ROMTEC UTILITIES OPERATION & MAINTENANCE MANUAL

FOR:

MIRALOMA RECHARGE BASIN

DATE: June 14, 2012

CUSTOMER CONTACT INFORMATION:
John Doe
Company Name
315 Street Avenue
City, State 90210
888-111-2211
name@company.com

ENGINEER CONTACT INFORMATION:
Jane Doe
Company Name
19 Street Avenue
City, State 90210
888-111-2211
name@company.com

ROMTEC UTILITIES

18240 North Bank Road ~ Roseburg ~ OR ~ 97470
541.496.9678(ph) / 541.496.0804(fx)
romtec9@romtecutilities.com

1. Contact Information

PROJECT ENGINEER:

John Doe
Company Name
19 Street Avenue
City, State 90210
888-111-2211
name@company.com

CONTRACTOR:

Jane Doe
Company Name
19 Street Avenue
City, State 90210
888-111-2211
name@company.com

PUMP STATION WET WELL SYSTEM

WET WELL SYSTEM SUPPLIER:

Romtec Utilities, Inc.
18240 North Bank Rd.
Roseburg, OR 97470
Phone: 541-496-9678; Fax: 541-496-0804
Email: info@romtecutilities.com; Website: www.romtecutilities.com

PLUG VALVE MANUFACTURER:

Company Name
888 East Street Road
City, State 13131
Ph: (888) 111-2255; Fax: (888)
111-1144 Email: name@company.com

CHECK VALVE MANUFACTURER:

Company Name
888 East Street Road
City, State 13131
Ph: (888) 111-2255; Fax: (888)
111-1144 Email: name@company.com

SUBMERSIBLE NON-CLOG PUMP SYSTEM

PUMPS & PUMP ACCESSORIES SUPPLIER:

Company Name
888 East Street Road
City, State 13131
Ph: (888) 111-2255; Fax: (888)
111-1144 Email: name@company.com

1. Contact Information-Continued

INSTRUMENTATION & CONTROL SYSTEM

EQUIPMENT SUPPLIER:

Romtec Utilities, Inc
18240 North Bank Rd
Roseburg OR 97470
Phone: 541-496-9678 Fax: 541-496-0804
Email: info@romtecutilities.com; Website: www.romtecutilities.com

EQUIPMENT MANUFACTURER:

Company Name
888 East Street Road
City, State 13131
Ph: (888) 111-2255; Fax: (888)
111-1144 Email: name@company.com

2.1 General Requirements-Warranty

NOTE: ENGINEER/CONTRACTOR PLEASE INSERT YOUR WARRANTY LETTERS IN THIS SECTION

2.01 ROMTEC UTILITIES LIMITED WARRANTY

Romtec Utilities, Inc. (herein referred to as "Romtec") warrants that the equipment supplied will be free from defects in material and workmanship under normal use and service, when used in accordance with Romtec's procedures as set forth below for a period of one year from date of acceptance (acceptance is defined as the date Romtec's "Start-Up" report is completed) or one year and six months from installation of the wet well (or delivery of the wet well or the date that the wet well was ready to deliver), whichever comes first. The obligation of Romtec under this warranty is limited to replacing or repairing any defective part. This warranty extends only to Romtec's direct customer (as named in the Romtec Purchase Order), herein called "CUSTOMER", and not to any person or entity with whom CUSTOMER has business relationships, or any party other than CUSTOMER.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PURPOSE, WHICH IMPLIED WARRANTIES ARE EXCLUDED. ROMTEC SHALL NOT BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES.

Components Resold or Supplied with Romtec Materials. Certain components are warrantable directly by the original manufacturer for periods between 90 days and 5 years. Specific details of such warranties are included with the Romtec Scope of Supply and Design Submittal document. Replacement for, repair or refund of defective workmanship or material under normal use shall be remunerated directly with the manufacturer of the component. Examples of components would be generators, manual cranes, pumps, pump controls, valves, etc.

Warranty Voidable. Start-up that is performed without the presence of Romtec's representative shall void all warranties.

Claims of Defective Manufacture. Claims that the merchandise was incorrectly manufactured or that is defective in any way must be made directly to Romtec on a product-by-product basis. All claims must be made within 72 hours of the defective condition, or the time when the defect should have been discovered, whichever is earlier. All claims must include the following:

1. A detailed description of the specific problem, failure, or other event giving rise to the claim; and
2. Supporting photographs or videos; and
3. Specific location; and
4. Names and phone numbers of individuals who can substantiate the claim, but who do not work for Contractor.

Failure of Pump Station

Romtec Utilities pump stations pump all types of water containing all kinds of materials. Sometimes pumps may clog or power may be lost and the pump station will fail to operate. If your station fails to operate, Romtec Utilities will suggest a local service company to evaluate the problem. If it is a warranty issue, Romtec Utilities will repair and/or replace per the terms of this warranty. If however, the pumps are simply "clogged" or the power is simply lost Romtec Utilities will advise you that it is not a warranty issue and you will simply pay for the service call and the associated services.

Action in Event of Established Claim. In the event it is determined that goods have been incorrectly manufactured or are defective, the liability of Romtec shall be limited to, at its option, repair or replacement of the goods. Romtec also reserves the right to establish reasonable time limits for completion of any specific installation tasks resulting from the replacement of defective merchandise.

No Third Party Claims. Under no circumstances shall Romtec be responsible for any damage claims by any party other than claims by Romtec direct customers.

Release and Hold Harmless. Contractor releases and agrees to defend, indemnify, and hold Romtec harmless from and against any and all claims, demands, actions, and causes of action for any matters arising out of or connected with the Materials whereby the Contractor is responsible for errors or omissions.

FURTHER LIMITATIONS ON ROMTEC LIABILITY

1. Specific Limitations.

Romtec's liability under the foregoing warranty and under the transaction of which this document is a part is limited as follows:

a. Romtec has designed the lift station supplied under this project to meet a specific design standard and specific set of parameters as dictated to Romtec by its CUSTOMER as set forth in the "Lift Station Design Form" located Tab 4 of the Romtec Utilities Scope of Supply and Design Submittal.

b. Romtec's Scope of Supply & Design Submittal is a part of and limited by CUSTOMER'S site civil and electrical plans.

c. Romtec makes no guarantees that any of its supply will fit on CUSTOMER'S site and/or building. However, at CUSTOMER'S request, Romtec will provide suggested layouts for the CUSTOMER'S project. Ultimately, the CUSTOMER decides to accept or reject any given layout.

d. Romtec cannot make final layout or equipment placement judgments at the site (i.e. generator or control panel "fit" in or out of a building). It is the responsibility of CUSTOMER'S site engineer and contractor to check dimensions, etc. If CUSTOMER has not accepted (or received) final dimensions, etc., please request further definition before approval. Romtec is not responsible for items that do not fit on the site.

e. It is Romtec's CUSTOMER'S responsibility and obligation to review Romtec's Scope of Supply & Design Submittal to insure it meets with CUSTOMER approval relative to any CUSTOMER third party agreements.

f. Romtec Utilities is not responsible for any aspect of the construction/installation of the Romtec Utilities lift station. The Contractor bears sole responsibility for installation of products manufactured by Romtec Utilities. The Romtec Utilities Scope of Supply and Design Submittal defines Romtec Utilities scope of supply relative to equipment, documentation, start-up services and warranty.

g. If Romtec Utilities is on site during the construction/installation of the Romtec Utilities lift station it is only as an advisor. Romtec Utilities is never on site to perform any construction and/or installation tasks.

Romtec Utilities designs and prefabricates its lift station system to enable contractors to install the Romtec Utilities system quickly and completely. However, Romtec Utilities has made no representation and/or claims as to "how long" it will take to construct/install the Romtec Utilities system.

Note: If any Romtec Utilities-supplied part is found to be defective and/or has been manufactured in error relative to this document, Romtec Utilities will repair and/or replace that part at Romtec Utilities' expense. Romtec Utilities does not offer, nor will Romtec Utilities accept, any charges and/or claims by anyone relative to the time it takes to install/construct the Romtec Utilities system and or claims for delays relative to a part that has to be repaired and/or replaced by Romtec Utilities.

h. Romtec Utilities' responsibility is to its direct customer. We want to help all parties, but we are ultimately responsible only to our direct customer.

   If Romtec Utilities' direct customer has hired a sub-contractor Romtec Utilities will communicate with that sub-contractor through a representative of Romtec Utilities' direct customer. In other words, Romtec Utilities will not direct and/or advise any sub-contractor. Instead, Romtec Utilities will communicate directly with its "direct customer" and they will communicate with their sub-contractors, engineers, and/or owners.

i. The Romtec Utilities design reflects all elevations and/or orientations to an accuracy of and/or minus .10'. Romtec Utilities does not claim to manufacture any aspect of its lift station systems to absolute elevations. It is simply not possible in the general underground construction world to meet absolutes. Therefore, any owner and/or installer of a Romtec Utilities system is accepting the Romtec Utilities system proposed herein to the plus or minus .10' offered by Romtec Utilities.

2. Performance Characteristics and Start-Up

a. The lift station is a sophisticated device that can be operated in many different ways. The Romtec Scope of Supply & Design Submittal defines Romtec's approach to the operation of the lift station.

Note: While there are many ways to vary and/or adjust "operational parameters" within the overall lift station, Romtec is only prepared to start-up per its own parameters (as specified in the CUSTOMER'S *design criteria, see attached)*.

b. Romtec's obligation is to show that the station can run as designed to meet specific design criteria as shown in its Scope of Supply & Design Submittal. It is understood that the regulating agency may want to test many other scenarios. This will not be part of the standard Romtec's start-up procedures and training. At start-up, Romtec will only prove that the station can run at the pre-specified design parameters.

c. Romtec is not an operator, installer or an electrical interconnector for the lift stations and equipment it supplies.

d. During start-up, Romtec is completely in charge. Romtec's start-up technician will start-up and "prove" the station per the approved Romtec Scope of Supply & Design Submittal. After the lift station is accepted other parties may choose to adjust and/or vary the operational parameters to suit their specific preference. However, Romtec will not be involved with these issues either during or after start-up, and is not responsible for problems arising from any adjustments or variations by such other parties.

3. Training

a. Romtec will perform start-up and training at no additional cost as part of its scope of supply if the training is scheduled for the day after start-up and CUSTOMER wants training at no additional cost. If training is scheduled for any other time other than the day after start-up, Romtec will require prepayment of the additional costs incurred as a result of the need to reschedule.

GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

The warranty excludes:

(a) Labor, transportation and related costs incurred by the dealer;
(b) Reinstallation costs of repaired equipment;
(c) Reinstallation costs of replacement equipment;
(d) Consequential damages of any kind; and,
(e) Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

(1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
(2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
(3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

THIS WARRANTY EXTENDS TO THE DEALER ONLY.

GOULDS PUMPS

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

IM107R03 March, 2006

Engineered for life

LIMITED WARRANTY

All products are warranted to be free of defects in material and workmanship for a period of one year from the date of shipment, subject to the limitations below.

If the purchaser believes a product is defective, the purchaser shall: (a) Notify the manufacturer, state the alleged defect and request permission to return the product; (b) if permission is given, return the product with transportation prepaid. If the product is accepted for return and found to be defective, the manufacturer will, at his discretion, either repair or replace the product, f.o.b. factory, within 60 days of receipt, or refund the purchase price. Other than to repair, replace or refund as described above, purchaser agrees that manufacturer shall not be liable for any loss, costs, expenses or damages of any kind arising out of the product, its use, installation or replacement, labeling, instructions, information or technical data of any kind, description of product use, sample or model, warnings or lack of any of the foregoing. NO OTHER WARRANTIES, WRITTEN OR ORAL, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY, ARE MADE OR AUTHORIZED. NO AFFIRMATION OF FACT, PROMISE, DESCRIPTION OF PRODUCT OF USE OR SAMPLE OR MODEL SHALL CREATE ANY WARRANTY FROM MANUFACTURER, UNLESS SIGNED BY THE PRESIDENT OF THE MANUFACTURER. These products are not manufactured, sold or intended for personal, family or household purposes.

VAL-MATIC®

VAL-MATIC® VALVE AND MANUFACTURING CORP.

905 RIVERSIDE DR. ELMHURST, IL. 60126
TEL. 708/941-7600 FAX. 708/941-8042

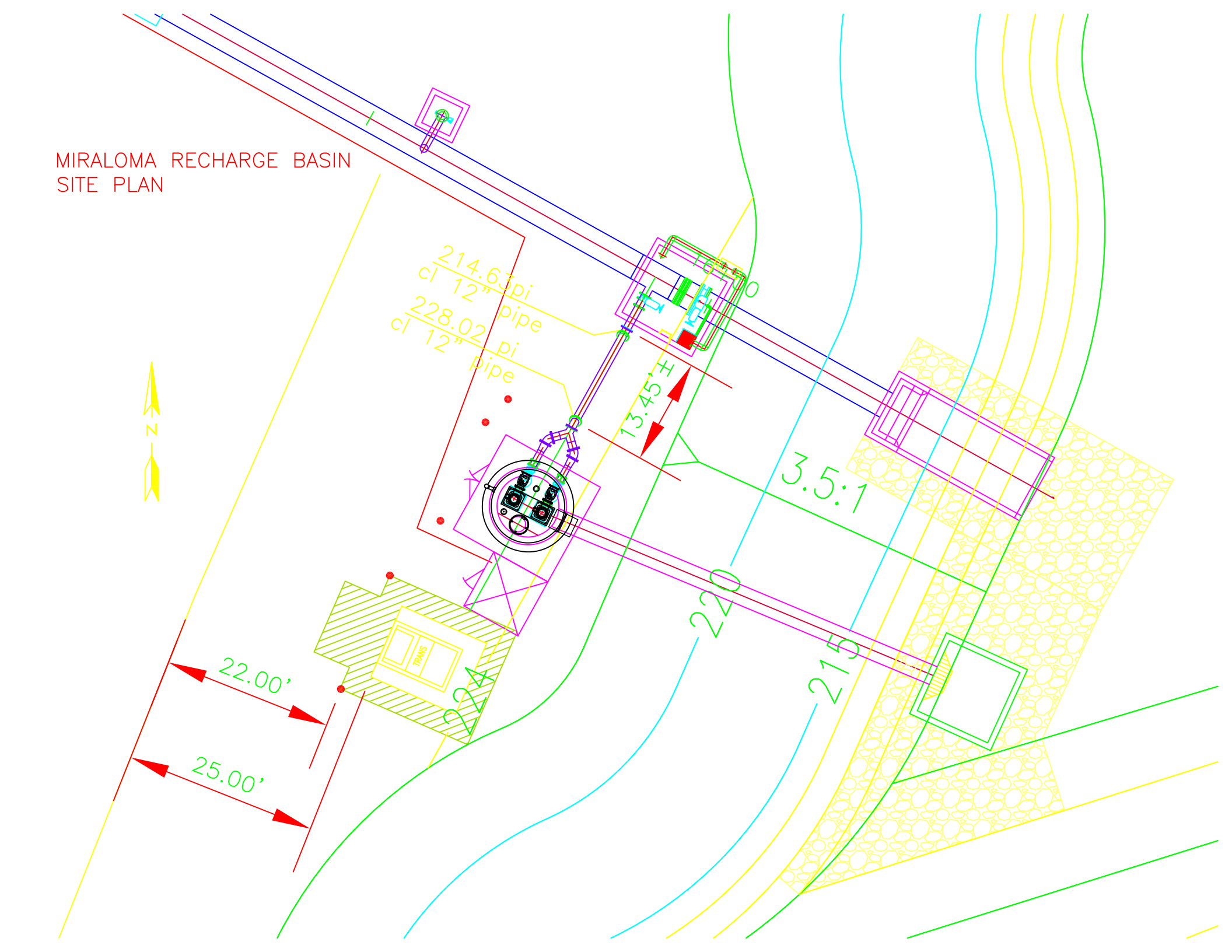
2.2 General Requirements-Permits, Tests & Inspection Reports

- PERMITS
- START-UP REPORTS

  (The Romtec Utilities Start-up Reports will be sent after the start-up is complete. Please insert in this section when received)

- ENGINEER/AGENCY INSPECTION REPORTS

2.3. General Requirements-Site Plan


MIRALOMA RECHARGE BASIN
SITE PLAN
214.63pi
cl 12" pipe
228.02 pi
cl 12" pipe
13.45'±
3.5:1
220
215
224
22.00'
25.00'
N
TRANS

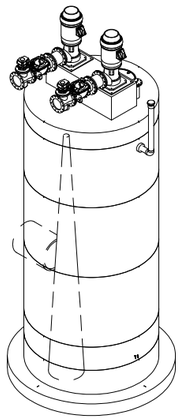
3. Wet Well & Related Equipment

WET WELL SYSTEM SUPPLIER:

Romtec Utilities, Inc.
18240 North Bank Rd.
Roseburg, OR 97470
Phone: 541-496-9678; Fax: 541-496-0804
Email: info@romtecutilities.com; Website: www.romtecutilities.com

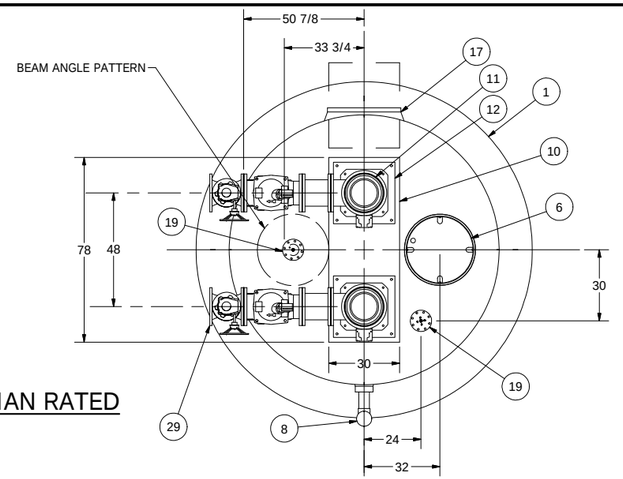
WET WELL – CONCRETE COMPONENTS SHOP DRAWINGS, COMPONENTS & SUPPORTING DATA

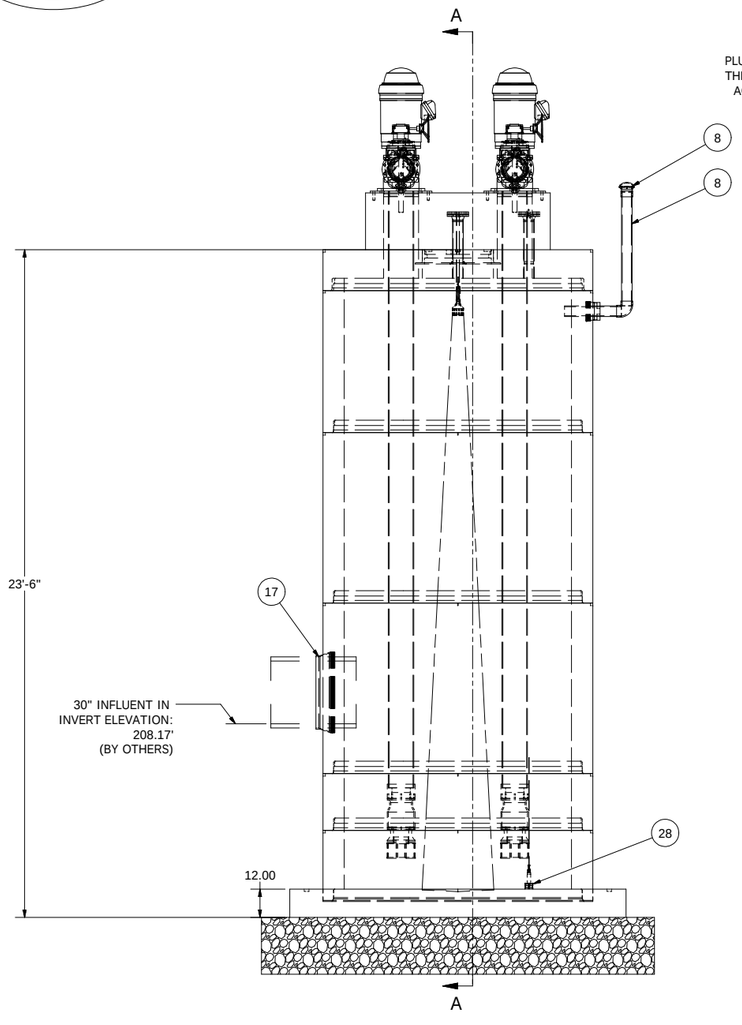
ROMTEC UTILITIES' WET WELL COMPONENT DRAWING
ROMTEC-OLDCASTLE 96" DIAM. WET WELL - PLAN, SECTION, DETAILS
ROMTEC-OLDCASTLE BASE SLAB – REINFORCEMENT DETAIL
ROMTEC-OLDCASTLE MANHOLE RISER – REINFORCEMENT DETAIL
ROMTEC-OLDCASTLE TOP SLAB – REINFORCEMENT DETAIL
ROMTEC-NPC KOR-N-SEAL PIPE-TO-MANHOLE CONNECTOR - TECHNICAL SPEC.
HAMILTON KEN PIPE & MANHOLE PRE-LUBRICATED GASKET
CONSEAL CONCRETE SEALANT
TAPE COAT JOINT TAPE
VALMATIC PLUG VALVE
VALMATIC CHECK VALVE

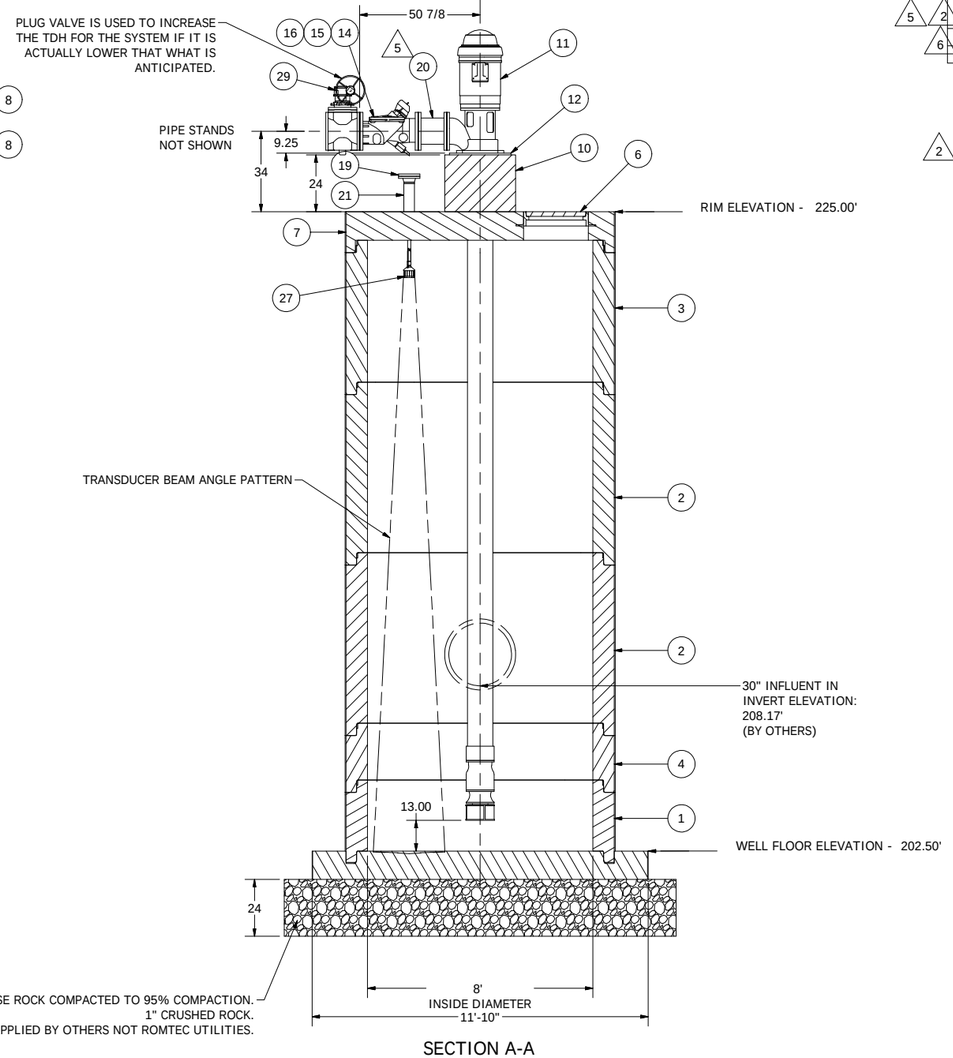


SENSOR AND ELEVATION TABLE		
LEVEL ELEVATION	DISTANCE BETWEEN POINTS	SET POINT DESCRIPTION
208.17		WATER INVERT IN
221.00		HIGH LEVEL ALARM
	0.50	SENSOR SPACING
220.50		LAG PUMP START
	0.50	SENSOR SPACING
220.00		LEAD PUMP START
	14.00	SENSOR SPACING
206.00		PUMP STOP
	3.50	DISTANCE TO FLOOR
202.50		FLOOR ELEVATION

NOTE: WET WELL TOP SLAB IS PEDESTRIAN RATED







SECTION A-A
SCALE 1/32

Parts List			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
1	1	10-6482	BASE - WW - 8ft - FLAT BASE - 142in DIA
2	2	12-6573	BARREL - 8ft DIA X 6ft H
3	1	12-6574	BARREL - 8ft DIA X 5ft H
4	1	12-6577	BARREL - 8ft DIA X 2ft H
5	5	12-ROM	BARREL GASKET
3 6	1	13-4011	MANHOLE ASSEMBLY - 30in
7	1	14-XXXX	TOP SLAB - WW - 8ft PED - DUPLEX
8	1	18-5157	4 INCH PVC VENT
9	1	18-5427	VENT - MUSHROOM CAP
10	1	18-XXXX	CONCRETE RISER
11	2	30-XXXX	TURBINE PUMP - GOULDS - 30HP - 460V/3PHASE
12	2	31-XXXX	SOLE PLATE - DISCHARGE HEAD
13	3	40-4127	PIPE - 304SS - 1in SCH40
14	2	41-4147	VALVE - SWING CHECK - 10in
15	2	41-5395	MECHANICAL INDICATOR - 10in
16	2	41-6159	BACKFLOW ACTUATOR - 8in & 10in
17	1	43-4194	KOR-N-SEAL - 34in X 30in IPS PIPE
18	1	43-5186	KOR-N-SEAL - 8in CORE -1.70 THRU 4.80 PIPE
5 3 19	2	44-XXXX	FLANGE -304SS - 4in - BLIND - 1in NPT - .5in HOLE
20	2	45-5208	SPOOL - FLG X FLG - 10in X 12in - DI
3 21	2	45-XXXX	LEVEL TRANSDUCER SPOOL - 4in 304SS
22	8	47-5252	GASKET - FLANGE - 10in X 1/8in
23	1	50-XXXX	3/8 X 4 EYEBOLT - STAINLESS STEEL - 316
24	150	51-5949	TAPECOAT - 6in X .65mils X LFT
25	145	51-6081	SEALANT - 1in X 1in X 14.5ft CS-202
26	1	51-ROM	NEVER SIEZE - TUBE
3 27	1	60-5044	ULTRASONIC TRANSDUCER - XPS-15
5 2 28	1	60-XXXX	PRESSURE TRANSDUCER - DRUCK PTX 1290 - 100ft CABLE - WITH 1/8" SS LIFTING CABLE
6 29	2	41-5396	VALVE - PLUG - 10in - GEAR OP
30	2	25-5161	PIPE STAND - 10in - S89 FLG - NO BASE

2 NOTE:

THE PUMP MOTORS WILL REQUIRE A MINIMUM OF 100FT OF POWER CABLE PER MOTOR. THIS POWER CABLE IS NOT SUPPLIED BY ROMTEC UTILITIES IT IS SUPPLIED BY OTHERS.

NOTE: ALL DIMENSIONS AND ELEVATIONS SHOWN ARE NOMINAL DIMENSIONS. IT IS THE RESPONSIBILITY OF THE ON-SITE CONTRACTOR OR ROMTEC UTILITIES CUSTOMER (NOT ROMTEC UTILITIES) TO VERIFY THE ACCURACY OF ANY CRITICAL DIMENSIONS OR ELEVATIONS PRIOR TO SETTING OR INSTALLING ANY EQUIPMENT.

8' DIAMETER WET WELL
10"DISCHARGE PIPING
30HP GOULDS TURBINE

ALL MATERIALS SHOWN ON THIS SHEET WILL BE SUPPLIED BY ROMTEC UTILITIES AND DELIVERED TO THE SITE AFTER THE HOLE HAS BEEN EXCAVATED AND SHORED. THE CONTRACTOR SHALL SUPPLY A CRANE OF SUFFICIENT SIZE TO LOWER ALL THE CONCRETE PIECES INTO THE HOLE SAFELY. THE THE CONTRACTOR SHALL INSTALL THE WET WELL (AND VALVE VAULT AND METERING VAULT IF APPLICABLE). ROMTEC UTILITIES WILL PROVIDE A REPRESENTATIVE FOR TECHNICAL ASSISTANCE ON THE DAY OF INSTALLATION TO ANSWER ANY QUESTIONS THAT MAY ARISE. THE CONTRACTOR IS RESPONSIBLE FOR ALL PLUMBING AND ELECTRICAL CONNECTIONS AND INSTALLATION. ITEMS NOTED AS "BY OTHERS" WILL BE PROVIDED AND INSTALLED BY THE CONTRACTOR. ROMTEC UTILITIES WILL NOT INSTALL ANY OF THE COMPONENTS SHOWN ON THIS PAGE.

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROV
7	REVISED QTY FOR SEALANT FOR PRODUCTION	2/1/12	AD
6	ADDED PLUG VALVE TO ASSEMBLY	1/11/12	AD
5	REVISED PER 12/20/11 COMMENTS	12-21-11	AD
4	PUMP CHANGED TO 30HP	9-16-11	AD
3	REVISED PER 9/8/11 COMMENTS	9-9-11	AD
2	REVISED P.T. AND ADDED POWER CABLE NOTE	9-1-11	AD
1	COMPONENT DRAWING	8-25-11	AD

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

DSN - AD
DRN - AD
CKD - AD
DATE - 8-25-11

COMPONENT DRAWING

ROMTEC UTILITIES
18240 NORTH BANK ROAD
ROSEBURG, OREGON 97470
(541) 496-9678
FAX (541) 496-0804

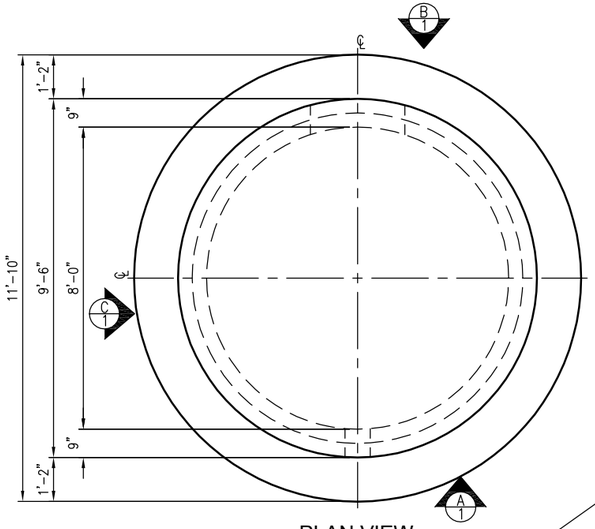
KEVIN BRANDT

MIRALOMA RECHARGE BASIN

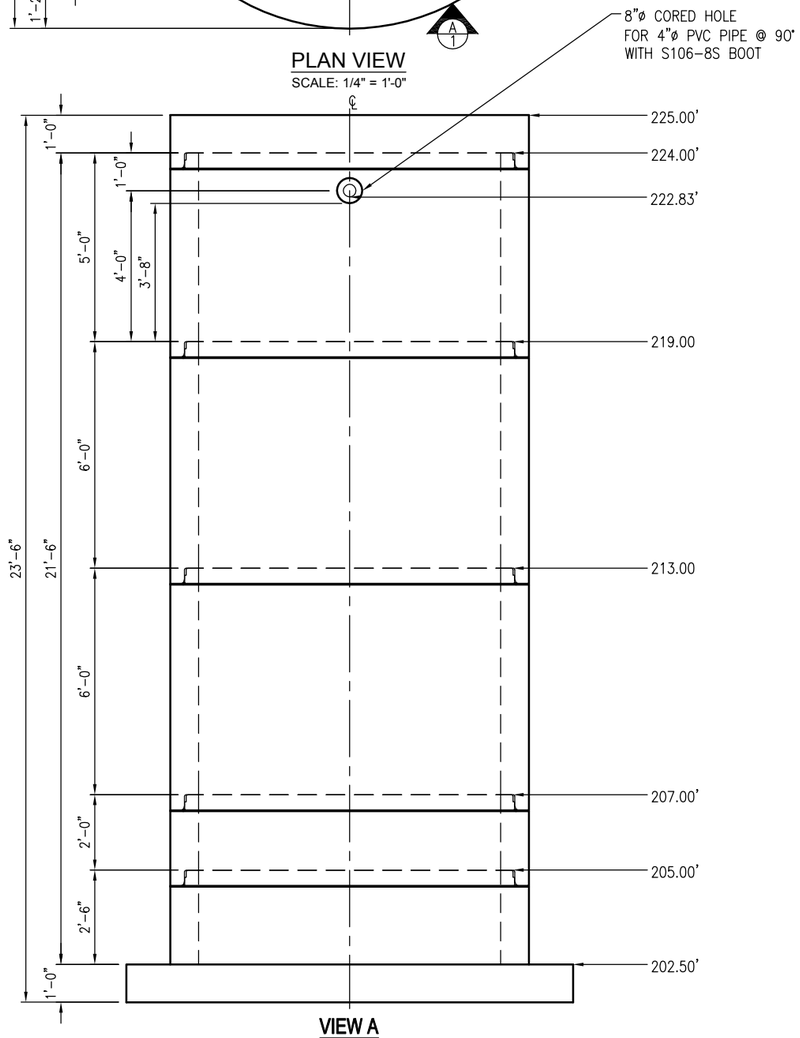
8' WET WELL W/ TURBINE PUMPS

SHEET
1 OF 2

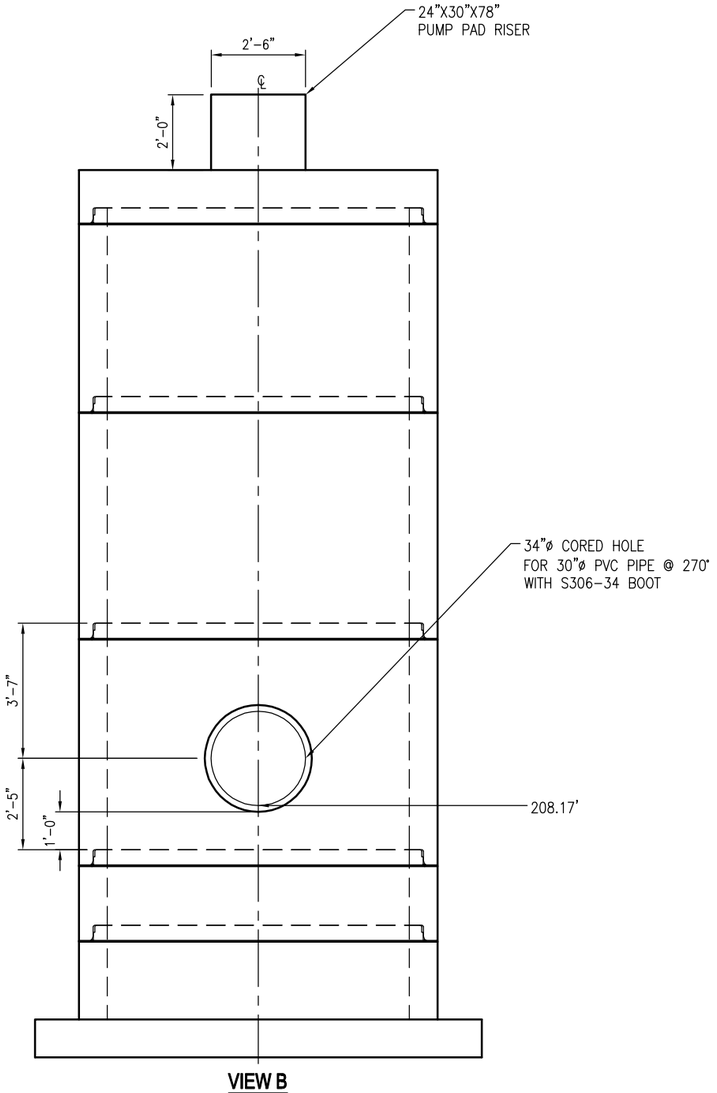
JOB NUMBER
RMTC
0000



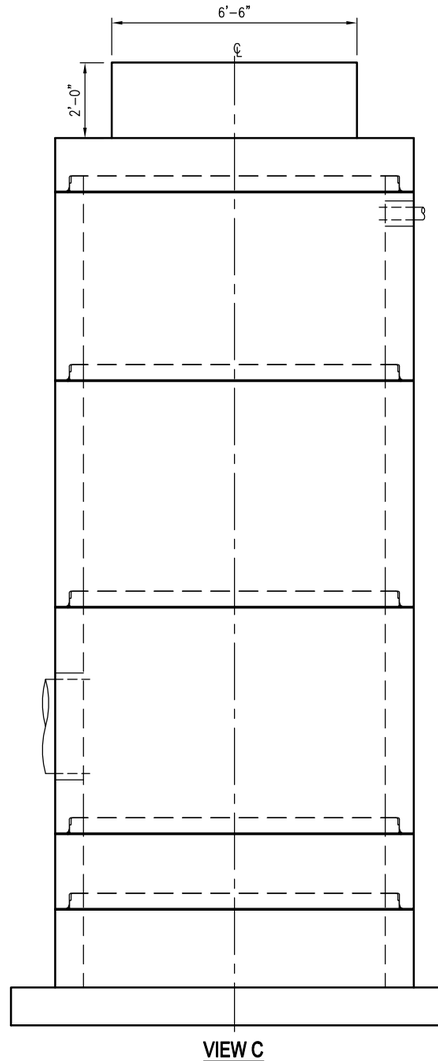
PLAN VIEW
SCALE: 1/4" = 1'-0"



VIEW A
SCALE: 1/4" = 1'-0"



VIEW B
SCALE: 1/4" = 1'-0"



VIEW C
SCALE: 1/4" = 1'-0"

STRUCTURAL NOTES:
LOADS:
- H20 TRAFFIC
- 150 PCF CONCRETE DENSITY; 120 PCF SOIL DENSITY
- H20 SURCHARGE: 128 PSF TO 8 FT BELOW GRADE
- DRY SOIL LATERAL LOAD - 40 PCF
- WET SOIL LATERAL LOAD - 80 PCF
- WATER TABLE - 5 FT

DESIGN SPECIFICATIONS
- ACI-318-08 BUILDING CODE
- ASTM C 478 STANDARD SPECIFICATIONS FOR REINFORCED CONCRETE MANHOLE SECTIONS

MATERIALS:
- CONCRETE - 28 DAY COMPRESSIVE STRENGTH f'c =6000 PSI
- REBAR - ASTM A 706 GRADE 60
- CEMENT - ASTM C150
- FLYASH - ASTM C618

GENERAL NOTES:
1)CONTRACTOR TO:
VERIFY ALL DIMENSIONS AND OPENING LOCATIONS
2)REBAR MAY BE TACK WELDED OR TIED
3)TOLERANCES PER ASTM C 478 STANDARD SPECIFICATIONS FOR REINFORCED CONCRETE MANHOLE SECTIONS
4)ALUMMINUM HATCH INTENDED FOR OFF STREET LOCATIONS THAT MAY OCCASIONALLY RECEIVE AASHTO H20 WHEEL LOAD

WEIGHTS / CONCRETE YD³

SECTION	WEIGHT
TOP SLAB	10,840 LBS / 2.624 CYD
5'-0" RISER	15,770 LBS / 3.817 CYD
6'-0" RISER	18,930 LBS / 4.582 CYD
6'-0" RISER	18,930 LBS / 4.582 CYD
2'-0" RISER	6,310 LBS / 1.527 CYD
BASE	24,720 LBS / 5.984 CYD
TOTAL LBS	95,500 LBS
TOTAL CYD	23.116 CYD

Oldcastle Precast®
2960 S. HIGHWAY 99 STOCKTON, CA 95215
PHONE: 209-466-4212 FAX: 209-466-2552

96"ØX21'-6" (I.D.) PRECAST WET WELL

MIRALOMA RECHARGE BASIN
LOCATION-UNSPECIFIED

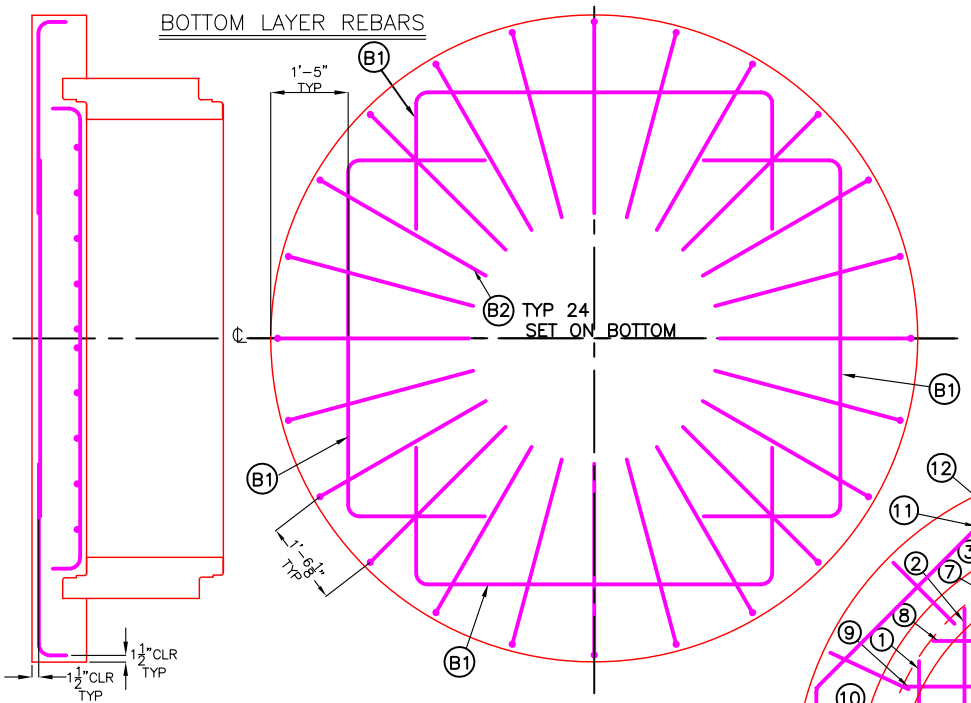
CUSTOMER
ROMTEC

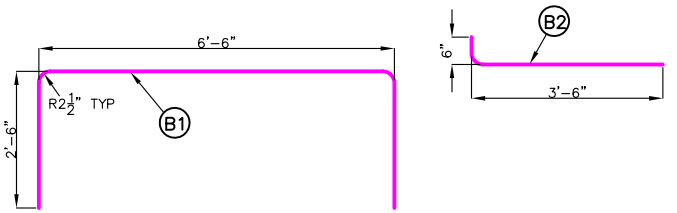
DATE	SALES	DRAWN	ENGINEER	CHECKED	SALES ORDER
8/31/11	BD	VK	JM	JM	S18973

DRAWING NUMBER	REVISION	SHEET
030-S18973-19	—	1 OF 1
	REV DATE —	

NO.	Revision Description	BY	DATE
1	ADDED TOP REBAR (12) & DELETED INSIDE SLOP PART	QLG	8/18/08

BOTTOM LAYER REBARS

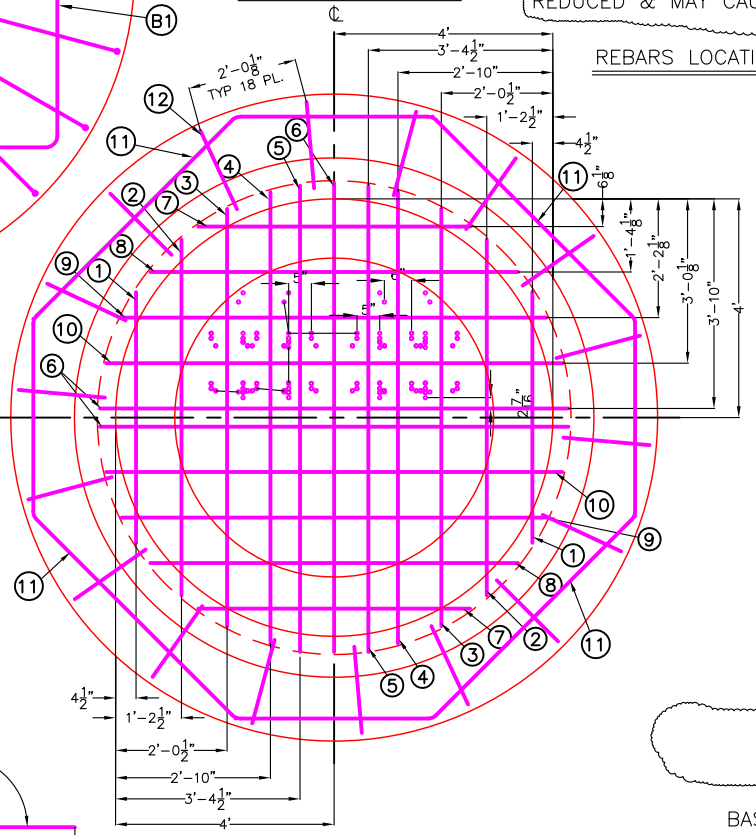




MARK THE TOP REBARS LOCATION ON TOP OF CONCRETE TO ENSURE THE REBARS ARE NOT DAMAGED WHEN DRILLING BOLT-HOLES.
IF REBAR IS DAMAGED THE BASE SLAB LOAD CAPACITY WILL BE REDUCED & MAY CAUSE BASE FAILURE.

TOP LAYER REBARS

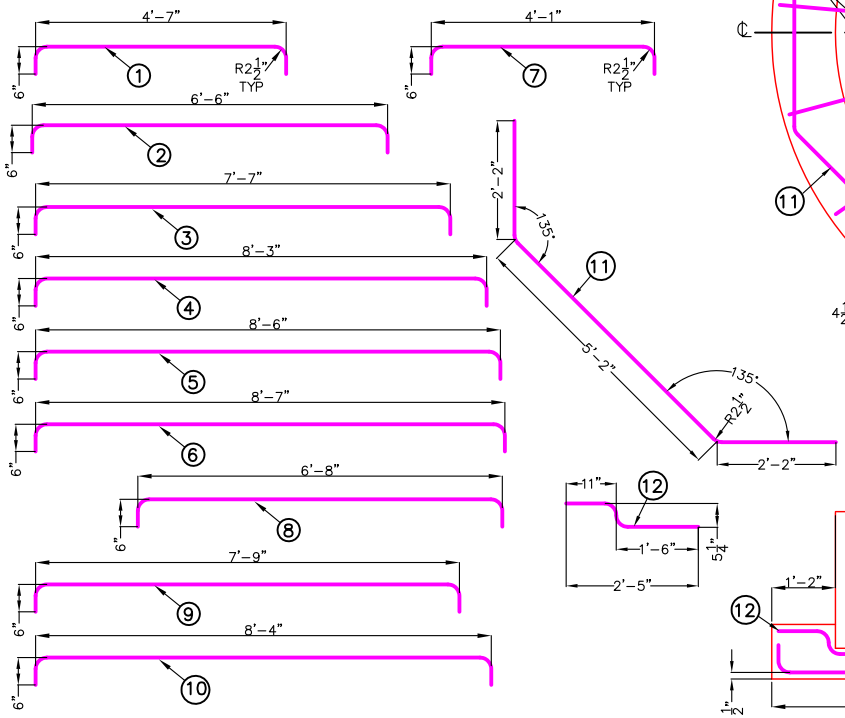
REBARS LOCATION MAXIMUM TOLARENCE IS 1/4"

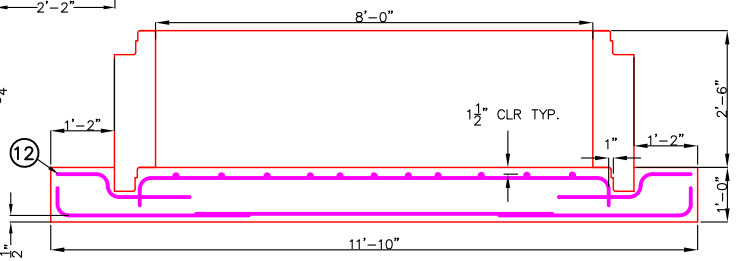


ASTM GRADE 60 STEEL #5 REBAR

	ITEM NO.	BAR LENGTH	QTY.	TOTAL LENGTH	TOTAL WEIGHT
BOTTOM ONLY	B1	11'-6"	4	46'-0"	48.0#
	B2	4'-0"	24	96'-0"	100.1#
TOP ONLY	1	5'-7"	2	11'-2"	11.7#
	2	7'-6"	2	15'-0"	15.6#
	3	8'-7"	2	17'-2"	17.9#
	4	9'-3"	2	18'-6"	19.3#
	5	9'-6"	2	19'-0"	19.8#
	6	9'-7"	3	28'-9"	30.0#
	7	5'-11"	2	11'-10"	12.3#
	8	7'-8"	2	15'-4"	16.0#
	9	8'-9"	2	17'-6"	18.3#
	10	9'-4"	2	18'-8"	19.5#
	11	9'-6"	4	38'-0"	39.6#
	12	2'-10"	18	51'-0"	53.2#
	TOTAL		71	403'-11"	421.3#

NOTE: LIFTING ANCHORS ARE MEADOW BURKE RL-24, #79042 (4 PLACES) W/ (4) #4 X 18" REBAR





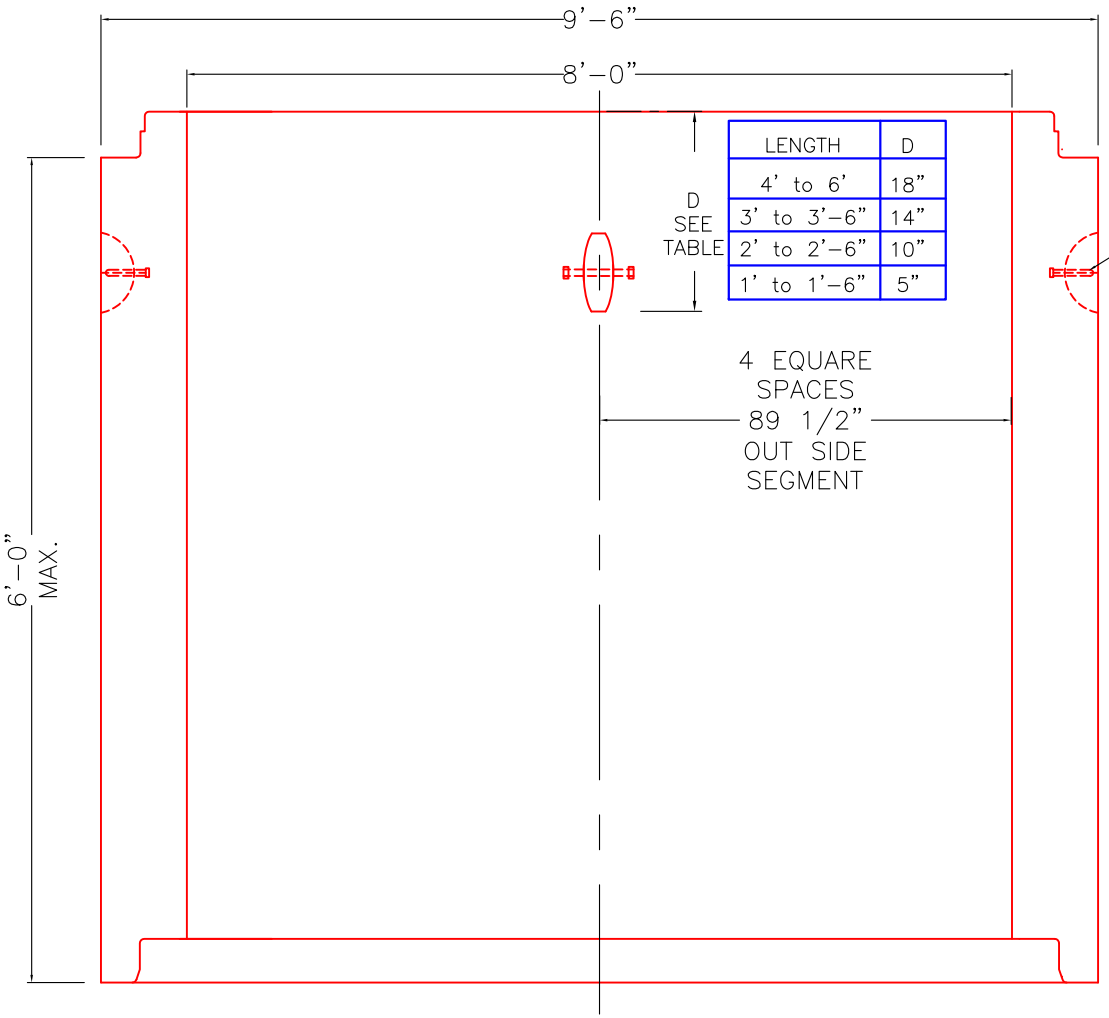
BASE SLAB CONCRETE QUANTITY = 4.1 C.Y.
AND 2'-6" LONG 96" RISER CONCRETE = 2.0 C.Y.
INSIDE OF RISER CONCRETE = 0.7 C.Y.
TOTAL CONCRETE = 6.8 C.Y.

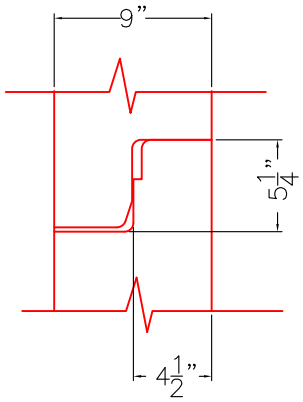
Oldcastle™ PRECAST
CALIFORNIA CONCRETE PIPE
2960 S. HIGHWAY 99 STOCKTON, CA. 95215
(209) 466-4212 FAX: (209) 466-2552

96" DIA. REINFORCED MANHOLE BASE FOR ROMTEC-C CLASS MAXIMUM DEPTH 30', 9" WALL, CONFORMS TO ASTM C478
CUSTOMER RESPONSIBILITY FOR SOIL CAPACITY & WATER FLOATING STABILITY

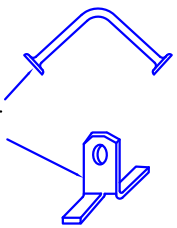
DRAWN	DATE	WT. 28000#	DRAWING NO.
QLG	4/21/08		
REVISED QLG	8/18/08	REVISION NO. 1	08-ROM-C-96BASE
		SCALE NO SCALE	SHEET 1 OF 1

5.	CHANGED BACK TO CAGE GAP SPEC.	QLG	8/23/07
4.	CHANGED CAGE LAP,ADDED LIFTING INSERTS & SPEC.	QLG	7/30/07
3.	CHANGED JOINT	QLG	11/3/05
2.	CHANGED APPROVE STAMP & THICKER LINE FOR REBAR	QLG	6/23/04
1.	ADDED CONCRETE VOLUME & CHANGED WEIGHT	QLG	7/16/03
0.	RELEASED FOR APPROVAL	RAS	4/30/01
	Revision Description	BY	DATE



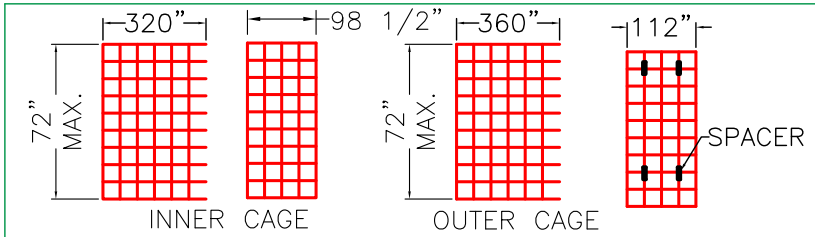


JOINT DETAIL



NOTE: 4 LIFTING INSERTS --
(1) CONAC 8CA18 FOR ORDINARY CUSTOMER.
(2) CONAC FFA 0806 FOR ROMTEC UTILITIES.

CONCRETE VOLUME = 0.764 C.Y./Ft.
6' TOTAL = 4.6 C.Y. WEIGHT = 18800#



CAGE	MESH	SPACES	GAP	SPACER	QTY.	CON. STRENGTH (psi)
outer	3x8-d3.5xw2.0	45	0"			4000
inner	3x8-d3.5xw2.0	40	2 1/2" OVER	A7.0	5/ft.	

789

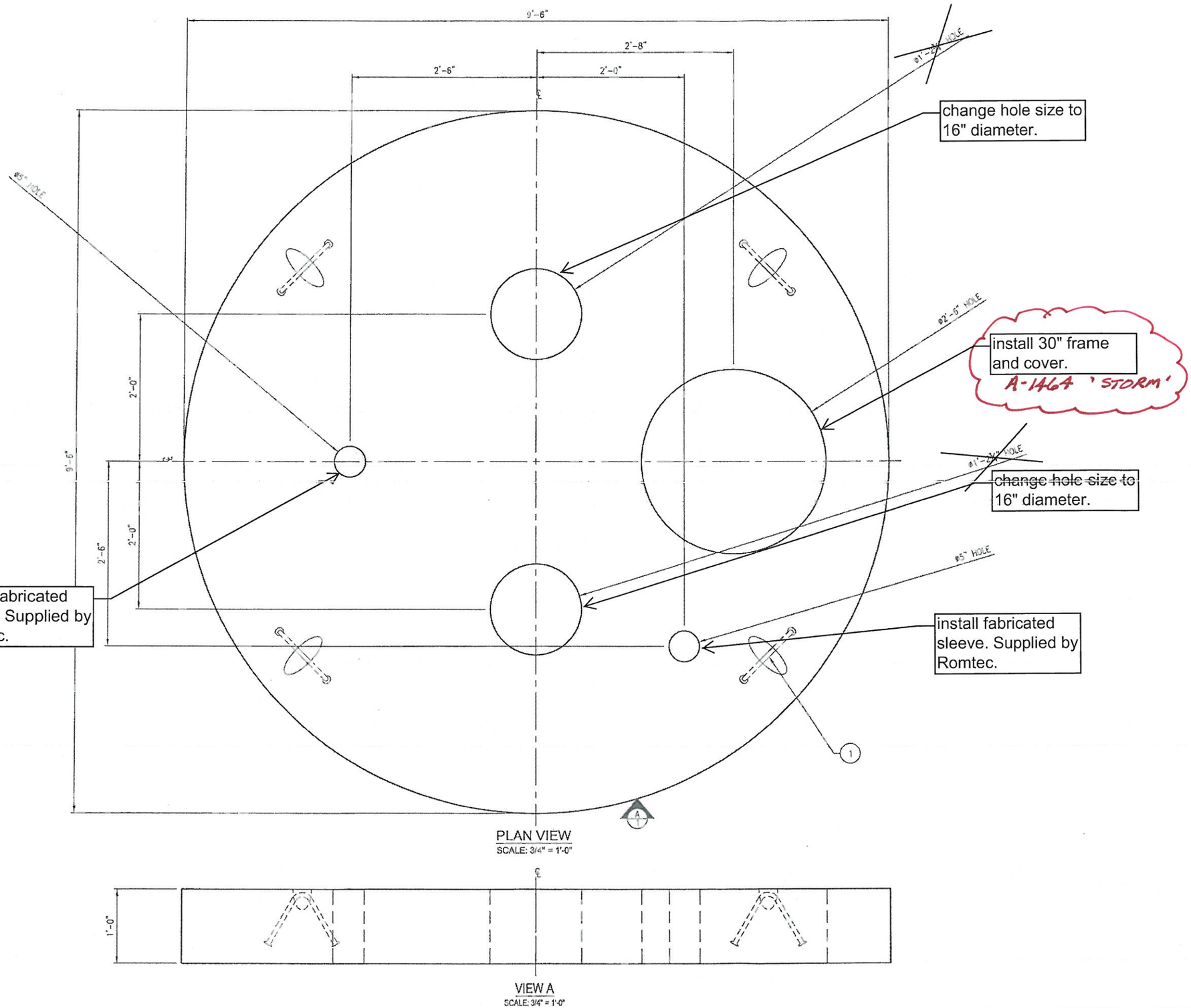
2960 S. HIGHWAY 99
STOCKTON, CA. 95215-8047

(209) 466-4212
FAX: (209) 466-2552

A DIVISION OF
Oldcastle™
PRECAST, INC.

