

The Wm. Powell Company's products include a wide variety of valves in bronze, iron, steel, and corrosion resistant alloys for class 125 to class 4500 pressure service. Our experience as pioneer in the development of industrial valves encompasses over a century and a half of craftsmanship and valve know-how. Through modern engineering, laboratory, research and testing facilities, the Wm. Powell Company has been a leader in changes in our industry. Our on-going program is a long-term commitment to the valve industry and is poised for significant future growth.

Powell Valves has endured a Civil War, World Wars I and II, and the Korean and Vietnam Wars. Powell rebuilt after floods, U.S. economic disaster in the Great Depression, and fierce foreign competition to help put men on the moon. Whether it was the "Manhattan Project", projects on U.S. Nuclear Submarines, Titan or Atlas rockets, in Nuclear Power plants, at Chemical or Petroleum plants, Pulp and Paper mills, or the harshness of cryogenic use, Powell Valves has a long tradition of quality in temperatures from – 425°F to 1500°F and pressures from Class 125 to 4500.

Powell's market base is the Industrial Users: Petrochemical, Industrial Gas, Pulp & Paper, Pharmaceutical, Hydrocarbon processing, Food processing, Mining, Power Generation, Pipeline, Chemical, and Mechanical construction. Powell has formed business partnerships with industrial end-users, contractors, distributors and A&E's in the United States and around the World. Business partnerships formed on competitively priced product, on-time delivery, service and our tradition of product reliability.

Powell's network of support and product availability is unmatched. Powell offers the most complete multi-turn product line from a single source manufacturer. Powell's products are of the highest quality standards, are competitively priced and are produced with modern manufacturing technology and astute materials sourcing, with strategic purchasing & financial ventures in place.

Powell's diverse products and services, industry knowledge, project capabilities and reputation, coupled with our high quality distribution network, create a win-win arrangement where the end-user, contractor, distributor and manufacturer can benefit.

The Wm. Powell Company has made a commitment to our industry to increase growth and market share, with quality competitive products and services and on-time delivery. This is a global commitment.

Powell's end user customers have to react quickly to the demands that are on them to expand their businesses by implementing increased capacity and introducing new products into the market place at low costs and fast turn around times. Powell has addressed our customer's needs by increasing finished product inventory to over $35,000,000 USD in the U.S.A. and with an additional inventory hub in Asia. As an additional advantage to our domestic and global customers, The Wm. Powell Company's Manning, SC facility is a Registered Free Trade Zone.

Powell also used its valve knowledge and expertise to construct a modification facility in the U.S.A. to assist customers with their needs, such as, automation, trim changes, end connection changes, additional quality inspections and special service pressure testing requirements, field service, etc…

The Wm. Powell Company is a closely held private corporation that has been in business since 1846. In fact, only nine presidents have led the Company through its 170, plus, years. The fact that we have been a healthy corporation during this period of time, having survived wars, depressions and natural disasters – in a very competitive marketplace – speaks well for itself.

We look forward to further discussing ways that The Wm. Powell Company can capture current and future opportunities together.

Again, The Wm. Powell Company thanks you for your interest in our company, our products and services. Powell looks forward to discussing ways to be your Preferred Valve Supplier. If you should have any questions, or comments, please contact us.

Sincerely,

Randy Cowart
President, CEO & Chairman
The Wm. Powell Company

HOW TO ORDER POWELL RESILIENT SEAT BUTTERFLY VALVES

The figure number system outlined below is designed to cover the most common configurations.
If special features are required which are not listed below please advise the detailed description for accurate processing.

Digit														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Size			Blank	Base Figure Number				End Code	Material Code	Trim	Packing/ Gasket	Option Code		
6	.	0		1	2	7	1	Q	6	E	T	G	L	V

Example Code for 6" Class 125, Resilient Seat Butterfly, Lug Style, Ductile Iron Body, SS 416 Stem, Ductile Iron Nickel Plated Disc, EPDM Seat, PTFE Packing, lever Operated

Size Code	
Code	Size
2.0	2"
2.5	2-1/2"
3.0	3"
4.0	4"
5.0	5"
6.0	6"
8.0	8"
10.	10"
12.	12"
14.	14"
16.	16"
18.	18"
20.	20"
24.	24"
etc.	etc.

Base Figure Number	
No	Class
1271	125

End Code	
Code	Type
Q	LUG
Y	Wafer
Z	Special ends

Material Codes	
Code	ASTM
6	Ductile Iron
Z	Special Material

Trim	
Code	Description
T	SS 416 Stem, 316 Disc, Teflon Seat
V	SS 416 Stem, 316 Disc, Viton Seat
E	SS 416 Stem, Ductile Iron, Nickel plated disc, EPDM Seat
B	SS 416 Stem, Ductile Iron, Nickel plated disc, Buna Seat
A	SS 416 Stem, 316 Disc, EPDM Seat
C	SS 416 Stem, 316 Disc, Buna Seat
D	SS 416 Stem, Bronze Disc, EPDM Seat
F	SS 416 Stem, Bronze Disc, Buna Seat
Z	Special Trim

Packing/Gasket	
Code	Option
T	PTFE Packing
G	Graphite Packing
Z	Special Packing

Option Codes	
Code	Option
XXX	No Options
GLV	Lever Operator
GXX	Gear Operator
M--	Actuated (Elec.)
	Actuated (pnue.)

POWELL VALVE DESIGN FEATURES:

1. Stem

– One piece through shaft

2. ISO Direct Mount Pad

– Ductile iron (ASTM A 536)

– 2"-12": square stem

– 14"and larger: double-D stem

3. O-Ring

– Prevention of stem leakage

4. Bushing

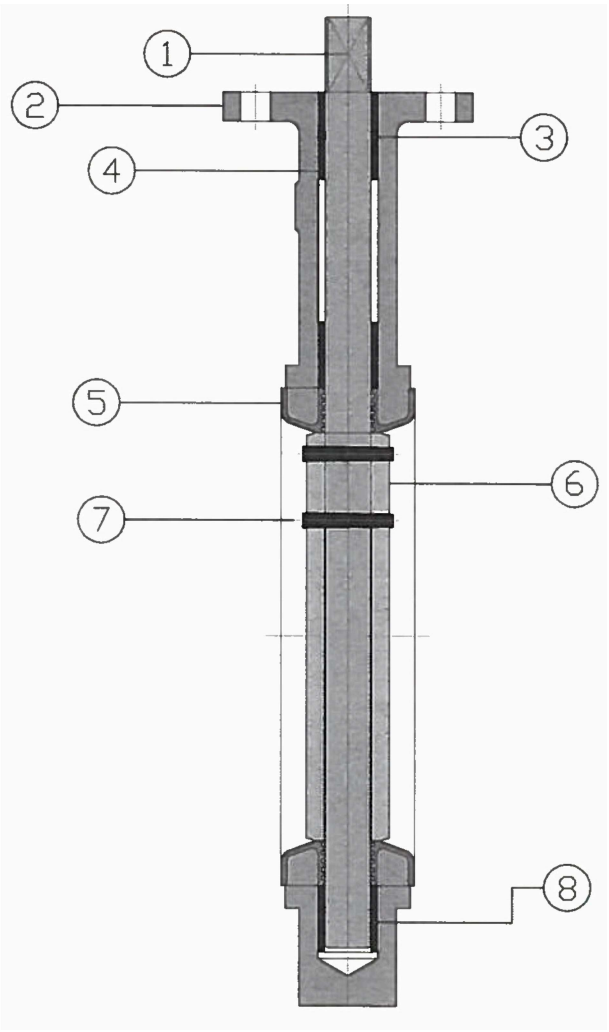
– Provides shaft support

5. Seat

– Phenolic back seat

6. Disc

– Provides bubble tight shut-off



7. Taper Pin

– Ensures a positive vibration-proof shaft

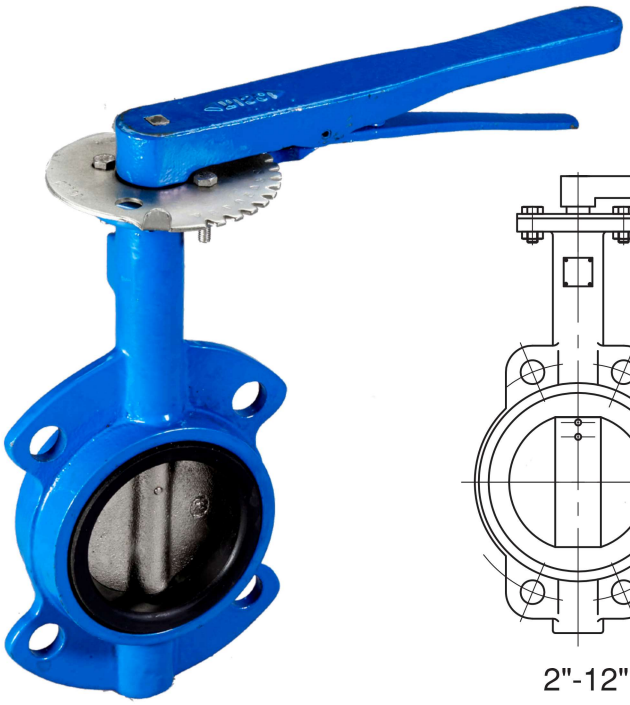
8. Support Shaft Seal

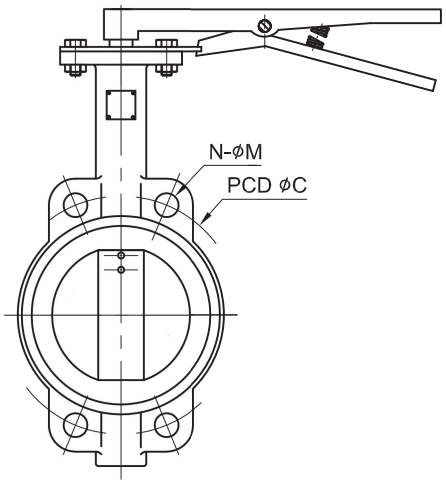
– Bonding of elastomer to phenolic backing ring protects against distortion, a common cause of shaft leakage

VALVE SEAT MATERIAL SELECTION GUIDE

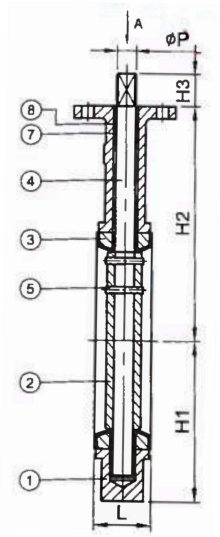
MATERIAL	DESCRIPTION	COLOR
PTFE	The material is the basic seat material used in most butterfly valves. Its chemical compatibility is excellent for almost all media service applications. **-40°F — 275°F**	White
EPDM	EPDM has good abrasion and tear resistance while offering excellent chemical resistance to a variety of acid and weak alkaline-based media. It also has exceptional weather aging and ozone resistance. EPDM is susceptible to attacks by oils and therefore is not recommended for applications involving petroleum oils, hydrocarbons, alcohols, strong acids, or strong alkalines. **-30°F — 275°F**	Black
BUNA-N	BUNA-N (NBR) is a general purpose polymer with good resistance to oil, water, solvents, and hydraulic fluids. With good compression, tensile strength and abrasion-resistance, BUNA-N perfoms well with diverse media such as fatty acids, oils, alcohols, compressed air, Di-ester based fluids, inactive gasses or glycerine. **10°F — 180°F**	Black
VITON	Viton is DuPont's trademark name for Fluoroelastomer and is widely recognized for excellent heat resistance. With extensive chemical compatibility spanning a wide range of concentration and temperature ranges, fluorocarbon elastomers have gained acceptance in a variety of applications. Viton offers excellent resistance to aggressive fuels and chemicals as well as diverse media as mineral acids, salt solutions, chlorinated hydrocarbons, and petroleum oils. **0°F — 350°F**	Black or Red

SERIES 1271 Y
RESILIENT SEAT BUTTERFLY VALVES
WAFER STYLE

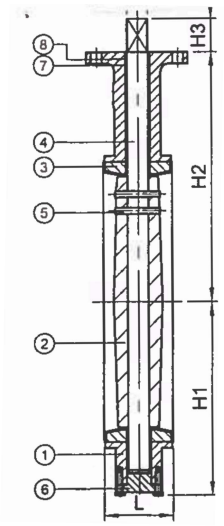




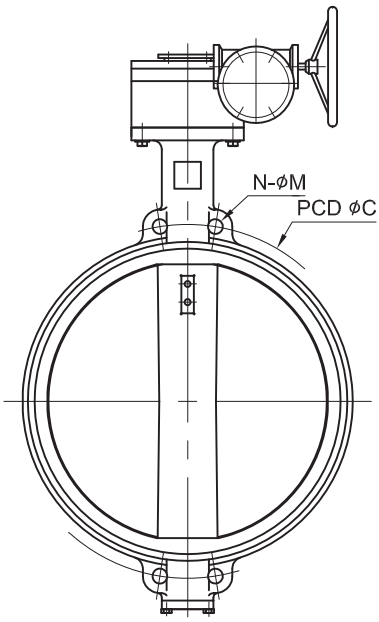
2"-12"



2"-12"



14" and above



14" ABOVE

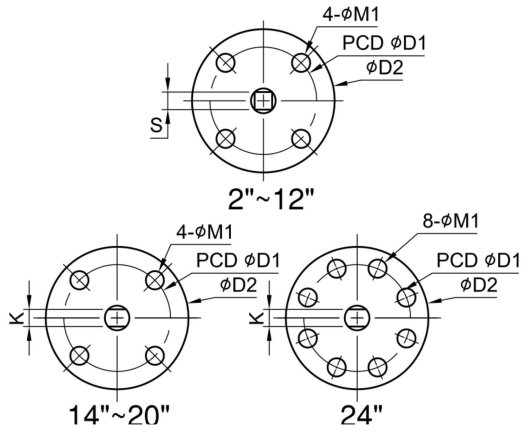
DESIGN FEATURES:

- Upper and Lower Bearings to maximize valve life
- Direct Mount
- 2"-12" standard with lever
- 14"and larger standard with gear
- Support shaft seal: bonding of elastomer to phenolic backing ring protects against distortion, a common cause of shaft leakage
- Integral ISO mounting pad for easy valve operation; no bracket needed
- One piece stem ensures dependability and positive disc positioning
- Available in Wafer and Lug styles
- Disc has a precision profile that provides bubble tight shut off and assures minimum torque
- Seat Materials: Multiple seat materials available (Page 7)
- Seat Face negates need for flange gaskets
- O-Ring ensures dependability and positive disc positioning

Class	Fig. No.	End
2"- 12" 200psi 14"- 24" 130psi	1271 Y	Wafer

See seating chart for temperature. (Page 7)

PART	MATERIAL
Body	DI
Seat	EPDM / BUNA / VITON / PTFE
Disc	DI / SS 316 / BRONZE
Seat	BUNA / EPDM / PTFE
Bushing	PTFE
O-Ring	EPDM / BUNA
Taper Pin	SS 316
Stem	SS 416



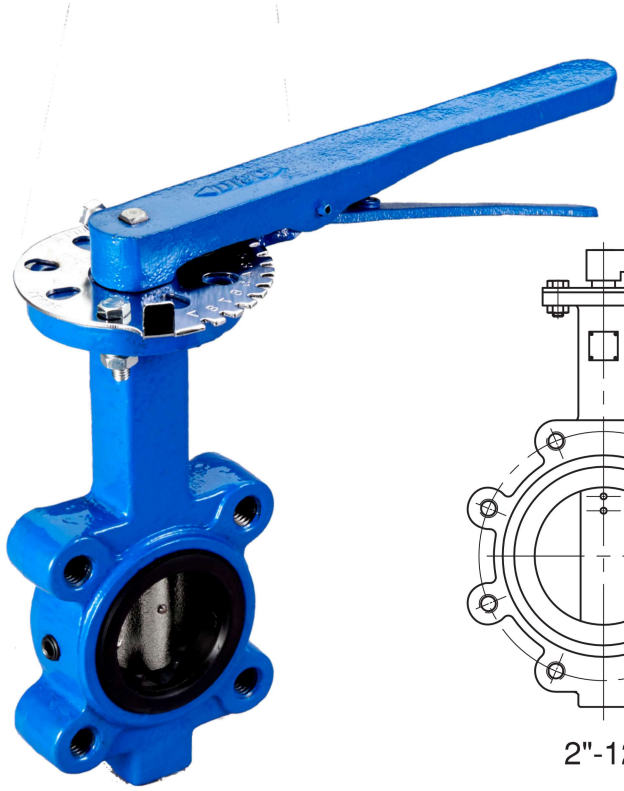
RESILIENT SEATED BUTTERFLY VALVE (WAFER STYLE) DIMENSIONS

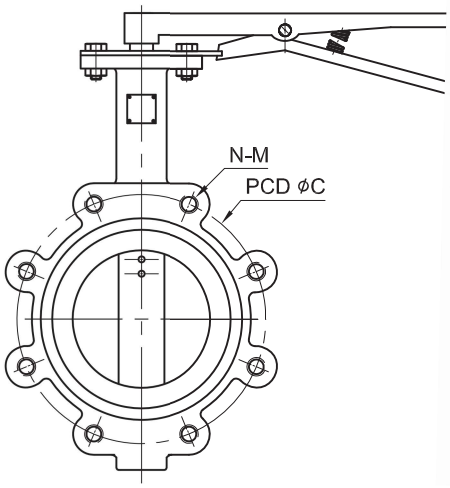
VALVE SIZE		C		L		H1		H2		H3		S		M.FL	WEIGHT
NPS	DN													ISO	LBS
2"	DN50	4.74	120.5	1.61	46	2.99	76	6.38	162	1.18	30	0.35	9	F07	5.5
2-1/2"	DN65	5.49	139.5	1.93	49	3.5	89	6.89	175	1.18	30	0.35	9		7.7
3"	DN80	6	152.5	1.93	49	3.74	95	7.13	181	1.18	30	0.35	9		8.8
4"	DN100	7.5	190.5	2.17	55	4.49	114	7.87	200	1.18	30	0.43	11		12
5"	DN125	8.5	216	2.32	59	5	127	8.39	213	1.18	30	0.55	14		16.5
6"	DN150	9.51	241.5	2.32	59	5.51	140	8.86	225	1.18	30	0.55	14		19
8"	DN200	11.75	298.5	2.52	64	6.97	177	10.24	260	1.42	36	0.67	17	F11	30
10"	DN250	14.25	362	2.81	71.5	7.99	203	11.5	292	1.42	36	0.87	22		21
12"	DN300	17.01	432	3.13	79.5	9.53	242	13.19	335	1.42	36	0.87	22		66
14"	DN350	18.74	476	3.19	81	10.51	267	14.49	368	1.77	45				129
16"	DN400	21.24	539.5	3.54	90	11.73	298	15.75	400	2.01	51			F14	222
18"	DN450	22.76	578	4.29	109	12.52	318	16.61	422	2.01	51				235
20"	DN500	25	635	5.31	135	13.74	349	18.86	479	2.52	64				352
24"	DN600	29.51	749.5	6.18	157	17.48	444	22.13	562	2.76	70			F25	501

VALVE SIZE		K		P		D1		D2		N	M		M1		M.FL	WEIGHT
NPS	DN														ISO	LBS
2"	DN50			0.5	12.7	2.76	70	3.54	90	4	0.75	0.19	0.41	10.5	F07	5.5
2-1/2"	DN65			0.5	12.7	2.76	70	3.54	90	4	0.75	0.19	0.41	10.5		7.7
3"	DN80			0.5	12.7	2.76	70	3.54	90	4	0.75	0.19	0.41	10.5		8.8
4"	DN100			0.62	15.8	2.76	70	3.54	90	8	0.75	0.19	0.41	10.5		12
5"	DN125			0.75	19.05	2.76	70	3.54	90	8	0.87	22	0.41	10.5		16.5
6"	DN150			0.75	19.05	2.76	70	3.54	90	8	0.87	22	0.41	10.5		19
8"	DN200			0.87	22.2	4.02	102	4.92	125	8	0.87	22	0.49	12.5	F11	30
10"	DN250			1.13	28.6	4.02	102	4.92	125	12	0.98	25	0.49	12.5		21
12"	DN300			1.25	31.8	4.02	102	4.92	125	12	0.98	25	0.49	12.5		66
14"	DN350	0.94	24	1.25	31.8	4.02	102	4.92	125	12	1.14	29	0.49	12.5		129
16"	DN400	1.06	27	1.31	33.3	5.51	140	6.89	175	16	1.14	29	0.71	18	F14	222
18"	DN450	1.06	27	1.5	38	5.51	140	6.89	175	16	1.26	32	0.71	18		235
20"	DN500	1.26	32	1.62	41.15	5.51	140	6.89	175	20	1.26	32	0.71	18		352
24"	DN600	1.42	36	1.99	50.65	10	254	11.81	300	20	1.38	35	0.71	18	F25	501

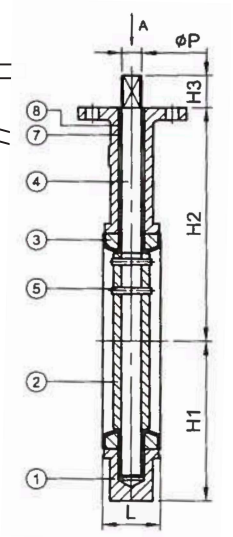
ADDITIONAL SIZES, MATERIALS AND CLASSES AVAILABLE UPON REQUEST.

SERIES 1271 Q
RESILIENT SEAT BUTTERFLY VALVES
LUG STYLE

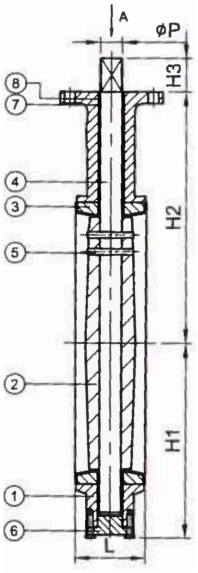




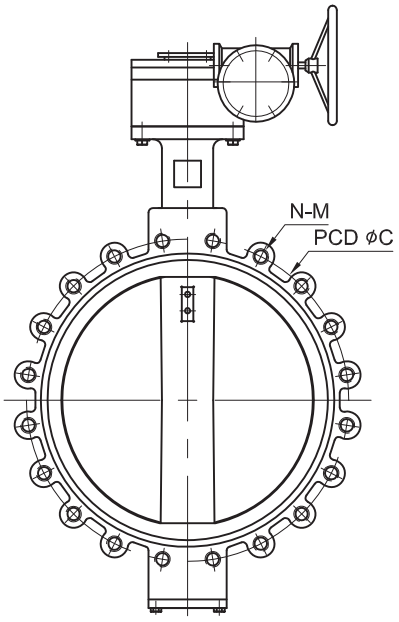
2"-12"



2"-12"



14" and above



14" ABOVE

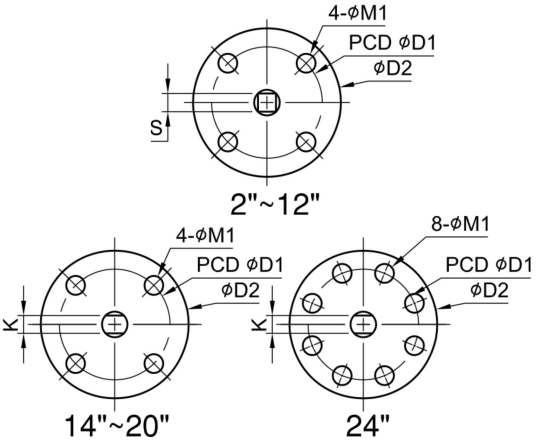
Class	Fig. No.	End
2"- 12" 200psi 14"- 24" 130psi	1271 Q	Lug

See seating chart for temperature. (Page 7)

DESIGN FEATURES:

- Upper and Lower Bearings to maximize valve life
- Direct Mount
- 2"-12" standard with lever
- 14"and larger standard with gear
- Support shaft seal: bonding of elastomer to phenolic backing ring protects against distortion, a common cause of shaft leakage
- Integral ISO mounting pad for easy valve operation; no bracket needed
- One piece stem ensures dependability and positive disc positioning
- Available in Wafer and Lug styles
- Disc has a precision profile that provides bubble tight shut off and assures minimum torque
- Seat Materials: Multiple seat materials available (Page 7)
- Seat Face negates need for flange gaskets
- O-Ring ensures dependability and positive disc positioning

PART	MATERIAL
Body	DI
Seat	EPDM / BUNA / VITON / PTFE
Disc	DI / SS 316 / BRONZE
Seat	BUNA / EPDM / PTFE
Bushing	PTFE
O-Ring	EPDM / BUNA
Taper Pin	SS 316
Stem	SS 416



RESILIENT SEATED BUTTERFLY VALVE (LUG STYLE) DIMENSIONS

VALVE SIZE		C		L		H1		H2		H3		S		M.FL	WEIGHT
NPS	DN													ISO	LBS
2"	DN50	4.74	120.5	1.81	46	2.99	76	6.36	162	1.18	30	0.35	9	F07	9
2-1/2"	DN65	5.49	139.5	1.93	49	3.5	89	6.89	175	1.18	30	0.35	9		11
3"	DN80	6	152.5	1.93	49	3.74	95	7.13	181	1.18	30	0.35	9		12
4"	DN100	7.5	190.5	2.17	55	4.49	114	7.87	200	1.18	30	0.43	11		19
5"	DN125	8.5	216	2.32	59	5	127	8.39	213	1.18	30	0.55	14		22
6"	DN150	6.51	241.5	2.32	59	5.51	140	8.86	225	1.18	30	0.55	14		31
8"	DN200	11.75	298.5	2.52	64	6.81	173	10.24	260	1.42	36	0.67	17	F11	42
10"	DN250	14.25	362	2.61	71.5	7.99	203	11.5	292	1.42	36	0.87	22		60.5
12"	DN300	17.01	432	3.13	79.5	9.33	237	13.27	337	1.42	36	0.87	22		88
14"	DN350	18.74	476	3.19	81	11.02	280	14.49	368	1.77	45				179
16"	DN400	21.24	539.5	3.54	90	11.97	304	15.75	400	2.01	51			F14	284
18"	DN450	22.76	578	4.29	109	14.25	362	16.73	425	2.01	51				349
20"	DN500	25	635	5.31	135	14.49	368	16.9	480	2.52	64				499
24"	DN600	29.51	749.5	6.18	157	17.46	444	22.13	562	2.76	70			F25	694

VALVE SIZE		K		P		D1		D2		N	M	M1		M.FL	WEIGHT
NPS	DN													ISO	LBS
2"	DN50			0.5	12.7	2.76	70	3.54	90	4	5/8"-11	0.41	10.5	F07	9
2-1/2"	DN65			0.5	12.7	2.76	70	3.54	90	4	5/8"-11	0.41	10.5		11
3"	DN80			0.5	12.7	2.76	70	3.54	90	4	5/8"-11	0.41	10.5		12
4"	DN100			0.62	15.8	2.76	70	3.54	90	8	5/8"-11	0.41	10.5		19
5"	DN125			0.75	19.05	2.76	70	3.54	90	8	3/4"-10	0.41	10.5		22
6"	DN150			0.75	19.05	2.76	70	3.54	90	8	3/4"-10	0.41	10.5		31
8"	DN200			0.87	22.2	4.02	102	4.92	125	8	3/4"-10	0.49	12.5	F11	42
10"	DN250			1.13	28.6	4.02	102	4.92	125	12	7/8"-9	0.49	12.5		60.5
12"	DN300			1.25	31.8	4.02	102	4.92	125	12	7/8"-9	0.49	12.5		88
14"	DN350	0.94	24	1.25	31.8	4.02	102	4.92	125	12	1"-8	0.49	12.5		179
16"	DN400	1.06	27	1.31	33.3	5.51	140	6.89	175	16	1"-8	0.71	18	F14	284
18"	DN450	1.06	27	1.5	38	5.51	140	6.89	175	16	1-1/8"-7	0.71	18		349
20"	DN500	1.26	32	1.62	41.15	5.51	140	6.89	175	20	1-1/8"-7	0.71	18		499
24"	DN600	1.42	36	1.99	50.65	10	254	11.81	300	20	1/4"-7	0.71	18	F25	694

ADDITIONAL SIZES, MATERIALS AND CLASSES AVAILABLE UPON REQUEST.

BOLTING DATA AND SOFT SEAT TORQUE DATA

Size and Quantity of Bolts for Valve Installation ANSI 125/150

	STUD BOLT FOR WAFER TYPE			HEXAGON HEAD BOLT FOR LUG TYPE	
SIZE	QTY	UNC	LENGTH	QTY	UNXCL
2"	4	5/8"	120	4x2	5/8"x35
2.5"	4	5/8"	130	4x2	5/8"x40
3"	4	5/8"	133	4x2	5/8"x40
4"	8	5/8"	139	8x2	5/8"x45
5"	8	3/4"	152	8x2	3/4"x45
6"	8	3/4"	155	8x2	3/4"x45
8"	8	3/4"	165	8x2	3/4"x50
10"	12	7/8"	183	12x2	7/8"x60
12"	12	7/8"	183	12x2	7/8"x65
14"	12	1"	214	12x2	1"x70
16"	16	1"	241	16x2	1"x85
18"	16	1 1/8"	265	16x2	1 1/8"x90
20"	20	1 1/8"	284	20x2	1 1/8"x100
24"	20	1 1/4"	305	20x2	1 1/4"x110

PTFE/VITON Seat Butterfly Valve Torques

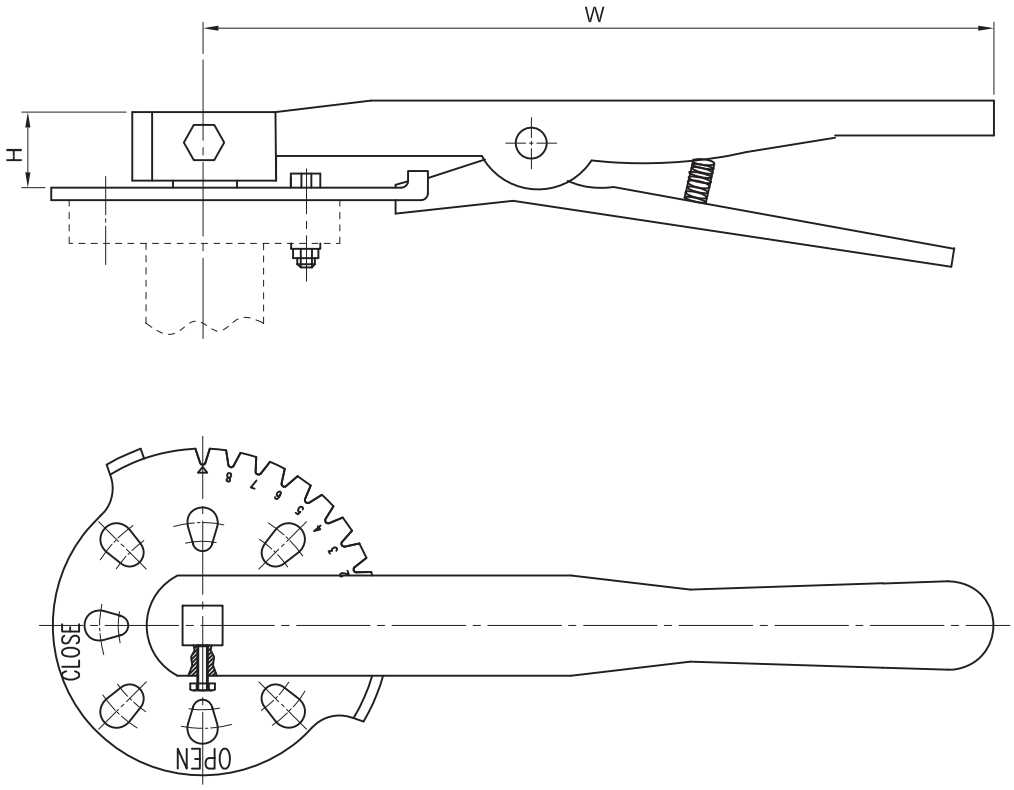
SIZE	TORQUE (N.m)	TORQUE (in.lb)
2"	20	177
2.5"	24	212
3"	32	283
4"	45	398
5"	60	531
6"	105	929
8"	260	2301
10"	365	3231
12"	520	4602

EPDM/NBR Seat Butterfly Valve Torques

SIZE	TORQUE (N.m)	TORQUE (in.lb)
2"	15	133
2.5"	17	150
3"	25	221
4"	35	310
5"	45	398
6"	80	708
8"	170	1505
10"	260	2301
12"	380	3363
14"	450	3983
16"	650	5753
18"	1000	8851
20"	1300	11506
24"	2200	19472

Note: The torque values are under wet condition. Torque values do not include a safety factor, proposed to increase by the safety value of 25%.
The torque values are for reference only.

POWELL LEVER OPERATORS

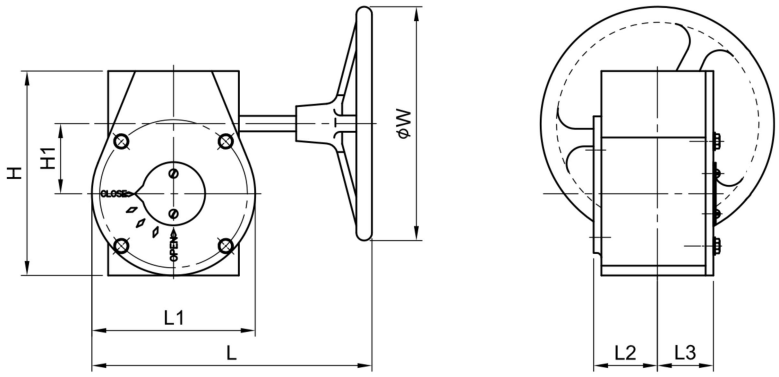


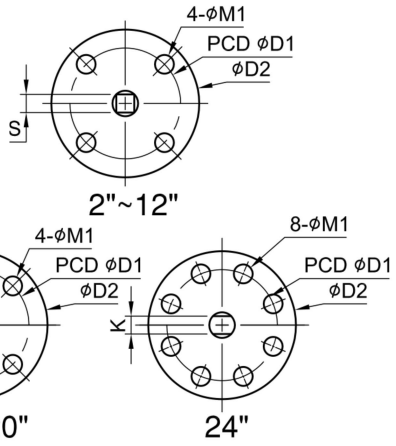
Dimension (in/mm)

VALVE SIZE NPS / DN	H	W
2"- 6" / DN50-DN150	1.18 / 29.97	10.81 / 274.57
10"- 12" / DN250-DN300	1.43 / 36.32	14.49 / 368.05

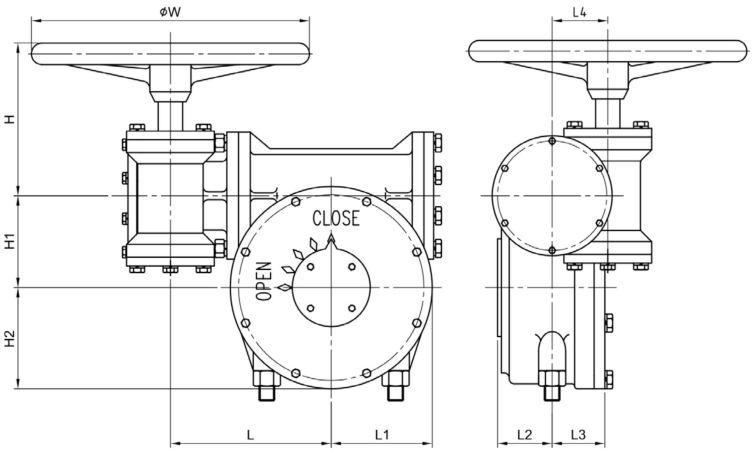
POWELL "A" SERIES QUARTER TURN WORM GEARS

Worm Gear - A





Worm Gear - B



Dimension (in/mm)

VALVE SIZE		S		K		P		D1		M1
NPS	DN									
2"	DN50	0.35	9	-	-	0.5	12.7	2.76	70	M8
2-1/2"	DN65	0.35	9	-	-	0.5	12.7	2.76	70	M8
3"	DN80	0.35	9	-	-	0.5	12.7	2.76	70	M8
4"	DN100	0.43	11	-	-	0.62	15.8	2.76	70	M8
5"	DN125	0.55	14	-	-	0.75	19.05	2.76	70	M8
6"	DN150	0.55	14	-	-	0.75	19.05	2.76	70	M8
8"	DN200	0.67	17	-	-	0.87	22.2	4.02	102	M10
10"	DN250	0.87	22	-	-	1.13	28.6	4.02	102	M10
12"	DN300	0.87	22	-	-	1.25	31.8	4.02	102	M10
14"	DN350	-	-	0.94	24	1.25	31.8	4.02	102	M10
16"	DN400	-	-	1.06	27	1.31	33.3	5.51	140	M16
18"	DN450	-	-	1.06	27	1.5	38	5.51	140	M16
20"	DN500	-	-	1.26	32	1.62	41.15	5.51	140	M16
24"	DN600	-	-	1.42	36	1.99	50.65	10	254	M16

POWELL "A" SERIES QUARTER TURN WORM GEARS

Gear Operators for Resilient Seat Butterfly Valves

POWELL PART #	DESCRIPTION	HEX DIMENSION	GEAR ISO PATTERN	FITS VALVE SIZE:
RBF-GEAR-15-9	Gear for Resilient Seat Butterfly - 2", 2.5", 3"	9 mm	F07	2", 2.5", 3"
RBF-GEAR-15-11	Gear for Resilient Seat Butterfly - 4"	11 mm	F07	4"
RBF-GEAR-15-14	Gear for Resilient Seat Butterfly - 5", 6"	14 mm	F07	5", 6"
RBF-GEAR-50-17	Gear for Resilient Seat Butterfly - 8"	17 mm	F10	8"
RBF-GEAR-50-22	Gear for Resilient Seat Butterfly - 10"	22 mm	F10	10"
RBF-GEAR-120-22	Gear for Resilient Seat Butterfly - 12"	22 mm	F10	12"

Dimensions (in/mm) , L - L3

VALVE SIZE		L		L1		L2		L3		TORQUE (in-lbs/N-m)		RATIO
NPS	DN											
2"- 6"	DN50-DN150	8.9	226.01	4.13	105	1.42	35.99	1.1	27.99	1327.6	150	24:1
8"- 10"	DN200-DN250	12.32	313	5.98	151.99	1.81	46	1.34	34.01	4425.4	500	32:1
12"- 14"	DN300-DN350	12.09	307.01	6.46	164.01	1.81	46	1.42	35.99	10620.8	1200	50:1

Dimensions (in/mm) , L - L4

VALVE SIZE		L		L1		L2		L3		L4		TORQUE (in-lbs/N-m)		RATIO
NPS	DN													
16"- 20"	DN400-DN500	6.5	165	4.09	103.99	2.21	56.01	2.13	54	2.24	57	22126.8	2500	532:1
24"	DN600	8.78	223.01	5.75	146	2.87	73	2.76	70	2.6	65.99	70805.6	8000	704.1

Dimensions (in/mm) , H - W

VALVE SIZE		H		H1		W		TORQUE (in-lbs/N-m)		RATIO
NPS	DN									
2"- 6"	DN50-DN150	5.04	127.99	1.77	45.01	5.91	150.01	1327.6	150	24:1
8"- 10"	DN200-DN250	7.05	179.02	2.48	62.99	11.81	300	4425.4	500	32:1
12"- 14"	DN300-DN350	7.87	200	3.07	78	11.81	300	10620.8	1200	50:1

Dimensions (in/mm) , H - W

VALVE SIZE		H		H1		H2		W		TORQUE (in-lbs/N-m)		RATIO
NPS	DN											
16"- 20"	DN400-DN500	6.14	156.01	3.7	94.01	4.1	104.01	11.22	284.99	22126.8	2500	532:1
24"	DN600	7.36	186.99	5.51	140	5.75	146	15.55	395	70805.6	8000	704.1

GENERAL TERMS AND CONDITIONS OF SALE

1. TERMS EXCLUSIVE: The terms and conditions of the purchase order or requisition to which these GENERAL TERMS AND CONDITIONS OF SALE (these "Terms and Conditions") relate or are attached (each, an "Order"), are exclusive and represent the full and final agreement of The William Powell Company, an Ohio corporation ("Powell") and the purchaser ("Purchaser") as they relate to the goods, materials, services or labor covered in the Order (all, whether or not tangible property or goods, the "Products"), and may not be added to, modified, superseded or altered except by written agreement or modification signed by Powell's authorized representative, notwithstanding any additional or other proposals, terms and conditions which may now or in the future appear on Purchaser's Orders or other forms (notification of objection thereto being given hereby), in whatever form transmitted, and notwithstanding any shipment of Products, acceptance of payments or other similar acts of Powell.