96" DIA. REINFORCED MANHOLE RISER
9" WALL , UP TO 6' LONG
CONFORMS TO: ASTM C478

DRAWN	RAS	DATE	04/30/01	WT. 3100#/ft.	DRAWING NO. MH-96
REVISED	QLG		8/23/07	REVISION NO. 5	
				SCALE NO SCALE	SHEET 1 OF 1



PLAN VIEW
SCALE: 3/4" = 1'-0"

VIEW A
SCALE: 3/4" = 1'-0"

STRUCTURAL NOTES:
LOADS:
- H20 TRAFFIC
- 150 PCF CONCRETE DENSITY; 140 PCF SOIL DENSITY
- H20 SURCHARGE: 128 PSF TO 8 FT BELOW GRADE
- SOIL LATERAL LOAD - 140 PCF
- WATER TABLE - 5 FT
- MINIMUM ALLOWABLE SOIL BEARING PRESSURE - 4000 PSF

DESIGN SPECIFICATIONS
- AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"
- ACI-318-08 BUILDING CODE
- ASTM C 478 STANDARD SPECIFICATIONS FOR REINFORCED CONCRETE MANHOLE SECTIONS
- CALTRANS BDS SECTION 5 - CULVERTS

MATERIALS:
- CONCRETE - 28 DAY COMPRESSIVE STRENGTH f'c =6000 PSI
- REBAR - ASTM A 706 GRADE 60
- CEMENT - ASTM C150
- ~~FLY ASH - ASTM C618~~
- WIRE MESH - ASTM A497
- WATER TIGHT GASKETS BETWEEN SECTIONS - ASTM C443

GENERAL NOTES:
1)CONTRACTOR TO:
VERIFY ALL DIMENSIONS AND OPENING LOCATIONS
2)REBAR MAY BE TACK WELDED OR TIED
3)TOLERANCES PER ASTM C 478 STANDARD SPECIFICATIONS FOR REINFORCED CONCRETE MANHOLE SECTIONS
4)ALUMINUM HATCH INTENDED FOR OFF STREET LOCATIONS THAT MAY OCCASIONALLY RECEIVE AASHTO H20 WHEEL LOAD

BOM

#	QTY.	DESCRIPTION	ITEM #
1	4 EA	MEADOW BURKE A-ANCHOR MBA10671	4520150
2		A 706 #4x40' REBAR	5510035
3		A 706 #6x40' REBAR	5510075
4		6,000psi STD CONCRETE	5010050

WEIGHTS / CONCRETE YD³

SECTION	WEIGHT
TOP SLAB	9,830 LBS / 2.370 CYD

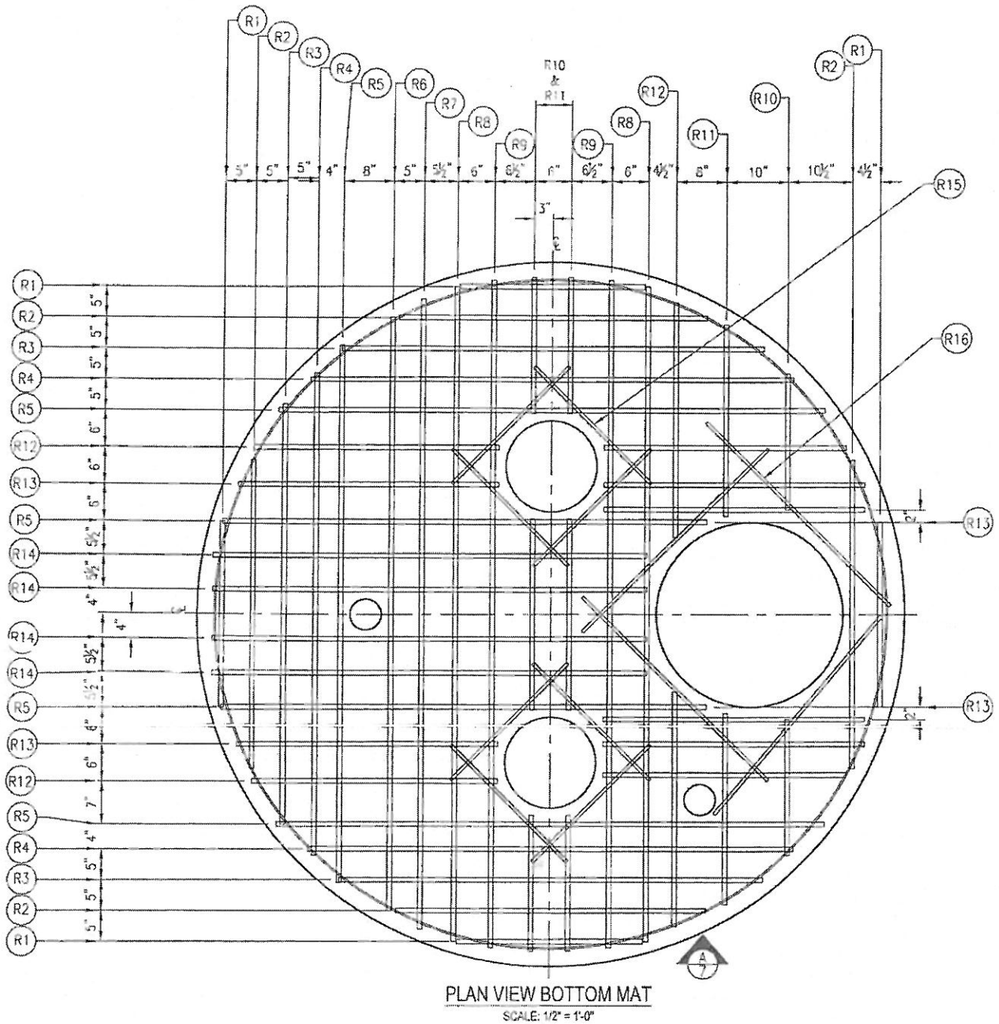
Oldcastle Precast®
2900 E. HIGHWAY 99 STOCKTON, CA 95215
PHONE: 209-466-4212 FAX: 209-466-0788

9'-6"Ø (O.D.) PRECAST TOP SLAB
SLAB FOR 8Ø WET WELL
MIRALOMA RECHARGE BASIN
MIRALOMA, CA

CUSTOMER
ROMTEC

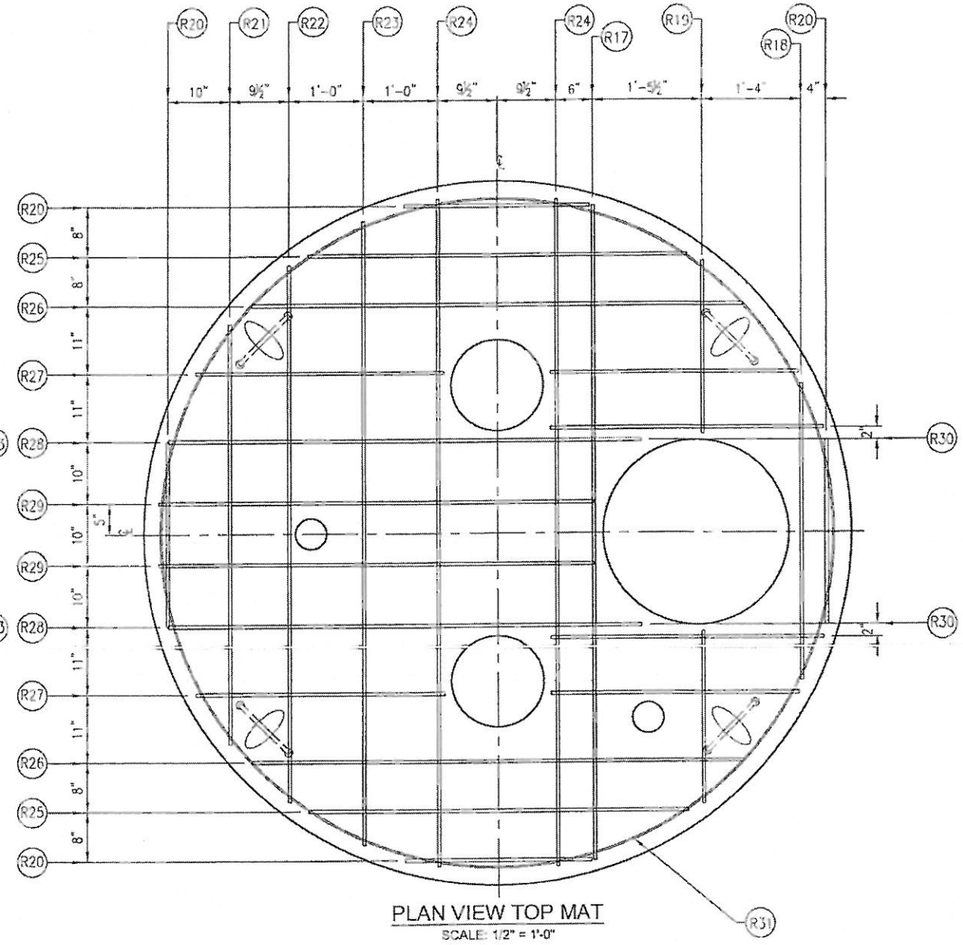
DATE	SALES	DRAWN	ENGINEER	CHECKED	SALES ORDER
9/14/11	SD	VK	JM	JM	S144443

DRAWING NUMBER: 030-S144443-001
REVISION: REV DATE —
SHEET: 1 OF 1



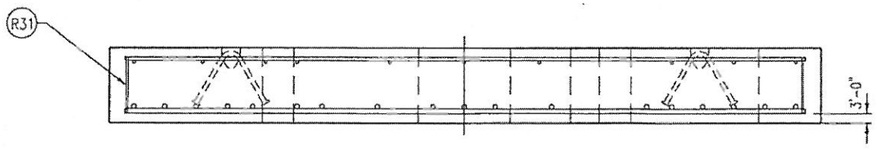
PLAN VIEW BOTTOM MAT

SCALE: 1/2" = 1'-0"



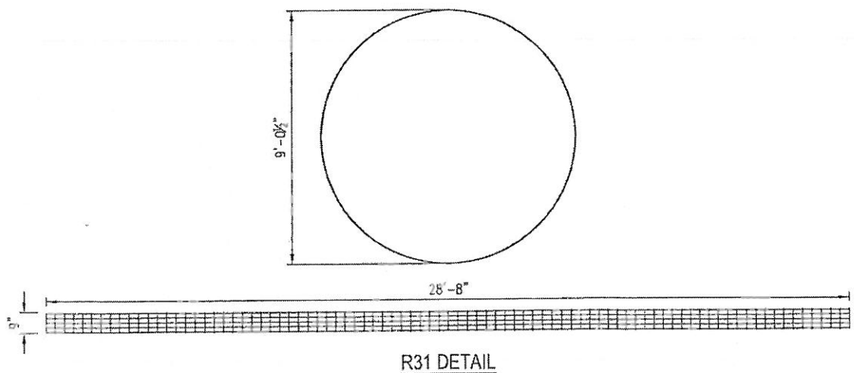
PLAN VIEW TOP MAT

SCALE: 1/2" = 1'-0"



VIEW A

SCALE: 1/2" = 1'-0"



R31 DETAIL

SCALE: 3/16" = 1'-0"

REBAR CUT LIST

R#	QTY.	MATERIAL	LENGTH
R1	4	#6 REBAR	2'-6"
R2	4	#6 REBAR	4'-2"
R3	3	#6 REBAR	5'-8"
R4	5	#6 REBAR	6'-6"
R5	3	#6 REBAR	7'-3"
R6	1	#6 REBAR	8'-0"
R7	1	#6 REBAR	8'-6"
R8	2	#6 REBAR	8'-10"
R9	2	#6 REBAR	9'-0"
R10	6	#6 REBAR	1'-10"
R11	4	#6 REBAR	2'-7"
R12	6	#6 REBAR	3'-3"
~~R13~~	~~5~~	~~#6 REBAR~~	~~2'-2"~~
R14	4	#6 REBAR	5'-11"
R15	8	#4 REBAR	2'-3"
R16	4	#4 REBAR	3'-6"
R17	1	#4 REBAR	8'-10"
R18	1	#4 REBAR	4'-0"
R19	2	#4 REBAR	2'-4"
R20	4	#4 REBAR	2'-6"
R21	1	#4 REBAR	5'-8"
R22	1	#4 REBAR	7'-3"
R23	1	#4 REBAR	8'-5"
R24	2	#4 REBAR	9'-0"
R25	2	#4 REBAR	5'-1"
R26	2	#4 REBAR	6'-7"
R27	4	#4 REBAR	3'-4"
R28	2	#4 REBAR	6'-4"
R29	2	#4 REBAR	5'-10"
R30	2	#4 REBAR	3'-8"
R31	1	2X2 MESH	21.5 SQ FT

BAR SIZE	WEIGHT
#4	112 LBS
#6	354 LBS
2X2-D3.5XW2	27 LBS

Oldcastle Precast®
2980 E HIGHWAY 99 STOCKTON, CA 95215
PHONE: 209-462-4212 FAX: 209-480-2952

9'-6"Ø (O.D.) PRECAST TOP SLAB

MIRALOMA RECHARGE BASIN
MIRALOMA, CA

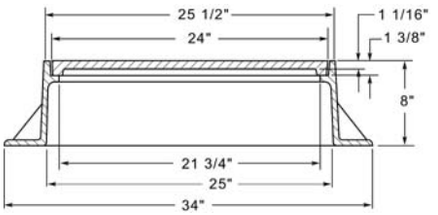
CUSTOMER
ROMTEC

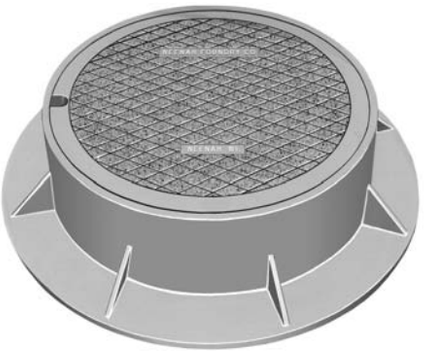
DATE	SALES	DRAWN	ENGINEER	CHECKED	SALES ORDER
9/14/11	SD	VK	JM	JM	S144443

DRAWING NUMBER	REVISION / REV. DATE	SHEET
030-S144443-001	--- / ---	7 OF 1

R-1555
Manhole Frame, Solid Lid

Heavy Duty

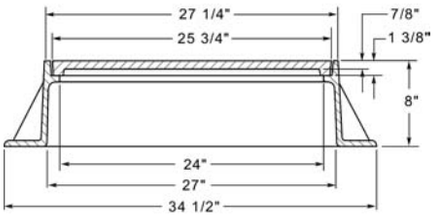




Available Grate: **R-2555**

R-1556
Manhole Frame, Solid Lid

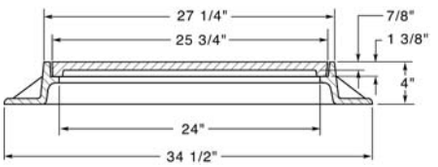
Heavy Duty

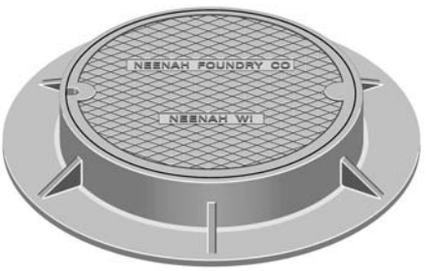


Available Grate: **R-2556**

R-1556-A
Manhole Frame, Solid Lid

Heavy Duty

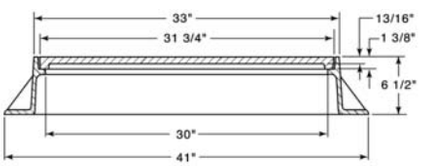


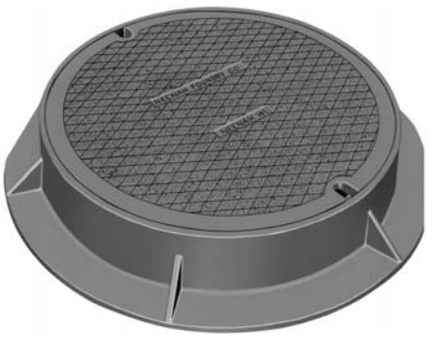


Available Grate: **R-2556-A**

R-1557
Manhole Frame, Solid Lid

Heavy Duty





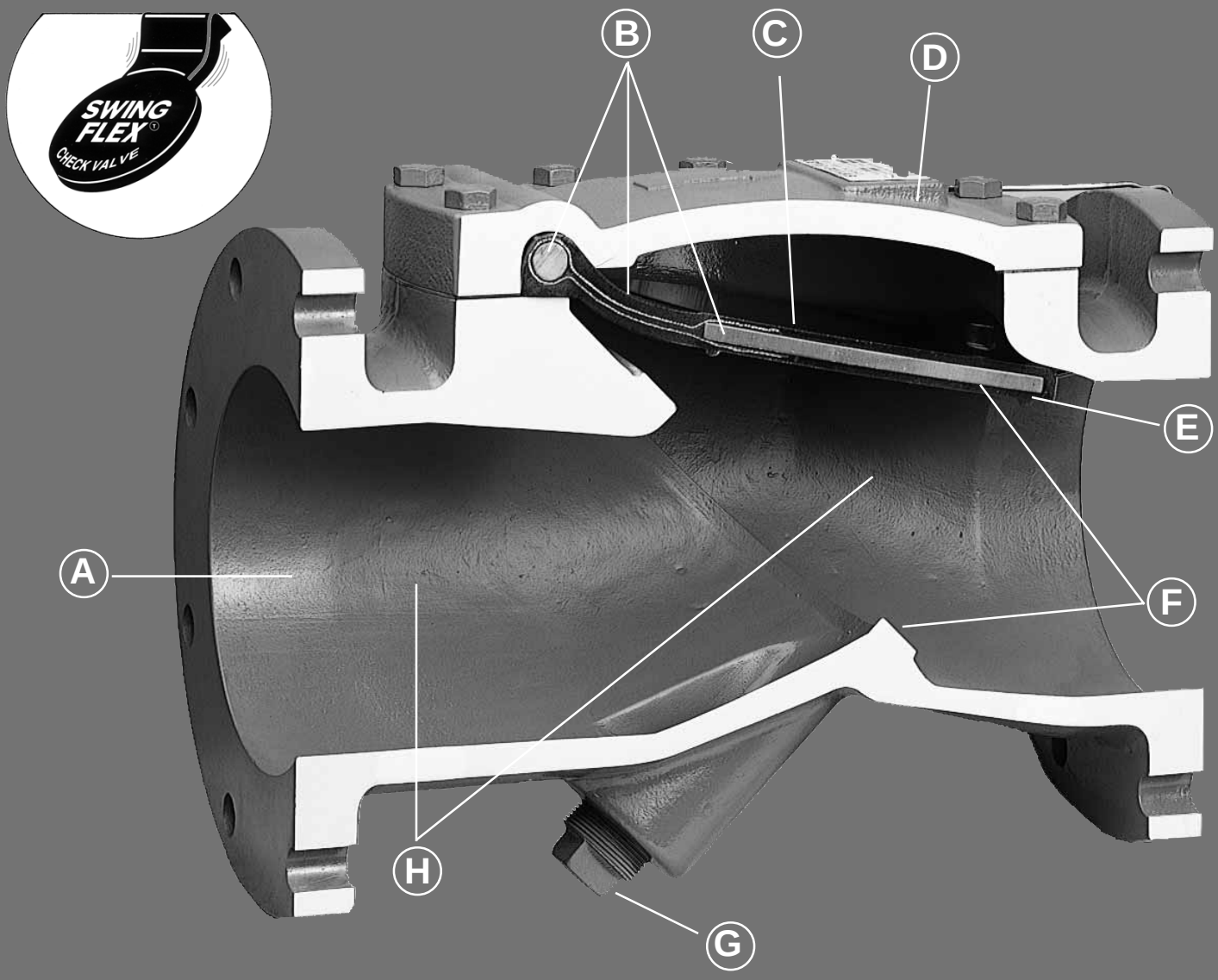
Available Grate: **R-2557**

BULLETIN 500

VAL-MATIC®

SWING FLEX® CHECK VALVE

EFFICIENCY & RELIABILITY THROUGH SIMPLICITY OF DESIGN



A. 100% FLOW AREA
For improved flow characteristics and lower head loss, the Val-Matic *Swing Flex*™ Check Valve provides 100% unrestricted flow area.

B. REINFORCED DISC
The one piece precision molded disc is steel and nylon reinforced to provide years of trouble free performance. (Tested for proof of design—see page 4).

C. ONE MOVING PART
The *Memory-Flex*™ disc, the only moving part, assures long life with minimal maintenance. No packing or O-rings, mechanical hinges, pivot pins or bearings to wear out.

D. DOMED ACCESS PORT
Full size top access port allows removal of disc without removing valve from line.

E. DROP TIGHT SEATING
The synthetic reinforced disc, with its integral O-ring type seal design, assures positive seating at high and low pressures.

F. NON-SLAM CLOSURE
"Short Disc Stroke" combined with *Memory-Flex*™" Disc Action reduces potentially destructive water hammer.

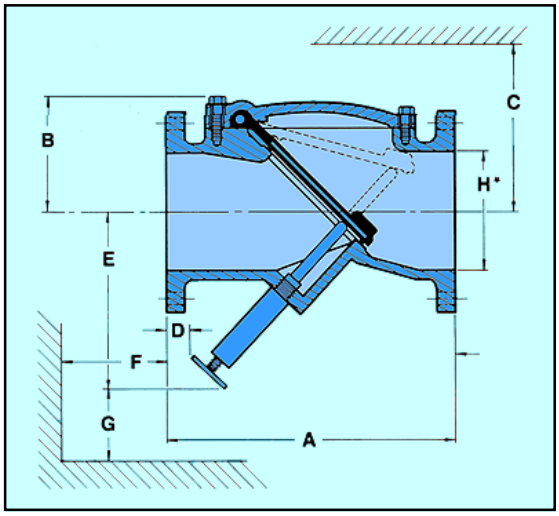
G. BACKFLOW ACTUATOR
The body is drilled and tapped for field installation of the optional backflow actuator (see options).

H. NON-CLOG DESIGN
The unrestricted full flow area combined with smooth streamlined contouring allows passage of large solids minimizing the potential for clogging.

INSTALLATION DIMENSIONS AND CONSTRUCTION

VALVE SIZE	MODEL NO.	A	B	○ C	▽ D	E	□ F	□ G
2	502	8	3 3/8	8 3/8	— 1/2	6 3/8	7/8	1 1/2
2 1/2	525	8 1/2	3 3/8	8 3/8	— 1/2	6 3/8	5/8	1 1/2
3	503	9 1/2	3 7/8	9	— 3/8	7 1/2	3/4	1 3/4
4	504	11 1/2	4 5/8	9 5/8	1 1/2	7 1/4	2 5/8	2 5/8
5	505	13 3/4	5 1/8	10 1/4	1 3/4	10 7/8	5 1/4	2 3/4
6	506	15	5 7/8	11	2	13	6 1/4	3 1/4
8	508	19 1/2	7 5/8	13 3/4	3	16 1/2	7 1/2	4 1/4
10	510	24 1/2	9 7/8	16	4	19 1/4	8	5 1/4
~~12~~	~~512~~	~~27 1/2~~	~~11 3/8~~	~~18 1/2~~	~~3 1/2~~	~~22 1/2~~	~~10~~	~~6 1/2~~
14	514	31	13 3/8	20 1/2	4	26 1/4	11 5/8	7 1/2
16	516	32	15 3/8	23 1/2	4 5/8	30	13 1/4	8 5/8
18	518	36	17 1/8	25 1/4	5 1/4	33 3/4	15	9 3/4
20	520	40	19 1/8	29 1/4	5 7/8	37 1/2	16 5/8	10 7/8
24	524	48	22 3/4	32 3/4	7	45	20	13

○ Dimension "C" represents the clearance required to remove access cover.
▽ Dimension "D" extends PAST flange on valve sizes 4" thru 24".
□ Dimensions "F" & "G" represent the clearance required to remove backflow actuator.



*Dimension "H" represents nominal valve size.

Note: Flanged ends conform to ANSI B16.1 Class 125.

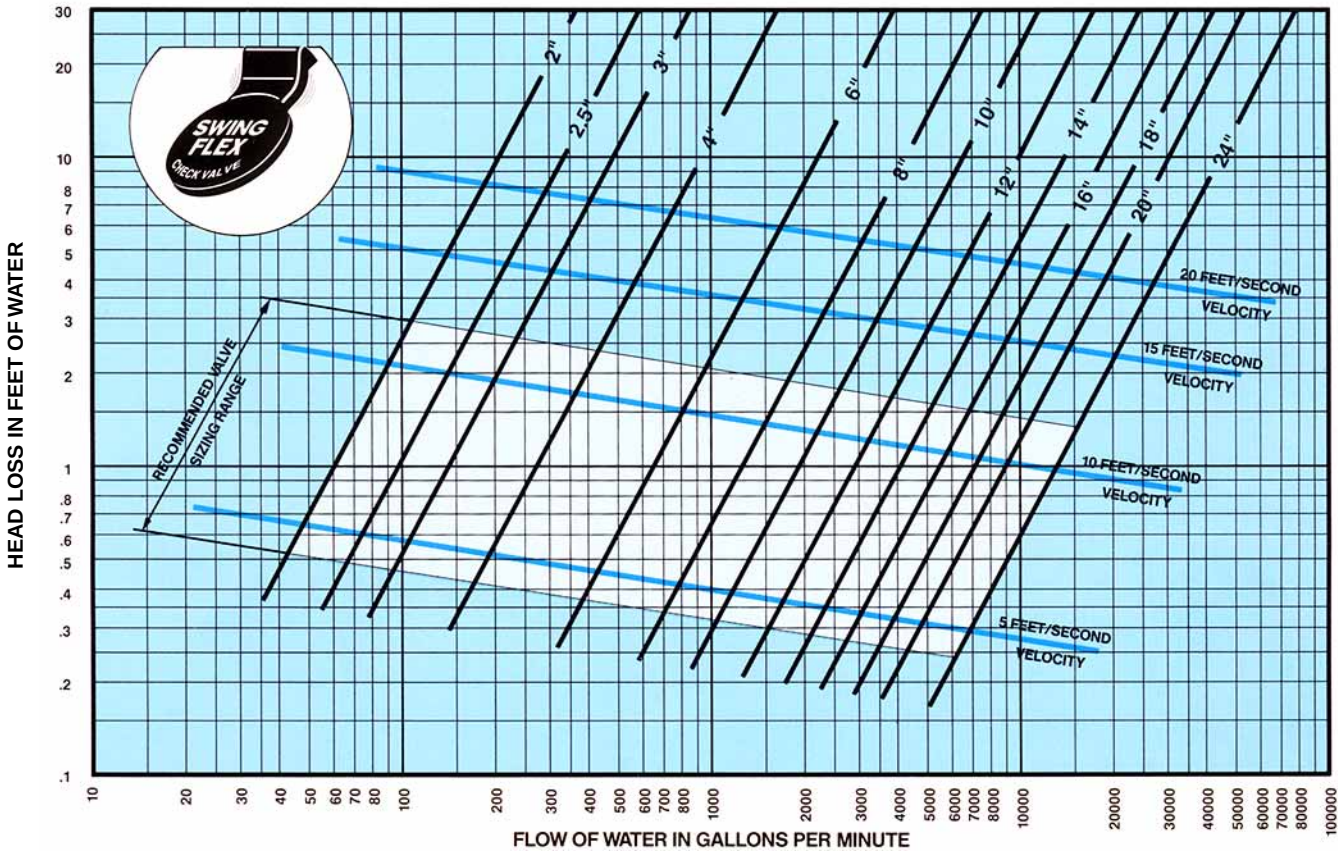
MATERIALS OF CONSTRUCTION			
Component		Standard	Optional
Body and Cover		Cast Iron ASTM A126, Class B	Ductile Iron, Bronze
Disc		Buna-N (NBR), ASTM D2000-BG	Viton (FPM), ASTM D2000-HK
Coatings	Interior	Epoxy	Rubber Lining
	Exterior	Universal Primer	Consult Factory

Consult factory for additional material and coating options.

ANSI MAXIMUM PRESSURE-TEMPERATURE RATING		
Maximum Non-Shock Working Pressure (P.S.I.) ANSI Class 125		
Temperature ° F	2" - 12"	14" - 24"
100°	200	150
150°		
200°	190	135
Hydrostatic Test Pressures	300	230

For Higher Temperatures Consult Factory

HEAD LOSS CHART



(Consult Factory for Air or Gas Service)

SAMPLE SPECIFICATIONS

The check valve shall be of the ***Swing Flex***™ full body flanged type, with a domed access cover and only one moving part, the valve disc.

The valve body shall have full flow equal to nominal pipe diameter at any point, through the valve. The seating surface shall be on a 45° angle to minimize disc travel. The top access port shall be full size, allowing removal of the disc without removing the valve from the pipeline. The access cover shall be domed in shape, to allow the disc to be fully operational in lines containing a high solids content.

The disc shall be of one piece construction, precision molded with an integral O-ring type sealing surface and contain steel and nylon reinforcements in both the ***Memory-Flex***™ and central disc areas. The flex portion of the disc shall be warranted for twenty-five years. Non-slam closing characteristic shall be provided through a short 35° disc stroke and a ***Memory-Flex***™ disc return action.

Backflow capabilities shall be available by means of an optional screw type backflow actuator. The actuator shall be field installable without modification to the valve, a need for special tools or removal of the valve from line.

The valve body and cover shall be ASTM A126, Class B cast iron.

The disc shall be Buna-N (NBR), ASTM D2000-BG.

The interior of the valve shall be coated with an epoxy suitable for potable water. The exterior shall be coated with a universal primer.

The valve shall be cycle tested 1,000,000 times with no signs of wear or distortion to the valve disc or seat and shall remain drop tight at both high and low pressures. The test results shall be independently certified.

The valve shall be series 500 as manufactured by Val-Matic Valve and Manufacturing Corporation or approved equal.

QUALITY ASSURANCE

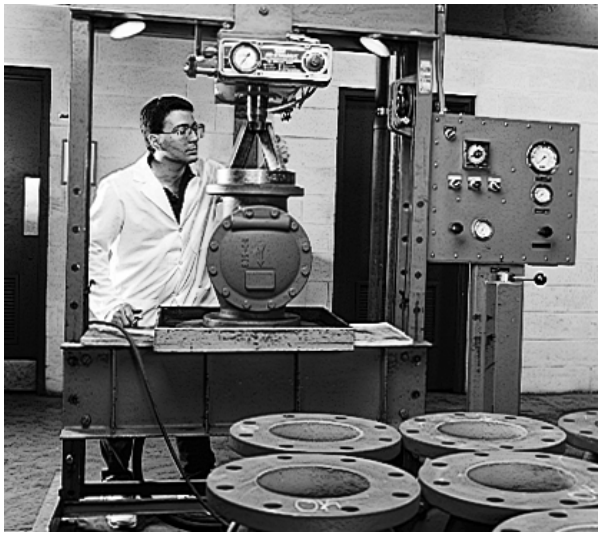
Quality Assurance at Val-Matic is the sum total of imaginative design, solid engineering, careful manufacturing and dedicated people, all combining to insure customer satisfaction. We recognize the need for, and encourage, individual pride and the self-satisfaction which is gained in producing sound, durable valves. This quality attitude permeates the corporation from the president through our newest employee.

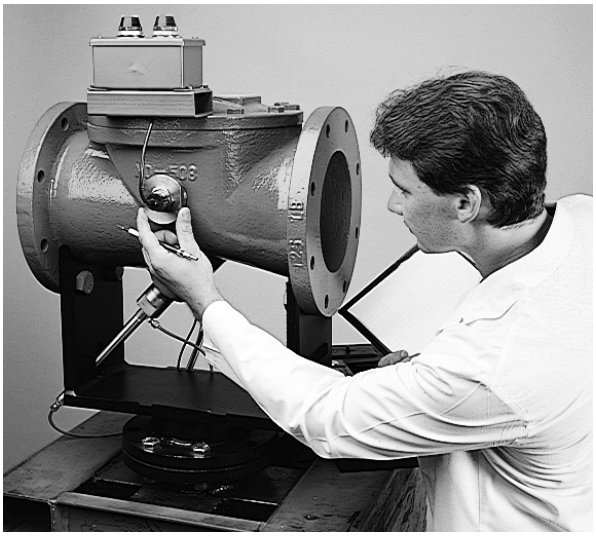
INDEPENDENT PROOF OF DESIGN TEST

In the case of the Val-Matic ***Swing Flex***™ Check Valve, we have taken quality assurance one step further by having the valve cycle tested. Utilizing an eight-inch ***Swing Flex***™ with optional signal switch, the valve was cycled over 1,000,000 (one million) times. To place one million (1,000,000) cycles in perspective, it would take an average of 100 cycles per day for more than twenty-seven years to equal 1,000,000 cycles. Upon conclusion, PSI/Pittsburgh Testing Laboratory Division reported the following results:

1. After 1,000,000 cycles the valve's disc showed no signs of wear or distortion. The flexible hinge area showed no signs of fatigue or stress cracks.
2. After 1,000,000 cycles the valve seating areas showed no signs of wear or distortion. The valve seating remained drop tight during the low and high pressure hydrostatic tests.
3. After 1,000,000 cycles the signal switch continued to function as designed.

Copies of the PSI/Pittsburgh Testing Laboratory Division report are available upon request.





EFFICIENCY... RELIABILITY ...BY DESIGN

Providing efficiency and reliability through simplicity of design is the key to the superior performance and long life of the Val-Matic ***Swing Flex***™ Check Valve.

ENERGY EFFICIENT...*BY DESIGN*
The streamline contour of the ***Swing Flex***™ body provides 100% flow area with no restrictions at any point through the valve (Figure 1). Flow tests performed by an independent laboratory have shown that this unique body design produces minimal head loss through the valve.

Flow and head loss charts, developed from the test data, are shown on page 3.

DISC STABILIZATION...*BY DESIGN*
In the full open position, the disc is stabilized by using body contouring to ease the direction of flow towards the disc assuring long disc life (Figure 1).

NON-CLOGGING... *BY DESIGN*
Clog resistant performance is achieved by maintaining an unobstructed 100% flow area, smooth streamline body contouring and the simplicity of one moving part. The entrapment or hang-up of solids and stringy materials is minimized by the elimination of mechanical devices in the valve design.

Figure 1

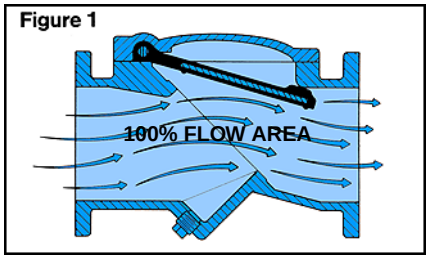


Figure 2 CONVENTIONAL SWING CHECK VALVE

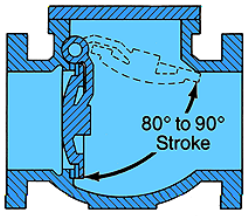
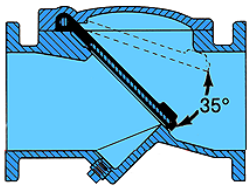


Figure 3 VAL-MATIC SWING FLEX™ VALVE

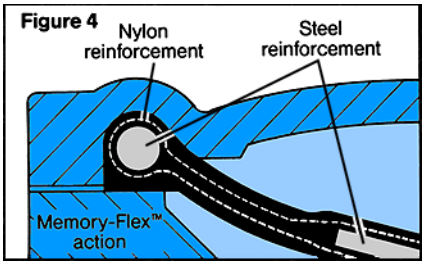


NON-SLAM CLOSING...*BY DESIGN*
The non-slam closing characteristic of the ***Swing Flex***™ Check Valve is achieved by utilizing a "Short Disc Stroke" in conjunction with the unique "***Memory-Flex***™ action" of the valve's disc. The 35° stroke, resulting from the angled seat, is less than half the typical 80° to 90° stroke of a conventional swing check valve (Figures 2 & 3). This feature is similar to that found in high performance tilted disc check valves. The considerable shorter disc stroke of the ***Swing Flex***™ valve, combined with the inherent "***Memory-Flex***™ action" of the disc (Figure 4), acts to reduce the closing time of the valve. This reduced closing time minimizes flow reversal and the resultant water hammer normally associated with the sudden stop of a reverse flow.

RELIABILITY... *BY DESIGN*
Operational reliability is achieved by utilizing only one moving part, the ***Memory-Flex***™ disc.

Extended life is designed into the disc by the inclusion of steel and nylon reinforcements. The steel and nylon are precision molded into the disc, providing a tough durable disc with a twenty-five year warranty* (Figure 4).

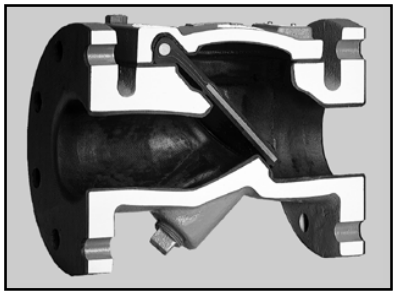
Figure 4



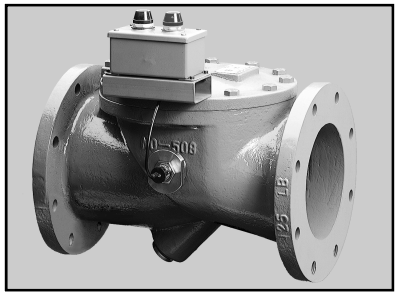
Unlike a conventional horizontal swing check valve, the ***Swing Flex***™ has no packing or O-rings, mechanical hinges, shafts, pivot pins, or bearings to wear out (Figure 4). To prove the point, we had the valve cycle tested 1,000,000 (one million) times. Upon conclusion of the test, the independent testing laboratory reported that the valve had no visible signs of wear and remained drop tight. (See page 4.)

POSITIVE SHUT OFF...*BY DESIGN*
The ***Memory-Flex***™ disc with its integral O-ring type seal design assures drop tight seating at both high and low working pressures. Each and every valve is tested to this standard. A certified report is available upon request.

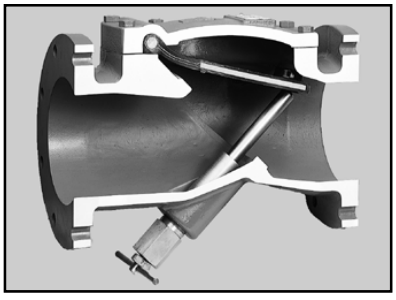
OPTIONAL ACCESSORIES



RUBBER LINING
The Val-Matic ***Swing Flex***™ Check Valve is designed to accept synthetic or natural rubber lining unlike conventional swing check valves. Body lining coupled with the synthetic ***Memory-Flex***™ disc makes the ***Swing Flex***™ ideally suited for systems containing abrasive or corrosive fluids.



SIGNAL SWITCH
A SCADA (Supervisory Control and Data Acquisition) compatible signal switch is available for applications requiring open/ close indication. The switch can be connected to optional signal lights on the valve, to a pump control panel, or to a SCADA system.



BACKFLOW ACTUATOR
A backflow actuator is available for use when manual backflow operation is required. It is most commonly used for priming pumps, backflushing, draining lines, and system testing. The Val-Matic Backflow Actuator can be installed at the factory or easily field mounted by system operators without the need for special tools or removal of the valve from the line.

*The Val-Matic warranty and its remedies are available for 25 years covering the flex portion of the disc.

SWING-FLEX® CHECK VALVE

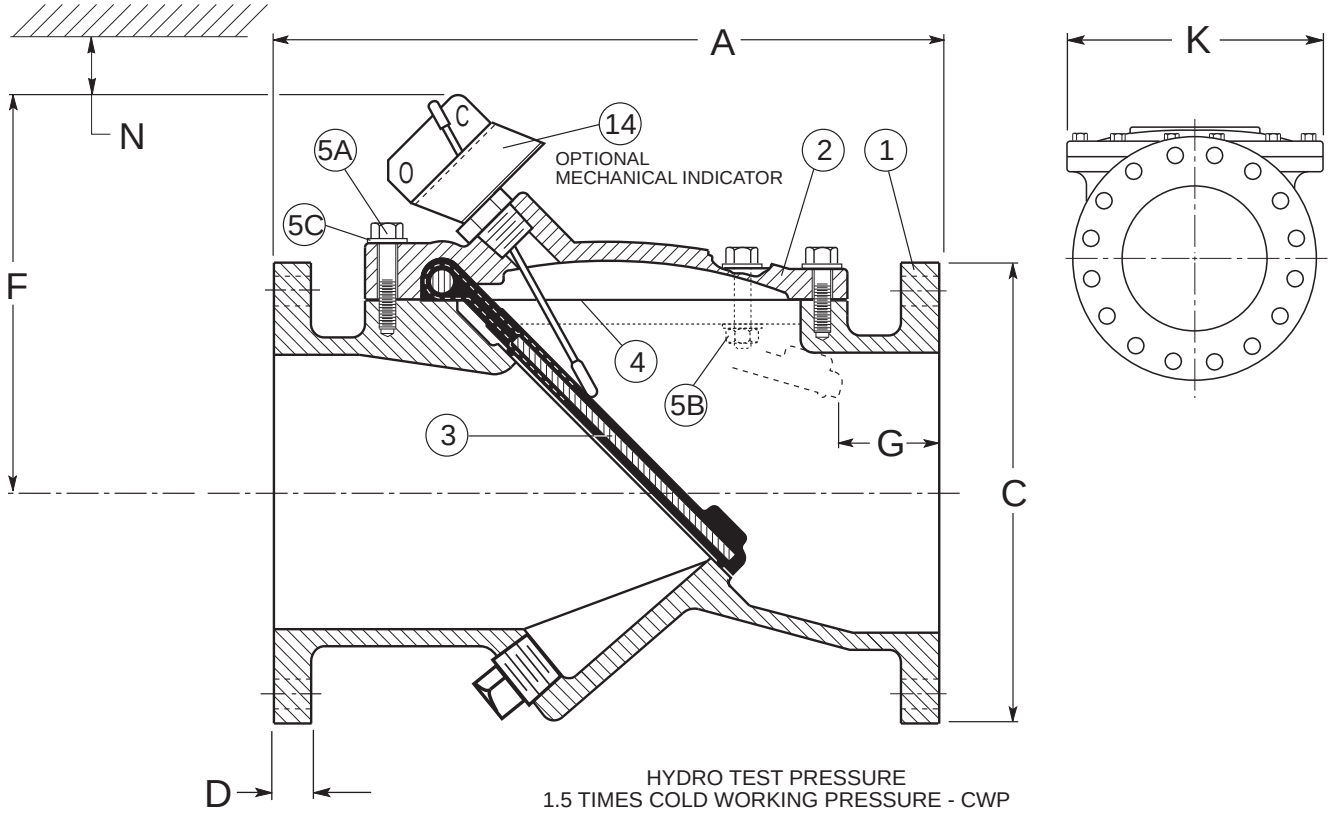
SERIES NO. 500BFMI & 500ABFMI ANSI CLASS 125

STANDARD MATERIALS OF CONSTRUCTION

PART NO.	PART NAME	MATERIAL
1	BODY BODY	DUCTILE IRON ASTM A536, GRADE 65-45-12 (SERIES 500A) CAST IRON ASTM A126, CLASS B (SERIES 500)
2	COVER COVER	DUCTILE IRON ASTM A536, GRADE 65-45-12 (SERIES 500A) CAST IRON ASTM A126, CLASS B (SERIES 500)
3	DISC	BUNA-N W/ ALLOY STEEL & NYLON REINFORCEMENT
4	COVER SEAL (4”-12”) COVER SEAL (2”-3”, 14”-42”)	BUNA-N COMPRESSED NON-ASBESTOS FIBER
5A	COVER BOLT	ALLOY STEEL SAE GRADE 5, PLATED
5B	COVER BOLT NUT (4”-12”)	ALLOY STEEL, PLATED
5C	WASHER	ALLOY STEEL, PLATED
6	BACKFLOW ACTUATOR (OPTIONAL)	BRASS
14	MECHANICAL INDICATOR (OPTIONAL, SIZES 3”-42”)	STAINLESS STEEL, TYPE 316

NOTE: ALL SPECIFICATIONS AS LAST REVISED.

MATERIALS OF CONSTRUCTION	DATE 11/17/08
VAL-MATIC® VALVE AND MANUFACTURING CORP.	DRWG. NO. VM-502ABFMI-M



HYDRO TEST PRESSURE
1.5 TIMES COLD WORKING PRESSURE - CWP

NOTE

DIMENSION "N" REPRESENTS THE MINUMUM CLEARANCE REQUIRED TO REMOVEOR INSTALL MECHANICAL INDICATOR.

SEE DRAWING NO. VM-503AMI-M FOR STANDARD MATERIALS OF CONSTRUCTION.

ANSI CLASS 125												
VALVE SIZE	MODEL NO.	CWP (PSI)	A	C	D	F	G	K	N	BOLT SIZE	NO. OF BOLTS	SHPG WT.
3	503AMI	250	9.50	7.50	0.75	7.63	1.63	7.50	2.00	5/8	4	45
4	504AMI	250	11.50	9.00	0.93	8.25	2.12	8.25	2.00	5/8	8	70
6	506AMI	250	15.00	11.00	1.00	9.38	2.12	11.12	2.00	3/4	8	130
8	508AMI	250	19.50	13.50	1.12	11.00	2.88	16.00	3.25	3/4	8	250
10	510AMI	250	24.50	16.00	1.18	13.38	3.12	21.00	3.25	7/8	12	430
12	512AMI	250	27.50	19.00	1.25	15.00	3.43	24.00	4.50	7/8	12	660
14	514AMI	250	31.00	21.00	1.38	17.63	3.63	23.25	4.50	1	12	750
16	516AMI	250	32.00	23.50	1.43	18.88	3.25	25.25	4.50	1	16	900
18	518AMI	250	36.00	25.00	1.56	20.00	3.12	28.25	4.50	1 1/8	16	1230
20	520AMI	250	40.00	27.50	1.68	21.38	3.50	30.63	7.75	1 1/8	20	1750
24	524AMI	250	48.00	32.00	1.88	23.88	5.00	36.00	7.75	1 1/4	20	2400
30	530MI	150	56.00	38.75	2.13	27.63	5.75	45.88	8.00	1 1/4	28	5110
30	530AMI	250	56.00	38.75	2.13	27.63	5.75	45.88	8.00	1 1/4	28	5110
36	536MI	150	63.00	46.00	2.38	31.00	3.88	55.00	8.00	1 1/2	32	6700
36	536AMI	250	63.00	46.00	2.38	31.00	3.88	55.00	8.00	1 1/2	32	6700
42	542MI	150	70.00	53.00	2.63	39.12	0.12	60.18	8.00	1 1/2	36	9110
42	542AMI	250	70.00	53.00	2.63	39.12	0.12	60.18	8.00	1 1/2	36	9110

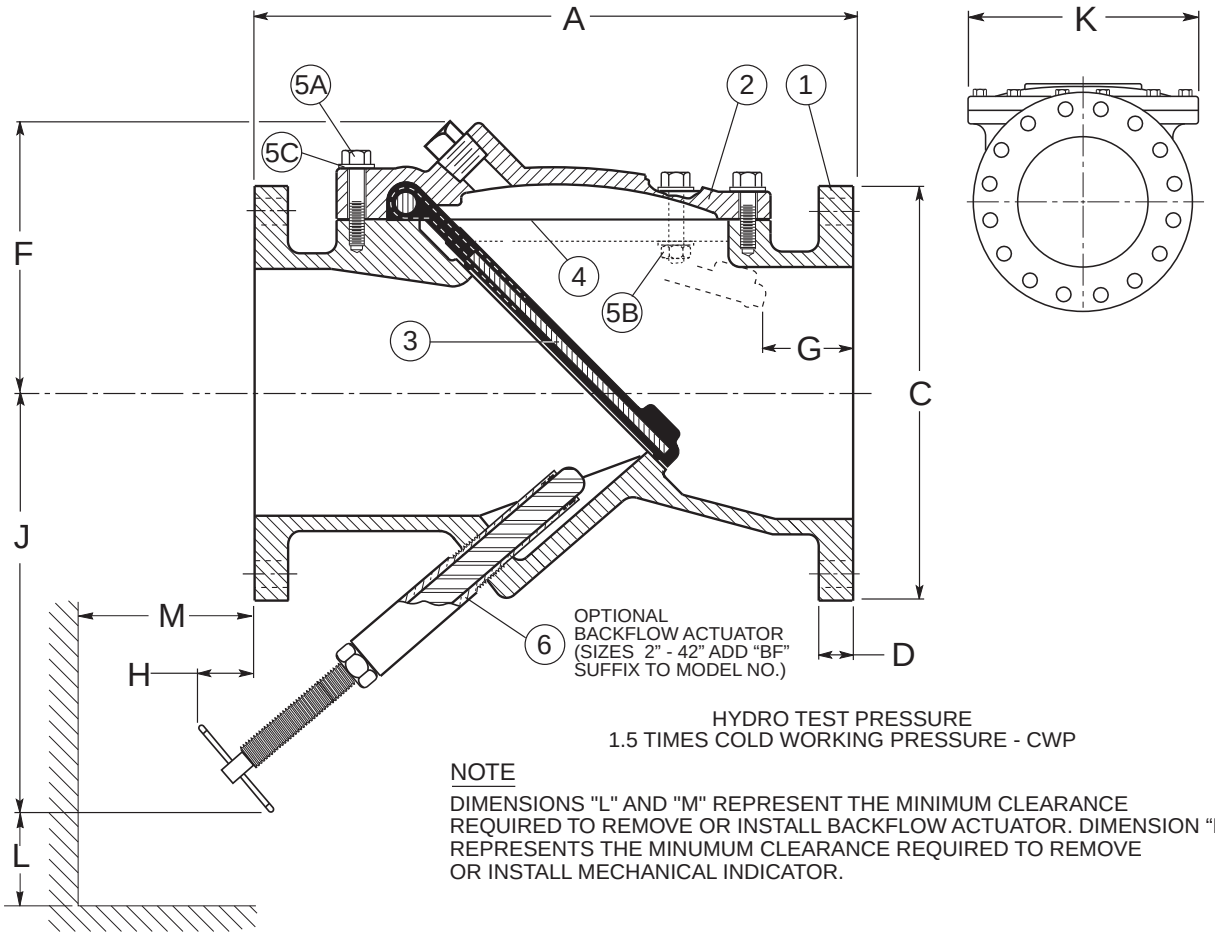
Revised 2-10-09

SWING-FLEX® CHECK VALVE W/ INDICATOR

DATE 8-13-08

VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. VM-503AMI



HYDRO TEST PRESSURE
1.5 TIMES COLD WORKING PRESSURE - CWP

NOTE

DIMENSIONS "L" AND "M" REPRESENT THE MINIMUM CLEARANCE REQUIRED TO REMOVE OR INSTALL BACKFLOW ACTUATOR. DIMENSION "N" REPRESENTS THE MINUMUM CLEARANCE REQUIRED TO REMOVE OR INSTALL MECHANICAL INDICATOR.

SEE DRAWING NO. VM-502ABF-M FOR STANDARD MATERIALS OF CONSTRUCTION.

ANSI CLASS 125

VALVE SIZE	MODEL NO.	CWP (PSI)	A	C	D	F	G	*H	J	K	L	M	BOLT SIZE	NO.OF BOLTS	SHPG. WT.
2	502ABF	250	8.00	6.00	0.63	3.38	1.63	-0.50	6.75	5.18	1.50	1.50	5/8	4	27
2 1/2	525ABF	250	8.50	7.00	0.68	3.38	1.63	-0.50	7.00	5.18	1.50	1.50	5/8	4	32
3	503ABF	250	9.50	7.50	0.75	5.12	1.63	-0.38	7.50	7.50	1.50	1.50	5/8	4	45
4	504ABF	250	11.50	9.00	0.93	5.75	2.12	3.38	10.75	8.25	2.50	2.50	5/8	8	70
6	506ABF	250	15.00	11.00	1.00	6.88	2.12	1.38	11.38	11.12	3.00	3.00	3/4	8	130
8	508ABF	250	19.50	13.50	1.12	8.38	2.88	2.00	15.75	16.00	5.75	5.75	3/4	8	250
10	510ABF	250	24.50	16.00	1.18	10.75	3.12	0.50	17.00	21.00	5.75	5.75	7/8	12	430
12	512ABF	250	27.50	19.00	1.25	12.50	3.43	3.50	22.50	24.00	6.50	6.50	7/8	12	660
14	514ABF	250	31.00	21.00	1.38	13.00	3.63	4.00	26.25	23.25	6.50	6.50	1	12	750
16	516ABF	250	32.00	23.50	1.43	14.25	3.25	4.63	30.00	25.25	6.50	6.50	1	16	900
18	518ABF	250	36.00	25.00	1.56	15.25	3.12	5.25	33.75	28.25	6.50	6.50	1 1/8	16	1230
20	520ABF	250	40.00	27.50	1.68	16.88	3.50	5.88	37.50	30.63	8.00	8.00	1 1/8	20	1750
24	524ABF	250	48.00	32.00	1.88	19.25	5.00	7.00	45.00	36.00	8.00	8.00	1 1/4	20	2400
30	530BF	150	56.00	38.75	2.12	23.00	5.75	-0.63	41.25	45.88	8.00	8.00	1 1/4	28	5110
30	530ABF	250	56.00	38.75	2.12	23.00	5.75	-0.63	41.25	45.88	8.00	8.00	1 1/4	28	5110
36	536BF	150	63.00	46.00	2.38	27.38	3.88	-.38	49.00	55.00	9.75	9.75	1 1/2	32	6700
36	536ABF	250	63.00	46.00	2.38	27.38	3.88	-.38	49.00	55.00	9.75	9.75	1 1/2	32	6700
42	542BF	150	70.00	53.00	2.63	36.88	0.12	-5.50	53.50	60.18	9.75	9.75	1 1/2	36	9110
42	542ABF	250	70.00	53.00	2.63	36.88	0.12	-5.50	53.50	60.18	9.75	9.75	1 1/2	36	9110

* DIMENSION "H" DOES NOT EXTEND PAST FLANGE ON VALVE SIZES 2" THRU 3", 30" THRU 42"

Revised 2-10-09

SWING-FLEX® CHECK VALVE W/ BACKFLOW ACTUATOR

DATE 8-13-08

VAL-MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO. VM-502ABF

Manual No.
SFCV-OM1-2

Swing-Flex® Check Valve

Operation, Maintenance and Installation Manual

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PARTS AND SERVICE	7
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VAL-MATIC'S SWING-FLEX® CHECK VALVE OPERATION, MAINTENANCE AND INSTALLATION

INTRODUCTION

The Swing-Flex® Check Valve has been designed to give years of trouble-free operation. This manual will provide you with the information needed to properly install and maintain the valve and to ensure a long service life. The valve is opened by the fluid flow in one direction and closes automatically to prevent flow in the reverse direction.

An optional backflow actuator may be mounted on the bottom of the valve to allow manual backflow through the valve in the reverse direction.

Optional Mechanical Indicators and Limit Switches may be mounted on the valve cover to provide local and remote position indication.

An oil dashpot may be mounted on the bottom of 6" and larger valves to provide slow closure over the last 10% of travel.

The valve is of the swing check type utilizing an angled seat and fully encapsulated, resilient disc. It is capable of handling a wide range of fluids including flows containing suspended solids. The Size, Flow Direction, Maximum Working Pressure, and Series No. are stamped on the nameplate for reference.

CAUTION:
Do not use valve for line testing at pressures higher than nameplate rating or damage to valve may occur.

The "Maximum Working Pressure" is the non-shock pressure rating of the valve at 150°F. The valve is not intended as an isolation valve for line testing above the valve rating.

RECEIVING AND STORAGE

Inspect valves upon receipt for damage in ship-ment. Unload all valves carefully to the ground without dropping. Do not allow lifting slings or chains to come in contact with the seat area; use eyebolts or rods through the flange holes on large valves.

WARNING
Do not use threaded holes in cover for lifting the valve. Serious injury may result.

Valves should remain crated, clean and dry until installed to prevent weather related damage. For long term storage greater than six months, the rubber surfaces of the disc should be coated with a thin film of FDA approved grease such as Lubriko #CW-606. Do not expose disc to sunlight or ozone for any extended period.

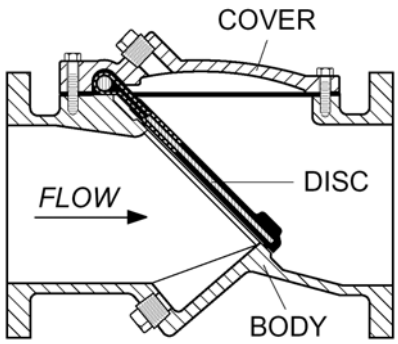


FIGURE 1. SWING FLEX® CHECK VALVE

DESCRIPTION OF VALVE OPERATION

The valve is designed to prevent reverse flow automatically. During system flow conditions, the movement of the fluid forces the disc to the open position allowing 100% un-restricted flow area through the valve. Under reverse flow conditions, the disc automatically returns to the closed position to prevent reverse flow.

Several optional features are a backflow actuator, mechanical indicator, limit switch and bottom oil dashpot. All of these options ship loose of the valve and require field installation.

INSTALLATION

Correct installation of the Swing-Flex® is important for proper operation. It may be installed in either horizontal or vertical flow-up applications. However, when horizontal, the valve must be installed with the nameplate facing up and the cover level. In all installations, the flow arrow cast in the valve cover must be pointed in the direction of flow during normal system operation.

WARNING
Do not use threaded holes in cover for lifting the valve. Serious injury may result.

FLANGED ENDS: Flanged valves can be mated with raised or flat-faced pipe flanges equipped with full-face or ring-type resilient gaskets. The valve and adjacent piping must be supported and aligned to prevent cantilevered stress on the valve. Once the flange bolts or studs are lubricated and inserted around the flange, tighten them uniformly hand tight. The tightening of the bolts should then be done in graduated steps using the **crossover tightening** method. Recommended lubricated torque values for use with resilient gaskets (75 durometer) are given in Table 1. If leakage occurs, allow gaskets to absorb fluid and check torque and leakage after 24 hours. Do not exceed bolt rating or extrude gasket.

CAUTION: The use of ring gaskets or excessive bolt torque may damage valve flanges.

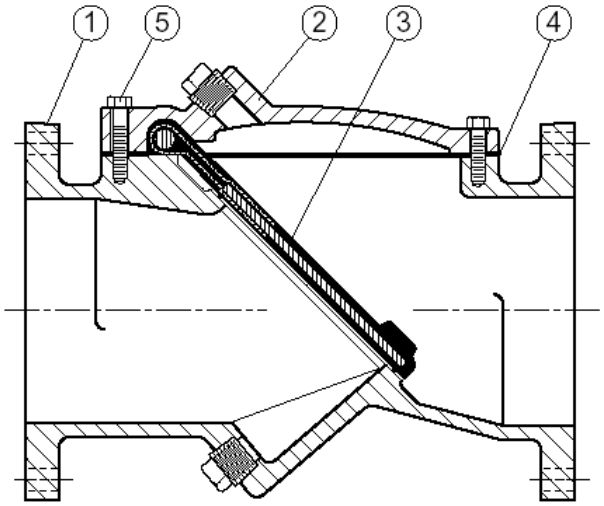
FLANGE BOLTS

VALVE SIZE (in)	BOLT DIA (in)	RECOM. TORQUE (ft-lbs)	MAX. TORQUE (ft-lbs)
3	5/8	25	90
4	5/8	25	90
6	3/4	30	150
8	3/4	40	150
10	7/8	45	205
12	7/8	65	205
14	1	80	300
16	1	80	300
18	1 1/8	100	425
20	1 1/8	100	425
24	1 1/4	150	600
30	1 1/4	160	600
36	1 1/2	300	900

TABLE 1. FLANGE BOLT TORQUES

VALVE CONSTRUCTION

The standard Swing-Flex® Check Valve is constructed of rugged cast iron with a rubber encapsulated disc. See the specific Materials List submitted for the order if other than standard cast iron construction. The disc is the only moving part assuring long life with minimal maintenance. The general details of construction are illustrated in Figure 2. The body (1) is flanged for connection to the pipeline with an open top sealed with a cast cover (2). The disc (3) is retained by the cover.



ITEM	DESCRIPTION	MATERIAL
1	Body	Cast Iron
2	Cover	Cast Iron
3	Disc*	Steel With Buna-N Facing
4	Gasket*	Non-Asbestos
5	Cover Bolt	Alloy Steel

*RECOMMENDED SPARE PART

FIGURE 2. CHECK VALVE CONSTRUCTION

MAINTENANCE

The Swing Flex® Check Valve requires no scheduled lubrication or maintenance. For service or inspection, the valve can be serviced without removal from the line.

VALVE INSPECTION: If inspection of the valve is required, follow the Disassembly Instructions given on page 3.

TROUBLESHOOTING

Several problems and solutions are presented below to assist you in troubleshooting the valve assembly in an efficient manner.

- Leakage at Bottom Actuator: Remove line pressure and exercise actuator. If leak persists, replace seals in actuator; see the Backflow Actuator Seal Replacement Procedure on page 4.
- Leakage at Cover or Flanges: Tighten bolts, replace gasket.
- Valve Leaks when Closed: Inspect disc for damage and replace. Inspect metal seating surface and clean if necessary.
- Valve Does not Open: Check for obstruction in valve or pipeline; see Disassembly procedure on page 4. Operating pressure may be less than cracking pressure. If less than 0.5 psig, review application with factory.

DISASSEMBLY

The valve can be disassembled without removing it from the pipeline. Or for convenience, the valve can be removed from the line. All work on the valve should be performed by a skilled mechanic with proper tools and a power hoist for larger valves. Disassembly may be required to inspect the disc for wear or the valve for deposits.

WARNING: The line must be drained before removing the cover or pressure may be released causing bodily harm.

1. Relieve pressure and drain the pipeline. Refer to Figure 2 on page 2. Remove the cover bolts (5) on the top cover.
2. Pry cover (2) loose and lift off valve body. 12” and larger valves have tapped holes in cover for lifting eyes.
3. Remove disc (3) and inspect for cracks, tears or damage in rubber sealing surface.
4. Clean and inspect parts. Replace worn parts as necessary and lubricate parts with FDA grease such as Lubriko #CW-606.

RE-ASSEMBLY

All parts must be cleaned. Gasket surfaces should be cleaned with a stiff wire brush in the direction of the serrations or machine marks. Worn parts, gaskets and seals should be replaced during reassembly.

1. Lay disc (3) over seat with beaded seating surface directed down.
2. Lay cover gasket (4) and cover (2) over bolt holes and disc hinge.
3. Insert lubricated bolts (5) noting that the bolts in the hinge area are longer than the other cover bolts.
4. Cover bolts should be tightened to the following specifications during assembly.

COVER BOLTS

VALVE	SIZE	TORQUE (FT-LBS)
2”-2.5”	1/2"	75
3”	7/16"	50
4”	1/2"	75
6”	7/16"	50
8”	9/16"	100
10”	3/4"	200
12”-20”	7/8”	250
24”	1”	300
30”	1 1/8”	500
36”	1 1/4”	700

TABLE 2. VALVE COVER BOLT TORQUES

BACKFLOW ACTUATOR FIELD INSTALLATION AND MAINTENANCE (OPTIONAL)

BACKFLOW ACTUATOR OPERATION:
An optional **backflow actuator** assembly is available which can be easily installed in the field. The actuator is not designed to operate at the valve's Maximum Working Pressure rating. Therefore, prior to using the actuator, close the pump isolation valve and bleed off line pressure. To operate, turn the handle clockwise. This will open the valve disc allowing backflow through the valve. The handle should turn easily. When resistance is felt, the disc has reached its body stop and is in the full open position. Upon completion of the back flushing operation, turn the handle counter-clockwise and the valve will automatically return to the closed position. Lock the actuator in the closed position with the jam nut provided. The system is again ready for normal operation

WARNING: Relieve line pressure before using backflow actuator or damage may occur.

BACKFLOW ACTUATOR FIELD INSTALLATION:
The backflow actuator is supplied as an optional assembly from the factory, which is shipped loose with the valve.

WARNING: Removal of the bottom plug while under pressure may cause bodily harm.

1. Depressurize and drain the pipeline.

2. Remove the pipe plug in the bottom boss of the valve.

3. Inspect the backflow rod and place in the non-extended position. (The rod should extend about 1" past the end of the brass bushing.) Apply Teflon thread sealant to brass threads.

4. Insert the threaded end of the assembly into the valve boss. Slowly turn the assembly into the boss taking care not to cross-thread the bushing. Continue turning the assembly into the valve for a tight fit.

BACKFLOW ACTUATOR SEAL REPLACEMENT:
There are two parts (8 & 9) on the backflow actuator that are subject to wear. To replace the seals, the pipeline must first be depressurized and drained. Next, remove the backflow assembly from the valve by turning the brass bushing (6) counter-clockwise. Disassemble the actuator as follows:

1. Remove one of the vinyl caps (12) .

2. Remove the T-Handle (10) and jam nut (11) from the rod (7).

3. Remove the rod (7) from the bushing (6) by screwing in the rod fully clockwise and pull the rod through the valve end of the bushing (6).

4. Lubricate new seals with FDA approved grease such as Lubriko #CW-606 and install in the bushing end grooves.

5. Clean, lubricate, and reinstall rod in bushing.

6. Re-install jam nut (11) and T-Handle (10).

7. Place vinyl cap (12) on handle (10).

8. Apply Teflon thread sealant to bushing and carefully thread into valve taking care not to cross-thread the bushing

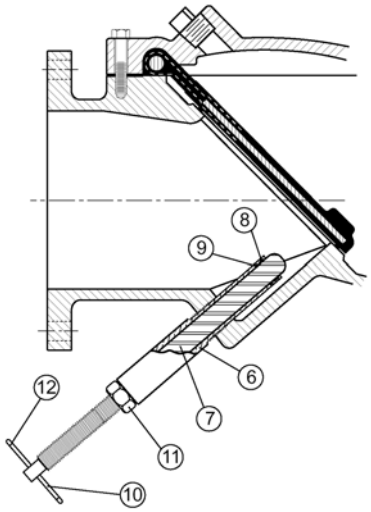


FIG. 3. BACKFLOW ACTUATOR ASSEMBLY

ITEM	DESCRIPTION	MATERIAL
6	Bushing	Brass
7	Rod	Stainless Steel
8	Rod Wiper*	Molythane
9	O-Ring*	Buna-N
10	Handle	Stainless Steel
11	Jam nut	Brass
12	Cap*	Vinyl

*RECOMMENDED SPARE PART

BACKFLOW ACTUATOR PARTS LIST

MECHANICAL INDICATOR (OPTIONAL)

The mechanical indicator is an option that fits into the cover and can easily be installed in the field by going through the following steps. The mechanical indicator is used to visually indicate when the valve is opened or closed.

1. Remove line pressure and drain valve.

> **WARNING: REMOVAL OF THE PIPE PLUG WHILE UNDER PRESSURE MAY CAUSE BODILY HARM.**

2. Remove the pipe plug from the cover.
3. Connect indicator adapter (24) to indicator rod (23).
4. Disconnect indicator spring (28) from plate (27).
5. Loosen the top indicator bushing (22) from the bottom bushing (21).
   Note: The bushings do not have to be completely removed from each other.
6. Apply pipe joint compound to the bottom bushing (21) threads.
7. Insert the indicator assembly into the valve cover boss.
8. Tighten the bottom bushing (21) into the valve cover boss.
9. Align indicator plate (27) with valve and tighten the top bushing (22).
10. Reconnect indicator spring (28).

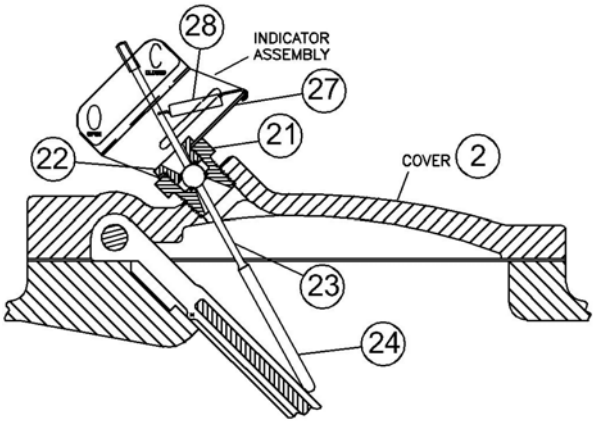


FIG. 4. MECHANICAL INDICATOR ASSEMBLY

Mechanical Indicator Parts List

Item	Description	Material
21	Body	Brass
22	Bushing	Brass
23	Rod	Stainless Steel T316
24	Adapter	Stainless Steel T316
27	Plate	Stainless Steel T316
28	Spring	Stainless Steel T302

LIMIT SWITCH (OPTIONAL)

The limit switch is used in conjunction with the Mechanical Indicator. The standard limit switch is MICROSWITCH Model Number 914CE20-3. The limit switch is SCADA (Supervisory Control and Data Acquisition) compatible for applications requiring open/close indication.

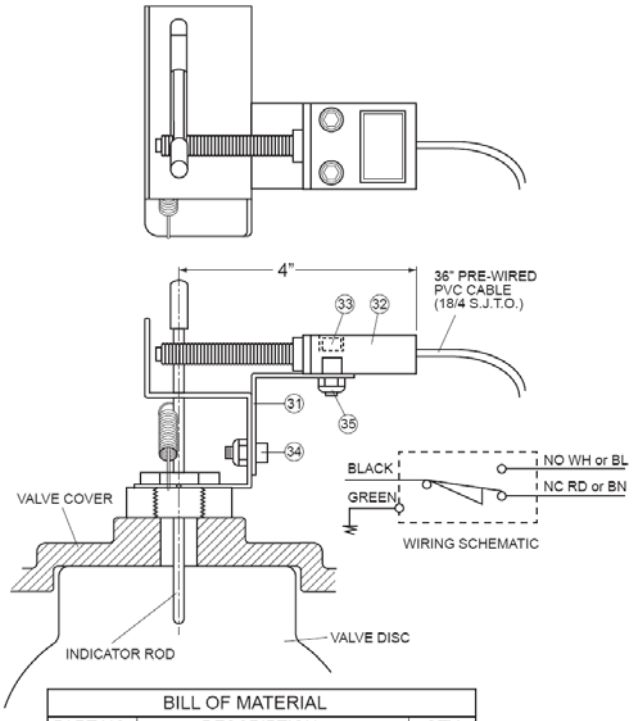
Nema Ratings: 1, 2, 4, 6, 6P, 12, 13
UL Ratings: 5 AMPS, 1/10 HP, 125 or 250 VAC, SPDT

Installation:

1. Attach limit switch assembly to indicator using the supplied screws (34) and bracket (31).

2. Position the assembly so that the switch trips when the valve is closed.

3. Connect wiring to either the normally open or normally closed contact as shown in the schematic diagram.



BILL OF MATERIAL

PART NO.	DESCRIPTION	QTY.
31	MOUNTING BRACKET	1
32	LIMIT SWITCH (SPDT) HONEYWELL 914CE20-3 ALLEN BRADLEY 802B-CSACXSXCE	1
33	SCREW	2
34	SCREW	2
35	NUT	4

FIGURE 5. LIMIT SWITCH ASSEMBLY

BOTTOM MOUNTED OIL DASHPOT FIELD INSTALLATION AND MAINTENANCE (OPTIONAL)

DASHPOT FIELD INSTALLATION: The bottom dashpot is supplied as an optional assembly from the factory. This unit provides control of the disc's final 10% travel to the closed position to reduce valve slam and water hammer. The 10% travel time is adjustable between 1 and 5 seconds.

1. Depressurize and drain the valve and pipeline.

   WARNING: Removal of the bottom plug in the valve while under pressure may cause bodily harm.

2. Remove the pipe plug in the bottom boss of the valve. Apply Teflon thread sealant or tape to brass threads on the dashpot.

3. Insert the threaded end of the assembly into the valve boss. Slowly turn the assembly into the boss taking care not to cross-thread the bushing. Continue turning the assembly into the valve for a tight fit and so that the tank is upright.

4. Adjust the air pressure in the tank to be a minimum of 50 psi over the line pressure. Set the flow control valve in the mid position (i.e. 1 turn open). The dashpot rod should be extended and hold the disc open about 1 inch. The water line pressure will close the disc.

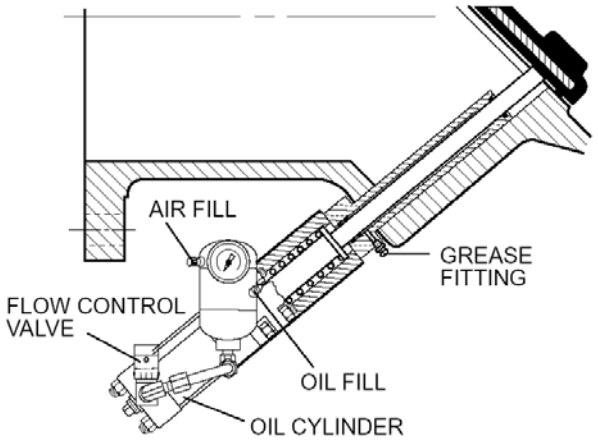


FIGURE 6. BOTTOM MOUNTED OIL DASHPOT

CHECKING OIL AND GREASE LEVELS:

1. The check valve should be closed.

2. The air in the oil reservoir must be bled from the reservoir, using the air fill valve mounted on the reservoir.

3. Remove the pipe plug from the oil reservoir fill port.

4. Add hydraulic fluid equal to Mobil #DTE 24 until fluid is up to level indicated on the reservoir. Replace pipe plug.

5. Recharge the reservoir with air pressure to a minimum of 50 psi over the water line pressure.

6. The grease level can not be checked but it is recommended that the grease fitting be charged with grease twice a year. Use a cartridge grease gun and pump grease into the fitting using two full strokes. An FDA approved grease such as Lubriko #CW-606 should be used (Master Lubricants Company, Philadelphia, PA)

DASHPOT SEAL REPLACEMENT: There are several seals in the unit that may require replacement.

1. Depressurize and drain the valve and pipeline.

2. Unscrew the dashpot from the valve and remove the 4 bolts holding the dashpot spacer.

3. Replace the (2) rod wipers and o-ring seal.

4. If the oil cylinder is leaking oil, tighten the tie rod nuts. The cylinder should be returned to the factory for rebuilding.

5. Reinstall the unit as listed above for a new unit..

PARTS AND

SERVICE

Parts and service are available from your local representative or the factory. Make note of the valve Model No and Working Pressure located on the valve nameplate and contact:

Val-Matic Valve and Mfg. Corp.
905 Riverside Drive
Elmhurst, IL 60126
PH: 630/941-7600
FAX: 630/941-8042

A sales representative will quote prices for parts or arrange for service as needed.

LIMITED WARRANTY

All products are warranted to be free of defects in material and workmanship for a period of one year from the date of shipment, subject to the limitations below.

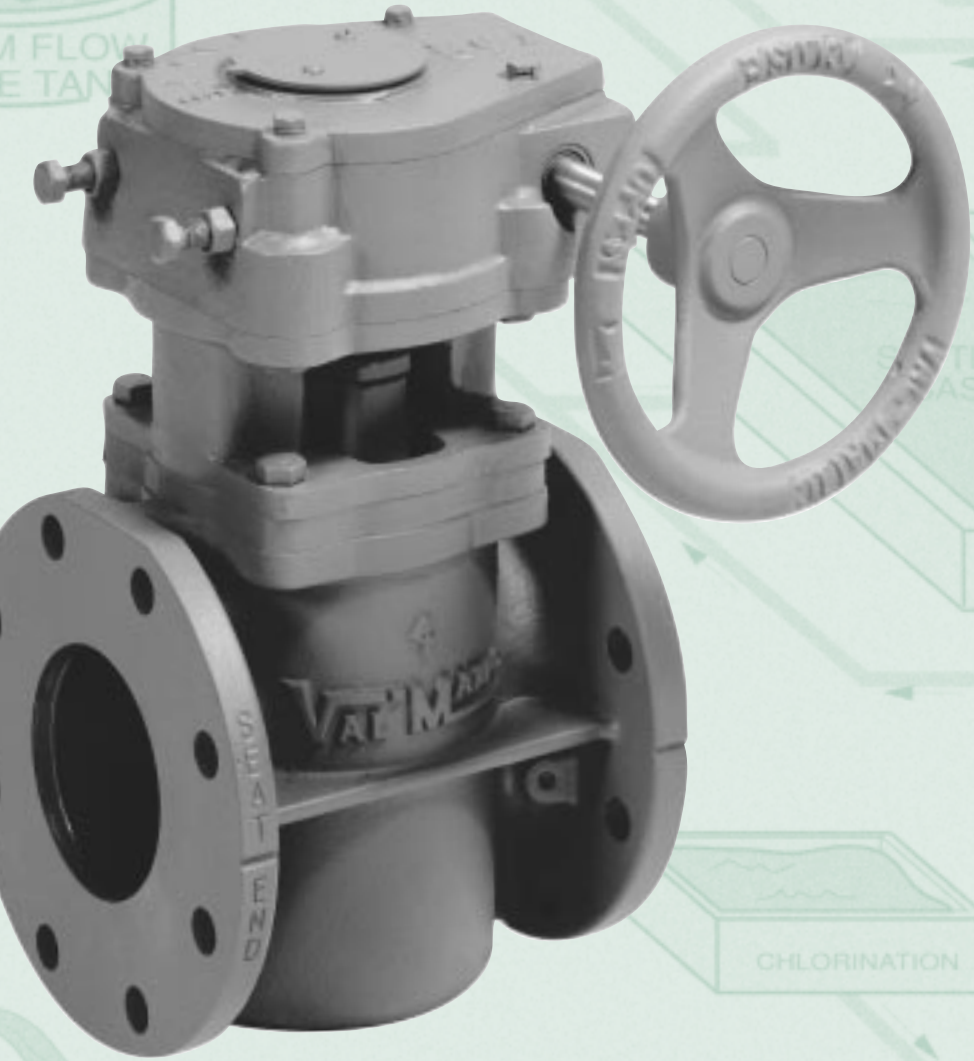
If the purchaser believes a product is defective, the purchaser shall: (a) Notify the manufacturer, state the alleged defect and request permission to return the product; (b) if permission is given, return the product with transportation prepaid. If the product is accepted for return and found to be defective, the manufacturer will, at his discretion, either repair or replace the product, f.o.b. factory, within 60 days of receipt, or refund the purchase price. Other than to repair, replace or refund as described above, purchaser agrees that manufacturer shall not be liable for any loss, costs, expenses or damages of any kind arising out of the product, its use, installation or replacement, labeling, instructions, information or technical data of any kind, description of product use, sample or model, warnings or lack of any of the foregoing. NO OTHER WARRANTIES, WRITTEN OR ORAL, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY, ARE MADE OR AUTHORIZED. NO AFFIRMATION OF FACT, PROMISE, DESCRIPTION OF PRODUCT OF USE OR SAMPLE OR MODEL SHALL CREATE ANY WARRANTY FROM MANUFACTURER, UNLESS SIGNED BY THE PRESIDENT OF THE MANUFACTURER. These products are not manufactured, sold or intended for personal, family or household purposes.

BULLETIN 5000

VAL-MATIC®

CAM-CENTRIC®

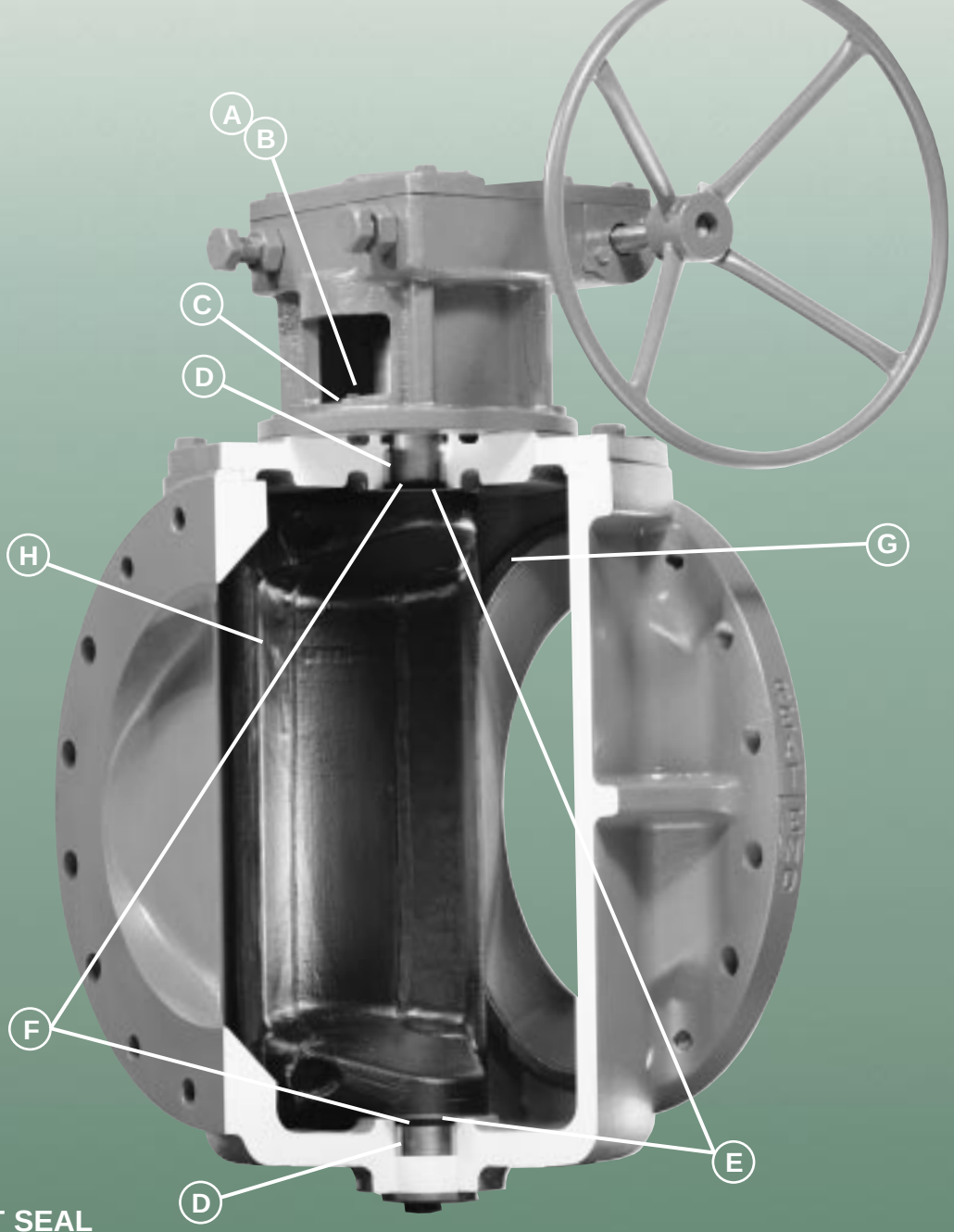
The Eccentric Plug Valve



TRADITIONAL FEATURES

ADVANCED TECHNOLOGY

TRADITIONAL FEATURES ■ ADVANCED TECHNOLOGY



VAL-MATIC® SHAFT SEAL SYSTEM WITH EXCLUSIVE POP™ SHIMS (PACKING OVERLOAD PROTECTION)

A. ADJUSTABLE PACKING FOLLOWER
Meets recommended requirements for adjustment of Vee type packing.

B. VEE TYPE PACKING
Field adjustable and replaceable without removal of actuator.

C. REMOVABLE POP™ SHIMS
Packing Overload Protection Shims protect packing by preventing overloading by field personnel.
(Patent applied for)

VAL-MATIC® BEARING PACKAGE

D. RADIAL BEARINGS
Heavy Duty, Stainless Steel, Permanently Lubricated.

E. THRUST BEARING
Lower: Stainless Steel
Upper: Teflon®

VAL-MATIC® GRIT-GUARD™ BEARING AND PACKING PROTECTOR

F. A VAL-MATIC® EXCLUSIVE
The Grit-Guard™ shaft seal extends packing and bearing life by minimizing contact with line media.

VAL-MATIC® SEATING SYSTEM

Performance Enhanced Technology

G. SEAT
Welded overlay of 99% pure nickel applied directly to the body using a state-of-the art robotic welding system for a consistent, high quality weld. (2 1/2" and larger)

H. PLUG
Resilient facing formulated by Val-Matic® and leading industry rubber experts to assure a tight seal and long life.

Teflon is a registered trademark of DuPont.

Technical papers discussing the technical enhancements of the Val-Matic® seating and shaft seal systems is available. Please contact Val-Matic® for complimentary copies.

WHY AN ECCENTRIC PLUG VALVE?

Installed in thousands of applications the world over, the eccentric plug valve has proven itself as the valve of choice in wastewater and water applications. Unlike a multi-turn gate valve, the eccentric plug valve is a 1/4 turn valve allowing cost effective, low torque actuation for shut-off and throttling service. And while the gate valve leaves its operating stem exposed to the flow, the plug valve shaft and gear are both removed from the flow and protected from the media. Slurries and sewage are easily handled without clogging and with minimal headloss due to the valves linear flow path. The valve's eccentric action rotates the plug in and out of the seat without scraping or binding. The combination of the eccentric action and heavy duty nickel seat assures long life with minimal maintenance.

WHY CAM-CENTRIC?

TRADITIONAL FEATURES...

of the Cam-Centric include the features engineers and operators have come to expect in a plug valve. Adjustable and replaceable Vee-Type packing is standard as are stainless steel, permanently lubricated radial bearings and a welded nickel seat. Val-Matic has been able to enhance the performance of these features through

...ADVANCED TECHNOLOGY

By incorporating the latest in design, material and manufacturing technologies, Val-Matic has significantly improved upon these time proven features.

SHAFT SEAL SYSTEM

Vee-Type packing leaks for two reasons. It's worn, or the gland follower has been over tightened destroying the packing's sealing capabilities. Val-Matic has enhanced the traditional design of Vee-Type packing systems to reduce wear and prevent over tightening of the follower.

Wear is reduced by the Grit-Guard™ seal which prevents grit, the prime cause of wear, from reaching the bearings and packing. The seals are supplied standard in both the upper and lower journals. (Figure 1 & 2)

To prevent the packing from being over tightened, the shaft seal incorporates POP™ (Packing Overload Protection) Shims. Adjustment is easily accomplished by removing shims as necessary by utilizing the pull tab feature. (Figure 1) Any minimal maintenance required to the Cam-Centric shaft seal can be done without removal of the actuator. This includes removal/ replacement of the packing as well as removal of shims. The shaft seal fully complies with ANSI/AWWA C504.

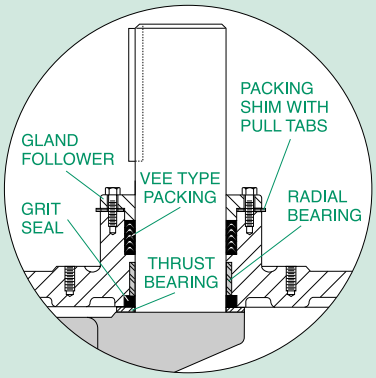


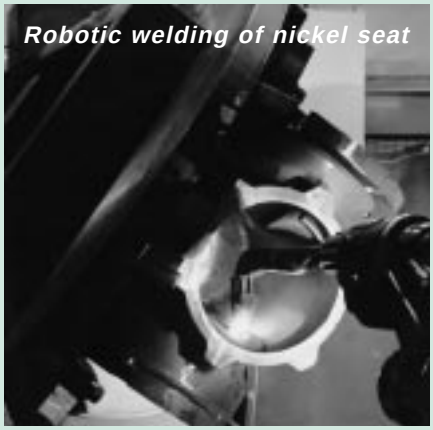
Figure 1: Upper Bearing Journal

CAM-CENTRIC BEARING PACKAGE

The Cam-Centric bearing package consists of T316 stainless steel, permanently lubricated Radial Bearings in both the upper and lower journals. Thrust bearing of Teflon (upper journal) and T316 Stainless Steel (lower journal) are also provided. Like the packing, the bearings are protected from grit related wear by the Grit-Guard™ grit seal.(Figure 1 & 2)

CAM-CENTRIC SEATING SYSTEM

The Cam-Centric utilizes a resilient faced plug formulated by Val-Matic in conjunction with leading industry rubber experts to assure a tight seal and long life. Its mating surface, the nickel seat is applied directly to a machined surface on the valve body using a state-of-the-art robotic welding system for a consistent, high quality weld.


Robotic welding of nickel seat

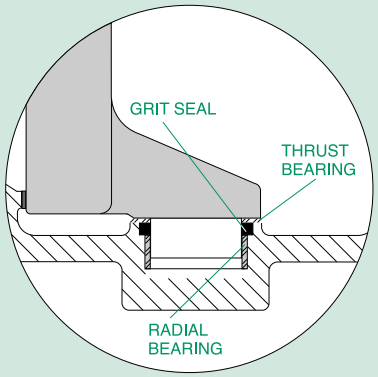


Figure 2: Lower Bearing Journal

PROOF OF DESIGN TESTING

The Cam-Centric has been subjected to rigorous testing per the requirements of ANSI/AWWA C504. All valve and actuation tests were third party witnessed and were successfully completed. Copies of the test reports are available from Val-Matic.

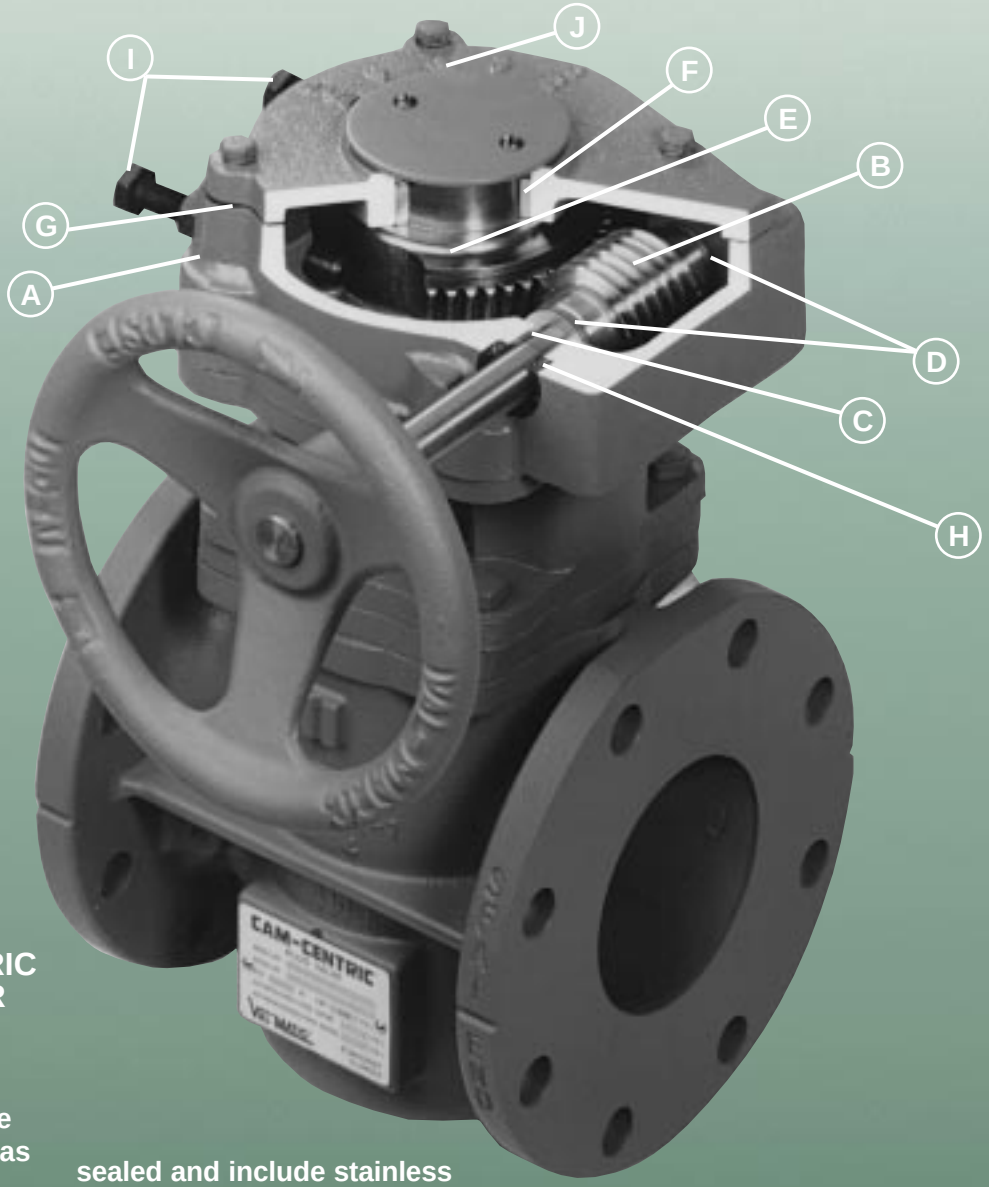
INCREASED PORT AREA FOR INCREASED FLOW

Cam-Centric® plug valves are designed to provide low headloss to maximize flow and reduce operating costs. 100% port areas are standard on valves 4" and smaller, optional on valves 6" and larger. Standard port areas for 6" and larger valves are larger than traditional rectangular ported valves.

A WORD ABOUT ANSI/AWWA COMPLIANCE

While most plug valve shaft seal and testing specifications refer to ANSI/AWWA C504, it should be remembered that C504 is a butterfly valve standard written for rubber seated butterfly valves for use in raw or potable water service. It was not written for plug valves, nor was it written for untreated wastewater to which plug valves are typically subjected. The reason the plug valve exists is because other valves, like the butterfly, are unable to handle solids bearing flow. For this reason, it is suggested that the specifier look at the requirements of ANSI/AWWA C504 as minimal requirements. Specify a valve that not only meets the requirements of C504 but exceeds them.

TRADITIONAL FEATURES ■ ADVANCED TECHNOLOGY



VAL-MATIC® CAM-CENTRIC WORM GEAR ACTUATOR

A QUALITY GEAR FOR A QUALITY VALVE

A valve actuator must be able to perform to the same level as the valve. The Cam-Centric worm gear is designed and built to provide the same long term service as the Cam-Centric Valve. The exclusive bearing package in the Cam-Centric worm gear includes four bronze sleeve bearings and two roller thrust bearings. This exclusive package assures smooth operation and long life regardless of the valve's orientation or application. The ductile iron segment gear coupled with upper and lower bronze radial bearings exceeds the requirements of AWWA C504 for strength and durability. All worm gears are designed to exceed, without damage, a rim pull of 200 pounds on handwheels and input torques of 300 foot pounds for operator nuts. Buried service worm gears are grease packed and sealed and include stainless steel shafts. Worm gears can be provided with handwheels, chainwheels or 2" operator nuts.

A. HOUSING
Heavy duty, totally enclosed and sealed.

B. WORM
Hardened steel for durability and long life

C. RADIAL SHAFT BEARINGS
Bronze shaft bearings extend life and provide ease of operation (rear shaft bearing not visible).

D. ROLLER THRUST BEARINGS
Provides smooth operation and extends life.

E. SEGMENT GEAR
Heavy duty ductile iron for high strength. Provided with precision bore and keyway for connection to the valve shaft in multiple positions.

F. SEGMENT GEAR RADIAL BEARINGS
Upper and lower bronze bearings provide ease of operation and extend life (lower bearing not visible).

G. COVER GASKET
Seals housing and prevents foreign matter from entering valve.

H. SHAFT SEAL
Prevents foreign matter from entering the valve.

I. EXTERNAL STOPS
Both open and closed stops are adjustable without removal of the valve cover.

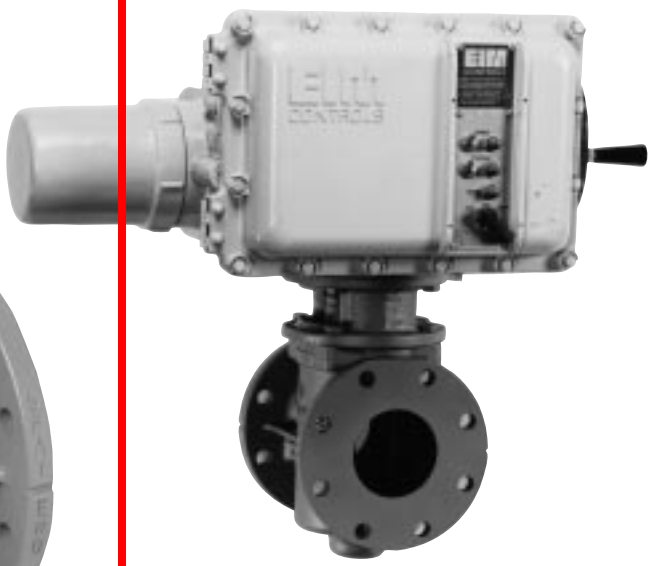
J. POSITION INDICATOR
Above ground only

ACTUATORS

The Cam-Centric is available with a wide range of actuation options. From pump check to lever operated, Val-Matic is well prepared to meet your specification requirements. Options include 2" operator nuts, worm gears, chain wheels, electric and cylinder actuation. A wide variety of mounting options such as floor stands and extension bonnets are also available (see accessories on page 7). Val-Matic Engineering personnel meet on a regular basis with cylinder and electric actuation manufacturers to assure actuator/valve compatibility. This helps assure the actuator you specify will deliver the performance you expect when coupled with a Cam-Centric Plug Valve.

Direct nut operated valve with memory stop:

- *Use with tee handles, levers, chain handles and extension stems. Supplied standard with memory stop for HVAC applications.*



Electric Actuation Including:

- *110 Single Phase, 230/460 Three Phase*
- *Compliance with AWWA C540 for Power Actuation*
- *Modulating Service*
- *Throttling Service*
- *Remote push button control and indication*
- *Torque Switches, Limit Switches*
- *De-clutchable hand wheels*

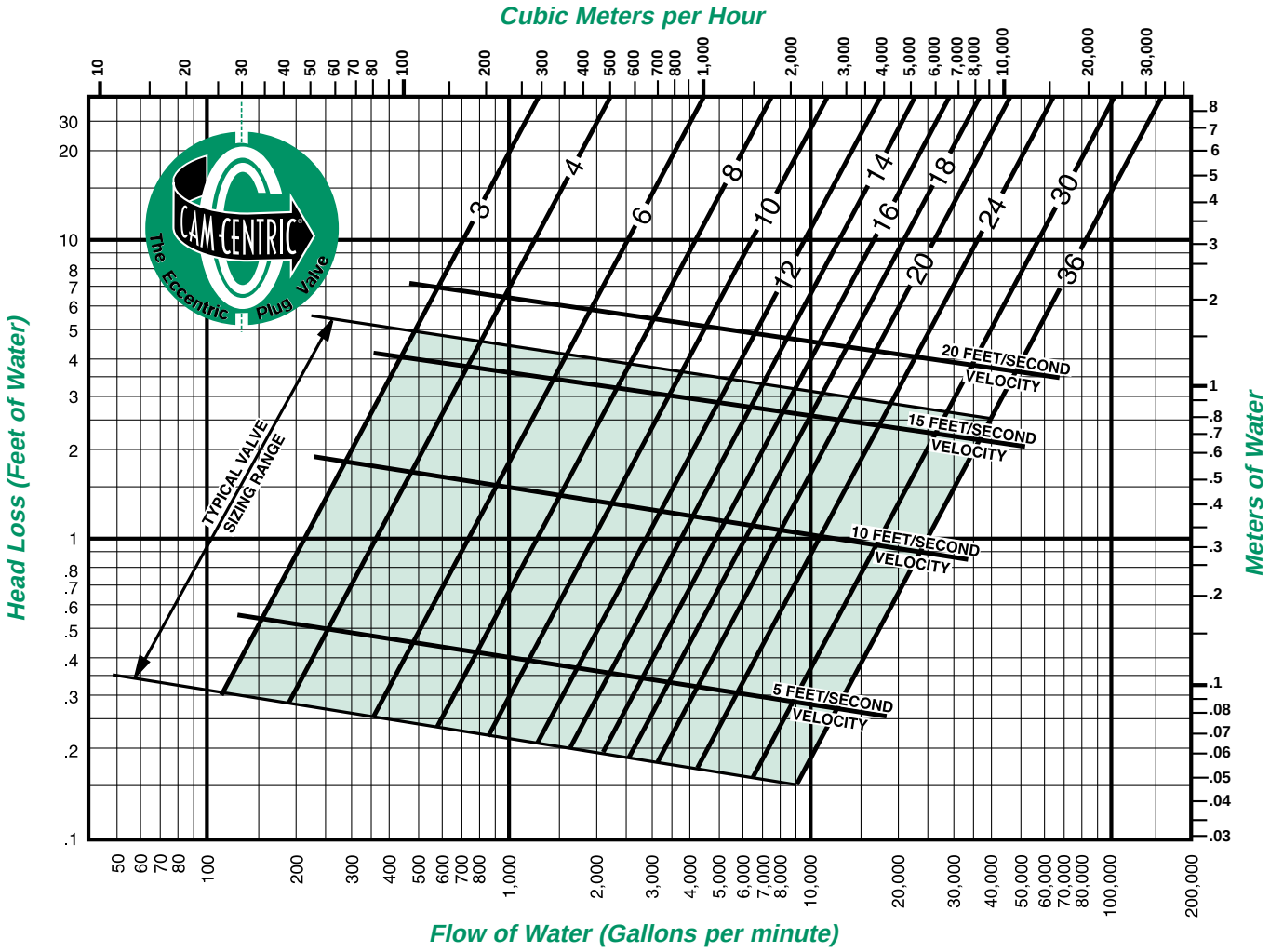
Val-Matic Worm Gears:

- *Heavy Duty, totally enclosed and sealed*
- *Designed and built by Val-Matic*
- *For above ground and buried service applications*
- *Bronze radial bearings and roller thrust bearings provide smooth operations and extended life*

Cylinder Actuation Including:

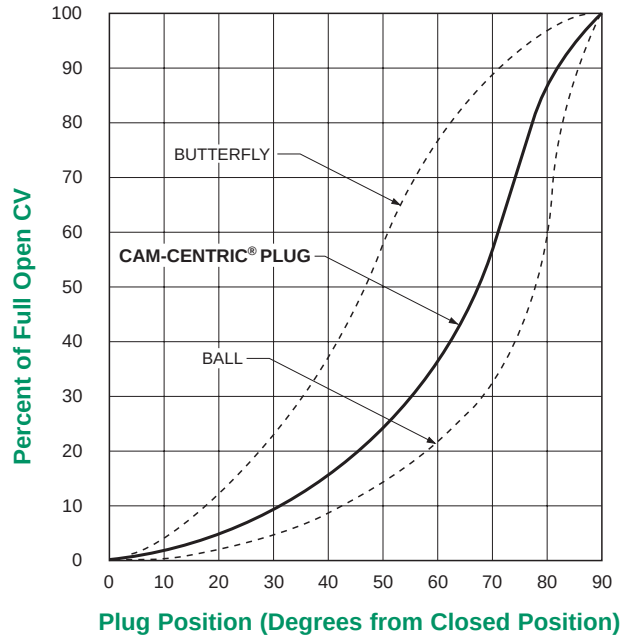
- *Pneumatic/Hydraulic*
- *Air/Oil*
- *Single Acting or Double Acting*
- *Fail Open/Closed for power failure*
- *Modulating Service*
- *Throttling Service*
- *Limit Switches, Solenoid Valves, Positioners*
- *Manual Overrides*
- *Pump Check*

FLOW CHARACTERISTICS



FLOW COEFFICIENTS															
Valve Size	1"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"
C_V*	37	150	320	570	1,200	2,070	3,250	4,750	6,150	8,050	10,200	12,600	18,100	28,300	40,700

* C_V = the number of U.S. Gallons/Minute of 60° F water that will flow through the valve with a 1 psi pressure drop.



INHERENT FLOW CHARACTERISTICS

To control pressure surges and provide good controllability, the flow characteristics of valves should be considered.

The graph at left shows the inherent flow characteristics at a constant ΔP for various valves.

The Plug valve has an inherent flow characteristic similar to a ball valve. When installed in a pipeline, the plug valve will approximate a linear flow characteristic because the piping system pressure losses will shift the flow curve to the left. A linear installed flow characteristic will help control surges and provide a wide range of controllability.

MATERIALS OF CONSTRUCTION
PRESSURE/TEMPERATURE RATINGS

MATERIALS OF CONSTRUCTION	
COMPONENT	**STANDARD**
Body, Cover and Plug	Cast Iron ASTM A126 Class B
Seating Surfaces	*Welded Nickel Overlay Resilient Plug Facing
Exterior Coating	Universal Primer

NOTE: Val-Matic offers a variety of optional materials, coatings and linings. Please consult factory for available options.
*2-1/2" and larger.

MAXIMUM NON-SHOCK PRESSURE-TEMPERATURE RATING, PSIG		
TEMPERATURE °F / VALVE SIZE	**1" - 12"**	**14" - 36"**
100	175	150
150	175	150
200	150	135
Hydrostatic Test Pressure	263	225

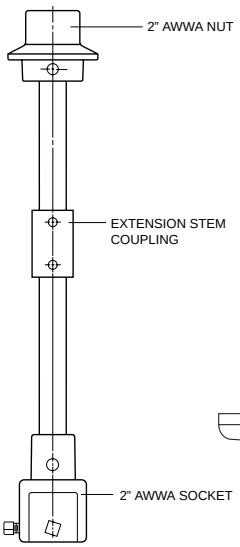
NOTES:

1. Above ratings are valve ratings. Actuator ratings (shut-off differential pressure) are included under Valve Dimensions and Actuator Selection on page 9.
2. Gas service applications require a worm gear, cylinder or power actuator. Valve orders for gas service should specify the application.
3. Worm gear actuation is recommended for all buried service valves.

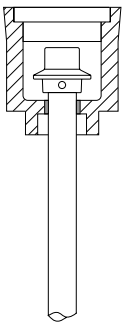
ACCESSORIES

Space limitations and applications such as submerged service often require special accessories. In addition to those shown below, Val-Matic offers a wide range of accessories to meet your application requirements. Please consult the factory for assistance.

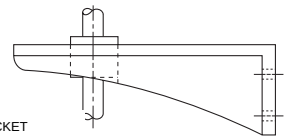
Extension Stem Assembly



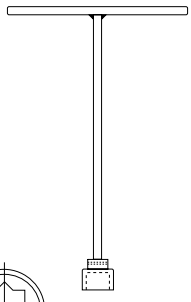
Valve Box



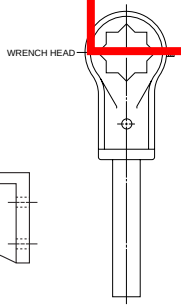
Stem Guide



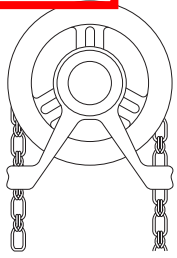
"T" Wrench



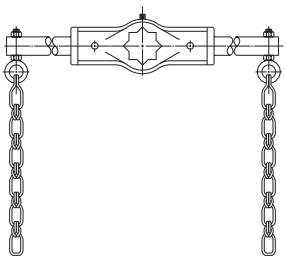
Lever



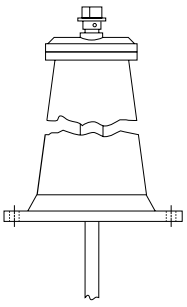
Chain Wheel



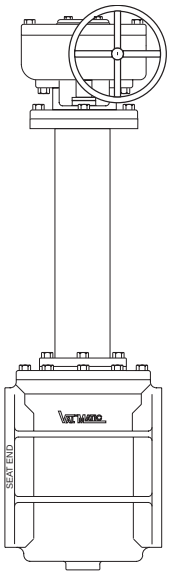
Chain Handle



Floor Stand



Extended Bonnet

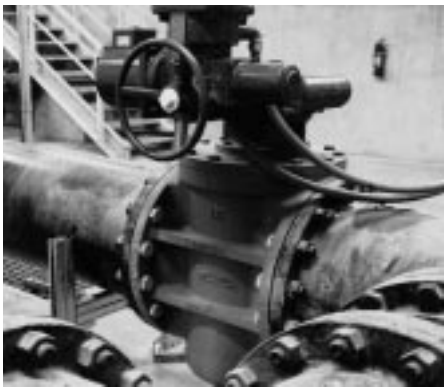


APPLICATIONS/FEATURES

18" Cam-Centric® plug valve with motor actuator.

14" Cam-Centric® plug valve with Val-Matic® Swing-Flex® Check Valve.

20" and 16" Cam-Centric® plug valves with worm gears and motor actuators.



18" motor actuated Cam-Centric® plug valve.

16" Cam-Centric® plug valve with extension stem and motor actuator.

16" Cam-Centric® plug valve. Cylinder actuated with hydraulic, manual override.

APPLICATIONS			
Potable Water	✓	Sludge	✓
Raw Water	✓	Primary Effluent	✓
Secondary Wastewater Effluent	✓	Salt Water, Sea Water, Brine, Brackish Water	✓
Raw Sewage	✓	Ozone Treatment	✓
Screened Sewage	✓	Irrigation	✓
Abrasive Slurries	✓	Buried Service	✓
Air Service	✓	Industrial Process Applications	✓
Corrosive Service	✓	Low Pressure Gas Service, Digester Gas	✓
Vertical Flow Up	✓	Throttling Service	✓
Vertical Flow Down	✓	Pump Check Service	✓
Non-Abrasive Slurries	✓	Modulating Service	✓

FEATURES			
Vee Type Packing with Exclusive POP™ Shims	✓	Gear, Hydraulic and Power Actuation	✓
Integral Nickel Welded Seat	✓	Port areas for valves 4" and smaller ≥ 100%	✓
Exclusive Stainless Steel/Teflon Bearing Package	✓	Port areas for valves 6" - 16" ≥ 85%	✓
Grit-Guard™ Bearing and Packing Protector	✓	Port areas for valves 18" - 24" ≥ 80%	✓

CAM-CENTRIC PLUG VALVE SPECIFICATIONS

2 1/2" AND LARGER

SCOPE

1.1 This specification covers the design, manufacture, and testing of 2 1/2 in. (60 mm) through 36 in. (900 mm) Cast Iron Eccentric Plug Valves suitable for water or wastewater service with pressures up to 175 psig (1200 kPa).

1.2 Plug Valves shall be quarter-turn, non-lubricated, eccentric type with resilient faced plug.

CONNECTIONS

2.1 Flanged valves shall have flanges with drilling to ANSI B16.1, Class 125.

~~2.2 Mechanical Joint valves shall fully comply with ANSI/AWWA C111/A21.11.~~

~~2.3 Threaded valves shall have NPT full size inlets. The connection shall be hexagonal for a wrench connection.~~

DESIGN

3.1 Port areas of not less than 100% of pipe area shall be supplied on valves 4" (75 mm) and smaller, 85% on 16" (400 mm) and smaller, 80% on 18"-24" (150 mm - 600 mm), and 70% on 30" (800 mm) and larger.

3.2 The valve seat shall be a welded overlay of 99% pure nickel applied directly to the body on a pre-machined, cast seating surface and machined to a smooth finish.

3.3 Shaft seals shall conform to ANSI/AWWA C504 and consist of V-type packing in a fixed gland with an adjustable follower designed to prevent over compression of the packing and to meet design parameters of the packing manufacturer. Removable, slotted shims shall be provided under the follower flanges to provide for adjustment and prevent over tightening.

3.4 Permanently lubricated, radial shaft bearings shall be supplied in the upper and lower bearing journals. Thrust bearings shall be provided in the upper and lower journal areas.

3.5 Both the packing and bearings in the upper and lower journals shall be protected by a Grit-Guard™ shaft seal located on the valve shaft to minimize the entrance of grit into the bearing journal and shaft seal areas.

MATERIALS

4.1 The valve body and cover shall be constructed of ASTM A126 Class B cast iron for working pressures up to 175 psig (1200 kPa). The words "SEAT END" shall be cast on the exterior of the body seat end.

4.2 The plug shall be of one-piece construction and made of ASTM A126 Class B cast iron with a resilient facing per ASTM D2000-BG and ANSI/AWWA C504 requirements.

4.3 Radial shaft bearings shall be constructed of self-lubricating type 316 stainless steel. The top thrust bearing shall be Teflon. The bottom thrust bearing shall by Type 316 stainless steel. Cover bolts shall be corrosion resistant with zinc plating.

NOTE: CONSULT FACTORY FOR 1/2" - 2" SPECIFICATIONS.

ACTUATORS

5.1 8 in. (200 mm) and smaller valves shall be equipped with a 2 inch square nut for direct quarter turn operation. The packing gland shall include a friction collar and an open position memory stop. The friction collar shall include a nylon sleeve to produce friction without exerting pressure on the valve packing.

5.2 When specified, 4 in. (100 mm) and larger valves shall include a totally enclosed and sealed worm gear actuator with position indicator (above ground service only) and externally adjustable open and closed stops. The worm segment gear shall be ASTM A536 Grade 64-45-12 ductile iron with a precision bore and keyway for connection to the valve shaft. Bronze radial bearings shall be provided for the segment gear and worm shaft. Alloy steel roller thrust bearings shall be provided for the hardened worm.

5.3 All gear actuators shall be designed to withstand, without damage, a rim pull of 200 lb (890 N) on the handwheel and an input torque of 300 foot pounds (406 N-m) for nuts.

5.4 Buried service actuators shall be packed with grease and sealed for temporary submergence to 20 feet of water. Exposed worm shafts shall be stainless steel.

OPTIONS

6.1 When specified, the port area shall have not less than 100% of pipe area.

~~6.2 Open and closed limit switches shall be provided on the actuator when specified.~~

MANUFACTURE

7.1 The manufacturer shall demonstrate a minimum of five (5) years experience in the manufacture of plug valves. The valves shall be proof of design tested in accordance with ANSI/AWWA C504. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.

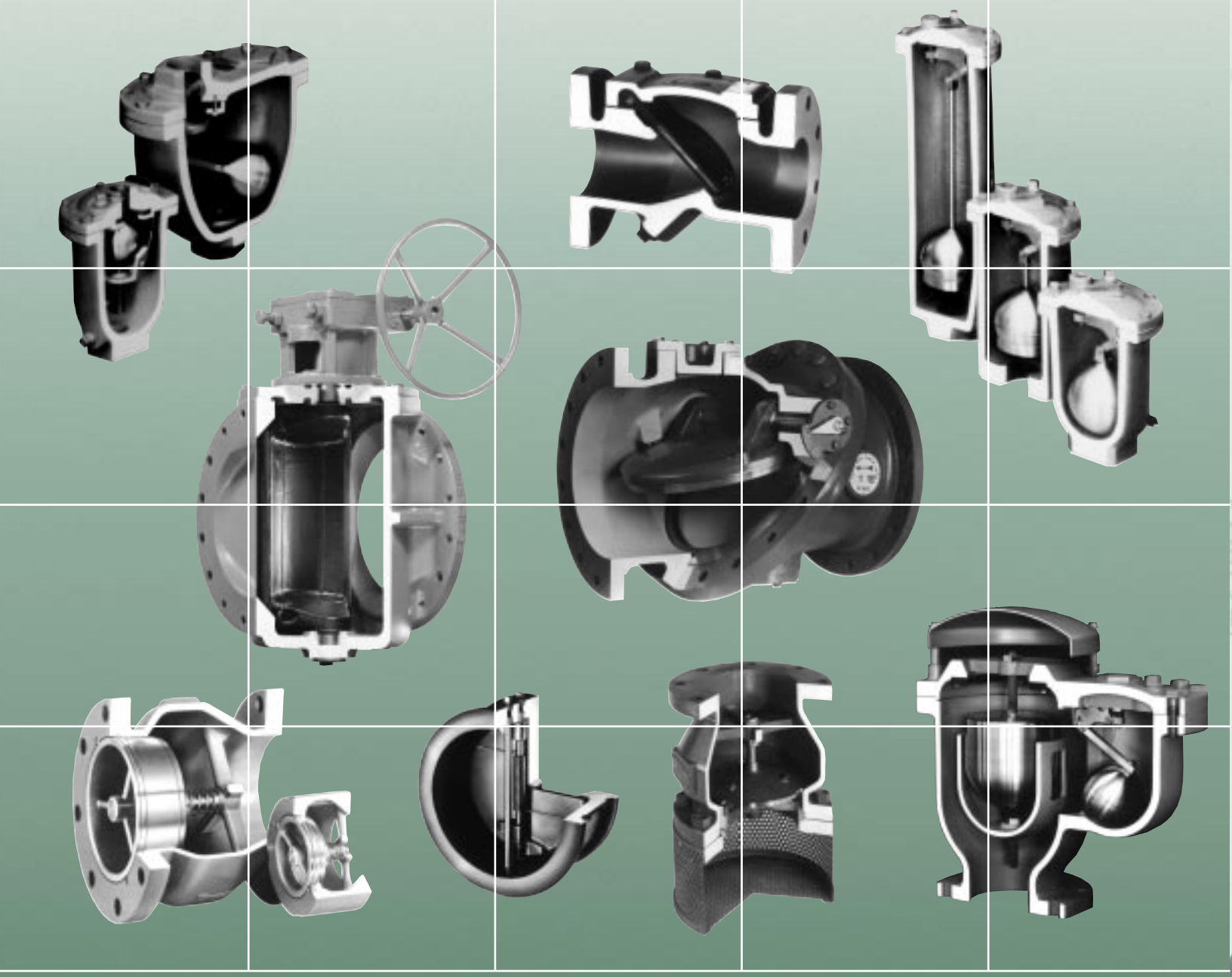
7.2 The exterior of the valve shall be coated with a universal alkyd primer.

7.3 Valves shall be marked with the Serial Number, Manufacturer, Size, Cold Working Pressure (CWP) and the Direct and Reverse Actuator Pressure Ratings on a corrosion resistant nameplate.

7.4 Eccentric Plug Valves shall be Series 5800R (Flanged), ~~5800RT (Threaded) or 5900R (Mechanical Joint) as~~ manufactured by Val-Matic® Valve & Mfg. Corporation, Elmhurst, IL. USA. or approved equal.

VAL-MATIC®

CAM-CENTRIC® The Eccentric Plug Valve



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Manual No.
CCPV-OM2-1

Cam-Centric®
Plug Valve

Operation, Maintenance and Installation Manual

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VAL-MATIC'S CAM-CENTRIC PLUG VALVE OPERATION, MAINTENANCE AND INSTALLATION

INTRODUCTION

The Cam-Centric® Plug Valve has been designed to give years of trouble-free operation. This manual will provide you with the information to properly install and maintain the valve to ensure a long service life. The valve is an eccentric, resilient seated, quarter-turn plug valve capable of handling many types of fluids including fluids with suspended solids. The Size, Cold Working Pressure (CWP), Actuator Rating, and Model No. are stamped on the nameplate for reference.

CAUTION: Do not use valve for line testing at pressures higher than nameplate rating or leakage and damage to valve may occur.

The "Cold Working Pressure" is the non-shock pressure rating of the valve at 150°F. The valve is not intended as a block valve for line testing above the valve rating. The "Actuator Rating" is the pressure that was used to size the actuator for operating conditions and may be less than the "Cold Working Pressure". Because the valve is eccentric, the valve may have a different actuator rating for reverse and direct pressure. If the valve is operated at pressures higher than the actuator ratings, the valve may be difficult to operate or leak.

RECEIVING AND STORAGE

Inspect valves upon receipt for damage in shipment. Unload all valves carefully to the ground without dropping. Do not lift valves with slings or chains around the actuator or through the seat area.

Valves should remain crated, clean and dry until installed to prevent weather-related damage. For long term storage greater than six months, the valve must remain open and the rubber surfaces of the plug coated with a thin film of FDA approved grease such as Dow Corning # 7. Do not expose plug to sunlight or ozone for any extended period.

DESCRIPTION OF OPERATION

As shown in Figure 2, the valve consists of a body and a ¼ turn plug that is offset from the seat centerline.

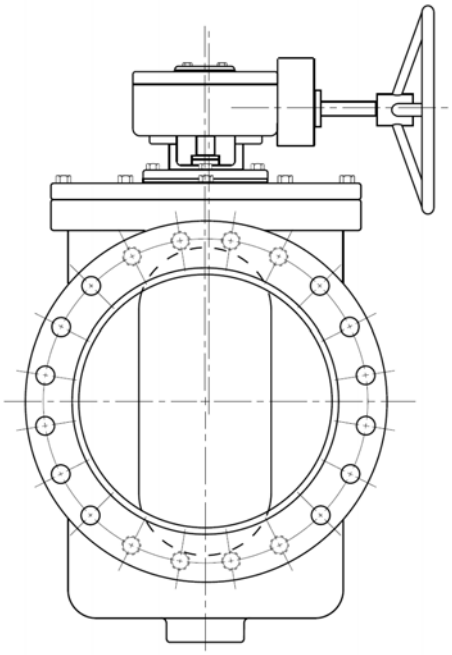


FIGURE 1. PLUG VALVE WITH GEAR ACTUATOR

The eccentric offset causes the plug to lift and rotate off the seat simultaneously to reduce seat friction and wear during operation. Direct Pressure pushes the plug into the seat and Reverse Pressure pushes the plug away from the seat. The valve can be operated with a direct nut, lever, or gear actuator. The gear actuator as shown in Figure 1 requires multi-turn input on a 2" square nut, handwheel, or chainwheel. The valve can also be automated with power actuators such as an electric motor or hydraulic cylinder.

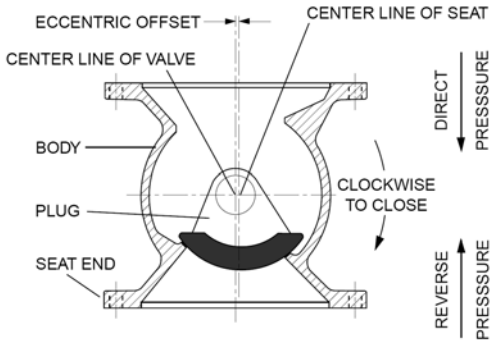


FIGURE 2. PLUG VALVE TERMS

VALVE CONSTRUCTION

The standard Cam-Centric® Plug Valve is constructed of rugged cast iron with a welded nickel seat and permanently lubricated bearings. See the specific Materials List submitted for the order if other than standard cast iron construction. The details of construction are illustrated in Figure 3.

The body (1) is available with flanged or mechanical joint ends for connection to the pipeline. The valve is designed to be serviced in-line by removing the cast cover (2). The ¼ turn plug (3) is guided by sleeve bearings (6) located in the cover and lower boss in the body. Grit-Guard seals (21) are located at the bottom of the bearings (6) to prevent abrasive material from wearing the bearing. Leak-tight closure is made when the rubber coated plug (3) is rotated into the nickel seat on the "SEAT END" of the body.

TABLE 1. STANDARD PLUG VALVE PARTS LIST

ITEM	DESCRIPTION	MATERIAL
1	Body	Cast Iron with Overlay Welded Nickel Seat
2	Cover	Cast Iron
3	Plug*	Cast Iron with Resilient Facing
6	Bearings*	316 Stainless Steel
7	V-Type Packing*	Buna-N
8	Cover Seal*	Buna-N
15	Cover Bolt	Alloy Steel, Gr 5
18	Packing Follower	Cast Iron
19	Follower Bolt	Alloy Steel, Gr. 5
21	Grit-Guard*	Buna-N
22	Thrust Bearing*	Teflon
23	Thrust Bearing*	316 Stainless Steel
24	Key*	Carbon Steel
29	Shims	304 Stainless Steel

*RECOMMENDED SPARE PART

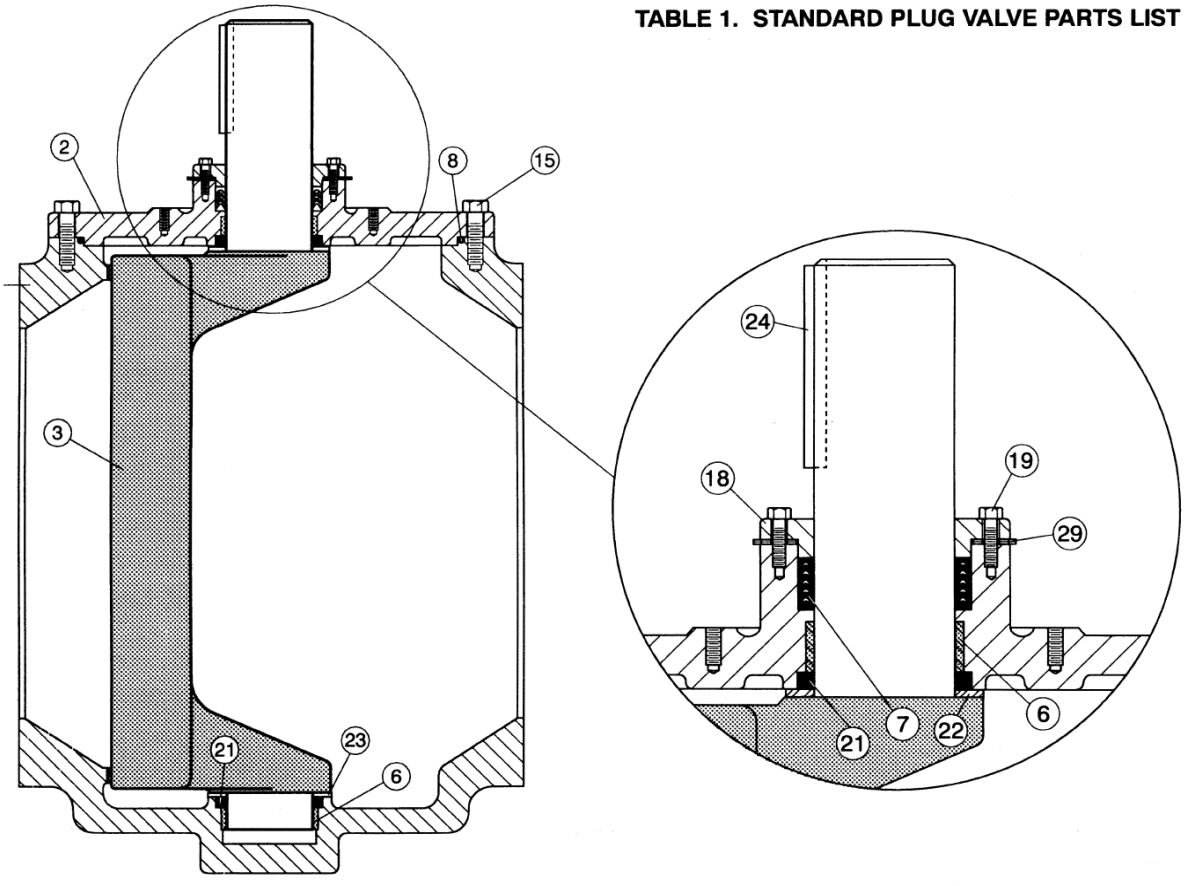


FIGURE 3. STANDARD PLUG VALVE CONSTRUCTION

INSTALLATION

The installation of the valve is important for its proper operation. The valve is capable of flow in either direction but the maximum operating pressure can vary with the location of the seat end. The words "SEAT END" are marked on the valve flange. Actuators are available for pressures up to the full rating in both direct and reverse pressure orientations. Actuator ratings will be indicated on the nameplate. Higher operating pressures may require adjustment of the closed position stop or a larger actuator, consult the factory.

SUSPENDED SOLIDS SERVICE: For fluids containing suspended solids, special orientations are needed to prevent debris from collecting in the valve. For horizontal installations (Figure 4), the valve should be installed with the flow entering the seat end of the valve and the shaft in a horizontal position with the plug up when open. For vertical installations (Figure 5), the valve must be installed with the seat end up regardless of flow direction.

CLEAN SERVICE: For both horizontal and vertical installations, install in the direct pressure orientation (pressure opposite the seat end).

AIR AND GAS SERVICE: Install valve in the direct pressure orientation (pressure opposite the seat end). Lubricate plug face with FDA approved silicone grease such as Dow Corning #7 before installation. Gear actuators are required for gas service applications.

PUMP DISCHARGE SERVICE: On all horizontal pump discharge applications (Figure 6), the seat end should be towards the pump.

BURIED SERVICE: Gear actuators are recommended for buried valves to hold the valve in position and provide multi-turn closure to prevent water hammer. The valve should be installed with the shaft horizontal and the actuator nut directed upwards. The valve box or extension pipe should be installed so that the actuator nut and extension stem turn freely.

NOTE: Adjust and test valve prior to backfill.

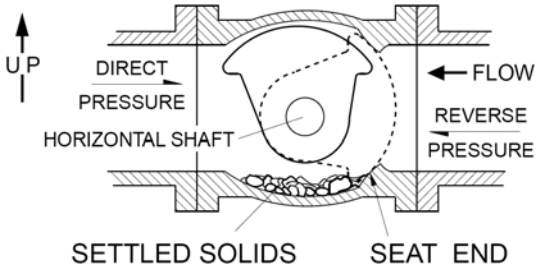


FIGURE 4. HORIZONTAL PIPE WITH SOLIDS

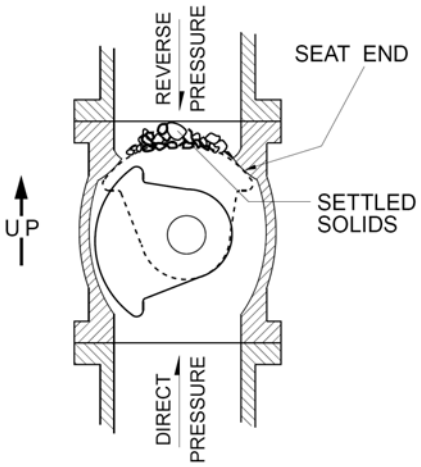


FIGURE 5. VERTICAL PIPE WITH SOLIDS

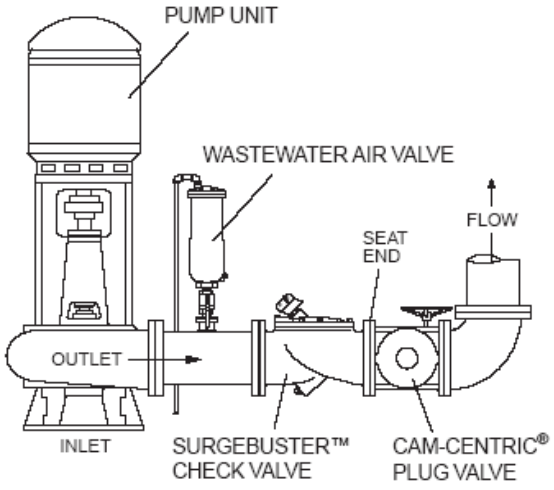


FIGURE 6. PUMP DISCHARGE SERVICE

FLANGED ENDS: Flanged valves should be mated with flat-faced pipe flanges equipped with resilient gaskets. When ring gaskets are used, the bolt material should be ASTM A307 Grade B of SAE Grade 2 Carbon Steel. Higher strength bolts may only be used with full-face gaskets.

The valve and adjacent piping must be supported and aligned to prevent cantilevered stress on the valve. Lower valve into line using slings or chains around the valve body. Lubricate the flange bolts or studs and insert them around the flange. Lightly turn bolts until gaps are eliminated.

The torquing of the bolts should then be done in graduated steps using the cross-over tightening method. Recommended lubricated torques for use with resilient gaskets (75 durometer) are given in Table 2. If leakage occurs, allow gaskets to absorb fluid and check torque and leakage after 24 hours. Do not exceed bolt rating or crush gasket more than 50 percent of its thickness.

VALVE SIZE (in)	BOLT DIA (in)	RECOM TORQUE (ft-lbs)	MAX TORQUE (ft-lbs)
3	5/8	25	90
4	5/8	30	90
6	3/4	30	150
8	3/4	40	150
10	7/8	45	205
12	7/8	65	205
14	1	80	300
16	1	90	300
18	1 1/8	100	425
20	1 1/8	120	425
24	1 1/4	150	600
30	1 1/4	175	600
36	1 1/2	175	600

TABLE 2. FLANGE BOLT TORQUES

CAUTION: The use of raised-face flanges or excessive bolt torque may damage valve flanges.

MECHANICAL JOINT ENDS: Clean ends of mating pipe and valve sockets with soapy water (Figure 7). Place lubricated gasket and retainer gland over pipe end prior to installing valve. Install valve socket over pipe. Press gland and gasket toward valve until gasket is evenly set into valve socket.

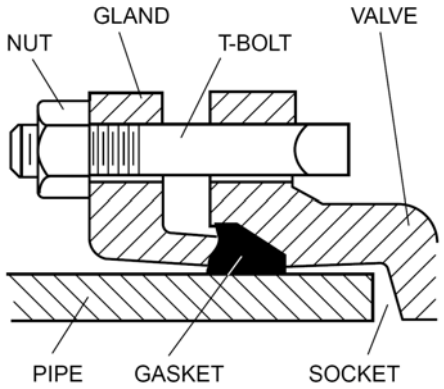


FIGURE 7. MECHANICAL JOINT INSTALLATION

Insert T-bolts in valve flange and hand tighten nuts. Torque nuts in four graduated steps using the cross-over tightening method without exceeding the torque listed in Table 3. Maintain an equal gap between the gland and the face of the valve at all points around the socket.

If a tight connection is not achieved, then the joint should be disassembled, thoroughly cleaned, and reassembled. Over-tightening may cause damage to the valve or gland.

VALVE SIZE (in)	T-BOLT DIA (in)	RECOM TORQUE (ft-lbs)	MAX TORQUE (ft-lbs)
3	5/8	45	60
4	3/4	75	90
6	3/4	75	90
8	3/4	75	90
10	3/4	75	90
12	3/4	75	90
14	3/4	75	90
16	3/4	75	90
18	3/4	75	90
20	3/4	75	90
24	3/4	75	90
30	1	100	120
36	1	100	120

TABLE 3. MECHANICAL JOINT NUT TORQUES

DIRECT NUT OPERATED VALVES: 8" and smaller valves may be equipped with a top-mounted nut for direct quarter-turn operation. The nut is 2" square to fit most valve wrenches and is mounted directly to the valve plug. To open the valve, slowly rotate the nut 90 degrees in the counter-clockwise (CCW) direction. The closed position is adjusted with a set screw and lock nut, see Figure 8. The open position can be adjusted by moving the bolt along the curved slot.

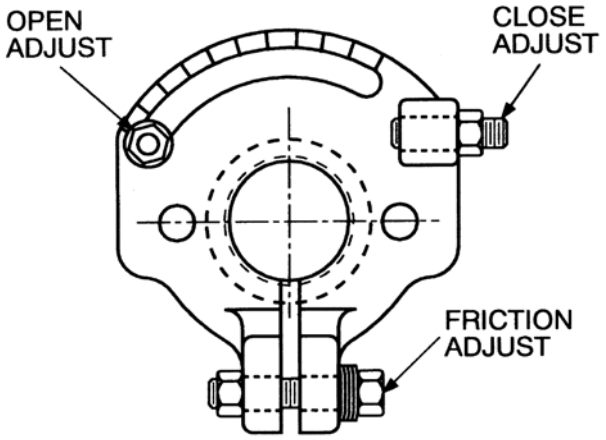


FIGURE 8. DIRECT NUT ADJUSTMENTS

DIRECT NUT FRICTION ADJUSTMENT: As shown in Figure 9, valves with direct nut actuators have a flanged packing follower (18) above the packing (7) to hold the valve in the open or closed position. If the valve is difficult to operate, or does not maintain its set position, adjust the clamp bolt (17) to provide sufficient friction to hold the valve in position. IF the valve is equipped with a hand lever, the setting should allow the valve to be operated with about 80 pounds of force on the end of the pipe handle.

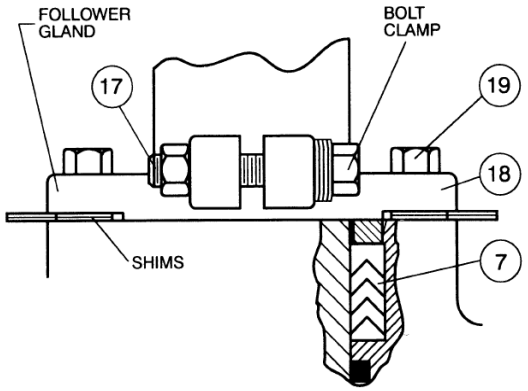


FIGURE 9. FRICTION ADJUSTMENT

LEVER OPERATED VALVES: A wrench head and lever (Figure 10) are available for use over the 2" nut for direct quarter-turn operation. Various lever lengths are available for specific direct and reverse pressure conditions as shown in Table 4.

WRENCH LENGTH, (Inches)

VALVE SIZE	DIRECT PRES. 100 psi	DIRECT PRES. 175 psi	REVERSE PRES. 50 psi	REVERSE PRES. 175 psi
2 1/2	22	22	22	22
3	22	22	22	22
4	22	22	22	22
6	44	*	44	*
8	44	*	44	*

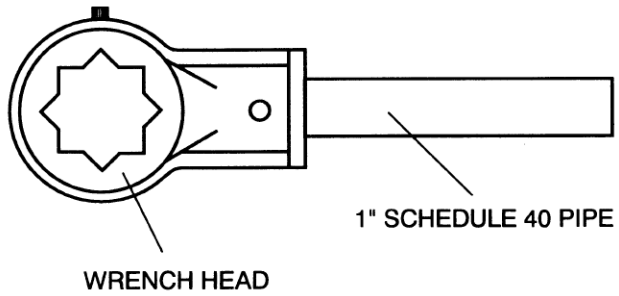


FIGURE 10. HANDLEVER

The wrench head is placed over the nut and can be secured with the set screw provided. To open the valve, rotate the lever 90 degrees in the CCW direction. The closed position is adjustable with a set screw and lock nut mounted below the nut, see Figure 8.

CAUTION: Open and close the valve slowly to prevent water hammer.

GEAR OPERATED VALVES: 4" and larger plug valves are available with a multi-turn manual gear actuator. The gear unit has a self-locking worm gear which multiplies the turning force on the handwheel or nut so that the valve can be operated with ease. A clamp-on chainwheel kit can also be used for installations high above the floor. An indicator on the top of the actuator housing indicates the position of the valve plug. The handwheel or nut must be rotated through 12-80 turns (depending on model) to open or close the plug valve. The direction of rotation to open

the valve is indicated on the 2" square actuator nut.
GEAR ACTUATOR ADJUSTMENT: The standard gear actuator is provided with factory-set open and closed position stops. If the valve does not shut off tight, the stop bolt can be adjusted allowing the plug to rotate further into the seat. Loosen the locknut, and turn the closed stop bolt CCW 1 turn at a time (Figure 8). If the valve continues to leak after all of the adjustment is taken verify the orientation of the valve during installation. If a tight shut-off can not be achieved, a larger gear actuator may be required for the system operating pressure; consult the factory.

CAUTION: Adjust closed stop bolt for tight shut-off only. Over adjustment may cause high operating torques and damage to the plug.

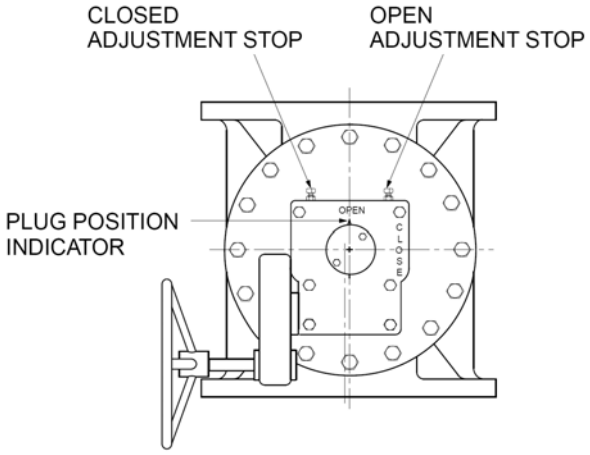


FIGURE 11: GEAR ACTUATOR ADJUSTMENT

MAINTENANCE

The Cam Centric® Plug Valve requires no scheduled lubrication or maintenance other than regular exercising and occasional inspection of the plug. The exercising is achieved by fully opening and closing the valve to verify smooth operation. If operation is difficult, it may be necessary to flush sediment from the valve by opening and closing the valve several times under flowing conditions.

CAUTION: Open and close the valve slowly to prevent water hammer.

The recommended interval for exercising is every six months or annually if the valve is regularly operated. Over the life of the valve, inspection and some regular adjustments may be needed as given below.
CLOSED POSITION ADJUSTMENT: The standard valve is factory-set to seal at the "Actuator Pressure Ratings" shown on the nameplate for direct and reverse pressure directions (see Figure 2). Higher pressure applications may require adjustment of the closed position stop or a larger actuator; consult the factory.

If the valve is found to leak in the closed position due to wear, the plug can be adjusted by loosening the closed position stop on the actuator and rotating the plug further into the seat. Because of the eccentric action of the valve, further rotation will provide additional interference between the rubber plug surface and the body seat. Valves that have been in service for several years may require inspection of the plug for damage or wear. See the Disassembly Instructions of this manual.

PACKING ADJUSTMENT: V-type packing is pressure sensitive and therefore self adjusting in nature. Over tightening will destroy both the pressure sensitive nature of the packing as well as its sealing capabilities. The packing configuration used in Cam-Centric Plug Valves follows the guidelines and recommendations of V-packing manufacturers.

Additional adjustment can be achieved by removing one or more shims found under the packing follower (18). If a leak develops, remove one shim (29) from the underside of the follower (18). An equal number of shims must be removed from both the left and right hand sides. Re-tighten the follower bolts (19) and check for leakage. If the leakage continues, remove additional shims or replace the packing.

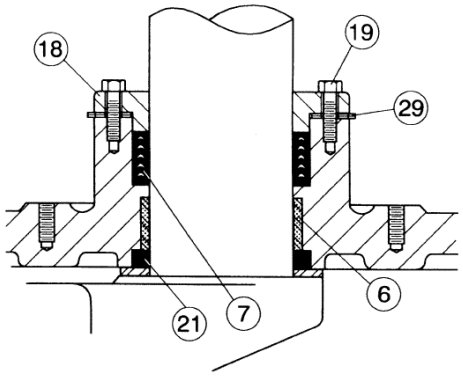


FIGURE 12. PACKING ASSEMBLY

PACKING REPLACEMENT: To replace the packing (7), it is recommended that the line be drained and the actuator removed. The valve can remain in the line. Te replace the packing, first open the valve and drain the line. Close the valve to hold it in position. For power actuators, turn off and lock out electrical and hydraulic supplies before proceeding.

CAUTION: Drain line and close valve before removing actuator or valve may rotate suddenly. Take precautions against exposure to toxic or hazardous fluids in the line.

Remove the small round cover on actuator to expose shaft and key. Remove actuator mounting bolts and lift actuator from valve taking care not to lose square key. See Figure 12 and remove gland bolts (19) and lift follower (18) from the valve shaft. Remove old packing (7) with packing hook. Lubricate new packing with FDA grease and set in place one ring at a time taking care not to bend over the lips of the packing rings. Reinstall follower with 2 shims (29) per bolt (3 shims for 12" and larger valves). With valve in the closed position, place the actuator over valve and reinsert key (24). Finally, reinstall cover on actuator indicating "Closed".

CAUTION: If packing assembly contains clamp style follower as shown in Figure 8, do not lubricate shaft or sleeve.

PACKING REPLACEMENT WITH ACTUATOR: The above procedure with removal of the actuator will result in the most reliable shaft seal. But if the actuator can not be removed, the following alternate procedure can be followed. To prevent the possibility of leakage during this procedure, open valve and drain the line.

CAUTION: Take precautions against exposure to toxic or hazardous fluids in the line.

Referring to Figure 12, remove follower bolts (19) and side follower (18) up to actuator. Remove packing adapters and rings (7) with packing hook. Cut rings with knife to remove. New packing rings should be cut at a 45 degree slope to allow insertion around the shaft and provide some overlap. Install rings one at a time with the tips down toward the valve. Stagger all joints 180 degrees around the shaft. Pull down follower (18) and reinsert bolts (19) with 2 shims (29) under follower (18). V-packing is pressure assisted and only requires light compression.

GEAR ACTUATOR MAINTENANCE: A typical gear actuator is shown in Figure 5 and consists of a worm (8) mounted on an input shaft (4). The worm engages a worm wheel (3). When the worm is turned, it drives the wheel through 90° of rotation. The rotation of the valve plug is displayed by the top indicator (5). The open and closed positions of the segment gear are controlled by an end position stop bolts. The stops can be adjusted by loosening the lock nut and rotating the bolts. The gears are lubricated with EP2 grease in a cast iron housing (1).

The gear box is factory lubricated and sealed. No regular maintenance is required. If difficult operation is observed, the cover can be removed and the unit inspected for wear. All moving parts should be coated with grease. The grease should have an even and smooth consistency. If needed, coat all moving parts with an lithium-based EP-2 grease such as Shell Alvania #2 or equal. Buried units should be packed 90% with grease.