2. SALE BY AGENT OR REPRESENTATIVE: These Terms and Conditions shall govern the liability and obligations of Powell in regard to the transaction in Products, whether the sale was procured directly by Powell or indirectly through an authorized sales representative.

3. CONTRACT: Orders may be submitted to Powell in writing (which will include via an electronic transmission) or orally, provided, however, that if Purchaser fails to provide a detailed, formal written Order (a) within ten (10) days of an oral Order or (b) before shipment of the Order, whichever is earlier, then Product descriptions, quantities, specifications, etc., as set forth in Powell's acknowledgement, acceptance and/or invoice, shall be conclusive and binding on both parties, and discrepancies shall be for Purchaser's account. All Orders are subject to credit approval and acceptance by Powell. An Order shall be deemed to have been accepted by Powell upon the first to occur of the following: (i) Powell's first shipment or other tender of the Order or (ii) acceptance thereof by Powell in writing.

4. PERMISSIBLE VARIATIONS: Powell has the right, prior to the delivery of Products to Purchaser and without the giving of notice to Purchaser, to make any changes in the composition, fabrication or design of the Products which, in the opinion of Powell, do not affect the general characteristics or properties of the Products. In addition, Powell may make any change or any variation in the Products, whether of quality or quantity, which is within governmental or professional standards or specifications applicable at the time of manufacture without giving notice to Purchaser. Purchaser will accept any Products which may incorporate any changes in the composition, fabrication or design.

5. PRICES: Prices for Products are quoted and payable in U.S. dollars ("USD"). Prices stated in general price lists are subject to change without prior notice, at Powell's sole discretion. Prices that are provided in a specific quotation will remain firm for thirty (30) days of the issued date of the written quotation. All prices are exclusive of freight costs, taxes and duties. All taxes (including, without limitation, sales, use, stamp, value added and other taxes) duties, fees, charges and assessments by whomsoever levied on or with respect to the Products, and whether levied against Purchaser or Powell, are for Purchaser's account and, unless invoiced, shall be paid by Purchaser directly to the appropriate governmental agency.

6. SHIPPING TERMS: Delivery of Products to Canada, the United States and Mexico shall be F.O.B. (as defined in the Uniform Commercial Code as in effect in the State of Ohio) Powell's plant of manufacture. Delivery of Products outside of Canada, United States and Mexico shall be Ex Works (as defined by INCOTERMS 2000) Powell's plant of manufacture. All transportation expenses, freight and insurance shall be paid by Purchaser, and risk of delay, loss or damage incurred in transit shall be borne by Purchaser, who shall be responsible to file any such claims with the relevant carrier(s) or insurers.

Upon tender of delivery, title shall pass to Purchaser, subject to Powell's right of stoppage in transit and to Powell's security interest in the Products, as set forth in Section 8.

If the Products are held by Powell subject to receiving instructions from Purchaser or in any case where Powell, in its sole discretion, determines any part of the Products should be held for Purchaser's account, Powell may invoice the Products, and Purchaser agrees to make payment in accordance with these Terms and Conditions. Products invoiced and held at any location by Powell will be held at Purchaser's risk, and Powell may charge for (but is not obligated to carry) insurance and storage.

If Purchaser has declared or manifested an intention not to accept delivery in accordance with these Terms and Conditions, no tender will be necessary, but Powell may, at its option, give notice to Purchaser that Powell is ready and willing to deliver and such notice will constitute a valid tender of delivery.

7. INSPECTION AND ACCEPTANCE: Each shipment shall be inspected by Purchaser for observable damage and/or non-conformity at the time of delivery of the Products. Failure to so inspect shall constitute a waiver of Purchaser's rights of inspection and shall constitute an unqualified acceptance of the Products. If, after such inspection, Purchaser attempts to reject any Products, Purchaser shall fully specify all claimed damage or non-conformity in writing in a notice of rejection sent to Powell within five (5) days of delivery of the Products. Purchaser's failure to so specify shall constitute a waiver of that damage or non-conformity. Partial deliveries shall be accepted by Purchaser and paid for according to these Terms and Conditions.

8. PAYMENT TERMS: Payment shall be due net thirty (30) days from the date of invoice. Overdue accounts shall be subject to a carrying charge of one and one-half percent (1.5%) per month or portion of a month on the unpaid balance until paid in full. In the event Purchaser shall default on its obligations hereunder, Purchaser shall be liable for all of Powell's costs and expenses of collection, including reasonable attorneys' fees. Powell may, at its option, cancel and/or sell any unshipped Products should Purchaser fail to fulfill the complete terms of payment. Purchaser will have no right to offset any amounts against any payment or other obligation which Powell may owe to Purchaser. Powell hereby reserves a security interest in the Products to secure Purchaser's payment of the purchase price and any other amounts owed by Purchaser, and Purchaser agrees that Powell may (but is not obligated to) take such action as Powell deems advisable to evidence and perfect such interest and that Purchaser will cooperate with Powell in the taking of such actions.

9. CREDIT APPROVAL: Notwithstanding the provisions of Section 8, Powell may at any time decline to make any shipment or delivery or perform any work except upon receipt of payment or upon terms and conditions or security satisfactory to Powell, including, but not limited to, requiring that Purchaser provide Powell one or more letters of credit.

10. LEAD TIMES: Estimated lead times, if specified, are approximate only and are not guaranteed. Failure to ship on or near the estimated date shall not entitle Purchaser to any remedy or to cancel the Order without charge. Estimated lead times are provided Ex Works Powell's plant in weeks after receipt of Order. Estimated lead times are stated on a net basis and do not include any additional lead time due to scheduled and/or unscheduled plant shutdowns. Scheduled plant shutdowns include a two (2) week shutdown each winter and each summer. Estimated lead times are quoted on the basis of material availability and plant loading at the time of quotation, which are subject to change. Purchaser should confirm any estimated lead times at time of Order.

11. MINIMUM ORDER CHARGE: With respect to any Order that includes spare, replacement or component parts ("Parts") as Products, a minimum Order charge of One Hundred USD ($100) shall apply. With respect to any Order that includes valves ("Valves") as Products, a minimum Order charge of Three Hundred Fifty USD ($350) shall apply.

12. RETURN OF PRODUCTS: No Products shall be returned to Powell without Powell's prior written agreement. Products returned by Purchaser shall be returned in the same condition as when delivery was affected by Powell. Only Products that are new, unused and in a condition suitable for immediate resale shall be considered for return. Powell reserves the right to assess a minimum thirty-five percent (35%) restocking charge for Products returned for reasons other than defects or non-conformity.

GENERAL TERMS AND CONDITIONS OF SALE

13. CANCELLATION/SUSPENSION: Purchaser shall not cancel or suspend an Order without Powell's prior written consent, which such consent Powell shall be under no obligation to provide. In the event of cancellation or suspension of an Order without Powell's prior written consent, in addition to Powell's other rights and remedies available hereunder and under applicable law, Purchaser shall pay cancellation charges as follows: (a) Order entered in Powell's system, but no engineering yet initiated, 5%, (b) Engineering work has begun and orders for casings and/or outside purchased parts have been placed, 25%, (c) Castings poured and/or components made, but not yet received at Powell's location, 75%, (d) Castings poured and/or components made and received at Powell's location, 85%, (e) Manufacturing process started, 95% and (f) Components finished, 100%.
Powell may cancel all or part of an Order immediately upon the happening of any of the following: Purchaser is delinquent on any of its obligations hereunder or under any order or transaction with Powell, insolvency of Purchaser; the appointment of a custodian as that term is defined in Title 11 U.S.C., as amended (the "Bankruptcy Code"), or the commencement of a case under any chapter of the Bankruptcy Code or the bankruptcy, receivership, insolvency or similar laws of any country for, by or against Purchaser; Purchaser's suspension or termination of business or assignment for the benefit of creditors; or any event, whether or not similar to the foregoing, which materially impairs Purchaser's ability to perform hereunder. Powell's rights to cancel or postpone set forth herein may be exercised by Powell without liability.

14. CORRECTIONS: Powell reserves the right to make corrections to price lists, quotations, invoices or other contract documents in the event of clerical or typographical errors.

15. COUNTRY OF ORIGIN: Powell reserves the right to furnish Products from any of its plants at its sole discretion and does not represent that the Products listed herein originate from any specific country. Any costs affected by country of origin, including, but not limited to, customs duties, are not included in the purchase price and are for Purchaser's account.

16. INFORMATION REGARDING PRODUCTS: Purchaser acknowledges that it has received and is familiar with Powell's and any other manufacturer's labeling and literature concerning the Products and will forward such information to its employees, agents and customers.

17. POWELL PRODUCT WARRANTY: For a period of (a) ninety (90) days from tender of delivery with respect to Parts and (b) the earlier of (i) eighteen (18) months from tender of delivery or (ii) twelve (12) months from installation with respect to Valves, Powell warrants to Purchaser that the Parts and/or Valves, as applicable, of its own manufacture are free of defects in material and workmanship, under normal use and proper operation. If any such Products fail to comply with such warranty, Powell, at Powell's option, shall either: (i) replace such defective Products; (ii) furnish replacement parts for repairing Products (iii) issue written authorization for Purchaser or others to replace or repair, without charge to Purchaser, at costs comparable to Powell's normal manufacturing costs, those parts proven defective; or (iv) refund all monies paid by Purchaser to Powell for such Products and, at the sole discretion of Powell, have the Products returned to Powell at Powell's expense. Finished materials and accessories purchased from other manufacturers are warranted only to the extent of the manufacturer's warranty to Powell (to the extent transferable by Powell to Purchaser). Any alteration in material or design of the Products or component parts thereof by Purchaser or others and/or the undertaking of repairs or replacement by Purchaser or its agents without Powell's written consent shall relieve Powell of all responsibility herewith.

Powell's obligations under this warranty shall be conditioned upon (a) Purchaser's notifying Powell of any alleged defect(s) in a writing that references Purchaser's Order number and provides complete identification of any allegedly defective Products within ten (10) days of the discovery of the damage or defect, and (b) Powell's satisfying itself upon inspection that its warranty has been breached. Purchaser may not bring any action under or arising from an Order or these Terms and Conditions unless such action is commenced within one year after the cause of action accrues.

EXCEPT AS SET FORTH IN THIS SECTION 17, POWELL MAKES NO WARRANTY CONCERNING THE PRODUCTS WHATSOEVER; POWELL DISCLAIMS AND EXCLUDES ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF NON-INFRINGEMENT AND THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE OBLIGATIONS SET FORTH IN THIS SECTION 17 ARE POWELL'S SOLE OBLIGATIONS AND PURCHASER'S EXCLUSIVE REMEDY. POWELL SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, AND PURCHASER HEREBY WAIVES, FOR ITSELF AND ITS SUCCESSORS AND ASSIGNS, (A) ANY AND ALL CLAIMS FOR PUNITIVE DAMAGES AND (B) ALL CLAIMS OF NEGLIGENCE OR STRICT LIABILITY OR BOTH. WITHOUT LIMITATION TO THE FOREGOING, IN NO EVENT SHALL POWELL BE LIABLE FOR THE LOSS OF USE OF THE PRODUCT OR FOR THE LOSS OF USE OF ANY OTHER PRODUCT, PROCESS, EQUIPMENT, OR FACILITIES OF PURCHASER OR OF THE END-USER, WHETHER PARTIALLY OR WHOLLY DUE TO DEFECTS IN MATERIAL AND/OR WORKMANSHIP AND/OR DESIGN OF POWELL'S PRODUCT, AND IN NO EVENT SHALL POWELL BE LIABLE FOR REMOVAL OF APPURTENANCES OR INCIDENTALS SUCH AS CONNECTIONS, PIPE WORK AND SIMILAR ITEMS OF OBSTRUCTION OR FOR ANY COSTS BROUGHT ABOUT BY NECESSITY OF REMOVING THE PRODUCT FROM ITS POINT OF INSTALLATION.

Purchaser (a) recognizes that the limitations contained in this Section 17 are material factors in Powell's sale of the Products at the price(s) specified, and (b) agrees that any accommodation to Purchaser by Powell, whether for sales policy reasons or otherwise, shall not be taken to establish any liability of Powell or any contract term inconsistent with this Agreement.
Purchaser shall neither make nor purport to make (a) any warranty to any person by or on behalf of Powell or (b) any warranty or representation inconsistent with this Section 17.

18. COMPLIANCE WITH LAWS: Powell certifies that the Products produced by it, if any, were produced in compliance with all applicable requirements of Sections 6, 7 and 12 of the Fair Labor Standards Act of 1938, as amended, and the Regulations and Orders of the Administrator of the Wage and Hour Division issued under Section 14 thereof.
Powell shall endeavor to comply with all applicable Ohio and United States federal laws. Powell is not responsible for compliance with any other laws or regulations, or with any Product standard or specification, whether of general or particular application, unless Purchaser has furnished specific written notice thereof prior to Powell's entry of Purchaser's Order.

All sales of Products are conditioned upon and subject to strict compliance with United States export control laws, rules and regulations, including, without limitation, the Export Administration Act, the Export Administration Regulations, the Arms Control Act, the International Traffic in Arms Regulations, the Trading With the Enemy Act, the International Economic Powers Act and the Foreign Assets Control Regulations, as they may be amended and supplemented from time to time (each, an "Export Law" and collectively, the "Export Laws"). For any sale of Products requiring a license, permit or other approval under any Export Law ("Restricted Products"), Powell shall determine the feasibility of obtaining such license, permit or other approval ("Export Approval") and whether it will fill the order for the Restricted Products in light of required Export Approval. In the event Powell applies for Export Approval for the Restricted Products, it shall do so at Purchaser's cost and expense and Purchaser agrees to reimburse Powell for any cost or expenses (including Powell's reasonable attorneys' fees) incurred by Powell in pursuing Export Approval. Powell shall not be under any obligation to ship any such Restricted Products unless and until such Export Approval is granted, and only in strict compliance with the terms and conditions of such Export Approval. Purchaser shall be responsible for timely obtaining and maintaining any required import license, permit or approval necessary to import any Restricted Products into Purchaser's country and any other required governmental authorization ("Import Approval"). Powell shall not be liable if any Export Approval or Import Approval is delayed, denied, revoked, restricted or not renewed, and Purchaser shall not be relieved thereby of its obligations to pay Powell for the Restricted Products or Powell's costs and expenses of obtaining Export Approval in respect of Restricted Products under the Export Laws.

GENERAL TERMS AND CONDITIONS OF SALE

For Products other than Restricted Products, Purchaser (or its designated export agent) shall be responsible for the timely application for any required export authorization and the payment of any required fees, duties, taxes, tariffs, levies or other charges necessary to export the Products out the United States of America and shall be responsible for timely obtaining and maintaining any required Import Approval and the payment of any required fees, duties, taxes, tariffs, levies or other charges necessary to import the Products into Purchaser's country. Powell shall not be liable if any export authorization or Import Approval is delayed, denied, revoked, restricted or not renewed, and Purchaser shall not be relieved thereby of its obligations to pay Powell for the Products.

Purchaser shall not make any disposition of any Products purchased hereunder, by way of transshipment, reexport, diversion or otherwise, other than in and to the ultimate end user and country of destination specified on Purchaser's order or declared as the ultimate end user and country of ultimate destination on Powell's invoices, except as the Export Laws or Export Approval may expressly permit. Purchaser shall not distribute or resell any Product to or within any country or to any individual, government authority or other entity that is presently or at any time in the future subject to sanctions of the United States government, or is in violation of any Export Laws or other United States federal laws, statutes, codes, Executive Orders, decrees, rules or regulations relating to terrorism, drug trafficking or money laundering, or is designated under any such authority as being subject to sanctions or connected in any way to terrorism, drug trafficking or money laundering, including, without limitation, on the Specially Designated Nationals List and Block Persons List maintained by the Office of Foreign Assets Control (OFAC), United States Department of the Treasury, and the Denied Persons List, the Entity List and the Unverified List maintained by the Bureau of Industry and Security, United States Department of Commerce.

Purchaser shall indemnify and hold harmless Powell from and against any damages, liabilities or expenses of any kind incurred by Powell as a result of Purchaser's direct or indirect breach of any term or condition related to the Export Laws.

19. SAFETY: Purchaser warrants that it will comply with all laws, regulations, standards and requirements which are applicable to the use of the Products and Purchaser's business.

20. CONFIDENTIALITY: Purchaser will not disclose or otherwise disseminate, directly or indirectly, any of the terms of these Terms and Conditions or any other information of Powell given to or received by Purchaser or its associates or agents, unless Purchaser received Powell's written permission or such information is required to be disclosed by law or becomes part of the public domain through no fault of Purchaser, its associates or agents.

21. GOVERNING LAW; JURISDICTION AND VENUE: These Terms and Conditions shall be governed by and construed in accordance with the internal laws of the State of Ohio, without regard to such state's choice of law principles. These Terms and Conditions shall not be governed by or construed in accordance with the United Nations Convention on the International Sale of Goods, 1980, for any purpose. Customer and Powell hereby submit to the jurisdiction and venue of the state and federal courts in Cincinnati, Hamilton County, Ohio over any controversy relating to or arising from these Terms and Conditions. Notwithstanding the foregoing, Powell's right to institute or defend any proceedings in any jurisdiction, in or out of the United State of America, shall not be limited.

22. SEVERABILITY: If any of the provisions of these Terms and Conditions are deemed invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions will in no way be affected or impaired thereby.

23. FORCE MAJEURE: Delivery of all or any part of the Products is contingent upon Powell's ability to obtain supplies, raw materials and services through its regular and usual sources of supply. If by reason of any contingency beyond Powell's reasonable control, including (but not limited to) war, governmental requests, restrictions or regulations, fire, flood, casualty, accident, or other acts of God, strikes or other difficulties with employees, delay or inability to obtain labor, equipment, material and services through Powell's usual sources, failure or refusal of any carrier to transport materials, delay in transport thereof, or any other similar occurrence, Powell is not able to meet anticipated deliveries, Powell shall not be liable therefore and may, in its discretion without prior notice to Purchaser, postpone the delivery date(s) under this document for a time which is reasonable under all the circumstances. If during the occurrence of any of the foregoing contingencies, Powell holds any of the Products, Powell may invoice and hold the same for the account of Purchaser and Purchaser agrees to make payment at the maturity of the invoice so rendered.

24. ASSIGNMENT: No right or interest in the contract arising from these Terms and Conditions shall be assigned by Purchaser and no delegation of any obligation owed by Purchaser shall be made without the prior written permission of Powell. As used herein, "Purchaser" and "Powell" include the respective heirs, executors, personal representatives, successors and permitted assigns of each.

25. REMEDIES CUMULATIVE; NO WAIVER: The individual rights and remedies of Powell reserved herein shall be cumulative and additional to any other or further remedies provided in law or equity or in this document. Waiver by Powell of performance or breach of any provision hereof by Purchaser, or failure of Powell to enforce any provision hereof which may establish a defense or limitation of liability, shall not be deemed a waiver of future compliance therewith or a course of performance modifying such provision, and such provision shall remain in full force and effect as written.

26. LIMITATION OF LIABILITY: UNDER NO CIRCUMSTANCES SHALL POWELL BE LIABLE TO PURCHASER UNDER OR IN CONNECTION WITH ORDERS FOR PRODUCTS AND THESE TERMS AND CONDITIONS, WHETHER ANY CLAIM FOR RECOVERY IS BASED UPON OR ARISES OUT OF THEORIES OF BREACH OF CONTRACT, BREACH OF WARRANTY, INDEMNIFICATION, NEGLIGENCE, TORT (INCLUDING STRICT LIABILITY) OR OTHERWISE, IN EXCESS OF AN AMOUNT EQUAL TO THE NET CONTRACT VALUE OF THE PRODUCTS PROVIDED BY POWELL TO PURCHASER DURING THE MOST RECENTLY ENDED CALENDAR QUARTER.

Manufacturing, Sales and Distribution Centers:

Global Corporate Headquarters
2503 Spring Grove Ave.
Cincinnati, OH 45214
513.852.2000
Sales and Engineering
800.888.2583

Powell South Carolina
Manning Manufacturing and Distribution Center
1567 Joe Rogers Jr. Blvd.
Manning, SC 29102

Orangeburg Manufacturing and Distribution Center
940 Cross Creek Road
Orangeburg, SC 29115

Powell Texas
Houston/Stafford Sales and Distribution Center
Freeport Ninety Business Park
13843 N. Promenade Blvd.
Building 5, Suite 650
Stafford, TX 77477
800.888.2583

Powell China
Yancheng Manufacturing, Sales and Distribution Center
Yancheng City, China

The Wm. Powell Company
2503 Spring Grove Ave.
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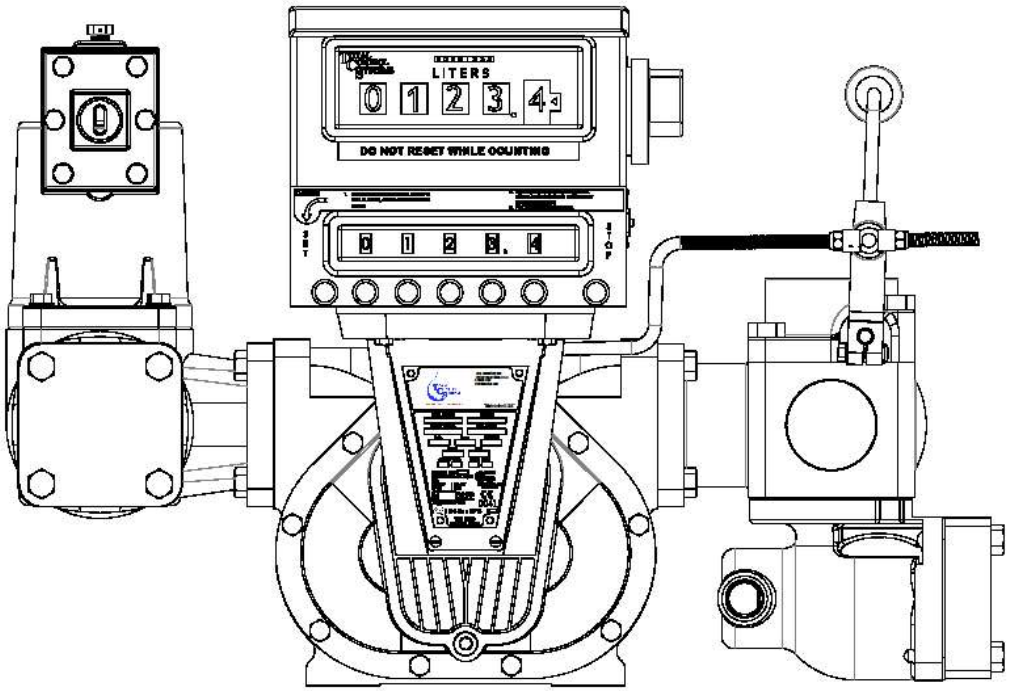
Leading the Industry Since 1846

TOTAL CONTROL SYSTEMS™
The Standard of Measurement

700-30/35
Rotary Meter



Installation, Operation & Maintenance Manual

Table of Contents

Warning Symbols

CAUTION
Follow the warning instructions within the following information to avoid equipment failure, personal injury or death.

TURN POWER OFF
Before performing any maintenance, be sure to turn system power off to avoid any potential electric spark

FLAMMABLE
Flammable liquids and their vapors may cause a fire or explosion if ignited.

EYE PROTECTION
Pressurized systems may cause hazardous leaks and spray that may be dangerous for your eyes. Always wear eye protection around pressurized systems and its hazardous liquids.

INJURY
Wear gloves for protection from hazardous liquids that may cause irritation or burns.

READ
Read and understand all related manuals thoroughly. The Engineering and OIM manuals will provide the knowledge for all systems, maintenance and operation procedures. If you have any questions, please consult the factory.

Receipt & Inspection

Upon receipt of meter shipment, be sure to inspect the packaging and the flow meter assembly for any damage before signing the receipt of the shipment. Notify the delivery company about possible damage and refuse receipt of the shipment.

Meters are individually boxed and are protected with packing material. Each package is identified with the flow meter assembly part number, description, direction of flow and serial number. Verify the meter model is the correct model, size, and configuration as ordered. Contact your distributor if there is any discrepancy or question.

Meter assemblies should be handled with appropriate methods for the awkwardness of size and weight involved. Appropriate clothing and shoes need to be utilized. Transport the meter package to the installation site with appropriate transportation methods, careful not to damage the flow meter.

Be careful of any loose or protruding staples from the packaging, as they can be very sharp and may potentially cause injury.

If foam has been used to protect meter, carefully remove top foam layer before attempting to remove meter assembly from box. Foam packaging maybe formed around the meter assembly making it difficult to remove. If meter is bolted to a wood pallet remove bolts while being careful not to let the meter tip over when the support has been removed. Do not lift the meter assembly by flex hoses, thermowells, wires, pulsers, or put objects through meter. Removing meter assembly from packaging without regard to these warnings may cause serious injury.

The wooden pallets and bases meet the ISPM 15; Guidelines for Regulating Wood Packaging Material in International Trade through the Timber Products Inspection Company (TP #2134).

Every effort has been made to remove the test fluid before shipment. All TCS flow meters are plugged and enclosed in a plastic bag. The test fluid Material Safety Data Sheet (MSDS) can be reviewed on page 50. Appropriate precautions should be taken regarding any personal, environmental and material compatibility with the end use system.

Notice

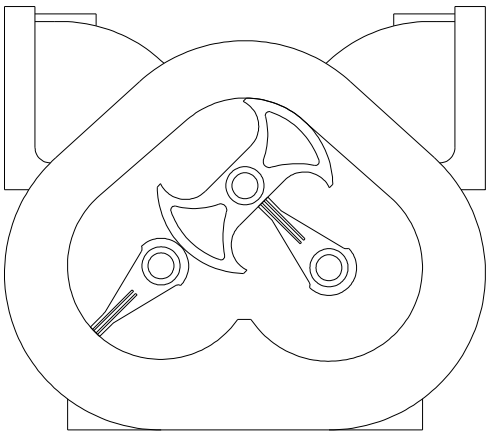
Total Control Systems (TCS) shall not be liable for technical or editorial errors in this manual or omissions from this manual. TCS makes no warranties, express or implied, including the implied warranties of merchantability and fitness for a particular purpose with respect to this manual and, in no event, shall TCS be liable for special or consequential damages including, but not limited to, loss of production, loss of profits, etc.

The contents of this publication are presented for informational purposes only, and while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, expressed or implied, regarding the products or services described herein or their use or applicability. We reserve the right to modify or improve the designs or specifications of such products at any time.

TCS does not assume responsibility for the selection, use or maintenance of any product. Responsibility for proper selection, use and maintenance of any TCS product remains solely with the purchaser and end-user.

Meter Overview

The TCS Model 700 series flow meter is a simple and efficient design. The meter consists of a single fluid chamber that contains a single blocking rotor and two displacement rotors whose rotation is synchronized with mating gears. As the fluid enters the fluid chamber, the blocking rotor is forced to rotate. The displacement rotors, also rotating in conjunction with the blocking rotor help direct the fluid flow through the chamber and to the outlet. The linear flow of the fluid is thus translated into rotary motion in the meter. The output of the meter is picked up from the rotation of the blocking rotor and transmitted to a register or pulse transmitter.



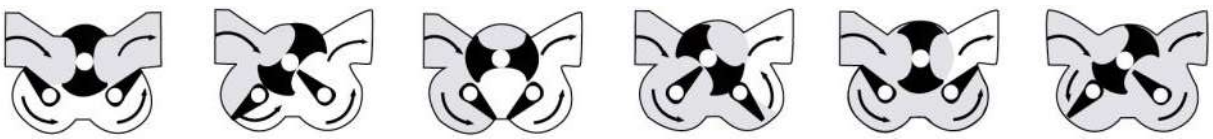
The rotors in the meter are designed to operate at close tolerances to one another and the wall of the fluid chamber. There are slight clearances between the rotors and the chamber wall. Because of this, it is important that the meter be properly applied for the flow rate and operating pressure of the system.

Because the fluid flowing through the meter is redirected only slightly from its natural flow, there is very little pressure drop across the meter, unlike other meters that use multiple measuring chambers.

The meter design uses high performance materials for the rotor bearings and journals. Since there is no contact between the rotors and the fluid chamber wall, these critical components have a long life expectancy.

Calibration of the meter involves adjusting the rotation of the output shaft relative to the rotation of the internal rotors of the meter. This is accomplished by changing the settings on an adjuster device. Calibration of the meter is discussed in detail in the section Meter Calibration.

FLOW ILLUSTRATION



Meter Specifications

Flange Connection: 3” NPT Flange Connection, 2” NPT Flange. Optional BSPT, Slip Weld or ANSI flanges available upon request.

Flow Rate: 700-30 up to 200 GPM (760 LPM)
700-35 up to 300 GPM (1135 LPM); only for fluids under 225 SSU

Maximum Pressure: 150 PSI (10.5 BAR)

Working Temperature: -40 F to 160 F (-40 C to 71 C)
-65 F to 160 F (-54 C to 71 C) with low temperature seal kit

Meter Types

SP - Standard Petroleum
For metering refined petroleum products such as Gasoline, Fuel Oils, Diesel, Bio-Diesel, Kerosene, Vegetable Oils, Motor Oils, Naptha, Ethylene Glycol (Antifreeze), etc.

SPA - Standard Petroleum (Aviation)
For metering refined petroleum products such as Aviation Gasoline, Jet Fuels, Ethanol, Gasoline, Fuel Oils, Diesel, Bio-Diesel, Kerosene, Vegetable Oils, Motor Oils, Naptha, Ethylene Glycol, etc.

SPD - Standard Petroleum (Ductile Iron)
For metering refined petroleum products such as Ethanol, Methanol, Gasoline, Fuel Oils, Diesel, Bio-Diesel, Kerosene, Aviation Gasoline, Vegetable Oils, Motor Oils, Naptha, Ethylene Glycol, etc.

AF - All-Ferrous
For metering Pesticides, Fertilizers, Food Processing Liquids, Industrial Chemicals, Solvents, Paints, Inks, Alcohols and many other liquids such as Liquid Sugars, Liquid Feeds, MEK, Ethanol, Corn Syrup, Soy Bean Oil, Shortenings, Latex Products, Adhesives, Naptha, etc.

IP - Industrial Products
For Food Processing, Chemicals, General Solvents and many other liquids such as Corn Syrup, Soy Bean Oil, Liquid Sugars, Shortenings, Latex Products, Adhesives, etc.

IC - Industrial Products (Carbon Bearings)
For metering Alcohols, Chemicals, Solvents, Water and many other non-lubricating liquids, such as Acetones, Ethanol, Naptha, Xylene, MEK, Toluene, Resins, etc.

Material of Construction

Description	SP	SPA	SPD	IP	IC	AF
Housing	Hardcoat Anodized Aluminum	Hardcoat Anodized Aluminum	Ductile Iron	Hardcoat Anodized Aluminum	Hardcoat Anodized Aluminum	Ductile Iron
Rotors	Hardcoat Anodized Aluminum	Hardcoat Anodized Aluminum	Ni-Resist	Hardcoat Anodized Aluminum	Hardcoat Anodized Aluminum	Ni-Resist
Rotor Journals	Plated SS	Plated SS	Plated SS	Plated SS	Plated SS	Plated SS
Bearing Plates	Ni-Resist	Ni-Resist	Ni-Resist	Ni-Resist	Ni-Resist	Ni-Resist
Bearing Sleeves	Ni-Resist	Carbon Graphite	Carbon Graphite	Ni-Resist	Carbon Graphite	Carbon Graphite
Timing Gears	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Packing Seal	FKM	FKM	Simriz®	Simriz®	Simriz®	Simriz®
Body O-rings	FKM	FKM	FKM	PTFE	PTFE	PTFE

Simriz® is a registered trademark of Freudenberg-NOK.

System Recommendations

Meter Selection

The flow meter must be carefully chosen from the Meter Selection factors in the Engineering Manual. The meter must be selected based on the operating system and product characteristics. System variables include flow rate, temperature and pressure. Product characteristics include the material compatibility, lubricity, viscosity, presence of suspensions, pH, and whether the product can congeal, crystallize or leave a dry film. Failure to select the correct flow meter may result in system failure or serious injury.

Air Elimination

In any system where the supply tank may be completely drained or multiple products manifold into one metering system, the possibility of air being introduced into the fluid piping increases. The solution is to utilize an air or vapor eliminator in the system, located upstream of the flow meter. The purpose of this device is to vent the air or vapor from the system before it can be measured by the meter. Air or vapor elimination is required for all weights and measures regulatory approvals in custody transfer applications.

System Recommendations (Continued)

Control Valves

Safety and isolation valves should be used throughout the metering system. In any pumping system where there is one (1) pump and multiple flow meters, a digital or hydro-mechanical Rate-of-Flow control valve must be used at each flow meter to prevent over-speeding of the flow meters.

Best Plumbing Configuration

1) The flow meter must be securely mounted to a riser or foundation.
2) The inlet and outlet piping must be securely supported, in such a manner so as to avoid pipe stress on the flow meter.
3) The system should be designed to keep the flow meter full of liquid at all times.
4) System piping should have full 3" pipe diameter throughout the metering system to allow for minimal pressure loss.
5) The pipe should be laid out as straight as possible to reduce pressure loss from flow restriction.
6) The meter and piping must be installed in such a way so as to avoid accidental draining of the meter. The inlet and outlet of the meter should be lower than the associated system plumbing. This is known as the sump position.
7) It is not necessary for the air eliminator to be installed directly adjacent to the meter. It can be installed upstream from the meter. For effective operation of the air eliminator, it should be mounted between the meter and any valves, tees or any other potential places where air may enter the system.
8) The metering system should include a means for calibration.

Protection From Debris

On new installations, care must be taken to protect the meter from damage during start-up. It is recommended that a strainer be installed in the system upstream from the meter. The meter could be subject to damage from the passage through of dirt, sand, welding slag or spatter, thread cuttings, rust, etc. A spool can be fabricated and installed in place of the meter until the system is flushed. A spool is a flanged length of pipe equal in length to the meter and any accessories attached to the meter such as an air eliminator or control valve. Another method is to temporarily bypass the plumbing containing the meter until the system is flushed. This will also protect the meter from debris. Once the system has run "clean" for a period of time the meter may be reinstalled or protective means removed.

Thermal Expansion

Most liquids will expand and contract with temperature. In any system where there is a chance for liquid to be captured between closed valves without relief, thermal expansion will likely occur. This can create dangerously high pressures within the system. When product is trapped within the system, the pressure will increase as temperature increases.