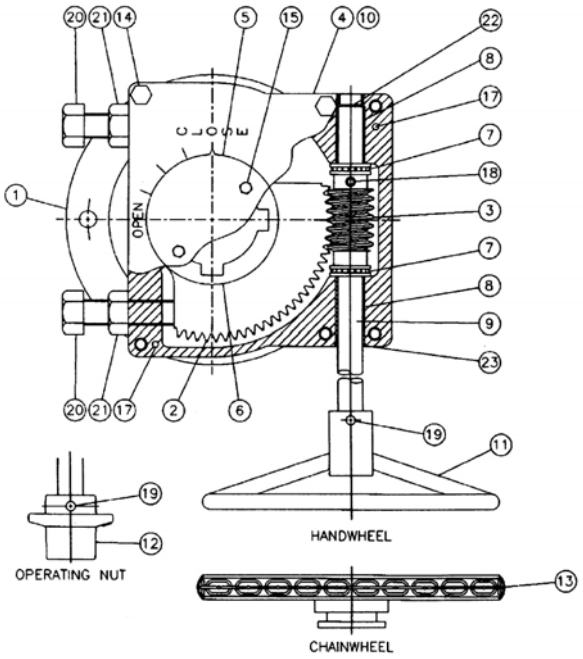


FIGURE 13. GEAR ACTUATOR CONSTRUCTION

ITEM	DESCRIPTION	MATERIAL
1	Housing	Cast Iron
2	Plug	Plastic
3	Wormwheel	Ductile Iron
4	Shaft	Steel
5	Indicator	Cast Iron
6	Paint	Primer
7	Cover	Cast Iron
8	Worm	Hardened Steel
9	Bearing	Bronze
10	Bearing Race	Steel
11	Grease	EP-2
12	Worm Spacer	Steel
13	Gasket	Fiberflex
14	Pipe Plug	Steel
15	Expansion Plug	Steel
16	Jam Nut	Hardened Steel
17	Dowel Pin	Hardened Steel
18	Spirol Pin	Steel
19	1/4-20 Cap Screw	Steel
20	3/8-16 Cap Screw	Steel, Gr. 5
21	5/8-11 Set Screw	Steel
22	O-Ring	Buna-N
23	U-Cup Seal	Buna-N

TABLE 2. GEAR ACTUATOR PARTS LIST

TROUBLESHOOTING

Several problems and solutions are presented below to assist you in troubleshooting the valve assembly in an efficient manner.

•Leakage at Valve Shaft: Adjust or replace packing .

•Leakage at Flanges: Tighten flange bolts, replace gasket.

•Valve Leaks when Closed: Pressure should be in the direction of pushing the plug into the seat. Adjust plug position by rotating the handwheel. Inspect plug for damage and replace.

•Hard to Open: Flush debris from valve. Check interior of valve for grit buildup or debris. On buried valves, check alignment of operating stem.

•Leaking Oil: Tighten actuator cover bolts. If leak persists, remove actuator cover, inspect grease, and replace actuator gasket.

•Noisy Operation: Flow noise is normal. Loud flow noise similar to hammering may be cavitation from dropping high pressures across valve; review application of valve. For gear actuator noise, inspect grease; add new grease if there are uncoated moving parts or grease has broken down into oil.

DISASSEMBLY

Disassembly may be required to inspect the plug for wear or remove debris and deposits from the valve. Work on the valve should be performed by a skilled mechanic with proper tools and a power hoist for large valves. The valve can be disassembled without removing the valve from the pipeline. Refer to Figure 14 for valve construction and parts.

WARNING: Open valve and drain line before removing cover bolts or pressure may be released causing injury. Place plug in lowest position before removing actuator or plug may rotate suddenly and jam or damage plug surface.

1. Open valve and drain the pipeline. Close valve until plug just touches the seat. Remove the small cover on the actuator to expose the shaft key.

2. Remove the actuator mounting bolts and lift actuator from valve taking care not to lose key (24).

3. Remove cover bolts (15). Matchmark cover (2) and body. Screw eye-bolts into actuator mounting holes and use hoist to lift cover (2) and plug assembly from valve. Use caution to prevent plug from dropping while lifting cover. To remove plug (3) from valve, use sling around top portion of plug.

4. Inspection of the bearings (6) is done by measuring diameter of shaft and inside diameter of bearing. Check for a normal running clearance of .005". Bearings are permanently lubricated.

5. Thrust bearing assembly (23) and packing gland (18) can be removed by removing all of the hex nuts (12).

REASSEMBLY

All parts must be cleaned and gasket surfaces should be cleaned with a stiff wire brush in the direction of the serrations or machine marks. Worn parts, gaskets and seals should be replaced during reassembly.

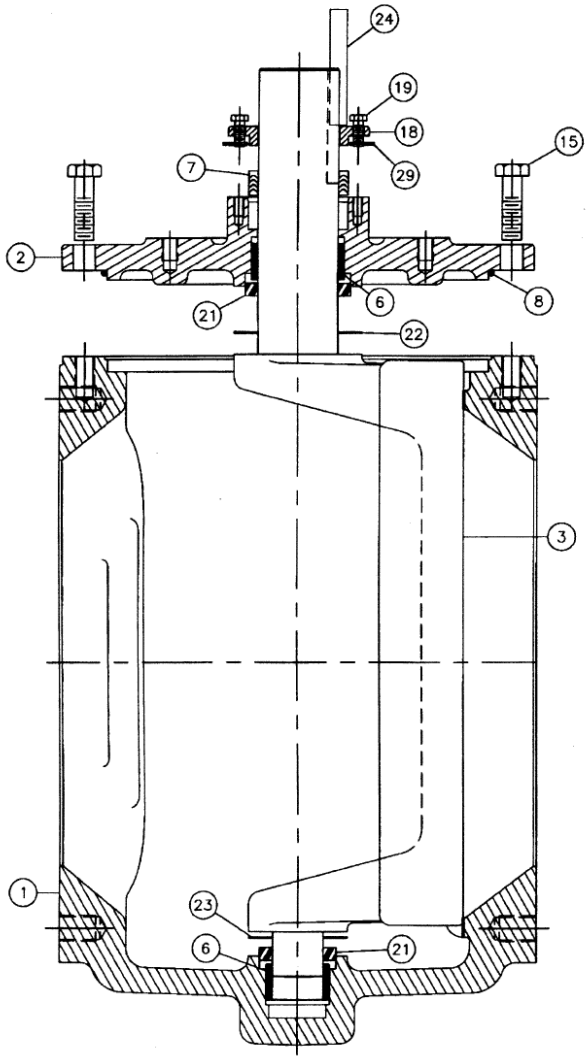


FIGURE 14. PLUG VALVE PARTS

1. Press new bearings (6) into cover and body with round, flat bar 1/4" below inside surfaces of body (1) and cover (2).

2. Install cover seal (8) over cover lip.

3. Apply thin film of FDA silicone grease such as Dow Corning #7 to plug rubber surface. Place stainless steel thrust bearing (23) over lower end of plug, Teflon bearing (22) over the upper end. Install grit seals (21) over the shafts of the plug.

4. Carefully place plug into the body (1) and insert lower plug shaft into bottom bearing (6). Plug (3) should be in the open position. Install cover (2) over plug shaft and into recess in body. Align match marks between body and cover (2). Torque cover bolts (15) per Table 6 in 3-4 increments using the cross-over tightening method.

5. Lubricate ID and OD of packing set with FDA grease and install in packing bore one ring at a time taking care to keep lips pointing down toward plug. Reinstall follower, gland bolts, and 2 shims per bolt.

   NOTE: If valve has friction assembly with direct nut actuator, follow Friction Adjustment procedure on page 5.

6. Insert key (24) into shaft and place actuator over valve. Reinstall actuator mounting bolts and torque per Table 6. Install cover on actuator.

7. Apply power to actuator and cycle valve. Apply pressure to valve and check for cover and shaft leakage. Tighten bolts as necessary. Adjust packing if necessary.

8. If valve does not shut off tight, adjust the closed position stop as described on page 6 under “Closed Position Adjustment.”

PARTS AND SERVICE

Parts and service are available from your local representative or the factory. Make note of the valve Size, Series No, and Serial No. located on the valve nameplate and contact:

Val-Matic Valve and Mfg. Corp.
905 Riverside Drive
Elmhurst, IL 60126
PH: 630/941-7600
FAX: 630/941-8042

A sales representative will quote prices for parts or arrange for service as needed.

TRELLEBORG

Kor-N-Seal® II
306 Series Pipe-to-Manhole Connector

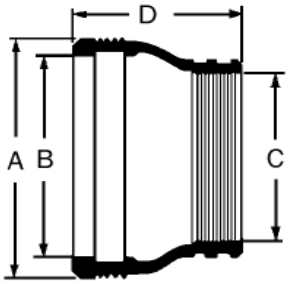
- *Allows you to fit large diameter pipe into the smallest possible manhole structures*
- *Can be used in cored or formed holes*

The Patented 4” wide Stainless Steel Korband is able to overcome the curvature of smaller sized manholes

Kor-N-Seal® II

306 Series Connector Sizing Chart

P/N	Suggested Pipe O.D. Range	Hole Size Range	Connector Dimensions			Pipe Clamp		Minimum Manhole Size
		A	B	C	D	Qty	P/N	
S306-22	17.625 - 18.500	21.98 - 22.13	19.875	19	10.5	2	I-318	36/4
S306-22L	18.500 - 19.625			20		2	I-348	
S306-24	19.625 - 20.500	23.98 - 24.13	21.875	21	10.5	4	I-180	36/4
S306-24L	20.500 - 21.625			22		4		
S306-26	21.625 - 22.500	26.00 - 26.20	23.875	23	10.5	4	I-190	36/4
S306-26L	22.500 - 23.625			24		4	I-218	
S306-28	23.625 - 24.500	28.00 - 28.20	25.875	25	10.5	4	I-218	48/5
S306-28L	24.500 - 25.625			26		4		
S306-30	25.625 - 26.500	30.00 - 30.20	27.875	27	10.5	4	I-218	48/5
S306-30L	26.500 - 27.625			28		4	I-242	
S306-32	27.625 - 28.500	32.00 - 32.20	29.875	29	10.5	4	I-242	48/5
S306-32L	28.500 - 29.625			30		4		
S306-34	29.625 - 30.500	34.00 - 34.20	31.875	31	10.5	4	I-258	48/5
S306-34L	30.500 - 31.625			32		4		
S306-36	31.625 - 32.500	36.00 - 36.20	33.875	33	10.5	4	80667 Power Gear	60/6
S306-36L	32.500 - 33.000			34		4		
S306-36-STORM	31.625 - 32.500	36.00 - 36.20	33.875	33	10.5	4	I-282	60/6
S306-36L-STORM	32.500 - 33.625			34		4		
S306-38	33.625 - 34.500	38.00 - 38.20	35.875	35	10.5	4	80667 Power Gear	60/6
S306-38L	34.500 - 35.000			36		4		
S306-38-STORM	33.625 - 34.500	38.00 - 38.20	35.875	35	10.5	4	I-282	60/6
S306-38L-STORM	34.500 - 35.625			36		4	I-306	
S306-40	35.625 - 36.500	40.00 - 40.20	37.875	37	10.5	4	80667 Power Gear	60/6
S306-40L	36.500 - 37.000			38		4		
S306-40-STORM	35.625 - 36.500	40.00 - 40.20	37.875	37	10.5	4	I-306	60/6
S306-40L-STORM	36.500 - 37.625			38		4		
S306-42	37.625 - 38.500	42.00 - 42.20	39.875	39	10.5	4	80667 Power Gear	72/7
S306-42L	38.500 - 39.000			40		6		
S306-42-STORM	37.625 - 38.500	42.00 - 42.20	39.875	39	10.5	4	I-318	72/7
S306-42L-STORM	38.500 - 39.625			40		4	I-348	
S306-44	39.625 - 40.500	44.00 - 44.20	41.875	41	10.5	6	80667 Power Gear	72/7
S306-44L	40.500 - 41.000			42		6		
S306-44-STORM	39.625 - 40.500	44.00 - 44.20	41.875	41	10.5	4	I-348	72/7
S306-44L-STORM	40.500 - 41.625			42		4		
S306-46	41.625 - 42.500	46.00- 46.20	43.875	43	10.5	6	80667 Power Gear	72/7
S306-46L	42.500 - 43.000			44		6		
S306-46-STORM	41.625 - 42.500	46.00 - 46.20	43.875	43	10.5	4	I-348	72/7
S306-46L-STORM	42.500 - 43.625			44		4		
S306-48	43.625 - 44.500	48.00 - 48.20	45.875	45	10.5	6	80667 Power Gear	72/7
S306-48L	44.500 - 45.000			46		6		
S306-48-STORM	43.625 - 44.500	48.00 - 48.20	45.875	45	10.5	6	I-242	72/7
S306-48L-STORM	44.500 - 45.625			46		6	I-258	



*Adapters are required when using corrugated pipe. Refer to the Corrugated Pipe Adapter Data Sheet for details.

Covered under U.S. Patent No. 6,641,176

Trelleborg Pipe Seals Milford, Inc.
250 Elm Street, P.O. Box 301, Milford, New Hampshire 03055 U.S.A.
Tel: 800-626-2180 603-673-8680 Fax: 603-673-7271 www.trelleborg.com/npc

TRELLEBORG
ENGINEERED SYSTEMS

Kor-N-Seal® II 306 Series Connector

Installation Instructions

Korband Installation (If not already installed)

1. Install Korband into Connector by first fitting Wedge Expander into center of cutout provided, then installing remainder of Korband. Make sure that head of bolt on Wedge Expander is located to the outside of Connector/inside of manhole.
2. Using pipe lubricant, lightly lube at least three to four sections of Korband by bending back rubber one section at a time. *Do not lube wedge area.*
3. Check to be sure Korband is properly located in Connector groove.

Connector Installation

1. Inspect the inside surface of the hole. If there is porosity or wire-to-concrete separation, use patching or hydraulic cement to smooth the surface.
2. Position the connector in the hole making sure that the wedge is located at 10:30 and that the top and the bottom of the connector are at the correct overhang position (see reverse side). The position of the wedge and the overhang are critical for proper performance.
3. Using a 1/2" torque wrench with a 3/8" hex bit socket (P/N 80718), tighten Single Wedge Bands to 75 foot pounds. Tighten Double Wedge Bands to 55 foot pounds. Double Wedge Bands must be tightened incrementally.
4. Place plastic cap over end of bolt(s).
5. Retorquing prior to shipping is recommended but not required.

Pipe Installation

1. Be sure sealing area of pipe is smooth and free of defects. Repair if needed.
2. Center pipe in Connector opening.
   (Pipe must not rest on Connector Korband)
3. Position the Pipe Clamp(s) in the Connector's Pipe Clamp groove.
4. Tighten the standard Pipe Clamp screws to 60 inch pounds with a T-handle Torque Wrench, P/N 80090. Power gear clamps torque to 120 inch pounds.

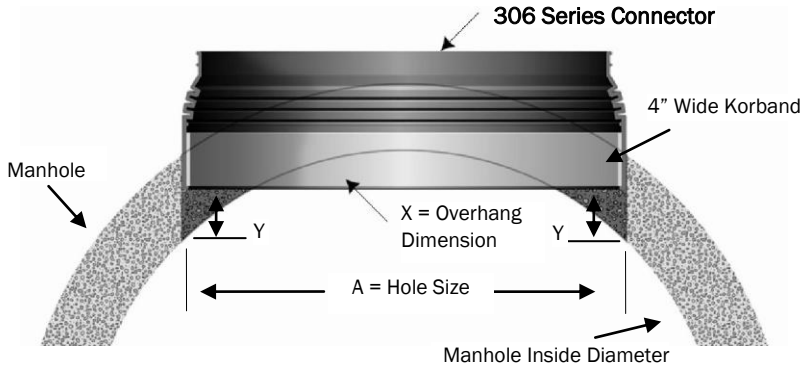
Note: On minimum pipe O.D. installations, lift the rubber up underneath the Pipe Clamp screw so that the Connector contacts the bottom surface of the pipe while the Pipe Clamp screw is being tightened. Application of pipe lubrication on the underside of the clamp will also help ensure that an even contraction of rubber is maintained throughout the clamping area.

Caution: Do not use impact wrench for installation.
All pipe stubs must be restrained.

Using Corrugated Pipe:
Adapters are required when using Corrugated Pipe.
Refer to the Corrugated Pipe Adapter Data Sheet for details.

TRELLEBORG
ENGINEERED SYSTEMS

Kor-N-Seal® II
306 Series Connector
Overhang Chart



Note Y dimension: Boot must be square in hole (even on both sides).

Hole Size	Manhole I.D.					
	48/4.75"	48/5"	60/5"	60/6"	72/6"	72/7"
"A"	X	X	X	X	X	X
28	1 1/2					
30	1 7/8	2				
32	2 1/4	2 1/4	1			
34	—	2 5/8	1 1/4			
36	—	—	1 1/2	1 3/4		
38	—	—	1 7/8	2 1/8		
40	—	—	2 1/8	2 3/8	1 1/2	
42	—	—	2 1/2	—	2	
44	—	—	—	—	2 1/4	1 7/8
46	—	—	—	—	2 1/2	2 1/4
48	—	—	—	—	—	2 1/2

All dimensions are in inches

Hamilton Kent
make the connection

Tylox® SuperSeal™ Pre-Lubricated Gasket

Say *Goodbye* to the lube bucket and brush …… Say *Hello* to fast, clean, simple installation

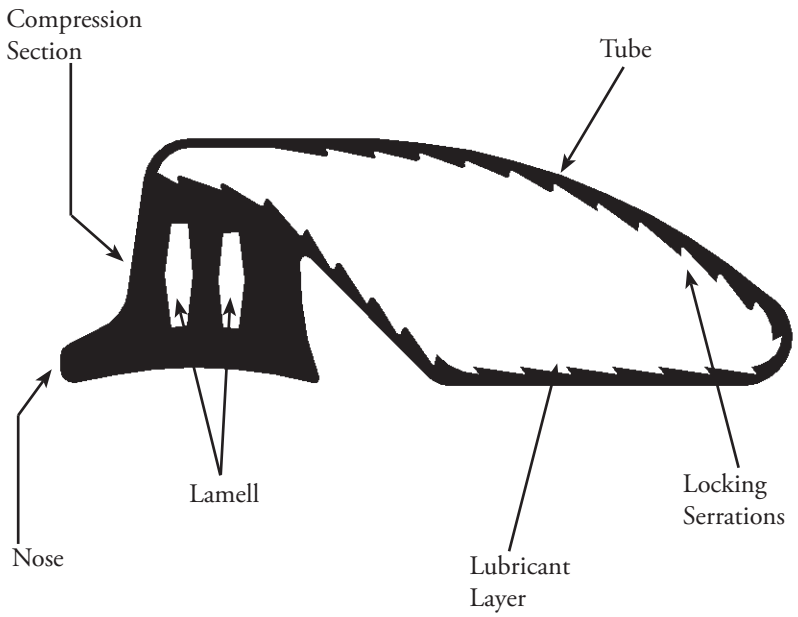
Requiring no field lubrication, the Tylox® SuperSeal™ gasket* has a layer of silcone lubricant installed on the inner surface of the tube during the manufacturing process; saving you time, and money, on the job-site.

Self-contained Lubricant. Sealed within the tube, the lube is impervious to mud, dirt and debris. If you drop it in the trench, simply wipe the gasket surface clean and you're ready to install. No special handling or packaging is required.

Easier installation, without equalization, is made possible due to the reduced gasket stretch required by the unique lamell/rolling tube design. Quick and easy to install means you save even more time.

No gasket "roll" or "twist" during coupling is another benefit of the unique lamell/rolling tube design, which reduces the insertion force required. Manual coupling of up to 36" pipe is possible.

For Single Offset Joints ...



… in Round or Elliptical Pipe, Man-Holes and Boxes

Self-Centering of the Spigot within the Bell is carried out as the tube rolls into the annular space during the homing process.

Elimination of Joint Kick Back, is caused by the rearward locking action of the serrations as the tube rolls forward

Bell and Spigot protection under deflection is accomplished by the cushioning effect of the tube, as it rests within the annular space.

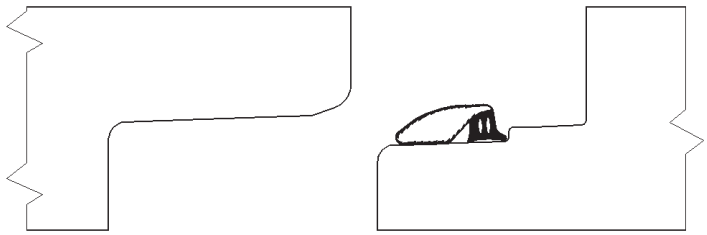
ASTM C361, ASTM C425, ASTM C443, AASHTO M198.4 and CSA A-257 material requirement compliance.

Pipe sizes to 144" can be accommodated.

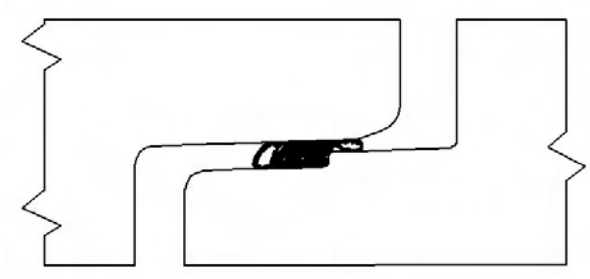
INSTALLATION

Ensure Bell, Spigot and Gasket are free from loose debris or foreign material.

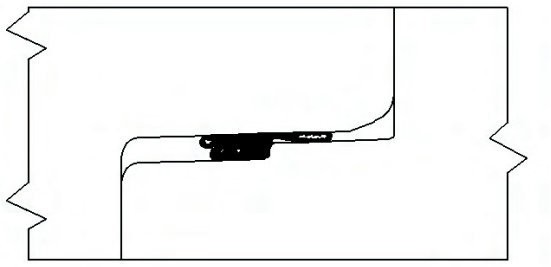
Stretch the gasket around the spigot, with the nose against the step, and the tube laying flat against the spigot. DO NOT LUBRICATE.



Align the spigot with the bell, and thrust the spigot home using suitable mechanical means. The homing process will cause the lubricated tube to "roll" over itself, above the compression section, allowing the pipe to slide forward.



Once fully homed, the compression section seals the total annular space; the rolling tube comes to rest within the small annular space - acting as a cushion against side loads, and the serrations act to resist pipe pull-out.



*Tylox SuperSeal Gaskets are patented under US Patent 4934716

MATERIALS

Tylox® SuperSeal™ gaskets* are available in the following materials:

- Isoprene

Optional Materials

- Nitrile (Oil Resistant)
- Isoprene / EPDM blend (Green Book & C425)
- Neoprene (Oil and Ozone Resistant)

Other materials may be available as special order.
Consult your Hamilton Kent agent for your specific requirements.

SPECIFICATIONS

Tylox® SuperSeal™ gaskets* are manufactured to meet the material requirements of the following specifications:

- ASTM C361, C425, & C443
- AASHTO M198.4
- CSA A257
- "Green Book"

Other specifications may be available as special order. Please consult your Hamilton Kent agent for your specific requirements.

CONTACT US

Hamilton Kent

77, Carlingview Drive
Toronto, Ontario, Canada.
M9W 5J6

Phone (800) 268-8479
Fax (888) 674-6960

Web-Site www.hamiltonkent.com
E-Mail sales@hamiltonkent.com

Lit_TSS_0601_ER4

NO LUBRICANT REQUIRED

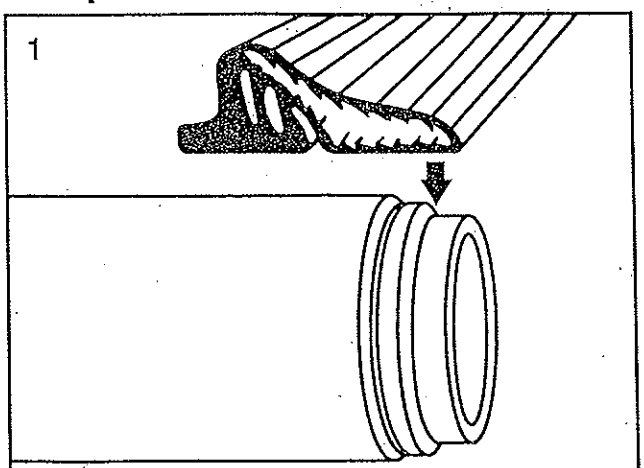
TYLOX Super Seal

Hamilton Kent
make the connection

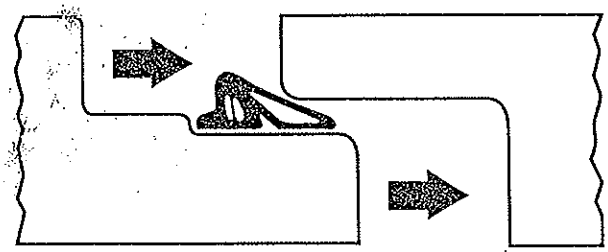
Pipe & Manhole Pre-lubricated Gasket Installation

Pipe

1

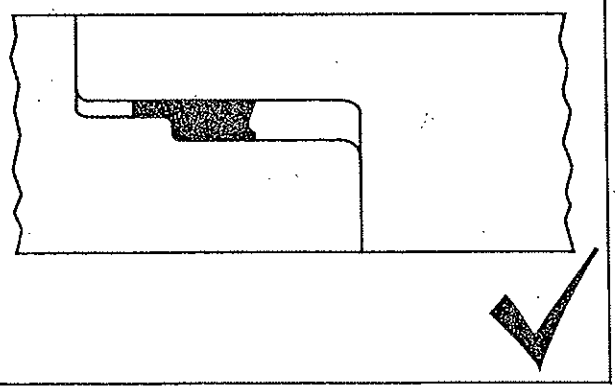


2



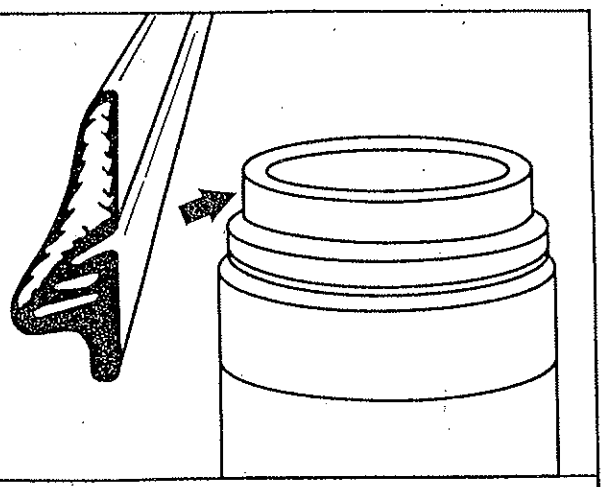
Gasket should be placed firmly against the offset all the way around the spigot of the pipe.

3

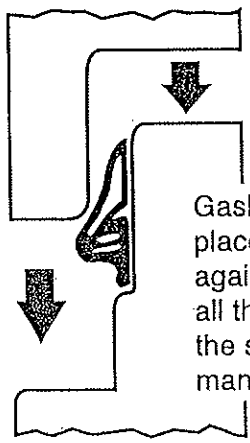


Manhole

1

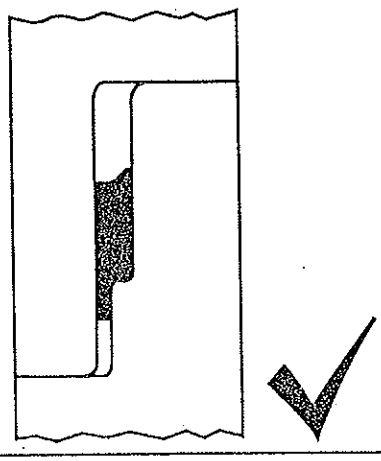


2



Gasket should be placed firmly against the offset all the way around the spigot of the manhole.

3



ConSeal™ Concrete Sealants INC.

CS-202

Butyl Rubber Sealant

APPLICATIONS

For self-sealing joints in: Manholes, Concrete Vaults, Septic Tanks, Concrete Pipe, Box Culverts, Utility Vaults, Burial Vaults, and Vertical Panel Structures.

SEALING PROPERTIES

- Provides permanently flexible watertight joints.
- Low to high temperature workability: 0°F to 120°F (-12°C to 48°C)
- Rugged service temperature: -30°F to +200°F (-34°C to +93°C)
- Excellent chemical and mechanical adhesion to clean, dry surfaces.
- Sealed Joints will not shrink, harden or oxide upon aging.
- No priming normally necessary. When confronted with difficult installation conditions, such as wet concrete or temperatures below 40°F (4°C), priming the concrete will improve the bonding action. Consult Concrete Sealants for the proper primer to meet your application.

HYDROSTATIC STRENGTH

ConSeal CS-202 meets the hydrostatic performance requirement as set forth In ASTM C-990 section 10.1 (Performance requirement: 10psi for 10 minutes in straight alignment – in plant, quality control test for joint materials.)

SPECIFICATIONS

ConSeal CS-202 meets or exceeds the requirements of Federal Specification SS-S-210 (210-A), AASHTO M-198B, and ASTM C-990-91.

P.O. Box 176, New Carlisle OH, 45344 • 937.845.8776 or 800.332.7325
FAX 937-845-3587 • www.conseal.com

ConSeal™ Concrete Sealants INC.

CS-202

Butyl Rubber Sealant

PHYSICAL PROPERTIES

	Spec	Required*	CS-202
Hydrocarbon blend content % by weight	ASTM D4 (mod.)	50% min.	52%
Inert mineral filler % by weight	AASHTO T111	30% min.	35%
Volatile Matter % by weight	ASTM D6	2% max.	1.2
Specific Gravity, 77°F	ASTM D71	1.15-1.50	1.20
Ductility, 77°F	ASTM D113	5.0 min.	12
Penetration, cone 77°F, 150 gm. 5 sec.	ASTM D217	50-100	60-65
Penetration, cone 32°F, 150 gm. 5 sec.	ASTM D217	40 mm	50-55
Flash Point, C.O.C., °F	ASTM D92	350°F min.	425°F
Fire point, C.O.C., °F	ASTM D92	375°F min.	450°F

IMMERSION TESTING

- 30-Day Immersion Testing: No visible deterioration when tested in 5% Caustic Potash, 5% Hydrochloric Acid, 5% Sulfuric Acid, and 5% saturated Hydrogen Sulfide. *

- One Year Immersion Testing: No visible deterioration when tested in 5% Formaldehyde, 5% Formic Acid, 5% Sulfuric Acid, 5% Hydrochloric Acid, 5% Sodium Hydroxide, 5% Hydrogen Sulfide and 5% Potassium Hydroxide.

* Requirements of ASTM C-990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

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ROMTEC UTILITIES RECOMMENTATION FOR USE AS JOINT TAPE

TAPECOAT® M860 PAVEMENT REPAIR COATING

Protection for Concrete and Asphalt Surfaces

Tapecoat M860 provides quick and easy repair of cracks in concrete and asphalt surfaces. This cold-applied, self-adhering tape is effective as a temporary patching material and also offers excellent bonding for repair of the substrate prior to a complete asphalt overlay. Tapecoat M860 solves maintenance problems in paving material on city streets, highways, and parking structures. This puncture-resistant coating can also protect transducer and sensor wiring from tire damage, prevent pavement deterioration due to deformation in heavy-traffic areas, and provide quick temporary repair to paved surfaces on bridges and airport runways and tarmacs. Tapecoat M860 retains its ability to bond under pressure at temperatures as low as 0˚F, making this coating ideal for temporary repairs during the cold winter months.

Tapecoat® M860 Pavement Repair Coating

- *Excellent bond to concrete and asphalt surfaces*
- *Applies easily in long lengths or short pieces*
- *Cold-applied tape with quick release liner*
- *Impermeable to water and salt*
- *Puncture-resistant*
- *Prefabricated to provide uniform thickness*
- *Environment-friendly*

Features/Specifications/Application

Tapecoat® M860

A pre-formed, cold-applied, self-adhering material that is impermeable to water and salt.

Composition

Tapecoat M860 is a pre-formed, cold-applied coating. The adhesive is manufactured from specially formulated elastomer and resins bonded to a woven highly puncture-resistant polymer.

Technical Data

Color:	Black
Shelf life:	Rotate stock yearly
Low temp flex:	Excellent
Bacteria resistance:	Excellent
Thickness:	.060" Nominal
Water Vapor Transmission Rate, Permeance:	0.01 perms(grams/sq.ft.hr./in. Hg) Maximum
Tensile Strength:	50 lb.in. Minimum
Puncture Resistance: (Mesh)	200 lb. Minimum
Pliability-1/4" Mandrel 180˚ bend -30˚F:	No cracks in mesh or adhesive

Surface Preparation

Tapecoat M860 should be applied over dry pavement that is free of dirt, debris or other foreign matter. Pavement cracks wider than 3/8" should be pre-filled with hot or cold crack material prior to applying Tapecoat M860 to assure longer protection of the crack filling material against surface wear.

Option

If the application is taking place in extreme cold (below 32˚F/0˚C) a liquid primer will enhance the immediate bond. TC Omniprime is the compatible primer for use with this product.

TAPECOAT
PO Box 631, Evanston, IL 60204-0631 • 1527 Lyons St. Evanston, IL 60201-3551 USA
800/758-6041 847/866-8500 Fax: 800/332-8273 Fax: 847/866-8596 www.tapecoat.com

4. Pump & Accessories

PUMPS & PUMP ACCESSORIES SUPPLIER:

ITT - Goulds
Jane Doe
888 East Street
City, State 13111
Ph: (888) 111-1111; Fax: (888)
111-1111 Email: name@company.com

TURBINE PUMPS – GOULDS MODEL DWT

PUMP DATA SHEET
DIMENSIONAL OUTLINE
HYDRAULIC ANALYSIS
SECTIONAL VIEW
PUMP OPERATION & MAINTENANCE MANUAL
MOTOR DATA

PUMP DATA SHEET Turbine 60 Hz

Company: ITT
Name:
Date: 09/14/11

Customer:
Order No:

Pump:

Size: 12FDHC (1 stages)
Type: Lineshaft
Synch speed: 1800 rpm
Speed: 1770 rpm
Dia: 6.875 in
Curve: E6412FDPC0
Specific Speeds:
Ns: 4238
Pump Notes for Standard Sizes:
Suction Size-10" Discharge Sizes-6",8",10". Curves are certified for water at 60°F only. Consult factory for performance with any other fluid.
Vertical Turbine:
Bowl size: 11.6 in
Max lateral: 0.75 in
Thrust K factor: 15 lb/ft

Search Criteria:

Flow: 2300 US gpm
Head: 32.5 ft

Fluid:

Water
Density: 62.25 lb/ft³
Viscosity: 1.105 cP
Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a
NPSHa: --- ft

Motor:

Standard: NEMA
Size: 30 hp
Speed: 1800
Sizing criteria: Max Power on Design Curve

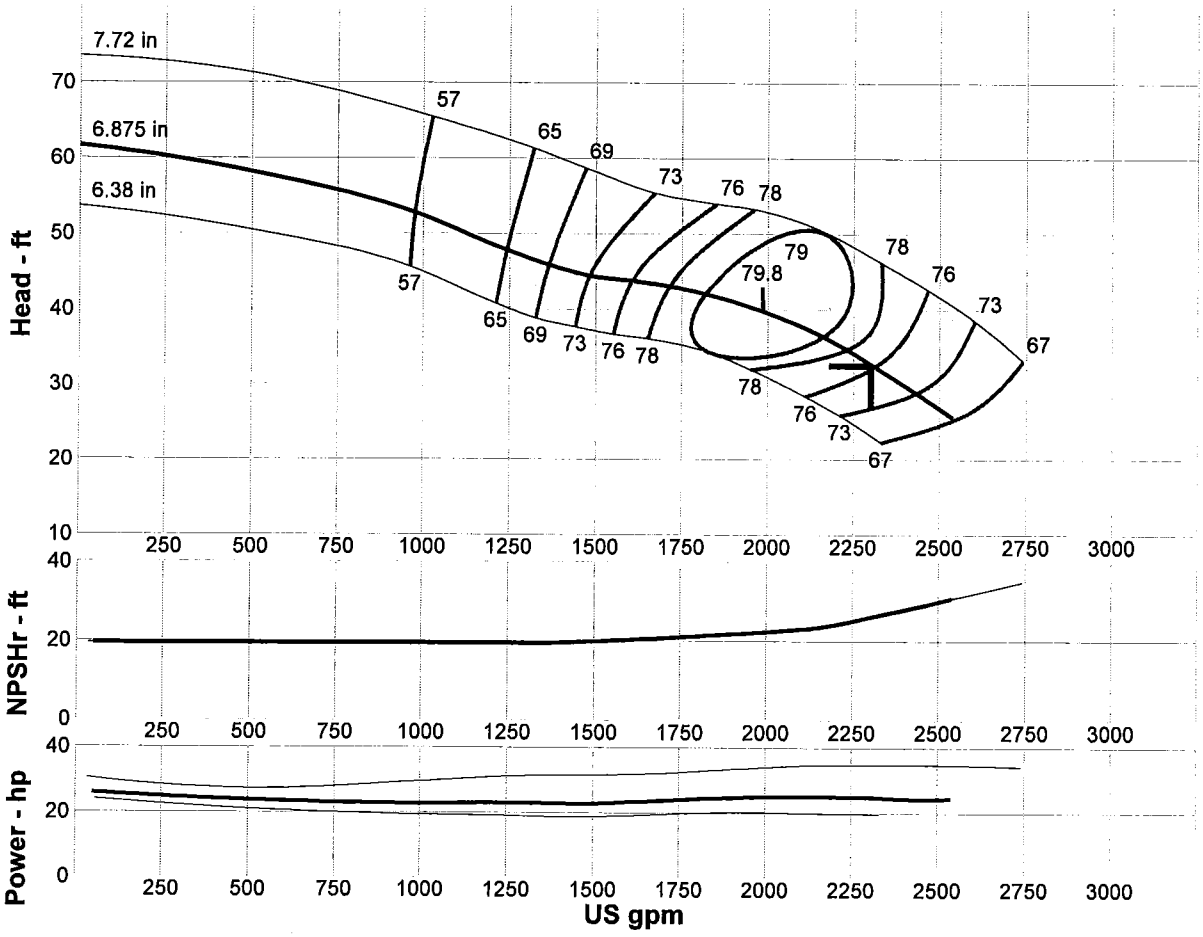
Pump Limits for Standard Construction:

Temperature: 120 °F
Pressure: 440 psi g
Sphere size: 0.81 in

---- Data Point ----
Flow: 2300 US gpm
Head: 32.7 ft
Eff: 76.3%
Power: 24.9 hp
NPSHr: 26.2 ft

-- Design Curve --
Shutoff Head: 61.7 ft
Shutoff dP: 26.7 psi
Min Flow: --- US gpm
BEP: 79.8% eff
@ 1985 US gpm
NOL Pwr: 26 hp
@ 46.9 US gpm

-- Max Curve --
Max Pwr: 34.9 hp
@ 2465 US gpm



Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
2760	1770	---	---	---	---
2300	1770	32.7	76.3	24.9	26.2
1840	1770	41.7	79.1	24.5	21.6
1380	1770	45.7	69.6	22.9	19.6
920	1770	53.4	54	22.9	19.5

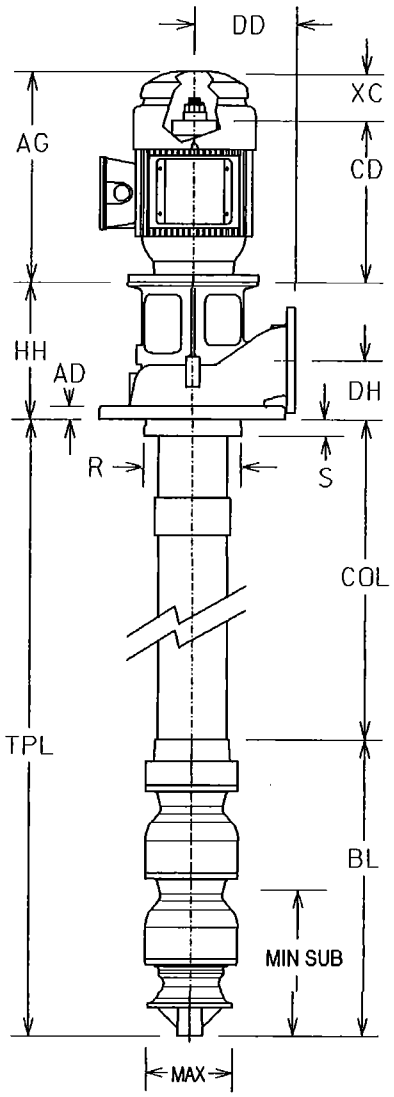
Selected from catalog: Goulds Lineshaft 60HZ Vers: 3.34

ITT

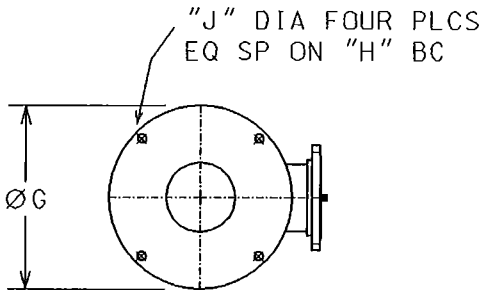
DIMENSIONAL OUTLINE

VIT-CATM

1 Stage 10x12FDHC



AD:	1.13
AG:	28.13
BD:	16.5
BL:	28.38
CD:	24.75
CL:	N/A
COL:	253.62"
DD:	14.00
MIN SUB:	29.9
DH:	9.25
G:	25.00
H:	22.75
HH:	19.00
J:	0.75
R:	14.60
S:	2.38
TPL:	282.0"
UG:	N/A
V:	
W:	
X:	
XC:	3.22
Y:	
Z:	
MAX:	11.60



DISC HEAD

Pump Data

Size:	12FDHC
Stages:	1
BowlShaft:	1.94"
LineShaft:	1.19"
LineShaft Type:	Open
Column:	Standard
Column:	10" Threaded
Bearing Spacing:	10 feet
Section Length:	10 feet
Head:	A:Cast
Flange (Disch.):	10"-125# FF
Suct.:	
Seal:	Packing
Strainer:	None
SubBase:	None

Hydraulic Data

Flow (gpm):	2300
Pump Head (ft):	29.9
TDH (ft):	32.7
Speed (rpm):	1770
Fluid:	Water
Temperature (F):	60
Viscosity:	1.105
Spec.Grav:	1

Miscellaneous

Thrust At Design (lb):	600
Thrust At Shutoff (lb):	1035
Pumping Level(in):	12

Weight

Pump (lb):	1660
Motor (lb):	325
Total (lb):	1985

Motor Data

Model:	HO30S2BLG
Make:	Goulds Choice
HP:	30
RPM:	1800
Type:	AU
Efficiency:	90.2
Frame:	286TPH
Ratchet:	NRR

Version: 4.13P

Customer:

Date: 09-14-2011

MOTOR THERMAL SENSORS INCLUDED.

ITT

HYDRAULIC ANALYSIS
VIT-CATM
1 Stage 10x12FDHC

Overall Pump Parameters

Size and Model:	12FDHC	Pump Operating Speed, RPM:	1770
Capacity, GPM:	2300	Total Dynamic Head, Ft.:	32.7
Total Pump Length, In.:	282.0	Impeller Trim, In.:	6.9
Pump Type:	OpenSump	Head Type:	A:Cast
Pump K-Factor:	15	Number of Stages:	1
		Pumping Level, In.:	12.0

LineShaft-Related Data

Shaft Diameter, In.:	1.19	Shaft Limit, HP:	106
Shaft Material:	C-1045	Matl Correction Fact:	1
LineShaft Length, In.:	253.62	Shaft Elongation, w/o Adder:	0.00
LineShaft Type:	Open	Impeller Running Clearance:	0.13

Bowl Data

Total Bowl Length, In.:	28.38	Bowl Diameter, In.:	11.6
Bowl Shaft Dia, In.:	1.94	Bowl Shaft Limit, HP:	588
		Bowl Shaft Material:	416SS

Column Data

Column Diameter, In.:	10	Column Load, Lb.:	484.3
Wall Thickness, In:	0.365	Column Elongation, In.:	0.00
		Shutoff Column Elongation, In.:	0.00

HorsePower Data

Shaft Friction Loss, Hp.:	0.15	Thrust Load Loss, Hp.:	0.08
Bowl HP At Design, Hp.:	24.9	Motor HorsePower, Hp.:	30

Other Data

Hydraulic Thrust, Lb.:	490.5	Thrust at Design, Lb.:	600.0
Thrust at Shutoff, Lb.:	1035.4	Actual Head above Grade, Ft.:	29.87
Available Lateral, In.:	0.75	Design Lateral, In.:	0.13
Shutoff Lateral, In.:	0.14		
Suction Pressure, psi:	0.0	Shutoff Disc Pressure, psi:	26.3
Column Loss, Ft.:	0.83	NPSHa, Ft.:	54.86
Head Loss, Ft.:	1.01	NPSHr, Ft.:	26.20
Total Loss, Ft.:	1.83	NPSH margin, Ft.:	28.66

Efficiency Data (Efficiencies estimated not guaranteed)

Bowl Efficiency:	76.30	Pump Efficiency:	71.35
Motor Efficiency:	90.20	Overall Efficiency:	64.36
		KWH/1000 gallons:	0.16

Component Weights

Bowl Weight, Lbs.:	275	Column Weight,Lbs.:	845
Head Weight, Lbs.:	540	Can Weight,Lbs.:	0
Motor Weight, Lbs.:	325	Total Pump Weight,Lbs.:	1985

Version: 4.13P Customer: Date: 09-14-2011

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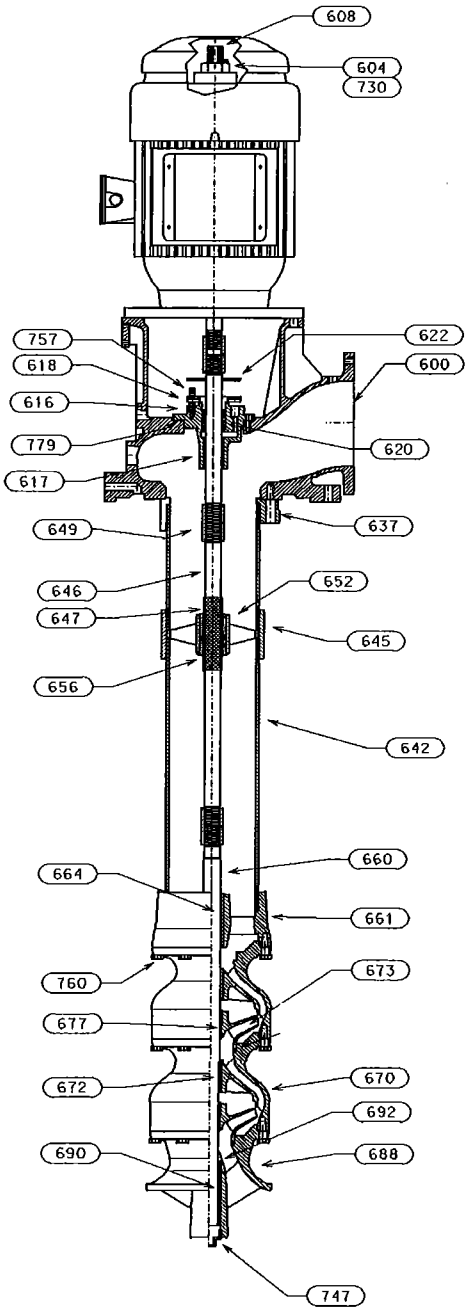
SECTIONAL
VIT-CATM
1 Stage 10x12FDHC



DISCHARGE HEAD ASSEMBLY

ITEM	NAME	Code	MATERIAL	ASTM
600	HEAD- DISCHARGE	8533	ENGARD 480 ON IRON	A48
604	NUT- ADJUSTING	2130	BRASS C36000	B16M-00
608	HEADSHAFT	2205	CARBON STEEL 1045	A108-99
616	HOUSING	1003	CAST IRON CL30	A48-94ae1
617	BEARING- HOUSING	1109	FEDERALLOY BISMUTH BRZ	B584-00
618	GLAND- SPLIT	1203	SST 316	A744M-00
620	PACKING	5026	GRAPHITE PACKING	ML402-99
622	SLINGER	5121	RUBBER EPDM	D3568-98
637	COLUMN FLANGE	8533	ENGARD 480 ON IRON	A48
730	KEY- MOTOR GIB	2242	CARBON STEEL 1018	A108-99
757	SCREW- GLAND ADJUSTING	2229	SST 316	A276-00a
779	GASKET- HOUSING	5136	ACRYLIC/NITRILE	5136 REV 4

COLUMN AND LINESHAFT ASSEMBLY

642	COLUMN PIPE	8535	ENGARD 480 ON STEEL	A536
645	COLUMN COUPLING	8535	ENGARD 480 ON STEEL	A536
646	LINESHAFT	2205	CARBON STEEL 1045	A108-99
647	LINESHAFT SLEEVE	4203	SST 304	A269-00
649	LINESHAFT COUPLING	2242	CARBON STEEL 1018	A108-99
652	RETAINER- BEARING	1102	SILICON BRONZE C87600	B584-00
656	LINESHAFT BEARING	5121	RUBBER EPDM	D3568-98

BOWL ASSEMBLY

660	SHAFT- BOWL	2227	SST 416	A582M-95b
661	BOWL- DISCHARGE	8533	ENGARD 480 ON IRON	A48
664	BEARING- DISC BOWL	1109	FEDERALLOY BISMUTH BRZ	B584-00
670	BOWL- INTERMEDIATE	8533	ENGARD 480 ON IRON	A48
672	BEARING- INT BOWL	1109	FEDERALLOY BISMUTH BRZ	B584-00
673	IMPELLER	1102	SILICON BRONZE C87600	B584-00
677	COLLET- IMPELLER	2242	CARBON STEEL 1018	A108-99
688	BOWL/BELL- SUCTION	8533	ENGARD 480 ON IRON	A48
690	BEARING- SUCTION	1109	FEDERALLOY BISMUTH BRZ	B584-00
692	SANDCOLLAR	1109	FEDERALLOY BISMUTH BRZ	B584-00
747	PLUG- PIPE	1046	MALLEABLE IRON	A197
760	CAPSCREW- HEX	2298	STEEL BOLTING GR 8	J429-99

Protective Coatings

A. **Potable Water** (drinking water) where no odor or contamination is allowed, such as in the food processing industry.

Type I/III Tnemec 140 (Epoxy applied at 4-6 mils per coat. Total minimum thickness is 8 mils. for **Type I** and 20 mils for **Type III**. Maximum service temperature 130° F.)

Type IV ScotchKote 134 (Fusion banded power epoxy applied at 10-12 mils, Maximum service temperature of 160° F.)

Note: These coatings are certified by **NSF International** in accordance with **ANSI/NSF Std. 61.**

B. **Sea Water, Brackish Water and Brine**

Type I Carboline Bitumastic 300M (Coal tar epoxy applied at 9 mils per coat, maximum 18 mils. Maximum service temperature 120° F.)

Type I/III Engard 460 (Epoxy applied at 10 mils per coat. Maximum 20 mils. Maximum service temperature 140° F.)

Type II Carbozinc 11 (Inorganic zinc at 2-3 mils per coat. DO NOT use this coating for acid or alkali solution **without** a suitable topcoat. Maximum service temperature 200° F.)

Type IV ScotchKote 134 (Fusion banded power epoxy applied at 12 mils, Maximum service temperature of 160° F.)

Note: If moderate amounts of sand are present in the pumpage, these coatings, applied at recommended maximum mils, also provide good wear protection for the interior of steel column and discharge head, and exterior surface of enclosing tubing.

Coatings for these liquids require pinhole-free surface, and smoothly ground welds, refer to factory for pricing of steel surfaces preparation.

C. **River Water with Abrasives** (silt and sand)

Type I Carboline Bitumastic 300M (Coal tar epoxy applied at 9 mils per coat, maximum 18 mils. Maximum service temperature 120° F.)

Type I/III Engard 460 (Epoxy applied at 10 mils per coat. Maximum thickness 20 mils. Maximum service temperature 140° F.)

Type IV ScotchKote 134 (Fusion banded power epoxy applied at 12 mils, Maximum service temperature of 160° F.)

Note: If moderate amounts of sand are present in the pumpage, these coatings, applied at recommended maximum mils, also provide good wear protection for the interior of steel column and discharge head, and exterior surface of enclosing tubing.

Effective November, 2005
D200E04

www.goulds.com
PRINTED IN U.S.A.
Specifications subject to change without notice.

NIDEC MOTOR CORPORATION
8050 WEST FLORISSANT AVE.
ST. LOUIS, MO 63136

DATE: 12/15/2011

P.O. NO.:
Order/Line NO.: 17166 MN

TO:

Model Number: BF42
Catalog Number: HO30S2BLG
HO30S2BLG,WPI,STD,AC MTR
60,230/460V
AU,30HP,4P,A286TPH,NRR

REVISIONS:
(NONE)

ALL DOCUMENTS HEREIN ARE CONSIDERED CERTIFIED BY NIDEC MOTOR CORPORATION.
THANK YOU FOR YOUR ORDER AND THE OPPORTUNITY TO SERVE YOU.

Features:

HorsePower	30
Enclosure	WPI
Poles	04
RPM (Full Load)	1760
Motor Frame Size	286TPH
Phase	3
Frequency	60
Voltage	460-230
Motor Type Code	AU
Rotor Inertia (LB-FT²)	2.36 LB-FT²
Qty. of Bearings PE (Shaft)	1
Qty. of Bearings SE (OPP)	1
Bearing Number PE (Shaft)	7310 BEP
Bearing Number SE (OPP)	6210-2Z-J/C3

NAMEPLATE DATA

CATALOG NUMBER:	HO30S2BLG			NAMEPLATE PART #:	422703-004		
MODEL	BF42	FR	286TPH	TYPE	AU	ENCL	WPI
SHAFT END BRG	7310 BEP - QTY 1			OPP END BRG	6210-2Z-J/C3 - QTY 1		
PH	3	MAX AMB	40 C	ID#			
INSUL CLASS	F	Asm. Pos.		DUTY	CONT		

HP	30		RPM	1760		HP		RPM	
VOLTS	460	230				VOLTS			
FL AMPS	37.0	73.0				FL AMPS			
SF AMPS	42.0	85.0				SF AMPS			
SF	1.15	DESIGN	B	CODE	F	SF		DESIGN	CODE
NEMA NOM EFFICIENCY	90.2	NOM PF	85.3	KiloWatt	22.380	NEMA NOM EFFICIENCY		NOM PF	
GUARANTEED EFFICIENCY	88.5	MAX KVAR	8.1	HZ	60	GUARANTEED EFFICIENCY		MAX KVAR	HZ

UL DATA (IF APPLICABLE):

DIVISION		CLASS I	GROUP I
TEMP CODE		CLASS II	GROUP II

VFD DATA (IF APPLICABLE):

VOLTS			
AMPS			
TORQUE 1		TORQUE 2	
VFD LOAD TYPE 1		VFD LOAD TYPE 2	
VFD HERTZ RANGE 1		VFD HERTZ RANGE 2	
VFD SPEED RANGE 1		VFD SPEED RANGE 2	
SERVICE FACTOR		FL SLIP	
NO. POLES	4	MAGNETIZING AMPS	11.9
VECTOR MAX RPM		Encoder PPR	
Radians / Seconds	1	Encoder Volts	

TEAO DATA (IF APPLICABLE):

HP (AIR OVER)		HP (AIR OVER M/S)		RPM (AIR OVER)		RPM (AIR OVER M/S)	
FPM AIR VELOCITY		FPM AIR VELOCITY M/S		FPM AIR VELOCITY SEC			

MOTOR THERMAL SENSORS INCLUDED.

ADDITIONAL NAMEPLATE DATA:

Decal / Plate	WD=109145	Customer PN	
Notes		Non Rev Ratchet	NRR
Max Temp Rise		OPP/Upper Oil Cap	GREASE
Thermal (WDG)		SHAFT/Lower Oil Cap	GREASE
Altitude			
Regulatory Notes		Regulatory Compliance	
COS		Marine Duty	
Balance	0.08 IN/SEC	Arctic Duty	
3/4 Load Eff.	91.8	Inrush Limit	
Motor Weight (LBS)	325	Direction of Rotation	
Sound Level		Special Note 1	
Vertical Thrust (LBS)	3300	Special Note 2	
Thrust Percentage		Special Note 3	
Bearing Life		Special Note 4	
Starting Method		Special Note 5	
Number of Starts		Special Note 6	
200/208V 60Hz Max Amps		SH Max. Temp.	
190V 50 hz Max Amps		SH Voltage	SH VOLTS=115V
380V 50 Hz Max Amps		SH Watts	SH WATTS= 48W
NEMA Inertia		Load Inertia	
Sumpheater Voltage		Sumpheater Wattage	
Special Accessory Note 1		Special Accessory Note 16	
Special Accessory Note 2		Special Accessory Note 17	
Special Accessory Note 3		Special Accessory Note 18	
Special Accessory Note 4		Special Accessory Note 19	
Special Accessory Note 5		Special Accessory Note 20	
Special Accessory Note 6		Special Accessory Note 21	
Special Accessory Note 7		Special Accessory Note 22	
Special Accessory Note 8		Special Accessory Note 23	
Special Accessory Note 9		Special Accessory Note 24	
Special Accessory Note 10		Special Accessory Note 25	
Special Accessory Note 11		Special Accessory Note 26	
Special Accessory Note 12		Special Accessory Note 27	
Special Accessory Note 13		Special Accessory Note 28	
Special Accessory Note 14		Special Accessory Note 29	
Special Accessory Note 15		Special Accessory Note 30	

NIDEC MOTOR CORPORATION

ST. LOUIS, MO

TYPICAL NAMEPLATE DATA
ACTUAL MOTOR NAMEPLATE LAYOUT MAY VARY
SOME FIELDS MAY BE OMITTED

MOTOR PERFORMANCE

MODEL NO.	CATALOG NO.	PHASE	TYPE	FRAME
BF42	HO30S2BLG	3	AU	286TPH

ORDER NO.	17166	LINE NO.	

MPI:	128806	128807
HP:	30	30
POLES:	4	4
VOLTS:	460	230
HZ:	60	60
SERVICE FACTOR:	1.15	1.15
EFFICIENCY (%):		
S.F.	88.8	88.8
FULL	90.2	90.2
3/4	91.8	91.8
1/2	91.9	91.9
1/4	88.8	88.8
POWER FACTOR (%):		
S.F.	85.8	85.8
FULL	85.3	85.3
3/4	82.7	82.7
1/2	75.2	75.2
1/4	54.9	54.9
NO LOAD	6.1	6.1
LOCKED ROTOR	47.5	47.5
AMPS:		
S.F.	42	85
FULL	37	73
3/4	27.8	56
1/2	20.3	41
1/4	14.4	28.8
NO LOAD	11.9	23.7
LOCKED ROTOR	204	408
NEMA CODE LETTER	F	F
NEMA DESIGN LETTER	B	B
FULL LOAD RPM	1760	1760
NEMA NOMINAL EFFICIENCY (%)	90.2	90.2
GUARANTEED EFFICIENCY (%)	88.5	88.5
MAX KVAR	8.1	8
AMBIENT (°C)	40	40
ALTITUDE (FASL)	3300	3300
SAFE STALL TIME-HOT (SEC)	0	0
SOUND PRESSURE (DBA @ 1M)	70	70
TORQUES:		
BREAKDOWN{% F.L.}	246	246
LOCKED ROTOR{% F.L.}	197	197
FULL LOAD{LB-FT}	89.5	89.5

The Above Data Is Typical, Sinewave Power Unless Noted Otherwise

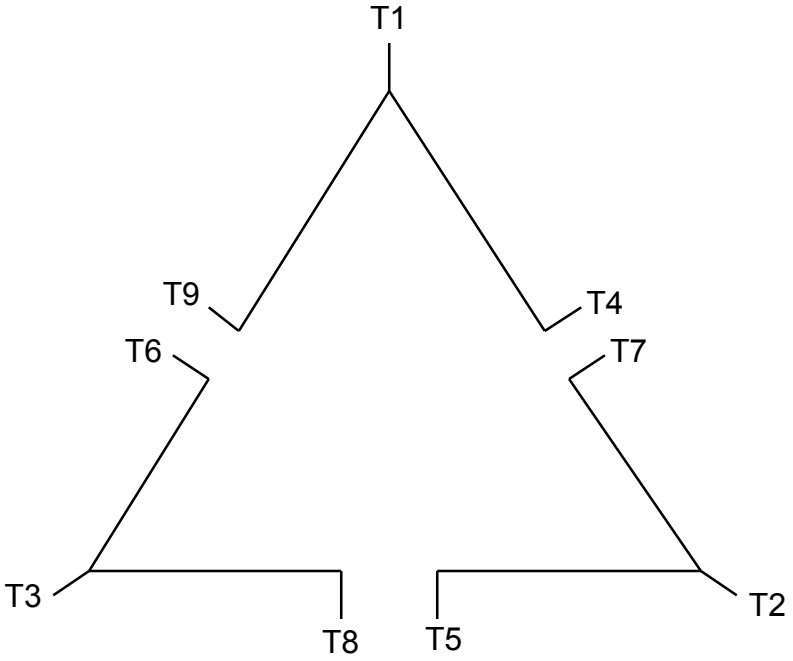
NIDEC MOTOR CORPORATION

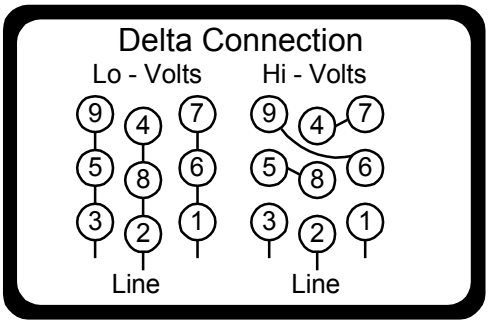
ST. LOUIS, MO

A109145

Motor Wiring Diagram

9 Lead, Dual Voltage (DELTA Conn.)





To reverse direction of rotation interchange connections L1 and L2.

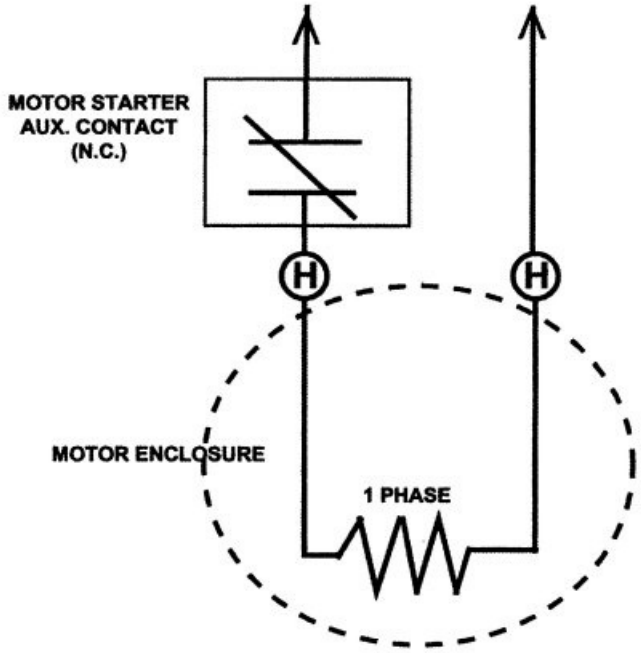
Each lead may have one or more cables comprising that lead.
In such case each cable will be marked with the appropriate lead number.

Connection Plate: A109145
Connection Decal: 344122

970798

SPACE HEATER CONNECTION DIAGRAM

SPACE HEATER LEADS MAY BE LOCATED IN EITHER THE MAIN OUTLET BOX OR IF SO EQUIPPED, AN AUXILIARY BOX



THIS EQUIPMENT IS SUPPLIED WITH ANTI-CONDENSATION HEATERS. HEATERS SHOULD BE ENERGIZED WHEN EQUIPMENT IS NOT OPERATING TO PROTECT UNIT BY PREVENTING INTERNAL CONDENSATION. CONNECT THE "H" OR HEATER LEADS TO	
115V VOLTS	**48W** WATTS RATING

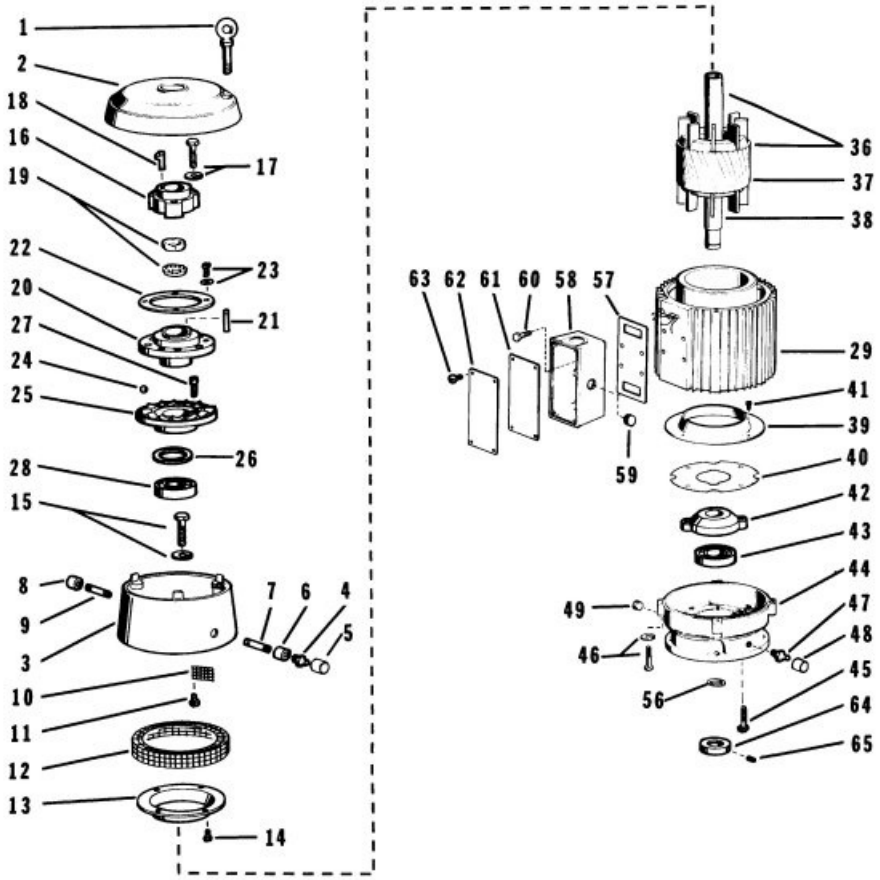
SPACE HEATER NAMEPLATE (ON MOTOR)

Revision: 7/30/2008
Mike Cullen

RENEWAL PARTS

FRAMES 254 THRU 286 - OPEN DRIPPROOF
TYPES: AU, AUE, AUI, AV, AV4, AV9, AVE, AVE4, AVI, AVI4, AU, AUE, AUI, AV, AV4, AVE, AVE4, AVI, AVI4

HIGH THRUST HOLLOSHAFT AND SOLIDSHAFT MOTORS



ITEM NO.	QTY	NAME OF PART
1	2	Eyebolt
2	1	Canopy Cap
3	1	Upper Bracket
4	1	Grease Fitting
5	1	Plastic Cap (Grease Fitting)

WARNING:
Any disassembly or repair work on explosionproof motors will void the Underwriters Laboratories, Inc. label unless done by the manufacturer, or a facility approved by the Underwriters Laboratories, Inc. Refer to your nearest sales office for assistance.

BEARINGS:
Refer to motor nameplate for the bearing numbers.

PRICES:
Parts stocking distributors: refer to renewal parts numerical index. All Others: refer to your nearest parts distributor.

reference: Renewal Parts Section 700, Pages 147 & 148

RENEWAL PARTS

FRAMES 254 THRU 286 - OPEN DRIPPROOF
TYPES: AU, AUE, AUI, AV, AV4, AV9, AVE, AVE4, AVI, AVI4, AU, AUE, AUI, AV, AV4, AVE, AVE4, AVI, AVI4

HIGH THRUST HOLLOSHAFT AND SOLIDSHAFT MOTORS

ITEM NO.	QTY	NAME OF PART
6	1	Pipe Coupling
7	1	Nipple Fitting
8	1	Pipe Cap (Plug)
9	1	Nipple Fitting
10	4	Bracket Screen (Intake)
11	4	Screws & Washers (Intake Screen)
12	1	Bracket Screen (Exhaust)
13	1	Air Deflector (Upper)
14	4	Screw (Air Deflector & Screen)
15	4	Screw & Lockwasher (Bracket to Stator)
16	1	Drive Coupling
17	3	Screw & Lockwasher (Drive Coupling)
18	1	Gib Key
19	1	Locknut & Lockwasher
20	1	Rotating Ratchet
21	1	Square Key
22	1	Ball Retaining Ring
23	4	Screw & Lockwasher (Ring)
24	10	Steel Balls (Optional)
25	1	Stationary Ratchet
26	As Req	Shims
27	3	Socket Head Cap Screw (Stationary Ratchet)
28	1	Ball Bearing (Upper) (Refer to Section 775)
29	1	Wound Stator Assembly
30-35	-	NOT USED IN THIS ASSEMBLY

ITEM NO.	QTY	NAME OF PART
36	1	Rotor Assembly (Includes Items 37 & 38
37	1	Rotor Core
38	1	Rotor Shaft
39	1	Air Deflector (Lower)
40	1	Bracket Screen
41	4	Screw (Air Deflector)
42	1	Bearing Cap (Lower)
43	1	Ball Bearing (Lower) (Refer to Section 775)
44	1	Lower Bracket
45	2	Screw & Lockwasher (Bearing Cap)
46	4	Screw & Lockwasher (Bracket to Stator)
47	1	Grease Fitting
48	1	Plastic Cap (Grease Fitting)
49	1	Pipe Plug
50-55	-	NOT USED IN THIS ASSEMBLY
56	1	Water Deflector
57	1	Gasket (Outlet Box to Base)
58	1	Outlet Box Base
59	1	Pipe Plug
60	4	Screw
61	1	Gasket (Outlet Box Cover)
62	1	Outlet Box Cover
63	4	Screw
64	1	Stabilizer Bushing (Optional)
65	1	Screw (Optional)

* With optional Stabilizer Bushing, delete Item No. 56 and add Items 64 & 65

WARNING:
Any disassembly or repair work on explosionproof motors will void the Underwriters Laboratories, Inc. label unless done by the manufacturer, or a facility approved by the Underwriters Laboratories, Inc. Refer to your nearest sales office for assistance.

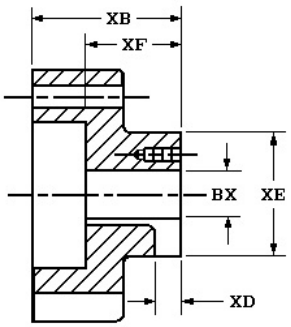
BEARINGS:
Refer to motor nameplate for the bearing numbers.

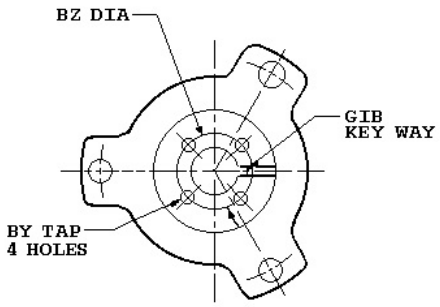
PRICES:
Parts stocking distributors: refer to renewal parts numerical index. All Others: refer to your nearest parts distributor.

reference: Renewal Parts Section 700, Pages 147 & 148

Vertical HOLLOSHAFT Coupling Dimensions

Standard Coupling Dimensions





Coupling Part Number	102999
BX Nominal	1
Actual Bore	1.001
BY	10-32
BZ	1 3/8
XB	2 9/16
XD	13/32
XE	2 1/4
XF	1 5/8
SQ. KEY	1/4

Notes:

1. All Rough casting dimensions may vary by 0.25" due to casting variations.
2. All tapped holes are Unified National Course, Right Hand thread.
3. Coupling bore dimension "BX" is machined with a tolerance of - .000", +.001" up to 1.50" bore inclusive. Larger bores: -.000", +.002".

TYPICAL REED CRITICAL FREQUENCY DATA

USEM MODEL NO: BF42
USEM CATALOG NO: HO30S2BLG

Frame: 286TPH Type: AU

REED CRITICAL FREQUENCY:	75	HZ
CENTER OF GRAVITY:	11	IN
DEFLECTION @ CENTER OF GRAVITY:	0.0017	IN
UNIT WEIGHT:	350	LBS.
BASE DIAMETER:	ALL	IN.
MAXIMUM MOTOR DIAMETER:	14.00	IN.
DATE:	12/15/2011	

Suitability of Integral Horsepower (IHP)* Motors on Variable Frequency Drives

Variable Frequency Drives (VFD)

Nidec Motor Corporation's Inverter Grade® insulated motors exceeded NEMA®† MG-1 Part 30 & 31 before the standards were established.

We are a leader in the development of electric motors to withstand pulse width modulated (PWM) drives evolution from power transistors to higher switching frequency insulated gate bipolar transistors (IGBTs).

Today, as the need for light and medium duty motor inverter applications grows, Nidec Motor Corporation provides products to meet these demands.

Through continued research and development, Nidec Motor Corporation has included the insulation wire from its Inverter Grade® motors on all Premium, Energy and Standard Efficient motors, enhancing their potential inverter compatibility.

Inverter compatibility with motors is complex. As a result, many variables must be considered when determining the suitability of certain types of motors. These variables include:

- Torque requirements (Constant or Variable)
- Speed Range
- Line/System Voltage
- Cable Length between VFD & Motor
- Drive Switching (Carrier) Frequency
- Motor Construction

Wider speed ranges, higher voltages, higher switching frequencies and increased cable lengths all add to the severity of the application and therefore the potential for premature motor failure. Nidec Motor Corporation has differentiated its products into families for your ease of selection for various inverter applications.

Warranty Guidelines

The information within this section refers to the motor and drive application guidelines and limitations for warranty.

Hazardous Location Motors

Use of a variable frequency drive with the motors in this catalog, intended for use in hazardous locations, is only approved for Division 1, Class I, Group D hazardous location motors with a T2B temperature code, with a limitation of 2:1 constant torque or 10:1 variable torque output. No other stock hazardous location motors are inherently suitable for operation with a variable frequency drive. If other requirements are needed, including non-listed Division 2, please contact your Nidec Motor Corporation territory manager to conduct an engineering inquiry.

Applying Inverter Grade® Insulated Motors on Variable Frequency Drives

The products within this catalog labeled "Inverter Duty" or "Vector Duty" are considered Inverter Grade® insulated motors. Inverter Grade® motors exceed the NEMA®† MG-1 Part 31 standard.

Nidec Motor Corporation provides a three-year limited warranty (see page ix) on all Inverter Grade® insulated motors and allows long cable runs between the motor and the VFD (limited to 400 feet without output filters). These motors may be appropriate for certain severe inverter application or when the factors relating to the end use application are undefined (such as spares).

Nidec Motor Corporation's U.S. Motors® brand is available in the following Inverter Grade® insulated motors:

- Inverter Duty motors good for 10:1 Variable Torque & 5:1 Constant Torque, including Vertical Type RUSI
- Inverter Duty motors good for 10:1 Constant Torque
- ACCU-Torq® and Vector Duty Motors with full torque to 0 Speed & 1024 PPR, 5-28VDC Encoder
- 841 Plus® motors that meet IEEE®† 841 Standards and are suitable for 5:1 Constant Torque

Applying Premium Efficient Motors on Variable Frequency Drives

Meet NEMA®† MG-1, Section IV, Part 31.4.4.2. They can be used with adjustable frequency drives under the following parameters: Up to 4:1 speed range on constant torque loads, standard two-year limited warranty (see page ix).

Cable Distances for Applying Premium Motors			
Maximum Cable Distance VFD to Motor			
Switching Frequency	460 Volt	230 Volt	380 Volt
3 Khz	196 ft	481 ft	295 ft
6 Khz	168 ft	340 ft	209 ft
9 Khz	113 ft	278 ft	170 ft
12 Khz	98 ft	241 ft	148 ft
15 Khz	88 ft	215 ft	132 ft
20 Khz	76 ft	186 ft	114 ft

Applying Standard & Energy Efficient Motors on Variable Frequency Drives

Meet NEMA®† MG-1, Section IV, Part 30.2.2.8. They can be used with adjustable frequency drives under the following parameters: Up to 2:1 speed range on constant torque loads, one year limited warranty (see page ix).

Cable Distances for Applying EPAct & Standard Motors			
Maximum Cable Distance VFD to Motor			
Switching Frequency	460 Volt	230 Volt	380 Volt
3 Khz	103 ft	435 ft	218 ft
6 Khz	73 ft	307 ft	154 ft
9 Khz	59 ft	251 ft	126 ft
12 Khz	51 ft	217 ft	109 ft
15 Khz	46 ft	194 ft	98 ft
20 Khz	40 ft	168 ft	85 ft

All Nidec Motor Corporation motors have 40°C ambient, 1.0 SF on Inverter Power, 3300 ft. max altitude, 460 voltage or less line power, up to 10:1 speed range on Variable Torque and Class F Insulation. 575-volt motors can be applied on inverters when output filters are used.

*This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL®† & CSA®† listings where indicated.
† All marks shown within this document are properties of their respective owners

Motor/ Inverter Compatibility

Thermal Overloads and Single Phase Motors

Motors with thermal overloads installed may not operate properly on a VFD. The current carrying thermal overload is designed for sine wave power. Operation on a VFD may cause nuisance tripping or potentially not protect the motor as would be expected on line power. Thermostats or thermistors installed in the motor and connected properly to the VFD may provide suitable thermal overload protection when operating on a VFD. (Consult Codes)

Single phase motors and other fractional horsepower ratings are not designed to be operated on a VFD. Within Nidec Motor Corporation standard products, all motors NEMA®† 48 frame (5.5" diameter) and smaller are not suitable for VFD applications. Three phase 56 and 143/145 frame applications should be noted on the catalog price page; or if in doubt ask an Nidec Motor Corporation technical representative for recommendations on compatibility with a VFD.

Slow Speed Motors

Motors with a base design of slower than six poles require special consideration regarding VFD sizing and minimizing harmonic distortion created at the motor terminals due to cable installation characteristics. Additional external PWM waveform filters and shielded motor cables designed for PWM power may be required to provide acceptable motor life. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%).

690V Applications

Motors that will be applied to 690Vac PWM VFDs require the use of an external filter to limit peak voltage spikes and the use of an Inverter Grade® motor. Where available, an alternative to using an output filter is to upgrade to a 2300V insulation system.

Low Voltage TITAN® Motors

The use of 449 frame and larger motors on PWM type VFDs should use the cable length limits of the second chart from the previous page as a guide for inverter application or consider the use of an external filter and shielded motor cables designed for PWM power to minimize harmonic distortion and peak voltages at the motor terminals. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%).

Bearing Currents related to PWM waveform

Due to the uniqueness of this condition occurring in the field, protection of the motor bearings from shaft currents caused by common mode voltages is not a standard feature on sinewave or Inverter Duty motor products, unless explicitly noted. Some installations may be prone to a voltage discharge condition through the motor bearings called fluting.

Fluting damage is related to characteristics of the PWM waveform, VFD programming and characteristics and installation.

Bearing fluting as a result of VFD sine wave characteristics may be prevented by the installation of a shaft grounding device such as a brush or ring and/or correction of the installation characteristics causing the shaft voltage condition.

Multiple Motors on a Single VFD

Special considerations are required when multiple motors are powered from a single VFD unit. Most VFD manufacturers can provide guidelines for proper motor thermal considerations and starting/stopping of motors. Cable runs from the VFD and each motor can create conditions that will cause extra stress on the motor winding. Filters may be required at the motor to provide maximum motor life.

Grounding and Cable Installation Guidelines

Proper output winding and grounding practices can be instrumental in minimizing motor related failures caused by PWM waveform characteristics and installation factors. VFD manufacturers typically provide detailed guidelines on the proper grounding of the motor to the VFD and output cable routing. Cabling manufacturers provide recommended cable types for PWM installations and critical information concerning output wiring impedance and capacitance to ground.

Vertical Motors on VFDs

Vertical motors operated on VFD power present unique conditions that may require consideration by the user or installation engineer:

- Slowest rpm that can be utilized and not cause the non-reversing ratchet to operate properly (in the range of 200 –300 rpm)
- Unexpected / unacceptable system vibration and or noise levels caused by the torque pulsation characteristics of the PWM waveform, a system critical frequency falling inside the variable speed range of the process or the added harmonic content of the PWM waveform exciting a system component
- Application related problems related to the controlled acceleration/deceleration and torque of the motor on VFD power and the building of system pressure/ load.
- The impact the reduction of pump speed has on the down thrust reflected to the pump motor and any minimum thrust requirements of the motor bearings
- Water hammer during shutdown damaging the non-reversing ratchet

Humidity and Non-operational Conditions

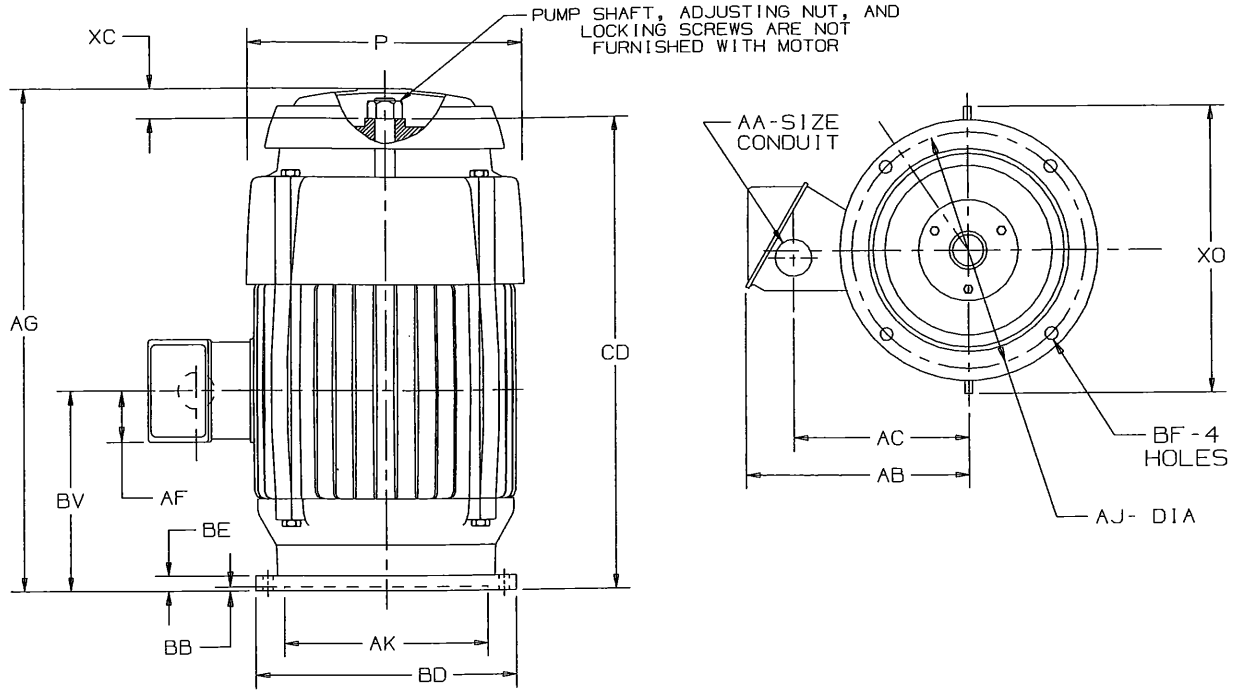
The possible build-up of condensation inside the motor due to storage in an uncontrolled environment or non-operational periods in an installation, can lead to an increased rate of premature winding or bearing failures when combined with the stresses associated with PWM waveform characteristics. Moisture and condensation in and on the motor winding over time can provide tracking paths to ground, lower the Megohm resistance of the motor winding to ground and lower the Corona Inception Voltage level of the winding.

Proper storage and maintenance guidelines are important to minimize the potential of premature failures. Space heaters or trickle voltage heating methods are the preferred methods for drying out a winding that has low megaohm readings. Damage caused by these factors are not covered by the limited warranty provided unless appropriate heating methods are properly utilized during non-operational periods and prior to motor start-up.

NEMA®† Application Guide for AC Adjustable Speed Drive Systems: http://www.nema.org/stds/acadjustable.cfm#download

*This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL®† & CSA®† listings where indicated.
† All marks shown within this document are properties of their respective owners

DIMENSIONS
THREE PHASE HOLLOSHAFT® MOTORS
WEATHER PROTECTED TYPE I
FRAME 284 THRU 286



ALL DIMENSIONS ARE IN INCHES & MILLIMETERS

BASIC FRAME	UNITS	P 2	AA	AB	AC	AF	AG	BV	CD	XC	XO
280	IN	14.00	1.50	11.07	8.32	2.59	28.13	12.25	24.75	3.22	16.88
	mm	356		281	211	66	715	311	629	82	429

FRAME	UNITS	AJ	AK	BB MIN	BD MAX	BE	BF
284,286TP	IN	9.125	8.250	.25	10.00	.94	.44
	mm	231.78	209.55	6	254	24	11
284,286TPH	IN	14.750	13.500	.25	16.50	.94	.69
	mm	375.65	342.90	6	419	24	18
284,286TPA	IN	9.125	8.250	.25	12.00	.94	.44
	mm	231.78	209.55	6	305	24	11

TOLERANCES	8.250 AK	13.500 AK
FACE RUNOUT	.004 F.I.R.	.007 F.I.R.
PERMISSIBLE ECCENTRICITY OF MOUNTING RABBET	.004 F.I.R.	.007 F.I.R.
"AK" DIMENSION	-.000;+.003	-.000;+.005

1: ALL ROUGH CASTING DIMENSIONS MAY VARY BY .25" DUE TO CASTING VARIATIONS.
2: LARGEST MOTOR WIDTH.
3: CONDUIT BOX MAY BE LOCATED IN STEPS OF 90° STANDARD AS SHOWN WITH CONDUIT OPENING DOWN.
4: TOLERANCES SHOWN ARE IN INCHES ONLY.

ITT

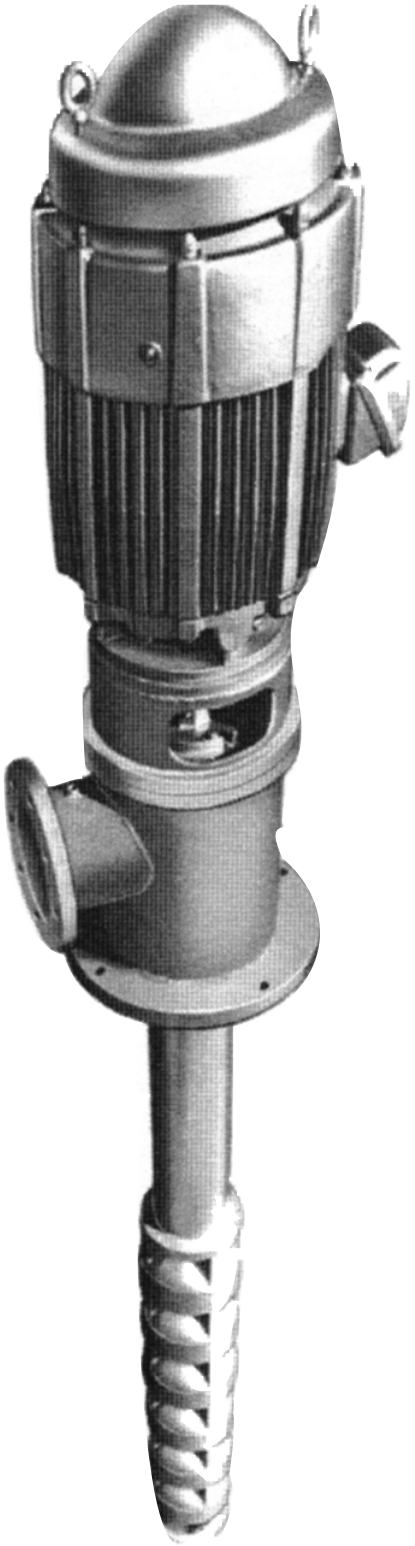
Irrigation, Municipal and Industrial

Goulds Pumps

MODEL VIT

Vertical Industrial Turbine Pumps

Installation, Operation and
Maintenance Instructions



GOULDS PUMPS

Goulds Pumps is a brand of ITT Corporation.

www.goulds.com

Engineered for life

Foreword

This manual provides instructions for the Installation, Operation, and Maintenance of the Goulds Vertical Industrial Turbine Pumps. This manual covers a standard product. For special options, supplemental instructions are available. **This manual must be read and understood before installation and start-up.**

This instruction manual covers several different pump models. Most assembly, disassembly, and inspection procedures are the same for all the pumps. However, where there are differences, these differences will be noted within the manual. The design, materials and workmanship incorporated in the construction of the Goulds VIT Pumps makes them capable of giving long, trouble-free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by correct application, proper installation, periodic inspection, condition monitoring and careful maintenance. This instruction manual was prepared to assist operators in understanding the construction and the correct methods of installing, operating, and maintaining these pumps.

The information contained in this book is intended to assist operating personnel by providing information on the characteristics of the purchased equipment. It does not relieve the user of their responsibility of using accepted safe engineering practices in the installation, operation and maintenance of this equipment.

Goulds Pumps shall not be liable for physical injury, death, damage, or delays caused by a failure to observe the instructions for installation, operation and maintenance contained in this manual.

Warranty is valid only when genuine Goulds Pumps parts are used.

Use of the equipment on a service other than stated in the order will nullify the warranty, unless written approval is obtained in advance from Goulds Pumps.

For information or questions not covered in this manual, contact Goulds Pumps at (806) 763-7867.

THIS MANUAL EXPLAINS :

- Proper Installation
- Start-up Procedures
- Operation Procedures
- Routine Maintenance
- Pump Overhaul
- Trouble Shooting
- Ordering Spare or Repair Parts

Owner's Information

Pump Model Number:_____

Pump Serial Number:_____

Motor Model Number:_____

Motor Serial Number:_____

Dealer: _____

_____

Dealer Telephone:_____

Purchase Date:_____

Installation Date:_____

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Safety Instructions – SECTION 1

TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN THE MANUAL AND ON THE PUMP.

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

THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT. THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.

⚠ WARNING

Hazardous voltage can shock, burn or cause death.

- Install, ground and wire according to local and National Electrical Code Requirements.
- Install an all leg disconnect switch near the pump.
- Disconnect and lockout electrical power before installing or servicing the pump.
- Electrical supply must match motor's nameplate specifications. Incorrect voltage can cause fire, damage motor and void the warranty.
- Single phase pump motors are equipped with an automatic thermal protector, which opens the motor's electrical circuit when an overload condition exists. This can cause the pump to start unexpectedly.

General Precautions

⚠ WARNING ***Personal injuries will result if procedures outlined in this manual are not followed***

⚠ CAUTION ***Electric supply MUST match pump's nameplate specifications. Incorrect voltage can cause fire, damage to motor and voids warranty.***

Safety Apparel:

- Insulated work gloves when handling hot sand collar.
- Heavy work gloves when handling parts with sharp edges, especially impellers.
- Safety glasses (with side shields) for eye protection.
- Steel-toed shoes for foot protection when handling parts, heavy tools, etc.
- Other personal protective equipment to protect against hazardous/toxic fluid.

Maintenance Safety:

- Always lock out power.
- Ensure pump is isolated from system and the pressure is relieved before disassembling the pump, removing plugs, or disconnecting the piping.
- Use proper lifting and supporting equipment to prevent serious injury or death.
- Observe all decontamination procedures.

General Information – SECTION 2

INTRODUCTION

NOTE: The information in this manual intends to be used as a guide only. If you are in doubt, consult your Goulds Pumps representative for specific information about your pump.

The design, material, and workmanship incorporated in the construction of Goulds VIT Pumps makes them capable of giving long, trouble free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by correct application, proper installation, periodic inspection and careful maintenance. This instruction manual was prepared to assist operators in understanding the construction and the correct methods of installing, operating and maintaining these pumps.

⚠ WARNING ***Rotating components of the pump assembly must be covered with a suitable rigid guard to prevent injury to personnel.***

Study thoroughly Sections 1 through 6 and carefully follow the instructions for installing and operating. Sections 5 contains answers to troubleshooting and maintenance questions. Keep this instruction manual handy for reference.

⚠ CAUTION ***Goulds Pumps will not be liable for any damages or delay caused by failure to comply with the provisions of this instruction manual.***

RECEIVING AND CHECKING

The pump should be carefully supported prior to unloading from the carrier. Handle all components carefully. Inspection for damage of the shipping crate should be made prior to unpacking the pump. After unpacking, visually inspect the pump and check the following:

1. Contents of the pump assembly against the packing list.
2. All components against damage.
3. All shafting for damage, should the crate be broken or show careless handling. All shafting must be checked for straightness.

Any shortages or damages should be immediately called to the attention of the local freight agent of the carrier by which the shipment arrived and proper notation made on the bill. This will prevent any controversy when a claim is made and facilitate prompt and satisfactory adjustment.

MATERIALS AND EQUIPMENT REQUIRED

The material and equipment necessary for installation of the pump will vary with the size of the pump and the type of installation.

The following list of standard tools and supplies is offered only as a guide.

BULK MATERIAL

- Anti-Galling lubricant (such as Dow Corning "MOLYKOTE")
- Thread Compound
- Lubrication Oil
- Turbine Oil
- Grease

RIGGING EQUIPMENT

- Mobile power hoist, traveling crane or derrick.
- Drag line and blocks.
- Elevator clamps, if unit is unassembled.
- Clevises – for use with eyebolts.
- Timbers – size, length and quantity to support long pump parts on the floor.
- I-Beams or timbers to support pump over installation.

HAND TOOLS

- Pipe wrenches.
- Feeler gauges.
- Set of mechanics tools including: files, wire brush, pliers, wire cutters and pocket knife.
- Clean rags.
- Dial indicator to assist in motor and pump alignment.

OPTIONAL TOOLS TO FACILITATE PUMP ASSEMBLY AND DISASSEMBLY

- Taperlock driver to assist in bowl assembly and disassembly for pumps with taper lock impellers only.

STORAGE

Goulds Pumps carefully preserves and protects its products for shipment. However, the effective life of the preservatives applied at the factory can vary from 3 to 18 months depending on the severity of the environment in which the equipment is stored. This section provides procedures for preparation prior to storage and maintenance during storage of Goulds VIT Pumps. These procedures are necessary to protect the precision parts of the pumps. Specific procedures for storing motors, gear drivers, and engines, should be obtained from the equipment manufacturer. This section is intended to be of general assistance to users of Goulds VIT Pumps. It shall not modify, amend and/or otherwise alter the scope of Goulds VIT Pumps warranty responsibilities to the purchaser in any way whatsoever.

Storage Preparation

Goulds VIT Pumps require proper preparation for storage and regular maintenance during storage. The pump shall be considered in storage when it has been delivered to the job site and is awaiting installation.

Preferably, the storage area shall be paved, well drained and free from flooding, and be indoors whenever possible.

Weatherproof coverings used for outdoor storage shall be flame resistant type sheeting or tarpaulins. They shall be placed so as to provide good drainage and air circulation and shall be tied down to protect from wind damage.

Storage area shall be maintained in a clean condition at all times.

Pumps and/or component parts shall be placed on skids, pallets, or shoring to permit good air circulation.

Pumps and/or component parts shall be sorted so as to permit ready access for inspection and/or maintenance without excessive handling.

Pumps and/or component parts stacked during storage shall be arranged so that the racks, containers, or crates bear full weight without distortion of pumps or parts. Identification markings must be readily visible. Any cover removed for internal access shall be replaced immediately.

Pump and bowl assembly shafting shall be rotated counter clockwise, as a minimum, once a month. Shaft shall not be left in the same previous position, nor in the extreme raised or lowered lateral position. Shaft should rotate freely.

NOTE: For further information on these procedures contact your Goulds Pumps representative.

Recommended Storage Procedures

Controlled storage facilities should be maintained at an even temperature 10° F (6° C) or more **above the dew point** with relative humidity less than 50% and little or no dust. (If these requirements can not be met the pump is to be considered in uncontrolled storage.)

For uncontrolled storage periods of 6 months or less, the pump is to be inspected periodically to insure that all preservatives are intact.

All pipe threads and flanged pipe covers are to be sealed with tape.

The pump must not be stored closer than six inches (15 cm) from the ground.

Uncontrolled Long Term Storage Preparations

When applicable to the pump, storage periods over six months require the preceding storage procedure and storage preparation plus the following:

Inspect the lube oil and seal flush piping and either fill the piping with rust preventative oil, or re-coat the piping periodically to prevent corrosion.

Place 10 pounds (4.5 kg) of moisture absorbing desiccant or 5 pounds (2.3 kg) of vapor phase inhibitor crystals near the center of the pump. If the pump is assembled, place an additional one pound (0.5 kg) in the discharge nozzle securely fastened to the discharge elbow.

Install a moisture indicator near the perimeter of the pump. Cover the pump with 6 mil (0.15 mm) minimum thickness black polyethylene or equal and seal it with tape. Provide a small ventilation hole approximately ½ inch (12 mm) diameter.

Provide a roof or shed shelter to protect from direct exposure to the elements.

GENERAL DESCRIPTION

The model VIT pump is a vertical turbine lineshaft pump, which is designed to meet wide ranges of service with maximum dependability. See Figure 1 or Figure 2 for open lineshaft pump and Figure 3 and Figure 4 for enclosed lineshaft pump.

Drivers

Hollow shaft motors or right angle gear drives, are often used with a separate head shaft through the driver and connected to the pump by a threaded coupling.

Discharge Head

The discharge head is either a cast iron head or a fabricated 'F' type head. Ports are provided for connecting the pressure gauge, stuffing box bypass return and lubricator connections. The driver support portion of the discharge head is designed with large windows for easy stuffing box or tension plate adjustment. The windows are covered with guards for safe operation.

Column

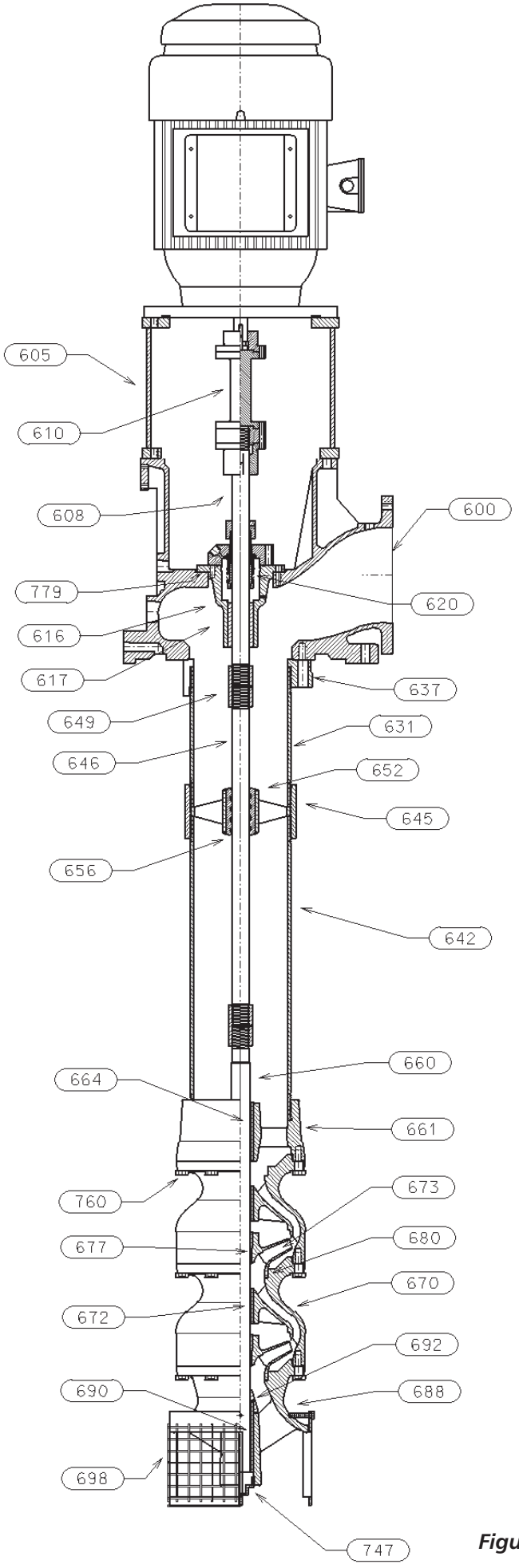
Threaded or flanged column construction provides positive shaft and bearing alignment. Bearings are spaced to provide vibration free operation away from the shaft critical speed in order to insure long bearing life and reduced shaft wear. For open lineshaft, the shaft is supported within the column by using bearing retainers in the column assembly. For enclosed lineshaft, the bearings are also the tube couplings of the shaft-enclosing tube. The shaft-enclosing tube is stabilized in the column pipe by tube stabilizer.

Bowl Assembly

The bowls are generally of flanged construction for accurate alignment and ease of assembly and disassembly. Impellers may be either open or enclosed depending on the design requirements. They are fastened to the pump shaft by taperlocks. For temperatures over 180° F (82° C) and in the larger size bowls (over 18"), impellers are keyed to the shaft. A special first stage low NPSH impeller may be provided on some pump for certain special application.

Thrust Pot

A thrust pot is utilized when the driver is not designed to carry the pump thrust.



DISCHARGE HEAD ASSEMBLY

ITEM	DESCRIPTION
600	DISCHARGE HEAD
601	MOTOR SUPPORT
608	HEADSHAFT
610	COUPLING ASSEMBLY
616	SEAL HOUSING
617	SEAL HOUSING BEARING
620	MECHANICAL SEAL
637	COLUMN FLANGE
779	SEAL HOUSING GASKET

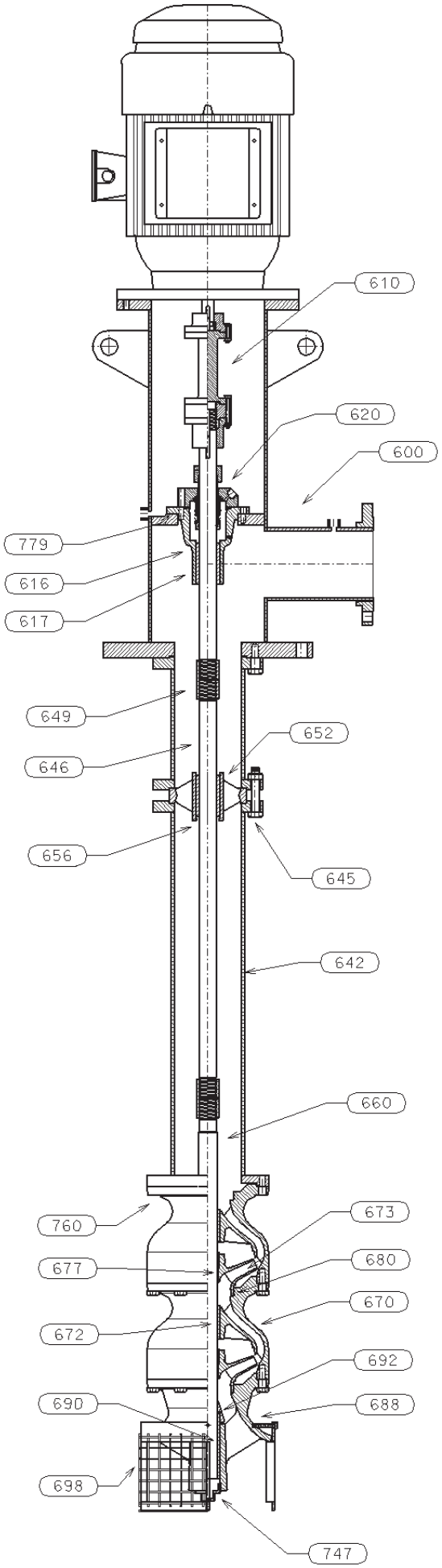
COLUMN ASSEMBLY

642	COLUMN PIPE
645	COLUMN COUPLING
646	LINESHAFT
649	LINESHAFT COUPLING
652	BEARING RETAINER
656	LINESHAFT BEARING

BOWL ASSEMBLY

660	BOWL SHAFT
661	DISCHARGE BOWL
664	DISCHARGE BEARING
670	INTERMEDIATE BOWL
672	INTERMEDIATE BOWL BEARING
673	IMPELLER
677	TAPERLOCK
680	WEAR RING (OPTIONAL)
760	HEX BOLT
692	SAND COLLAR
688	SUCTION BOWL/BELL
690	SUCTION BEARING
698	SUCTION STRAINER
747	PLUG

Figure 1 **Open Lineshaft Pump with Threaded Column Pipe**



DISCHARGE HEAD ASSEMBLY

ITEM	DESCRIPTION
600	DISCHARGE HEAD
608	HEADSHAFT
610	COUPLING ASSEMBLY
616	SEAL HOUSING
617	SEAL HOUSING BEARING
620	MECHANICAL SEAL

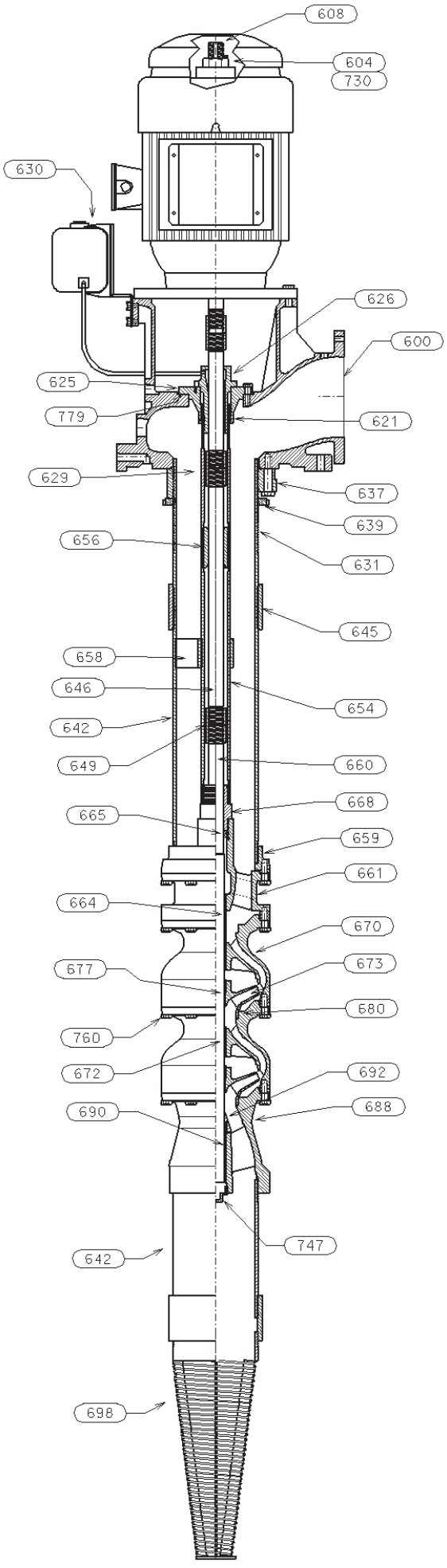
COLUMN ASSEMBLY

642	COLUMN PIPE
645	COLUMN BOLTING
646	LINESHAFT
649	LINESHAFT COUPLING
652	BEARING RETAINER
656	LINESHAFT BEARING

BOWL ASSEMBLY

660	BOWL SHAFT
670	INTERMEDIATE BOWL
672	INTERMEDIATE BOWL BEARING
673	IMPELLER
677	TAPERLOCK
680	WEAR RING (OPTIONAL)
760	HEX BOLT
692	SAND COLLAR
688	SUCTION BOWL/BELL
690	SUCTION BEARING
698	SUCTION STRAINER
747	PLUG

Figure 2 **Open Lineshaft Pump with Flanged Column**



HEAD ASSEMBLY

ITEM	DESCRIPTION
600	DISCHARGE HEAD
604	ADJUSTING NUT
608	HEADSHAFT
621	O-RING
625	TENSION PLATE
626	TENSION NUT
630	OILER
637	COLUMN FLANGE
730	GIB KEY
779	TENSION PLATE GASKET

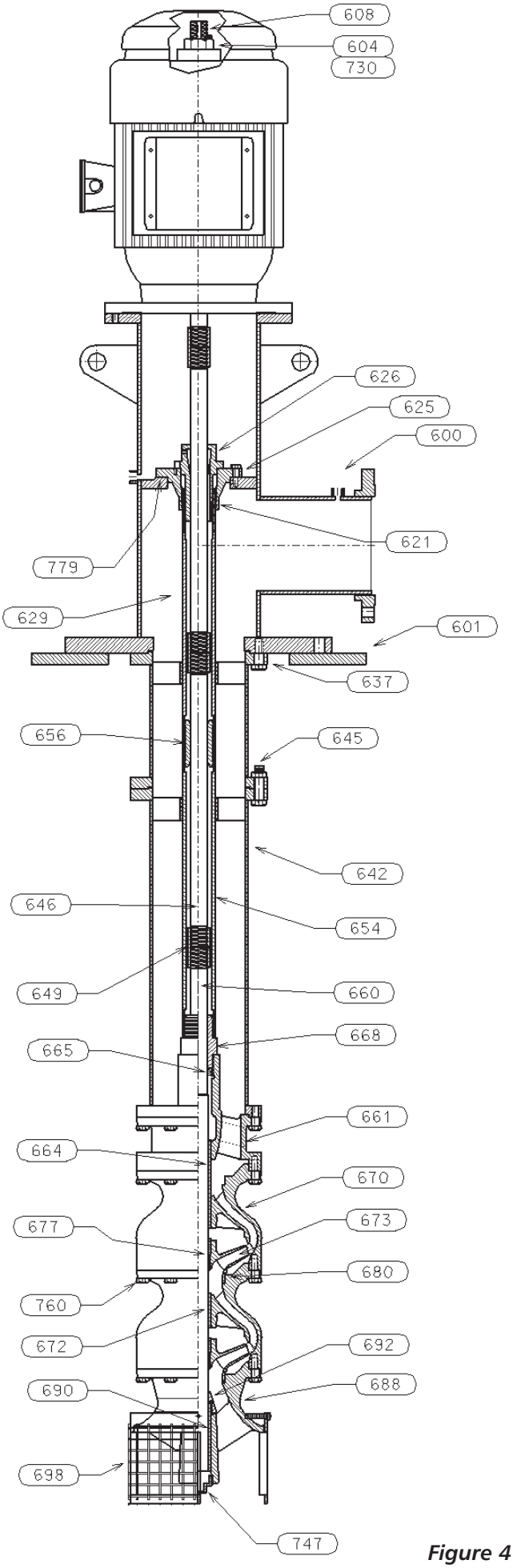
COLUMN ASSEMBLY

629	TUBE NIPPLE
631	COLUMN NIPPLE
639	COLUMN LOCK RING
642	COLUMN PIPE
645	COLUMN COUPLING
646	LINESHAFT
649	LINESHAFT COUPLING
654	OIL TUBE
656	LINESHAFT BEARING
658	TUBE STABILIZER

BOWL ASSEMBLY

659	COLUMN ADAPTER
660	BOWL SHAFT
661	DISCHARGE BOWL
664	DISCHARGE BEARING
665	OIL SEAL
668	TUBE ADAPTER BEARING
670	INTERMEDIATE BOWL
672	INTERMEDIATE BOWL BEARING
673	IMPELLER
677	TAPERLOCK
680	WEAR RING (OPTIONAL)
688	SUCTION BOWL/BELL
690	SUCTION BEARING
692	SAND COLLAR
698	SUCTION STRAINER
747	PLUG
760	HEX BOLT

Figure 3 **Enclosed Lineshaft Pump with Threaded Column Pipe**



HEAD ASSEMBLY

ITEM	DESCRIPTION
600	DISCHARGE HEAD
604	ADJUSTING NUT
608	HEADSHAFT
621	O-RING
625	TENSION PLATE
626	TENSION NUT
630	OIL RESERVOIR
637	COLUMN FLANGE
730	GIB KEY
779	TENSION PLATE GASKET

COLUMN ASSEMBLY

629	TUBE NIPPLE
642	COLUMN PIPE
645	COLUMN BOLTING
646	LINESHAFT
649	LINESHAFT COUPLING
654	OIL TUBE
656	LINESHAFT BEARING
658	TUBE STABLIZER

BOWL ASSEMBLY

660	BOWL SHAFT
661	DISCHARGE BOWL
664	DISCHARGE BEARING
665	OIL SEAL
668	TUBE ADAPTER BEARING
670	INTERMEDIATE BOWL
672	INTERMEDIATE BOWL BEARING
673	IMPELLER
677	TAPERLOCK
680	WEAR RING (OPTIONAL)
688	SUCTION BOWL/BELL
690	SUCTION BEARING
692	SAND COLLAR
698	SUCTION STRAINER
747	PLUG
760	HEX BOLT

Figure 4 **Enclosed Lineshaft Pump with Flanged Column**

FOUNDATION AND PIPING

SUB BASE (SOLE PLATE) INSPECTION

Sub base and sole plate are terms in common use to describe a general class of solid steel plates mounted in grout (or bolted to steel structures) at the pump-foundation interface.

1. Remove the sub base from the pump discharge head, when shipped assembled.

2. Completely clean the underside of the sub base. It is sometimes necessary to coat the underside of the sub base with an epoxy primer. (This is available as an option.)

3. Remove the rust preventative solution from the machined topside with an appropriate solution.

SITE WITH CONCRETE FOUNDATION

1. A pump should have adequate space for operation, maintenance and inspection.

2. Sub base mounted pumps are normally grouted on a concrete foundation, which has been poured on a solid footing. The foundation must be able to absorb any vibration and to form a permanent, rigid support for the pumping unit.

3. The foundation must be of adequate strength to support the complete weight of the pump, plus the weight of the liquid passing through it. A typical installation will have bolts with a pipe sleeve 2½ times the bolt diameter embedded in the concrete.

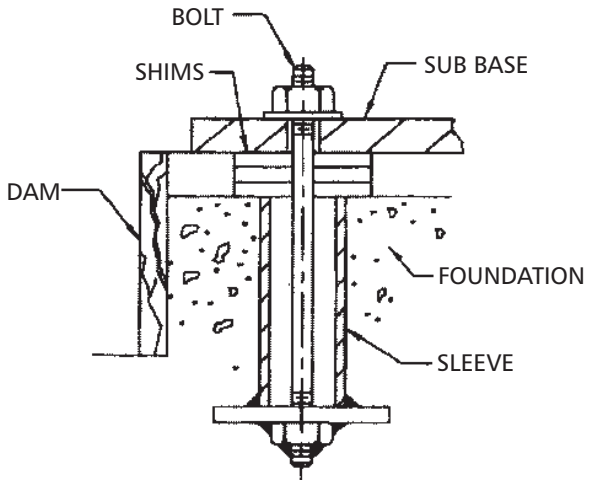


Figure 5

Bolts should be sized and located in accordance with the dimensions given on the Certified Pump Outline Drawing, if provided. The pipe sleeve allows movement for the final positioning of the foundation bolts to conform to the holes in the sub base flange. See Figure 5.

4. Remove water and/or debris from anchor bolt holes/sleeves prior to grouting. If the sleeve type bolts are being used, fill the sleeves with packing or rags to prevent grout from entering.

5. Carefully lower the sub base onto the foundation bolts. Hand tighten the nuts.

6. Leveling the sub base may be done by several methods. Two common methods are:

   A. Using leveling wedges. This is shown in Figure 6.
   B. Leveling nuts on the anchor bolts.

   Regardless of the method, a machinist level must be used for leveling.

NOTE: When using a machinist level, it is important that the surface being leveled is free of all contaminants, such as dust, to ensure an accurate reading.

7. Level the sub base in two directions at 90 degrees on the machined surface. The levelness tolerance is 0.005 inches per foot for commercial, and 0.001 inches per foot for API.

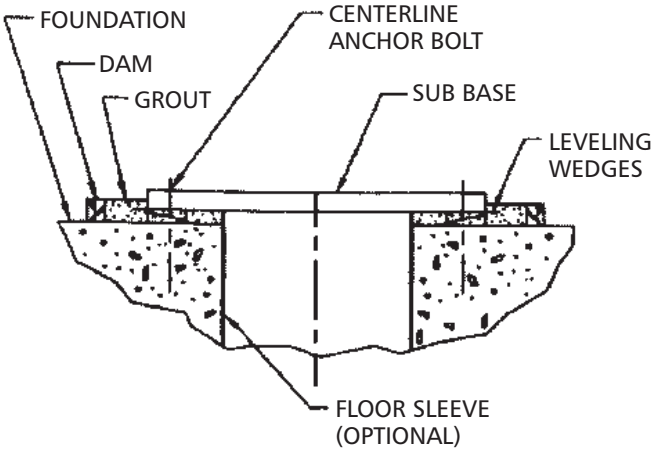


Figure 6

SUB BASE GROUTING

1. Inspect foundation for dust, dirt, oil, chips, water, etc. and remove any contaminants. Do not use oil-based cleaners as grout will not bond to them. Refer to grout manufacturer's instructions.

2. Build dam around foundation (See Figure 6). Thoroughly wet foundation. Refer to grout manufacturer's instructions.

3. Pour grout between sub base and concrete foundation, up to level of dam. Remove air bubbles from grout as it is poured by puddling, using a vibrator, or pumping the grout into place. Non-shrink grout is recommended. Refer to grout manufacturer's instructions.

4. Allow grout to set at least 48 hours.

5. Tighten foundation bolts.

PIPING

Guidelines for piping are given in the "Hydraulic Institute Standards", available from: Hydraulic Institute,

9 Sylvan Way, Parsippany, NJ 07054-3802 and must be reviewed prior to pump installation.

⚠ WARNING ***Never draw piping into place by forcing the flange connections of the pump. Pipe strain will adversely effect the operation of the pump resulting in damage to the equipment and possible physical injury.***

1. All piping must be supported independently of, and line up naturally with the pump flange so that undue pipe strain is not imposed on the pump.

2. **DO NOT** connect piping to pump until grout has hardened and pump hold-down bolts have been tightened.

3. It is suggested that expansion loops or joints, if used, be properly installed in the discharge line. When handling liquids at elevated temperatures expansion joints are used, so linear expansion of piping will not draw pumps out of alignment.

4. Carefully clean all pipe parts, valves and fittings, and piping branches prior to assembly.

5. Isolation and check valves should be installed in discharge line. Locate the check valve between isolation valve and pump, this will permit inspection of the check valve. The isolation valve is required for regulation of flow, and for inspection and maintenance of pump. The check valve prevents pump or seal damage due to reverse flow through the pump when the driver is turned off.

6. Increasers, if used, should be placed between pump and check valves.

7. Cushioning devices should be used to protect the pump from surges and water hammer if quick-closing valves are installed in the system.

PUMP INSTALLATION

Pumps of 20 feet (6M) or less in length are usually shipped assembled, with the exception of the driver, mechanical seal with tubing and coupling assembly, spacer or non spacer type. When provided, refer to the Certified Pump Outline for the applicable base plate plan for the location of anchor bolt holes.

INSTALLING AN ASSEMBLED PUMP

1. If a base plate was supplied, install as described in Foundation/Piping Section (page 11).

2. Clean the mounting surface of the plate and clean bottom surface of discharge head mounting flange.

3. Sling through discharge head holes or thread two eyebolts through bolt holes in the mounting flange and hoist unit into position over foundation. **NOTE: Eyebolts or sling should be rated to handle in excess of the pump weight (See Outline Drawing).**

4. Lower the unit and carefully guide it so that unit does not strike the side of the base plate. Continue to lower unit until the discharge head flange engages and rests firmly on the plate, then secure with capscrews provided.

5. **When a lineshaft is shipped separately check shaft for straightness; average total run out should not exceed 0.005" TIR (0.127mm) for 10 feet (3m). Shaft must be within tolerance prior to installation.**

6. Refer to remainder of this manual for complete assembly, startup, maintenance, disassembly and recommended lubricants for the pump.

INSTALLING A PARTIALLY ASSEMBLED PUMP

⚠ WARNING ***Do not work under a heavy suspended object unless there is positive support and safe guards, which will protect personnel, should a hoist or sling fail.***

⚠ CAUTION ***Do not attempt to lift bowl assembly by the pump shaft. This can result in damaging the pump shaft.***

1. Prior to installing the bowl assembly, check that all capscrews are tight. Turn the pump shaft by hand and make sure it turns freely. Remove all accumulated dust, oil or other foreign material from the external surfaces.

2. Place two I-beam supports across the base plate opening, strong enough to safely support the weight of the entire pump assembly. These I-beams should be connected by threaded rods and nuts so as to clamp them firmly together to support the pump. (See Figure 7).

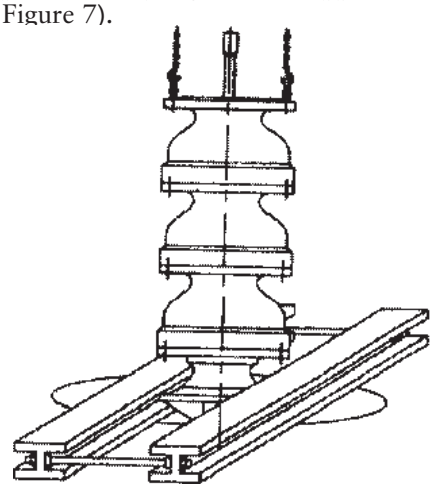


Figure 7

3. Place a suitable hoist or derrick over base plate opening with the hook in the center.

4. If a suction strainer is provided, assemble it to the suction bell (or suction bowl).

5. Place the elevator clamps just below the discharge bowl. For flanged discharge, install two threaded eye bolts through bolt holes in the flange 180° apart.

6. Attach sling to elevator clamps or eye bolts and hoist into position over foundation opening (See Figure 7).

7. Carefully lower bowl assembly, guiding the unit so it does not strike the sides of the opening. Continue to lower bowl assembly until the elevator clamps or discharge bowl flange rests firmly on the I-beam supports.

8. Place a cover over the discharge bowl opening to prevent entrance of dirt or other foreign matter until ready for installation of the column assembly.

⚠ CAUTION ***Do not drop any foreign object into the bowl assembly. Such an object can cause serious damage to the pump and any downstream components. Any foreign object dropped into the bowl assembly must be retrieved prior to continuing assembly.***

COLUMN

OPEN LINESHAFT

Lineshafts are coupled with threaded couplings. Column pipe may be threaded or flanged. When provided, see the Certified Pump Outline Drawing for the number of column and shaft sections required. The top and bottom sections may be special lengths:

1. **Check the lineshaft (646) for straightness. Average total runout should be less than 0.0005" TIR per foot, not to exceed 0.005" T.I.R. for every 10 feet of shafting.**

⚠ CAUTION **Bottom section of column pipe should not be longer than 5 feet.**

2. Hoist the first piece of lineshaft over the bowl assembly. Lower the lineshaft until the bottom end is properly aligned with the coupling of the pump shaft. Apply a thin film of oil to the threads on the lineshaft (646) and the coupling (649) (for non-galling material, or Molykote if galling material).

⚠ CAUTION ***Use "MOLYKOTE" Dow Corning or equal for all galling material such as 316 stainless steel.***

3. With lineshaft in the proper position on the coupling, screw lineshaft into the coupling manually until resistance is felt. A fine wire inserted in the hole at the center of the coupling can be used as a gage to determine when the coupling is correctly positioned on the shaft. **Remove the wire after installing the shaft.** Completely tighten the joint by using a pair of pipe wrenches. Use care not to damage any bearing journal areas on the shaft. *NOTE: Shaft threads are left-handed.*

⚠ CAUTION ***Make up threaded joints manually to verify that the threads are properly engaged prior to applying a wrench. If cross-threading occurs, break the joint and repair the threads. If the threads are beyond repair, replace the damaged part.***

4. For threaded column, secure a friction clamp immediately below the column coupling. Hoist column section over bowl assembly. Lower column over lineshaft until column pipe engages the discharge bowl. Manually screw the column into discharge bowl. Complete joint by tightening column with chain tongs until the end of the column butts firmly against discharge bowl.

5. For flanged column, install two eyebolts diametrically opposite the upper flange of the bottom column. Attach a sling to the eyebolts and to the hoist hook. Lower column section until the flange engages the flanged top bowl register. Insert as many bolts through both flanges as possible. Lift column assembly high enough to allow rotation of the supports. Install and tighten remaining capscrews gradually in diametrically opposite pairs until all are uniformly tightened.

6. Lift the assembly and remove the elevator clamp or supports and slowly lower the bowl and the column assembly. Place supports on the base plate and continue to lower the assembly until the column elevator clamps or column flange comes to rest on the supports. Place an elevator clamp under the column pipe and allow it to butt firmly against the column pipe coupling.

7. Place the bearing retainer over the shaft and locate it in the column coupling recess. Make sure the end faces of the column pipe are clean. For flanged columns, fit the retainer in the female register of the flange. Make sure the contact faces in the flanges are clean.

8. Check that the shaft is approximately centered in the bearing. Move the shaft around slightly so as to center it in its bearing. Only a slight amount of force should be required. **If an excessive amount of force is required, the pipe or shaft may not be butted properly or the shaft may be bent.** In any case, the problem must be corrected prior to proceeding further.

9. Repeat the preceding procedures until all column sections required have been installed.

10. Install the top shaft or stub shaft and coupling. If the pump is equipped with column adjusting nipple, install it with longer threaded end upward. Screw the lock ring on to the nipple until you reach the end of the thread.

⚠ CAUTION ***Do not drop any foreign object into the column assembly. Such an object can cause serious damage to the pump and any downstream components. Any foreign object dropped into the column assembly must be retrieved prior to continuing assembly.***

ENCLOSED LINESHAFT

1. Insert tube (654) and shaft (646) sections into column section.

2. Place an elevator clamp near top of column just below and butt firmly against column pipe coupling (645). For flanged columns, place the elevator clamp just below the flange.

3. Attach a sling to hoist hook. Attach bottom of shaft (646) to column (644), by tying a tail rope to deep-throated clamp attached to bottom of column. (See Figure 8). Tie a clove hitch or double half hitch around the enclosing tube and then around the shaft in threaded area. Figure 8 also shows the alternate method (dotted lines).

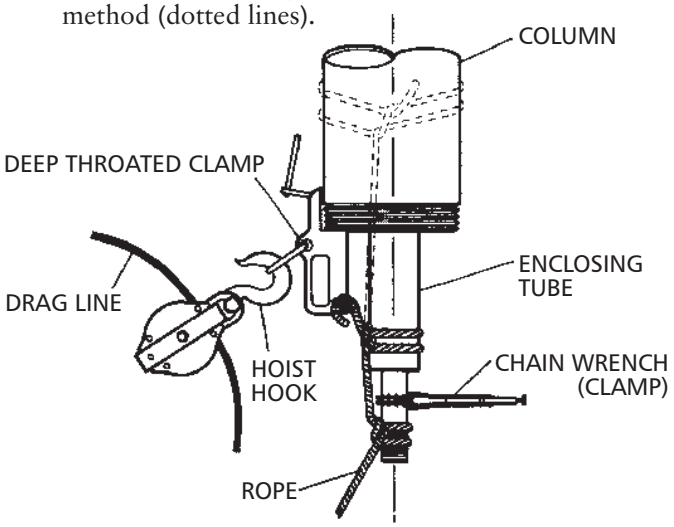


Figure 8

4. Utilize the remaining tail rope to keep tension on the knots during hoisting. Lower end of column section shall be guided by a drag line which is pulled by the hoist. A traveling block for the drag-line shall be attached to a deep-throated clamp, which is secured to bottom of the column threads.

5. Hoist column section over pump, keeping tension on tail rope. With column in a vertical position, remove drag-line and traveling block, lower column until bottom line shaft is properly aligned with pump shaft coupling.

6. Apply a thin film of oil to the threads on the lineshaft (646) and the coupling (649) (for non-galling material or Molykote if galling material).

⚠ CAUTION ***Use "MOLYKOTE" Dow Corning or equal for all galling material such as 316 stainless steel.***

7. With lineshaft in proper position on the coupling, remove tail rope and screw lineshaft into coupling until resistance is felt. A fine wire inserted in the hole at the center of the coupling can be used as a gage to determine when the coupling is correctly positioned on the shaft. **Remove the wire after installing the shaft.** Completely tighten the joint by using a pair of pipe wrenches. Use care not to damage any bearing journal areas of the shaft. ***NOTE: Shaft threads are left-handed.***

⚠ CAUTION ***Make up threaded joints manually to verify that the threads are properly engaged prior to applying a wrench. If cross-threading occurs, break the joint and repair the threads. If the threads are beyond repair, replace the damaged part.***

8. Carefully lower column section until lower end of the tube section rests on the adapter bearing (668). **The end faces of the tube should be clean and free of nicks.** Remove tail rope, clean outside of the adapter bearing and lubricate with thread compound. Screw tube section onto adapter bushing manually, until resistance is felt. Complete tube joint by utilizing a pair of pipe wrenches or chain tongs, butting the end of tube against the upper end of the tube adapter bearing.

9. Clean column threads and lubricate with thread compound.

10. Lower column until column pipe engages in the discharge bowl. Manually thread the column into discharge bowl. Complete joint by tightening column, utilizing chain tongs until the end of the column butts firmly against discharge bowl.

11. Lift the pump assembly and remove elevator clamp secured to discharge bowl. Slowly lower assembly into well or sump until elevator clamp gently comes to rest on timbers or I-beam supports and remove the sling.

12. Remove the exposed lineshaft bearing, pour oil into the tubing and reinstall the bearing. The amount of oil to be poured is given in the following table:

Tube Size	Amount of oil per section	
	10 ft. Sections	20 ft. Sections
1¼, 1½, 2	½ Cup	1 Cup
2½, 3, 3½	1 Cup	½ Qt.
4 and larger	½ Qt.	1 Qt.

See page 27 for recommended oil.

13. Repeat the preceding procedures. Throughout the column assembly, install tube stabilizer (658) over the enclosing tube (654) every 40 feet. The last one should be less than 20 feet below the bottom of the discharge head. Use soapy water as lubricant when sliding the stabilizer over the tube.

14. Continue the procedure until all column sections for the proper setting have been installed, excluding the column adjusting nipple (631) and tube nipple (629), if provided.

15. Install the top shaft or stub shaft and coupling.

⚠ CAUTION ***Do not drop any foreign object into the bowl assembly. Such an object can cause serious damage to the pump and any downstream components. Any foreign object dropped into the bowl assembly must be retrieved prior to continuing assembly.***

INSTALLING THE DISCHARGE HEAD

VIT Pumps are provided with either a cast iron or fabricated steel type head. For pump with below ground discharge, a motor stand is provided instead the discharge head. Install the discharge head as follows:

1. If the stuffing box (See Fig. 9) or tension nut (See Fig. 10) is assembled to the head, remove it and all the attached piping.
2. For threaded column, **check to be sure that the column flange (637) is securely attached to the bottom of the discharge head. Check and tighten the capscrews** (or socket head screw) gradually in diametrically opposite pairs.
3. Remove coupling guard if provided. Attach a sling to the lifting lugs on the side of the discharge head through windows and hoist discharge head over the protruding top shaft (or stub shaft).

⚠ CAUTION ***Do not bump or scrape the shaft protruding above the column. This could result in bending or damaging the shaft.***

4. Orient the discharge head in the required position and lower the head. Center the vertical hole with the top shaft protruding above the column. For threaded column, continue to lower the discharge head until the large threaded hole in the bottom of the discharge head rests squarely on top of column. Clean the threads at upper end of column assembly and lubricate with thread compound. Rotate discharge head, screw it onto the column, for short set-pump, (without the column adjusting nipple) butting the top of column tightly against the discharge head.
5. For flanged column, continue to lower the discharge head until the discharge head engages the column flange. Install capscrews and secure discharge head to the column flange. Tighten capscrews gradually in diametrically opposite pairs. Lift the pump assembly high enough to allow rotation of the supports. Realign and lower assembly. Install and tighten remaining capscrews. Repeat the rotating and the tightening procedure until all capscrews are uniformly tight.
6. Hoist the discharge head by lifting lug and remove the elevator clamp attached to column.
7. Remove the support timbers or I-beams and clean the top of foundation or base plate. Orient the discharge head in the required position.

NOTE: Sling should be rated to handle in excess of the pump weight.

8. Lower bowl, column and head assembly, until discharge head mounting flange engages base plate. Secure discharge head to the foundation or base plate. Check the levelness of the discharge head in all directions, utilizing a machinist level across the driver's mounting surface of the discharge head.
9. Check whether the top shaft (or stub shaft) is in the center of the stuffing box bore. If not, the shaft must be centered by shimming the head base and the sub base (or the foundation).
10. Rotate the shaft approximately 90°. Check again whether the shaft is at the center of the stuffing box bore or not. If not, either the top shaft is bent or the first shaft below it did not butt properly. Correction must be made before the installation procedures can proceed.

INSTALLING THE STUFFING BOX

Assemble stuffing box as shown in Figure 9.

1. Clean the surface of the discharge head where the stuffing box will be mounted and remove any nicks or burrs with a fine flat file. Position gasket on surface. Slide stuffing box (616) down over headshaft and into position on the gasket. Secure stuffing box with capscrews. Make sure the capscrews are torqued equally to prevent misalignment.
2. Grease the packing ring (620) for easier installation.
3. Twist the packing ring sideways to get it around the shaft easily. Start the first ring into the stuffing box. When the entire ring is worked in using the fingers, tamp it down using a split wood bushing (or equal) and push the packing ring down firmly. It must seal on the shaft and bore of the stuffing box. Install all three (3) rings in this manner. Stagger ring joints 90° apart. The split gland may be used as a tamper for the top ring.
4. Insert lantern ring (622) into stuffing box. Be sure it is properly positioned so that it aligns with the lubrication passage in the stuffing box.
5. Insert three (3) additional rings of packing. Stagger ring joint 90° apart.
6. Install the split gland and screw nuts on the split gland studs. Tighten nuts then relieve the nuts and tighten finger tight.

⚠ CAUTION ***Check that the split gland is square in the stuffing box. Cocking can cause uneven compression of packing and damage to the shaft or sleeve and heat up the shaft and stuffing box.***

7. The stuffing box is shipped with both ports plugged. If discharge pressure over 100 PSI, remove the plug on Port "A" and attach bypass line. If the discharge pressure is over 200 PSI the Port "B" should also be opened and attached another relief line.
8. Final adjustment of the stuffing box must be made at pump start up. A properly packed stuffing box should be loose enough to allow the shaft to be turned manually. Also, packing must allow leak. See page 24, Pump Start Up #5.

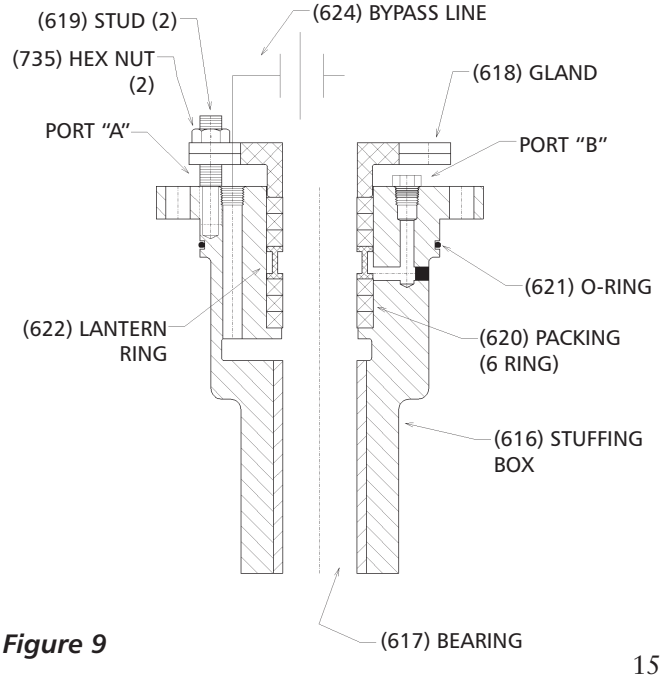


Figure 9

⚠ CAUTION *Do not over tighten packing or excessive wear can occur on the shaft or sleeve.*

INSTALLING THE MECHANICAL SEAL

Vertical turbine pumps are usually supplied with cartridge type mechanical seals, shipped assembled - ready for installation, when mechanical seals are supplied. Instructions for installing mechanical seals are provided by the seal manufacturer. Consult the seal manufacturer's instructions (furnished with the seal) for information on the type of seal used. Additionally, refer to factory furnished outline drawing and seal piping schematic on complex seal piping arrangements.

GENERAL REQUIREMENTS FOR INSTALL SEALS

1. Check surfaces at the face of the seal housing and at the bottom of the seal housing to insure that they are clean, flat and free of burrs. The face surface must be smooth to form a good sealing surface for a gasket or O-ring.

2. Check that shaft is smooth, and free of burrs, nicks and sharp corners that could nick or cut the O-ring or shaft packing. When further clean up is required, protect by covering the inside of the pump seal housing. Remove burrs, nicks and sharp corners by using a strip of emery cloth "shoeshine fashion" over the shaft threads. File threads around the keyway with a smooth mill file or emery cloth. Sharp edges must be rounded.

3. Remove all chips and dust from the shaft area.

4. Check that all rotary unit parts of the seal fit over the shaft. A pre-check may be made by removing the O-ring(s) from the cartridge sleeve Inside Diameter (ID) and then installing the seal on the shaft. Further shaft clean up will be necessary when the seal will not pass all the way into the seal housing.

5. Remove the seal after the pre-check and re-install the sleeve O-ring(s).

6. Sparingly lubricate the shaft and sleeve ID with the lubricant included with the mechanical seal or recommended by the mechanical seal manufacturer. The following lubricants may be used, for water service, when no lubricant is supplied or recommended by the mechanical seal manufacturer.