Care should be taken in designing the system in which thermal expansion may occur by implementing Pressure Relief Valves or Thermal Expansion Joints in the system design.

System Recommendations (Continued)

Thermal Shock

The metal parts within the flow meter will expand or contract with variations in the system operating temperature. For any systems where sudden or immediate temperature increases of 68 F (20 C) degrees or more are possible, the meter will require clearance rotors. The extra clearance will be necessary to eliminate the effects of immediate expansion of the rotors vs. the meter body, caused by thermal shock.

Hydraulic Shock (Water Hammer)

Hydraulic shock is a rise in pressure, which happens when an operating system undergoes an immediate change in flow direction. This is most often the result of a rapid valve closure while the system is operating at a high flow rate. Hydraulic shock can damage any system component. Particularly susceptible are internal components of the meter, valves, and pump. System design and improper operating procedures will contribute to the seriousness of this problem. In order to eliminate hydraulic shock, the valve closure rate must be slowed. The use of 2-stage preset control valves or surge suppressing bladders or risers will help reduce or eliminate this problem.

Products that Dry/Congeal/Crystallize

There are many liquids that crystallize, harden and/or solidify on contact with air or with an increase in temperature. A proper system design and a good understanding of the product being measured will help to avoid the possibility of air entering into the system and the product and effective operation of the meter being affected.

Calibration

The meter shall be tested and calibrated with the product it is intended to measure when installed. Total Control Systems shall not be responsible for loss of product or any damages resulting from the end user's failure to test this meter to insure proper calibration. Every 700 series meter is tested at the factory to prove that the meter can be calibrated in your system. It is the owner's responsibility to report this device to the local Weights and Measures officials for their inspection before the meter is put to use.

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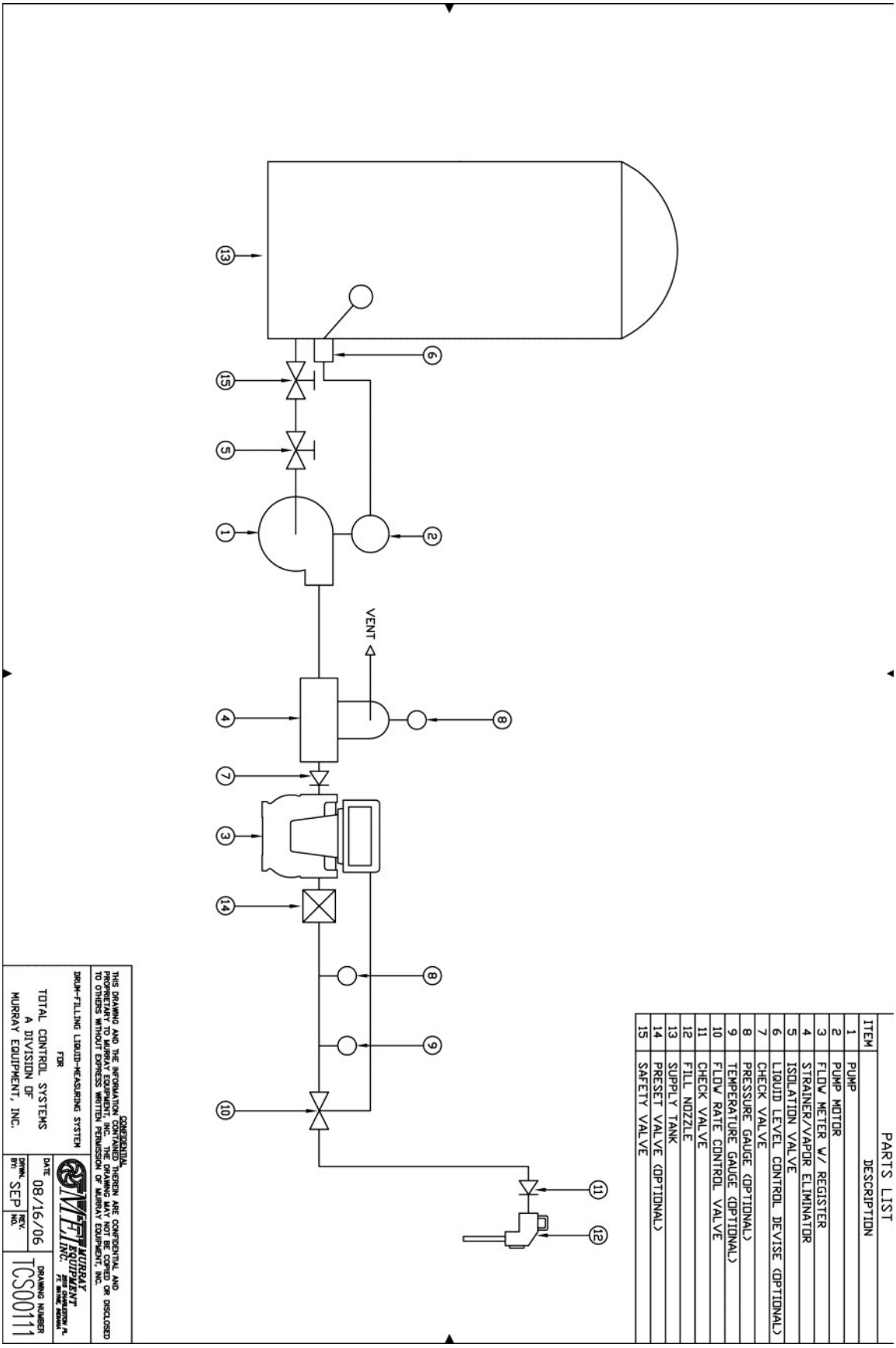

PARTS LIST

ITEM	DESCRIPTION
1	PUMP
2	PUMP MOTOR
3	FLOW METER W/ REGISTER
4	STRAINER/VAPOR ELIMINATOR
5	ISOLATION VALVE
6	LIQUID LEVEL CONTROL DEVISE (OPTIONAL)
7	CHECK VALVE
8	PRESSURE GAUGE (OPTIONAL)
9	TEMPERATURE GAUGE (OPTIONAL)
10	FLOW RATE CONTROL VALVE
11	CHECK VALVE
12	FILL NOZZLE
13	SUPPLY TANK
14	PRESET VALVE (OPTIONAL)
15	SAFETY VALVE

DRUM-FILLING LIQUID-MEASURING SYSTEM
FOR
TOTAL CONTROL SYSTEMS
A DIVISION OF
MURRAY EQUIPMENT, INC.

MURRAY EQUIPMENT INC.

DRAWN BY: SEP
DATE: 08/16/06
REV. NO.:
DRAWING NUMBER: TCS00111

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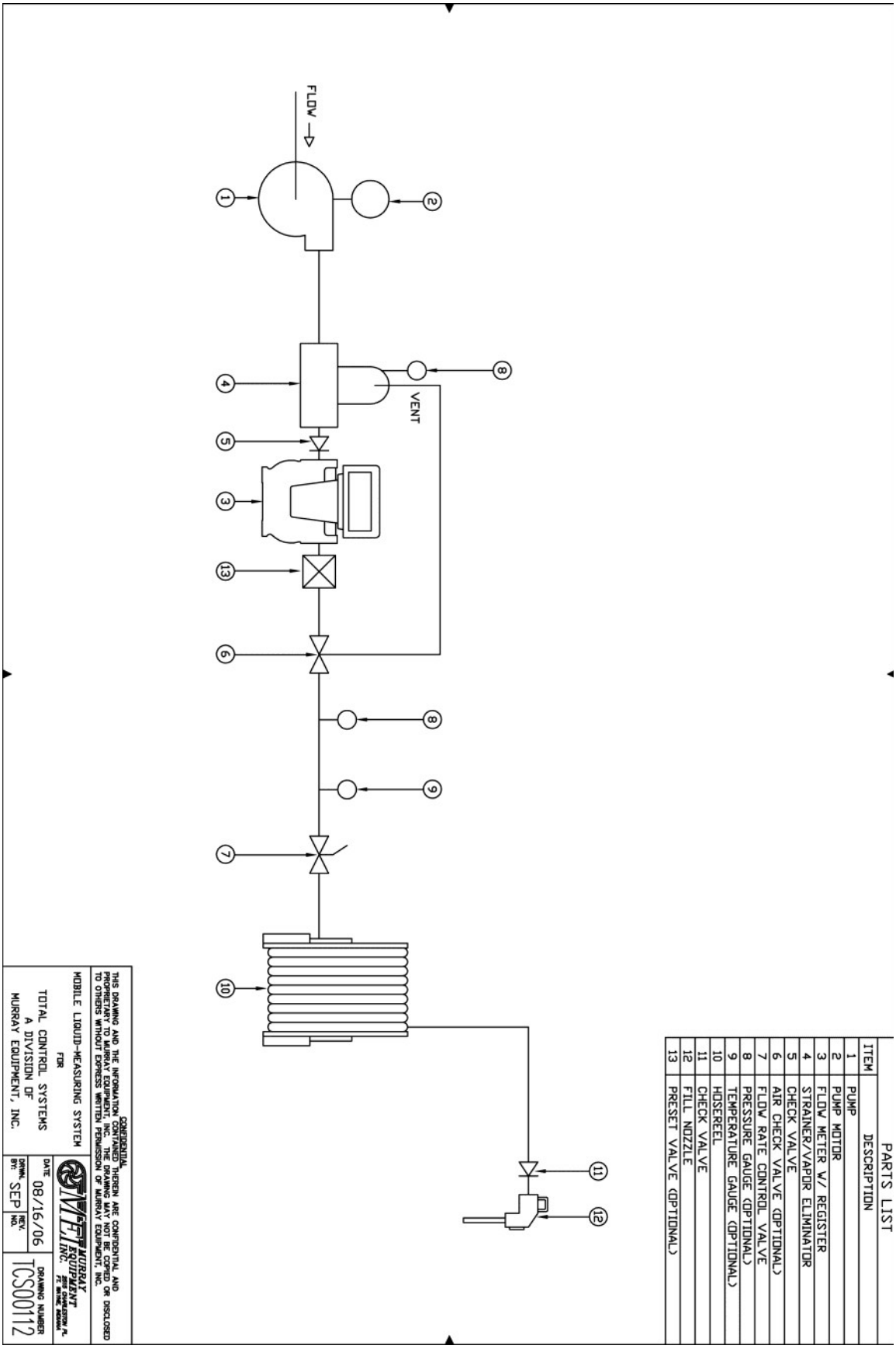


PARTS LIST

ITEM	DESCRIPTION
1	PUMP
2	PUMP MOTOR
3	FLOW METER W/ REGISTER
4	STRAINER/VAPOR ELIMINATOR
5	CHECK VALVE
6	AIR CHECK VALVE (OPTIONAL)
7	FLOW RATE CONTROL VALVE
8	PRESSURE GAUGE (OPTIONAL)
9	TEMPERATURE GAUGE (OPTIONAL)
10	HOSEREEL
11	CHECK VALVE
12	FILL NOZZLE
13	PRESET VALVE (OPTIONAL)

MOBILE LIQUID-MEASURING SYSTEM
FOR
TOTAL CONTROL SYSTEMS
A DIVISION OF
MURRAY EQUIPMENT, INC.

VEEDER-ROOT
MURRAY EQUIPMENT INC.

DRAWN BY: SEP
DATE: 08/16/06
REV. NO.:
DRAWING NUMBER: TCS00112

Start up Recommendations

¡WARNING!

Test equipment should be grounded to prevent a possible spark. Test area should have no ignition source. Operators should wear personal protection and prevent any product exposure and environmental issues.

Start-up instruction for new installations or after maintenance and repairs:

1) Only properly trained personal should design, install, or operate metering system.
2) Remove plastic threaded plugs placed in meter for shipping protection. They are not to be used in meter system because of the PVC plugs low rated pressure, compatibility, and sealing issues.
3) Place the meter in an area with ample workspace, secure from vibration, and pipe line stress. Mount and bolt down on to a fixed stand or platform. This prevents meter stress, which will cause leakage and metal fatigue.
4) Apply thread sealing compound and gasket materials that are compatible with product.
5) Do not weld to meter or meter accessories such as valves and air eliminators. This will weaken housings, cause O-ring and casting leaks and potentially distort the critical tolerances within the flow meter.
6) Always wear personal safety protection equipment such as goggles, steel toed shoes, gloves and full body clothing.
7) Be sure to install a pressure relief valve or expansion joint in the system to protect against thermal expansion.
8) Make sure all system components are properly secured and tightened.
9) All meter assembly bolts and connections are tight.
10) The air eliminator vapor release must be properly vented to atmospheric pressure and piped into a reservoir container or back to the supply tank.
11) Electrical connections are properly installed and start/stop switches are off and locked-out.
12) Ensure that there is flooded suction to the Pump and that fluid is available to system to prevent the starving or cavitation of the pump.
13) Flood the system slowly. **Start the system with all shut off valves in the closed position.** When a pump is turned on and a valve opened in a new, dry system, tremendous liquid and air pressure can build up in the piping and be forced through the meter. The high pressure and volume of air causes the meter to rotate more rapidly than normal. When the fluid product reaches the meter, there is an abrupt slowing of the meter rotor. This can cause damage to the register, rotor shafts, packing gear and/or blade, timing gears and other components.

    The recommended method of starting any system is to flood the piping gradually. This allows product to slowly force the air from the entire system.

Start-Up Recommendations (CONTINUED)

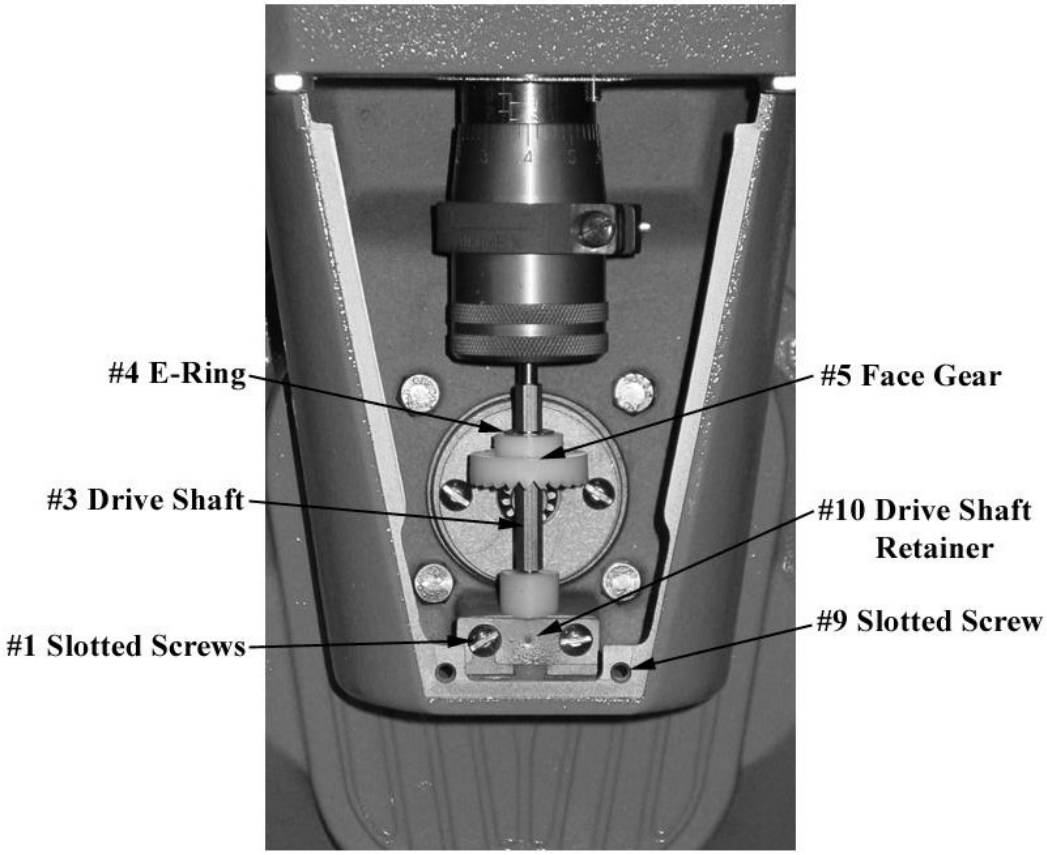
14) When operating the meter with accessories, valves should be opened slowly to avoid a pressure surge that can damage the meter or air eliminator. System pressures should be maintained below 70 PSI (4.9 BAR).

15) Custody transfer metering systems must be calibrated by a regulatory agency before product can be sold off the meter. Contact your local authorities for proper calibration.

16) Strainers should be cleaned frequently as part of a regular maintenance schedule. Doing so will ensure a clean system and long service life.

Direction of Flow

The meter is set up at the factory for left to right flow. To change the meter for right to left flow, begin by removing the screws (#9 on the Meter Assembly Breakdown) and the adjuster cover plate (#7) on the front of the meter. Remove the screws (#1), the drive shaft retainer (#10), the drive shaft (#3), the e-ring (#4) and the face gear (#5). Reinstall the gear on the shaft with the gear teeth facing up. Snap the e-ring back into place to hold the gear in place. Reinstall the shaft, mating the face gear with the drive gear of the packing capsule assembly. Reinstall the screw and cover plate. The meter will now be set up for right to left flow. See Page 22 for a parts breakdown of entire meter assembly.



Meter Calibration

The method of proving should be selected, and necessary provisions made, during the design stage of the installation. Of the most commonly used systems, portable provers have the advantage of more closely reproducing the conditions under which the product is normally delivered.

Use an Accurate Prover
Scientifically designed provers are commercially available for proving meters, and no other kind should be used.

Scientifically designed test measures have proper drainage means built into them, a calibration gauge glass neck and protection against deformation (which would cause volume changes).

Scientifically designed provers are not merely truck compartments or drums. A "homemade" prover, whether a drum or a tank is not likely to be satisfactory, and may cause expensive errors due to inaccurate meter calibration.

Even scientifically designed provers should be checked periodically for accuracy. Weights and Measures officials have been very cooperative in giving assistance to checking privately owned volumetric provers.

Recommended size of test measure
The prover capacity should be equal to at least one minute's flow through the meter at its maximum rate.

Setting the Prover
The prover should be set level, using the levels provided on the prover, or separate leveling means. This insures consistent results when moving the prover from meter to meter and provides the basis for accurate readings on the prover scale.

Where to Test a Meter
The best place to test a meter is in its normal operating position, instead of a test stand. In this way, the correctness of the installation and of the operating conditions of the system will be verified by the test. Always test a meter with the same liquid it is to measure. Even slight differences in viscosity, temperature or system plumbing can have a significant effect on meter accuracy.

Discharge Line from Meter
Where a portable prover is used, the liquid is generally discharged into the prover in the same manner as a normal delivery would be made (with a hose reel and nozzle, for example). Where a special delivery test connection is used, the discharge line must be arranged to drain to the same point on each test. The meter flow rate and start and stop must be controlled at the end of the discharge line.

Wetting the Prover
Reset the meter register to zero, and fill the prover to the zero line or 100% marking of the scale. Disregard this meter reading. Drain the prover and reset the register. The reason for disregarding the first meter reading is that the prover must be wetted. The calibrated capacity of the prover has been determined by its manufacturer based its wet measure capacity. Once wetted, the prover will be wet for all the subsequent tests to be run.

Allow the prover to drain for a set amount of time before closing the dump valve. 30 seconds is a commonly used time interval. However, you must ensure that the prover is completely empty prior to closing the dump valve. This time interval must be the same for each test to ensure uniform results. If a considerable length of time is to elapse between tests (lunch break or phone call), the wetting operation can be eliminated by allowing the prover to remain full until the next test is to be run.

Meter Calibration (Continued)

Making the Tests
Reset the register to zero, and run the required test quantity through the meter. Do not exceed the maximum recommended rate of flow for the meter. Maximum and minimum recommended rates of flow for each 700 series flow meter is marked on the meter identification plate and also in the maintenance manual.

Determining Test Results
Run the meter close to the mark on the indicator corresponding to the full prover capacity. Read the over or under delivery in cubic inches, gallons or percent on the calibrated plate on the neck of the prover. If the plate is calibrated in cubic inches, the percentage error can readily be computed on the following basis:

One gallon is equal to 231 cu.in.

Example: A 100-gallon prover holds 23,100 cu.in. Therefore, 23.1 cu.in. represents 0.1% error.

Meter Tolerance
In the United States, the National Institute of Standards and Technology, in NIST Handbook 44 specifies plus or minus tolerances according to the following:
In Europe, the plus or minus meter tolerances are specified by OIML R117-1. In Canada, the plus or minus tolerances are specified by the National Measurement Act.
Acceptance tolerances apply to new meters and repaired meters after reconditioning. Maintenance tolerances apply to meters already in service. Special tolerances apply to meters in the United States only, for special instances as determined by weights and measures officials.

Indication of Device	Tolerance			
	Acceptance Test	Maintenance Test	Special Test	Repeatability
USA-Wholesale	+/- 0.20%	+/- 0.30%	+/- 0.50%	0.12%
USA-Vehicle	+/- 0.15%	+/- 0.30%	+/- 0.45%	0.12%

Changing Meter Calibration

Indication of Device	Tolerance			
	Acceptance Test	Maintenance Test	Special Test	Repeatability
Europe	+/- 0.30%	+/- 0.50%	N/A	0.20%
Canada	+/- 0.1875%	+/- 0.375%	N/A	0.15%

Refer to meter literature for method of changing meter calibration. Any change in the meter calibration adjustment will change the delivery in the same amount for all rates of flow. That is, the calibration curve retains its shape, but is moved up or down. Therefore, if a meter tests satisfactorily at full flow, but drops off too much at low flow, changing the calibration will not remedy this condition; it will bring the low flow test to 100%, but it will also bring the full flow above 100% by the same amount that the low flow was raised. A condition of this kind is caused either by the metering system, need for meter cleaning or repairs, or because of an attempt to retain accuracy below the minimum recommended rate of flow for the meter.

Repeatability
Consider the percentage error readings from each test run made at the same flow rate and draft size (calibration run). The difference between the reading with the highest value and that with the lowest value must be less than a value which is 40% of the applicable maintenance tolerance. For example, a meter in the USA, this would be 0.12% (0.30% x 0.4 = 0.12%). The percentage error of all test runs at each flow rate must still be within the applicable tolerance.

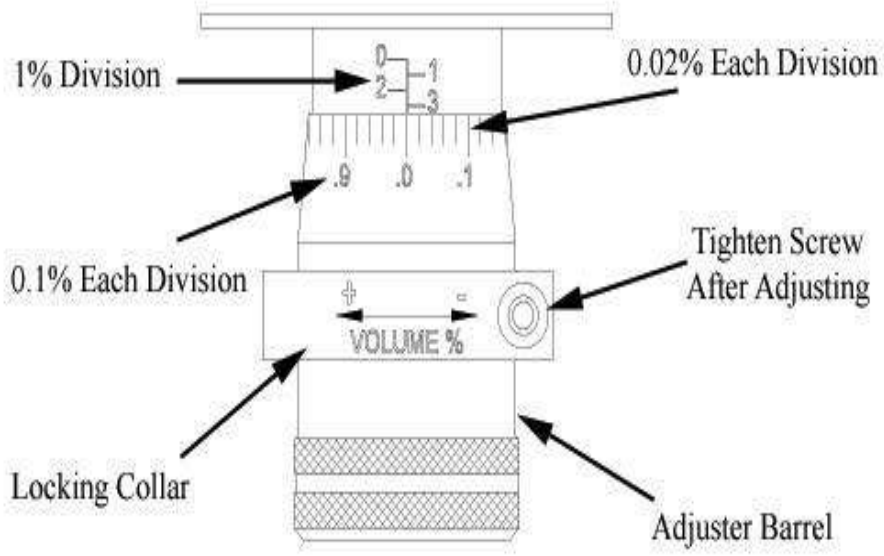
Meter Calibration (Continued)

Temperature Correction
If the testing conditions are such that the temperature of the liquid differs by more than a few degrees between the meter and the prover, it is advisable to apply temperature correction to the prover readings. Thermowells must be installed into the system and temperature readings must be taken during test runs at the meter and in the prover. Corrections are made by the use of API Volume Correction Factor Tables.

Calibration Adjustment

One complete turn of the adjuster barrel is equal to 1 gallon in 100 gallons or 1% of delivered volume. The adjuster body will show divisions of 1%, while the adjuster barrel has divisions of 0.02%. For volumes other than 100 gallons, the following formula may be used to calculate the Adjuster percent to increase or decrease prover volume.

$$\frac{\text{Volume on Prover minus Volume on Meter Counter}}{\text{Volume on Prover}}$$



Split Compartment Test

Purpose: A product depletion test verifies the proper operation of the air elimination system when the storage tank for the product being measured is pumped dry. This test is necessary for meters that may drain a tank completely, such as a vehicle tank meter.

Multiple-Compartment Test Procedure:

1) Begin the test from a compartment (ideally the largest compartment) containing an amount of fuel equal to or less than one-half the nominal capacity of the prover being used. Operate the meter at the normal full flow rate until the compartment is empty. There are several methods for determining that the compartment is empty. There may be a significant change in the sound of the pump. There may be visual evidence that the compartment has run dry. The meter register may stop entirely or may begin to count erratically (pause, resume running, then pause, then run again.)

2) Continue the test until the meter indication stops entirely for at least 10 seconds. If this occurs, proceed to Step 3. If the meter indication fails to stop entirely for a period of 10 seconds, continue to operate the system in this condition for 3 minutes.

3) Close the valve from the empty compartment, and if top filling, close the nozzle or valve at the end of the delivery hose. Open the valve from another compartment containing the same product. Carefully open the valve at the end of the delivery hose. Pockets of vapor or air may cause product to splash out of the prover. The test results may not be valid if product is splashed out of the prover. Appropriate attire and protection is required, and always use caution.

4) Continue delivering product at the normal full flow rate until the liquid level in the prover reaches the nominal capacity.

5) Close the delivery nozzle or valve and stop the meter. Allow any entrained air to settle, then read the prover sight gauge.

6) Compare the meter indication with the actual delivered volume in the prover.

7) Calculate the meter error. Apply the Product Depletion Test Tolerance to determine whether the meter error is within acceptable limits. Refer to NIST Handbook 44 for further information.

Product Depletion Test Tolerance for Vehicle-Tank Meters:

Marked Maximum Flow Rate	Product Depletion Test Tolerance
Less than 100 GPM (380 LPM)	0.5%
100 GPM (380 LPM) or greater	0.6%

The results of the product depletion test may fall outside of the applicable test tolerance as this is a stand-alone test.

The test draft should be equal to at least the amount delivered by the device in 1 minute at its maximum discharge rate, and in no case should it be less than 50 gallons.

Split Compartment Test (Continued)

Single Compartment Test Procedure:

The test of single-compartment tanks is easier to accomplish if there is a quick-connect hose coupling between the compartment valve and the pump that supplies product to the meter. If the system does not have quick-connect couplings between the compartment and the meter, an additional source of sufficient product at the test site is required.

Without a quick-connect coupling:

1) Begin the test from a compartment (ideally the largest compartment) containing an amount of fuel equal to or less than the nominal capacity of the prover being used. Operate the meter at the normal full flow rate until the compartment is empty. There are several methods for determining that the compartment is empty. There may be a significant change in the sound of the pump. There may be visual evidence that the compartment has run dry. The meter register may stop entirely or may begin to count erratically (pause, resume running, then pause, then run again.)

2) Continue the test until the meter indication stops entirely for at least 10 seconds. If this occurs, proceed to Step 3. If the meter indication fails to stop entirely for a period of 10 seconds, continue to operate the system in this condition for 3 minutes.

3) Close the valve from the empty compartment, and if top filling, close the nozzle or valve at the end of the delivery hose. Stop the pump and load sufficient product from the alternate source into the supply compartment that feeds the meter being tested. Allow a brief time for the product to stand in the compartment to allow entrained vapor or air to escape.

4) Open the compartment valve and restart the pump without resetting the meter to zero. Carefully open the nozzle of valve at the end of the delivery hose. Pockets of vapor or air may cause product to splash out of the prover. The test results may not be valid if product is splashed out of the prover. Appropriate attire and protection is required, and always use caution.

5) Continue delivering product at the normal full flow rate until the liquid level in the prover reaches the nominal capacity.

6) Close the delivery nozzle or valve and stop the meter. Allow any entrained air to settle, then read the prover sight gauge.

7) Compare the meter indication with the actual delivered volume in the prover.

8) Calculate the meter error. Apply the Product Depletion Test Tolerance to determine whether the meter error is within acceptable limits. Refer to NIST Handbook 44 for further information.

Split Compartment Test (Continued)

With a quick-connect coupling:

1) During a normal full flow test run, close the compartment valve when the prover is approximately one-half full to its normal capacity. Then slowly and carefully disconnect the quick-connect coupling, allowing the pump to drain the supply line.

2) Continue the test until the meter indication stops entirely for at least 10 seconds. If the meter fails to stop entirely for at least 10 seconds, continue to operate the system for 3 minutes.

3) After 10 seconds (or 3 minutes if the meter indication did not stop entirely), close the delivery nozzle or valve at the end of the delivery hose if top filling.

4) Disconnect and reconnect the quick-connect coupling and open the compartment valve.

5) Carefully open the nozzle or valve at the end of the delivery hose. Pockets of vapor or air may cause product to splash out of the prover. The test results may not be valid if product is splashed out of the prover. Appropriate attire and protection is required, and always use caution.

6) Continue the delivery of product at the normal full flow rate until the liquid level in the prover reaches the prover's nominal capacity.

7) Close the delivery nozzle or valve. Stop the pump. Allow any entrained air to settle, then read the prover sight gauge.

8) Compare the meter indication with the actual delivered volume in the prover.

9) Calculate the meter error. Apply the Product Depletion Test Tolerance to determine whether the meter error is within acceptable limits. Refer to NIST Handbook 44 for further information.

Product Depletion Test Tolerance for Vehicle-Tank Meters:

Marked Maximum Flow Rate	Product Depletion Test Tolerance
Less than 100 GPM (380 LPM)	0.5%
100 GPM (380 LPM) or greater	0.6%

The results of the product depletion test may fall outside of the applicable test tolerance as this is a stand-alone test.

The test draft should be equal to at least the amount delivered by the device in 1 minute at its maximum discharge rate, and in no case should it be less than 50 gallons.

Maintenance

¡WARNING!

Test equipment should be grounded to prevent a possible spark. Test area should have no ignition source. Operators should wear personal protection and prevent any product exposure and environmental issues.

1) Keeping accurate maintenance and calibration records can be an excellent tool in determining the frequency of inspection or maintenance for a system. As the meter wears, the calibration will be affected and require adjustment. A personality profile can be created for each meter to help guide in a maintenance schedule.

2) Great care should be utilized in the maintenance of the metering system. Personal safety protection, environmental hazards, and government regulations need to be the foremost priority. Only fully trained personnel should be involved in maintenance. Failure to use original TCS replacement parts will void any Weights and Measures approvals, warranty and risk damage to the meter system.

3) ALWAYS RELIEVE INTERNAL SYSTEM PRESSURE TO ZERO BEFORE DISASSEMBLY OR INSPECTION.

4) SERIOUS INJURY OR DEATH FROM FIRE OR EXPLOSION COULD RESULT FROM MAINTENANCE OF AN IMPROPERLY DEPRESSURIZED AND EVACUATED SYSTEM.

5) Total Control Systems flow meters and accessories are often used with petroleum, solvents, chemicals, and other liquids that may be explosive, extremely flammable, very toxic, oxidizing, and corrosive. Severe injury or fatalities may arise if appropriate safety precautions are not followed.

6) Before replacing or cleaning filter/strainer screen, the electrical system must be turned off. Product must be drained from system. Collect all product and return to storage or dispose of properly. Replace all drain plugs that were removed. Personal safety protection must be warn at this time. Make sure there is adequate ventilation in the area. The metering system will not completely drain so extra product must be collected when the strainer cover is removed. Clean the screen once a week, or more often if there is a lot of sediment in the system. Ensure that there is no ignition source and that the system is grounded. Replace all plugs that were removed for drainage.

7) The metering system is heavy and awkward so take precaution to handle it properly.

8) Do not use force to disassemble or use a screwdriver to pry open any part of the metering system. Have the proper tools available before trying to repair the meter system. Use caution when handling the internal parts as they can be sharp and heavy. Do not drop the housing or rotors as they can cause injury and can be damaged or destroyed. Use caution when inspecting and aligning the timing gears and rotors as they can pinch fingers. Turn these slowly to verify smooth operation.

9) When inspecting the spring loaded preset valves do not place anything inside the housing, as the action of the valve will pinch this object when the valve closes.

Maintenance (CONTINUED)

¡WARNING!

Test equipment should be grounded to prevent a possible spark. Test area should have no ignition source. Operators should wear personal protection and prevent any product exposure and environmental issues.

10) When removing gaskets or O-rings, carefully check for damage or corrosion. Any cracked, rough, worn, elongated or swollen O-rings must be replaced. When replacing the O-rings, place grease along the inside of the O-ring groove or completely around the O-ring to help the O-ring stay in the O-ring groove during assembly. If an O-ring is pinched or not in the O-ring groove, the meter system will leak and cause serious problems to the environment and equipment. Collect all replaced parts and dispose of properly.

11) Do not weld onto any part of the meter system or accessories as this will weaken the part and allow for leaks.

12) Bolts and screws must be coated with Anti-Seize lubricant. Follow the torque specifications for each flow meter, air eliminator, strainer or preset valve bolt found on page 31.

13) Recommended levels of maintenance and inspection will depend upon the system variables, such as the characteristics of the products being measured (viscosity, corrosiveness, suspensions, etc.), system pressure requirements, government or company regulations, and the age of the metering system. If hydrostatic testing is required, the system pressure should not exceed 1.5 times the marked meter pressure. It is not recommended to pneumatically test the meter system at any time.

14) If any component of the meter system is removed from the system, it should be thoroughly flushed with a compatible liquid. After this is done, immediately refill the meter or accessory with a compatible liquid to prevent corrosion and water build up.

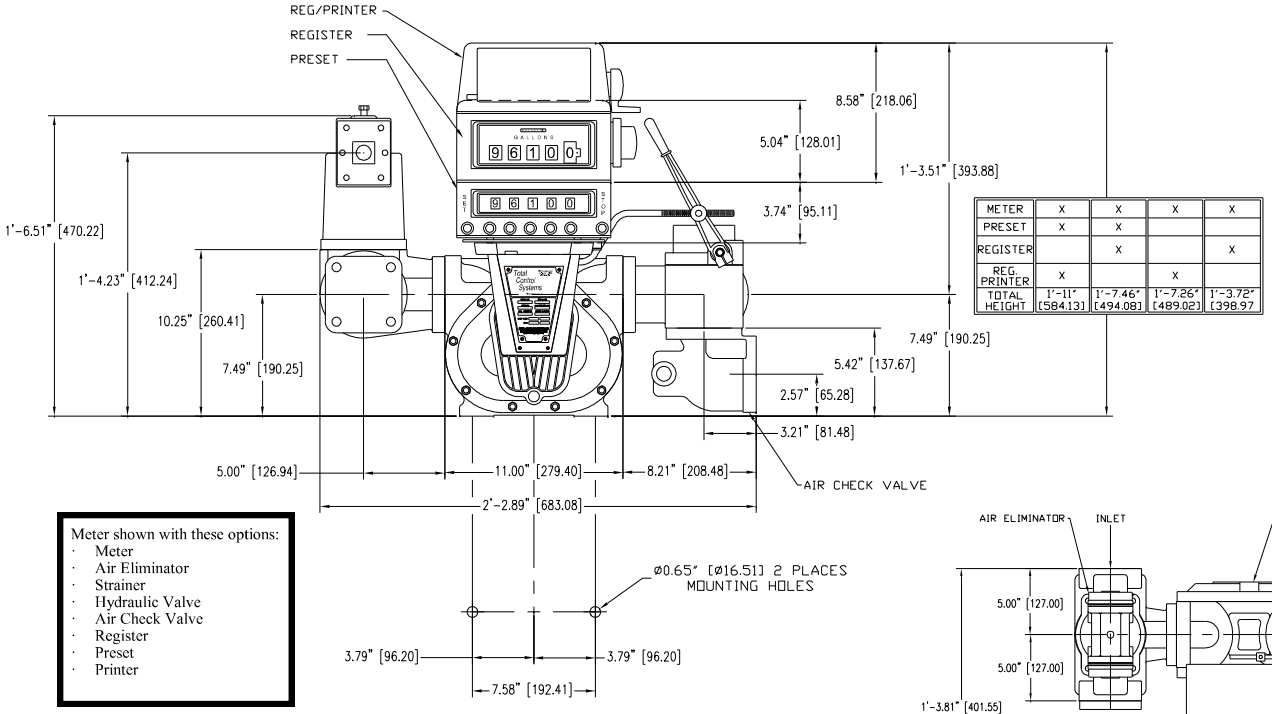
Storage Instructions

Short periods of non-use of the meter (a week or less) should present no problem, provided that the meter remains full of product. For long periods of non-use, such as winter storage, the following procedure is recommended.

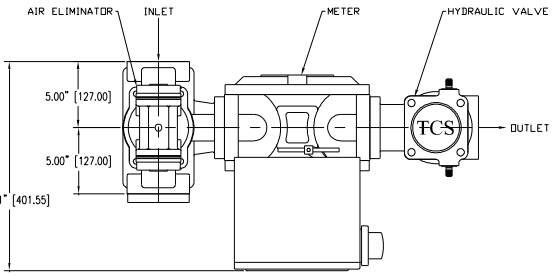
1). To store the meter when it is left in line, flush the system with clean water until 70-80 gallons of water have passed through the meter.
2). Pump a 50% anti-freeze / 50% water solution through the entire system (100% RV antifreeze may be used instead). With the pump running, shut off a valve downstream from the meter, making sure that the system is full of anti-freeze solution to that point. Then close an upstream valve, such that the meter remains full of anti-freeze solution.
3). Remove the register from the meter, and lubricate the drive coupling shaft. After lubrication, reassemble the register onto the meter.