   - Light oil (SAE #10 or 20)
   - Dow Corning #4 Grease
   - Silicone lubricant
   - Wax or Clay
   - Soapy water

   Oil based lubricants will damage EPR / EPDM elastomer O-rings. Silicone lube and soapy water are safe for EPR / EPDM elastomer O-rings.

7. Install the O-ring or gasket, between the seal housing and seal. Install the seal over the shaft and ease it into position against the face of the seal box. Take care when passing the sleeve and O-ring over keyways or threads to avoid damaging the O-ring.

⚠ CAUTION *Do not bump carbon members against The shaft as they may chip, crack or break.*

8. Position seal gland on discharge head seal housing and secure with capscrews (or nuts for studs) provided. Tighten capscrews gradually and uniformly in a criss-cross pattern, taking 2 or 3 passes.

⚠ CAUTION *Do not over tighten capscrews on gland. This can distort seal seat and cause seal failure.*

9. Install all seal piping as required. Prior to making final connections of sealing liquid pressurizing lines, make sure the seal housing and all sealing liquid lines are flushed free of dirt, scale and other particles that would be abrasive to the sealing faces.

10. The Driver and Coupling must now be installed per instruction. (See page 24 - INSTALLING THE HOLLOW SHAFT DRIVER or page 26 - INSTALLING THE SOLID SHAFT DRIVER).

INSTALLING THE TENSION PLATE WITH CAST IRON TENSION NUT

INSTALLING THE TUBE TENSION PLATE

1. (See Figure 10). Lubricate tube threads and underside of tension plate flange with thread compound. Thread the tension plate (625) onto the enclosing tube nipple (629) manually until its shoulder rests on the discharge head.

TENSIONING THE ENCLOSING TUBE

The enclosing tube sags from its own weight as it is installed and must be pulled tight (tensioned) to make it straight. This section describes two methods of tensioning the tube. The direct pull method is more precise and is preferred. The second method--the wrenching method--is given as an alternate.

NOTE: The correct tension is equal to the weight of the enclosing tube plus 10%.

Weights per unit length for each tube size are given in the Table 1. Multiply by total length of the tube to determine the total weight.

TABLE 1 – Weight-per-foot of Enclosing Tubing

TUBE SIZE (INCH)	WEIGHT PER FOOT (LB.)
1¼	2.99
1½	3.63
2	5.02
2½	7.66
3	10.25
3½	12.50
4	14.98
5	20.78
6	28.57

DIRECT PULL METHOD

1. The upper end of the tube may be pulled by the hoist to obtain the predetermined tension value.

This requires the use of a dynamometer scale and an adapter fitting to grip the tube. TUBE TENSION ADAPTER AVAILABLE THROUGH FACTORY. With the tension plate installed manually but not tightened, thread the special fitting onto the top of the tube to full engagement. Attach the dynamometer scale to the fitting, and connect the upper end of the scale to the hoist hook. Operate the hoist hook to apply the required tension. This should pull the tension plate off the discharge head. Manually thread the tension plate to reset it. Release tension, remove dynamometer scale and special fitting.

WRENCHING METHOD

1. If a dynamometer is not available, the tube can be tensioned by wrenching the tube tension plate. Make up a spanner wrench to straddle the projecting threaded tube end and to engage the tube tension plate capscrew holes by two lugs. Torque the tension plate to take all the slack out of the shaft tubing and induce a reasonable amount of tension by turning the tension plate counterclockwise. For tubing 2½" (63.5mm) and larger, a man's full strength on a 3 foot (915mm) lever arm is sufficient. For smaller sizes, less pull must be exercised.

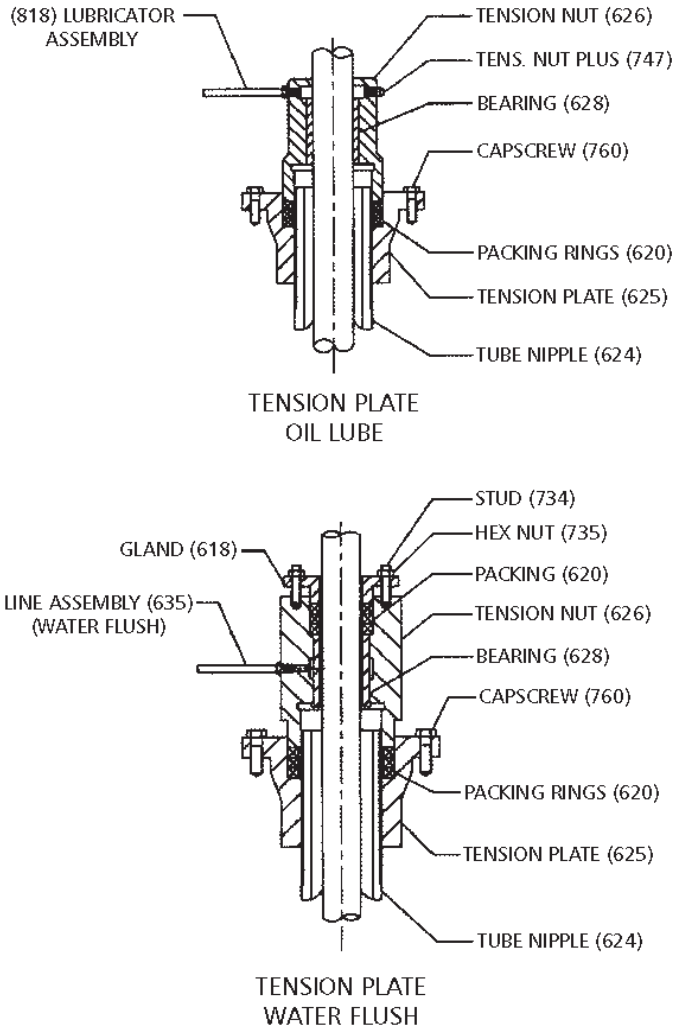


Figure 10

NOTE: Do not turn clockwise to align holes in tension plate and discharge head.

INSTALLING TENSION NUT

1. (See Figure 10). Install capscrews (760) in the tension plate. Pour one pint of oil down the oil tube. **Note: Factory assembled unit has no oil in it. Oil must added in the field.**

2. Install packing (620) in the tension plate and thread the tension nut (626), tightening it firmly against the packing.

3. If a packed type tension nut (626) is used (for water flush), install packing (620), packing gland (618) and secure with stud (734) and nut (735). Screw nut finger tight. Install line assembly (635) and connect to flush liquid supply (see Figure 10).

⚠ CAUTION ***Be sure that the top of the enclosing tube does not interference with the tension nut.***

4. If the top of the tube interferes with the tension nut, determine the distance, if the tube is too long or too short. If the tube is too short, it must be replaced with a longer tube of the correct length. If the tube is too long, it must be cut to the correct length and re-threaded. Reinstall and re-level pump.

LUBRICATION SYSTEM

1. Connect solenoid valve (if provided), oil lines, and fill the oil reservoir with oil.

2. Check the lubricator feed and see that the oil reservoir is flowing freely. (In the case of a solenoid valve, temporary power connections are required.) Set the proper drops per minute on the regulator. Table 2 shows recommended regulator setting.

TABLE 2 – Regulator Setting

Shaft Size (in.)	Basic drops per minute	Additional drops per minute per 100 ft. setting
0.75 - 1.18	5	2
1.50 - 1.68	7	3
1.94 - 2.43	10	4
2.68 and larger	12	5

INSTALLING THE TENSION PLATE WITH BRONZE TENSION NUT

Assemble Tension Plate Assembly as shown in Figure 11.

1. Remove the lock bolt (636) and o-ring (621). Thoroughly clean the tension plate (625) include the o-ring groove. Lightly grease the o-ring and re-install it.

2. Clean the surface of the discharge head where the tension plate will be mounted and remove any nicks or burrs with a fine flat file. Clean the O.D. of the tube nipple. Carefully install the tension plate and gasket (779). Evenly tighten the mounting capscrews (759F).

3. Pour one pint of recommended oil down the tube nipple (629). (See page 27 for recommended lubricants.) **Note: Factory assembled unit has no oil in it. Oil must be added in the field.**

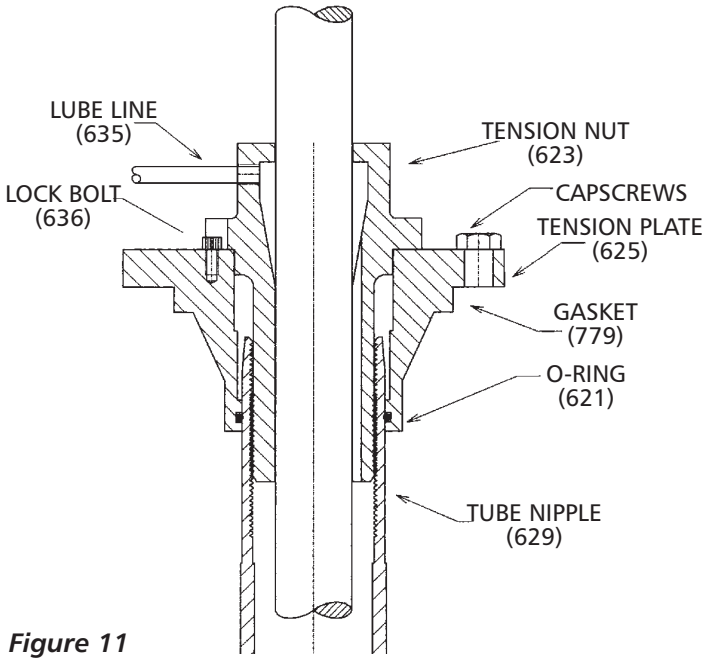


Figure 11

4. Clean the tension nut (623) and lightly oil its bore and the threads. Screw the tension nut into the tube nipple until the flange face of the nut contact the tension plate.

5. For setting less than 100 feet, tighten the tension nut until a slot aligns with the nearest locking position. Install the locking bolt.

INSTALLING THE DRIVER

INSTALLATION OF A HOLLOW SHAFT DRIVER

This refers to either VHS type electric motors or hollow shaft type gear drives. A small paragraph will be devoted to combination electric motor and right angle gear drives.

⚠ WARNING ***Do not work under a heavy suspended object unless there is a positive support and safe guards which will protect personnel should a hoist or sling fail.***

1. The driving mechanism of all hollow shaft driver is shown on Figure 12. The head shaft (608) extends up through the quill or hollow shaft of the driver and is held in place by an adjusting nut (604), which not only carries all the static and hydraulic thrust of the impellers and shaft, but also provides the adjustment for the impeller clearances. The head shaft is connected to top shaft (or stub shaft) by a threaded coupling or a rigid flange coupling.

2. When a motor stand is furnished and not installed, proceed as follows:

   A. Hoist the motor stand, inspect the mounting surfaces, register and clean these surfaces thoroughly.

   B. Install the motor stand on discharge head and secure with capscrews provided.

3. Attach a sling to the lifting lugs of driver and hoist the driver up. Inspect the mounting surface, register and clean these surfaces thoroughly. If any burrs are found, remove burrs with a smooth mill file, cleaning thoroughly afterward.

4. For motor, orient the motor conduit box in the required position. For the right angle gear, orient the input shaft to the desired position. Align the driver mounting holes with the mating tapped holes on the discharge head. Lower the driver until the registers engage and the driver rests on the discharge head. Secure driver with capscrews provided.

5. Lubricate the driver bearings in accordance with instructions given on lubrication plate attached to the driver case (or in the motor IOM).

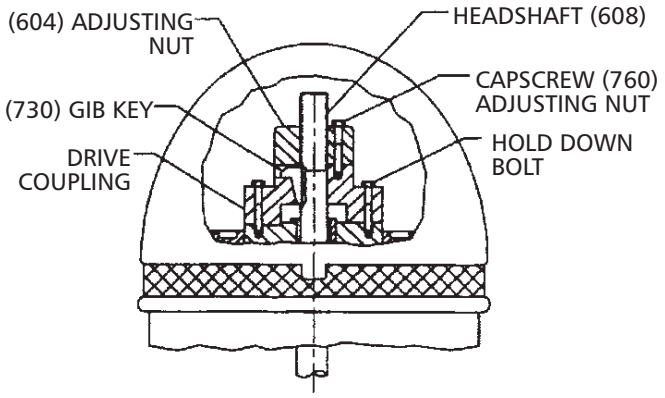


Figure 12

6. After lowering and orienting the driver as explained above, remove the drive coupling and the hold down bolts (See Figure 12). **Be sure to mark the location of the coupling before removing it.**

7. Lower the head shaft through the motor quill shaft to meet the shaft coupling. Apply a thin film of oil to head shaft threads (if non-galling material) and screw into the shaft coupling (located above the stuffing box). Make sure the shaft is not damaged in any way. Tighten the joint.

8. Check that the head shaft centers inside the driver quill shaft within 0.06" (1.5 mm). If it does not, misalignment is indicated.

9. Any head shaft misalignment with driver quill shaft could be caused by a bent headshaft, burrs, or foreign matter between shaft ends or any of the mounting flanges: motor flange to discharge head top flange, discharge head base flange to base plate or the base plate itself could be out of level. If the latter, shimming between base plate and discharge head base, will correct it. Also, check concentricity of motor to motor-stand (if provided) to discharge head.

10. With the motor in place and the head shaft projecting through the motor quill shaft, make temporary electrical connection to check the motor rotation. **(Be sure to remove the ratchet pins or balls before checking motor rotation.)** Motor must rotate counter-clockwise when viewed from the top. See arrow on pump name plate. If motor does not rotate counter-clockwise, you can change the rotation by

interchanging any two leads. (For three phase only. For single phase motors see motor manufacturer's instructions.)

⚠ CAUTION ***Never check motor rotation with the drive coupling in place. The bore clearance between the drive coupling and the pump shaft O. D. is so close that should the motor spin with this shaft stationary, galling and locking together is very likely to take place.***

11. Install motor drive coupling. **(Be sure to line up the match mark made at step 6.)** Inserting the ratchet pins if a non-reverse ratchet is used. Match the coupling lugs with corresponding holes in motor. Tighten hold down bolts evenly, making sure driver coupling is properly seated in the register fit.

12. Fit gib key (730) into keyway, by filing if necessary, to where there is a snug but sliding fit. This key must be able to be removed by gentle leverage with a screwdriver under it.

13. Be careful that the gib key (730) is not too high so as to hold up the adjusting nut (604) from seating on the drive coupling. If it is, cut off some length of the key.

14. Install adjusting nut (604) to hand tight.

COMBINATION ENGINE AND MOTOR DRIVES

1. On combination drivers, the motor is invariably on top with a projecting head shaft extension.

2. Follow all procedures outlined in the previous paragraph, except that the motor must be lowered over this extended head shaft and great care must be taken to center it exactly so as not to bump or mis-align the shaft while the motor is being lowered into place.

3. There are several methods of running engines without electric motors and vice versa, requiring simple adjustment to the combination drive, but they are too numerous to mention here and can be obtained from the gear manufacturers instructions included with the shipment.

IMPELLER ADJUSTMENT FOR ALL HOLLOW SHAFT DRIVERS

NOTE: Shaft adjustment up or down is accomplished by turning the adjusting nut (604) Figure 13.

NOTE: There are five holes in the adjusting nut and only four in the motor coupling. See Figure 13.

1. With shafting all the way down and the impellers resting on their seats, turn the adjusting nut (604) in counter-clockwise direction, thus lifting the shaft, until the impellers just clear their seats and the shaft/motor turns free by hand. This removes all deflection from the shaft.

2. **If pump setting is 200 ft. or less,** make another two turns on the adjusting nut for the first 100 ft. (3 turns for 12 thread/inch shaft). Line-up one of the holes in the adjusting nut with the nearest hole in the driver coupling. Insert the capscrew in the hole and tighten it.

NOTE: 1.00" and 1.18" diameter shafts are 12 thread per inch. All the larger sizes are 10 thread per inch.

3. **For pump setting over 200 ft. see IOM for DWT.**

FOR OPEN IMPELLERS

1. With shafting all the way down and the impellers resting on their seats, turn the adjusting nut (604) in counter-clockwise direction, thus lifting the shaft, until the impellers just clear their seats and the shaft/motor turns free by hand. This removes all deflection from the shaft.

2. Align hole "A" in the adjusting nut (604) and hole "C" in the driver coupling (See Figure13) or whatever similar holes are in like position. If care is exercised, this will give an initial impeller clearance of 0.001" to 0.003" depending on shaft size or the pitch of the thread.

3. Insert capscrew into hole "B" provided these are the nearest matching holes for counter-clockwise rotation of adjusting nut, turn adjusting nut counter-clockwise until holes "B" and "D" line up. This gives 1/20 of a turn which is 0.004" on 12 threads per inch shaft or 0.005" on 10 threads per inch shaft.

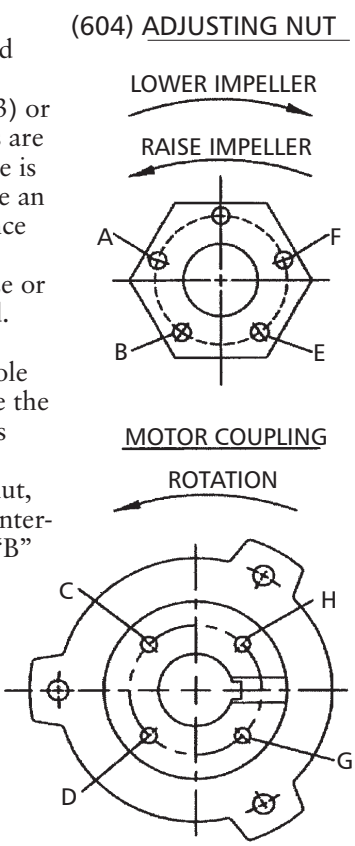


Figure 13

4. Normal impeller clearance for the open impeller is consider to be 0.015" for the first 10 ft of the column length and 0.010" additional clearance for each 10 ft of length thereafter. This can be reduced in some instances where is necessary, but should not be attempted without consulting the factory or factory serviceman if present.

INSTALLATION OF A SOLID SHAFT DRIVER

NOTE: When pump is supplied with an oil lubricated thrust pot, do not secure driver to discharge head until after the thrust pot and flexible coupling are installed. (See page 22 for thrust pot installation instruction.)

⚠ WARNING ***Do not work under a heavy suspended object unless there is a positive support and safe guard which will protect personnel should a hoist or sling fail.***

The coupling between the driveshaft and discharge head shaft may be a non-spacer type (see Figure 14), or a spacer type (see Figure 15). The latter is used on pumps furnished with a mechanical seal to permit servicing of the seal without removal of the driver.

1. Driver support. When a driver support is furnished and not installed, proceed as follows.

   A. Hoist driver support, inspect the mounting surfaces, register and clean these surfaces thoroughly.

   B. Install driver support on discharge head and secure with capscrews provided.

2. Attach a sling to the lifting lugs of driver, hoist motor, inspect the mounting surface, register, and shaft extension, and clean those surfaces thoroughly. If any burrs are found, remove burrs with a smooth mill file, cleaning thoroughly afterward.

3. Orient the motor conduit box in the required position. Align the motor mounting holes with the mating tapped holes on the discharge head. Lower the motor until the registers engage and the motor rests on the discharge head. Secure motor with capscrews provided.

4. On drivers having a non-reverse ratchet or pins, manually turn the driver shaft clockwise viewed from the top until the non-reverse ratchet or pins fully engage.

5. Lubricate motor bearings in accordance with instructions given on lubrication plate attached to the motor case.

NOTE: Please read and follow the motor manufacturer's instructions before lubricating the motor bearings. Too much lubricant can cause the bearings to overheat and prematurely fail.

⚠ WARNING ***The motor must not be tested for direction of rotation when coupled to the pump. If pump should rotate in the wrong direction, serious damage to the pump and motor would result. Also serious injury to personnel could result.***

6. Make temporary electrical connections according to tagged leads or diagram attached to the motor. Motor must rotate counter-clockwise when viewed from the top. See arrow on pump name plate. If motor does not rotate counter-clockwise, you can change the rotation by interchanging any two leads (For three phase only, for single phase motors see motor manufacturer's instructions.)

7. Motor shaft end play adjustment: if required, motor shaft end play shall be checked with a dial indicator prior to connecting the pump coupling to the solid shaft motor. Consult the applicable motor manufacturer's instruction manual for detailed information on motor shaft end play.

COUPLING INSTALLATION: (SEE FIGURES 14 and 15)

1. Check all mating face with a fine flat file before installation. Remove all burrs from face.
2. Apply a thin film of oil on the pump key (730) and insert key into headshaft keyway seat.
3. Gently lower pump hub of coupling (614) onto headshaft.
4. Thread on the adjusting plate (613) onto the headshaft until flush with top of the headshaft.
5. Clean driver shaft by removing all grease and burrs. Try to fit the key on the driver hub (610) before installing it to the driver shaft.

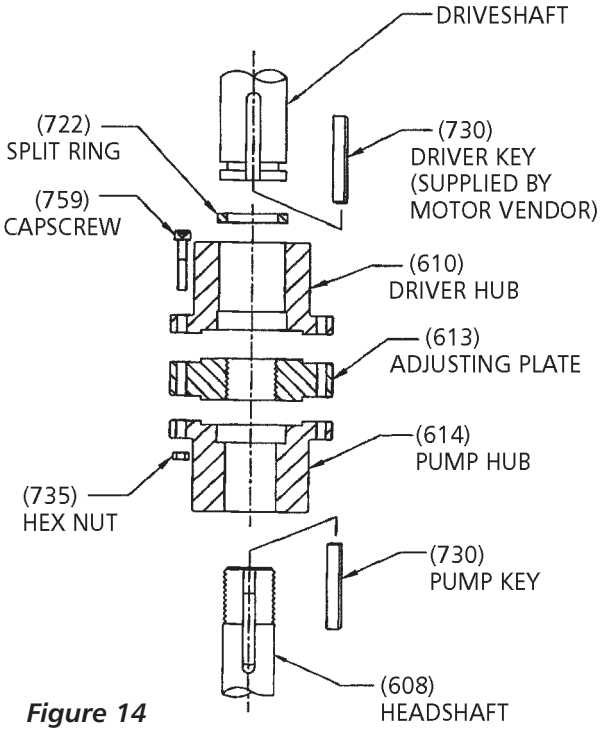


Figure 14

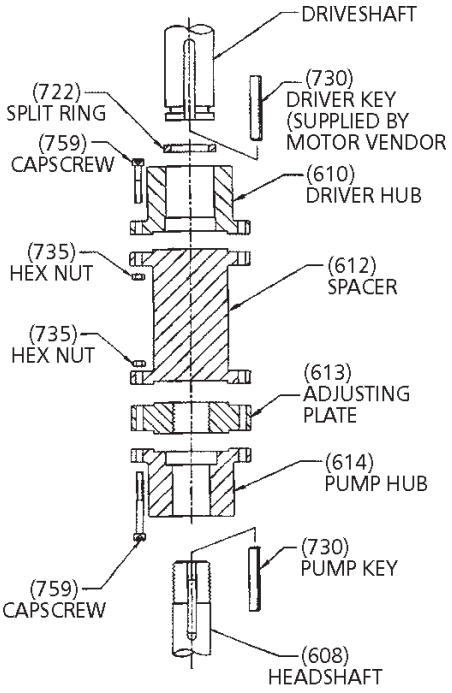


Figure 15 SPACER COUPLING (TYPE AS)

6. Apply a thin film of oil to the driver key (730) and insert key into drive shaft keyway seat. Place the driver hub (610) onto the drive shaft and with key slide it up the drive shaft until the annular grove is exposed. Install split ring (722) in the groove and slide driver hub down over the split ring to capture it.
7. If the pump is supplied with an adjustable spacer coupling (see Figure 15), install spacer (612) between headshaft and driveshaft hubs. Secure with capscrews (759) and hex nuts (735).

IMPELLER ADJUSTMENT

Impeller adjustment is identical for all motors and right angle gear drives. Adjustment is accomplished by turning the adjusting plate (613). (See Figure 16 or 17). The correct adjustment is listed on the Outline Drawing for the specific unit. If the pump has a thrust pot, do not adjust the impeller position until the thrust pot has been installed and adjust the impeller position by using the adjust nut on the thrust pot.

NOTE: Mechanical seal, when provided, must not be secured to the shaft prior to impeller adjustment. (open or enclosed type impellers). Shaft must move up or down within the seal Assembly.

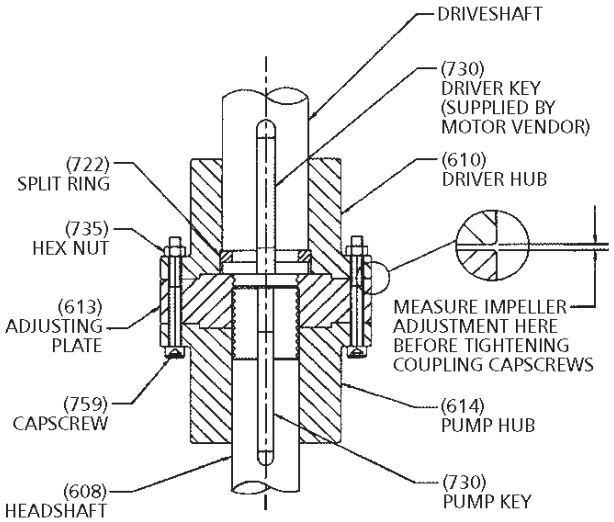
For pumps handing liquids between –50° to 200° F, impeller adjustment can be made under ambient conditions. For liquids in excess of this range, it is recommended that impeller adjustment be made after the pump surface temperature has reached an equilibrium when charged with the pumpage. In those cases, where this is not feasible due to safety consideration or impossible due to external ice build up in cryogenic applications, refer to factory for specific instructions.

OPEN IMPELLERS

1. With the impellers touching the bottom of the bowls, turn the adjusting plate (613) towards the driver hub (610) or spacer (612) to obtain 0.015 inch clearance between the adjusting plate and driver hub or spacer for the first 10 feet of column. Add 0.010” for each additional 10 feet of column. See Figures 16 and 17. **Note: The determination of driver shaft end play can be critical and should be added to this setting.** For larger pumps over 8”, this amount may be too little; please refer to Outline Drawing.

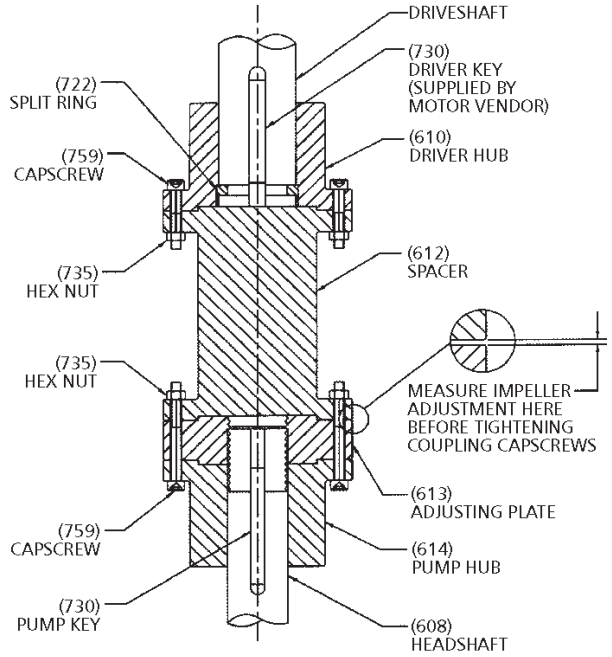
   Example: total pump length is 50 feet - set impellers at 0.055 inch.
2. After impeller adjustment, align adjusting plate (613) with the pump hub (614), and tightly draw coupling flanges together with capscrews (759) and nuts (735). (See Figures 14 and 15.)
3. Check shaft run out with dial indicator. For mechanical seal installation, the run out should be 0.005" or less.
4. Set seal after impeller adjustment. Securely tighten all set screws in the collar. Remove the spacer between the gland plate and collar. Retain spacer for future resetting of seal.

NOTE: When impellers are reset, the seal must also be reset.



ADJUSTABLE COUPLING (TYPE A)
IMPELLER ADJUSTMENT

Figure 16



SPACER COUPLING (TYPE AS)
IMPELLER ADJUSTMENT

Figure 17

ENCLOSED IMPELLERS

For enclosed impellers obtain the clearance between the adjusting plate and driver hub or spacer as specified on the outline drawing. See Figure 16 or 17.

INSTALLING THE GREASE LUBRICATED THRUST POT

This type of thrust pot and the motor stand are assembled on the discharge head by the factory. This thrust pot is designed to be used with NEMA Vertical C-face motors. The motor shaft and the pump shaft are to be coupled with flexible coupling.

INSTALLATION:

1. Install both coupling halves prior to mounting the motor. Refer to the coupling manufacturer's instructions.
2. Using the lifting lugs on the motor, carefully lower the motor onto to the motor stand of the thrust pot (See Figure 18) and align the bolt holes.
3. Install the bolts finger tight.
4. Make temporary electrical connections according to tagged leads or diagram attached to the motor. Motor must rotate counterclockwise when viewed from the top. See arrow on pump name plate. If motor does not rotate counterclockwise, you can change the rotation by interchanging any two leads.

⚠ WARNING ***Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power will result in serious physical injury.***

ALIGNMENT OF FLEXIBLE COUPLING:

Alignment of the pump and motor is extreme importance for trouble-free mechanical operation. Straight edge alignment by an experienced installer proves adequate for most installations.

1. Check for coupling alignment by laying a straight edge across both coupling rims at four points 90° apart.
2. Move motor until straight edge rests evenly at each position. Repeat procedure until correct alignment is achieved.
3. Install flexible sleeve between the hubs per the manufacture's instructions.
4. Tighten all motor bolts.

NOTE: Be sure the relief fitting (#11 in Figure 18) is clear of paint or any other obstructive material. Otherwise it will cause premature failure of the thrust pot and is not covered under warranty.

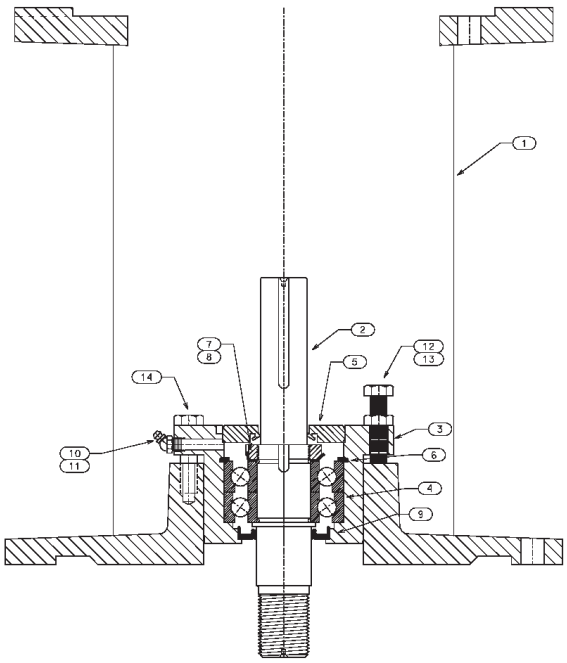


Figure 18 – Grease Lubricated Thrust Pot

INSTALLING THE OIL LUBRICATED THRUST POT

If the unit is supplied with a thrust pot (see Figure 19), the thrust pot should be installed on top of the discharge head or motor stand before installing the driver. The driving mechanism of the thrust pot assembly is similar to the hollow shaft motor. (See Figure 12)

1. Attach a sling to the thrust pot assembly through the windows on the motor adapter and hoist the assembly over the top of the discharge head.
2. Clean the mounting face with a flat file to remove any burrs of the discharge head and the thrust pot. Lower the thrust pot assembly and orient it so that the bolt hole on the base of the thrust pot and the top flange of the discharge head are line up. Install all the bolts to secure the assembly to the discharge head.
3. Lower the drive shaft through the quill of the thrust pot assembly to meet the shaft coupling. Apply a thin film of oil to the head shaft thread and screw into the shaft coupling.
4. For unit with mechanical seal and flanged coupling, install the spacer flange coupling as instructed on page 20.
5. Install the gib key (#16) into the drive shaft and the hollow shaft clutch.
6. Install the adjusting nut (#17) to hand tight.
7. With shafting all the way down and the impellers resting on their seats, turn the adjusting nut (#17) in counter-clockwise direction, thus lifting the shaft, until the impellers just clear their seats and the shaft/motor turns free by hand. This removes all deflection from the shaft.
8. For enclosed impellers, if pump setting is 200 feet or less, make another two turns on the adjusting nut for the first 100 feet (3 turns for 12 thread/inch shaft) Line-up one of the holes in the adjusting nut with the nearest hole in the driver coupling. Insert the capscrew in the hole and tighten it.

NOTE: 1.00" and 1.18" diameter shafts are 12 threads per inch. All the larger sizes are 10 threads per inch.

ITEM	DESCRIPTION
1	Motor stand
2	Head shaft
3	Bearing housing
4	Bearings
5	Top seal
6	Snap ring
7	Lock nut
8	Lock washer
9	Lower seal
10	Grease lube fitting
11	Grease relief fitting
12	Hex tap bolt
13	Hex nut
14	Hex capscrew

9. Install the bottom of the flexible coupling to the top of the drive shaft.

10. Attach a sling to the lifting lugs of driver and hoist the driver up. Inspect the mounting surface, register and clean these surfaces thoroughly. If any burrs are found, remove burrs with a smooth mill file, cleaning thoroughly afterward. Temporarily attach the top half of the flexible coupling to the motor shaft.

11. Orient the motor conduit box in the required position. Align the driver mounting holes with the mating tapped holes on the discharge head. Lower the driver until the registers engage and the driver rests on the thrust pot assembly. Secure driver with capscrews provided.

12. Secure the flexible coupling assembly.

13. Install the coupling guard.

14. Fill the oil reservoir with recommended oil.

Pump Startup And Operation – SECTION 4

PRE-START PROCEDURE

Consult the applicable manufacturer's instructions for detailed information for the prime mover (electric motor, engine or steam turbine), coupling, driveshaft, gear driver. Prior to startup, check the following:

1. Confirm that the following procedures described in the "Installing the Drivers" sections have been performed:

   A. Wiring of Driver.

   B. Driver must rotate counterclockwise (CCW) when viewed from above.

⚠ WARNING ***Do not check motor rotation unless motor is bolted to pump and drive coupling is removed.***

Be sure to remove all the hand tools and to install the coupling guards around all exposed shafts and couplings before start up of the pump. Failure to comply may result in sever personnel injury or death.

   C. Check alignment of pump and driver.

   D. Impeller adjustment has been made.

   E. Mechanical seal lock collar is attached to shaft.

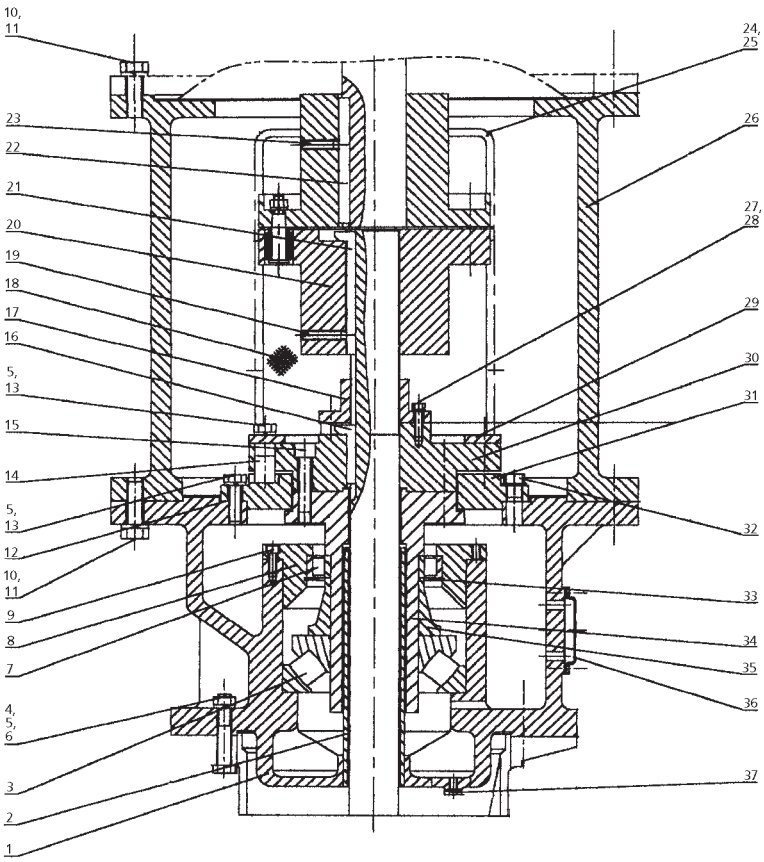


Figure 19 – Oil Lubricated Thrust Pot

ITEM	DESCRIPTION
1	Thrust pot body
2	Tube - oil retaining
3	Thrust bearing
4	Capscrew - head to thrust pot
5	Washer - head to thrust pot
6	Hex Nut - head to thrust pot
7	Roller bearing
8	Bearing seat
9	Allen head screw
10	Capscrew - motor adapter to motor or thrust pot
11	Washer - motor adapter to motor or thrust pot
12	Gasket
13	Capcsrew
14	Non-reverse pin
15	Socket head screw
16	Gib key
17	Adjusting nut
18	Coupling guard
19	Setscrew

ITEM	DESCRIPTION
20	Flexible shaft coupling
21	Gib key
22	Key (motor shaft)
23	Setscrew
24	Round head screw for coupling guard
25	Washer coupling guard
26	Motor adapter
27	Capscrew - adjusting nut
28	Washer - adjusting nut
29	Retaining ring
30	Hollow shaft clutch
31	Non-reverse plate
32	Pipe plug - oil filling
33	Retaining ring
34	Hollow shaft
35	Shaft sleeve
36	Sight gauge
37	Pipe plug - oil drain

2. For open lineshaft pump, make sure the stuffing box bleed line is connected (if applicable). For enclosed lineshaft pump, make sure the oil lubrication piping is connected and oil reservoir filled with the recommended oil. (See page 15 and 18.)

3. For pump with mechanical seal, make sure mechanical seal is properly lubricated and all piping to seal is connected. Also, check that all cooling, heating and flushing lines are operating and regulated.

4. For open lineshaft pump, when water level exceeding 30 feet, pre-lubrication is necessary. If it is equipped with prelube system supplied from a pressurized header, open the supply valve and allow the prelube water to flow for 15 seconds plus 15 seconds per 100 ft of pump setting. If it is equipped with a tank type prelube system, open the valve between the prelube tank and the pump and allow approximately half of the water in the tank to run into the pump before start the pump. The prelube valve should remain open during the start up.

5. For oil lubricated pump, clean and fill the lubricator tank with recommended oil. (See page 27.) Manually open the lubricator valve and allow oil to run into the shaft enclosing tube for at least 20 minutes for each 100 feet of setting prior to start up. On the system equipped with a solenoid operated lubricator valve that cannot be energized independently, it will be necessary to remove the valve stem to allow the oil to flow into the tube. If the start up is delayed or the pump has been shut down for over 150 hours, the lubrication procedure must be repeated just prior to actual start up.

6. Open the air release system isolation valve. Adjusting the air release system throttling device so that it is partially open. It should not be closed or fully open.

NOTE: Not exhausting the air or exhausting it too fast can damage the pump.

7. All connections to driver and starting device match wiring diagram. Voltage, phase and frequency on motor nameplate agree with line current.

8. Rotate shaft manually to ensure impellers are not binding.

9. Verify that driver bearings are properly lubricated and check oil level in housing.

10. Inspect discharge piping connection, valves and pressure gauges for proper operation.

PUMP STARTUP

1. Partially close the valve in the discharge line.

2. Start the pump. If any abnormal noises, jerking or vibration is noted, stop the pump immediately, determine the cause of the abnormalities and correct them.

3. After the pump is operating at full speed, slowly open discharge valve. If driver overheats or there is excessive vibration, stop the pump, determine the causes and correct them.

4. If the air release valve is manually operated, close it.

5. For open lineshaft pumps, with the pump in operation, there should be some leakage at the stuffing box packing. The correct leakage rate is approximately one drop per second. Check the temperature of the leakage as well as the discharge head. If the pump runs hot and the leakage begins to choke off, stop the pump and allow it to cool down. A few light taps with a hammer on the gland will upset the packing sufficiently to resume leakage. After pump has cooled, restart pump and follow preceding procedure. Run pump 15 minutes, check leakage, if it exceeds two drops per second, adjust packing as described in “Packing Adjustment and Replacement”.

6. For enclosed line shaft pumps, adjust the lubricator valve for the proper flow rate of the lubrication oil. (See Page 17.)

7. For pump with mechanical seal, if seal leaks slightly at startup, allow a reasonable amount of time for seal to adjust itself. Liquids with good lubricating qualities normally take longer to wear in the seal than liquid with lesser qualities. When a seal starts out with a slight leak and gets progressively less while running, it is indicative of leakage across the seal faces. Continued running will eliminate this. Where leakage occurs immediately and remains constant, unaffected by running, it usually indicates secondary seal (Shaft packing) damage, or seal faces are warped out of flat.

PREVENTIVE MAINTENANCE

⚠ WARNING ***Before initiating maintenance procedures, disconnect all electric sources to the equipment and accessories and completely. Discharge all parts and accessories which retain electric charges. Failure to comply may result in severe personnel injury or death.***

Preventive maintenance includes periodic inspection of oil level in the oil reservoir (for pump with oil lube column) re-lubrication of electric motors, gear drives and prime mover. Systematic inspection of the pump and its components shall be made at regular intervals. The frequency required depends upon the operating conditions of the pump and its environment. See following Preventive Maintenance schedule. Consult the applicable manufacturer's instructions for detailed information on maintenance for the prime mover, driveshaft, electric motors and gear drives. Any deviation in performance or operations from what is expected can be traced to some specific cause. Variances from initial performance will indicate changing system conditions, wear, or impending breakdown of the unit.

PREVENTIVE MAINTENANCE SCHEDULE

PROCEDURE	TIME INTERVAL (in operating hours)
Clean dirt, oil and grease from driver and discharge head.	As required
Clean driver ventilation passage to prevent overheating.	As required
Change lubrication in gear drive.	2,000 or once a year
Change lubrication in thrust pot.	See page 27
Check oil level in the reservoir. It should never be less than ½ full. Refill, check drip rate.	24
Tighten all loose bolts and check for excessive vibration.	As required
If packing is grease lubricated, add as required.	100
Check that there is some leakage through stuffing box while pump is in operation. Do not tighten gland nuts unless necessary. Refer to page 24 for tightening requirement.	As required
Maintain a liquid film of lubrication between the seal rubbing faces.	As required
Re-grease the motor bearings: 1800 RPM and above Below 1800 RPM	 Refer to Motor IOM Refer to Motor IOM

PACKING ADJUSTMENT AND REPLACEMENT

Pumps equipped with packing, shall be adjusted whenever the leakage rate exceeds two drops per second. If there is no leakage or the stuffing box overheats, do not back off gland nuts while the pump is running. This will allow the entire set of rings to move away from the bottom of the box, without relieving pressure of the packing on the shaft. Stop the pump and allow packing to cool then restart the pump.

It may be necessary to repeat this procedure several times before proper amount of liquid comes through to efficiently prevent overheating. If leakage is excessive, adjust the stuffing box as follows:

1. With the pump in operation, tighten the gland nuts one-quarter turn for each adjustment. Allow packing to equalize against the increased pressure and leakage to gradually decrease to a steady rate, before making another adjustment.

⚠ CAUTION ***Do not over tighten the stuffing box. Excessive pressure can wear out packing prematurely and seriously damage the shaft.***

2. With the pump shut down and when packing has been compressed to the point that the gland is about to contact the upper face of stuffing box, remove the split gland, add one extra packing ring and readjust. If this fails to reduce leakage to two drops per second, remove all packing rings and replace with new rings.
3. Remove the packing with the aid of a packing hook. If a lantern ring is provided, remove it by inserting a wire hook in the slots of the ring and pull it from the packing box. Thoroughly clean the stuffing box of all foreign matter.
4. If the replacement packing is in the form of a continuous coil or rope, it must be cut into rings before installing. Tightly wrap one end of the packing material around the top shaft like one coil spring, and cut through the coil with a sharp knife. For re-packing sequence, refer to "Installing the Stuffing Box" (page 15).

⚠ WARNING ***Do not over tighten the stuffing box. Excessive pressure can wear out packing prematurely and seriously damage the shaft.***

SEASONAL SHUTDOWN

⚠ WARNING ***Prior to restarting the pump, manually rotate the shaft several times.***

1. For oil lubricated pumps that are shut down for an extended period of time, it is suggested that the pump be operated for at least 15 minutes every two weeks with oil feed wide open 2 hours before and during startup in order to maintain a film of oil on the shafting and shaft bearings.

2. For product (or water) lubricated pump, if the pump is to be shut down for an extended period of time, operate it for at least 15 minutes with adequate pre-lubrication every two weeks.

3. Before resuming normal operations, oil should be changed on drivers, right angle gear and lubricating oil system. After 15 minutes of operation adjust the lateral.

THRUST POT LUBRICATION AND MAINTENANCE

OIL LUBRICATED THRUST POT (SEE FIGURE 19)

⚠ WARNING ***Pumps are shipped without oil. Oil-lubricated bearings must be lubricated at jobsite.***

It is a good practice to flush the oil reservoir before first time operation and at the time of oil changes to remove all grit particles in the oil reservoir sump. Use the same type of oil to flush reservoir as specified for lubrication. (See page 27 on recommended turbine oil.) Remove drain plug (Item # 39) before flushing. Flushing oil may be poured through oil fill opening (item #33) after removing oil fill plug #39. The proper oil level when the unit is not running shall be not more than $^1/_8$" to ¼" from the top of the oil sight gauge (Item #37). Overfilling may result in overheating of the unit. During operation the oil level in the sight gauge may be higher than the recommended range mentioned above. Under no circumstance is it allowed to rotate the unit when the oil in the sight gauge is not at the required level.

To avoid oxidation of the anti-friction bearings during shut-down periods lasting longer than one week, it is recommended to fill up the oil reservoir until the oil runs over the oil retainer tube (Item #2) and down the shaft so that the bearings remain completely immersed in the oil. Before startup, do not forget to drain the excess oil to its required level. Oil change depends on the severity of the environment. Generally speaking, when the oil in the sight gauge changes to a darkish brown color it is time for an oil change. However, for a longer bearing life, it is recommended that the oil be changes every six months. Be sure to flush the oil reservoir (see above) with each oil change.

GREASE LUBRICATED THRUST POT (SEE FIGURE 18)

Lubricating Intervals in Operating Hours

Thrust Rating	Operating Speed (RPM)			
	<1770	1770	2900	3500
2000 lbs	2000	2000	2000	1800
4000 lbs	2000	2000	1600	1400
6600 lbs	2000	2000	1400	1200

The bearing is pre-lubricated at factory. Re-grease the bearing according the following procedure and per the schedule in the above table. Following are the re-grease procedure:

1. Wipe dirt from grease fittings.
2. Check relief port 180° from fitting to make sure it is open.
3. Fill the grease cavity through the fitting until fresh grease comes out the relief hole.
4. Ensure the relief port closes.

NOTE: The bearing temperature usually rises after re-greasing due to an excess supply of grease. Temperature will return to normal after the pump has run and purged the excess from the bearings, usually two to four hours.

For most operating conditions, lithium based NLGI 2 grease is recommended. This is the grease factory used for pre-lubrication. This grease is acceptable for bearing temperatures of 5° to 230° F. Temperature extremes (either high or low) may require different type grease. Following table lists some various manufacturers' compatible grease:

Mobil	Mobilith AW2
Amoco	Amolith EP2
Ashland	Multilube EP2
Exxon	Unirex N2
Shell	Alvania EP LF2
Unocal	Unoba EP2
Chevron	Dura-Lith EP NLGI2

NOTE: If it is necessary to change the grease type or consistency, the bearing must be removed and all the old grease eliminated from the housing and bearing.

⚠ WARNING ***Bearings must be lubricated properly in order to prevent excess heat generation, spark and premature failure.***

RECOMMENDED LUBRICANTS		
	Grease for Lineshafts, Suction Bowl Bearings and Shaft Packings	**Turbine oils for Lineshafts, Suction Bowl Bearings and similar applications**
Operating Temperature Range	20º F to 120º F	20º F to 120º F
Required properties Pour Point : Flash Point : 100º F Viscosity : ASTM Dropping Point : Nitrile Rubber Swell : Thickener Type: Thickener Percent:	 20º F or lower (base oil) 300º F or higher (base oil) 450 SUS or higher (base oil) 160º F or higher Minimal (up to 3%) Calcium or Lithium 15% Minimum	 20º F or lower 300º F or higher 150 SUS or higher 32 Minimal (up to 3%)

Manufacturer	Recommended Standard Industrial Lubricants	
Chevron Texaco Corp.	Chevron Ulti-Plex Grease EP2	Chevron *Hydraulic Oil AW32
	Texaco Novatex EP2	Texaco *Regal EP 32
CITGO Petroleum Corp.	Mystik Oil & Grease Mystik JT-6 Grease (5484)	Mystik Oil & Grease *Mystik Turbax Oil 32 (1812)
	Citgo Oil & Grease Premium Lithium EP2	Citgo Oil & Grease Pacemaker Oil 32
	Lyondell Lubricants Litholine HEP Grease	Lyondell Lubricants *Duro Oil 32
Exxon Mobil Corp.	Mobil Mobilux Grease EP2	Mobil DTE Oil 24
	Exxon Lodok EP 2	Exxon *Nuto H Hydraulic Oil 32
76 Lubricants Co.	76 Lubricants Multiplex EP Grease 2	76 Lubricants Hydraulic Oil AW/D 32
Shell Oil	Shell Alvania EP Grease 2	Shell *Tellus Plus Oil 32

*Note: * in front of the oil grade means it is suitable for sub zero (F) temperature service.*

Manufacturer	Recommended Food Machinery Lubricants	
Chevron Texaco Corp.	Chevron #FM Grease EP2	Chevron *#Lubricating Oil FM32
	Texaco #Cygnus Grease 2	Texaco #Cygnus Hydraulic Oil 32
CITGO Petroleum Corp.	Mystik Oil & Grease #Mystik FG2 Grease (5607)	Mystik Oil & Grease #Mystik FG/AW 32 Oil (1931)
	Citgo Oil & Grease #Clarion FG HTEP Grease	Citgo Oil & Grease #Clarion FG AW Oil 32
	Lyondell Lubricants Ideal FG 2 Grease	Lyondell Lubricants #Ideal FG 32 Oil
Exxon Mobil Corp.	Mobil #Mobil Grease FM102	Mobil DTE FM 32 Oil
	Exxon Foodrex FG 1	Exxon *Nuto FG Hydraulic oil 32
76 Lubricants Co.	76 Lubricants 76 Pure FM Grease	76 Lubricants 76 FM Oil 32

*Note: 1. * in front of the oil grade means it is suitable for sub zero temperature (F) service.*

2. Food machinery lubricants meet USDA H-1 requirements and FDA document 21 CFR 178.3570. In addition, # in front of the product name means it is NSF 61 registered products.

TROUBLESHOOTING		
TROUBLE	**PROBABLE CAUSE**	**REMEDY**
1. Pump does not start	A. Electrical circuit open or not completed	Check circuit and correct.
	B. Improper lateral adjustment. Impeller on bottom.	Reset impeller adjustment, See pages 19 or 21.
	C. Low voltage supplied to electric driver	Check whether driver wiring is correct and receiving full voltage.
	D. Defective motor	Consult factory.
2. No liquid delivered	A. Discharge valve closed	Be sure the discharge valve is in full open position.
	B. Speed is too low	Check if driver is directly across the line and receiving full voltage.
	C. Wrong rotation	Check for CCW rotation when viewed from above. Check engagement of motor coupling.
	D. Obstruction in liquid passage	Pull pump, inspect suction strainer, impeller and bowls.
	E. Water level in the well is below 1st stage impeller	Increase pump setting by adding column.
	F. Static lift too high	Check the dynamic water level in well. Consult factory for adding stages or increase impeller diameter.
	G. Field head requirement greater than design head	Check system friction loss. Increase discharge piping size. Consult factory for adding stages or increase impeller diameter
	H. Damaged bowl assembly; Broken or disconnected shaft	Pull pump and repair all damaged components.
	I. Driver with reduced voltage, or reduced current starting does not come up to speed	Check RPM, voltage and amps.
3. Not enough liquid	A. Same as items 2-A thru 2-G	Same as items 2-A thru 2-G.
	B. Cavitation	Insufficient NPSH available. Consider lowering the bowl assembly by adding column.
	C. Impellers adjusted too high	See pages 19 or 21.
	D. Air or gas in the water	If successive starts and stops do not remedy, lower pump if possible, or close discharge valve to maintain well pumping level at a lower GPM.
	E. Excessive pump wear	Pull pump and repair as required.
4. Not enough pressure	See not enough liquid.	See not enough liquid.
5. Pump works for a while and quits	A. Excessive horsepower required.	Use larger driver. Consult factory.
	B. Pumping higher viscosity or specific gravity liquid than designed for.	Test liquid for viscosity and specific gravity.
	C. Mechanical failure of critical parts	Check bearings and impellers for damage. Any irregularities in these parts will cause a drag on the shaft.
	D. Suction strainer clogged	Pull pump and clean the strainer.
	E. Misalignment	Realign pump and driver.
	F. Break suction	Check dynamic water level in the well. Lower bowl assembly by adding column.

TROUBLESHOOTING		
TROUBLE	**PROBABLE CAUSE**	**REMEDY**
6. Pump takes too much power	A. Damaged impeller	Inspect, replace if damaged.
	B. Foreign object lodged between impeller and bowl	Remove object as required.
	C. Specific gravity higher than pump designed for	Test liquid for viscosity and specific gravity.
	D. Viscosity too high, partial freezing of pumpage	Check for both. They can cause drag on impeller.
	E. Defective bearing	Replace bearing, check shaft or shaft sleeve for scoring.
	F. Packing is too tight	Release gland pressure. Retighten. (See page 15.) Keep leakage flowing. If no leakage, check packing, sleeve or shaft.
7. Pump is too noisy	A. Cavitation	Same as Item 3-B.
	B. Bent shaft	Straighten as required. See Page 13 for runout limits.
	C. Rotating parts binding, loose or broken.	Replace as required.
	D. Bearings are worn out	Replace bearings.
	E. Resonance	Check piping strain, consult factory.
8. Excessive vibrations	A. Coupling misalignment, bent impeller unbalance, worn bearings, cavitation, piping strain and/or resonance	Determine cause utilizing shaft vibration frequency analyzer and/or disassemble pump. Complex problem may require factory service assistance.
	B. Motor or gear driveshaft end play maladjustment	See Installation of Hollow Shaft Driver (VHS), Page 18.
	C. Bent shaft	Straighten as required. See Page 13 for runout limits.
	D. Crooked well.	Survey the well and consult factory.
9. Pump leaks excessively at stuffing box	A. Defective packing	Replace worn packing.
	B. Wrong type of packing	Replace packing not properly installed or run-in. Replace improper packing with correct grade for liquid being pumped.
10. Stuffing box is overheating	A. Packing is too tight	See item 6-F.
	B. Packing is not lubricated	Release gland pressure and replace all packing if burnt or damaged. Re-grease packing as required.
	C. Wrong grade of packing	Consult factory.
	D. Stuffing box improperly packed	Repack stuffing box.
11. Packing wears too fast	A. Shaft or shaft sleeve worn	Pull pump and remachine, or replace shaft and/or sleeve.
	B. Insufficient or no lubrication	Repack and make sure packing is loose enough to allow some leakage.
	C. Improperly packed	Repack properly, make sure all old packing is removed and stuffing box is clean.
	D. Wrong grade of packing	Consult factory.

DISASSEMBLY

⚠ WARNING *Before working on pump or motor, lock out driver power to prevent accidental startup and physical injury.*

NOTE: Pump components should be match-marked prior to disassembly to ensure they are reassembled in the correct location.

HEAD AND COLUMN

1. On pumps which are driven through a gear drive, remove the driveshaft between the gear and the prime mover.

2. On pumps, which are electric motor driven, remove the electrical connections at the conduit box and tag the electrical leads, so they can be reassembled the same way they were disassembled.

3. Uncouple driver (or gear box) from pump shaft and mounting flanges and lift off by the lifting lugs or eyebolts as furnished.

⚠ WARNING *Never try to lift entire pump assembly by the lifting lugs or eyebolts furnished for the driver only.*

4. Disconnect discharge head from the discharge piping. Remove all hold down bolts and external piping. Remove coupling, packing box and proceed with disassembly down to the bowls by reversing the procedures described in detail for assembling the unit.

BOWL ASSEMBLY

The bowl assembly is composed of a suction bowl/bell, intermediate bowl(s), top bowl, impellers and securing hardware, bearings, and pump shaft.

Turbine bowl impellers are secured to the shaft by either a taperlock or a key and split thrust ring. Follow only those procedures that apply to the particular construction supplied.

NOTE: Match mark bowl assembly in sequence of disassembly to aid in the reassembly procedure.

TAPERLOCK CONSTRUCTION BOWL DISASSEMBLY

1. Remove capscrews that secure top intermediate bowl (669), not shown, to intermediate bowl (670). See Figure 1 or 2.

2. Slide discharge bowl and top bowl off the pump shaft (660).

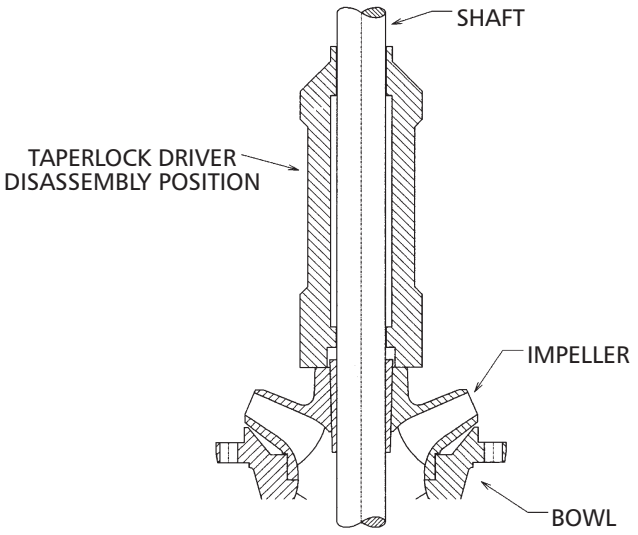


Figure 20

3. Pull shaft out as far as possible and strike the hub of the impeller by taperlock driver, or equivalent, until the impeller is off the taperlock (See Figure 20).

4. After the impeller is free, insert a screw-driver into the slot in the taperlock and spread it open. Slide the taperlock and impeller off the pump shaft.

5. Repeat the above procedures until the bowl assembly is completely disassembled.

KEYED BOWL DISASSEMBLY

1. Remove capscrews that secure top bowl (669) to intermediate bowl (670).

2. Slide top bowl off the pumpshaft (660).

3. Remove capscrews (759) and split thrust ring (725) from pump shaft.

4. Slide impeller off the pumpshaft and remove the key (730). If impeller is seized to the shaft, strike impeller with a fiber mallet and drive impeller off the pumpshaft.

5. Repeat the above procedures until the bowl assembly is completely disassembled.

TURBINE BOWL – WEAR RING REMOVAL

1. Remove set screws or grind off tack weld, when rings are furnished with those locking methods.

2. Utilizing a diamond point chisel, cut two “V” shaped grooves on the bowl wear ring approximately 180° apart. Use extreme care not to damage the wear ring seat.

3. With a chisel or drift, knock the end of one half of the ring in, and pry the ring out.

4. On special materials such as chrome steel, set up the bowl in a lathe and machine the wear ring off using extreme care not to machine or damage the ring seat.

IMPELLER WEAR RING REMOVAL

1. Utilizing a diamond point chisel, cut two "V" shaped grooves on the impeller wear ring approximately 180 degrees apart. Use extreme care not to damage the wear ring seat.

2. With a chisel or drift, knock the end of one half of the ring out, and pry the ring off.

3. On special materials such as chrome steel, set up the impeller in a lathe and machine the wear ring off using extreme care not to machine or damage the ring seat.

BOWL AND LINESHAFT BEARING REMOVAL

Utilizing an arbor press and a piece of pipe or sleeve with outside diameter slightly smaller than the outside diameter of the bearing to press the bearing out.

NOTE: Bowl bearings are press fit. Do not remove unless replacement is necessary.

INSPECTION AND REASSEMBLY

INSPECTION AND REPLACEMENT

1. Clean all pump parts thoroughly with a suitable cleaner.

2. Check bearing retainers for deformation and wear.

3. Check shafts for straightness and excessive wear on bearing surfaces. Average total runout should be less than 0.0005" TIR per foot, not to exceed 0.005" T.I.R. for every 10 feet of shafting.

4. Visually check impellers and bowls for cracks and pitting. Check all bowl bearings for excessive wear and corrosion.

5. Replace all badly worn or damaged parts with new parts. In addition, replace all gaskets and packing as required.

TURBINE BOWL WEAR RING INSTALLATION

Place chamfered face of the bowl or impeller wear ring towards the ring seat and press the ring into the seat. Use an arbor press or equal, making sure the ring is flush with the edge or the wear ring seat.

INSTALL BOWL AND LINESHAFT BEARING

(Refer to Figure 1 for components numbers)

1. Press bearing (653) into retainer (652) using an arbor press or equal.

2. Press bearing (690) into suction bowl/bell (689) by using an arbor press or equal. The top of the bearing should protrude above the suction hub equal to the depth of the counter bore in the sand collar.

3. Place the bowl (670) with the flange downward and press bearing (672) through chamfered side of bowl hub until the bearing is flush with the hub by using an arbor press or equal.

REASSEMBLY OF THE BOWL ASSEMBLY WITH TAPERLOCK CONSTRUCTION

1. For ease in reassembly apply a thin film of turbine oil to all mating and threaded parts.

2. If the sand collar is not assembled to the shaft, install the sand collar. The sand collar is attached to the shaft with a shrink fit. The larger diameter of the counterbore of the sand collar goes toward the suction bell bearing. Heat the sand collar until it slips over the shaft and quickly position it so that the bottom of the sand collar is set according to the "X" dimension, before it cools. See Figure 21. See Table 3 for the "X" dimensions. Slide the plain end of the pump shaft into the suction bowl/bell bearing until the sand collar rests against the suction bowl/bell.

⚠ WARNING ***Wear protective gloves and use appropriate eye protection to prevent injury when handling hot parts.***

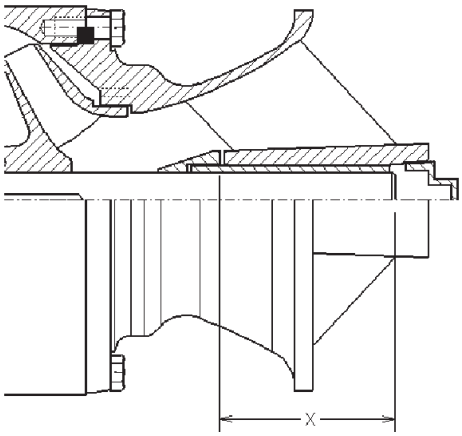


Figure 21

TABLE 3 Sand Collar Location Dimension

Pump Model	"X" Dim.		Pump Model	"X" Dim.
5C, 5T	1.88"		13A, 13RA	7.19"
5RWA	1.81"		13C	5.13"
6A, 6RA	3.13"		14DH	8.13"
6C	2.25"		14F, 14H, 14RH	7.13"
6DH	3.50"		14RJ	5.06"
7A, 7RA	3.13"		15F	9.50"
7C, 7T, 7WA	2.81"		16B	6.56"
8A, 8RA	3.13"		16DH	8.63"
8DH	4.44"		16DM	5.88"
8I	2.94"		16F, 16RG	6.69"
8RJ	2.88"		18B	7.25"
9A, 9RA	3.41"		18C	6.63"
9RC, 9T, 9WA	5.19"		18D	7.56"
10A, 10RA	4.31"		18G	5.75"
10DH	6.31"		20B, 18L	6.88"
10L	6.25"		20E, 18H	7.00"
10RJ	5.00"		20C	6.44"
10WA	5.19"		20H	9.00"
11A, 11RA	5.31"		24C	12.38"
11C	4.88"		24D	9.38"
11WA	5.13"		24E	8.13"
12C	5.31"		24F	10.44"
12DH	5.19"		24G	8.00"
12FR	6.50"		26G	7.75"
12WA, 12RA	5.00"		28G	8.75"
12RJ	4.94"		30B	N/A

3. Hold the shaft in this position by inserting a long capscrew (or all thread rod with a hex nut) with an assembly jig into the bottom end of the suction hub and secure tight into the threaded hole at the end of the shaft. **Be sure the shaft has been cleaned and checked for straightness.**

4. Slide the first impeller over the shaft until it seats on the suction bowl/bell.

NOTE: If there are different diameter impellers, put the large diameter impeller at the lower stage.

5. Insert a screwdriver into the slot in the taperlock (677) to spread the slot and slide the taperlock over the pump shaft. Hold the impeller against bowl and slide the taperlock into the impeller hub. **Be sure the taperlocks have been cleaned and are dry.**

6. Hold impeller firmly against the suction bowl/bell and drive the taperlock into place with a taperlock driver, (See Figure 22). After the impeller is secured in position, the top end of the taperlock should be 1/8" above the impeller hub.

7. Slide intermediate bowl (670) onto shaft and secure with capscrews provided.

8. Repeat preceding procedure for number of stages required.

9. Remove long capscrew and the assembly jig at the end of suction hub and check that the shaft rotates freely without dragging or binding. Also check for adequate lateral (end play).

FINAL ASSEMBLY

After reassembling the bowl assembly, see Section 3 for installation. Refer to Section 4, for startup and operation procedures.

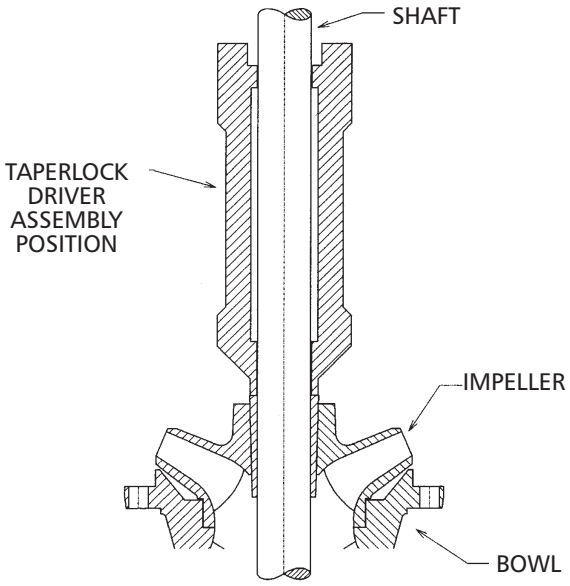


Figure 22

ORDERING PARTS

When ordering spare or replacement parts, the pump serial number and size and type of pump must be given. This can be found on the nameplate furnished with the unit. Give the complete name and reference number of each part as indicated on the applicable sectional drawings, Figure 1 to Figure 4, and the quantity required.

STOCKING SPARE PARTS

Spare parts to be kept in inventory will vary according to service, field maintenance, allowable down time and number of units. A Minimum inventory of one complete set of bearings and one spare of each moving part is suggested.

RETURNING PARTS

A completed Return Material Authorization (RMA) form must accompany all materials returned to the factory. The RMA forms can be obtained direct from the factory or through your local Goulds Pumps representative. The RMA form must be filled in completely and forwarded as directed thereon. Parts being returned under warranty claim must have a complete written report submitted with the RMA form.

⚠ WARNING ***Returned goods must be free of any hazardous materials, substances, or residue.***

⚠ CAUTION ***Returned material must be carefully packaged to prevent transit damage - the factory cannot assume any responsibility for parts damaged in transit.***

ITT

Irrigation, Municipal and Industrial

LIMITED WARRANTY

Company warrants title to the product(s) and, except as noted with respect to items not of Company's manufacturer, also warrants the product(s) on date of shipment to Purchaser, to be of the kind and quality described herein, and free of defects in workmanship and material. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS, AND CONSTITUTES THE ONLY WARRANTY OF COMPANY WITH RESPECT TO THE PRODUCT(S).

If within one year from date of initial operation, but not more than 18 months from date of shipment by Company of any item of product(s), Purchaser discovers that such item was not as warranted above and promptly notifies Company in writing thereof, Company shall remedy such nonconformance by, at Company's option, adjustment or repair or replacement of the item and any affected part of the product(s). Purchaser shall assume all responsibility and expense for removal, reinstallation, and freight in connection with the foregoing remedies. The same obligations and conditions shall extend to replacement parts furnished by Company hereunder. Company shall have the right of disposal of parts replaced by it. Purchaser agrees to notify Company, in writing, of any apparent defects in design, material or workmanship, prior to performing any corrective action back-chargeable to the Company. Purchaser shall provide a detailed estimate for approval by the Company.