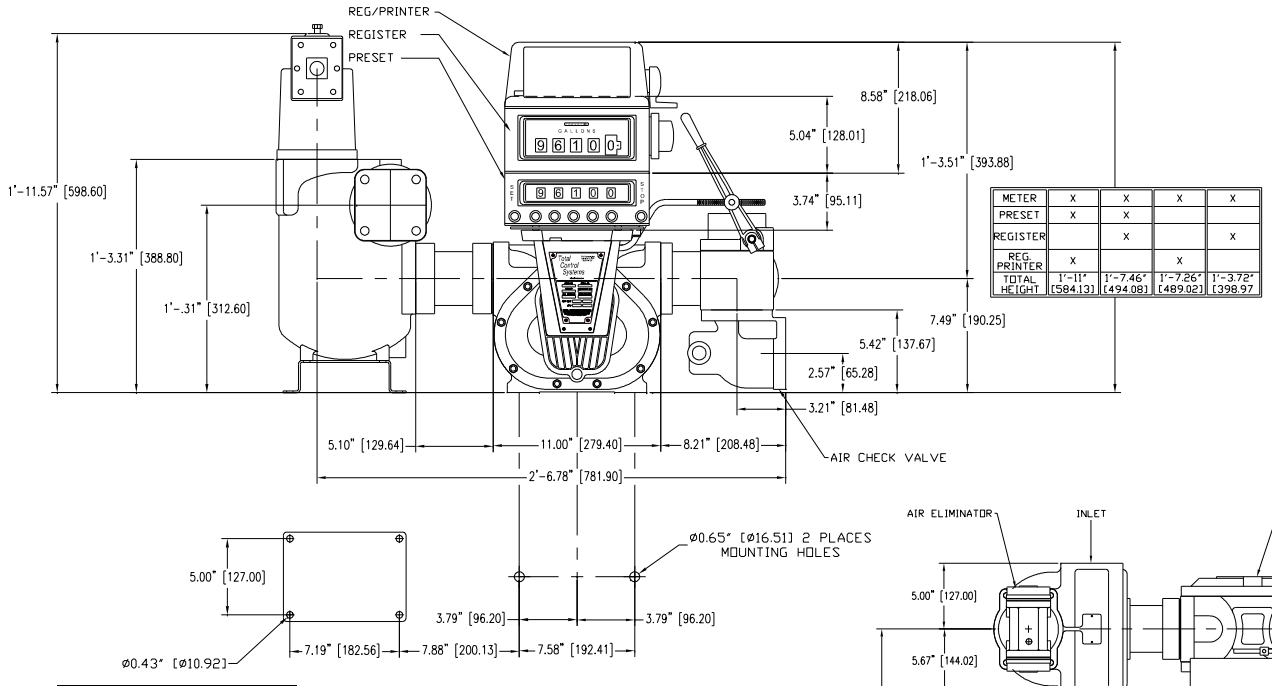
When starting the system after a period of storage, it is recommended that the meter calibration be rechecked.

700-30 / 700-35 Dimensions

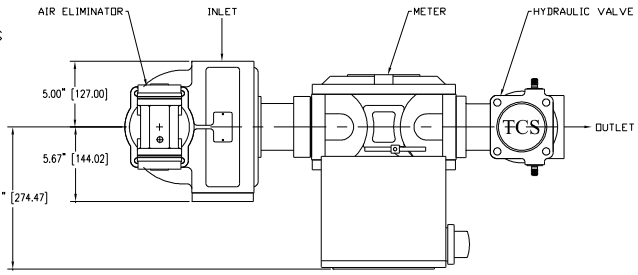


Meter shown with these options:
- Meter
- Air Eliminator
- Strainer
- Hydraulic Valve
- Air Check Valve
- Register
- Preset
- Printer

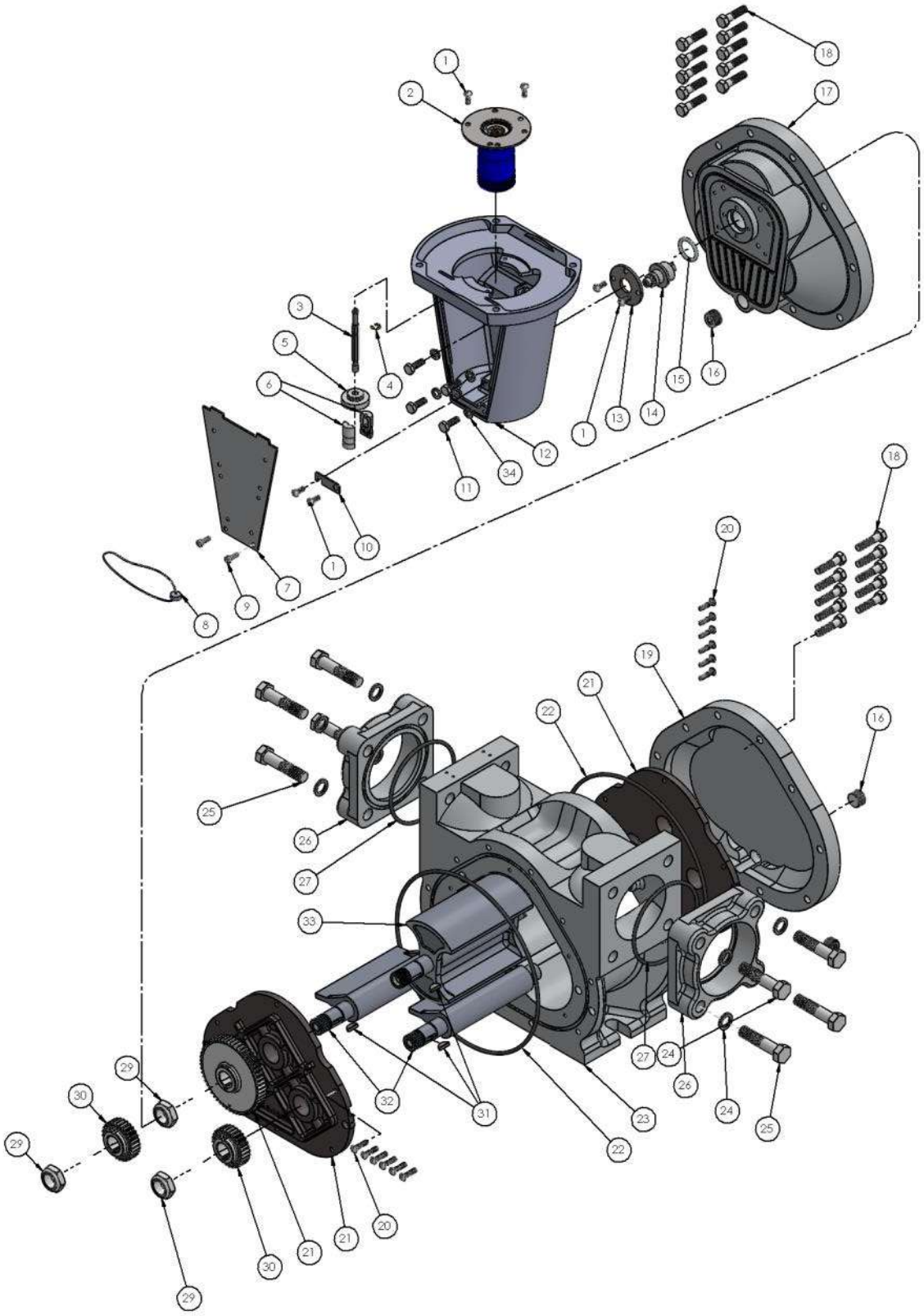




Meter shown with these options:
- Meter
- Air Eliminator
- High Capacity Strainer
- Hydraulic Valve
- Air Check Valve
- Register
- Preset
- Printer



700-30 / 700-35 Meter Assembly



700-30 / 700-35 Meter Assembly

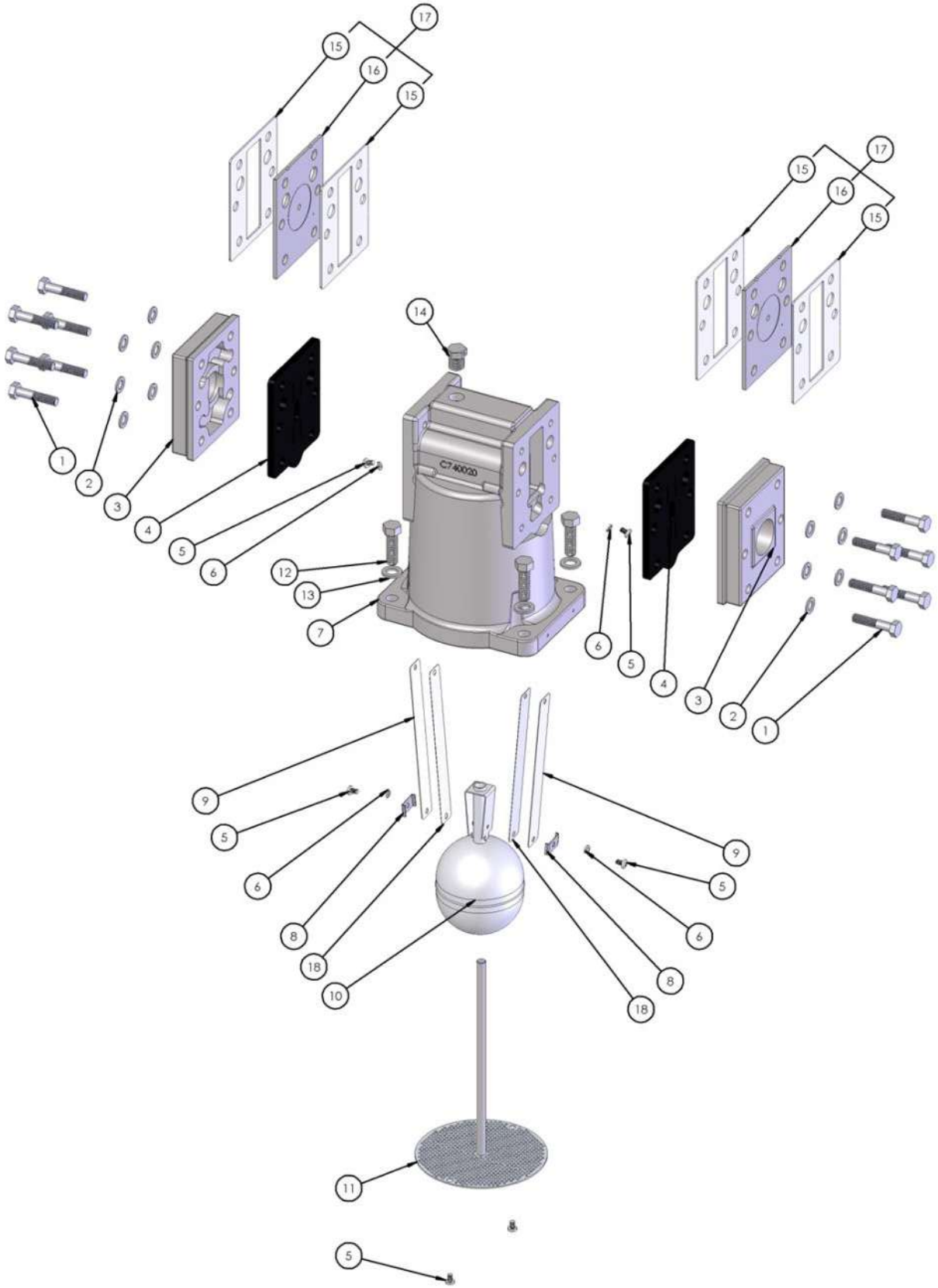
Item	Description	Qty	700-30						700-35	
			SP	SPA	SPD	IP	IC	AF	SPA	SPD
1	Round Head Screw	6	1-128279	1-128279	1-128279	1-128279	1-128279	1-128279	1-128279	1-128279
2	Adjuster Assembly	1	700100	700100	700100	700100	700100	700100	700100	700100
3	Drive Shaft	1	700019	700019	700019	700019	700019	700019	700019	700019
4	E-Ring	1	700016	700016	700016	700016	700016	700016	700016	700016
5	Acetal Face Gear	1	700018	700018	700018	700018	700018	700018	700018	700018
6	Acetal Bushing	2	700020	700020	700020	700020	700020	700020	700020	700020
7	Adjuster Cover Plate	1	700017	700017	700017	700017	700017	700017	700017	700017
8	Seal Wire	1	1-118849	1-118849	1-118849	1-118849	1-118849	1-118849	1-118849	1-118849
9	Drilled Head Screw	2	700042	700042	700042	700042	700042	700042	700042	700042
10	Drive Shaft Retainer	1	700022	700022	700022	700022	700022	700022	700022	700022
11	Head Mount Screw	4	700040	700040	700040	700040	700040	700040	700040	700040
12	Register Support	1	700200	700200	700200	700200	700200	700200	700200	700200
13	Packing Retaining Plate	1	700015	700015	700015	700015	700015	700015	700015	700015
14A	2:1 Packing Capsule Assy.	1	700150	700150	700155	700155	700155	700155	700150	700155
14B	1:1 Packing Capsule Assy.	1	700170	700170	700175	700175	700175	700175	700170	700175
15	Packing O-ring	1	700009	700009	700010	700010	700010	700010	700009	700010
16	Plug	2	700024	700024	700024	700024	700024	700024	700024	700024
17	Front Cover	1	703500	703500	703503	703500	703500	703503	703500	703503
18A	Cap Screw	16	703016	703016	703016	703016	703016	703016	703016	703016
18B	Drilled Cap Screw	4	703016D	703016D	703016D	703016D	703016D	703016D	703016D	703016D
19	Rear Cover	1	703550	703550	703553	703550	703550	703553	703550	703553
20	Round Head Screw	12	702014	702014	702014	702014	702014	702014	702014	702014
21	Bearing Plate	2	703230	703235	703235	703230	703225	703225	703225	703225
22	Cover O-ring	2	703001	703001	703071	703002	703002	703002	703001	703002
23	Housing	1	703110	703110	703113	703110	703110	703113	703110	703113
24	Flat Washer	8	703018	703018	703018	703018	703018	703018	703018	703018
25	Cap Screw	8	703017	703017	703017	703017	703017	703017	703017	703017
26A	Flange, 3” NPT	2	703600	703600	703613	703600	703600	703613	703600	703613
26B	Flange, 3” BSPT	2	703603	703603	703611	703603	703603	703611	703603	703611
27	Flange O-ring	2	703012	703012	703013	703013	703013	703013	703013	703013
28	Blocking Rotor Gear	1	703351	703351	703351	703350	703350	703350	703351	703351
29	Rotor Lock Nut	3	703010	703010	703010	703010	703010	703010	703010	703010
30	Displacement Rotor Gear	2	703451	703451	703451	703450	703450	703450	703451	703451
31	Rotor Key	3	703008	703008	703008	703008	703008	703008	703008	703008
32	Displacement Rotor	2	703405	703405	703422	703410	703410	703425	703405	703422
33	Blocking Rotor	1	703305	703305	703322	703310	703310	703325	703305	703322
34	Lock Washer	4	700071	700071	700071	700071	700071	700071	700071	700071

Meter Cold Weather Seal Kit—TCS 703078
Contents:

(15) Packing O-Ring	Qty. 1
(22) Housing O-ring	Qty. 2
(27) Flange O-ring	Qty. 2

All seals are low temperature Nitrile Rubber

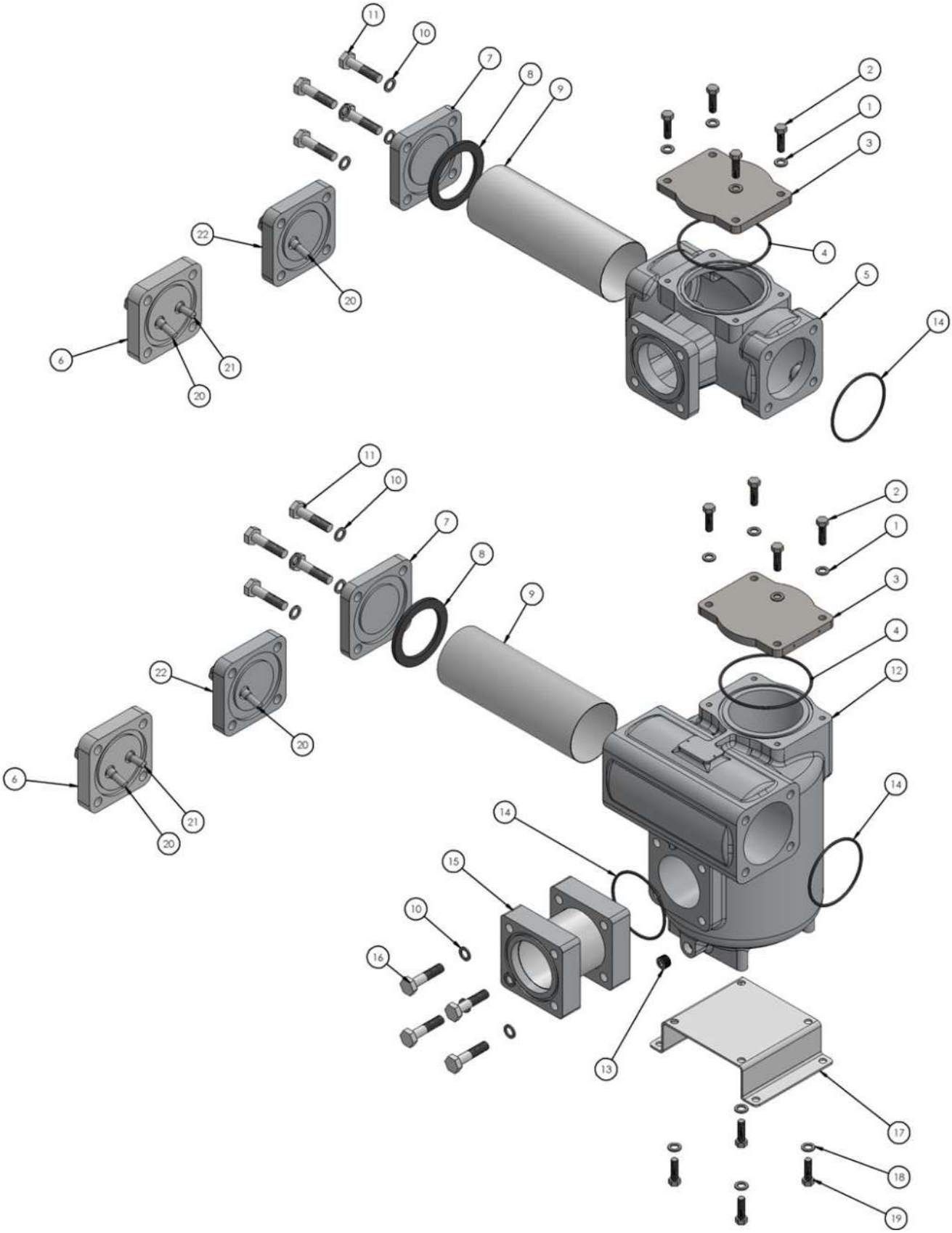
730 Air Eliminator Assembly



730 Air Eliminator Assembly

Item	Description	Qty	730-20			
			SP	SPD	IP	AF
1A	Cap Screw	8	740050	740050	740050	740050
1B	Drilled Cap Screw	4	740050D	740050D	740050D	740050D
2	Ring Washer	12	740051	740051	740051	740051
3A	Outlet Cover; NPT	2	740010	740016	740010	740016
3B	Outlet Cover; BSPT	2	740710	740716	740710	740716
4	Encapsulated Valve Plate	2	740205	740205	740215	740215
5	Screw	4	740030	740030	740030	740030
6	Split Lock Washer	4	740017	740017	740017	740017
7	Air Eliminator Housing	1	740020	740022	740020	740022
8	Retaining Clip	2	740012	740012	740012	740012
9	PTFE Reed Strip	2	-	740077	740077	740077
10	Float Assembly	1	740013	740013	740013	740013
11	Diffuser & Shaft Assy.	1	740035	740035	740035	740035
11A	Large Hole Diffuser & Shaft Assy.	1	740095	740095	740095	740095
12A	Cap Screw	2	700054	700054	700054	700054
12B	Drilled Cap Screw	2	700054D	700054D	700054D	700054D
13	Flat Washer	4	702018	702018	702018	702018
14	Plug	1	2-126146	2-126146	2-126146	2-126146
15	Plate Seal	4	740005	740004	740004	740004
16	Valve Plate	2	740038	740006	740006	740006
17	Valve Plate Kit	2	740138	740106	740106	740106
18	Reed Valve	2	740007	740007	740007	740007

720-30 Strainer & 725-30 High Volume Strainer Assembly



720-30 Strainer & 725-30 High Volume Strainer Assembly

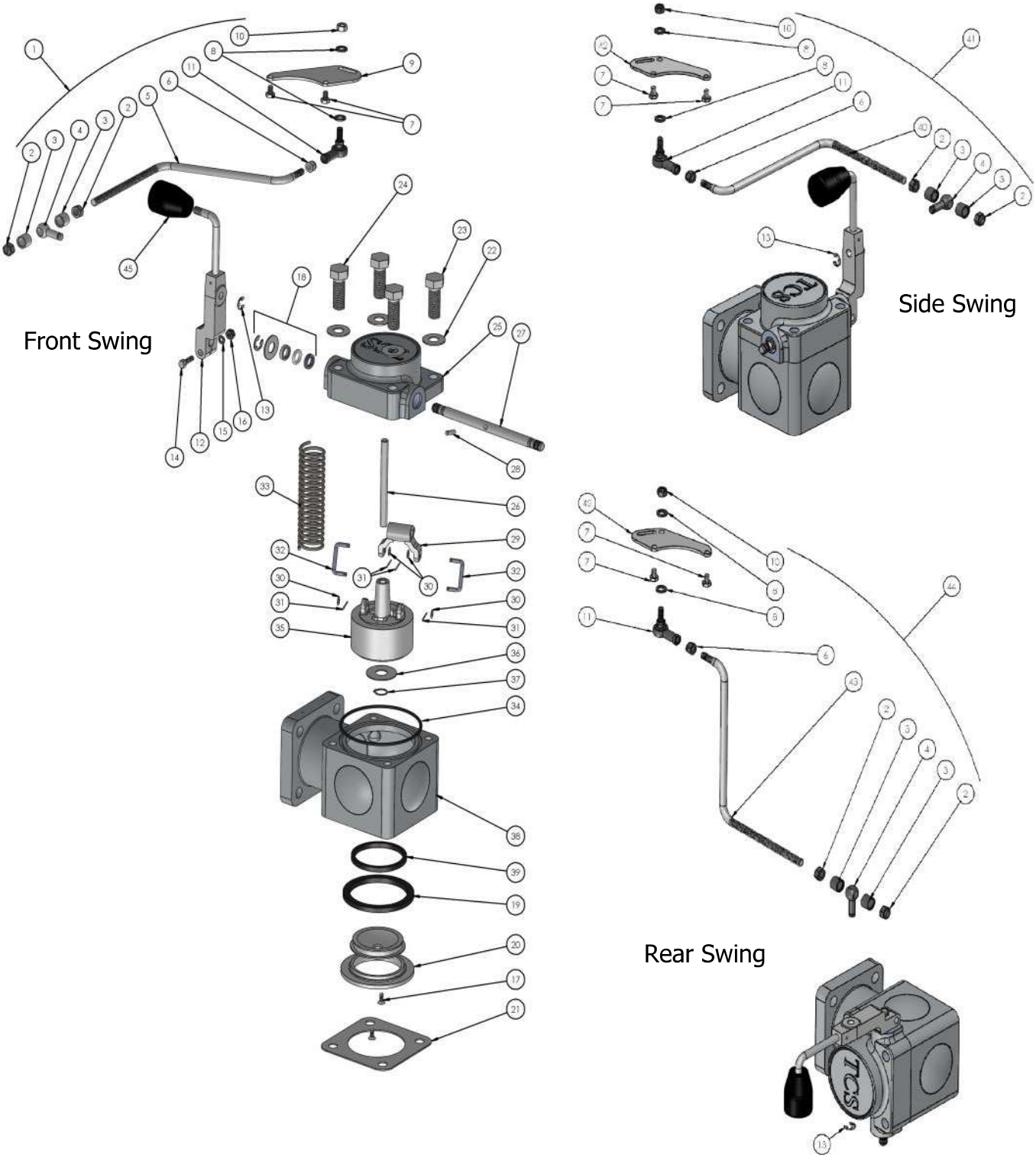
Item	Description	Qty	720-30				725-30
			SP	SPD	IP	AF	SP
1	Flat Washer	8	703018	703018	703018	703018	703018
2A	Cap Screw	2	703017	703017	703017	703017	703017
2B	Drilled Cap Screw	2	703017D	703017D	703017D	703017D	703017D
3	Strainer Cover, Optional	1	740041	740042	740041	740042	740041
4	Top Seal O-ring	1	740009	740019	740019	740019	740009
5	Strainer Housing	1	743021	743023	743021	743023	-
6	Basket Cover, Two 1/2" NPT Ports	1	743055	743256	743055	743256	743055
7	Basket Cover, STD	1	743050	743053	743050	743053	743050
8	Seal Ring	1	743003	743004	743004	743004	743003
9A	0.050 Strainer Basket, STD	1	-	-	743005	743005	-
9B	40M Strainer Basket, STD	1	743010	743010	-	-	743010
9C	80M Strainer Basket	1	743015	743015	-	-	743015
9D	100M Strainer Basket	1	743025	743025	-	-	743025
10	Flat Washer	8	-	-	-	-	703018
11A	Cap Screw	2	-	-	-	-	703017
11B	Drilled Cap Screw	2	-	-	-	-	703017D
12	High Capacity Strainer Housing	1	-	-	-	-	745031
13	Plug	1	-	-	-	-	700024
14	Flange O-ring	1	703012	703013	703013	703013	703012
15	Strainer Adapter	1	-	-	-	-	745038
16	Cap Screw	4	-	-	-	-	745005
17	Foot Mounting Bracket	1	-	-	-	-	745025
18	Ring Washer	4	-	-	-	-	745006
19	Cap Screw	4	-	-	-	-	745005
20	3/8" x 1/2" NPT Thermowell	1	740305	740405	740305	740405	740305
21	1/2" x 1/2" NPT Thermowell	1	740300	740400	740300	740400	740300
22	Basket Cover, One 1/2" NPT Port	1	743155	743156	743155	743156	743155

Strainer Cold Weather Seal Kit—TCS 743078
All seals are low temperature Nitrile Rubber

Contents:

(4) Top Seal	Qty. 1
(8) Seal Ring	Qty. 1
(14) Flange O-ring	Qty. 2

750-30 Hydraulic Preset Valve Assembly



750-30 Hydraulic Preset Valve Assembly

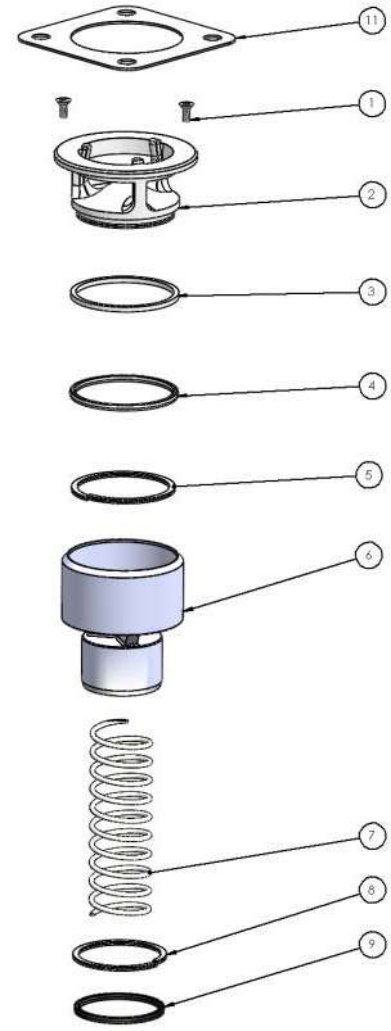
Item	Description	Qty	750-30		
			SP	IP	SPD
1	Linkage Assembly Kit, STD	1	753062KT	753062KT	753062KT
2	Linkage Lock Nut	2	750001	750001	750001
3	Linkage Sleeve	2	750002	750002	750002
4	Linkage Spherical Pivot	1	750003	750003	750003
5	Linkage Arm	1	753062	753062	753062
6	Hex Nut	1	750010	750010	750010
7	Linkage Screw	2	750011	750011	750011
8	Flat Washer	2	68001	68001	68001
9	Preset Bracket	1	753099	753099	753099
10	Locking Nut	1	750012	750012	750012
11	Ball & Stud	1	753053	753053	753053
12	Operating Lever	1	753210	753210	753210
13	Linkage E-Ring	1	750004	750004	750004
14	Cap Screw	1	753002	753002	753002
15	Star Washer	1	750035	750035	750035
16	Hex Nut	1	750037	750037	750037
17	Screw	2	792004	792004	792004
18	Shaft Seal Kit	2	753314KT	753314KT	753314KT
19	Lower Seal	1	753033	753034	753133
20	Piston Guide	1	753031	753031	753031
21	Gasket	1	703022	703022	703022
22	Flat Washer	4	753013	753013	753013
23	Cap Screw, Drilled	2	703027D	703027D	703027D
24	Cap Screw	2	703017	703017	703017
25	Valve Cover	1	753015	753015	753018
26	Shaft	1	753008	753008	753008
27	Lever Arm Shaft	1	753006	753006	753006
28	Spring Pin	1	753022	753022	753022
29	Lever	1	753023	753023	753023
30	Flat Washer	4	753024	753024	753024
31	Cotter Pin	4	753037	753037	753037
32	Swivel Pin	2	753027	753027	753027
33	Internal Valve Spring	1	753019	753019	753019
34	Cover O-Ring	1	753044	753044	753144
35	Piston	1	753020	753020	753020
36	Flat Washer	1	753028	753028	753028
37	Snap Ring	1	753029	753029	753029
38	Valve Body	1	753040	753040	753043
39	Upper Seal	1	753036	753036	753036
40	Side Swing Linkage Arm	1	753001	753001	753001
41	Side Swing Linkage Kit	1	753001KT	753001KT	753001KT
42	Side Swing Preset Bracket	1	750020	750020	750020
43	Rear Swing Linkage Arm	1	753061	753061	753061
44	Rear Swing Linkage Kit	1	753061KT	753061KT	753061KT
45	Lever Knob	1	753052	753052	753052

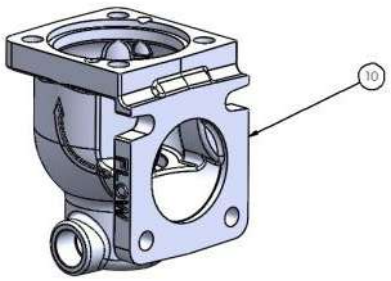
Valve Cold Weather Seal Kit—TCS 753078 All seals are low temperature Nitrile Rubber, FKM or PTFE
Contents:

(19) Lower Seal	Qty. 1	(39) Upper Seal	Qty. 1
(14) Flange O-ring	Qty. 2	(34) Cover Seal	Qty. 1
(*) Shaft Seal	Qty. 2	(*) Top Seal	Qty. 2

(*) - Items replace components from item 14

760-30SP Air Check Valve Assembly





Item	Description	Qty	760-30SP
1	Screw	2	792004
2	Piston Guide	1	793015
3	Piston Guide External Seal	1	793020
4	Piston Guide Internal Seal	1	793023
5	Piston Guide Snap Ring	1	793035
6	Piston	1	793002
7	Spring	1	793001
8	Body Snap Ring	1	793030
9	Housing Seal	1	793025
10A	Valve Housing; 1/2” NPT	1	793011
10B	Valve Housing; 1/2” BSPT	1	793711
11	Gasket	1	703022

Torque Specifications

700-30/35 METER ASSEMBLY

Part Number & Description	Tool	Bolt/Nut Size	Foot Lbs.		Newton Meter	
			Unlubricated	Lubricated	Unlubricated	Lubricated
TCS 703016 Cover Screws	1/2” hex wrench/socket	5/16-18 UNC 2B	11	6.6	14.9	8.9
TCS 1-128279 Dust Cover	slotted screwdriver	10-24 UNC-2B	1.9	1.1	2.6	1.5

740-30 AIR ELIMINATOR/STRAINER ASSEMBLY

Part Number & Description	Tool	Bolt/Nut Size	Foot Lbs.		Newton Meter	
			Unlubricated	Lubricated	Unlubricated	Lubricated
TCS 740050 Cover Plate	1/2” hex screw wrench/socket	5/16-18 UNC 2B	11	6.6	14.9	8.9
TCS 703017 Cap Screws	9/16” hex screw wrench/socket	1/2-13 UNC 2B	43.1	25.9	58.4	35.1

750-30 HYDRAULIC PRESET VALVE ASSEMBLY

Part Number & Description	Tool	Bolt/Nut Size	Foot Lbs.		Newton Meter	
			Unlubricated	Lubricated	Unlubricated	Lubricated
TCS 753011 Cover	3/4” hex screw wrench/socket	1/2-13 UNC 2B	43.1	25.9	58.4	35.1
TCS 753012 Cover	3/4” hex nut wrench/socket	1/2-13 UNC 2B	43.1	25.9	58.4	35.1

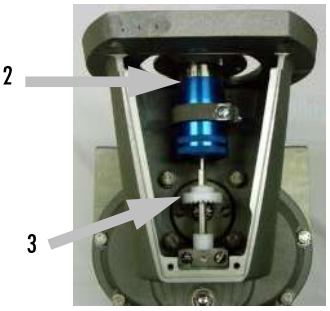
This Torque Chart is for 18-8 Stainless Steel Bolts
Values can be +/- 10% of value listed

Drive Components

Removing the Dust Cover

1) Cut dust cover seal. Remove the dust cover screws with a standard flathead screwdriver.
2) Note the setting on calibration adjuster.
3) Note the position of the drive gear (either above or below the packing gland pinion).

1



Removing the Adjuster

1) Loosen the retaining screws using a standard flathead screwdriver.
2) Slide the retaining clip up and over to the right side.

1

2

3) From the top, remove the screws to adjuster plate.
4) Lift adjuster out of the counter adapter.
5) Remove the adjuster drive assembly.

3

4

5

Disassembly of Meter

¡WARNING!

All internal pressure must be relieved to ZERO (0) pressure before beginning disassembly of meter or components

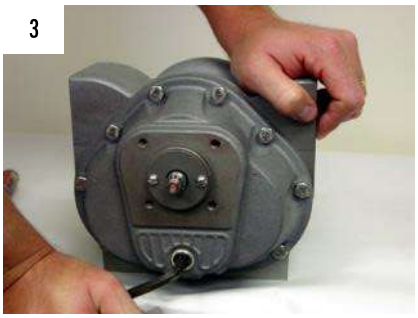
Draining Meter & Removing Counter Support

1) Drain the meter by turning it on either the inlet or outlet side.
2) Remove the counter bracket screws with a hex wrench or socket driver.
3) Remove the drain plugs on the front and rear covers using an allen wrench. Allow more fluid to drain from the meter.

1

2

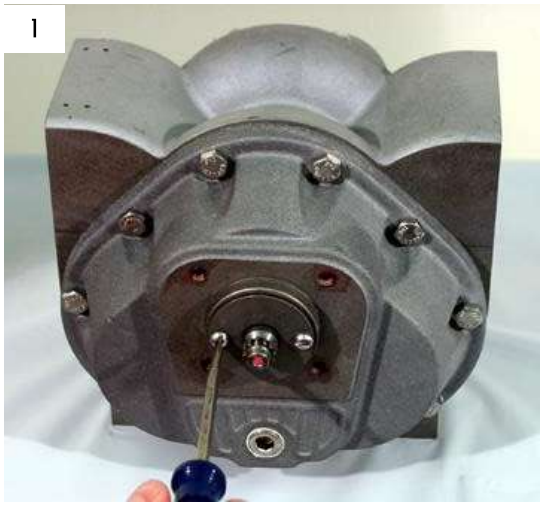
3



Removing Packing Capsule

1) Remove the retaining plate using a standard flathead screwdriver.
2) Pull out the packing gland from the meter.