ANY SEPARATE LISTED ITEM OF THE PRODUCT(S) WHICH IS NOT MANUFACTURED BY THE COMPANY IS NOT WARRANTED BY COMPANY and shall be covered only by the express warranty, if any, of the manufacturer thereof.

THIS STATES THE PURCHASER'S EXCLUSIVE REMEDY AGAINST THE COMPANY AND ITS SUPPLIERS RELATING TO THE PRODUCT(S), WHETHER IN CONTRACT OR IN TORT OR UNDER ANY OTHER LEGAL THEORY, AND WHETHER ARISING OUT OF WARRANTIES, REPRESENTATIONS, INSTRUCTIONS, INSTALLATIONS OR DEFECTS FROM ANY CAUSE. Company and its suppliers shall have no obligation as to any products which have been improperly stored or handled, or which have not been operated or maintained according to instructions in Company or supplier furnished manuals.

LIMITATION OF LIABILITY – Neither Company nor its suppliers shall be liable, whether in contract or in tort or under any other legal theory, for loss of use, revenue or profit, or cost of capital or of consequential damages, or for any other loss or cost of similar type or for claims by Purchaser for damages of Purchaser's customers. Likewise, Company shall not under any circumstances be liable for the fault, negligence, wrongful acts of Purchaser or Purchaser's employees, or Purchaser other contractors or suppliers.

IN NO EVENT SHALL COMPANY BE LIABLE IN EXCESS OF THE SALES PRICE OF THE PART OR PRODUCT FOUND DEFECTIVE.

GOULDS PUMPS

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

IMVITR01 April, 2007

Engineered for life

5. Instrumentation & Control System

EQUIPMENT MANUFACTURER:

Company Name
111 Street Road
City, State 363636
Phone: 888-111-1111; Fax:
888-555-7777 www.company.com

EQUIPMENT SUPPLIER:

Romtec Utilities, Inc.
18240 North Bank Rd.
Roseburg, OR 97470
Phone: 541-496-9678; Fax: 541-496-0804
Email: info@romtecutilities.com; Website: www.romtecutilities.com.

LEVEL SENSORS

XPS 15 UTRASONIC TRANSDUCER
DRUCK PRESSURE TRANSDUCER

CONTROL PANEL

AS-BUILT DRAWINGS
DATA /SPEC SHEETS

PTX/PMP 1290

PTX/PMP 1290

Wastewater Submersible Pressure Transmitters/Transducers

- All-titanium construction backed by 5 year corrosion warranty
- Accuracy: <±0.25% FS BSL
- Flush teflon-coated elastomeric diaphragm
- Intrinsically safe approved
- Outputs: 4-20mA, 1-5 Vdc
- Submersible with vented polyurethane cable

The 1290 Series submersible/depth pressure transducers are specifically designed for the wastewater, pump/lift station application. The all-titanium construction assures excellent life in the most hostile environments, including corrosive and hazardous chemical applications. Druck backs its titanium construction with a 5 year corrosion warranty. Standard vented cable is polyurethane.

The 1290 Series pressure transmitter is similar to Druck's field proven submersible sensors with the exception of the pressure port. It is equipped with a flush teflon-coated elastomeric diaphragm that reduces the likelihood of grease or biosolids buildup. The pressure transfer medium is a silicone grease that maintains its elasticity between -40 and +250ºF.

An advanced micro-machined silicon piezoresistive pressure sensor provides excellent performance and resistance to shock and vibration. A tough, polyurethane cable is molded to the transducer body, providing a high integrity, waterproof assembly. The cable is strengthened with kevlar so that there is no measurable elongation when the cable is lowered into deep wells.

The fully isolated, all-titanium design ensures long term reliable measurements in water and wastewater management, industrial, process and marine applications.

STANDARD SPECIFICATION

Operating Ranges
Any range from 6 Ft H2O to 46 Ft H2O with elastomeric diaphragm. Higher ranges to 500 psi g available with plastic screen in place of elastomeric diaphragm.

Overpressure
4X minimum

Pressure Media
Fluids compatible with Titanium and polyurethane

Transduction Principle
Piezoresistive-micromachined silicon strain gauge

Combined Non-linearity, Hysteresis and Repeatability
<±0.25% FS BSL

Temperature Effects
±1.5% FS TEB 10 psig and up
Ranges 5 psig and below prorated

Resolution
Infinite

Insulation Resistance
100 megOhms @ 500 Vdc

Relative Humidity
0 to 100%

Operating Temperature Range
-5ºF to +140ºF

Compensated Temperature Range
30ºF to 86ºF

Electrical Characteristics

PTX 1290
2-wire, 4-20mA
9-32 Vdc excitation

PMP 1290
3-wire, 1-5 Vdc
8-30 Vdc excitation
<2 mA current @80ºF

Mechanical Characteristics

Sensor Body
Titanium

Measurement Diaphragm
Internal-Titanium
External-Teflon coated Nitrile Rubber

Pressure Connection
Flush elastomeric diaphragm with titanium retaining ring

Electrical Connection
Vented polyurethane cable (specify length)

Diameter
1.20" max O.D.

Weight
5 oz. nominal (excluding cable)

Compatible Fluids
Any fluids compatible with titanium, polyurethane and teflon coated nitrile rubber

Safety Classification
UL, cUL, intrinsically safe; Class I, Div 1
Groups A, B, C and D
Class II, Groups E, F and G
Class III

Ingress Protection
NEMA 6 (IP68)

Caution
Do not remove the retaining ring that holds elastomeric diaphragm in place. This will void the calibration and could result in a loss of the silicone pressure transfer compound.

ASSOCIATED PRODUCTS

1230 Series	Submersible sensor
DPI 280	Digital display w/ alarms
STE 110	Sensor termination enclosure w/ desiccant
Lightning Arrestors	
	MDK-24 2 wire
	MDK-LV 3 wire
	MDK-LC 4 wire
SCU-220	Din rail mountable sensor termination enclosure w/ desiccant and 4-20mA electronics
DPI 610	Portable pressure calibrator
TRX II	Portable temperature and pressure calibrator

ORDERING INFORMATION

Please state the following:
(1) Type number
(2) Pressure range
(3) Cable length

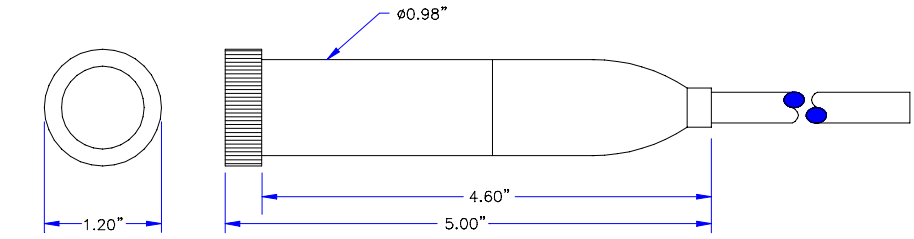
For non-standard requirements please specify in detail.

Shipping, Storage and Handling
Each transmitter is purged with clean dry nitrogen and shipped with desiccant to prevent moisture ingress during transit.

Continuing development sometimes necessitates specification changes without notice.

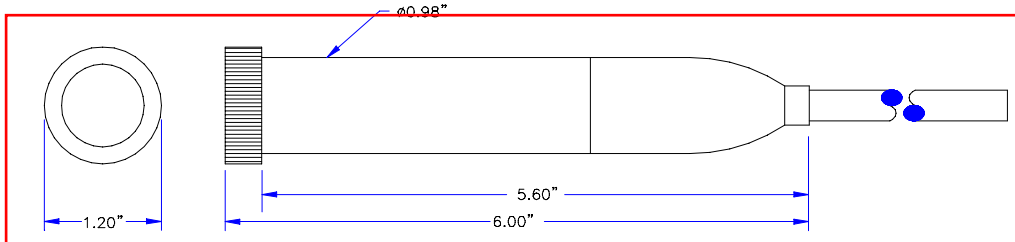
Druck is an ISO 9001 registered company.

INSTALLATION DRAWINGS: Dimensions in inches



PMP 1290
Electrical Connection

Red	Positive Supply
White	Negative Supply
Yellow	Positive Output
Shield	Connected to Case



PTX 1290
Electrical Connection

Red	Positive Supply
Black	Negative Supply
Shield	Connected to Case

Druck Incorporated

Representative

GE Druck PTX / PMP 1290
Distributor: ThermX Southwest 800-284-3769
www.thermx.com

Druck

100' OF 1/8" SS CABLE

Echomax XPS and XCT

Overview

Echomax® XPS/XCT transducers use ultrasonic technology to measure level in a wide range of liquids and solids.

Benefits

- Integral temperature compensation
- Low ringing effect reduces blanking distance
- Optional foam facing for dusty applications
- Self-cleaning and low-maintenance
- Chemically resistant
- Hermetically sealed

Application

The transducers can be fully immersed, are resistant to steam and corrosive chemicals and can be installed without flanges.

The XPS series offers versions for various measuring ranges up to 40 m (130 ft) and up to a max. temperature of +95 °C (+203 °F).

The XCT series can be used in applications at higher temperatures to measure level up to a distance of 12 m (40 ft) and at a max. temperature of +145 °C (+293 °F).

During operation, the Echomax transducers emit acoustic pulses in a narrow beam. The level monitor measures the propagation time between pulse emission and its reflection (echo) to calculate the distance.

Technical specifications

Input	XPS-10 (standard and F models)	XPS-15 (standard and F models)	XPS-30	XPS-40	XCT-8 (standard and sanitary models)	XCT-12
Measuring range	0.3 to 10 m (1 to 33 ft)	Standard: 0.3 to 15 m (1 to 50 ft) Flanged: 0.45 to 15 m (1.5 to 50 ft)	0.6 to 30 m (2 to 100 ft)	0.9 to 40 m (3 to 130 ft)	0.6 to 8 m (2 to 26 ft)	0.6 to 12 m (2 to 40 ft)
Output						
Frequency	44 kHz	44 kHz	30 kHz	22 kHz	44 kHz	44 kHz
Beam angle	12°	6°	6°	6°	12°	6°
Environmental						
Location	Indoors/outdoors					
Ambient temperature	-40 to +95 °C (-40 to +203 °F)				Standard: -40 to +145 °C (-40 to +293 °F) Sanitary: -40 to +125 °C (-40 to +260 °F)	-40 to +145 °C (-40 to +293 °F)
Pollution degree	4					
Pressure	8 bar (120 psi) Flanged: 0.5 bar (7.25 psi)	8 bar (120 psi) Flanged: 0.5 bar (7.25 psi)	0.5 bar (7.25 psi) Flanged: 0.5 bar (7.25 psi)	0.5 bar (7.25 psi)	Standard: 4 bar (60 psi): -40 to +138 °C (-40 to +280 °F) Standard: 8 bar (120 psi): -40 to +95 °C (-40 to +203 °F) Flanged: 0.5 bar (7.25 psi) Sanitary: XCT-8: 0.5 bar (7.25 psi)	
Design						
Weight	0.8 kg (1.8 lbs)	1.3 kg (2.8 lbs) Flanged: 2 kg (4.4 lbs)	4.3 kg (9.5 lbs)	8 kg (18 lbs)	0.8 kg (1.7 lbs)	1.3 kg (2.8 lbs)
Power supply	Operation of transducer only with approved Siemens Milltronics controllers					
Material	Standard: PVDF Flanged: PVDF with CPVC flange Option: PTFE face with CPVC flange	Standard: PVDF Flanged: PVDF with CPVC flange Option: PTFE face with CPVC flange	Standard: PVDF Flanged: PVDF with CPVC flange Option: PTFE face with CPVC flange	PVDF	Standard: PVDF Options: DERAKANE® flange; PTFE face with universal PVDF flange	
Color	Standard: blue F: gray	Standard: blue F: gray	blue	blue	white	
Process connection	Standard: 1" NPT or 1" BSPT F: 1" NPT	Standard: 1" NPT or 1" BSPT F: 1" NPT	1.5" universal thread (NPT or BSPT)		1" NPT or 1" BSPT	
Cable	2 wire twisted pair/braided and foil shielded 0.5 mm² (20 AWG) PVC jacket				2 wire twisted pair/braided and foil shielded 0.5 mm² (20 AWG) silicone jacket	
Separation	Max. 365 m (1200 ft)					
Certificates and approvals	Standard: CE[1], CSA, FM, ATEX II 2GD F: FM Class I, Div 1, Groups A, B, C and D, Class II Div 1, Groups E, F and G, Class III	Standard: CE[1], CSA, FM, ATEX II 2GD F: FM Class I, Div 1, Groups A, B, C and D, Class II Div 1, Groups E, F and G, Class III	CE[1], CSA, FM, ATEX II 2G 1D	CE[1], CSA, FM, ATEX II 2G 1D	Standard: CE[1], CSA, FM, ATEX II 2G Sanitary: CSA, 3A	CE[1], CSA, FM, ATEX II 2G

[1] EMC certificate available on request.

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Echomax XPS and XCT

Selection and Ordering data		Order No.
Echomax XPS-10 ultrasonic transducer	C)	7ML1115 -
High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. Measuring range: min. 0.3 m, max.10 m		0
Mounting thread and facing		
1" NPT (ANSI/ASME B1.20.1)		0
1" NPT (ANSI/ASME B1.20.1) with foam facing[1]		1
1" NPT (ANSI/ASME B1.20.1) with PTFE facing[2]		2
1" BSPT (EN 10226-1)		3
1" BSPT (EN 10226-1) with foam facing[1]		4
1" BSPT (EN 10226-1) with PTFE facing[2]		5
Cable length		
5 m (16.40 ft)		B
10 m (32.81 ft)		C
30 m (98.43 ft)		E
50 m (164.04 ft)		F
100 m (328.08 ft)		K
Mounting flange		
None		A
3" ASME, 150 lb, flat faced		C
4" ASME, 150 lb, flat faced		D
6" ASME, 150 lb, flat faced		E
8" ASME, 150 lb, flat faced		F
DN 80, PN 10/16, Type A, flat faced		G
DN 100, PN 10/16, Type A, flat faced		J
DN 150, PN 10/16, Type A, flat faced		L
JIS10K3B Style		M
JIS10K4B Style		P
JIS10K6B Style (Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5 or EN 1092-1, or JIS B 2238 standard.)		R
Approvals		
ATEX II 2 GD, FM Class I Div. 2, SAA Class I		3
CSA Class I Div. 1[3]		4
Further designs		Order code
Please add "**-Z**" to Order No. and specify Order code(s).		
Stainless steel tag [69 mm x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text		**Y15**

Selection and Ordering data		Order No.
Instruction Manual		
Quick Start guide, multi-language	C)	**7ML1998-5QM82**
Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order.	C)	**7ML1998-5HV61**
This device is shipped with the Siemens Milltronics manual CD containing the complete instruction manual library.		
Accessories		
Submergence shield kit		**7ML1830-1BH**
Easy Aimer 2, with ¾" x 1" NPT PVC coupling		**7ML1830-1AQ**
Easy Aimer 2, aluminum with M20 adapter and 1" and 1½" BSPT aluminum couplings		**7ML1830-1AX**
Easy Aimer 304, with stainless steel coupling		**7ML1830-1AU**
Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings		**7ML1830-1GN**
Universal box bracket, mounting kit		**7ML1830-1BK**
Channel bracket, wall mount		**7ML1830-1BL**
Extended channel bracket, wall mount		**7ML1830-1BM**
Channel bracket, floor mount		**7ML1830-1BN**
Extended channel bracket, floor mount		**7ML1830-1BP**
Bridge channel bracket, floor mount (See Mounting Brackets on page 5/118 for more information.)		**7ML1830-1BQ**
1" NPT locknut, plastic		**7ML1830-1DS**
1" BSPT locknut, plastic		**7ML1830-1DR**
Split flanges		
3", aluminum		**7ML1830-1AV**
3", 304 stainless steel		**7ML1830-1AW**
Gasket Kit 3", neoprene		**7ML1930-1BF**
4", aluminum		**7ML1830-1BA**
4", 304 stainless steel		**7ML1830-1BB**
Gasket Kit 4", neoprene		**7ML1930-1BG**
6", aluminum		**7ML1830-1BC**
6", 304 stainless steel		**7ML1830-1BD**
Gasket Kit 6", neoprene		**7ML1930-1BH**
Instruction manual		**7ML1998-1EP01**

[1] Not available with flanged versions

[2] Available with flanged versions only

[3] Valid with mounting thread and facing options 0, 1 and 2 only

C) Subject to export regulations AL: N, ECCN: EAR99

Refer to page 5/117 for split flanges for XPS-10 transducers.

Ordering data		Order No.
Echomax XPS-10F ultrasonic transducer	C)	**7ML1170-**
High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. Measuring range: min. 0.3 m, max.10 m		**0**
Mounting thread and facing		
1" NPT (ANSI/ASME B1.20.1)		**1**
Cable length		
5 m (16.40 ft)		**B**
10 m (32.81 ft)		**C**
30 m (98.43 ft)		**D**
50 m (164.04 ft)		**E**
100 m (328.08 ft)		**F**
Mounting flange, flush mount		
None		**A**
3" ASME, 150 lb, flat faced		**B**
4" ASME, 150 lb, flat faced		**C**
6" ASME, 150 lb, flat faced		**D**
8" ASME , 150 lb, flat faced (Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5, or EN 1092-1, or JIS B 2238 standard.)		**E**
Approvals		
FM Class I Div. 1		**1**
Further designs		Order code
Please add "**-Z**" to Order No. and specify Order code(s).		
Stainless steel tag [69 mm x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text		**Y15**
Instruction manual		
English Note: The Instruction manual should be ordered as a separate line item on the order.	C)	**7ML1998-1DU01**
Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order.	C)	**7ML1998-5HV61**
This device is shipped with the Siemens Milltronics manual CD containing the complete instruction manual library.		
Accessories		
Submergence shield kit		**7ML1830-1BH**
Easy Aimer 2, with ¾" x 1" NPT PVC coupling		**7ML1830-1AQ**
Easy Aimer 304, with stainless steel coupling		**7ML1830-1AU**
Universal box bracket, mounting kit		**7ML1830-1BK**
Channel bracket, wall mount		**7ML1830-1BL**
Extended channel bracket, wall mount		**7ML1830-1BM**
Channel bracket, floor mount		**7ML1830-1BN**
Extended channel bracket, floor mount		**7ML1830-1BP**
Bridge channel bracket, floor mount (See Mounting Brackets on page 5/118 for more information.)		**7ML1830-1BQ**
1" NPT locknut, plastic		**7ML1830-1DS**
Split flanges		
3", aluminum		**7ML1830-1AV**
3", 304 stainless steel		**7ML1830-1AW**
Gasket Kit 3", neoprene		**7ML1930-1BF**
4", aluminum		**7ML1830-1BA**
4", 304 stainless steel		**7ML1830-1BB**
Gasket Kit 4", neoprene		**7ML1930-1BG**
6", aluminum		**7ML1830-1BC**
6", 304 stainless steel		**7ML1830-1BD**
Gasket Kit 6", neoprene		**7ML1930-1BH**
Instruction manual		**7ML1998-1EP01**

Refer to page 5/117 for split flanges for XPS-10 transducers.
C) Subject to export regulations AL: N, ECCN: EAR99

Echomax XPS and XCT

Selection and Ordering data		Order No.
Echomax XPS-15 ultrasonic transducer	C)	**7ML1118 -**
High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. Measuring range: min. 0.3 m, max. 15 m		**0**
Mounting thread and facing		
1" NPT (ANSI/ASME B1.20.1)		**0**
1" NPT (ANSI/ASME B1.20.1) with foam facing[1]		**1**
1" NPT (ANSI/ASME B1.20.1) with PTFE facing[2]		**2**
1" BSPT (EN 10226-1)		**3**
1" BSPT (EN 10226-1) with foam facing[1]		**4**
1" BSPT (EN 10226-1) with PTFE facing[2]		**5**
Cable length		
5 m (16.40 ft)		**B**
10 m (32.81 ft)		**C**
30 m (98.43 ft)		**E**
50 m (164.04 ft)		**F**
100 m (328.08 ft)		**K**
Mounting flange		
None		**A**
6" ASME, 150 lb, flat faced		**D**
8" ASME, 150 lb, flat faced		**E**
DN 150, PN 10/16, Type A, flat faced		**J**
DN 200, PN 10/16, Type A, flat faced		**K**
JIS10K 6B		**N**
JIS10K 8B (Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5 or EN 1092-1, or JIS B 2238 standard.)		**P**
Approvals		
ATEX II 2 GD, FM Class I Div. 2, SAA Class I		**3**
CSA Class I Div. 1, available with mounting options 0, 1, 2 only		**4**
Further designs		Order code
Please add "**-Z**" to Order No. and specify Order code(s).		
Stainless steel tag [69 mm x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text		**Y15**
Instruction manual		
Quick Start Manual, multi-language Note: Due to ATEX regulations, one Quick Start Manual is included with every transducer.	C)	**7ML1998-5QM82**
Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order.	C)	**7ML1998-5HV61**
This device is shipped with the Siemens Milltronics manual CD containing the complete instruction manual library.		

Selection and Ordering data	Order No.
Accessories	
Submergence shield kit	**7ML1830-1BJ**
Universal box bracket, mounting kit	**7ML1830-1BK**
Channel bracket, wall mount	**7ML1830-1BL**
Extended channel bracket, wall mount	**7ML1830-1BM**
Channel bracket, floor mount	**7ML1830-1BN**
Extended channel bracket, floor mount	**7ML1830-1BP**
Bridge channel bracket, floor mount (See Mounting Brackets on page 5/118 for more information.)	**7ML1830-1BQ**
1" NPT locknut, plastic	**7ML1830-1DS**
1" BSPT locknut, plastic	**7ML1830-1DR**
Easy Aimer 2, with ¾" x 1" NPT PVC coupling	**7ML1830-1AQ**
Easy Aimer 2, aluminum with M20 adapter and 1" and 1½" BSPT aluminum couplings	**7ML1830-1AX**
Easy Aimer 304 with stainless steel coupling	**7ML1830-1AU**
Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings	**7ML1830-1GN**
Split flanges	
6" aluminum	**7ML1830-1BE**
6" 304 stainless steel	**7ML1830-1BF**
Gasket Kit 6", neoprene	**7ML1930-1BH**
Split Flanges Instruction manual	**7ML1998-1EP01**

[1] Not available with flanged versions

[2] Available with flanged versions only

C) Subject to export regulations AL: N, ECCN: EAR99

Refer to page 5/117 for split flanges for XPS-15 transducers.

Selection and Ordering data — Order No.

Echomax XPS-15F ultrasonic transducer C) **7ML1171-**

High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor.
Measuring range: min. 0.3 m, max. 15m — **0**

Mounting thread and facing
1" NPT (ANSI/ASME B1.20.1) — **1**

Cable length
5 m (16.40 ft) — **B**
10 m (32.81 ft) — **C**
30 m (98.43 ft) — **D**
50 m (164.04 ft) — **E**
100 m (328.08 ft) — **F**

Mounting flange, flush mount
None — **A**
6" ASME, 150 lb, flat faced — **B**
8" ASME, 150 lb, flat faced — **C**
(Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5, or EN 1092-1, or JIS B 2238 standard.)

Approvals
FM Class I Div. 1 — **1**

Further designs	Order code
Please add "**-Z**" to Order No. and specify Order code(s).	
Stainless steel tag [69 mm x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text	**Y15**

Instruction manual

English Note: The Instruction manual should be ordered as a separate line item on the order.	C)	**7ML1998-1DU01**
Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order.	C)	**7ML1998-5HV61**
This device is shipped with the Siemens Milltronics manual CD containing the complete instruction manual library.		

Accessories

Submergence shield kit	**7ML1830-1BJ**
Universal box bracket, mounting kit	**7ML1830-1BK**
Channel bracket, wall mount	**7ML1830-1BL**
Extended channel bracket, wall mount	**7ML1830-1BM**
Channel bracket, floor mount	**7ML1830-1BN**
Extended channel bracket, floor mount	**7ML1830-1BP**
Bridge channel bracket, floor mount (See Mounting Brackets on page 5/118 for more information.)	**7ML1830-1BQ**
1" NPT locknut, plastic	**7ML1830-1DS**
Easy Aimer 2, with ¾" x 1" NPT PVC coupling	**7ML1830-1AQ**
Easy Aimer 304 with stainless steel coupling	**7ML1830-1AU**
Split Flanges 6" aluminum	**7ML1830-1BE**
Split Flanges 6" stainless steel	**7ML1830-1BF**
Split Flanges Gasket kit 6"	**7ML1930-1BH**
Split Flanges Instruction manual	**7ML1998-1EP01**

Refer to page 5/117 for split flanges for XPS-15 transducers.

Selection and Ordering data — Order No.

Echomax XPS-30 ultrasonic transducer C) **7ML1123-**

High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor.
1½" universal thread compatible with 1½" NPT and 1½" BSPT
Measuring range: min. 0.6 m (1.97 ft), max. 30 m (98.43 ft) — **0**

Mounting thread and facing
1½" universal thread — **0**
1½" universal thread, foam facing[1] — **1**
1½" universal thread, PTFE facing[2] — **2**

Cable length
5 m (16.40 ft) — **B**
10 m (32.81 ft) — **C**
30 m (98.43 ft) — **E**
50 m (164.04 ft) — **F**
100 m (328.08 ft) — **K**

Mounting flange
None — **A**
6" ASME, 150 lb, flat faced — **D**
8" ASME, 150 lb, flat faced — **E**
DN 150, PN 10/16, Type A, flat faced — **J**
DN 200, PN 10/16, Type A, flat faced — **K**
JIS10K 6B — **N**
JIS10K 8B — **P**
(Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5 or EN 1092-1, or JIS B 2238 standard.)

Approvals
ATEX II 2G 1D, FM Class I Div 2, SAA — **5**

Further designs	Order code
Please add "**-Z**" to Order No. and specify Order code(s).	
Stainless steel tag [69 mm x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text	**Y15**

Instruction manual

Quick Start Manual, multi-language Note: Due to ATEX regulations, one Quick Start Manual is included with every transducer.	C)	**7ML1998-5QM82**
Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order.	C)	**7ML1998-5HV61**
This device is shipped with the Siemens Milltronics manual CD containing the complete instruction manual library.		

Accessories

1½" BSPT locknut, plastic	**7ML1830-1DP**
Easy Aimer 2, 1½" NPT galvanized coupling	**7ML1830-1AN**
Easy Aimer 2, 1½" NPT with stainless steel coupling	**7ML1830-1AT**
Easy Aimer 2, aluminum with M20 adapter and 1" and 1½" BSPT aluminum couplings	**7ML1830-1AX**
Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings	**7ML1830-1GN**

[1] Not available with flanged versions
[2] Available with flanged versions only
C) Subject to export regulations AL: N, ECCN: EAR99.

Echomax XPS and XCT

Selection and Ordering data		Order No.
Echomax XPS-40 ultrasonic transducer	C)	**7ML1127-**
High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. 1½" universal thread compatible with 1½" NPT and 1½" BSPT Measuring range: min. 0.9 m (2.95 ft), max. 40 m (131.23 ft)		**0**
Mounting thread and facing		
1½" universal thread		**0**
1½" universal thread, foam facing		**1**
Cable length		
5 m (16.40 ft)		**B**
10 m (32.81 ft)		**C**
30 m (98.43 ft)		**E**
50 m (164.04 ft)		**F**
100 m (328.08 ft)		**K**
Mounting flange		
None		**A**
Approvals		
ATEX II 2G 1D, FM Class I Div 2, SAA		**5**
Further designs		Order code
Please add "**-Z**" to Order No. and specify Order code(s).		
Stainless steel tag [69 mm x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text		**Y15**
Instruction manual		
Quick Start Manual, multi-language Note: Due to ATEX regulations, one Quick Start Manual is included with every transducer.	C)	**7ML1998-5QM82**
Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order.	C)	**7ML1998-5HV61**
This device is shipped with the Siemens Milltronics manual CD containing the complete instruction manual library.		
Accessories		
1½" BSPT locknut, plastic		**7ML1830-1DP**
Easy Aimer 2, 1½" NPT galvanized coupling		**7ML1830-1AN**
Easy Aimer 2, 1½" NPT with stainless steel coupling		**7ML1830-1AT**
Easy Aimer 2, aluminum with M20 adapter and 1" and 1½" BSPT aluminum couplings		**7ML1830-1AX**
Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings		**7ML1830-1GN**

C) Subject to export regulations AL: N, ECCN: EAR99

Selection and Ordering data		Order No.
Echomax XCT-8 ultrasonic transducer	C)	7ML1132-
High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. Ambient temperatures up to +145 °C Measuring range: min. 0.6 m (2 ft), max. 8 m (26 ft)		0
Mounting thread and facing		
1" NPT (ANSI/ASME B1.20.1)		0
1" NPT (ANSI/ASME B1.20.1), PTFE facing[1]		1
1" BSPT (EN 10226-1)		2
1" BSPT (EN 10226-1), PTFE facing[1]		3
Cable length		
1 m (3.28 ft)		A
5 m (16.40 ft)		B
10 m (32.81 ft)		C
30 m (98.43 ft)		E
50 m (164.04 ft)		F
100 m (328.08 ft)		K
Mounting flange		
None		A
3" ASME, 150 lb, flat faced		C
4" ASME, 150 lb, flat faced		D
6" ASME, 150 lb, flat faced		E
DN 80, PN 10/16, Type A, flat faced		G
DN 100, PN 10/16, Type A, flat faced		J
DN 150, PN 10/16, Type A, flat faced		L
JIS10K 3B		M
JIS10K 4B		P
JIS10K 6B (Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5 or EN 1092-1 or JIS B 2238 standard.)		R
3" universal[2]		S
4" universal[3]		T
6" universal[4]		U
4" sanitary flange, available with approval option 6 and PTFE facing only		V
Approvals		
ATEX II 2G, FM Class I, Div. 2, SAA		4
CSA Class I Div. 1, available with mounting thread and facing option 0		5
3A Sanitary (only with 4" sanitary flange, option V)		6
Further designs		Order code
Please add "**-Z**" to Order No. and specify Order code(s).		
Stainless steel tag [69 mm x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text		**Y15**

Selection and Ordering data		Order No.
Instruction manual		
Quick start manual, multi-language Note: Due to ATEX regulations, one Quick start manual is included with every transducer.	C)	**7ML1998-5QM82**
XCT-8 with Sanitary Flange, multi-language Note: This manual should be ordered as a separate line item with Mounting Option V.	C)	**7ML1998-5HX61**
Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order.	C)	**7ML1998-5HV61**
This device is shipped with the Siemens Milltronics manual CD containing the complete instruction manual library.		
Accessories		
Submersible hood		**7ML1830-1BH**
Universal box bracket, mounting kit		**7ML1830-1BK**
Channel bracket, wall mount		**7ML1830-1BL**
Extended channel bracket, wall mount		**7ML1830-1BM**
Channel bracket, floor mount		**7ML1830-1BN**
Extended channel bracket, floor mount		**7ML1830-1BP**
Bridge channel bracket, floor mount (See Mounting Brackets on page 5/118 for more information.)		**7ML1830-1BQ**
1" NPT locknut, plastic		**7ML1830-1DS**
1" BSPT locknut, plastic		**7ML1830-1DR**
Easy Aimer 304 with stainless steel coupling		**7ML1830-1AU**
Easy Aimer, aluminum, with M20 adapter and ¾ to 1" and 1½" BSPT couplings		**7ML1830-1AX**
Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings		**7ML1830-1GN**
Sanitary, 4" mounting clamp		**7ML1830-1BR**
Sanitary, isolating gasket	C)	**7ML1830-1KC**
Split flanges		
3", aluminum		**7ML1830-1AV**
3", 304 stainless steel		**7ML1830-1AW**
Gasket Kit 3", neoprene		**7ML1930-1BF**
4", aluminum		**7ML1830-1BA**
4", 304 stainless steel		**7ML1830-1BB**
Gasket Kit 4", neoprene		**7ML1930-1BG**
6", aluminum		**7ML1830-1BC**
6", 304 stainless steel		**7ML1830-1BD**
Gasket Kit 6", neoprene		**7ML1930-1BH**
Instruction manual		**7ML1998-1EP01**

[1] Available with flange versions S, T, U and V only
[2] Universal fits 3" ASME, DN80, JIS 10K3B style
[3] Universal fits 4" ASME, DN100, JIS 10K4B style
[4] Universal fits 6" ASME, DN150, JIS 10K6B style
C) Subject to export regulations AL: N, ECCN: EAR99
Refer to page 5/117 for split flanges for XCT-8 transducers.

Echomax XPS and XCT

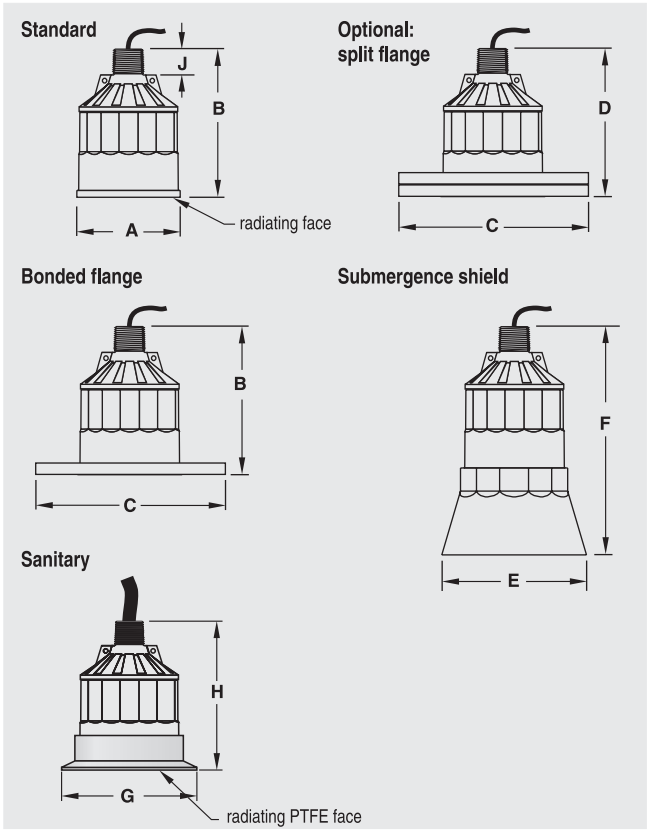
Selection and Ordering data		Order No.
Echomax XCT-12 ultrasonic transducer High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. Ambient temperatures up to +145 °C Measuring range: min. 0.6 m (2 ft), max.12 m (40 ft)	C)	**7ML1136 - ■■■■ 0**
Mounting thread and facing		
1" NPT (ANSI/ASME B1.20.1)		**0**
1" NPT (ANSI/ASME B1.20.1), PTFE facing, available for flange options U only		**1**
1" BSPT (EN 10226-1)		**2**
1" BSPT (EN 10226-1), PTFE facing, available for flange options U only		**3**
Cable length		
1 m (3.28 ft)		**A**
5 m (16.40 ft)		**B**
10 m (32.81 ft)		**C**
30 m (98.43 ft)		**E**
50 m (164.04 ft)		**F**
100 m (328.08 ft)		**K**
Mounting flange		
None		**A**
6" ASME, 150 lb, flat faced		**D**
8" ASME, 150 lb, flat faced		**E**
DN 150, PN 10/16, Type A, flat faced		**J**
DN 200, PN 10/16, Type A, flat faced		**K**
JIS10K 6B		**N**
JIS10K 8B (Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5 or EN 1092-1 or JIS B 2238 standard.)		**P**
6" universal for 6" ASME, DIN 150 or JIS 10K6B style		**U**
Approvals		
ATEX II 2G, FM Class I, Div. 2, SAA		**3**
CSA Class I, Div. 1, available with mounting thread and facing option 0 only		**4**
Further designs		Order code
Please add "**-Z**" to Order No. and specify Order code(s).		
Stainless steel tag [69 mm x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text		**Y15**
Instruction manual		
Quick Start Manual, multi-language Note: Due to ATEX regulations, one Quick Start Manual is included with every transducer.	C)	**7ML1998-5QM82**
Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order.	C)	**7ML1998-5HV61**
This device is shipped with the Siemens Milltronics manual CD containing the complete instruction manual library.		

Selection and Ordering data	Order No.
Accessories	
Submergence shield kit	**7ML1830-1BJ**
Universal box bracket, mounting kit	**7ML1830-1BK**
Channel bracket, wall mount	**7ML1830-1BL**
Extended channel bracket, wall mount	**7ML1830-1BM**
Channel bracket, floor mount	**7ML1830-1BN**
Extended channel bracket, floor mount	**7ML1830-1BP**
Bridge channel bracket, floor mount (See Mounting Brackets on page 5/118 for more information.)	**7ML1830-1BQ**
1" NPT locknut, plastic	**7ML1830-1DS**
1" BSPT locknut, plastic	**7ML1830-1DR**
Easy Aimer 304 with stainless steel coupling	**7ML1830-1AU**
Easy Aimer 2, aluminum with M20 adapter and 1" and 1½" BSPT aluminum couplings	**7ML1830-1AX**
Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings	**7ML1830-1GN**
Split Flanges 6" aluminum	**7ML1830-1BE**
Split Flanges 6" stainless steel	**7ML1830-1BF**
Split Flanges Gasket Kit 6", neoprene	**7ML1930-1BH**
Split Flanges Instruction manual	**7ML1998-1EP01**

C) Subject to export regulations AL: N, ECCN: EAR99

Refer to page 5/117 for split flanges for XCT-12 transducers.

Dimensional drawings

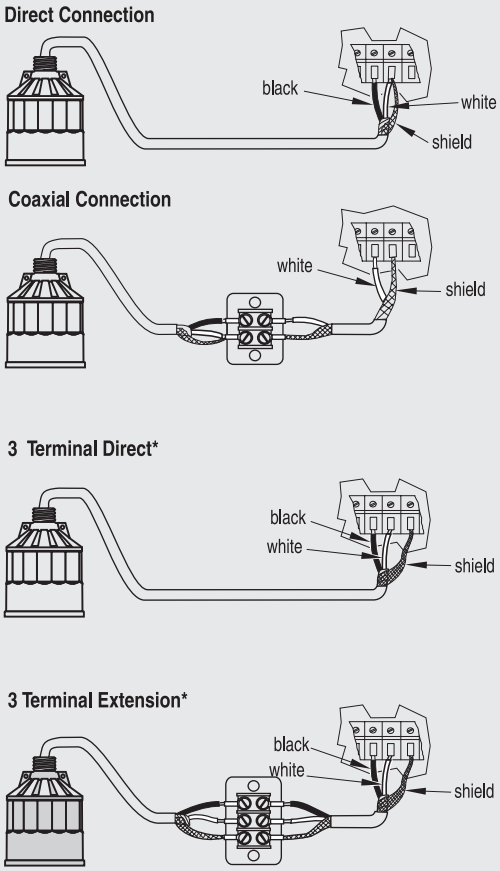


XPS and XCT ultrasonic transducer dimensions

Version				
Dimen.	**XPS-10**	**XPS-15**	**XPS-30**	**XPS-40**
A	88 mm (3.464")	121 mm (4.764")	175 mm (6.890")	206 mm (8.110")
B	122 mm (4.803")	132 mm (5.197")	198 mm (7.795")	229 mm (9.016")
C	According to ASME, DIN and JIS	n/a		
D	128 mm (5.039")	138 mm (5.433")	204 mm (8.031")	n/a
E	124 mm (4.882")	158 mm (6.220")	n/a	n/a
F	152 mm (5.984")	198 mm (7.795")	n/a	n/a
J	28 mm (1.1")	28 mm (1.1")	28 mm (1.1")	28 mm (1.1")

Version		
Dimen.	**XCT-8**	**XCT-12**
A	88 mm (3.464")	121 mm (4.764")
B	122 mm (4.803")	132 mm (5.197")
C	According to ASME, DIN and JIS	
D	128 mm (5.039")	138 mm (5.433")
E	n/a	n/a
F	n/a	n/a
G	sanitary version: 119 mm (4.68")	n/a
H	sanitary version: 122 mm (4.8")	n/a
J	28 mm (1.1")	28 mm (1.1")

Schematics



* For SITRANS LUC500, MultiRanger 100/200, HydroRanger 200

Mounting
Make particularly sure that the radiating face of the transducer is protected from damage. Mount the transducer so that it is above the maximum material level by at least the blanking value. On liquid applications, the transducer must be mounted so that the axis of transmission is perpendicular to the liquid surface. On solids applications, a Milltronics Easy Aimer should be used to facilitate aiming the transducer. Consider the optional temperature sensor when mounting the transducer.

Interconnection
Do not route cable openly or near high voltage or current runs, contactors and SCR control drives. For optimum isolation against electrical noise, run cable separately in a grounded metal conduit. Seal all thread connections to prevent ingress of moisture.

XPS and XCT ultrasonic transducer connections

5

Operation Manual · February 2005

English
Dansk
Deutsch
Ελληνικά
Español
Français
Italiano
Nederlands
Português
Suomi
Svenska

million
in one

xps/xct

ECHOMAX

SIEMENS

Echomax XPS/XCT Operation Manual

English

This manual outlines the essential features and functions of the Echomax XPS/XCT Series transducers. This manual, and the *Transducer Applictions Manual*, are also available on our website: www.siemens.com/processautomation. Printed copies are available from your local Siemens Milltronics representative.

Questions about the contents of this manual can be directed to:

Company Name
111 Street Road
City, State 363636
Phone: 888-111-1111; Fax:
888-555-7777 www.company.com

Safety Guidelines

Warning notices must be observed to ensure personal safety as well as that of others, and to protect the product and the connected equipment. These warning notices are accompanied by a clarification of the level of caution to be observed.

⚠ **WARNING: relates to a caution symbol on the product, and means that failure to observe the necessary precautions can result in death, serious injury, and/or considerable material damage.**

! **WARNING: means that failure to observe the necessary precautions can result in death, serious injury, and/or considerable material damage.**

CAUTION: means that failure to observe the necessary precautions can result in considerable material damage.

Note: means important information about the product or that part of the operating manual.

Unit Repair and Excluded Liability

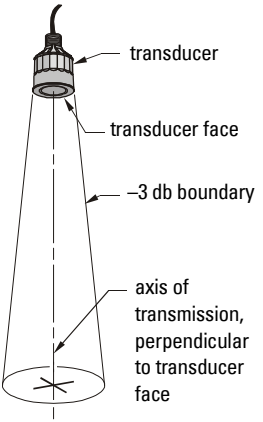
- The user is responsible for all changes and repairs made to the device by the user or by the user's agent.
- All new components are to be provided by Siemens Milltronics Process Instruments Inc.
- Restrict repair to faulty components only.
- Do not reuse faulty components.

Introduction

The Echomax XPS/XCT series of transducers operate with Siemens Milltronics ultrasonic level monitoring products.

The transducer converts the electrical transmit pulse from the transceiver into acoustical energy. It then converts the acoustical energy of the echo back into electrical energy for the controller.

The transducer face emits acoustical energy radiating outward, decreasing in amplitude at a rate inversely proportional to the square of the distance. Maximum power radiates perpendicularly from the transducer face on the axis of transmission. Where power is reduced by half (– 3 dB), a conical boundary centered around the axis of transmission defines the sound beam, the diameter of which is the beam angle.



The XPS/XCT transducers have an integrated temperature sensor that reports the air temperature at the transducer to the controller.

General Guidelines

⚠ **WARNING:** Materials of construction are chosen based on their chemical compatibility (or inertness) for general purposes. For exposure to specific environments, check with chemical compatibility charts before installing.

XPS/XCT Series – Certificate SIRA 99ATEX5153X

This equipment may be used in hazardous areas associated with all gases with temperature classes T1, T2, T3 and T4 for the XPS series (XPS-10, XPS-15, XPS-30, and XPS-40) and T1, T2, and T3 for the XCT series (XCT-8 and XCT-12). The XPS series is only certified for use in ambient temperatures in the range of - 40 °C to 95 °C and the XCT series is only certified for use in ambient temperatures in the range of -40 °C to 145 °C. Neither should be used outside of their respective temperature ranges.

Installation shall be carried out in accordance with the applicable code of practice, and by suitably trained personnel.

These devices should only be supplied from a circuit containing a suitably-rated fuse that has a breaking capacity of 4000A. This fuse is included in Siemens Milltronics controllers.

Repair of this equipment shall be carried out in accordance with the applicable code of practice.

The certification of this equipment relies on the following materials used in their construction:

	XPS Series	XCT Series
Enclosure	Kynar® [1]710	Kynar® 710
Encapsulant	Stycast LA-9823-76	Durapot® 861-F3 & 864

1. Kynar® is a registered trademark of ELF Atochem.
Durapot® is a registered trademark of Cotronics Corporation.

For manual override, use the disconnect switch provided in the building installation of the associated controller.

XPS 30/40 Series – Certificate SIRA 01ATEX5153X

This equipment may be used in hazardous dust zones with all conductive and non-conductive dusts. The XPS-30 and XPS-40 type series transducers have a maximum surface temperature of 135 °C (275 °F) (Temperature Class T4). These units are certified for use in ambient range of -40 to 95 °C (-40 to 203 °F). The transducers should not be used outside this temperature range. The XPS-30 and XPS-40 ultrasonic transducers must be installed so the face of the transducer is not substantially subjected to light.

Installation shall be carried out in accordance with the applicable code of practice, and by suitably trained personnel. Repair of the equipment shall be carried out in accordance with the applicable code of practice and installation instructions.

These devices should only be supplied from a circuit containing a suitably rated fuse that has a breaking capacity of 4000A. This fuse is included in Siemens Milltronics controllers.

The certification of this equipment relies on the following materials used in their construction:

Enclosure:	Kynar® 710
Encapsulant:	Stycast LA-9823-76

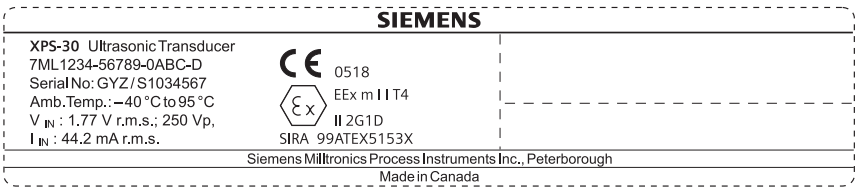
For manual override, use the disconnect switch provided in the building installation of the associated controller.

Product Marking

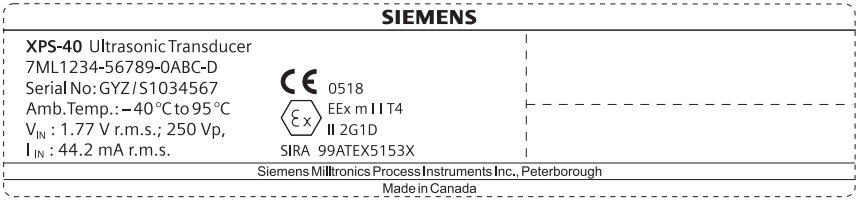
Note: Kynar® polyvinylidene flouride is resistant to attack from most chemicals under the described operating conditions. However, for exposure to specific environments, check with chemical compatibility charts prior to installation.

⚠ **WARNING:** This product is designated as a Pressure Accessory per Directive 97/23/EC and is <u>not</u> intended for use as a safety device.

XPS-30



XPS-40



Note:

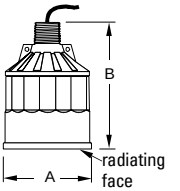
- Product configuration number shown for example only.
- Serial number shown for example only.

Specifications

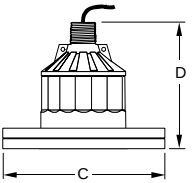
	XPS-10	XPS-15	XPS-30	XPS-40	XCT-8	XCT-12
Measurement Range	0.3 - 10 m (1 - 33 ft)	0.3 - 15 m (1 - 50 ft)	0.6 - 30 m (2 - 100 ft)	0.9 - 40 m (3 -130 ft)	0.6 - 8 m (2 - 26 ft)	0.6 - 12 m (2 - 40 ft)
Frequency (kHz)	44	44	30	22	44	44
Beam Angle	12°	6°	6°	6°	12°	6°
Environmental						
Location	indoor/outdoor	indoor/outdoor	indoor/outdoor	indoor/outdoor	indoor/outdoor	indoor/outdoor
Maximum Altitude (m)	2000	2000	2000	2000	2000	2000
Ambient Temperature	-40 to 95 °C (-40 to 203 °F)	-40 to 95 °C (-40 to 203 °F)	-40 to 95 °C (-40 to 203 °F)	-40 to 95 °C (-40 to 203 °F)	-40 to 145 °C (-40 to 293 °F)	-40 to 145 °C (-40 to 293 °F)
Pressure	8 bar (120 psi)	8 bar (120 psi)	Europe: 0.5 bar N. America: 15 psi	Europe: 0.5 bar N. America: 15 psi	8 bar (120 psi)	8 bar (120 psi)
Pollution Degree	4	4	4	4	4	4
Construction						
Housing	PVDF	PVDF	PVDF	PVDF	**Standard**: PVDF **Optional**: Universal* sized flange available with PTFE facing	
Mounting	1" NPT or BSP conduit connection	1" NPT or BSP conduit connection	1-1/2" NPT or BSP conduit connection	1-1/2" NPT or BSP conduit connection	1" NPT or BSP conduit connection	1" NPT or BSP conduit connection
Options	• factory bonded to suit ANSI, DIN, and JIS standards • polyethylene foam facing for dusty or steamy environments • submergence shield, where flooding can occur (available only for XPS-10, XPS-15) • split flange for field mounting to suit ANSI, DIN, and JIS standards (not available for XPS-40)					
Cable	2-wire twisted pair/braided and foil shielded, 0.5mm² (20 AWG), PVC jacket		• 2-wire twisted pair/braided and foil shielded, 0.5mm² (20 AWG), PVC jacket **Maximum separation:** 100 m (330 ft) • RG-62 A/U coax **Maximum separation:** 365 m (1200 ft)		Silicon Jacket	
Weight**	0.8 kg (1.7 lb)	1.3 kg (2.8 lb)	4.3 kg (9.5 lb)	8 kg (18 lb)	0.8 kg (1.7 lb)	1.3 kg (2.8 lb)
Maximum Separation	365 m (1200 ft)	365 m (1200 ft)	365 m (1200 ft)	365 m (1200 ft)	365 m (1200 ft)	365 m (1200 ft)
Supply Source	Transducers shall only be supplied by Siemens Milltronics certified controllers					
Approvals	CE***, CSA, FM, CENELEC/ATEX: See nameplate or consult Siemens Milltronics for current approvals.					

* Universal flange fits ANSI, DIN, and JIS standards.
** Approximate shipping weight of transducer with standard cable length.
*** EMC performance available upon request.

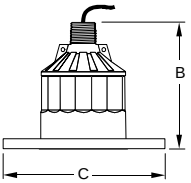
Outline and Dimensions



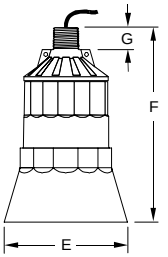
standard



optional bonded flange
refer to associated instructions



optional split flange
refer to associated instructions



optional submergence shield
refer to associated instructions

Dimension	XPS-10	XPS-15	XPS-30	XPS-40	XCT-8	XCT-12
A	88 mm (3.4")	121 mm (4.8")	175 mm (6.9")	206 mm (8.1")	88 mm (3.4")	121 mm (4.8")
B	122 mm (4.8")	132 mm (5.2")	198 mm (7.8")	229 mm (9.0")	122 mm (4.8")	132 mm (5.2")
C	to suit ANSI, DIN and JIS standards					
D*	128 mm (5.0")	138 mm (5.4")	204 mm (8.0")	235 mm (9.2")	128 mm (5.0")	138 mm (5.4")
E	124 mm (4.9")	158 mm (6.2")	n / a	n / a	n / a	n / a
F	152 mm (6.0")	198 mm (7.8")	n / a	n / a	n / a	n / a
G	28 mm (1.1")	28 mm (1.1")	28 mm (1.1")	28 mm (1.1")	28 mm (1.1")	28 mm (1.1")

* nominal

WARNING: Optional Split Flange, Bonded Flange, and Easy Aimer configurations are not suitable for pressure applications.

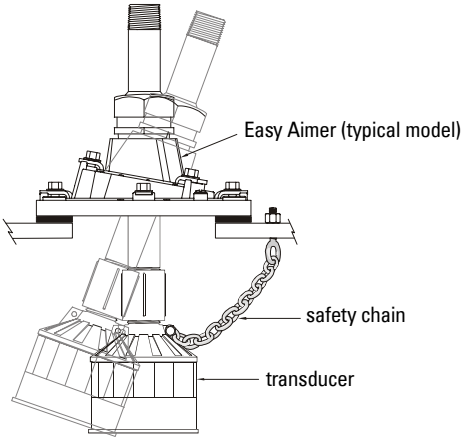
Mounting

WARNING: Special handling precautions must be taken to protect the face of the transducer from any damage.

- Mount the transducer so that it is **above the maximum material level by at least the blanking value.** Refer to the associated controller manual.
- On liquid applications, mount the transducer face parallel to the liquid surface. On solids applications, use a Siemens Milltronics Easy Aimer to help aim the transducer.
- Do not overtighten. Most applications require only hand tightening of the mounting hardware. Connect a safety chain from the transducer to a structural member to secure installation. Consider using the optional **temperature sensor** when a flanged transducer is used, when a fast temperature response is required, or in high temperature vessels.

Note: For pressure tight applications, install transducers hand tight plus ½ turn to 1½ turns. PTFE tape or other appropriate sealant may be used to aid in sealing the threads for use in pressure applications.

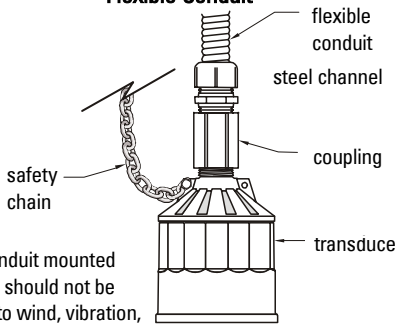
Mounting – Solids Applications



⚠ **WARNING:** Improper installation may result in loss of process pressure.

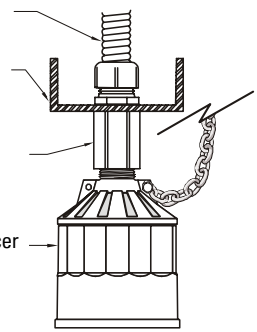
Mounting – Liquid Applications

Flexible Conduit

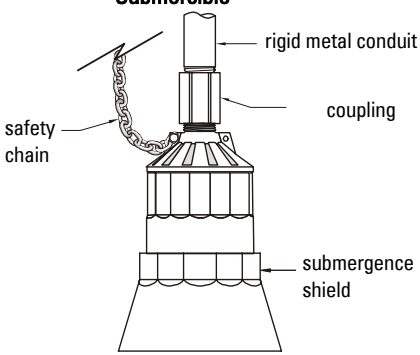


Flexible conduit mounted transducer should not be subjected to wind, vibration, or jarring.

Bracket



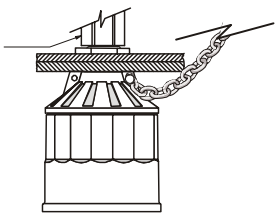
Submersible



Transducer with submergence shield, used in applications where flooding is possible.

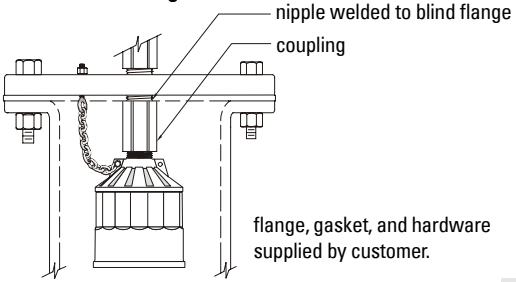
Plywood

Plywood mounting provides excellent isolation, but must be rigid enough to avoid flexing if subjected to loading.



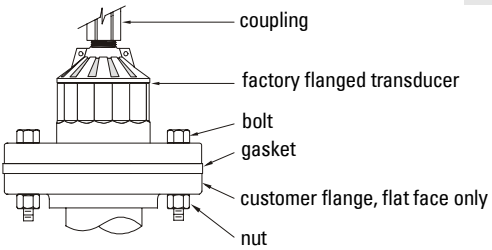
Mounting – Liquid Applications (cont'd)

Blind Flange



Note: Tighten the flange bolts evenly in order to ensure a good seal between the mating flanges. **Caution: Overtightening can cause performance degradation.**

Flanged



Customer flanged standpipe. If a metal flange must be welded to pipe, refer to Liquid Applications - Standpipes in the *Transducer Applications Manual*.

Installation

Note: Installation shall only be performed by qualified personnel and in accordance with local governing regulations.

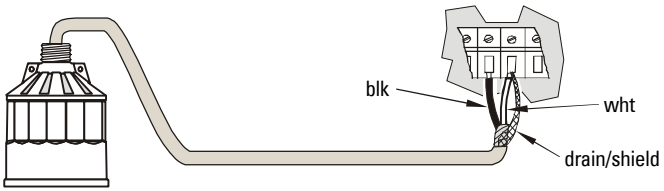
- Do not route cable openly. For optimum isolation against electrical noise, run cable separately in a grounded metal conduit. Seal all thread connections to prevent ingress of moisture.
- Do not run cable near high voltage or current runs, contactors, and SCR control drives. For pressure tight applications, install transducers hand tight plus ½ to 1½ turns.
- PTFE tape or other appropriate sealant may be used to aid in sealing the threads for use in pressure applications.

⚠ **WARNING:** Never attempt to loosen, remove, or disassemble process connection while vessel contents are under pressure.

Interconnection

Direct Connection

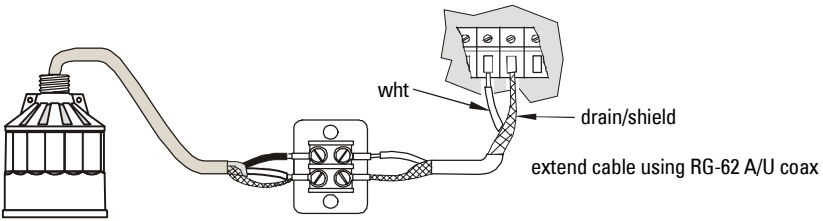
Connect the transducer directly to the Siemens Milltronics transceiver via the two conductor shielded cable.



Note: When connecting to an EnviroRanger ERS 500, a MultiRanger 100/200, or a HydroRanger 200, the white, black, and shield wires are all connected separately. DO NOT tie the white and shield wires together.

Coaxial Connection

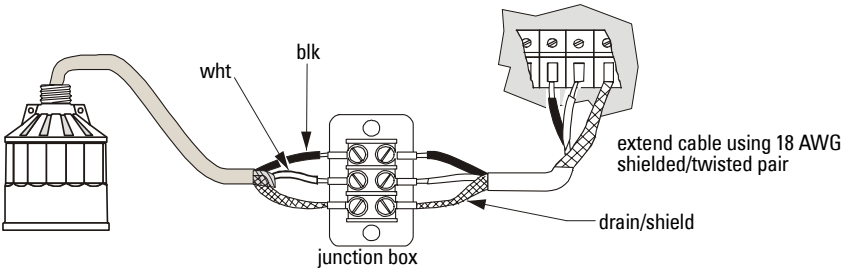
Connect the transducer to the Siemens Milltronics transceiver via a junction box and RG–62 A/U coaxial cable. This setup is effective for combined runs up to 365 m (1200 ft).



Note: When connecting to an EnviroRanger ERS 500, MultiRanger 100/200, and HydroRanger 200, do NOT use coaxial cable; see diagram below for proper procedure.

2-Wire Extension

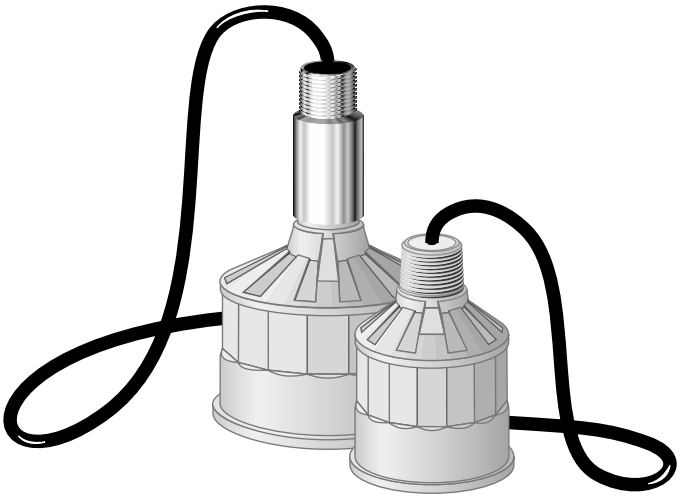
(for EnviroRanger ERS 500, MultiRanger 100/200, and HydroRanger 200 only)



MILLTRONICS

XPS-10/15 F SERIES TRANSDUCER

Instruction Manual PL-551 January 2001



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Rev. 2.2

XPS-10/15 F SERIES TRANSDUCER

Safety Guidelines

Warning notices must be observed to ensure personal safety as well as that of others, and to protect the product and the connected equipment. These warning notices are accompanied by a clarification of the level of caution to be observed.

Qualified Personnel

This device/system may only be set up and operated in conjunction with this manual. Qualified personnel are only authorized to install and operate this equipment in accordance with established safety practices and standards.

Warning: This product can only function properly and safely if it is correctly transported, stored, installed, set up, operated, and maintained.

Note: Always use product in accordance with specifications.

Contact SMPI Technical Publications at the following address:

Technical Publications
Siemens Milltronics Process Instruments Inc.
1954 Technology Drive, P.O. Box 4225
Peterborough, Ontario, Canada, K9J 7B1
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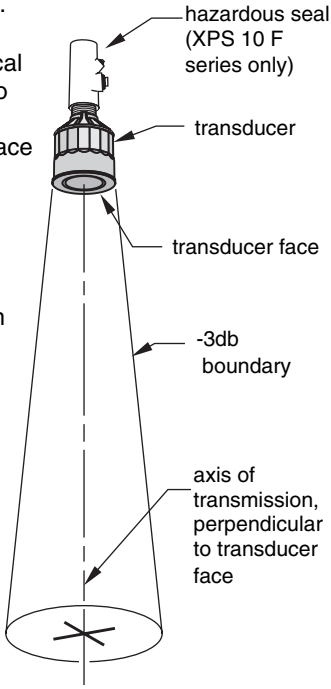
Installation Diagram for the XPS 10 F **26**

About Milltronics' Transducers

The Echomax XPS F series of transducers operates in association with Milltronics ultrasonic level monitoring products.



The transducer operates by converting electrical pulses that are provided by the transceiver into *ultrasonic pulses*. When transmitted, these ultrasonic pulses reflect from the material surface and echo back to the transducer. The echo is converted back to an electrical signal, and is interpreted by the Milltronics tranceiver using our proven Sonic Intelligence™ algorithms.

The effective acoustical energy is emitted from the transducer face and radiated outward, decreasing in amplitude at a rate inversely proportional to the square of the distance.

Maximum power is radiated axially (perpendicular) from the transducer face in a line referred to as the axis of transmission. Where power is reduced by half (– 3 dB), a conical boundary defining the sound beam, centered about the axis of transmission, is established. The diametric measurement of the cone in degrees defines the beam angle. Impedance matching techniques are used to optimize the transfer of power from the transducer into air and vice versa.

The XPS F series transducers incorporate an integral temperature sensor that reports the air temperature at the transducer to the transceiver. The connection is transparent, in that both the ultrasonic and temperature components of the transducer use the same leads.

Hazardous Area Applications

The Echomax XPS F series of transducers can be used in hazardous areas.

For the XPS 10 F series transducer, a hazardous seal must be used to suit hazardous area classification. This seal is **not** supplied by Milltronics.

The XPS 15 F comes equipped with a stainless steel coupling suitable for use in hazardous locations.

Specifications

XPS 10 F Series Transducers

Measurement Range:

- 0.3 – 10m (1 – 33ft)

Frequency:

- 43kHz

Beam Angle:

- 12°

Environmental

- location: indoor/outdoor
- altitude: 2000m maximum
- ambient temperature: -20 to 95°C (-4 to 203°F)
- pollution degree: 4

Construction

- exposure: Kynar®[1]
- colour: slate gray
- mounting: 1” NPT conduit connection
- options:
  - factory flange to suit ANSI standard
  - submergence shield, where flooding can occur
  - split flange for field mounting to suit ANSI
- cable: 2-wire shielded / twisted, 0.5 mm^2 (20 AWG) PVC jacket

Supply Source

- Transducer shall only be supplied by a Milltronics certified controller.

Weight[2]

- 0.8kg (1.8lb)

Separation

- 365m (1200ft) from transducer

Approvals

- FM Class 1 Div 1, Group A, B, C and D
- FM Class 2 Div 1, Group E, F, and G
- see nameplate or consult Milltronics for other current approvals

---

[1] Kynar® is registered trade mark of ELF Atochem.
[2] approximate shipping weight of transducer with standard cable length

XPS 15 F Series Transducers

Measurement Range:

- 0.45 – 15m (1.5 – 50ft)

Frequency:

- 43kHz

Beam Angle:

- 6°

Environmental

- location: indoor/outdoor
- altitude: 2000m maximum
- ambient temperature: -20 to 95°C (-4 to 203°F)
- pollution degree: 4

Construction

- exposure: Kynar®[3]
- colour: slate gray
- mounting: 1" NPT conduit connection
- options:
  - factory flange to suit ANSI standard
  - submergence shield, where flooding can occur
  - split flange for field mounting to suit ANSI
- cable: 2-wire shielded / twisted, 0.5 mm^2 (20 AWG) PVC jacket

Supply Source

- Transducer shall only be supplied by a Milltronics certified controller.

Weight[4]

- 2.0 kg (4.4lb)

Separation

- 365m (1200ft) from transducer

Approvals

- FM Class 1 Div 1, Group A, B, C and D
- FM Class 2 Div 1, Group E, F, and G
- see nameplate or consult Milltronics for other current approvals

---

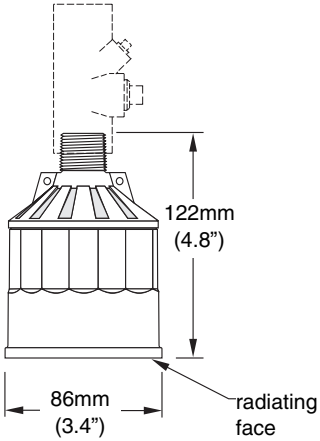
[3] Kynar® is registered trade mark of ELF Atochem

[4] approximate shipping weight of transducer with standard cable length

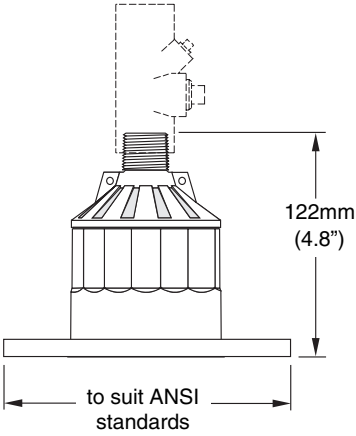
Outline and Dimensions

XPS 10 F Series Transducers

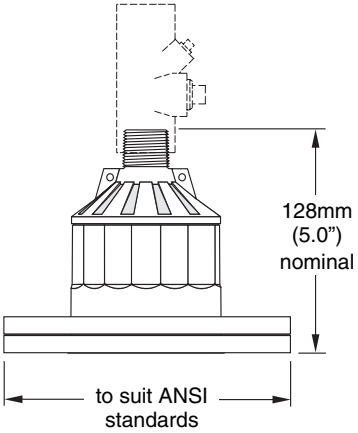
Standard



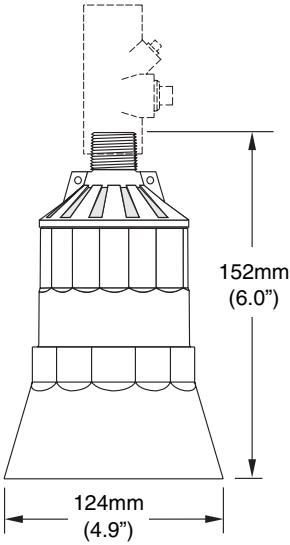
Flange (optional)



Split Flange (optional)



Submergence Shield (optional)

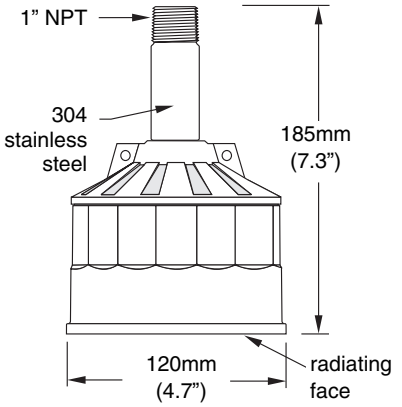


Refer to submergence shield instructions
(Milltronics' manual number PL-530)

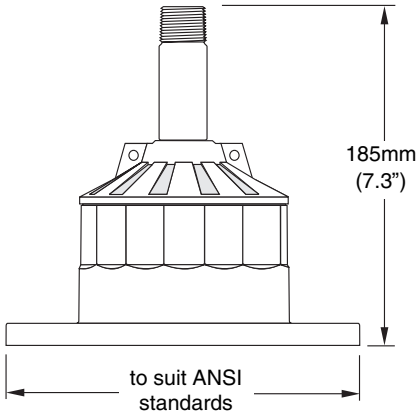
Note:
For the XPS 10 F series transducer, a hazardous seal must be used to suit hazardous area classification. This seal is **not** supplied by Milltronics. For more information, refer to page 26.