1



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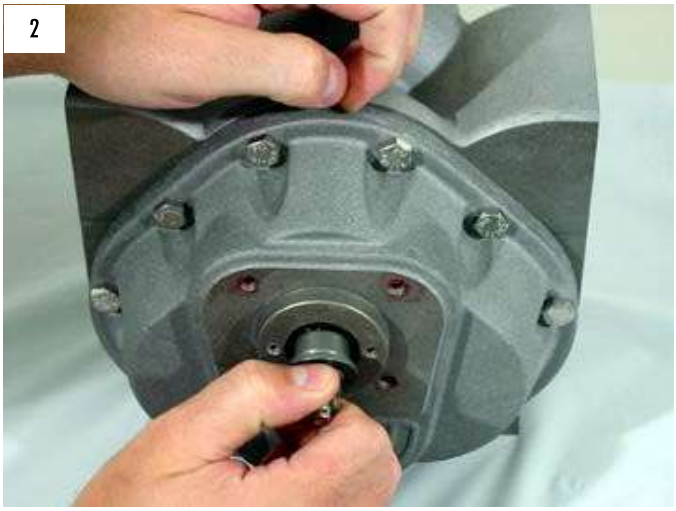
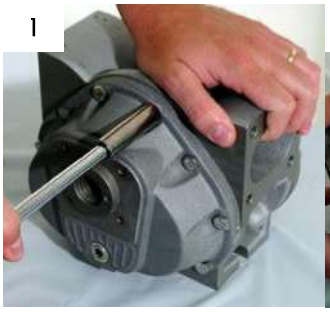
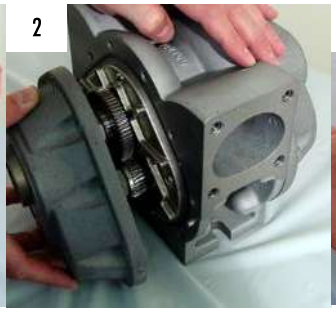


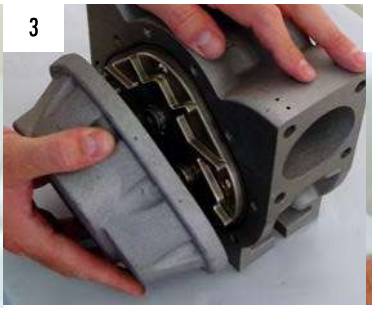
Disassembly of Meter (Continued)

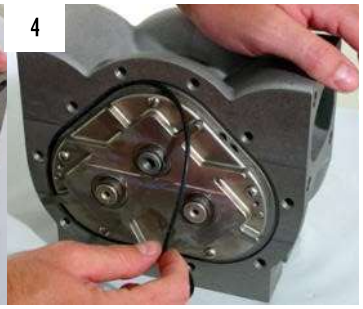
Front & Rear Cover

1) Remove the screws on the front cover using a socket or box wrench.
2) Remove front cover.
3) Remove the screws on the back and remove rear cover.
4) Remove the O-ring from both sides of the housing

1 

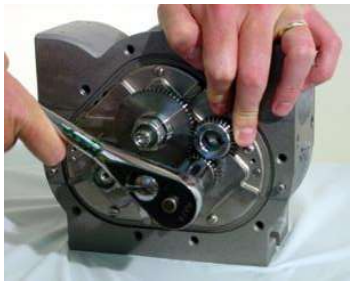
2 

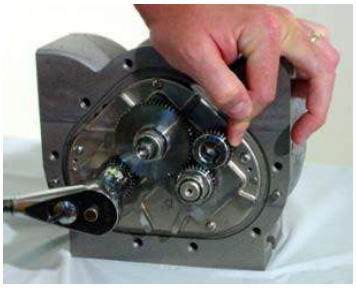
3 

4 

Rotor Gears

1) Using a spare displacement rotor gear, place it between the rotor and blocking gear on the meter.
2) Use the socket or box wrench to loosen the right rotor gear lock nut. Repeat for the left rotor gear lock nut.
3) Move the spare displacement rotor gear to the other side and loosen the blocking rotor lock nut.

1 

2 

3 

Special Notes

1) DO NOT remove rotor gears using a screwdriver! This could damage the rotor gear and create potential wear problems within the measuring chamber.
2) If a spare rotor gear is not available, then use shop rag between gear teeth.

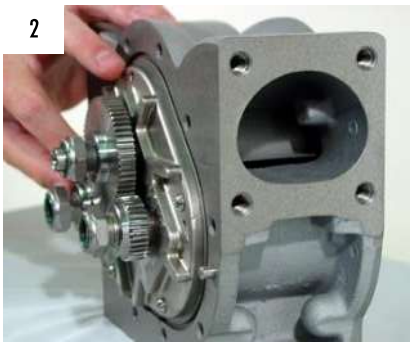
1 

2 

Disassembly of Meter (Continued)

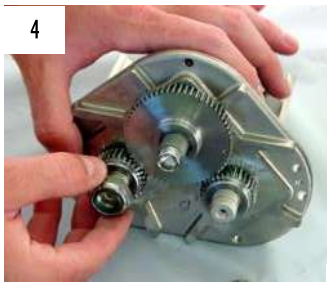
Removing Bearing Plate

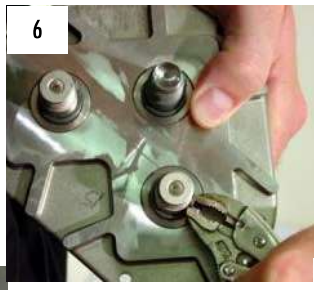
1) Remove the bearing plate retaining screws with a standard flathead screwdriver.
2) To remove bearing plate & rotors, insert a screwdriver into the notches near the dowel pins.
3) Gently pry the bearing plate off the dowel pins and slide out the bearing plate and rotors from the housing.

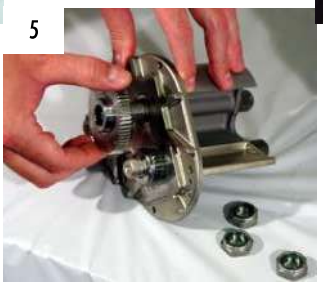


Removing Lock Nuts & Rotors

4) Remove rotor lock nuts from each gear.
5) Pull gears off of rotor shaft.
6) Remove rotor key using pliers (this might not be necessary as rotor may slide right out of bearing plate).
7) Remove rotors from bearing plate.

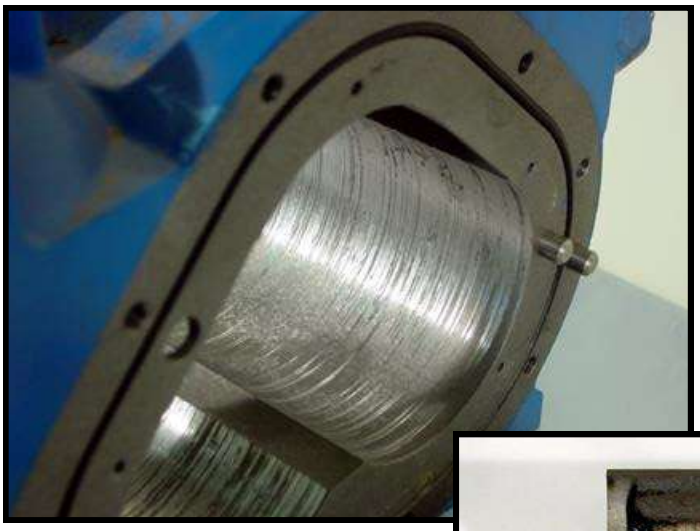






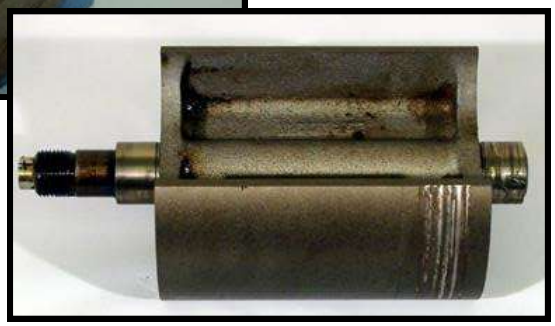
Inspection of Parts

1) Inspect the surfaces of rotors, bearing plates, meter housing and gear teeth for any damage or wear.
2) Replace parts as needed.



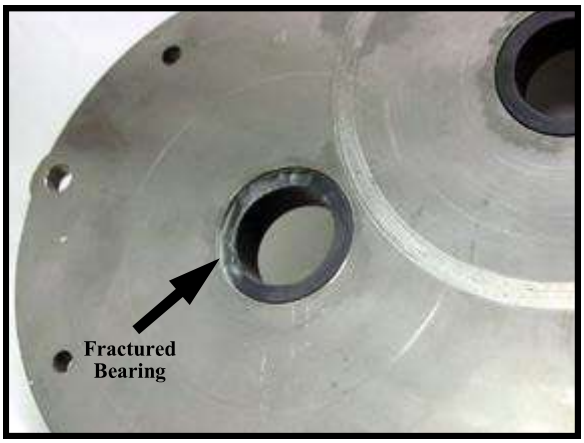
CHAMBER WEAR

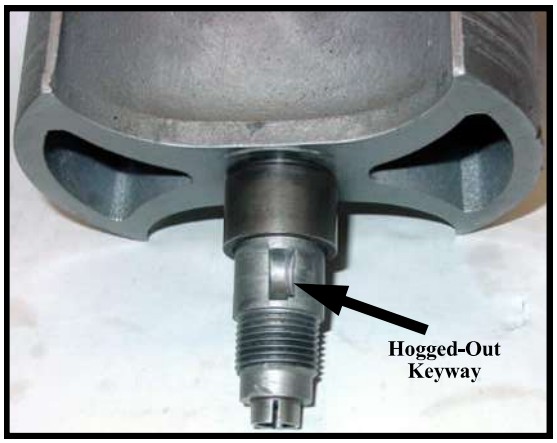
A) Foreign debris, similar to sand or sludge, has run through the meter.
B) Meter has been operated at a higher capacity and has worn the bearings out, allowing rotors to drop into the chamber.



GEAR WEAR

A) Meter has been run on air.
B) Meter has been operated at a higher volume capacity than what is rated.





HYDRAULIC SHOCK

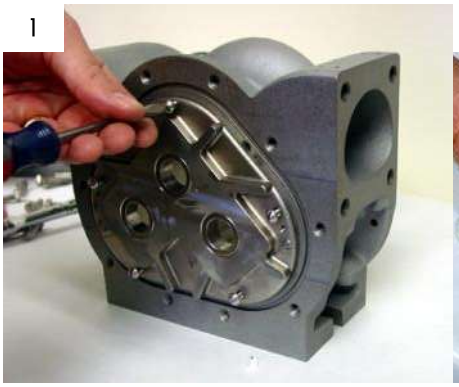
A) A valve downstream of the flow meter has abruptly shut off, creating hydraulic shock.
B) Flow meter potentially had large volume of free air flowing within the system, followed by fluid.

Reassembly of Meter

Reinstalling Rotors

1) Install rear bearing plate on meter.
2) Insert threaded end of blocking rotor and the right displacement rotor into front gear plate (reinsert rotor keys if necessary).
3) Align the two rotors (see picture 3) before applying gears.

1



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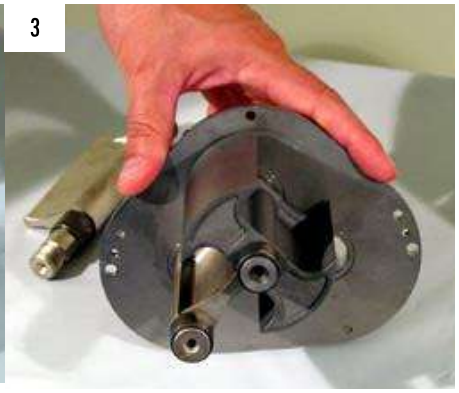
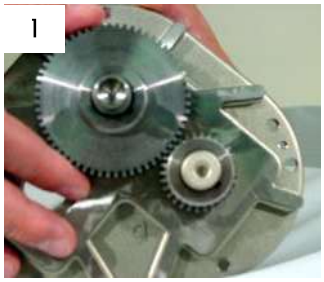


Rotor Gear Timing

1) Slide on blocking rotor gear and position the ‘arrow’ that it is pointing toward the right displacement gear.
2) Align ‘arrow’ on displacement gear with the ‘arrow’ on the blocking gear and slide on right displacement gear.
3) Rotate the blocking rotor gear toward the left displacement gear and again align ‘arrows’ and slide on left displacement gear.
4) Gears and rotors should rotate freely if gears have been installed properly. If so, proceed with starting on the lock nuts until finger tight.

1



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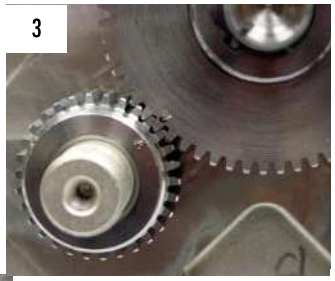

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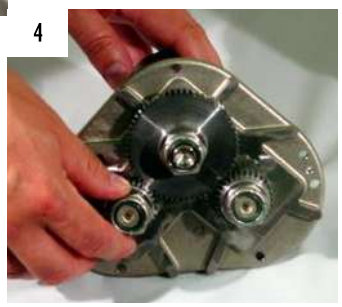
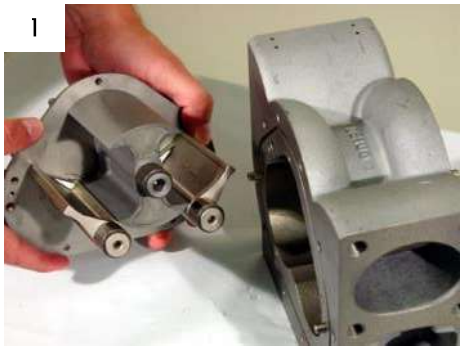


Reassembly of Meter

Reinstalling Bearing Plate

1) Align rotors on bearing plate (see picture) before inserting into meter.
2) Slide front bearing plate with rotors into meter housing and rear bearing plate.
3) Again, rotate gears to make sure they turn freely within the housing before proceeding.

1



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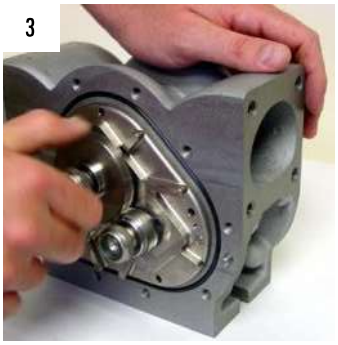
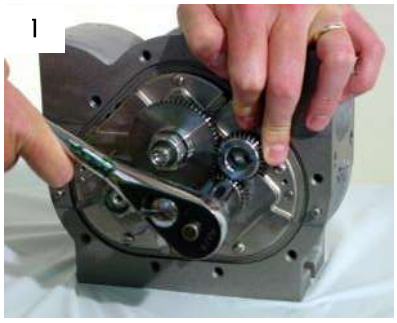


Reinstalling Rotor Gears & Lock Nuts

1) Using the spare displacement gear (or shop rag), position between right displacement gear and blocking rotor gear.
2) Using the torque specifications, apply and tighten the lock nut on the right and left displacement gears.
3) Move the spare gear between the left displacement and blocking rotor gears and then tighten the lock nut on the blocking rotor gear.

1



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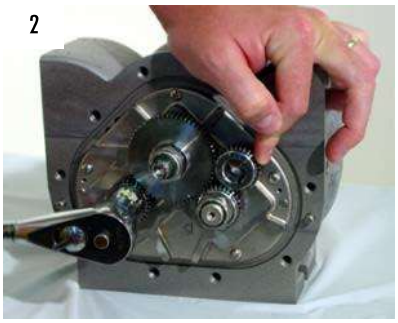

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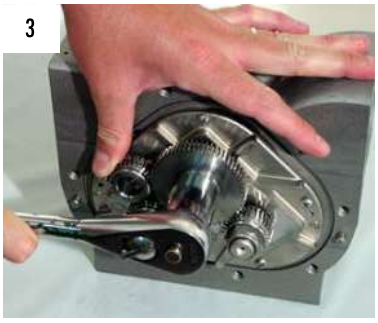
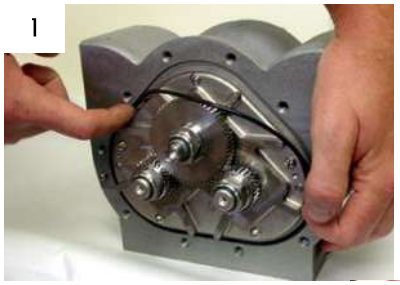
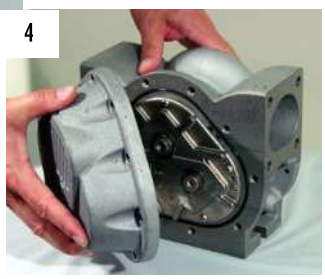


Reassembly of Meter

Reinstalling Packing Capsule & Front/Rear Covers

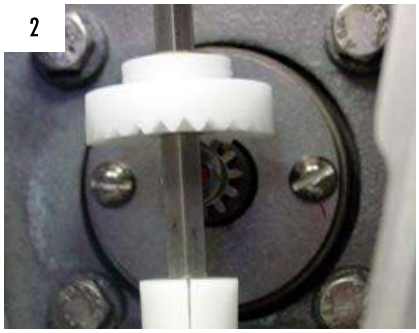
1) Reinstall cover O-rings on the front and rear of meter housing.
2) Reinsert packing capsule into front cover of meter with retaining plate and tighten screws.
3) When attaching front cover, align packing capsule blade with the slot on the blocking rotor sleeve. Tighten all front cover screws.
4) Attach rear cover and tighten all screws.

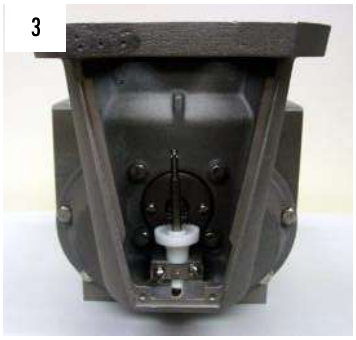




Reinstalling Counter Support & Adjuster Drive Shaft

1) Position the counter support on the front side of meter and tighten all screws.
2) Reinsert adjuster drive shaft into the support housing. Assure that adjuster face gear teeth mesh completely with the packing capsule gear. The face gear and packing gear should mesh snugly, but do not overtighten as this will cause premature wear on the gears.
3) Slide down the adjuster mounting bracket and tighten the screws.



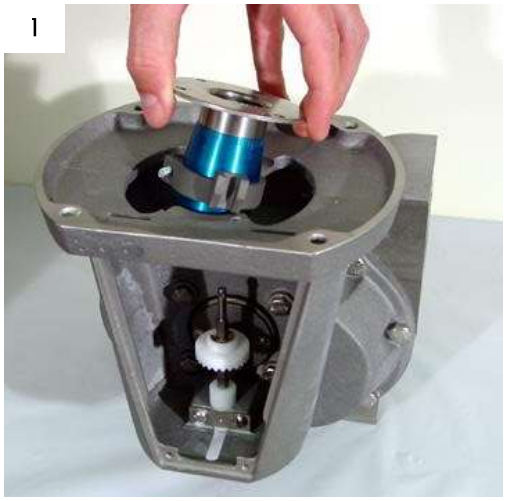


Reassembly of Meter (Continued)

Reinstalling Adjuster

1) Reinsert the adjuster into the top of the counter support and assuring that it mates with the drive shaft.
2) Tighten the screws that secure the adjuster plate to the counter support.

1



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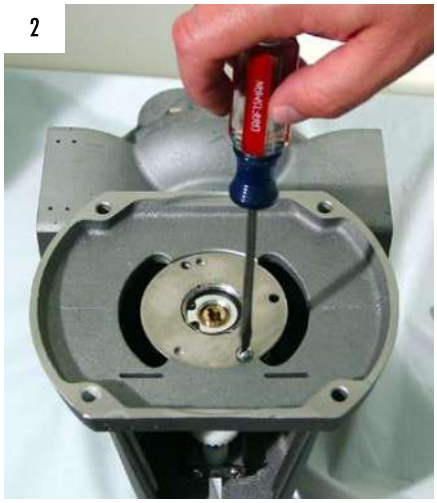
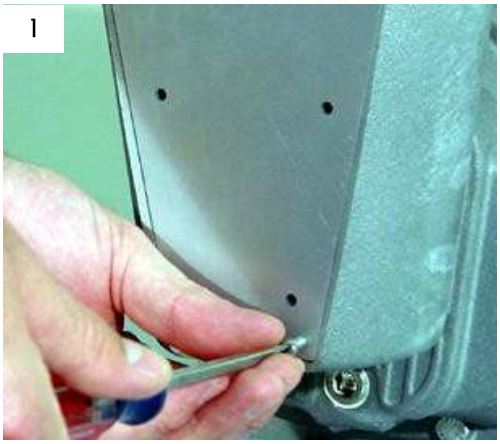


Reinstalling Dust Cover

1) Reattach dust cover and tighten the screws.
2) Back where we started.

1



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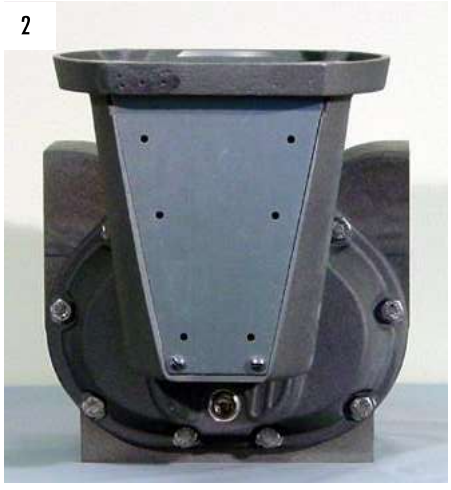
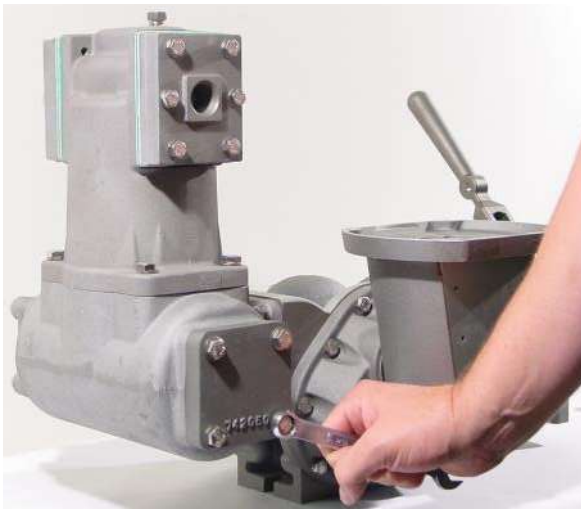


Disassembly of 720 Strainer Assembly

¡WARNING!

All internal pressure must be relieved to ZERO (0) pressure before beginning disassembly of meter or components

1) Using a hex or socket wrench, remove the four screws and washers from the cover plate.
2) Remove the cover plate and O-ring from the housing.
3) Remove the strainer screen.
4) Check inside housing for any debris and remove using a clean cloth.
5) Clean strainer screen by rinsing with a liquid cleaning agent compatible to your product application. A brush may be used to remove imbedded particles. If screen is too dirty to clean, then replace the screen.
6) Wipe clean the face of the cover plate and seal ring. Check O-rings for damage and replace as needed.



Reassembly of 720 Strainer Assembly

1) Replace the strainer screen into the housing.
2) Place the end cover O-ring in the groove of the end cover.
3) Put the end cover with O-ring installed on the strainer housing.
Replace and fasten end cover with the 4 screws and washers. Tighten the screws according to the torque chart.

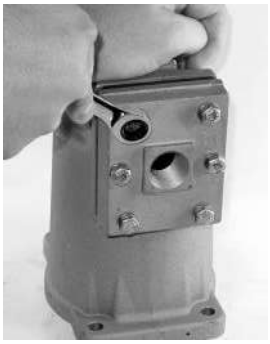
Disassembly of 730 Air Eliminator Assembly

¡WARNING!

All internal pressure must be relieved to ZERO (0) pressure before beginning disassembly of meter or components

1) Using a 1/2” wrench or socket, remove the cover screws from air eliminator cover plate.
2) Remove cover plate.
3) Remove valve plate, inspect and replace as needed.

1

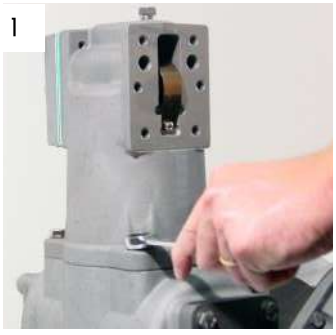


2

3

1) To remove the air eliminator assembly, remove the four screws and washers attaching it to the strainer assembly.
2) Using a flathead screwdriver, remove the screws attaching reed valves to air eliminator housing.
3) Remove the two screws on the diffuser screen.
4) Slide out diffuser shaft assembly.
5) Remove the two screws attaching reed valve to the float assembly. Inspect and replace reed valves as needed.

1



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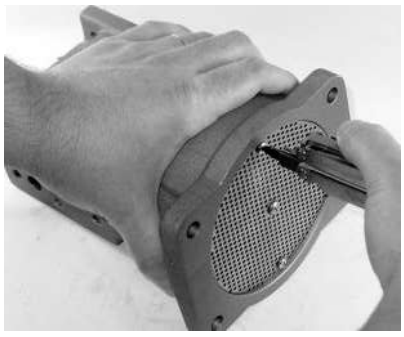


4

5

Disassembly of 750-30 Hydraulic Valve

¡WARNING!

All internal pressure must be relieved to ZERO (0) pressure before beginning disassembly of meter or components

1) Drain all fluid from metering system prior to valve removal.
2) Using a hex or socket wrench, remove the four screws connecting the valve to the meter.
3) Remove valve from meter and piping.
4) Place valve on flat surface with valve outlet facing downward.
5) Slowly loosen the four screws located on the valve cap. You should feel force from the compression spring on the valve cap.
6) Completely remove three bolts on the valve cap first. While holding the valve cap down, then remove the remaining bolt until you feel no more force from the compression spring.
7) The components are in the cap and will come out of the valve housing.



8) To remove the cap assembly, remove the four cotter pins (this is only needed when replacing spring or cup).
9) To replace the flat washer, remove the retaining ring on end of guide shaft.
10) Turn outlet of valve so that is facing upward.
11) Remove the two screws that hold the guide and seal.
12) Remove the retaining ring from one side of the valve shaft.
13) Remove shaft seal, bearing, O-ring, inner bearing and inner O-ring.
14) Inspect and replace parts as needed.
15) Press down on the valve housing so that the valve piston is forced in and pushing the valve shaft handle away from valve housing.
16) While keeping pressure on the valve, remove the swivel pin.
17) Slowly release the valve until spring exerts no pressure. As the valve housing is lifted, the piston and spring should slide out of valve housing.
18) Inspect piston and seals, clean and replace as needed.

Disassembly of 750-30 Hydraulic Valve

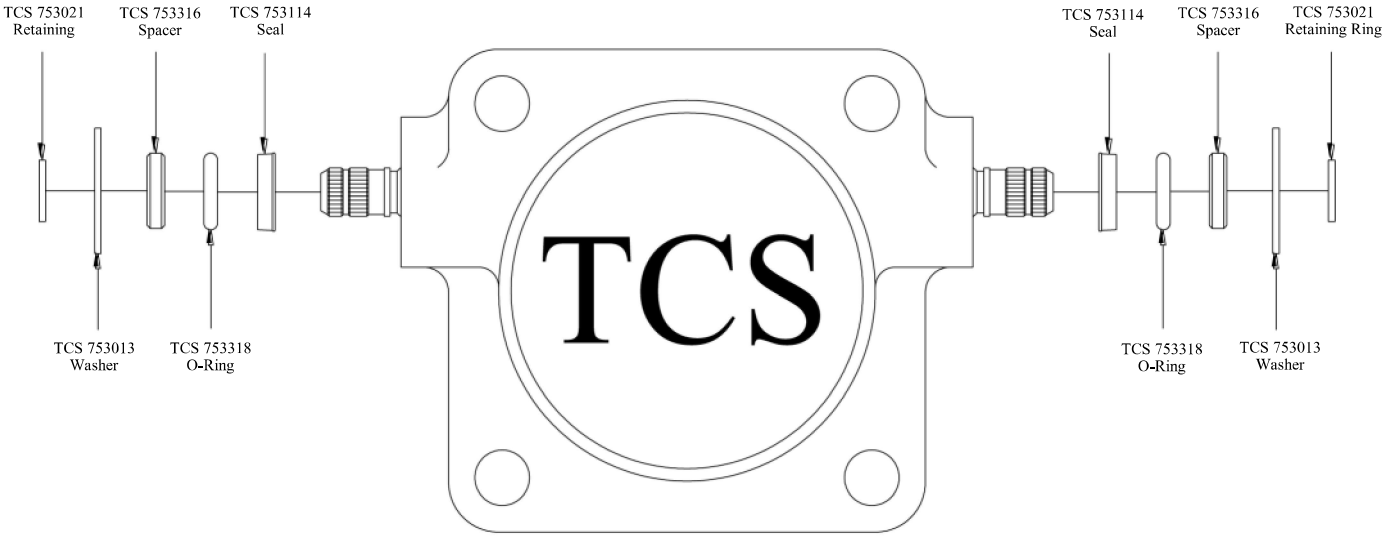
1) Remove the piston guide from the valve body.
2) Remove and inspect the upper and lower seals and replace as needed.
3) Using a flathead screwdriver, gently remove the valve body O-ring, inspect and replace if needed.

Reassembly of 750-30 Hydraulic Valve

1) Place the seal into valve housing.
2) Place guide into valve outlet.
3) Secure seal and guide with the two screws.
4) Turn outlet of valve in downward position.
5) Place the flat washer, spring and washer on the valve shaft and secure by placing nut on the end of the valve shaft.
6) Place the compression spring into the valve housing.
7) Insert the valve shaft and piston assembly into valve housing.
8) Place the assembly on a flat surface with piston facing downward.
9) Press down on the valve housing, compressing the spring.
10) While keeping pressure on the valve assembly, insert link connector through the valve shaft opening and the valve handle opening.

750 Hydraulic Valve Seal Replacement

1) Remove retaining ring (TCS 753021) and washer (TCS 753013) from shaft.
2) Remove spacer bearing (TCS 753314).
3) Remove seal (TCS 753114).
4) Inspect and clean seal chamber.
5) Apply thin layer of grease to the shaft and seal chamber.
6) Install new seal (TCS 753114) with the spring side facing the inside of the seal chamber.
7) Install new o-ring (TCS 753318).
8) Install new spacer bearing (TCS 753316).
9) Install washer (TCS 753013) and retaining ring (TCS 753021).

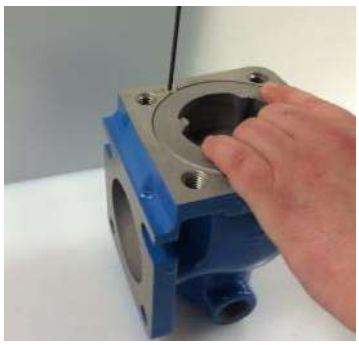


Disassembly of 760 Air Check Valve

¡WARNING!

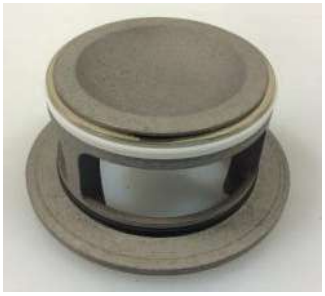
All internal pressure must be relieved to ZERO (0) pressure before beginning disassembly of meter or components

1) Use a fixture or vice to compress and hold the poppet in place before loosening any screws.
2) Using a 1/8" Allen wrench, loosen and remove two screws.
3) Slowly release the poppet from the housing until it is no longer under spring pressure.
4) Remove the poppet assembly and spring from the housing .
5) Check housing interior for any debris. Wipe with a clean cloth.
6) Inspect and replace the seals as needed (refer to the table on page 30).
    a. Housing Seal with Snap Ring
    b. Piston Guide External Seal
    c. Piston Guide Internal Seal with Snap Ring
    d. Gasket


Reassembly of 760 Air Check Valve

1) Install Housing Seal with Snap Ring into Housing. Note that the spring side is facing up.
2) Install Piston Guide External Seal.
3) Install Piston Guide Internal Seal with Snap Ring. Note: Remove Spring from seal, if present.
4) Place Piston onto Piston Guide (Poppet Assembly). Must move freely.
5) Place the Poppet Assembly and spring inside Housing.
6) With the Poppet Assembly completely compressed into the housing, replace the two screws with the 1/8" Allen Wrench.
7) Verify the two screws are below the surface. Apply the flange gasket.


Meter Trouble Shooting

PROBLEM: Leaking packing gland and/or housing

A) Check to see whether any O-Rings have been damaged or cover bolts have not been tightened enough.

B) Two common causes of packing gland leakage are thermal expansion and hydraulic shock.

C) If two valves in a piping system (on either side of the meter) are closed, isolating the meter, and if the temperature rises as little as 1°F in the system, the possible rise in pressure due to temperature would exceed the working pressure rating of the meter. To avoid this hazard caused by thermal expansion, a pressure-relief valve must be installed in the system near the meter.

D) Hydraulic shock occurs when a large volume (mass) of liquid is moving through a pipe line at normal operating flow rate and a valve is suddenly closed. When the flow is so suddenly stopped, the entire mass of the liquid in the piping system acts as a battering ram, causing a shock effect within the meter. The greater the mass, length of line and/or velocity, the greater the hydraulic shock. Since the valve is usually located at the meter outlet, the meter housing, packing gland and the meter internal components receive the full impact of this hydraulic shock. To prevent this hazard, a slow closing two-stage valve should be used in conjunction with the metering system. On those systems where mass, length of line, etc. are of such magnitude as to preclude the elimination of hydraulic shock with the use of a two-stage slow closing valve, an impact-absorbing air cushioning device should be used.

PROBLEM: Product flows through meter but register does not operate

A) Gear train motion interrupted by non-functioning gear due to broken pin or key. Replace pin or key where required.
B) If all meter parts are moving then problem is in register.
C) Remove register from meter. If all meter parts are moving but output shaft of adjuster assembly is not, adjuster is worn and must be replaced.
D) If totalizer numerals (small numbers) on register are recording, but the big numerals are not moving, register needs repair.

PROBLEM: Product flows through meter but register does not record correctly

A) Adjuster assembly not properly calibrated, See METER CALIBRATION on page 13 for more instructions.
B) The factory installed gear train may have incorrect gearing ratio.
C) Check register for defects.

PROBLEM: No flow through meter

A) Faulty non-functioning pump.
B) Foreign matter within the system, meter or components.
C) Meter has a broken rotor or rotor shaft.
D) Excessive wear on timing gears or bearings.
E) Meter “frozen” due to build-up of chemical “salts” inside metering chamber, sufficient to stop rotation of rotors.
F) Valve not open or not functioning.

PROBLEM: Meter runs too slow

A) There is a flow restriction within the system (tees, elbows, valves, etc.)
B) Foreign matter in system, meter or components.
C) Product viscosity is different or has changed from what was originally known.
D) Meter gears or rotors partially “salted” enough to slow up rotation of parts.
E) Valve internal mechanism faulty. Valve does not open fully or the linkage is not properly adjusted.

Air Eliminator Trouble Shooting

PROBLEM: Product is flowing from the Air Eliminators vents

A) Foreign matter located in between seal plate O-rings and metal reeds.
B) The seal plate O-ring may be worn through service life.
C) The seal plate O-ring may be cut or dislodged and requires replacement.
D) The float may have been punctured, containing liquid, not allowing the float to rise and seal the air vents.
E) The float may have been ruptured from a surge of pressure within the system.
F) The metal reeds may be fatigued and requires replacement.
G) The metal reeds may be out of alignment with the seal plate.

PROBLEM: The meter is still registering air within the system

A) The air return line is not the required minimum of 1/2" ID.
B) The metering system has insufficient means of eliminating air to the atmosphere. For example, an incorrectly installed "Catch Can" reservoir is located lower than the air eliminator itself, the reservoir is allowed to become full or the vent is improperly sized.

There can be numerous reasons why the meter may still register air. First look at the system configuration and see where air is being introduced into the system. Then determine if the meter is registering "free air" or "entrained air". Free Air is much easier to remove from the metering system and may require the use of a Spring Loaded Back Check Valve and/or a Differential Air Check Valve and/or a High Volume Strainer to help the air eliminator operate more effectively.

Entrained Air is much more difficult to remove. Typically the best way to eliminate Entrained Air will be to remove the source of entry of air into the system. Some typical examples would be a cavitating pump or a leaking pump or faulty valve seals. A High Volume Strainer may help accumulate the liquid long enough to disperse the Entrained Air from the system. See Air Elimination in the Service Manual for more information.

Preset Valve Trouble Shooting

PROBLEM: The valve will not close completely.

A) The shaft of the piston may be bent from excessive force.
B) Debris may be located between the piston and piston guide.
C) The upper or lower seals may be worn, swollen from incompatibility or cut from debris.
D) The mechanical linkage to the Veeder-Root 7889 preset counter may be tight. The linkage must be loose for the preset to operate correctly.
E) The Veeder-Root preset may have a worn or bent trip mechanism that is not allowing the preset to function.

PROBLEM: The valve shuts immediately upon first stage trip, bypassing the second stage closure.

A) The mechanical linkage might need to be adjusted, moving the Nylon locking nuts forward or backwards to change the closing of the preset valve.
B) The Veeder-Root preset may need to be "raked" or adjusted for the correct shut-off volume. See Veeder Root 7889 preset service manual for further instructions.
C) The Veeder-Root preset may have a worn or bent trip mechanism that is not allowing the preset to function.

PROBLEM: The preset batch over or under registers correct volume.

A) The mechanical linkage might need to be adjusted, moving the Nylon locking nuts forward or backwards to change the closing of the preset valve.
B) The Veeder-Root preset may need to be "raked" or adjusted for the correct shut-off volume. See Veeder Root 7889 preset service manual for further instructions.
C) The Veeder-Root preset may have a worn or bent trip mechanism that is not allowing the preset to function.

760 Air/Vapor Check Valve Trouble

PROBLEM: Product will not be pumped through the meter.

A) Pressure has increased behind the air check piston and will not open the valve. One of the valve plates on the air eliminator outlet must be installed so that the round tab is located to the top of the device. This allows the minimum bleed function on the valve plate to work properly. Ensure that the air check side outlet is connected to the air eliminator outlet cove where the plate with the round tab is toward the top. This will allow for the proper release of pressure from the air check.

Test Liquid Material Safety Data Sheet (MSDS)

24 HOUR EMERGENCY ASSISTANCE
(260) 833-3173

GENERAL MSDS ASSISTANCE
(260) 484-0301

CODE: RPS

HAZARD RATING> LEAST-0 SLIGHT-1 MODERATE-2 HIGH-3 EXTREME-4

DR LUBRICANTS, INC.
4611 NEWAYGO ROAD, SUITE D
FORT WAYNE, IN 46808

DATE: 01/21/06

TELEPHONE NUMBER: (260 484-0301

SECTION I - PRODUCT IDENTIFICATION

PRODUCT: **RP 1060**

SECTION II - COMPOSITION AND HAZARDOUS INFORMATION*

CHEMICAL NAME	CAS NUMBER	WT. PERCENT IS LESS THAN	OCCUPATIONAL EXPOSURE LIMITS (TLV-TWA) (TLV-STEL)
PETROLEUM HYDROCARBON	64741-65-7	45.0	100MG/M3
PETROLEUM HYDROCARBON	64742-53-6	65.0	5MG/M3

*ITEMS NOT SHOWN ARE NOT LISTED IN THE OSHA - T.S.C.A. HAZARDOUS CHEMICALS LISTING.

SECTION III - PHYSICAL DATA

BOILING RANGE:	NA	VAPOR DENSITY:	NA
ODOR:	PETROLEUM ODOR	EVAPORATION RATE:	NA
APPEARANCE	AMBER LIQUID	SOLUBILITY:	INSOLUBLE
VOLATILE BY WEIGHT:	NA	PRODUCT DENSITY:	0.829
VOLATILE BY VOLUME:	NA		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION: COMBUSTIBLE FLASH POINT: 170 F (CLEVELAND OPEN CUP) LEL: NA UEL: NA

DOT: COMBUSTIBLE LIQUID

EXTINGUISHING MEDIA: CARBON DIOXIDE, DRY CHEMICAL, FOAM

Test Liquid Material Safety Data Sheet (Continued)

PRODUCT: RP 1060
PAGE - 2

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

UNUSUAL FIRE AND EXPLOSION HAZARDS : DO NOT DIRECT A SOLID STREAM OF WATER ONTO BURNING PRODUCT. THIS MAY CAUSE SPREADING AND INCREASE THE FIRES INTENSITY. COMBUSTION MAY PRODUCE: OXIDES OF CARBON, AND INCOMPLETELY BURNED HYDROCARBONS IN THE FORM OF FUMES AND SMOKE.

SPECIAL FIREFIGHTING PROCEDURES: WEAR A SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE.

SECTION V - HEALTH HAZARD DATA

EFFECTS OF OVER EXPOSURE: MAY CAUSE MILD EYE IRRITATION AND REDNESS. PROLONGED OR REPEATED EXPOSURE TO THE SKIN MAY RESULT IN LOSS OF NATURAL OILS ACCOMPANIED BY DRYNESS, CRACKING AND DERMATITIS. INGESTION MAY RESULT IN NAUSEA, DIARRHEA AND GASTRO INTESTINAL IRRITATION. OVEREXPOSURE TO MIST MAY CAUSE UPPER RESPIRATORY TRACT IRRITATION AND DIFFICULTY BREATHING.

MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: NONE KNOWN.

PRIMARY ROUTE(S) OF ENTRY: DERMAL INHALATION INGESTION.

EMERGENCY AND FIRST AID PROCEDURES: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH EYES WITH CLEAN WATER FOR AT LEAST 15 MINUTES. IF EYE IRRITATION PERSISTS, CONTACT A PHYSICIAN. IN CASE OF SKIN CONTACT, REMOVE ANY CONTAMINATED CLOTHING AND RINSE SKIN THOROUGHLY WITH WATER FOR AT LEAST 15 MINUTES. IF SKIN IRRITATION PERSISTS, CONTACT A PHYSICIAN. IN CASE OF OVEREXPOSURE TO MIST, REMOVE VICTIM TO FRESH AIR: IF BREATHING IS DIFFICULT ADMINISTER OXYGEN: AND CONTACT A PHYSICIAN IMMEDIATELY. IF PRODUCT IS INGESTED DO NOT INDUCE VO MITING: CONTACT A PHYSICIAN.

SECTION VI - REACTIVITY DATA

STABILITY: THIS PRODUCT IS STABLE UNDER NORMAL STORAGE CONDITIONS.

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR UNDER NORMAL CONDITIONS.

HAZARDOUS DECOMPOSITION PRODUCTS: THERMAL DECOMPOSITION MAY RESULT IN THE FORMATION OF: OXIDES OF CARBON, AND INCOMPLETELY BURNED HYDROCARBONS IN THE FORM OF FUMES AND SMOKE.

CONDITIONS TO AVOID: AVOID CONTACT WITH OPEN FLAME, STORE IN ROOM TEMPERATURE AREA.

INCOMPATIBILITY: AVOID CONTACT WITH STRONG OXIDIZING AND REDUCING AGENTS AND STRONG ALKLI.

Test Liquid Material Safety Data Sheet (Continued)

PRODUCT: RP 1060
PAGE - 3

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: FOR SMALL SPILLS: SOAK UP SPILL WITH ABSORBENT MATERIAL. FOR LARGE SPILLS: DIKE SPILL AND PUMP INTO DRUMS FOR PROPER DISPOSAL.

WASTE DISPOSAL METHOD: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL STATE AND FEDERAL REGULATIONS.

SECTION VIII - SAFE HANDLING AND USE INFORMATION

RESPIRATORY PROTECTION: NORMALLY NOT REQUIRED, HOWEVER, WHEN THE TLV IS EXCEEDED WEAR THE APPROPRICATE MSHA/NIOSH APPROVED RESPIRATOR.

VENTILATION: PROVIDE ADEQUATE VENTILATION (SUCH AS MECHANICAL OR LOCAL) TO ASSURE TLV IS NOT EXCEEDED.

PROTECTIVE GLOVES: NORMALLY NOT REQUIRED, HOWEVER, IF HANDS ARE FREQUENTLY IN FLUID WEAR OIL AND CHEMICAL IMPERVIOUS GLOVES.

EYE PROTECTION: SAFETY GLASSES REQUIRED FOR NORMAL USAGE, WEAR CHEMICAL GOGGLES WHEN EXCESSIVE SPLASHING MAY OCCUR.

OTHER PROTECTIVE EQUIPMENT: NORMALLY NOT REQUIRED, HOWEVER, WHERE REPEATED CONTACT OCCURS, WEAR IMPERVIOUS CLOTHING AND BOOTS.

HYGIENIC PRACTICES: FOLLOW STANDARD INDUSTRIAL HYGIENE PRACTICES. LAUNDER ANY CONTAMINATED CLOTHING BEFORE RE-USE.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: DO NOT STORE IN THE PRESENCE OF HEAT, SPARKS, FLAME OR ANY OTHER SOURCES OF IGNITION. STORE AWAY FROM STRONG OXIDIZING AGENTS. EMPTY DRUMS MAY CONTAIN PRODUCT RESIDUES. ALL SAFETY PRECAUTIONS TAKEN WHEN HANDLING THIS PRODUCT SHOULD ALSO BE TAKEN WHEN HANDLING EMPTY DRUMS AND CONTAINERS.

OTHER PRECAUTIONS: NONE

Test Liquid Material Safety Data Sheet (Continued)

SECTION X - HMIS/NFPA RATINGS

HMIS:HEALTH:1 FLAMMABILITY:2 REACTIVITY:0 PERSONAL PROTECTION:C
NFPA:HEALTH:1 FLAMMABILITY:2 REACTIVITY:0 SPECIFIC HAZARD:

SECTION XI - OTHER REGULATORY INFORMATION

LAND (TDG)

PROPER SHIPPING NAME: PETROLEUM DISTILLATES, N.O.S.
HAZARD CLASS & DIVISION: 3
UN NUMBER: 1268
PACKING GROUP: III

THE INFORMATION CONTAINED HEREIN IS, TO THE BEST OF OUR KNOWLEDGE AND BELIEF, ACCURATE. HOWEVER, SINCE THE CONDITIONS OF HANDLING AND USE ARE BEYOND OUR CONTROL, WE MAKE NO GUARANTEE OF RESULTS, AND ASSUME NO LIABILITY FOR DAMAGES INCURRED BY USE OF THIS MATERIAL. IT IS THE RESPONSIBILITY OF THE USER TO COMPLY WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS AND REGULATIONS.

Notes

Warranty Information

New 700 rotary meters, equipment or components manufactured by Total Control Systems, a division of Murray Equipment, Inc. (TCS) with which this warranty is enclosed, are warranted by TCS to the original purchaser only for a period of TWELVE (12) months from installation or eighteen (18) months from the date of shipment, to be free, under normal use and service, from defects in material and workmanship.

Defects occurring within the stated warranty period, TCS will repair or replace, at TCS's option; provided that part or parts are returned to TCS transportation charges prepaid, and TCS's examination discloses the parts or workmanship to have been defective upon delivery to the purchaser.

EXCLUSIONS: Warranty does not cover any parts and equipment not manufactured by TCS, but these items may be covered by separate warranties of their respective manufacturers. This warranty does not extend to any equipment that has been subjected to misuse, negligence or accident or if operated in any manner other than in accordance with TCS's operating instructions and specifications.

CLAIM PROCEDURES: In order to obtain performance by TCS of its obligations under this warranty, the original purchaser must obtain a Return Goods Authorization (RGA) number from TCS's customer service department within 30 days of discovery of a purported breach of warranty, but not later than the expiration of the warranty period. Once authorization is received, return the RGA and defective meter, piece of equipment, or component covered by this warranty, with transportation charges prepaid, to TCS together with a written RGA form, MSDS sheet and packaging clearly marked with the RGA number. All RGA procedures must strictly be followed for safety and quick resolve. TCS reserves the right of refusal for shipments sent back freight collect and/or without proper paperwork.

LIMITATIONS: There are no other warranties of any kind, expressed or implied. TCS specifically disclaims any warranty of merchantability or of fitness for any particular purpose. TCS will determine if all parts or meter defect falls within the warranty guidelines and will repair or replace within a reasonable time span. TCS is not responsible for any in or out bound freight. TCS's sole obligation shall represent the buyer's sole and exclusive remedy shall be to repair or at TCS's option to replace any product or part determined to be defective. In no event shall TCS be liable for any special, direct, indirect, incident, consequential or other damages of similar nature, including without limitation, loss of profits, products, production time, or loss of expenses of any nature incurred by the buyer or any third party. TCS has not authorized on its behalf any representation or warranties to be made, nor any liability to be assumed except as expressly provided herein; there is no other express or implied warranty.

REPAIR WARRANTY: All repair work is warranted for ninety (90) days from the date of shipment to customer. Some parts may be warranted for longer periods by the Original Equipment Manufacturer.

DESIGN AND EQUIPMENT CHANGES: Any changes in design or improvements added shall not create any obligation to install same on equipment previously sold or ordered.

2515 Charleston Place
Fort Wayne, IN 46808

Toll Free: (800) 348-4753
Phone: (260) 484-0382
Fax: (260) 484-9230
Email: sales@tcsmeters.com
Website: www.tcsmeters.com

TITAN FLOW CONTROL, INC.

SWING CHECK VALVE ❖ WAFER TYPE ❖ SINGLE DISC

ANSI CLASS 150 ❖ CARBON AND STAINLESS STEEL

MODELS: CV 32-CS

(CARBON - VITON SEAT)

CV 32-SS

(STAINLESS - PTFE SEAT)

SIZES: 2" ~ 12"

FEATURES

- ◇ SHUT-OFF IS ACHIEVED VIA THE FULLY AUTOMATIC, SPRING-ASSISTED, DISC THAT CLOSES AT ZERO FLOW VELOCITY
- ◇ QUICK CLOSURE OF THE DISC REDUCES WATER HAMMER BY CREATING A POSITIVE SHUTOFF PRIOR TO FLOW REVERSAL
- ◇ HEAD LOSS IS MINIMIZED BY PROVIDING A COMPACT FACE-TO-FACE AND A LARGE, VIRTUALLY UNOBSTRUCTED FLOW PATH
- ◇ CAN BE INSTALLED IN ANY POSITION VERTICAL (WITH UPWARD FLOW ONLY) OR HORIZONTAL
- ◇ ANTI-CORROSIVE, STAINLESS STEEL TRIM (DISC, SPRING, AND SHAFT) ARE STANDARD
- ◇ NARROW FACE-TO-FACE DIMENSIONS AND LIGHTWEIGHT DESIGN PROVIDE AN ECONOMICAL, SPACE-SAVING SOLUTION
- ◇ PRECISION MACHINED DISCS COUPLED WITH DYNAMIC SOFT SEATS (VITON FOR CARBON AND PTFE FOR STAINLESS) ENSURE A BUBBLE-TIGHT SEAL IS ACHIEVED

TECHNICAL

PRESSURE/ TEMPERATURE RATING CS - ASTM A216 GR.WCB - CLASS 150
WOG: 285 PSI @ 100 °F
PRESSURE/ TEMPERATURE RATING SS - ASTM A351 GR. CF8M - CLASS 150
WOG: 275 PSI @ 100 °F
SEAT MATERIAL (O-RING)
VITON: -40 ~ 400 °F PTFE: -100 ~ 400 °F

APPLICATIONS

MARKETS: GENERAL INDUSTRY, CHEMICAL, PETROCHEMICAL, POWER, AND FOOD & BEVERAGE

SERVICE: INTENDED FOR LIQUID SERVICE THAT IS STEADY, CLEAN (NO ABRASIVES) AND NON-PULSATING. FLOW RATE SHOULD NOT EXCEED 15 FT/SEC. NOT RECOMMENDED FOR STEAM SERVICE OR RECIPROCATING COMPRESSOR SERVICE.

PTFE PROPERTIES: RECOMMENDED FOR MOST CHEMICAL ENVIRONMENTS INCLUDING ACIDS, BASES, OILS, STEAM AND OTHER PROCESS FLUIDS. OFFERS EXCELLENT TEAR, ABRASIVE, CHEMICAL, ACID, AND ALKALI RESISTANCE. NOT RECOMMENDED FOR HIGH PRESSURE STEAM OR LARGE TEMPERATURE VARIATION APPLICATIONS.

VITON PROPERTIES: OFFERS A BROAD RANGE OF CHEMICAL RESISTANCE AND EXCELLENT HEAT RESISTANCE. GOOD MECHANICAL PROPERTIES AND COMPRESSION SET RESISTANCE. OFTEN USED IN APPLICATIONS WERE NOTHING ELSE WILL WORK. FAIR LOW TEMPERATURE RESISTANCE AND LIMITED HOT-WATER RESISTANCE AND SHRINKAGE.

The above data represents common market and service applications. No representation or guarantee, expressed or implied, is given due to the numerous variations of concentrations, temperatures and flow conditions that may occur during actual service.

TITAN FLOW CONTROL, INC.

YOUR PIPELINE TO THE FUTURE!

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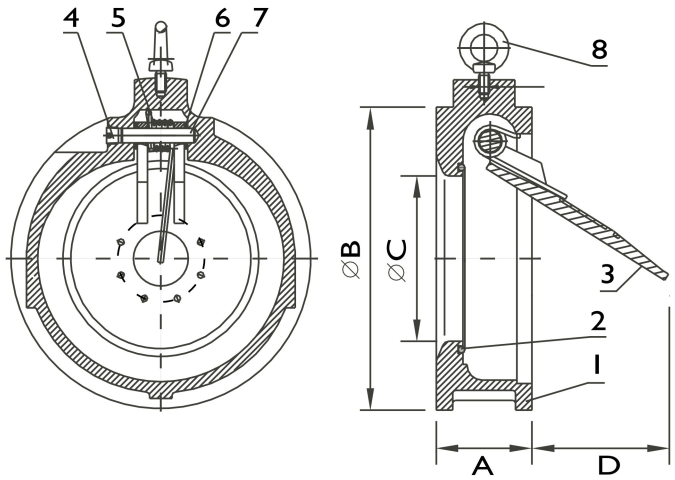
SWING CHECK VALVE • WAFER TYPE
SINGLE DISC
MODELS: CV 32-CS (Carbon - Viton Seat)
CV 32-SS (Stainless - PTFE Seat)

ANSI Class
150 lb

BILL OF MATERIALS (1)

No.	PART	CV 32-CS	CV 32-SS
1	Body	Carbon Steel A216 Gr. WCB	Stainless Steel A351 Gr. CF8M
2	Seat (2)	Viton O-RING	PTFE Commercial O-RING
3	Disc (2)	Stainless Steel AISI 316	Stainless Steel AISI 316
4	Plug	Carbon Steel ASTM A307B	Stainless Steel AISI 316
5	Spring (2)	Stainless Steel AISI 304	Stainless Steel AISI 304
6	Spacer	PTFE Commercial	PTFE Commercial
7	Shaft	Stainless Steel AISI 316	Stainless Steel AISI 316
8	Eye Bolt	Carbon Steel ASTM A307B	Carbon Steel ASTM A307B

1. Bill of Materials represents standard materials. Equivalent or better materials may be substituted at the manufacturer's discretion. All materials conform toASTM specifications.
2. Denotes recommended spare parts.

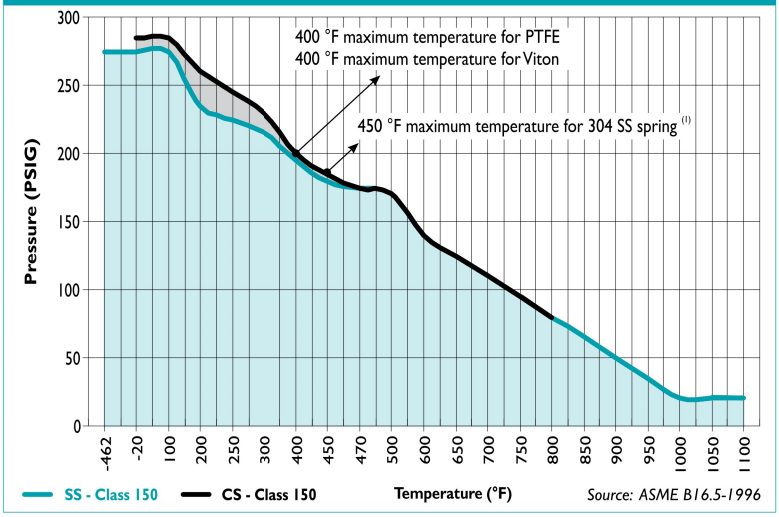


DIMENSIONS AND PERFORMANCE DATA

SIZE		2	2 1/2	3	4	5	6	8	10	12
	mm	50	65	80	100	125	150	200	250	300
A DIMENSION FACE TO FACE	in	1.75	1.875	2.00	2.25	2.50	2.75	2.875	3.125	3.375
	mm	45	48	51	58	64	70	74	80	86
ØB DIMENSION OVERALL DIAMETER	in	4.125	4.875	5.375	6.875	7.75	8.75	11.00	13.375	16.125
	mm	105	124	137	175	197	223	280	340	410
ØC DIMENSION INLET DIAMETER	in	1.313	1.85	2.063	3.00	3.75	4.75	6.438	7.625	9.50
	mm	34	47	53	77	96	121	164	194	242
D DIMENSION DISC MAX TRAVEL	in	.50	.75	1.31	2.31	2.75	3.38	4.00	4.75	5.00
	mm	13	20	34	59	70	86	102	121	127
ASSEMBLED WEIGHT	lb	5.0	6.0	8.0	12.0	18.0	22.0	35.0	57.0	85.0
	kg	2.3	2.7	3.6	5.4	8.2	10.0	15.9	25.8	38.5
Flow Coefficient	C_V	62	109	166	318	471	720	1384	2298	4153
Cracking Pressure	psi	< .25	< .25	< .25	< .25	< .25	< .25	< .25	< .25	< .25

Dimensions and weights are for reference only. When required, request certified drawings.

PRESSURE/TEMPERATURE: A216 Gr. WCB & A351 Gr. CF8M CLASS 150



1. As the temperature increases, the load capacity of the spring diminishes significantly. At higher temperatures, Inconel Springs must be used.

REFERENCED STANDARDS & CODES

CODE	DESCRIPTION
ANSI B16.34	Steel Valves - Flanged, Threaded, & Welding Ends
ANSI B16.10	Face-to-Face & End-to-End Dimensions of Valves
ANSI B16.5	Pipe Flanges & Flanged Fittings
API 594	Wafer, Wafer-Lug, & Double Flanged Type Check Valves
API 598	Valve Inspection and Testing
MSS SP-6	Standard Finishes for Connecting-end Flanges
MSS SP-25	Standard Marking System for Valves
MSS SP-55	Quality Standard for Valve Castings

PRESSURE/TEMPERATURE RATING

	A216 Gr. WCB	A351 Gr. CF8M
WOG (water, oil, gas)	285 PSI @ 100 °F	275 PSI @ 100 °F

SEAT MATERIAL

VITON:	-40 ~ 400 °F
PTFE:	-100 ~ 400 °F

Ordering Code: _____ Size: _____
Customer/Project: _____
Inq./P.O. No.: _____
Titan Order No.: _____
Certified By: _____ Date: _____

Engineering Specification Submittal

Titan FCI makes every effort to ensure the information presented on our literature accurately reflects exact product specifications. However, as changes occur, there may short-term differences between actual product specifications and the information shown on our literature. Titan FCI reserves the right to make specification changes to improve our products without prior notification.

Wafer Type - Swing Check Valve - Single Disc • Models: CV 32-CS/SS

Size	Model Number	Description	Drawing Number

PREFACE:

This manual contains information concerning the installation, operation, and maintenance of Titan Flow Control (Titan FCI) WYE Type Strainers. To ensure efficient and safe operation of Titan FCI WYE Strainers, the instructions in this manual should be thoroughly read and understood. This manual is general in nature and is not meant to take the place of an on-site, process engineer or pipe fitter. As such, Titan FCI recommends that only experienced, skilled personnel be allowed to install and maintain Titan FCI WYE Strainers. Please retain this manual in a location where it is readily available for reference.

GENERAL INFORMATION:

A WYE Strainer is installed into a pipeline system to remove unwanted debris from the pipeline flow by utilizing a perforated or mesh lined straining element. This is illustrated in Figure 1. WYE Strainers remove only insoluble floating impurities with the most common range of particle retention ranging from 1 inch to 40 micron (.0015 inch).

Straining of the pipeline flow is accomplished via a perforated or mesh lined screen, internal to the strainer. In general, the size of the screen perforation should be slightly smaller than the smallest debris particle to be removed. If the screen perforation is undersized, the screen may require excessive cleaning. Consequently, if the screen perforation is oversized, unwanted debris may be permitted to flow through the pipeline; possibly damaging downstream equipment.

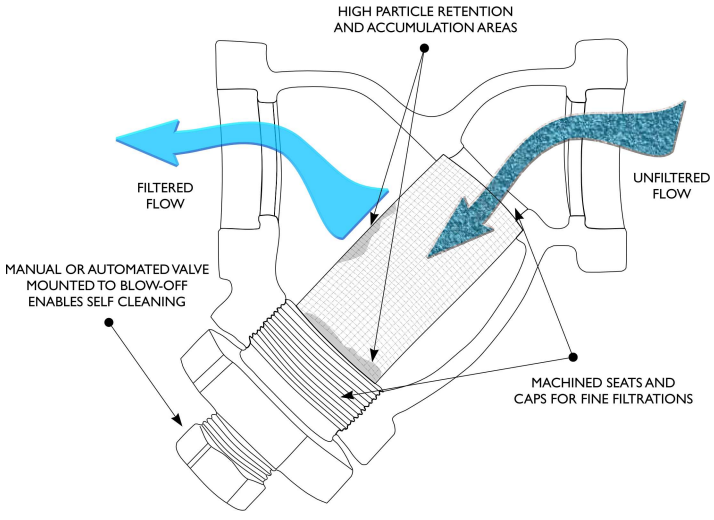


Figure 1: WYE Strainer Straining Illustration

GENERAL INFORMATION: continued...

Titan Flow Control offers a wide variety of WYE Strainer styles to meet all of your strainer requirements. Specific engineering design data, not contained in this manual, may be located within the Specification Sheets for each Strainer Model or within the certified engineering drawing.

Figure 2: WYE Strainer ~ Threaded Ends

Prior to selection of a Titan FCI WYE Strainer, the following factors must be determined:

- Material construction requirements of WYE Strainer.
- Design and working pressure/temperature requirements.
- Operating conditions (throttling, pressure drop, condensation, flow reversal, operation frequency, etc.).
- Pipeline service media type (liquid, gas, abrasive, corrosive, dirty, etc).
- The debris size to be removed.
- The debris loading of the pipeline.
- Pipeline media flow-rate and viscosity.
- Clean start-up pressure of the pipeline.
- Space availability for installation.

Please contact a Titan Design Engineer to assist in the determination of these requirements prior to selection and purchase.

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UNPACKING AND INSPECTION:

Upon receipt of product, it is important to follow these unpacking and inspection procedures.

All Titan FCI WYE Strainers are shipped in specialized shipping containers designed to prevent damage during transportation. If external damage to the shipping container is evident upon receipt of product, please request that a representative of the shipping carrier be present before unpacking the product.

- Carefully open the shipping container, following any instructions that may be marked on the container. Remove all packing material surrounding the Strainer and carefully lift it from the container. It is recommend to keep the shipping container and all packing material for reuse in storage or reshipment.

CAUTION:

For large or heavy Strainers, the appropriate material handling equipment must be used to prevent injury and possible damage to the WYE Strainer.

- Visually inspect the WYE Strainer for any signs of damage including scratches, loose parts, broken parts or any other physical damage that may have occurred during shipment. If damage is observed, immediately file a claim with the shipping carrier. WYE Strainers that are damaged during transportation are the responsibility of the customer. For information regarding Titan FCI's warranty policy, please refer to the last page of this document.

- Before installation, the WYE Strainer's cover should be removed and inspected internally for any loose or foreign materials that may have become trapped in the screen during transportation. After inspection, ensure sealing surfaces are clean and replace the gasket and cover. Make sure the gasket is seated correctly before tightening the cover bolts.

- If the WYE Strainer is not required to be installed immediately, it should be stored indoors in a clean, dry, consistent temperature environment. It is also recommended to utilize the original shipping container and packing materials to properly store the WYE Strainer. If long term storage is required, a desiccant may be necessary. This would be based upon the local, environmental storage conditions. Please consult a Titan FCI Design Engineer to assist in this determination.

Figure 3: WYE Strainer ~ Flanged Ends

UNPACKING AND INSPECTION: continued...

- When ready to install, remove any preservatives with solvent dampened cloths. Remove any loose material and protective packing material.

INSTALLATION:

Pre-Installation Checklist

- Ensure Working conditions (pressure/temperature) are within the specified capacity of the product being installed. Please refer to the certified drawings to assist in determining these values.

- Make sure that the construction material of the Strainer is chemically compatible with the media flowing in the pipeline.

- Inspect all sealing surfaces to ensure gasket surfaces are free of defects (no nicks or cuts). The pipeline should also be checked for proper alignment. Titan FCI WYE Strainers should never be utilized to realign an existing piping system.

- Ensure that the pipeline's mating flanges are the same type as the WYE Strainer being installed. Raised face flange ends cannot be mated to flat face flange ends.

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Pre-Installation Checklist continued...

- For flanged units, ensure Strainer end-to-end length and installation gap are with in ¼ in gap for gasket, and have sufficient clearance for easy opening of cover and screen removal. Refer to the certified drawing for screen removal clearance requirements.

- If the WYE Strainer is to be located on the discharge side of a pump, then a safety release valve must be installed between the WYE Strainer and the pump.

PRECAUTION:

A Titan FCI WYE Stainer should always be installed ahead of pumps and other expensive, downstream equipment to help ensure proper protection and trouble-free operation. This even holds true for "clean lines" to protect against pipe scale and accidentally introduced items such as: gaskets or tools.

Installation Procedure

Step 1:
Install blow down valve (if provided) at blow-off connection. Also, for maximum efficiency, install a differential pressure gauge at inlet and outlet connections or at the Strainer gauge tap (if provided).

Step 2:
Titan WYE Strainers must be positioned in the pipeline ahead of the equipment requiring protection. If the equipment requiring protection is a pump, the WYE Strainer must be placed on the suction side of the pump.

Step 3:
To provide for easier maintenance, the WYE Strainer should be located where the drain plug can be removed. Additionally, ensure the drain or blow-off is located at the lowest position when installed. If installed in the vertical position, the WYE side of the strainer must be pointing downward.

Step 4:
Ensure there is ample space at the WYE side of the Strainer for screen removal. Refer to the certified engineering drawing to determine the screen clearance requirements.

Step 5:
Before placing the WYE Strainer into place, support the existing pipeline with pipe supports near the inlet and outlet connections.

Figure 4: WYE Strainer ~ Solder Ends

Installation Procedure continued...

Step 5:
Place the WYE Strainer into the pipeline, ensuring that the flow arrow on the body of the WYE Strainer is pointing in the direction of the pipeline flow. For large or heavy Strainers, appropriate material handling equipment must be used.

Step 5:
Install a standard, ANSI (1/8" thick) flange gasket between the WYE Strainer and pipeline flanges, on both sides. Install lubricated flange bolts and hand tighten. Flange bolts should then be tightened, using a star or crisscross pattern to evenly load the bolts, in accordance with established piping standards. This is illustrated in Figure 5.

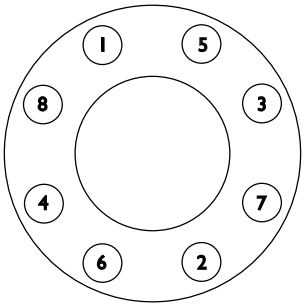

Figure 5: Bolting Sequence Pattern

CAUTION:

Excessive bolt torque may damage flanges. Please refer to established flange bolt torques for guidelines.

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OPERATION:

Once proper installation has been successfully completed, start the system gradually, at start up as well as after shut down. This eliminates sudden shock to the strainer and other equipment in the line. This is extremely important for steam service.

Start-up Procedure:

Step 1:
Open blow-down valve to remove air from the Strainer. To remove all fluid from the Strainer belly, a drip-leg can be installed or the piping can be placed at a 1/4" slope.

CAUTION:

With piping systems that contain fluids other than water or when the working temperature is above 120° F, fluid must be drained to safe area, away from the operator. Operators should always be fitted with appropriate protective equipment (goggles, gloves, vests, etc.) when venting or servicing is performed.

Step 2:
Start the piping system by opening the outlet valve nearest the WYE Strainer's outlet first. Then gradually open the inlet valve nearest the WYE Strainer's inlet, approximately 25% of normal operational flow. It is important to start the system gradually to avoid displacing or damaging the WYE Strainer.

Step 3:
Continue to open the inlet valve until the desired service flow has been reached.

Step 4:
Close the blow-down when air is removed and fluid begins to flow. The system is now ready to start.

MAINTENANCE:

Titan Flow Control WYE Strainers require little monitoring once they are properly installed. The pressure differential across the strainer should be check periodically to determine if the screen needs to be cleaned or replaced. If the pressure differential goes unchecked and the screen becomes completely clogged, the screen will break and require replacing.

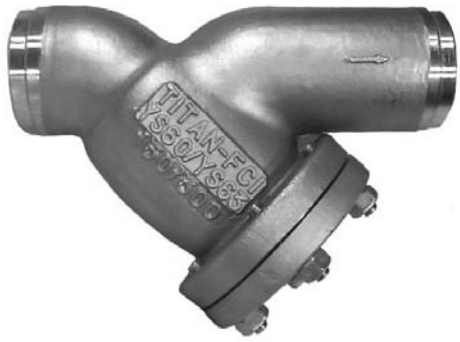

Figure 6: WYE Strainer ~ Butt-Weld Ends

CAUTION:

Strainer screens are not designed to withstand the same pressure ratings as the housings. If the screen becomes completely clogged, it will be exposed to the same pressure as the housing. In most cases, this will cause the screen to fail and potentially damage downstream equipment.

Titan FCI WYE Strainers are designed to require very little maintenance. Regular maintenance involves:

- Blow-down cleaning.
- Timely cleaning or replacement of screen.
- Periodically checking for leaks.

During normal use, the screen will become clogged with foreign matter, causing the differential pressure to increase. Once the differential pressure has increased to an unacceptable value, typically by 5 psi to 10 psi, it is time to clean or replace the screen. It is not advisable to let the differential pressure increase by 20 psi. This may cause the screen to fail and possibly damage downstream equipment.

A convenient and safe way to determine when the screen needs to be replaced is to install pressure gauges on the inlet and outlet sides of the Strainer. The maximum acceptable pressure drop across the Strainer will indicate when the screen needs to be replaced. Screen size and construction determine the maximum pressure drop a Strainer screen can withstand. Please consult factory for exact pressure ratings.

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Blow-Down Cleaning:

To avoid shutting down the system, when possible, clean the screen when pressure differential is 7 to 10 PSI. Clean the screen of debris by opening the blow-down valve. Keep valve open until all debris has been removed and pressure differential returns to normal range. Close the valve and resume normal operation. If pressure differential does not return to an acceptable level after blow-down cleaning then the screen needs to be removed and cleaned or replaced.

CAUTION:

Before removing the cover of the WYE Strainer, the pressure inside the vessel must be reduced to atmospheric via suction or venting. Failure to do so may result in serious bodily injury.

CAUTION:

Before removing the WYE Strainer's cover, ensure that the media that is flowing in the pipeline is known and any special handling precautions are understood. Please review the Material Safety Data Sheet (MSDS) for that specific fluid.

Screen Removal/Cleaning/Replacement:

Step 1:
Isolate the Strainer by closing the inlet and outlet valve connections on either side of the WYE Strainer. Make sure valves are bubble tight.

Step 2:
Open blow-down valve or other vent to relieve pressure inside and drain fluid from the Strainer.

Step 3:
Once pressure is relieved, remove the WYE side cap or cover.

Step 4:
Remove screen and clean. Do not permit screen to dry as it will be difficult to remove debris after it has hardened. Avoid banging or hitting the screen to remove stubborn debris. For perforated screens, it is recommended to use high pressure water or air stream to clean the screen. This is not recommended for mesh or mesh-lined screens as this may cause the mesh to tear. Solvent may be required if service is fuel, oil, or chemicals. Follow manufacturer's instructions when using solvent to clean the screen.

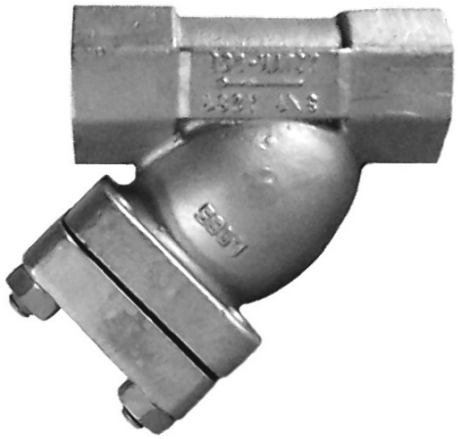

Figure 7: WYE Strainer ~ Socket-Weld Ends

Screen Removal/Cleaning/Replacement: continued...

Step 5:
Inspect screen and cover gasket for damage. If either is damaged, replace. Always ensure there is a spare gasket and screen on hand prior to maintenance.

Step 6:
Remove any debris or sludge from within the Strainer.

Step 7:
Replace cleaned or new screen into its original position, ensuring it is squarely positioned on the screen seat.

Step 8:
Replace cover gasket and cap or cover. Tighten cap or cover to specified torque rating.

Step 9:
Close blow-down valve.

Follow the Start-up procedure outlined within the OPERATION section of this manual.

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SPARE PARTS LIST:

For the bill of materials and spare parts listing of each WYE Strainer model, please refer to the corresponding Engineering Specification Sheet. For special or fabricated units, please refer to the certified engineering drawing for that unit.

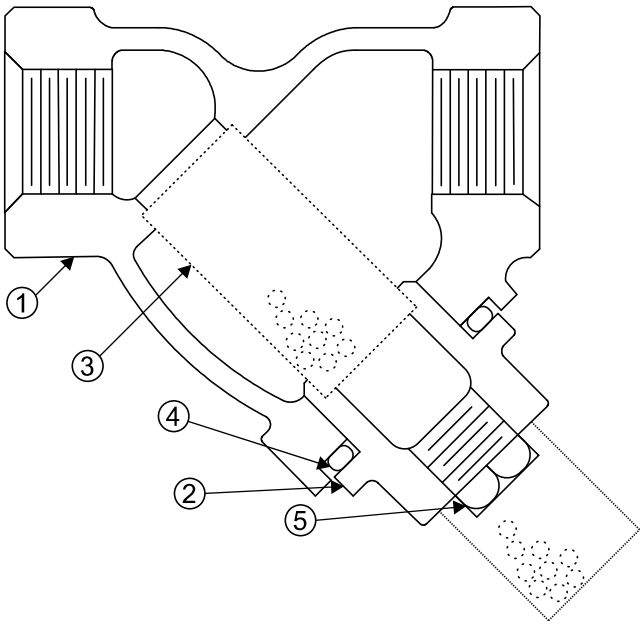

Figure 8: CAD Illustration

PARTS LIST	
No.	**WYE Strainer**
1	BODY
2	COVER/CAP
3*	SCREEN
4*	GASKET
5	PLUG

* Denotes recommended spare parts

WARRANTY:

Seller warrants each of the products and parts sold hereunder, under normal use of service, and subject to user's compliance with any operating instructions and other directions given by seller, to be free from defects in materials or workmanship for a period of one year from date of shipment from seller's plant. Seller's liability, under this warranty, shall be limited to, at the seller's option, to repairing or replacing any such defective product FOB seller's plant in Lumberton, NC, and reimbursing purchaser for shipping costs, subject to the following: (1) Timely receipt of purchaser's written notice that such products are defective. (2) Seller's written authorization to purchaser for the return of such products, (3) the return of such products to seller with shipping charges prepaid and (4) seller's inspection of and confirmation that such products are defective in materials or workmanship. If seller's inspection shows that the products returned are defective due to dirt, rust or any foreign material not attributable to seller: improper usage, over tightening on threads, abuse or incorrect assembly in the field, or other cause not due to seller's improper manufacture, seller will, subject to purchaser's written authorization, repair or replace such products at cost. Seller's factory inspection and testing reports will be made available to purchaser upon request.

THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY. SELLER SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES. NO REPRESENTATIVE OR SELLER HAS AUTHORITY TO MAKE ANY REPRESENTATIONS OR WARRANTIES, EXCEPT AS STATED HEREIN.

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290 Corporate Drive ◇ PO Box 7408 ◇ Lumberton, NC 28358

Components

Panel Component Cut Sheets

COOPER Bussmann

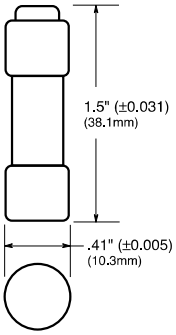
Low-Peak™

Dual-Element, Time-Delay Fuses
Class CC — 600 Vac/dc

LP-CC

1/2 -30A

Dimensional Data



Catalog Symbol: LP-CC

Description: Time-delay, current-limiting, rejection-type fuse – 12 seconds (minimum) at 200% rated amps.

Dimensions: 13/32″ x 1 ½″ (10.3 x 38.1mm).

Ratings:

Volts — 600Vac (or less)
— 300Vdc (½-2½A & 20-30A)
— 150Vdc (2⅘-15A)

Amps — ½-30A

IR — 200kA RMS Sym.
— 20kA DC

Agency Information: CE, Std. 248-4, Class CC, UL Listed, Guide JDDZ, File E4273, CSA Certified; Class 1422-02, File 53787.

Catalog Numbers (Amps)

LP-CC-½	LP-CC-1½	LP-CC-3	LP-CC-6	LP-CC-12
LP-CC-6/10	LP-CC-1 6/10	LP-CC-3 2/10	LP-CC-6¼	LP-CC-15
LP-CC-8/10	LP-CC-1 8/10	LP-CC-3½	LP-CC-7	LP-CC-20
LP-CC-1	LP-CC-2	LP-CC-4	LP-CC-7½	LP-CC-25
LP-CC-1⅛	LP-CC-2¼	LP-CC-4½	LP-CC-8	LP-CC-30
LP-CC-1¼	LP-CC-2½	LP-CC-5	LP-CC-9	—
LP-CC-1 4/10	LP-CC-2 8/10	LP-CC-5 8/10	LP-CC-10	—

Carton Quantity and Weight

Amp Ratings	Carton Qty.	Weight* Lbs.	Weight* Kg.
0-30	10	.193	.088

*Weight per carton.

Recommended fuse blocks/fuse holders for Class CC 600V fuses

See Data Sheets listed below

- Open fuse blocks - 1105
- Finger-safe fuse holders - 1109, 1102, 1103, Reorder #3184
- Panel-mount fuse holders - 2114, 2113
- In-line fuse holders - 2126

General Information:

LP-CC Low-Peak™ Fuse

- A superior all-purpose, space-saving branch circuit fuse that meets most protection requirements up to 30A.
- Very compact; physical size is only 13/32″ × 1½″ (10.3mm × 38.1mm) with rejection tip.
- The unique yellow color makes it easy to tell that the correct fuse type is installed.
- Faster response to damaging short-circuit currents and higher interrupting rating than mechanical overcurrent protective devices.

200kA Interrupting Rating

- Maximum interrupting rating for available fault current in today's large capacity systems.
- Helps ensure that future growth will not obsolete the system.

Dual Characteristics

- Time-delay to avoid unwanted fuse openings from surge currents.
- Fast speed of response under short-circuit conditions for a high degree of current-limitation.
- **ADVANTAGE:** The Low-Peak fuse can be sized close to full load ratings for maximum overload and short-circuit protection.
- **ADVANTAGE:** Can be used where either a time-delay or a fast-acting fuse is needed, making selection easier and reducing spare fuse inventories for substantial cost reduction.

Superior Motor Protection

- For protection of small horsepower motor circuits.
- Proper sizing can provide Type "2" coordinated protection for NEMA and IEC motor controllers.
- Motors receive maximum protection against burnout from overloads and single phasing.

Current-Limiting Effects

Prospective Short-Circuit Current	*Let-Through Current (Apparent RMS Symmetrical) 1¼A	2⅘A	15A	20A	25A	30A
1,000	100	135	240	305	380	435
3,000	140	210	350	440	575	580
5,000	165	255	420	570	690	710
10,000	210	340	540	700	870	1,000
20,000	260	435	680	870	1,090	1,305
30,000	290	525	800	1,030	1,300	1,520
40,000	315	610	870	1,150	1,390	1,700
50,000	340	650	915	1,215	1,520	1,820
60,000	350	735	1,050	1,300	1,650	1,980
80,000	390	785	1,130	1,500	1,780	2,180
100,000	420	830	1,210	1,600	2,000	2,400
200,000	525	1,100	1,600	2,000	2,520	3,050

*RMS Symmetrical Amperes Short-Circuit

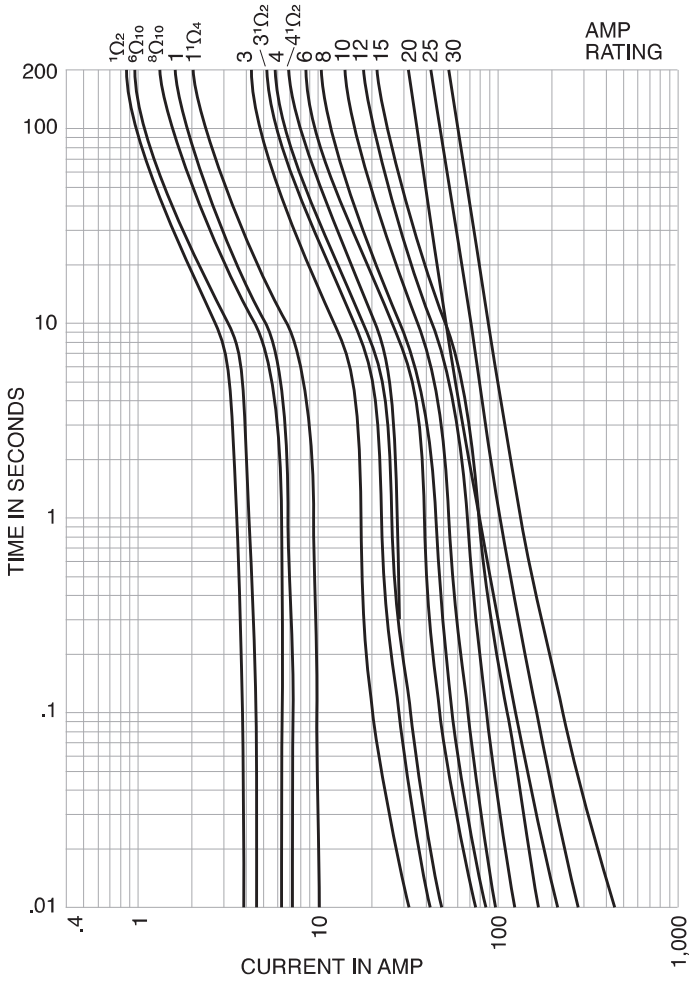
NOTE: To calculate I_p (I_{peak}) multiply I_{RMS} value ≈ 2.3.

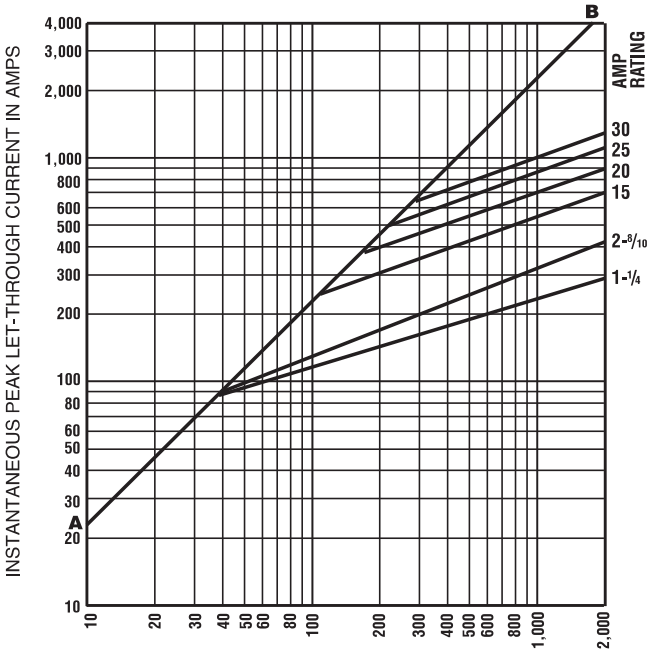
LOW-PEAK™

Dual-Element, Time-Delay Fuses
Class CC — 600 Vac/dc

LP-CC

1/2 -30A





Hannay Reels®
The reel leader.

Hannay Reels, Inc.
553 State Route 143, Westerlo, NY 12193
www.hannay.com
Email: reels@hannay.com

Phone 1-518-797-3791
Toll Free 1-877-GO-REELS (467-3357)
Fax 1-800-REELING (733-5464)
Int'l Fax 1-518-797-3259

TSB 2013.08.006

Installation Instructions for DC and AC Electric Rewind Reels

Date Issued: October-2013

NOTE: FAILURE TO FOLLOW THESE INSTRUCTIONS WILL VOID THE WARRANTY.

UPACKING AND MOUNTING THE REEL

1. Inspect the reel for shipping damage.
2. Check the wiring kit against the parts list.
3. Fasten the reel frame securely to a level surface.
4. Turn the reel discs by hand. The spool should turn freely. If it binds, adjust the self-aligning bearings.
5. Check motor voltage matches the supply voltage.

CONNECTING THE INLET

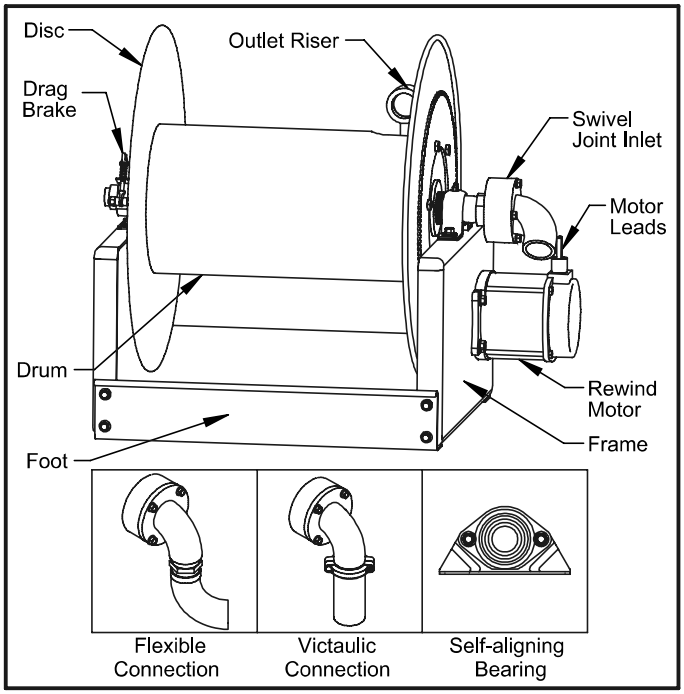
1. Threaded-type swivel joint inlets must be connected to the fluid supply by a **flexible connector** or the Hannay Warranty will be void.
2. Victaulic-type inlet connections must be carefully aligned. Two victaulic connections, correctly installed, will normally allow adequate flexibility for smooth rotation.
3. Install a union fitting as near as possible to the swivel joint so the joint can be easily removed for servicing.

WIRING THE REEL

1. Certain accessories have been provided to wire your reel (see following pages). You will, however, need to provide a few additional materials:
   - Insulated Cable (see motor nameplate for amperage)
   - Various Insulated Ring Terminal and Wire Nut Connectors (installation specific)
   - Circuit Breaker (see chart for amperage ratings)
   - Ground Strap for Reel - Vapor-proof Conduit (optional)
2. Follow the appropriate wiring diagram on the following pages to make the necessary connections. Check all ground connections before using motor.
   NOTE: #6 AWG wire should be sufficient in most installations to prevent significant voltage drop. However, you may choose to use heavier #4 AWG if the total circuit length is unusually long.
3. The solenoid (12V DC or 24V DC motors only) should be mounted as close as possible to the battery and/or starter and grounded securely. A circuit breaker MUST be wired into the circuit between the solenoid and battery.
4. The motor rotation can be reversed by interchanging the motor leads.
5. If you choose to use vapor-proof conduit between the solenoid and motor, then seal the open end of the conduit with a sealing compound and wrap with electrical tape.
6. A ground strap must be securely fastened between the reel frame and a grounded part of the vehicle body. The motor ground lead must be directly bonded to the chassis. Do NOT rely on the reel structure for grounding. For explosion proof applications, the ground lead must be run to, and bonded to, the chassis in a non hazardous location such as the engine compartment of the vehicle.
7. Tape all connections and check each one to make sure they are secure.

CONNECTING THE HOSE

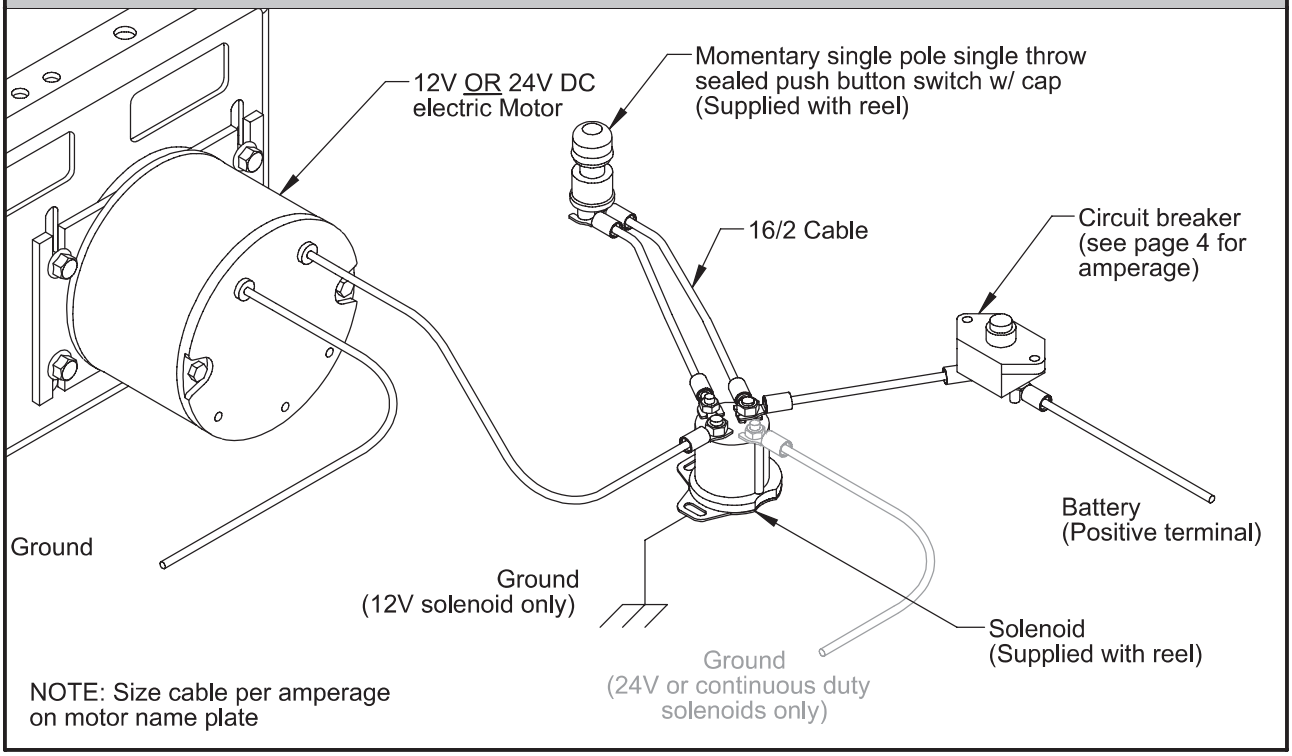
1. Do NOT attach the hose until the reel has been installed and wired.
2. Charge the hose before winding it on the reel. This will protect the drum from excessive pressure.
3. If reel has flanged outlet riser: Remove the entire riser from the hub. Be careful not to damage the gasket/o-ring. Apply thread compound to all threads and bushings. Thread the hose onto the outlet riser. Replace the riser and tighten securely, making sure the gasket/o-ring is seated properly. If reel does NOT have flanged riser: The riser can't be removed, so you will need to thread the hose directly onto the riser.
4. Wind the hose onto the reel (either electrically or with the hand crank).



WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

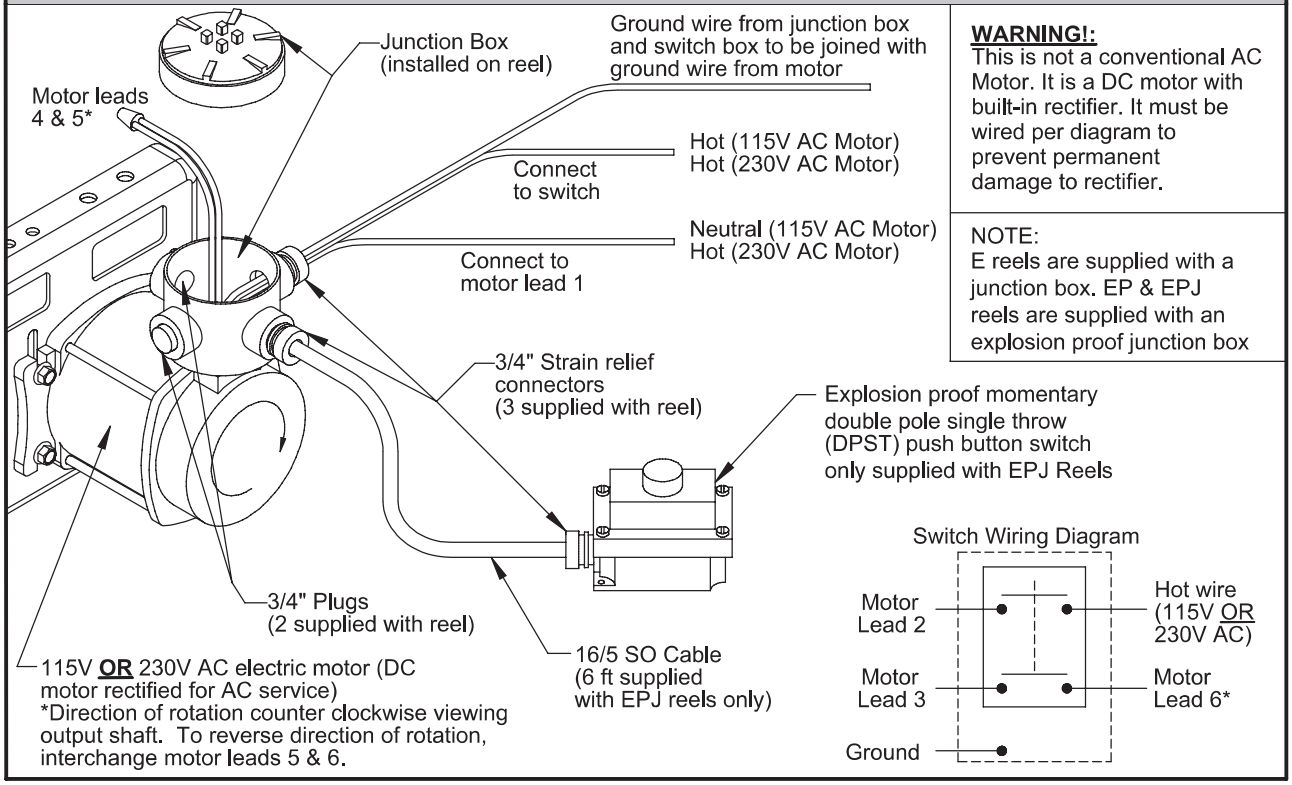
WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

E or EP Reels with either a 12V DC Motor OR a 24V DC Motor



WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

E, EP or EPJ Reels with either a 115V AC Motor OR a 230V AC Motor



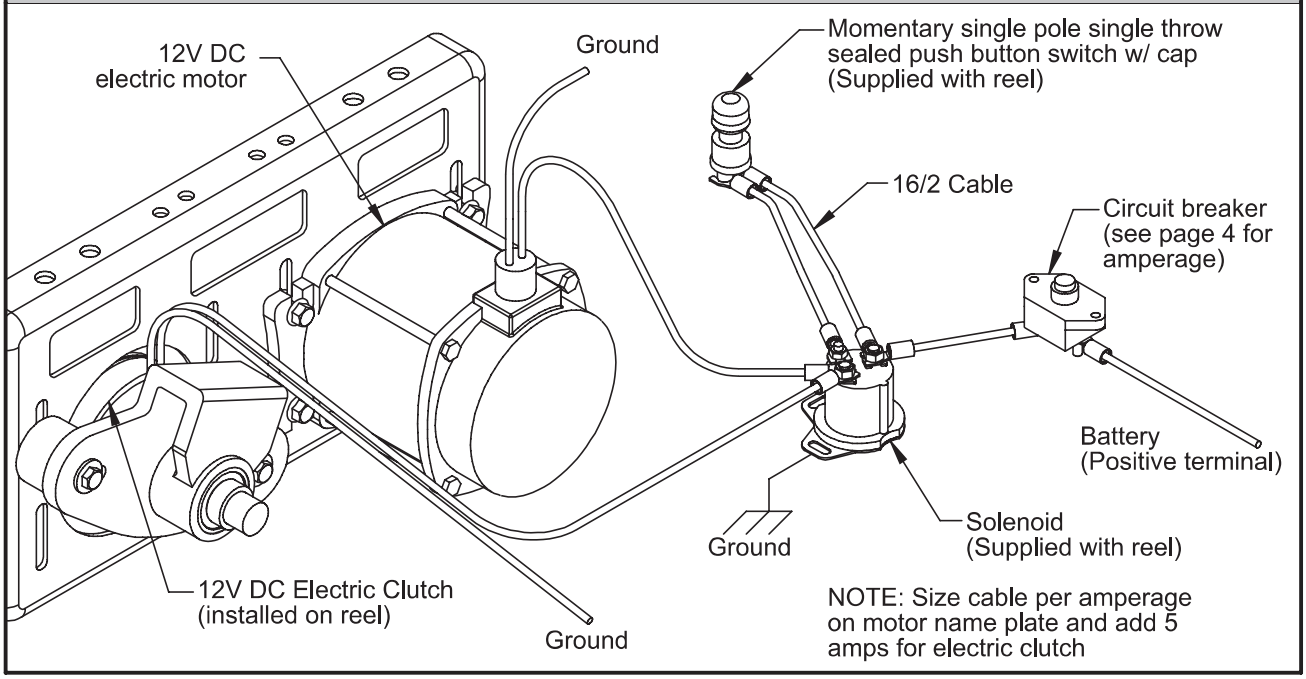
WARNING!:
This is not a conventional AC Motor. It is a DC motor with built-in rectifier. It must be wired per diagram to prevent permanent damage to rectifier.

NOTE:
E reels are supplied with a junction box. EP & EPJ reels are supplied with an explosion proof junction box

NOTE: USING A 115V MOTOR ON A 230V CIRCUIT WILL VOID WARRANTY. BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

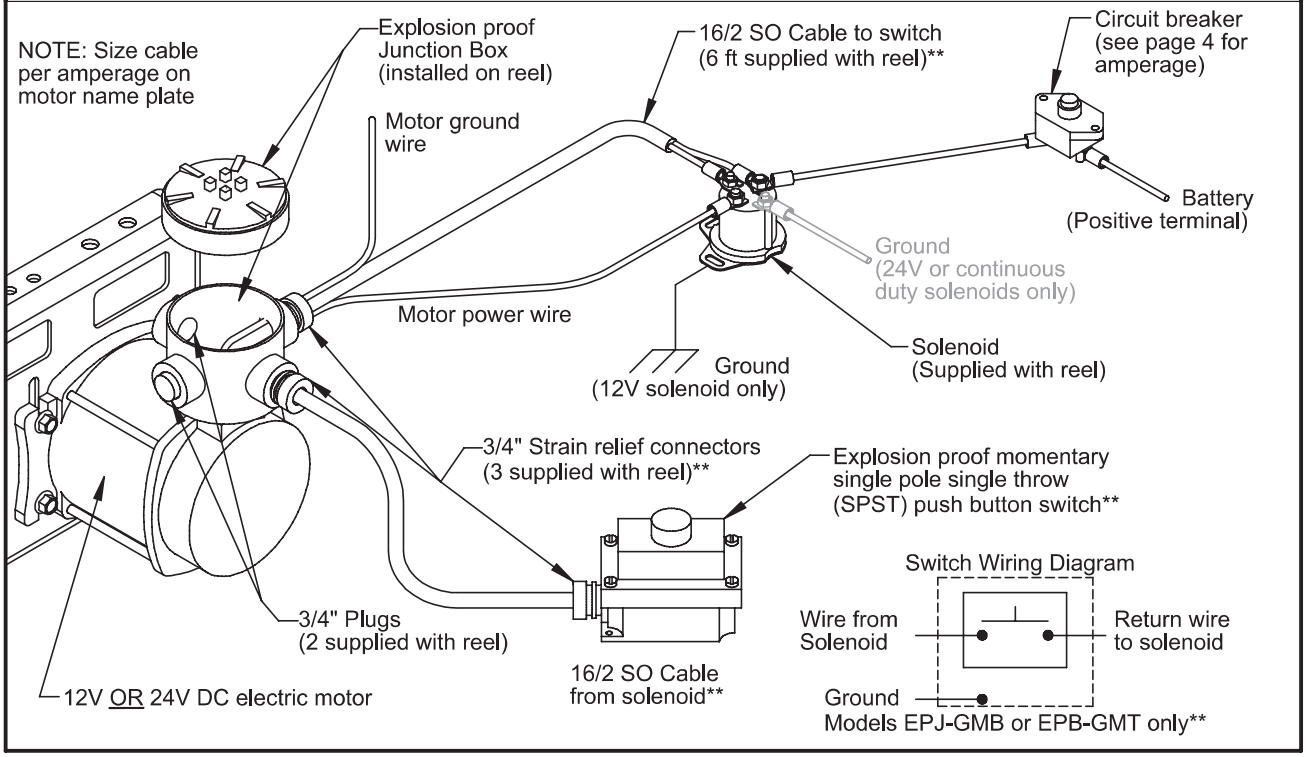
WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

EP Reels with 12 Volt DC Motor and Optional Electric Clutch



WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

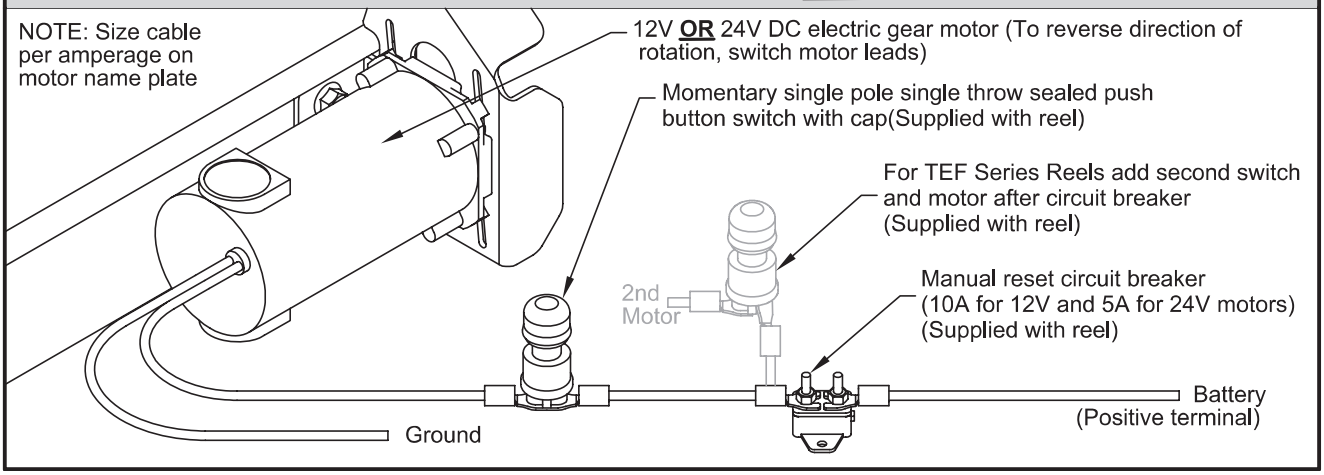
EPJ or EPB Reels with either a 12V DC Motor OR a 24V DC Motor**



** **NOTE:** If reel is equipped with Hannay Guidemaster (model prefix **EPB-GMB** or **EPB-GMT**), then switch and cord are replaced with Guidemaster switch and accompanying mounting hardware. Additionally, only 2 strain relief connectors are provided. See note on wiring diagram for installing Guidemaster switch.

WARNING: BEFORE WIRING MOTOR BE SURE TO VERIFY THE MOTOR VOLTAGE LISTED ON THE MOTOR TAG MATCHES THE SUPPLY VOLTAGE.

Reels with either a 12V DC Gear Motor OR a 24V DC Gear Motor

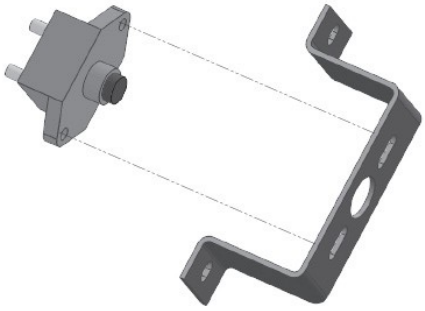


CIRCUIT BREAKER RECOMMENDATIONS

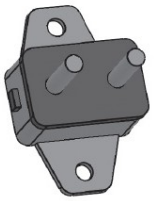
All electric rewind reels manufactured by Hannay Reels require a properly sized circuit breaker to protect the motor from a sustained overload condition. Type 3 manual reset circuit breakers are required in all Hannay motor applications.

Hannay Circuit Breakers

Circuit Breaker (50 or 70 Amp)



Circuit Breaker Mounting Bracket 9917.0024



Circuit Breaker (5 through 40 Amp)

MOUNTING – The larger-sized manual circuit breakers (50 and 70 Amp) sold by Hannay Reels can be purchased with a convenient mounting bracket. Mount the breaker away from any heat source such as an exhaust manifold or radiator. Since this style of breaker must be manually reset if tripped, it should also be mounted in a location convenient to the end user.

With the smaller manual reset circuit breakers (5 through 40 Amp), no mounting bracket is necessary since there are already mounting tabs provided on the circuit breaker itself.

AMPERAGE RATING – The goal in choosing an appropriately sized circuit breaker is to choose a breaker that will open the circuit in a short period of time (ideally in less than 30 seconds) when the reel motor is stalled, but not so quickly that 'nuisance trips' occur. Be aware that ambient temperature can cause trip times to vary.

The chart below shows recommended circuit breaker sizes to use with the motors used on Hannay-manufactured reels.

Hannay Motor Model	Wire Sizes	Circuit Breaker Size	Circuit Breaker Part Number	Mtg. Bracket Part Number
Bodine 550 Gear Motor (12V)	16 AWG	10 Amp	9917.0018	Included
TEF Series Gear Motor (12V)	16 AWG	10 Amp	9917.0018	Included
AN250 (12V)	10 AWG	15 Amp	9917.0019	Included
AN239 (12V)	10 AWG	25 Amp	9917.0171	Included
AN227 (12V)	10 AWG	35 or 40 Amp	9917.0172	Included
SX001, SX007 or SX102 (12V)	8 AWG	50 Amp	9917.0021	9917.0024
SX043, SX103, SX139, SX153 or SX743 (12V)	6 AWG	70 Amp	9917.0022	9917.0024
Bodine 990 Gear Motor (24V)	16 AWG	5 Amp	9917.0017	Included
AN248 or AN249 (24V)	10 AWG	15 Amp	9917.0019	Included
SX123, or SX145 (24V)	8 AWG	25 Amp	9917.0171	Included
AN351 or SX163 (115V AC)	16 AWG	5 Amp	----------	----------

HAZARDOUS LOCATION BREATHER DRAINS

INDUSTRY STANDARDS

Ex e Breather Drains
Certified for Zone 1 or 2 areas
ATEX
- Sira 13ATEX3354U
- Ex e IIC Gb
- Ex tb IIIC Db IP66

IECEx
- IECEx SIR 13.0138U
- Ex e IIC Gb
- Ex tb IIIC Db IP66

cCSAus Certified Class 1 Zone 1, Ex e II, IP66, Type 4X
NEMA/EEMAC Type 4, 4X
IEC 60529, IP66
Maintain enclosure Type 4, 4X rating when properly installed

Ex d Breather Drains
Certified for Zone 1 or 2 areas
ATEX
- ITS13ATEX17900X
- Ex d IIC Gb
- Ex e IIC Gb
- Ex tb IIIC Db IP66

IECEx
- IECEx ITS 13.0049X
- Ex d IIC Gb
- Ex e IIC Gb
- Ex tb IIIC Db IP66

NEMA/EEMAC Type 4, 4X
IEC 60529, IP66
Maintain enclosure Type 4, 4X rating when properly installed

APPLICATION

Hazardous Location Breather Drains prevent moisture build-up within hazardous approved enclosures while maintaining enclosure UL Type rating. Drains are to be used when an enclosure is subject to fluctuations in temperature which can lead to the formation of condensation and a subsequent moisture build-up. These drains allow air within an enclosure to breathe with the surrounding atmosphere, preventing condensation and any potential damage to electrical equipment.

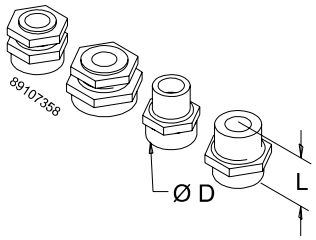
FEATURES

- Reduce corrosion that can limit the life of internal electrical and electronic components
- Prevent condensation when installations are subject to fluctuations in temperature in hazardous locations
- Effectively drain any water present within the enclosure
- Minimize moisture build-up within the enclosure by allowing air in the enclosure to breathe with surrounding atmosphere
- Position at the lowest point of an enclosure to ensure optimal draining of any moisture
- Maintain enclosure's UL Type rating when properly installed
- Available for Increased Safety (Ex e) and Flameproof (Ex d) applications

SPECIFICATIONS

Ex e Breather Drains:
- Type 316 stainless steel with castellated nut and nitrile O-ring
- 10mm thread length
- Install in a clearance hole 0.5 to 1.0mm larger than major diameter, or in a tapped hole
- Operating temperature of -58 F (-50 C) to 185 F (85 C)

Ex d Breather Drains:
- Type 316 stainless steel with silicone O-ring
- 16mm thread length
- Install in a tapped hole
- Operating temperature of -22 F (-30 C) to 302 F (150 C)



BULLETIN: HLY

Catalog Number	AxBxC in.	AxBxC mm	Description	Thread Type	D (in.)	D (mm)	L (in.)	L (mm)	Weight (lbs.)	Weight (kg)
EXEBDM20SS6	1.57 x 1.57 x 0.98	40 x 40 x 25	Ex e M20 Breather Drain	M20	1.13	28.7	.99	25.1	0.16	0.1
EXEBDM25SS6	1.57 x 1.57 x 0.98	40 x 40 x 25	Ex e M25 Breather Drain	M25	1.41	35.8	1.30	33.0	0.27	0.1
EXDBDM20SS6	1.57 x 1.57 x 0.98	40 x 40 x 25	Ex d M20 Breather Drain	M20	1.06	26.9	.99	25.1	0.18	0.1
EXDBDM25SS6	1.57 x 1.57 x 0.98	40 x 40 x 25	Ex d M25 Breather Drain	M25	1.2	31.8	1.30	33.0	0.25	0.1

Notes

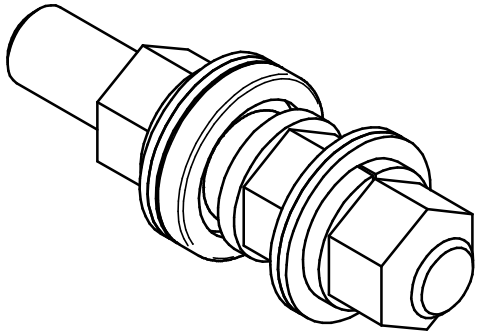
PART No. GRDT375

for more information visit

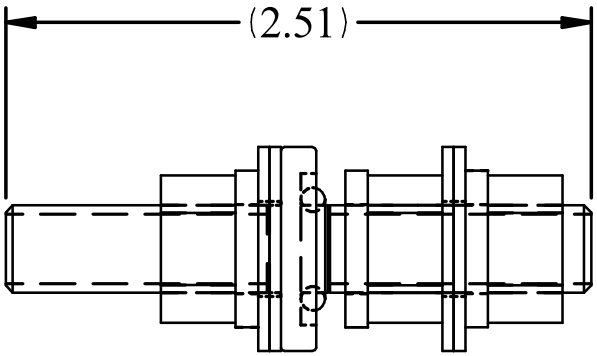
www.hammondmfg.com

Data subject to change without notice

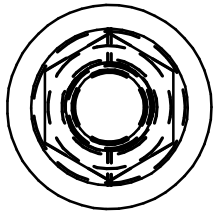
Isometric drawing Not to Scale



ISOMETRIC VIEW



SIDE VIEW



END VIEW

FG5 Cut Sheet

Hammond finger guard, primary or secondary side. For use with fused and unfused 1 kVA and 1.5 kVA Imperator series control transformers as well as PH750PG.

For complete product information, please see this item on our store at the following link:

Technical Specifications

Brand	Hammond
Item	Finger guard
Cover Type	Primary or secondary side
For Use With	Fused and unfused 1 kVA and 1.5 kVA Imperator series control transformers as well as PH750PG

Agency Approvals

UL Listed File #	None
UL Recognized File #	None
UL Hazardous File #	None
CSA File #	None
RoHS Status	Yes (See CE Doc)
EU REACH	View EU REACH document

PFK3 Cut Sheet

Hammond primary side fuse kit, for use with 350-1500 VA MQMJ and PG Imperator series control transformers.

For complete product information, please see this item on our store at the following link:

Technical Specifications

Brand	Hammond
Item	Primary side fuse kit
For Use With	350-1500 VA MQMJ and PG Imperator series control transformers
Kit Includes	4 fuse clips, 4 mounting screws and instruction sheet

Agency Approvals

UL Listed File #	None
UL Recognized File #	E50394
UL Hazardous File #	None
CE	None
RoHS Status	No
EU REACH	View EU REACH document

PH1500MQMJ Cut Sheet

Hammond control transformer, encapsulated core, 1.5 kVA, 1-phase, 240/480 VAC, 120/240 VAC secondary, 50/60 Hz, panel mount.

For complete product information, please see this item on our store at the following link:

Technical Specifications

Brand	Hammond
Series	Imperator
Item	Transformer
Transformer Type	Control
Core Type	Encapsulated
Power Rating	1.5 kVA
Number of Phases	1
Primary Voltage	240/480 VAC
Secondary Voltage	120/240 VAC
Frequency	50/60 Hz
Fused	No
Electrostatic Shield	No
Mounting	Panel
Connection	Screw terminal

Agency Approvals

UL Listed File #	E50394
UL Recognized File #	None
UL Hazardous File #	None
CE	View CE declarations
CSA File #	None
RoHS Status	Yes (See CE Doc)
EU REACH	View EU REACH document

We connect and protect

Mounting Bracket Kit

Mounting bracket kits are field-installable. DMFK1 and DMFK2 include two 14-gauge steel external mounting brackets and fasteners. CMFK, CMFKSS, and CMTGFT include four brackets per kit.

FEATURES

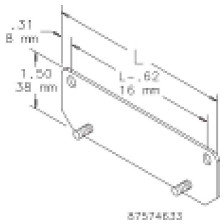
- Plastic mounting foot kits are rated for 500 lb (227 kg) maximum load
- Sealing washers are provided with each kit to maintain Type 4 and 12 after installation
- Stainless steel and plastic mounting bracket kits are rated to Type 4X
- All hardware is included

SPECIFICATIONS

Table 1/1

Catalog Number	Article Number	Height (H)	Width (W)	Depth (D)	Material	Finish
DMFK1	60580	1.5in	4.75in	0.07in	Mild Steel	Plated
DMFK2	60090	1.5in	8.75in	0.07in	Mild Steel	Plated
CMTGFT	73370	3.06in	1.34in	0.6in	Fiberglass	Smooth Matte
CMFKSS	65750	3.06in	1.34in	0.6in	Stainless Steel 304	Polished
CMFK	62490	3.06in	1.34in	0.6in	Mild Steel	Plated

DIAGRAMS



WARNING

nVent products shall be installed and used only as indicated in nVent's product instruction sheets and training materials. Instruction sheets are available at www.nvent.com and from your nVent customer service representative. Improper installation, misuse, misapplication or other failure to completely follow nVent's instructions and warnings may cause product malfunction, property damage, serious bodily injury and death and/or void your warranty.

We connect and protect

Concept Panel, fits 16.00x16.00 inch Enclosure, White, Mild Steel

CATALOG NUMBER

CP1616

Concept panels are taller and wider than corresponding NEMA-size panels.

FEATURES

- Painted white or conductive finish
- Include a formed flange along any side that is longer than 22.20 in (564 mm)
- Optional wood panels are made of 3/4-in plywood, pre-cut and pre-drilled to install on panel mounting studs in the rear of the cabinet

PRODUCT ATTRIBUTES

- Article Number: 78530
- Height: 14.2in
- Width: 14.2in
- Material: Mild Steel
- Finish: Powder Coated
- Color: White
- Thickness: 12in
- Type: Painted Steel
- Gauge: 12ga
- Weight: 5.9lb

ADDITIONAL PRODUCT DETAILS

Catalog number CP4230 is used on Concept disconnect enclosures.

WARNING

nVent products shall be installed and used only as indicated in nVent's product instruction sheets and training materials. Instruction sheets are available at www.nvent.com and from your nVent customer service representative. Improper installation, misuse, misapplication or other failure to completely follow nVent's instructions and warnings may cause product malfunction, property damage, serious bodily injury and death and/or void your warranty.

We connect and protect

Concept Wallmount 1/4-Turn Latch Type 4X, 16x16x8, Brushed, Stainless 304

CATALOG NUMBER

CSD16168SS

For indoor or outdoor applications that require corrosion protection from chemicals and water. Concept Enclosures feature streamlined styling with an attractive stroked finish and flush quarter-turn latches for secure closure.

INDUSTRY STANDARDS

UL 508A Listed; Type 3R, 4, 4X, 12; File No. E61997

cUL Listed per CSA C22.2 No 94; Type 3R, 4, 4X, 12; File No. E61997

Mounting brackets required to meet UL/CSA external mounting requirements.

NEMA/EEMAC Type 3R, 4, 4X, 12, 13

IP66

IEC 60529, IP66

Meets NEMA Type 3RX requirements

FEATURES

Minimum-width body flange provides maximum body opening
External formed 90-degree body flange
Panel mounting studs fit optional Concept panels and other accessories
Mounting holes in back of body for direct mounting or for optional external mounting brackets
Type 316 stainless steel hidden hinges promote clean aesthetic appearance
Corner formed doors are interchangeable and easily removed by pulling clip-style hinge pins
Provision on door (except when B = 12 inch (305mm)) for thermoplastic data pocket
Provision on door (except when B = 12 inch (305mm)) for optional doorstop kit
Quarter-turn latches furnished with flush slotted insert
Seamless foam-in-place gasket
Self-grounding latch system with double seal
Bonding provision on door; grounding stud on body
Furnished hardware kit consists of panel-mounting nuts, panel-grounding hardware and sealing washers for wall-mounting hole

PRODUCT ATTRIBUTES

Article Number: 48530

Height: 16in

Width: 16in

Depth: 8in

Material: Stainless Steel 304

Finish: Brushed #4

Body Thickness: 16ga

Door Thickness: 16ga

Mounting: 14.50 x 14.50in

Latch Quantity: 1

Weight: 21.2lb

Latch Type: Quarter-Turn

ADDITIONAL PRODUCT DETAILS

Purchase panels separately. Optional stainless steel, composite and aluminum panels are also available for most sizes.

Optional NEMA style steel and stainless steel panels require conversion kit catalog number CCPM4.

WARNING

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DXN30 RECEPTACLE

22-34043

SPECIFICATIONS

30 A
480 VAC
IP66/IP67
10 hp

Rated Current (A)	30 A
Rated Voltage (V)	480 VAC
Horsepower Rating	10 hp
Contact Configuration	3P+G
Auxiliary Contacts	NO AUX
Ratings Information	CURRENT INTERRUPTING
Environmental Rating	IP 66/67
Short Circuit Rating	25 kA - CLOSE & WITHSTAND
Impact Rating	IK09
Material	POLY
Product Color	BLACK
Minimum Operating Temperature	-40F -40C
Maximum Operating Temperature	140F 60C
Wiring Capacity - Phase Contacts	14 AWG – 6 AWG SCREW TERMINAL
Hazardous Ratings	-40C < Ta < +60C Class I Zone1 AEx de IIC T5 Gb -40C < Ta < +60C Zone 21 AEx tD T77C Db Class I Div 2 Gr A,B,C,D Class II Div 2 Gr E,F,G
Applicable Standards	cCSAus C22.2 No. 182.1-13
Accessory Size	2
Base Drawing Number	22-34xxx.pdf
Catalog	meltric-catalog-dxn30-en.pdf

MELTRIC
A COMPANY OF MARECHAL ELECTRIC

DXN30 INLET

22-38043

SPECIFICATIONS

30 A
480 VAC
IP66/IP67
10 hp

Rated Current (A)	30 A
Rated Voltage (V)	480 VAC
Horsepower Rating	10 hp
Contact Configuration	3P+G
Auxiliary Contacts	NO AUX
Ratings Information	CURRENT INTERRUPTING
Environmental Rating	IP 66/67
Short Circuit Rating	25 kA - CLOSE & WITHSTAND
Impact Rating	IK09
Material	POLY
Product Color	BLACK
Minimum Operating Temperature	-40F -40C
Maximum Operating Temperature	140F 60C
Wiring Capacity - Phase Contacts	14 AWG – 6 AWG SCREW TERMINAL
Hazardous Ratings	-40C < Ta < +60C Class I Zone1 AEx de IIC T5 Gb -40C < Ta < +60C Zone 21 AEx tD T77C Db Class I Div 2 Gr A,B,C,D Class II Div 2 Gr E,F,G
Applicable Standards	cCSAus C22.2 No. 182.1-13
Accessory Size	2
Base Drawing Number	22-38xxx.pdf
Catalog	meltric-catalog-dxn30-en.pdf

Terminal strip marker carrier - KLM-A - 1004348

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Terminal strip markers, for strip marking, adjustable height, for use with end clamps E/UK, E/NS 35 N or CLIPFIX 35, lettering field size: 44 x 7 mm

RoHS

Key Commercial Data

Packing unit	1 pc
Minimum order quantity	100 pc
GTIN	4 017918 012038
GTIN	4017918012038
Weight per Piece (excluding packing)	1.600 g
Custom tariff number	39269097
Country of origin	Germany

Technical data

Dimensions

Length (b)	46 mm
Width (a)	9.5 mm

Ambient conditions

Ambient temperature (operation)	-40 °C ... 80 °C

General

Color	transparent
Components	free from silicone and halogen
Flammability rating according to UL 94	HB
Material	ABS

Terminal strip marker carrier - KLM-A - 1004348

Technical data

General

Marking mounting type	plug in

Standards and Regulations

Flammability rating according to UL 94	HB

Classifications

eCl@ss

eCl@ss 4.0	24190200
eCl@ss 4.1	24190200
eCl@ss 5.0	27141100
eCl@ss 5.1	27141100
eCl@ss 6.0	27141100
eCl@ss 7.0	27141137
eCl@ss 8.0	27141137
eCl@ss 9.0	27144075

ETIM

ETIM 2.0	EC000761
ETIM 3.0	EC000761
ETIM 4.0	EC000761
ETIM 5.0	EC000761
ETIM 6.0	EC002248
ETIM 7.0	EC002248

UNSPSC

UNSPSC 6.01	30211811
UNSPSC 7.0901	39121410
UNSPSC 11	39121410
UNSPSC 12.01	39121410
UNSPSC 13.2	39131505
UNSPSC 19.0	39131505

Accessories

Accessories

Conductor marking

Terminal strip marker carrier - KLM-A - 1004348

Accessories

Insert label - EMT (44X7)R - 0819275

Insert label, Roll, white, unlabeled, can be labeled with: THERMOMARK ROLLMASTER 300/600, THERMOMARK X1.2, THERMOMARK ROLL X1, THERMOMARK ROLL 2.0, THERMOMARK ROLL, mounting type: insert, cable diameter range: 16 ... 35 mm, lettering field size: 44 x 7 mm, Number of individual labels: 500

Device marking

Snap-in markers - US-EMP (44X7) - 0829438

Snap-in markers, Card, white, unlabeled, can be labeled with: BLUEMARK ID COLOR, BLUEMARK ID, THERMOMARK PRIME, THERMOMARK CARD 2.0, THERMOMARK CARD, mounting type: snapped into marker carrier, lettering field size: 44 x 7 mm, Number of individual labels: 40

Labeled device marker

Snap-in markers - US-EMP (44X7) CUS - 0830048

Snap-in markers, can be ordered: By card, white, labeled according to customer specifications, mounting type: snapped into marker carrier, lettering field size: 44 x 7 mm

Terminal marking

Insert strip - ESL 44X7 - 0808244

Insert strip, Sheet, white, unlabeled, can be labeled with: Office printing systems, perforated, mounting type: insert, lettering field size: 44 x 7 mm, Number of individual labels: 136

CLIPFIX 35 - End bracket

3022218

https://www.phoenixcontact.com/us/products/3022218

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Quick mounting end clamp for NS 35/7,5 DIN rail or NS 35/15 DIN rail, with marking option, width: 9.5 mm, color: gray

Your advantages

- Design width of just 9.5 mm
- Large-surface marking
- Phoenix Contact has engineered its CLIPFIX end brackets to maintain a secure grip on the various DIN rail systems

Commercial data

Item number	3022218
Packing unit	1 pc
Minimum order quantity	50 pc
Sales key	BE07
Product key	BE7111
Catalog page	Page 538 (C-3-2019)
GTIN	4017918156541
Weight per piece (including packing)	5.268 g
Weight per piece (excluding packing)	5.1 g
Customs tariff number	39269097
Country of origin	PL

Technical data

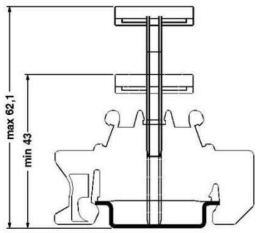
Product properties

Product type	End bracket

Connection data

Cross section AWG	(converted acc. to IEC)

Dimensions

Dimensional drawing	
Width	9.5 mm
Height	55.6 mm
Depth on NS 35/7,5	35.5 mm
Length	55.6 mm

Material specifications

Color	gray
Material	PA
Flammability rating according to UL 94	V2
Static insulating material application in cold	-60 °C
Temperature index of insulation material (DIN EN 60216-1 (VDE 0304-21))	125 °C
Relative insulation material temperature index (Elec., UL 746 B)	125 °C
Fire protection for rail vehicles (DIN EN 45545-2) R22	HL 1 - HL 2
Fire protection for rail vehicles (DIN EN 45545-2) R23	HL 1 - HL 2
Fire protection for rail vehicles (DIN EN 45545-2) R24	HL 1 - HL 2

Environmental and real-life conditions

Ambient conditions

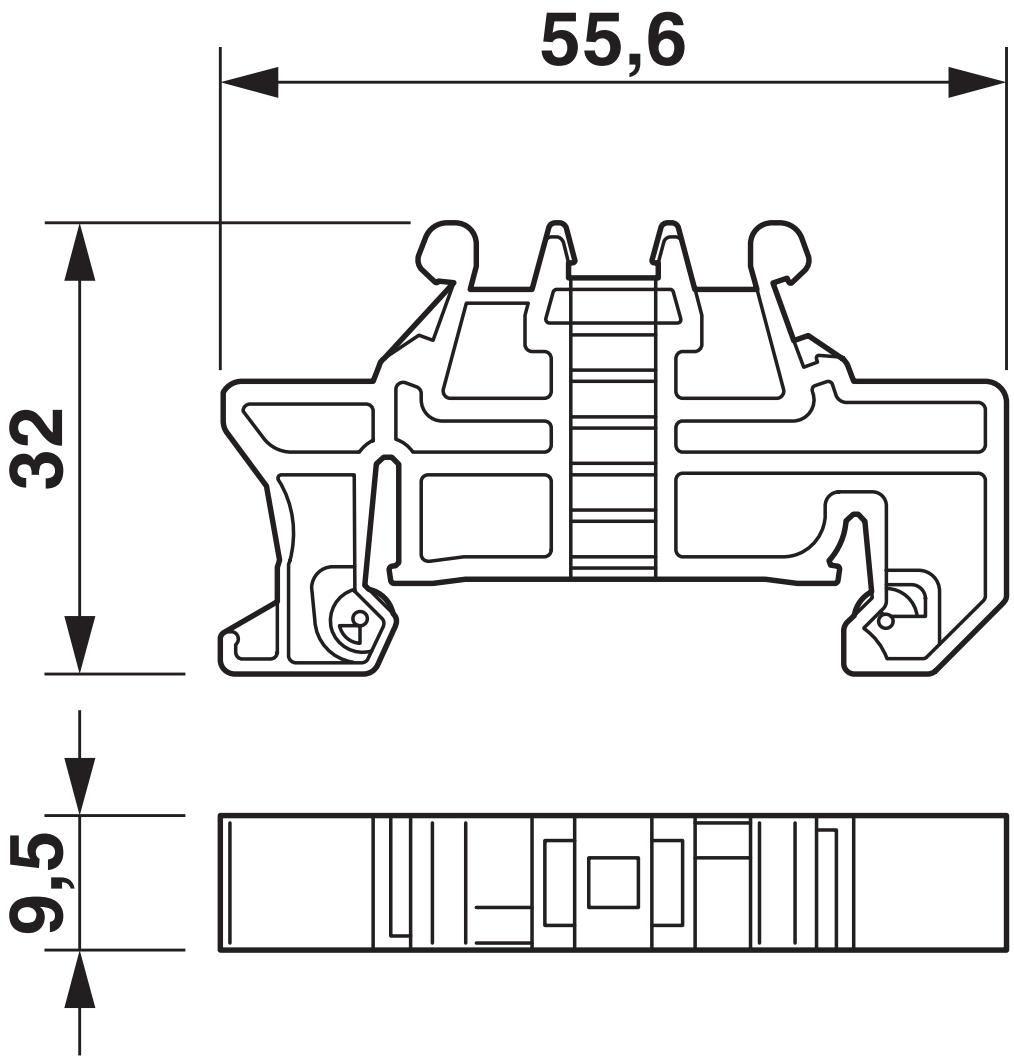
Ambient temperature (operation)	-60 °C ... 105 °C (max. short-term operating temperature RTI Elec.)
Ambient temperature (storage/transport)	-25 °C ... 60 °C (for a short time, not exceeding 24 h, -60 °C to +70 °C)
Ambient temperature (assembly)	-5 °C ... 70 °C
Ambient temperature (actuation)	-5 °C ... 70 °C
Permissible humidity (storage/transport)	30 % ... 70 %

Mounting

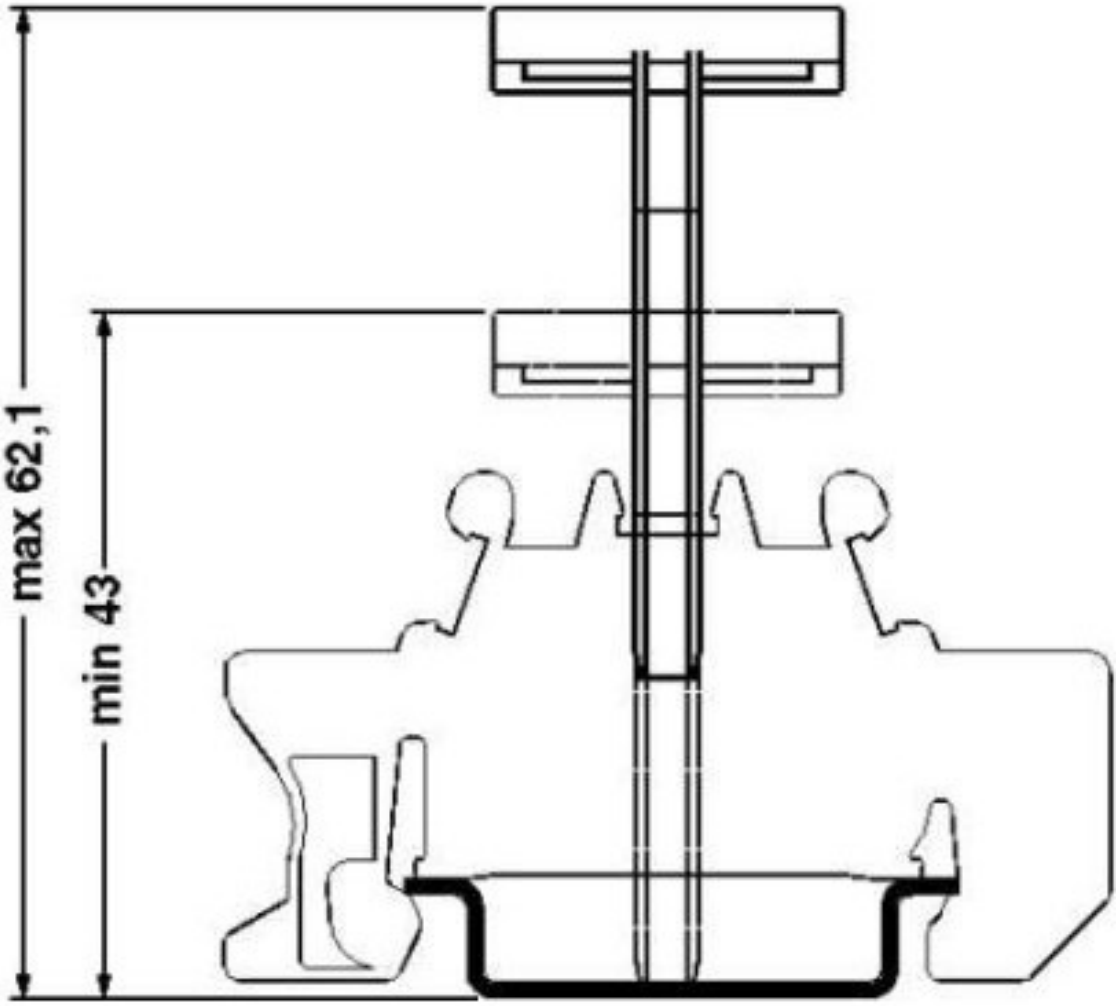
Mounting type	NS 35/7,5
	NS 35/15

Drawings

Dimensional drawing



Dimensional drawing



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Middletown, PA 17057, United States
(+717) 944-1300
info@phoenixcon.com

Feed-through terminal block - UT 4 - 3044102

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Feed-through terminal block, Connection method: Screw connection, Cross section: 0.14 mm² - 6 mm², AWG: 26 - 10, Width: 6.2 mm, Color: gray, Mounting type: NS 35/7,5, NS 35/15

Product Features

- The large wiring space enables the connection of solid and stranded conductors without ferrules, even above the nominal cross section
- Tested for railway applications
- As well as saving space, the compact design enables user-friendly wiring in a small amount of space
- The multi-conductor connection offers maximum flexibility and wiring density
- Optimum screwdriver guidance through closed screw shafts
- The cable entry funnel enables the use of conductors with ferrules and plastic collars within the nominal cross section

Key commercial data

Packing unit	1 pc
Minimum order quantity	50 pc
Weight per Piece (excluding packing)	9.198 GRM
Custom tariff number	85369010
Country of origin	Germany

Technical data

General

Number of levels	1
Number of connections	2
Color	gray
Insulating material	PA
Inflammability class according to UL 94	V0
Area of application	Railway industry

Feed-through terminal block - UT 4 - 3044102

Technical data

General

	Mechanical engineering
	Plant engineering
	Process industry
Maximum load current	41 A (with 6 mm² conductor cross section)
Rated surge voltage	8 kV
Pollution degree	3
Surge voltage category	III
Insulating material group	I
Connection in acc. with standard	IEC 60947-7-1
Maximum load current	41 A (with 6 mm² conductor cross section)
Nominal current I_N	32 A (with 4 mm² conductor cross section)
Nominal voltage U_N	1000 V
Maximum load current	41 A (with 6 mm² conductor cross section)
Open side panel	ja
Shock protection test specification	DIN EN 50274 (VDE 0660-514):2002-11
Back of the hand protection	guaranteed
Finger protection	guaranteed
Surge voltage test setpoint	9.8 kV
Result of surge voltage test	Test passed
Power frequency withstand voltage setpoint	2.2 kV
Result of power-frequency withstand voltage test	Test passed
Checking the mechanical stability of terminal points (5 x conductor connection)	Test passed
Bending test rotation speed	10 rpm
Bending test turns	135
Bending test conductor cross section/weight	0.14 mm² / 0.2 kg
	4 mm² / 0.9 kg
	6 mm^2 / 1.4 kg
Result of bending test	Test passed
Conductor cross section tensile test	0.14 mm²
Tractive force setpoint	10 N
Conductor cross section tensile test	4 mm²
Tractive force setpoint	60 N
Conductor cross section tensile test	6 mm²
Tractive force setpoint	80 N
Tensile test result	Test passed
Tight fit on carrier	NS 35

Feed-through terminal block - UT 4 - 3044102

Technical data

General

Setpoint	1 N
Result of tight fit test	Test passed
Requirements, voltage drop	≤ 3.2 mV
Result of voltage drop test	Test passed
Temperature-rise test	Test passed
Conductor cross section short circuit testing	4 mm²
Short-time current	0.48 kA
Conductor cross section short circuit testing	6 mm²
Short-time current	0.72 kA
Short circuit stability result	Test passed
Proof of thermal characteristics (needle flame) effective duration	30 s
Result of thermal test	Test passed
Test specification, oscillation, broadband noise	DIN EN 50155 (VDE 0115-200):2008-03
Test spectrum	Service life test category 1, class B, body mounted
Test frequency	f_1 = 5 Hz to f_2 = 150 Hz
ASD level	1.857 $(m/s^2)^2/Hz$
Acceleration	0.8g
Test duration per axis	5 h
Test directions	X-, Y- and Z-axis
Oscillation, broadband noise test result	Test passed
Test specification, shock test	DIN EN 50155 (VDE 0115-200):2008-03
Shock form	Half-sine
Acceleration	5 g
Shock duration	30 ms
Number of shocks per direction	3
Test directions	X-, Y- and Z-axis (pos. and neg.)
Shock test result	Test passed
Temperature index, insulating material (DIN EN 60216-1 (VDE 0304-21))	130 °C
Static insulating material application in cold	-60 °C

Dimensions

Width	6.2 mm
End cover width	2.2 mm
Length	47.7 mm
Height NS 35/7,5	47.5 mm
Height NS 35/15	55 mm

Connection data

Feed-through terminal block - UT 4 - 3044102

Technical data

Connection data

Connection in acc. with standard	IEC 60947-7-1
Connection method	Screw connection
Note	Note: Product releases, connection cross sections and notes on connecting aluminum cables can be found in the download area.
Conductor cross section solid min.	0.14 mm²
Conductor cross section solid max.	6 mm²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	10
Conductor cross section stranded min.	0.14 mm²
Conductor cross section stranded max.	6 mm²
Min. AWG conductor cross section, stranded	26
Max. AWG conductor cross section, stranded	10
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	4 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	4 mm²
2 conductors with same cross section, solid min.	0.14 mm²
2 conductors with same cross section, solid max.	1.5 mm²
2 conductors with same cross section, stranded min.	0.14 mm²
2 conductors with same cross section, stranded max.	1.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	2.5 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.14 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1.5 mm²
Stripping length	9 mm
Internal cylindrical gage	A4
Screw thread	M3
Tightening torque, min	0.6 Nm
Tightening torque max	0.8 Nm

Classifications

eCl@ss

eCl@ss 4.0	27141120
eCl@ss 4.1	27141120

Feed-through terminal block - UT 4 - 3044102

Classifications

eCl@ss

eCl@ss 5.0	27141120
eCl@ss 5.1	27141120
eCl@ss 6.0	27141120
eCl@ss 7.0	27141120
eCl@ss 8.0	27141120

ETIM

ETIM 2.0	EC000897
ETIM 3.0	EC000897
ETIM 4.0	EC000897
ETIM 5.0	EC000897

UNSPSC

UNSPSC 6.01	30211811
UNSPSC 7.0901	39121410
UNSPSC 11	39121410
UNSPSC 12.01	39121410
UNSPSC 13.2	39121410

Approvals

Approvals

Approvals

CSA / UL Recognized / VDE Gutachten mit Fertigungsüberwachung / cUL Recognized / LR / GL / DNV / RS / IECEE CB Scheme / EAC / EAC / cULus Recognized

Ex Approvals

IECEx / ATEX / UL Recognized / cUL Recognized / EAC Ex / cULus Recognized

Approvals submitted

Approval details

Feed-through terminal block - UT 4 - 3044102

Approvals

CSA

	B	C
mm²/AWG/kcmil	26-10	26-10
Nominal current IN	30 A	30 A
Nominal voltage UN	600 V	600 V

UL Recognized

	B	C
mm²/AWG/kcmil	26-10	26-10
Nominal current IN	30 A	30 A
Nominal voltage UN	600 V	600 V

VDE Gutachten mit Fertigungsüberwachung

mm²/AWG/kcmil	0.2-4
Nominal voltage UN	800 V

cUL Recognized

	B	C
mm²/AWG/kcmil	26-10	26-10
Nominal current IN	30 A	30 A
Nominal voltage UN	600 V	600 V

LR

GL

DNV

Feed-through terminal block - UT 4 - 3044102

Approvals

RS

IECEE CB Scheme

mm²/AWG/kcmil	0.2-4
Nominal voltage UN	800 V

EAC

EAC

cULus Recognized

Drawings

Circuit diagram

End cover - D-UT 2,5/10 - 3047028

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End cover, Length: 47.7 mm, Width: 2.2 mm, Height: 48.4 mm, Color: gray

Key commercial data

Packing unit	1 pc
Minimum order quantity	50 pc
Weight per Piece (excluding packing)	2.4 GRM
Custom tariff number	85389099
Country of origin	Germany

Technical data

Product type	End cover

Classifications

eCl@ss

eCl@ss 4.0	27141111
eCl@ss 4.1	27141111
eCl@ss 5.0	27141133
eCl@ss 5.1	27141133
eCl@ss 6.0	27141133
eCl@ss 7.0	27141133
eCl@ss 8.0	27141133

ETIM

ETIM 2.0	EC000886
ETIM 3.0	EC000886
ETIM 4.0	EC000886
ETIM 5.0	EC000886

End cover - D-UT 2,5/10 - 3047028

Classifications

UNSPSC

UNSPSC 6.01	30211827
UNSPSC 7.0901	39121424
UNSPSC 11	39121424
UNSPSC 12.01	39121424
UNSPSC 13.2	39121424

Fuse modular terminal block - UK 10,3-CC HESI N - 3048580

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The figure shows a version of the article

Fuse modular terminal block, connection method: Screw connection, cross section: 1.5 mm² - 25 mm², AWG: 16 - 4, nominal current: 32 A, nom. voltage: 600 V, width: 18 mm, fuse type: Class CC, fuse type: Glass / ceramics / ..., mounting type: NS 35/7,5, NS 35/15, color: black

RoHS

Key Commercial Data

Packing unit	1 STK
Minimum order quantity	10 STK
GTIN	4 046356 115971
GTIN	4046356115971
Weight per Piece (excluding packing)	52.000 g
Custom tariff number	85369095
Country of origin	Germany

Technical data

General

Number of levels	1
Number of connections	2
Nominal cross section	25 mm²
Color	black
Insulating material	PA
Flammability rating according to UL 94	V0
Maximum power dissipation for nominal condition	3.26 W
Fuse	Class CC
Fuse type	Glass / ceramics / ...

Fuse modular terminal block - UK 10,3-CC HESI N - 3048580

Technical data

General

Rated surge voltage	6 kV
Degree of pollution	3
Overvoltage category	III
Insulating material group	IIIb
Maximum load current	30 A (the current and voltage are determined by the fuse)
Nominal current I_N	32 A (the current and voltage are determined by the fuse)
Nominal voltage U_N	600 V (the current and voltage are determined by the fuse)
Open side panel	No

Dimensions

Width	18 mm
Length	81 mm
Height NS 35/7,5	65.5 mm
Height NS 35/15	73 mm

Connection data

Conductor cross section solid min.	1.5 mm²
Conductor cross section solid max.	25 mm²
Conductor cross section flexible min.	1.5 mm²
Conductor cross section flexible max.	25 mm²
Conductor cross section AWG min.	16
Conductor cross section AWG max.	4
Conductor cross section flexible, with ferrule without plastic sleeve min.	1.5 mm²
Conductor cross section flexible, with ferrule without plastic sleeve max.	16 mm²
Conductor cross section flexible, with ferrule with plastic sleeve min.	1.5 mm²
Conductor cross section flexible, with ferrule with plastic sleeve max.	16 mm²
Cross section with insertion bridge, solid max.	10 mm²
Cross section with insertion bridge, stranded max.	10 mm²
2 conductors with same cross section, solid min.	1.5 mm²
2 conductors with same cross section, solid max.	4 mm²
2 conductors with same cross section, stranded min.	1.5 mm²
2 conductors with same cross section, stranded max.	4 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	1.5 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	4 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	1.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	10 mm²

Fuse modular terminal block - UK 10,3-CC HESI N - 3048580

Technical data

Connection data

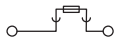
Cross section with insertion bridge, solid max.	10 mm²
Cross section with insertion bridge, stranded max.	10 mm²
Connection method	Screw connection
Stripping length	12 mm
Internal cylindrical gage	B6
Screw thread	M5
Tightening torque, min	2.5 Nm
Tightening torque max	3 Nm

Standards and Regulations

Connection in acc. with standard	CSA
Flammability rating according to UL 94	V0

Drawings

Circuit diagram



Classifications

eCl@ss

eCl@ss 4.0	27141116
eCl@ss 4.1	27141116
eCl@ss 5.0	27141116
eCl@ss 5.1	27141116
eCl@ss 6.0	27141116
eCl@ss 7.0	27141116
eCl@ss 8.0	27141116
eCl@ss 9.0	27141116

ETIM

ETIM 2.0	EC000897
ETIM 3.0	EC000899
ETIM 4.0	EC000899
ETIM 5.0	EC000899
ETIM 6.0	EC000899

Fuse modular terminal block - UK 10,3-CC HESI N - 3048580

Classifications

UNSPSC

UNSPSC 6.01	30211811
UNSPSC 7.0901	39121410
UNSPSC 11	39121410
UNSPSC 12.01	39121410
UNSPSC 13.2	39121410

Approvals

Approvals

Approvals

CSA / UL Listed / cUL Listed / EAC / cULus Listed

Ex Approvals

Approval details

CSA		http://www.csagroup.org/services-industries/product-listing/	225908

mm²/AWG/kcmil	18-4
Nominal current IN	30 A
Nominal voltage UN	600 V

UL Listed		http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 244294

mm²/AWG/kcmil	18-4
Nominal current IN	30 A
Nominal voltage UN	600 V

Fuse modular terminal block - UK 10,3-CC HESI N - 3048580

Approvals

cUL Listed		http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 244294

mm²/AWG/kcmil	18-4
Nominal current IN	30 A
Nominal voltage UN	600 V

EAC		EAC-Zulassung

cULus Listed		

Product data sheet

Specifications

Power distribution block, Linergy, 3 pole, 1 line, 4 load, 175A Cu, 600V

9080LBC362104

Product availability: Stock - Normally stocked in distribution facility

Main

Range	9080LB
Product	Power Distribution Block
Current Rating	175 A copper
Short Circuit Current Rating	65 kA

Complementary

Voltage Rating	600 V AC/DC
Mounting Type	Surface mount
Number of poles	3
Terminals per Pole	1 line 4 load
Wire Size	Line 4, AWG 14...AWG 2/0, copper Load 2, AWG 14...AWG 4, copper
Electrical Connection	Tin plated copper lugs
SCCR	100 kA UL 508 A
Ambient Air Temperature for Operation	-40…302 °F (-40…150 °C)
Block Material	Phenolic: block
Terminal Tightening Torque	Line lug 40 lbf.in (4.5 N.m) AWG 8 copper Line lug 35 lbf.in (4.0 N.m) AWG 14...AWG 10 copper Line lug 120 lbf.in (13.6 N.m) AWG 6...AWG 2/0 copper Load lug 35 lbf.in (4.0 N.m) AWG 14...AWG 4 copper
Wire stripping length	Load: 0.38 in (9.65 mm) for top connection Line: 0.75 in (19.05 mm) Load: 0.88 in (22.35 mm) for bottom connection
Height	2.88 in (73.15 mm)
Width	2.75 in (69.85 mm)
Depth	1.78 in (45.21 mm)
End Barrier	9080LB23

Environment

Certifications	CSA file 70361 class 6228 01 UL recognized E60616 CCN XCFR2 CE

Ordering and shipping details

Category	US10CP121711

Price is “List Price” and may be subject to a trade discount – check with your local distributor or retailer for actual price.

Discount Schedule	0CP1
GTIN	785901097662
Returnability	Yes
Country of origin	US

Packing Units

Unit Type of Package 1	PCE
Nbr. of units in pkg.	1
Package 1 Height	1.900 in (4.826 cm)
Package 1 Width	2.800 in (7.112 cm)
Package 1 Length	2.700 in (6.858 cm)
Package weight(Lbs)	13.600 oz (385.554 g)

Contractual warranty

Warranty	18 months

Environmental Data

Schneider Electric aims to achieve Net Zero status by 2050 through supply chain partnerships, lower impact materials, and circularity via our ongoing “Use Better, Use Longer, Use Again” campaign to extend product lifetimes and recyclability.

Environmental Data explained >

How we assess product sustainability >

Use Better

Materials and Substances

Packaging made with recycled cardboard	Yes
Packaging without single use plastic	No
EU RoHS Directive	Compliant
REACh Regulation	REACh Declaration
California proposition 65	WARNING: This product can expose you to chemicals including: Lead and lead compounds, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

Use Again

Repack and remanufacture

Take-back	No
WEEE Label	The product must be disposed on European Union markets following specific waste collection and never end up in rubbish bins.

Technical Illustration

Dimensions