XPS-15 F Series Transducers

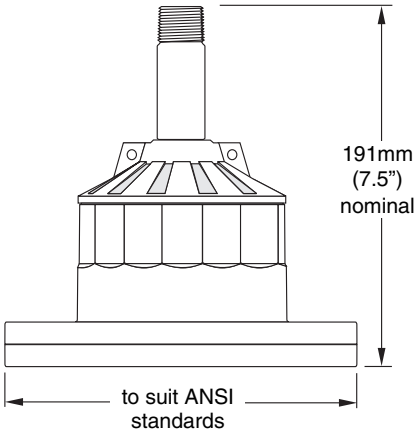
Standard



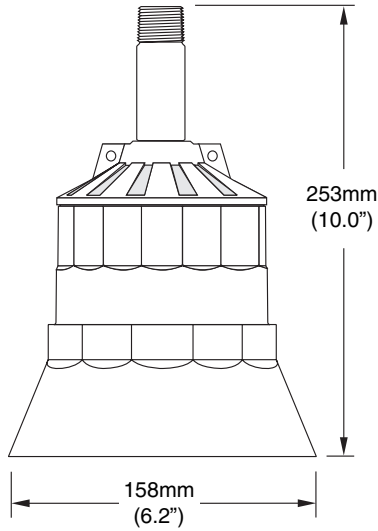
Flange (optional)



Split Flange (optional)



Submergence Shield (optional)



Refer to submergence shield instructions
(Milltronics' manual number PL-530)

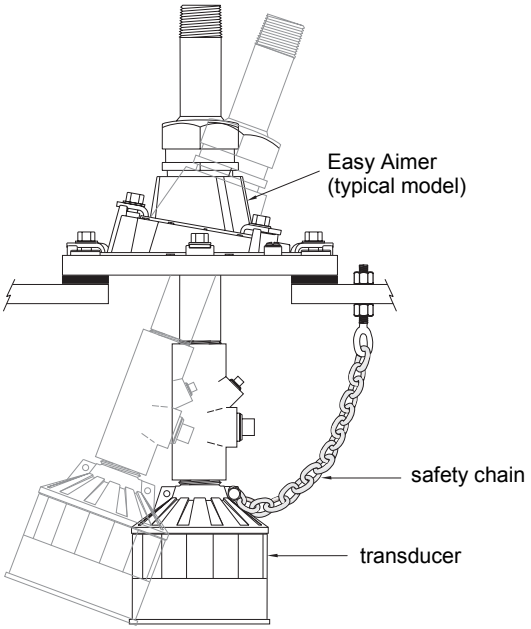
Note:
The XPS 15 F comes equipped with a stainless steel coupling suitable for use in hazardous locations.

Mounting

Recommendations

- Special handling precautions must be taken to protect the face of the transducer from any damage.
- Mount the transducer so that it is *above the maximum material level by at least the blanking value (0.3m for XPS 10 F and 0.45m for XPS 15 F)*. Refer to the associated transceiver manual for instructions on setting the blanking value.
- On liquid applications, the transducer must be mounted so that the axis of transmission is perpendicular to the liquid surface.
- On solids applications, a Milltronics Easy Aimer should be used to facilitate aiming of the transducer.
- *Do not over-tighten mounting*. Hand tightening of the mounting hardware is sufficient.
- Secure installation by connecting a safety chain from the transducer to a structural member.
- Consider the optional *temperature sensor* when mounting the transducer.

Solids Applications (XPS 10 F shown)

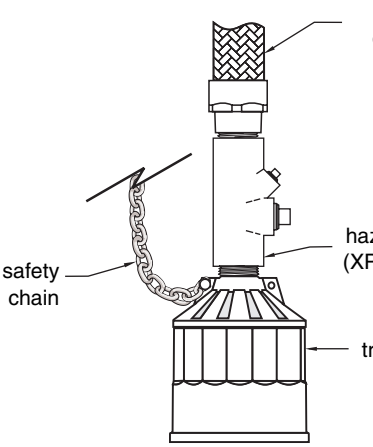


Note:
For the XPS 10 F series transducer, a hazardous seal must be used to suit hazardous area classification. This seal is not **supplied by Milltronics. For more information, refer to page 26.**

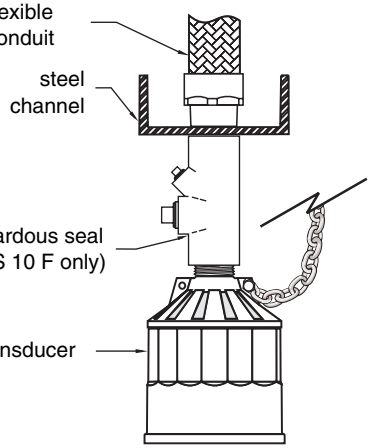
Liquid Applications

Notes:
- In, the examples that follow, an XPS 10 F Series transducer is shown using a hazardous seal. This seal is **not** supplied by Milltronics.
- An XPS 15 F transducer can also be used in these applications, but, because it comes equipped with a stainless steel coupling, no hazardous seal is required.

Flexible Conduit (XPS 10 F shown)

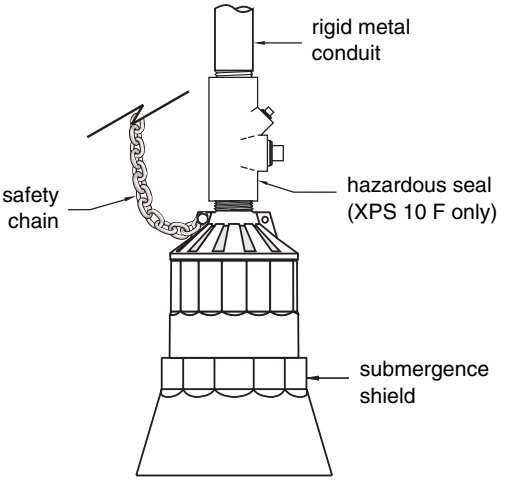


Bracket (XPS 10 F shown)



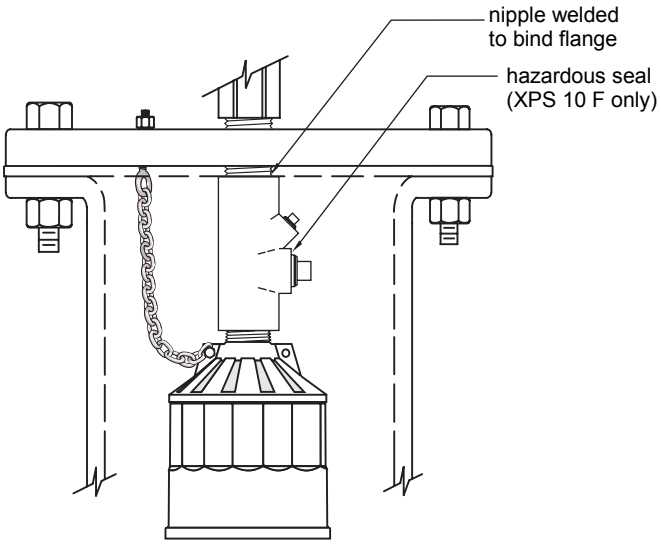
Flexible conduit transducer should not be subjected to wind, vibration or jarring.

Submersible (XPS 10 F shown)



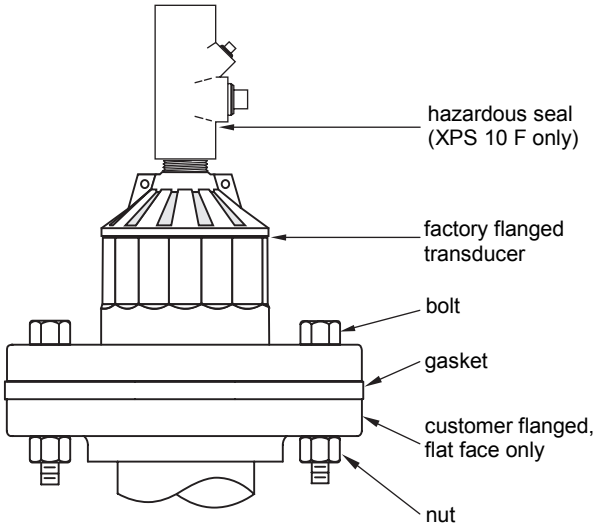
Submersible transducer, used in applications where flooding is possible.

Blind Flange (XPS 10 F shown)



Flange, gasket, hazardous seal and hardware supplied by customer.
Refer to page 19

Flanged (XPS 10 F shown)



Flange, gasket, and hardware supplied by customer.
Refer to page 19

Note: Tighten the flange bolts evenly in order to ensure a good seal between the mating flanges.
Caution: Over-tightening can cause performance degradation.

Interconnection

Note:
Installation should only be performed by qualified personnel and in accordance with local governing regulations.

Recommendations

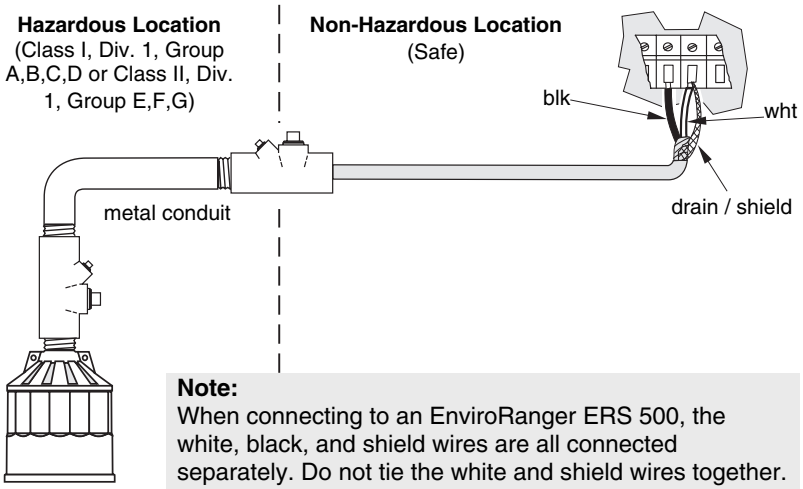
- When using an XPS 15 F transducer, configure the electronic transceiver for an XCT-12. These two transducers use the same settings.
- Do not route cable openly.
- For optimum isolation against electrical noise, run cable separately in a grounded metal conduit.
- Seal all thread connections to prevent ingress of moisture.
- Do not run cable near high voltage or current runs, contactors and SCR control drives.

Note:

In the interconnection examples that follow:

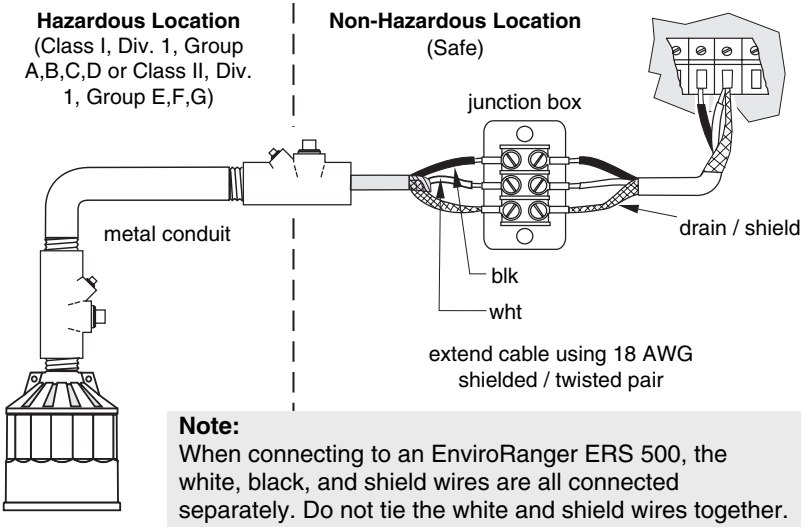
- an XPS 10 F Series transducer is shown. An XPS 15 F transducer can also be used, but no hazardous seal is required.
- assume that the transducer is located in a Hazardous location (Class I, Div. 1, Group A,B,C,D or Class II, Div. 1, Group E,F,G.) and the transceiver in a Non-Hazardous (Safe) Location.

Direct Connection (XPS 10 F shown)



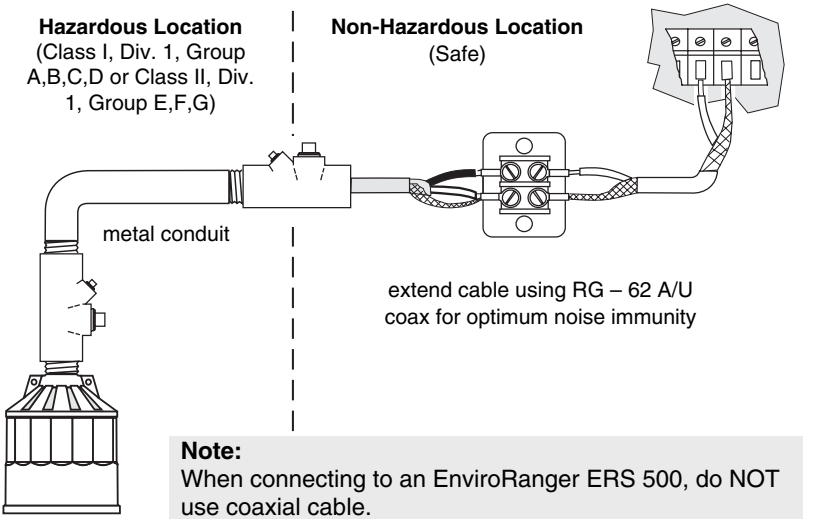
Note:
When connecting to an EnviroRanger ERS 500, the white, black, and shield wires are all connected separately. Do not tie the white and shield wires together.

2-Wire Extension (XPS 10 F shown)



Note:
When connecting to an EnviroRanger ERS 500, the white, black, and shield wires are all connected separately. Do not tie the white and shield wires together.

Coaxial Cable (XPS 10 F shown)



Note:
When connecting to an EnviroRanger ERS 500, do NOT use coaxial cable.

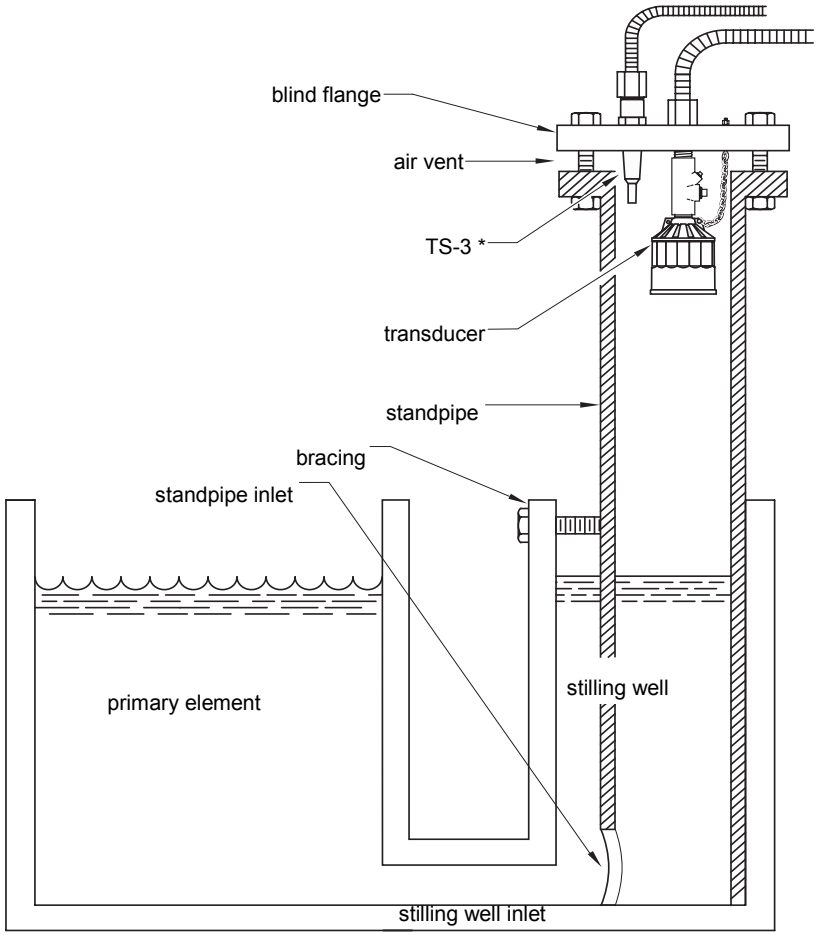
Applications

Notes:

- The transducer is to be used only in the manner outlined in this instruction manual.
- Normally, the transducer requires no cleaning or maintenance. However, if performance changes are observed, immediately shut down the level measurement system and perform a thorough inspection, especially on the transducer.
- An XPS 10 F Series transducer is shown in these examples. An XPS 15 F transducer can also be used, but no hazardous seal is required.

Liquid Applications

Stilling Well / OCM



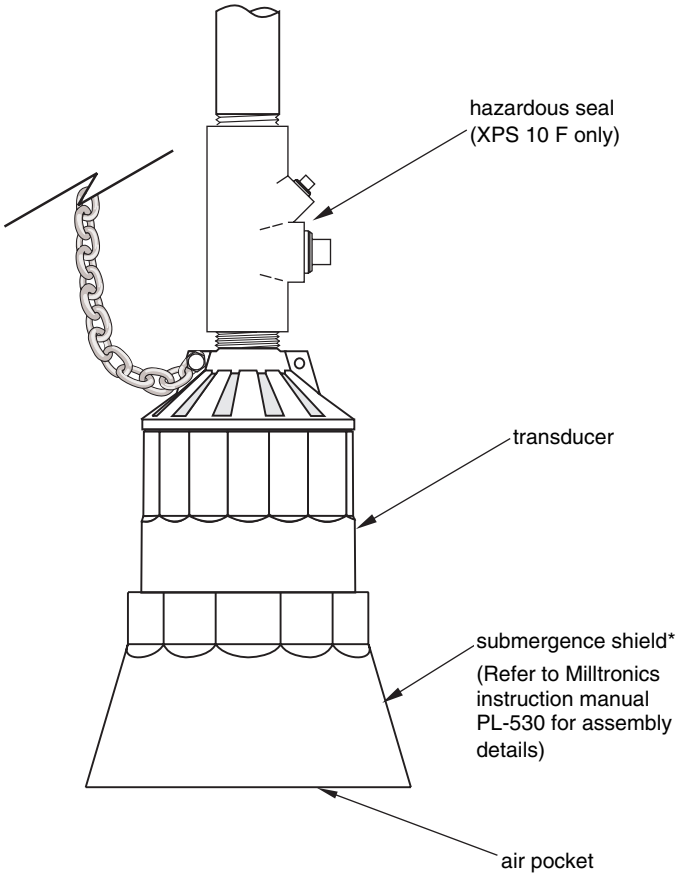
Refer to page 19.

* the use of a TS-3 temperature sensor provides better temperature tracking in applications where the temperature can change quickly.

Submergence

In applications where flooding is possible, the transducer can be fitted with a submergence shield*. The shield acts as a bell to create an air pocket in front of the transducer face. The associated transceiver* interprets this as a flooding condition, and reacts accordingly.

Note:
Refer to transceiver manual for programming requirements.



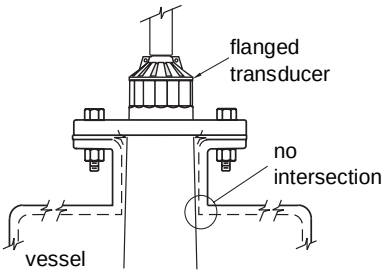
* on applicable models

Standpipes

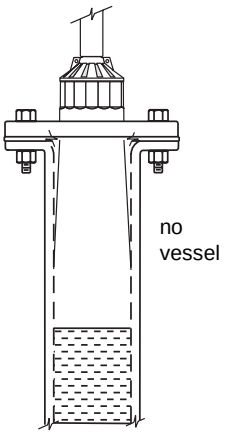
In many applications, access must be made via a standpipe. In such cases, Milltronics can provide factory bonded flanged transducers or a split flange kit that will readily mate to the flanged standpipe. Another option is to hang the transducer from a blind flange.

The standpipe length should be as short and the diameter as large as possible. As a rule of thumb, the -3 dB cone of the sound beam should not intersect the standpipe wall in applications opening into a vessel or larger area. Otherwise, additional blanking will be required to compensate for the interference zone created by the opening.

Note: When using a stilling well, make sure there is no build-up, welds, couplings, or other debris on the inside of the well wall. This can affect reliability of measurement.



no additional blanking required



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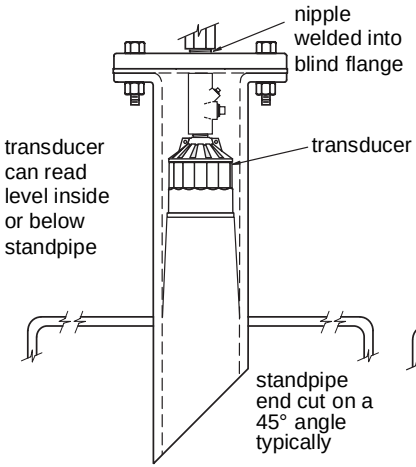

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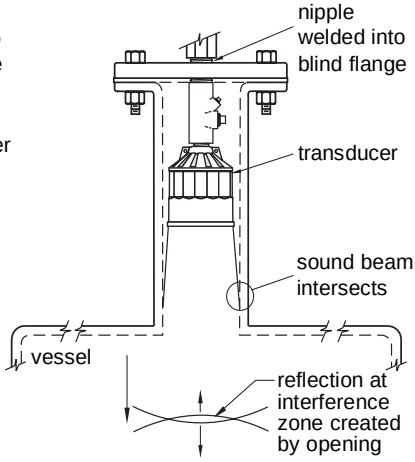
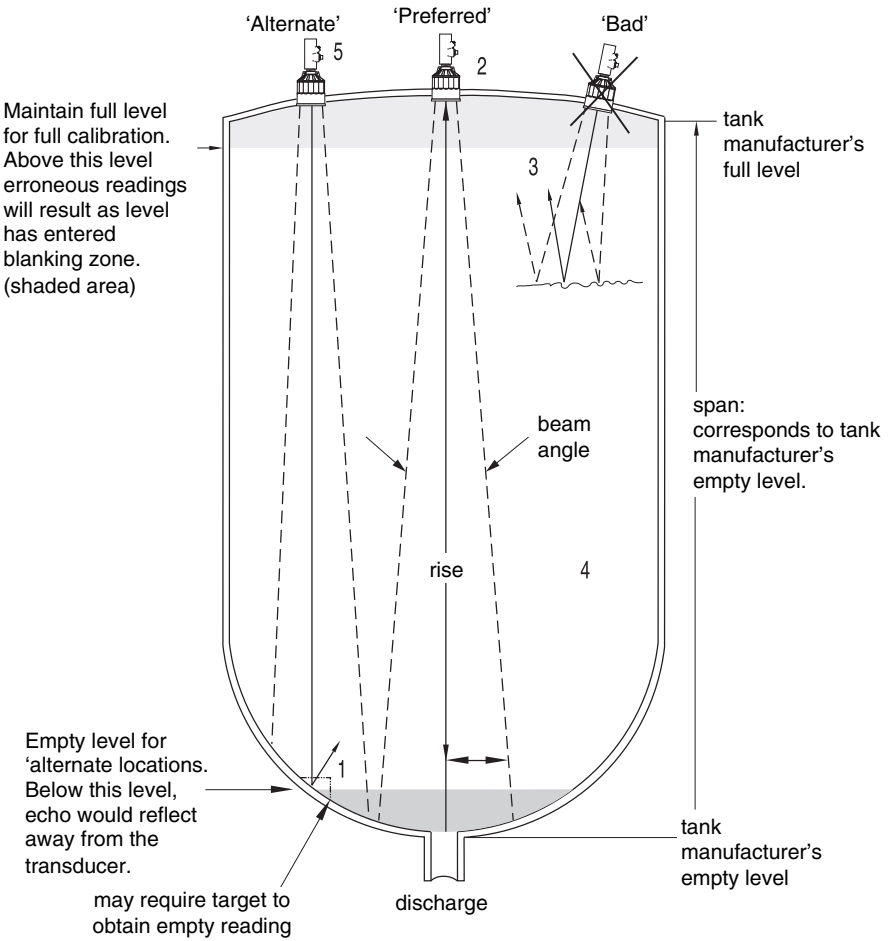


near blanking extension of 150 mm (6”)

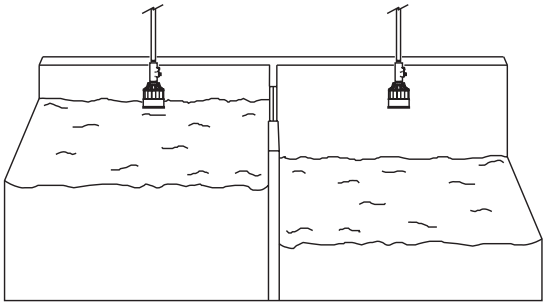
Volume



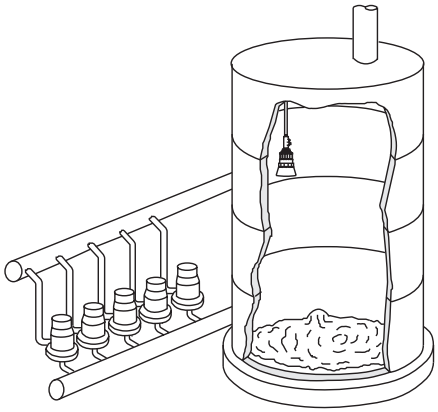
1. Beam should not detect bin bottom. If this occurs, use range extension parameters (on transceivers where available) to omit false echoes. A 6° beam angle (XPS 15 F) represents a rise:run of about 20:1 (10:1 for the 12° beam angle of the XPS 10 F). In most tanks, the transducer should be centered as much as possible (without interference from inlet) for optimum reading range.
2. Sound beam must be perpendicular to liquid surface. If standpipe is used, refer to page 19.
3. Echo has missed improperly levelled transducer.
4. When performing an empty or full calibration, the tank must contain its normal vapour and be at its normal temperature.
5. When used in hazardous areas, the XPS 10 F series transducer (shown) must use a hazardous seal. This seal is **not** supplied by Milltronics. The XPS 15 F Series transducer comes equipped with a stainless steel coupling suitable for use in hazardous locations.

Water / Wastewater

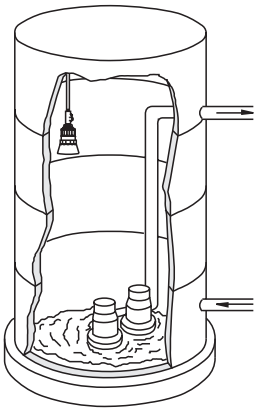
Differential Level



Pump Control



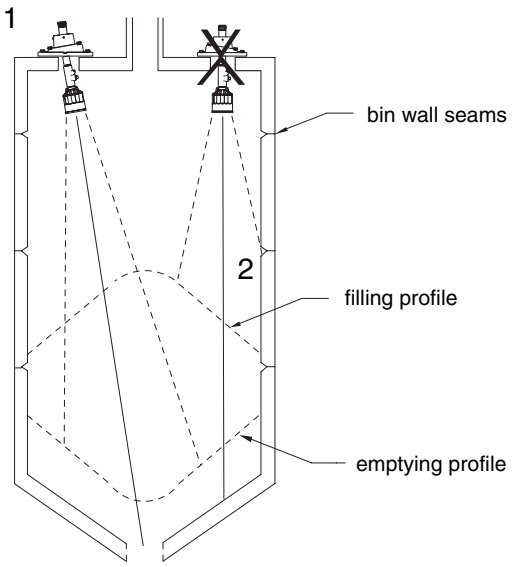
Sewage Lift



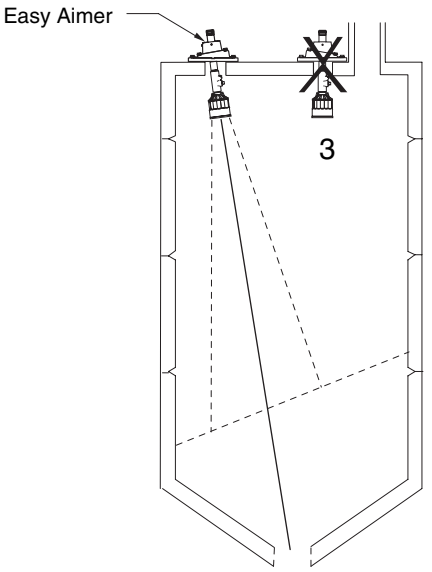
Solids Applications

Typical

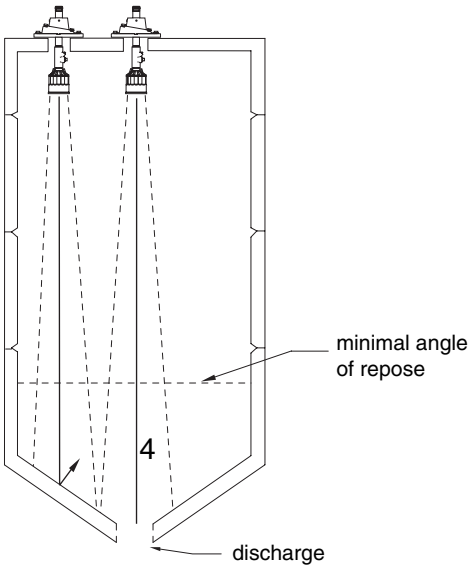
1. Transducer angled to avoid seams in bin wall and aimed at discharge in order to read bin when empty.
2. Avoid intersecting bin wall seams, structural members and wall irregularities.



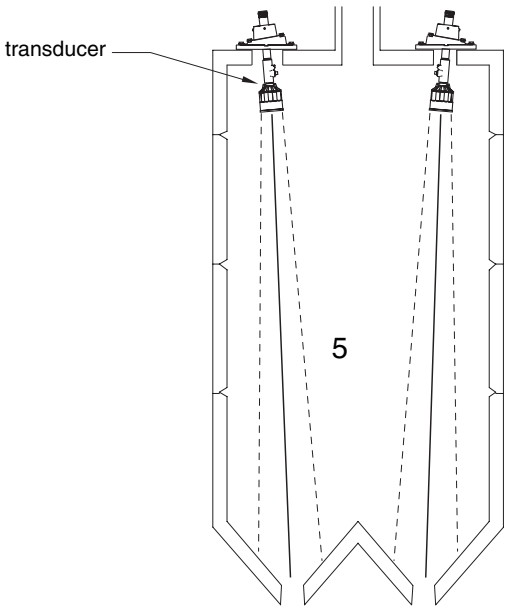
3. Transducer too close to material inlet. Falling material will intersect sound beam and cause erroneous readings or loss of echo.



4. On fluid like solids, aim transducer perpendicular to material surface.



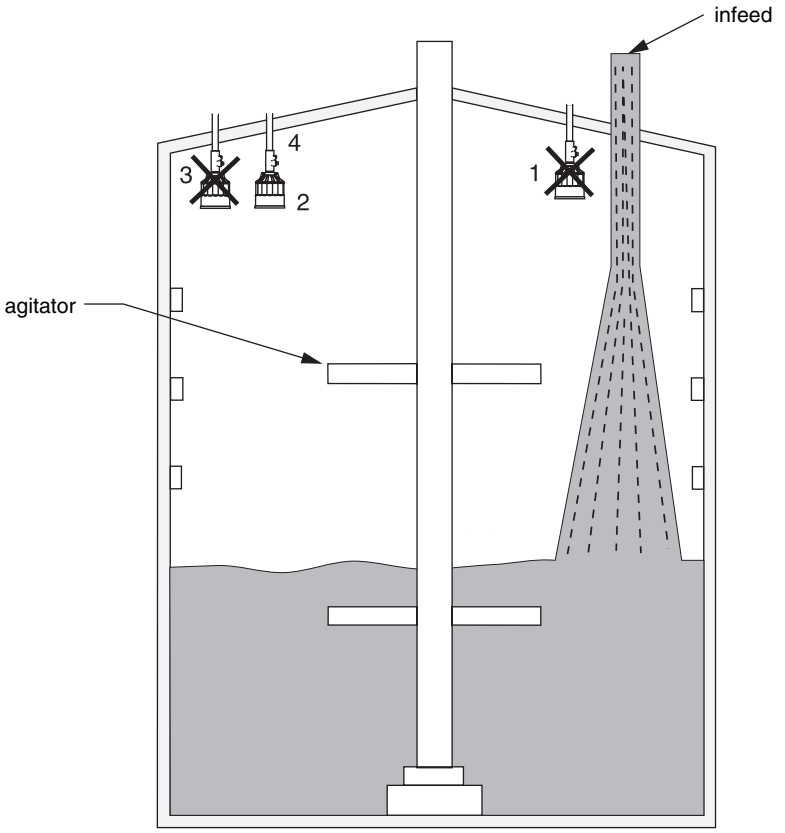
5. On dual discharge bins, aim each transducer at the discharge point.



Special

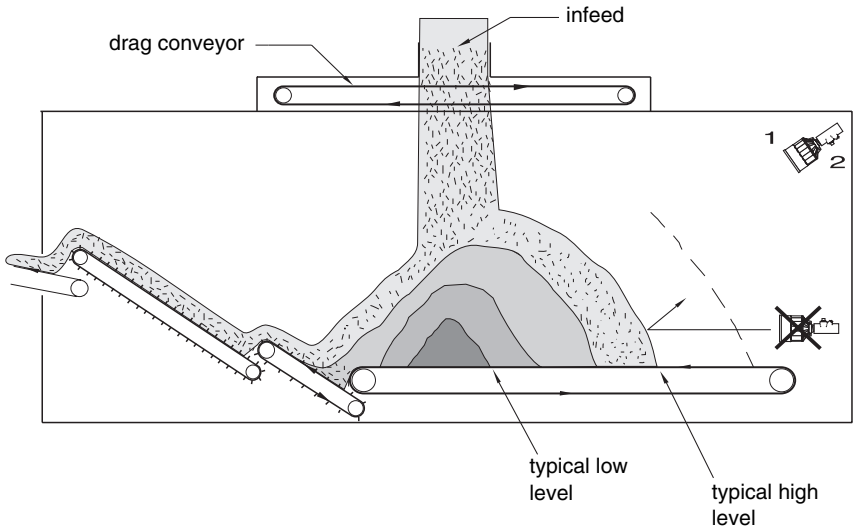
Storage Bin with Agitator

1. Transducer should be kept away from infeed.
2. Where agitators are in use, use the Agitator Discrimination parameter on transceivers where available.
3. Transducer should be aimed away from wall projections.
4. When used in hazardous areas, the XPS 10 F series transducer (shown) must use a hazardous seal. This seal is **not** supplied by Milltronics. The XPS 15 F Series transducer comes equipped with a stainless steel coupling suitable for use in hazardous locations.

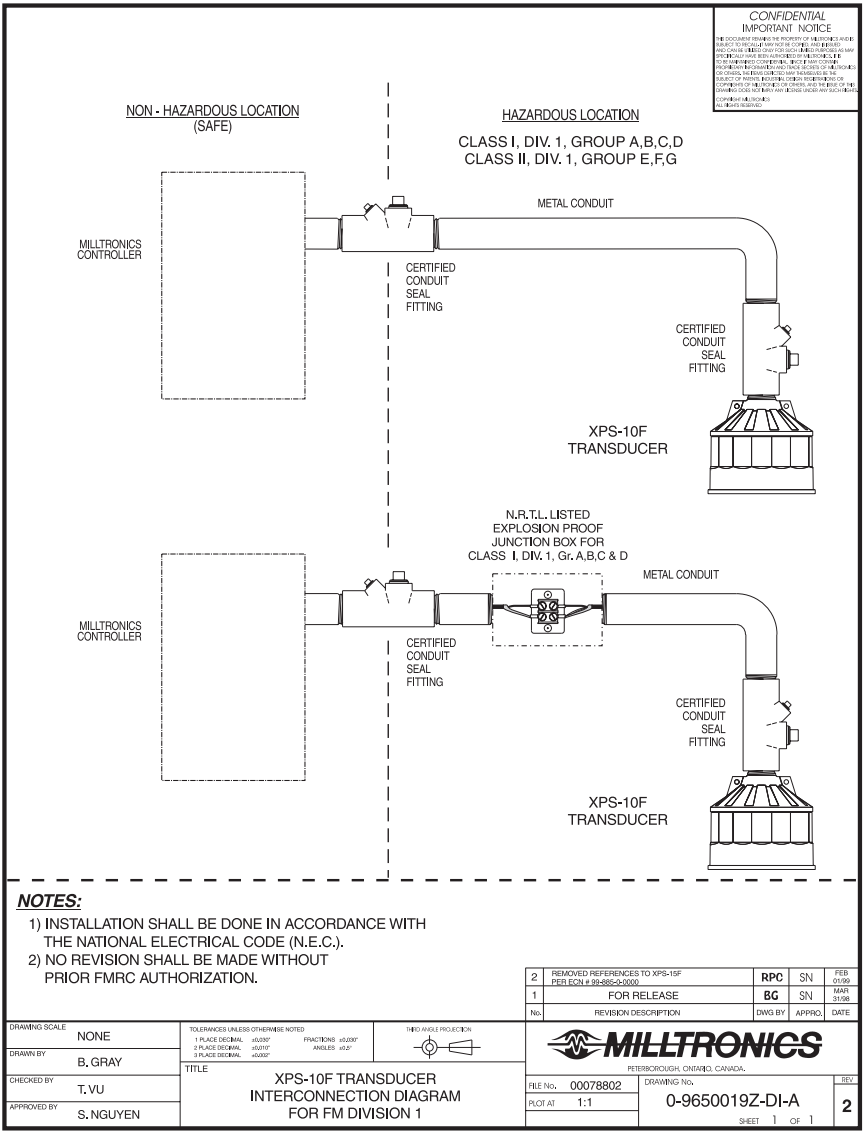


Dryer - Wood Chips

1. Transducer should be mounted perpendicular to slope of wood chips.
2. When used in hazardous areas, the XPS 10 F series transducer (shown) must use a hazardous seal. This seal is **not** supplied by Milltronics. The XPS 15 F Series transducer comes equipped with a stainless steel coupling suitable for use in hazardous locations.



Installation Diagram for the XPS 10 F



MILLTRONICS

Siemens Milltronics Process Instruments Inc.
1954 Technology Drive, P.O. Box 4225
Peterborough, ON.Canada K9J 7B1
Tel: (705) 745-2431 Fax: (705) 741-0466
www.milltronics.com

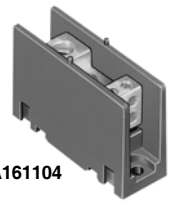
7ML19981DU01
Printed in Canada

Power Distribution Blocks
Class 9080—Type LB


LBC165212


LBA365212


LBA361104


LBA161104

Standard Power Distribution Blocks

Lug WireRange▲		Aluminum■						Dim. Type
Main	Branch	One Pole		Two Pole		Three Pole		
		Type ★	Price	Type ★	Price	Type ★	Price	
(1) #14–2/0	(1) #14–2/0	LBA162101	$ 6.90	LBA262101	$ 14.70	LBA362101	$ 17.10	2
(1) #6–350 kcmil	(1) #6–350 kcmil	LBA163101	35.60	LBA263101	54.00	LBA363101	71.00	3
(1) #4–600 kcmil	(1) #4–600 kcmil	LBA164101	63.00	N/A	. . .	LBA364101	122.00	4
(2) #4–350 kcmil	(2) #4–350 kcmil	LBA165202	65.00	LBA265202	98.00	LBA365202	126.00	5
(2) #4–500 kcmil	(2) #4–500 kcmil	LBA1652021	60.00	LBA2652021	137.00	LBA3652021	162.00	5
(1) #14–2/0	(4) #14–4	LBA162104	20.30	LBA262104	30.50	LBA362104	45.60	2
(1) #14–2/0	(6) #14–4	N/A	. . .	N/A	. . .	LBA362106	87.00	...▼
(1) #6–400 kcmil	(4) #14–2	LBA163104	37.20	LBA263104	56.00	LBA363104	75.00	3
(1) #6–400 kcmil	(6) #14–2	LBA163106	39.30	LBA263106	59.00	LBA363106	81.00	3
(1) #6–400 kcmil	(8) #14–2	LBA164108	51.00	LBA264108	77.00	LBA364108	107.00	4
(1) #4–500 kcmil	(6) #14–2/0	LBA165106	84.00	LBA265106	126.00	LBA365106	155.00	5
(1) #4–500 kcmil	(12) #14–2	LBA165112	89.00	LBA265112	134.00	LBA365112	174.00	5
(2) #14–2/0	(6) #14–4	LBA163206	39.80	LBA263206	60.00	LBA363206	81.00	3
(2) #4–500 kcmil	(8) #14–2/0	LBA165208	84.00	LBA265208	126.00	LBA365208	167.00	5
(2) #4–500 kcmil	(12) #14–4	LBA165212	90.00	LBA265212	137.00	LBA365212	174.00	5

Miniature Power Distribution Blocks

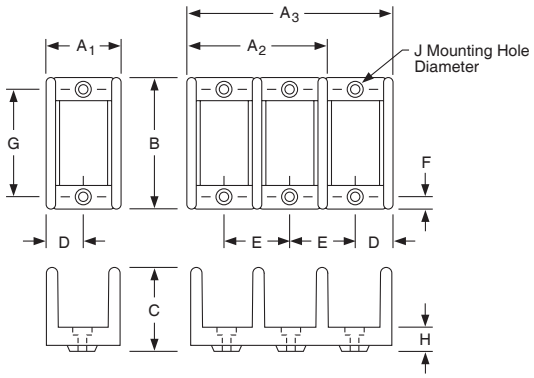
Lug Wire Range▲		Aluminum■						Dim. Type
Main	Branch	One Pole		Two Pole		Three Pole		
		Type ★	Price	Type ★	Price	Type ★	Price	
(1) #14–2	(1) #14–2	LBA161101	$ 8.90	N/A	. . .	LBA361101	$ 16.60	1
(1) #14–2	(4) #18–10	LBA161104	17.60	LBA261104	$20.40	LBA361104	38.70	1

Copper Power Distribution Blocks

Lug Wire Range▲		Copper						Dim. Type
Main	Branch	One Pole		Two Pole		Three Pole		
		Type ★	Price	Type ★	Price	Type ★	Price	
(1) #18–1/0	(1) #18–1/0	LBC162101	$ 66.00	N/A	. . .	LBC362101	$134.00	2
(1) #6–250 kcmil	(1) #6–250 kcmil	LBC163101	83.00	N/A	. . .	LBC363101	155.00	3
(1) #14–2/0	(4) #14–4	LBC162104	66.00	LBC262104	$ 98.00	LBC362104	165.00	2
(1) #4–500 kcmil	(6) #14–2	LBC163106	102.00	LBC263106	156.00	LBC363106	236.00	3
(2) #14–2/0	(6) #14–4	LBC163206	89.00	LBC263206	134.00	LBC363206	179.00	3
(2) #4–500 kcmil	(8) #14–2/0	LBC165208	181.00	N/A	. . .	LBC365208	395.00	5
(2) #4–500 kcmil	(12) #14–2	LBC165212	189.00	N/A	. . .	LBC365212	378.00	5

▲ Lugs suitable for use with 75°C conductors. (#) indicates number of conductors.
■ Aluminum blocks will accept either Al or Cu conductors.
♦ Cu blocks will accept copper conductors only.
★ CE Marked.
▼ Refer to catalog for dimensions.

Dimensions



Dimensions (Inches)

Type	A1	A2	A3	B	C	D	E	F	G	H	J
1	.76	1.40	2.03	2.29	1.62	.38	.64	.19	1.93	.32	.201
2	1.13	1.94	2.75	2.88	1.78	.56	.81	.31	2.25	.24	.205
3	1.94	3.47	5.00	4.00	2.61	.97	1.53	.31	3.38	.40	.203
4	2.28	4.16	6.04	4.75	2.92	1.14	1.88	.31	4.13	.51	.20
5	3.17	5.88	8.54	5.50	3.12	1.58	2.69	.38	4.75	.50	.265

Clear Plastic Covers (0.045 in. thick)
Note: There are no covers for miniature blocks.

For LBA Type	Type	Price △	Dim. A	Dim. B
LBA162..., LBC162	LB21	$ 7.50	1.062	2.750
LBA262..., LBC262	LB22	9.00	1.875	2.750
LBA362..., LBC362 □	LB23	10.50	2.688	2.750
LBA163..., LBC163	LB31	8.30	1.782	3.813
LBA263..., LBC263	LB32	9.80	3.313	3.813
LBA363..., LBC363	LB33	11.30	4.844	3.813
LBA164...	LB41	9.00	2.125	4.563
LBA264...	LB42	10.50	4.000	4.563
LBA364...	LB43	12.00	5.875	4.563
LBA165..., LBC165	LB51	9.80	2.719	5.313
LBA265..., LBC265	LB52	11.30	5.656	5.313
LBA365..., LBC365	LB53	12.80	8.375	5.313

△ Above covers must be ordered in multiples of 5 covers.
Above covers are supplied with two self tapping screws per cover.
□ Will not work on a 9080LBA362106 block.

Application Data
UL component recognized (File E60616 CCN XCFR2).
CSA certified (File LR70361).
Voltage Rating—Class B & C—600 V
Blocks are rated based on NEC Table 310-16 using 75°C wire.
Aluminum blocks are tin plated high conductive aluminum.
Copper blocks are tin plated high conductive copper.
Housing material:
- Miniature Blocks are made from high impact thermoplastic rated at 125°C. max. & -40°C. min.
- Full Size Blocks are made from general purpose phenolic rated at 150°C. max. & -40°C. min.

All blocks have a flammability rating of UL 94V-0.

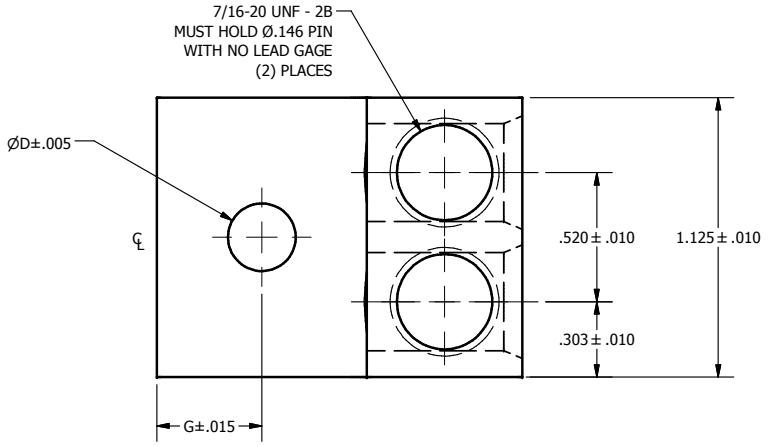
For additional information, reference Catalog # 9080CT9603.

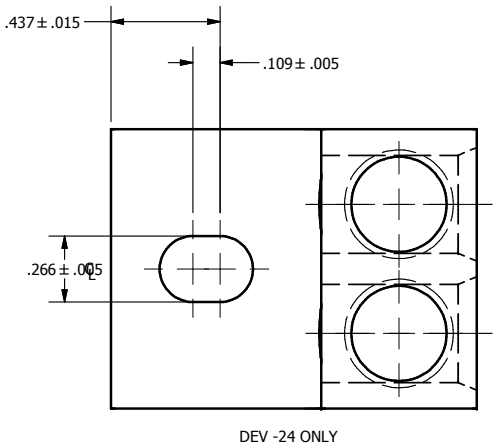
CP1 | Discount Schedule

SCREW:E0980	MATERIAL:ALUMINUM, X0031	CELL: ABM	TOLERANCES-UNLESS OTHERWISE SPECIFIED 2 PL. DEC. ±.010 TRUE C.L. ±.015 3 PL. DEC. ±.007 ANGLES ±1	DWG. NO. D1112	ILSCO CORP.
CAT. NO.:	PLATING:EL-TIN	STUFFER SHT.:SEE CHART			
MASS:SEE CHART	MARKING: SEE CHART		DRAWN BY:CLH SCALE: 2:1 DATE:1/16/2008 SIZE: B	SHEET 1 OF 1	
SURFACE AREA:SEE CHART²					

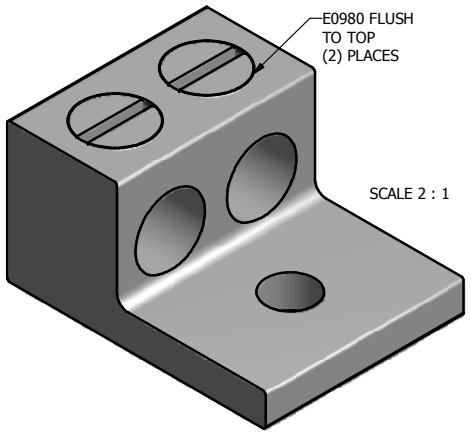
REV.	DESCRIPTION
F	

Cat #: AU-0
AU-0-B2

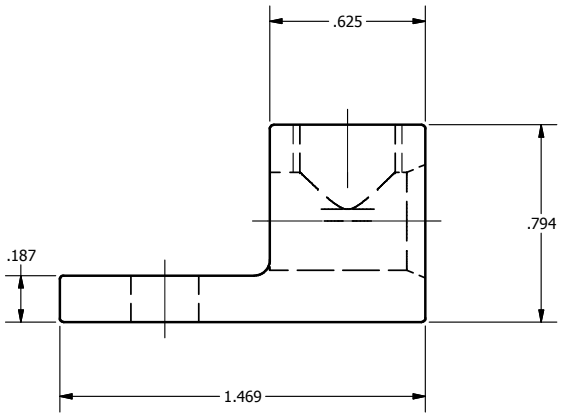


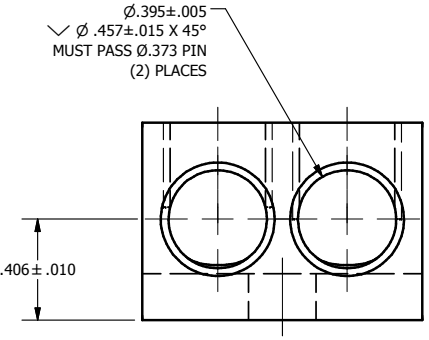


DEV -24 ONLY



SCALE 2 : 1





DEV	D	G	MASS LBS.	A	MARKING
-22	.272	.422	.509	7.5048	ILSCO, D1112, AU-0, 1/0-14, AL9CU

Instruction Bulletin	Boletín de instrucciones	Directives d'utilisation

Series
Serie
Série
0

Replaces
Reemplaza
Remplace
40272-078-03
10/2005

40272-078-04
05/2007
Lexington, KY, USA

40283-565-50/51

PK7GTA Grounding Bar Kit
Accesorio de barra de puesta a tierra
Kit de barres de m.à.l.t.

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

Precautions | Precauciones | Précautions

⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying the equipment where this kit will be installed before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañia, consulte la norma 70E de NFPA.
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Desenergice el equipo en el que se instalará este accesorio, antes de realizar cualquier trabajo en él.
- Siempre utilice un dispositivo detector de tensión nominal adecuado para confirmar la desenergización del equipo.
- Vuelva a colocar todos los dispositivos, las puertas y las cubiertas antes de volver a energizar el equipo.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC

- Portez un équipement de protection personnelle (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Coupez l'alimentation de l'appareil avant d'y travailler.
- Utilisez toujours un dispositif de détection de tension ayant une valeur nominale appropriée pour vous assurer que l'alimentation est coupée.
- Replacez tous les dispositifs, les portes et les couvercles avant de mettre l'appareil sous tension.

Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.

02637

7 85901 02637 2

a brand of Schneider Electric

SQUARE D

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Contents

1 Grounding bar
2 Mounting screws

NOTE: Grounding bar suitable for No. 14–4 Cu, No. 12–4 Al, two No. 14 or 12 Cu, or two No. 12 or 10 Al.

Installation

1. Turn off all power supplying the equipment where this kit will be installed, before working on or inside the equipment.
2. For use in QO6-12L100, QO14-8L125, and HOM4-8125: Mount grounding bar to embossed holes in back of box using 8-32 x 0.687 inch screws (two required), as shown below.
3. Place marker “Equipment Grounding Terminal” near grounding bar after installation.

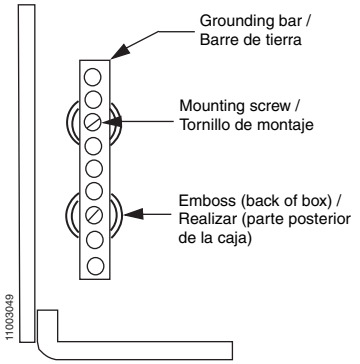
Contenido

1 Barra de tierra
2 Tornillo de montaje

NOTA: Barra de tierra adecuada para conductores de Cu calibres 14 a 4, de Al calibres 12 a 4, dos conductores de Cu calibre 14 ó12 o dos conductores de Al calibre 12 ó 10.

Instalación

1. Desenergice el equipo donde será instalado este accesorio antes de realizar cualquier trabajo en el equipo.
2. Para usarse en los centros de carga QO6-12L100, QO14-8L125 y HOM4-8125: Coloque la barra en los agujeros realizados ubicados en la parte posterior de la caja utilizando tornillos de 8-32 x 0,687 pulg (se necesitan dos), como su muestra abajo.
3. Coloque el marcador “Terminal de tierra de protección” junto a la barra de tierra después de la instalación.



Made in Canada **Hecho en Canada**

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

Schneider Electric USA
1601 Mercer Road
Lexington, KY 40511 USA
(1-888-778-2733)
www.us.SquareD.com
40272-078-04

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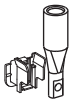
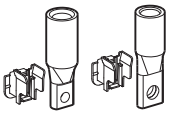
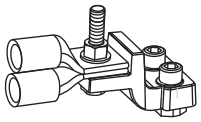
Schneider Electric México, S.A. de C.V.
Calz. J. Rojo Gómez 1121-A
Col. Gpe. del Moral 09300 México, D.F.
Tel. 55-5804-5000
www.schneider-electric.com.mx

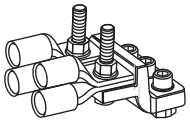




J-frame Compression Lugs



P-frame Compression Lug Kit



R-frame Compression Lug Kit

Table 7.86: Compression Lug Kits for PowerPact Circuit Breakers

	Circuit Breaker Type	System Range	Mounting Type	Dimension A (in)	Max. Lugs per Terminal	Cat. No.	Lugs Per Kit	$ Price Per Kit
Compression Lug Kits for H-frame and J-frame Circuit Breakers								
Aluminum Compression Lug Kits	H-frame	6–2 AWG Al or Cu	Unit	1.2	1	YA060HD	3	**129.00**
		1–4/0 AWG Al or Cu		2.5	1	YA150HD	3	**129.00**
	J-frame	1/0–3/0 AWG Al or Cu		1.2	1	YA150JD	3	**129.00**
		3/0–350 kcmil Al or Cu		2.5	1	YA250J35	3	**129.00**
Copper Compression Lug Kits	H-frame	6–1/0 AWG Cu		1.0	1	CYA060HD	3	**129.00**
		4–2/0 AWG Cu		1.2	1	CYA150HD	3	**129.00**
	J-frame	6–1/0 AWG Cu		0.7	1	CYA150JD	3	**129.00**
		2/0–300 kcmil Cu		1.1	1	CYA250J3	3	**129.00**
Compression Lug Kits for D-frame Circuit Breakers								
Not Available								
Compression Lug Kits for M-frame, P-frame, and R-frame Circuit Breakers								
Aluminum Compression Lug Kits	M-, P-Frame♦	2/0-300 kcmil	Unit	3.7	2	YA250P3	1	**63.00**
		4/0-500 kcmil		3.9	2	YA300P5	1	**63.00**
		2/0-300 kcmil		4.3	2	YA400P3	2	**126.00**
		500-750 kcmil		3.7	2	YA400P7	1	**86.00**
		4/0-500 kcmil		3.9	2	YA600P5	2	**126.00**
		500-750 kcmil		4.3	2	YA800P7	2	**172.00**
	R-Frame▲♦	2/0-300 kcmil	I-line	3.8	4	YA1200R3	4	**252.00**
		4/0-500 kcmil		4.0	4	YA1200R5	4	**252.00**
		500-750 kcmil		4.4	4	YA1200R7	4	**344.00**
		2/0-300 kcmil	Unit	▲	8	YA2000R3	2	**64.00**
		4/0-500 kcmil		▲	8	YA2000R5	2	**64.00**
		500-750 kcmil		▲	8■	YA2500R7	2	**64.00**
Copper Compression Lug Kits	M-, P-Frame♦	4/0-500 kcmil	Unit	3.3	2	CYA400P5	1	**63.00**
		4/0-500 kcmil		3.3	2	CYA600P5	2	**126.00**
		500-750 kcmil		3.6	2	CYA800P7	2	**172.00**
	R-Frame♦	4/0-500 kcmil	I-Line	3.5	4	CYA1200R5	4	**252.00**
		500-750 kcmil		3.8	4	CYA1200R7	4	**344.00**

▲ All unit-mount R-frame circuit breakers require terminal pads for mounting lugs of any type. See page 7-40.
■ 9 lugs for 3000 A circuit breakers
♦ Not for use on I-Line® circuit breakers

PDC6HD6

PDC6JD4

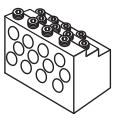
PDC3HD2

PDC3JD20

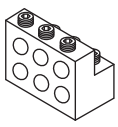
Table 7.87: Power Distribution Connectors for H-frame, J-frame and D-frame Circuit Breakers

Use with Circuit Breaker Type	Circuit Breaker Ampere Rating	Wires Per Terminal & Wire Range	Dimension A (in.)	Cat. No.	Quantity Per Kit	$ Price Per Kit
HD, HG, HJ, HL★	15–150	(6) 14–6 AWG Cu	1.0	PDC6HD6	3	**61.00**
	15–150	(3) 14–2 AWG Cu	1.2	PDC3HD2	3	**61.00**
JD, JG, JJ, JL★	150–250	(6) 14–4 AWG Cu	1.0	PDC6JD4	3	**114.00**
	150–250	(2) 14–1 AWG Cu	1.5	PDC3JD20	3	**114.00**
DG, DJ, DL	150–600	(3) 14–2 AWG (2) 14–2/0 AWG	1.65△	PDC5DG20	3	**258.00**
	150–600	(12) 14–4 AWG	1.65△	PDC12DG4	3	**258.00**

★ OFF end only when OFF end is the load end.



PDC6P20

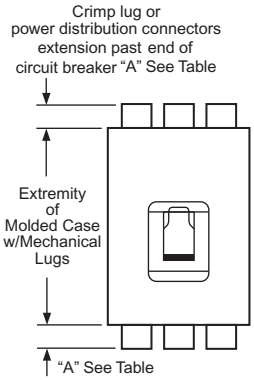


PDC12P4

Table 7.88: Power Distribution Connectors for M-frame and P-frame Circuit Breakers▼

	Ampere Rating	(Wires Per Terminal) Wire Range	Cat. No.	Qty Per Kit	$ Price Per Kit
Use for multiple load connections on one circuit breaker in place of standard distribution block to save space and time. • Use on load end of circuit breaker only • Use in UL508 Industrial Control applications only. • Use in UL1995/CSA C22.2 No. 236 heating and cooling equipment. • For Cu wire only.	250–1200 A	(6) 3–2/0 AWG Cu (6) 6–4 AWG Cu	PDC6P20	3	**258.00**
		(6) 8 AWG Cu (6) 12–10 AWG Cu	PDC6P204	4	**343.00**
	250–1200 A	(12) 6–4 AWG Cu (12) 8 AWG Cu (12) 10 AWG Cu	PDC12P4	3	**258.00**
			PDC12P44	4	**343.00**

▼ Not for use with I-Line® circuit breakers.
△ Kit includes long terminal shield and cover, which adds 1.65 inches to standard lug with short terminal shield.



Product Data Sheet

HDL36150

Molded Case Circuit Breaker (H-Frame) 150A, 3-Pole, 600 Vac/250 Vdc, 80% Rated

Technical Characteristics

Circuit Breaker Type	Standard
Ampere Rating	150A
Fixed Magnetic Trip	Hold: 900A - Trip: 1700A
Approvals	UL Listed - CSA Certified - IEC Rated
General Application	Provides overload and short circuit protection
For Use With	Industrial Enclosures and Switchboards
Frame Type	H-Frame
Voltage Rating	600VAC/250VDC
Mounting Type	Unit Mount
HACR Rated	Yes
Weight	5 Pounds
Marketing Trade Name	Powerpact
Interrupting Rating	25kA@240VAC - 18kA@480VAC - 14kA@600VAC - 20kA@250VDC
Number of Poles	3-Pole
Terminal Type	Line: Lug - Load: Lug
Circuit Breaker Rating	80% Rated
Depth	4.36 Inches
Wire Size	#14 to #3/0 AWG(Al/Cu)
Height	6.40 Inches
Width	4.12 Inches

Shipping and Ordering

Category	01110 -
Discount Schedule	DE2
GTIN	00785901623212
Package Quantity	1
Weight	4.08 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US

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PowerPact® Electronic Motor Circuit Protectors

Turn It On: motor circuit protection solutions that offer reliability and flexibility

Delivering more reliable start-ups, better protection for equipment and a wide range of adjustments to meet users' motor starting needs, the Square D® PowerPact® electronic motor circuit protectors (MCP) are available for the PowerPact H- and J-Frame molded case circuit breakers.

To adjust to users' needs, the new PowerPact MCP has a unique design that includes one dial that allows for a wide range of full load amperes (FLA) adjustment and a second dial for motor selection. These adjustments ensure motor circuits are set to the in-rush characteristics of the motor, while achieving National Electrical Code® (NEC®) compliance.

What can PowerPact electronic motor circuit protectors do for you?

- **Reliable equipment start-ups**
  - Instantaneous trip points align with the motor and NEC requirements to ensure compliant installation
  - Two dials allow quick and precise adjustment of settings to ensure proper protection
- **Simple installation**
  - Wide adjustments range means no need to change devices to cover the starter's horsepower range
  - 30 A MCP has an FLA adjustment range of 1.5 A to 27 A, covering the entire range of a NEMA Size 1 starter
  - Settings align directly with the information published on the motor nameplate for quick and easy installation
- **Improved equipment protection and safety**
  - Improved longevity of equipment from quick and decisive tripping when motor limitations are exceeded
  - Ensures that breaker contacts correspond to the ON, OFF or tripped indication
- **Lower life cycle costs**
  - Due to the PowerPact MCPs flexibility, it eliminates the need to stock a wide variety of unique fuses and non-electronic MCPs

Where do you use PowerPact electronic motor circuit protectors?

- **Industrial Control Panels**
  - Branch Motor Circuits
- **HVAC Equipment**
  - Branch Motor Circuits

a brand of Schneider Electric

SQUARE D

PowerPact® Electronic Motor Circuit Protectors

Product Specifications

Product Feature	Benefit
SCCR Ratings for UL 508A	Up to 100 kA at 480 V SCCR rating with Square D® NEMA and Telemecanique® TeSys® contactors and starters
NEC Code Compliance	Adjustment for standard and energy efficient motors make code compliance simple
Motor In-rush	Trip unit setting to allow dampening for in-rush current from an electric motor
Voltage Ratings	Rated for both wye and delta voltage systems Allowing use on 480 Y/277 V, 480 V delta, 600 Y/347 V and 600 V delta voltages
Certifications	UL, IEC, CSA, NOM and CE

Product Selection

Frame/Current		Full-Load Amperes Range (A)		J Interrupting (see SCCR table)	L Interrupting (see SCCR table)
				Catalog Number	Catalog Number
H-Frame	30A	1.5 – 25	9 – 325	HJL36030M71	HJL36030M71
	50A	14 – 42	84 – 546	HJL36050M72	HJL36050M72
	100A	30 – 80	180 – 1040	HJL36100M73	HJL36100M73
	150A	58 – 130	348 – 1690	HJL36150M74	HJL36150M74
J-Frame	250A	114 – 217	684 – 2500	JJL36250M75	JJL36250M75

For more information

Visit our Web site at www.squared.com/powerpact for more information on the PowerPact MCP.
The following literature is available from your authorized Square D® distributor or Schneider Electric sales office:

- Brochure, New Motor Circuit Protectors Improve Start-ups, document number 0106HO0601
- Catalog, PowerPact H- and J-Frame Circuit Breakers, document number 0611CT0401
- Brochure, UL 508A tested SCCR Combinations 0101BR0601
- Application Guide, PowerPact H- and J-Frame Circuit Breakers, document number 0611BR0401
- Brochure, PowerPact MCCB, document number 0611BR0402
- Application Guide, MCP Based Starters, document number 0600DB0701

For technical support, please call 888-SQUARED.

Schneider Electric - North America

2641 Sumner Boulevard
Raleigh, NC 27616
Tel: 800-468-5342
www.us.squared.com

document number 8000HO0706

02-07 jb

Product Data Sheet

S29450

CIRCUIT BREAKER AUXILIARY SWITCH

SQUARE D by Schneider Electric

List Price $297.00 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Marketing Trade Name	Powerpact
Ampere Rating	6A
Circuit Breaker Type	Standard
Voltage Rating	600VAC
General Application	Provides a Remote Signal Indicating the Circuit Breaker Contacts are Open or Closed, Auxiliary Switch 1A/1B, Trip indication, Overcurrent indication
For Use With	Molded Case Breakers

Shipping and Ordering

Category	01250 - Circuit Breakers, Accessories for M, P & R Frame Breakers, UL/IEC
Discount Schedule	DE2
GTIN	00785901506416
Package Quantity	1
Weight	0.07 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	CN

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Schneider Electric

3" Handle Assembly

Class 9421 Type L Circuit Breaker Mechanisms

Type L door-mounted, variable-depth operating mechanisms feature heavy duty, all metal construction with trip indication. All can be padlocked in the "OFF" position when the enclosure door is open. Further, the handle assemblies can be locked "OFF" with up to three padlocks, which also locks the door closed. (The 3" handle accepts one padlock.)

Complete Kits

Complete kits are rated for NEMA Type 1, 3R and 12 enclosures, and a door-drilling template is supplied to ease installation. They include a handle assembly, operating mechanism, and shaft assembly.

Standard Handle Assembly

Complete Kit Does Not Include Circuit Breaker. Use With			Includes: Operating Mechanism Standard 6" Handle Standard Shaft Kit		Includes: Operating Mechanism Standard 6" Handle Long Shaft Kit		Includes: Operating Mechanism Short 3" Handle Long Shaft Kit	
Circuit Breaker or Interrupter Type	Number of Poles	Frame Size (A)	Type	Mounting Depth▲ Min.-Max.	Type	Mounting Depth▲ Min.-Max.	Type	Mounting Depth▲ Min.-Max.
GJL	3	75, 100	LG1	$5^1/_2$-$10^1/_4$	LG4	$5^1/_2$-$20^7/_8$	LG3	$5^1/_2$-$20^7/_8$
FAL, FCL, FHL	2-3	100	LN1	$5^1/_2$-$10^7/_{16}$	LN4	$5^1/_2$-21	LN3	$5^1/_2$-21
KAL, KCL, KHL	2-3	250	LP1	$6^1/_4$-$11^3/_{16}$	LP4	$6^1/_4$-$21^3/_4$	LP3	$6^1/_4$-$21^3/_4$
LAL, LHL, Q4L	2-3	400	LR1	$6^5/_{16}$-$10^7/_8$	LR4	$6^5/_{16}$-$21^1/_2$	3" handles are not recommended for use with these circuit breakers.	
MEL, MXL	2-3	800	LT1†	$7^3/_{16}$-$11^5/_8$	LT4†	$7^3/_{16}$-$22^1/_4$		
MAL, MHL	2-3	1000	LT1†	$7^3/_{16}$-$11^5/_8$	LT4†	$7^3/_{16}$-$22^1/_4$		
NAL, NCL, NEL, NXL	2-3	1200	LX1†	$8^1/_4$-$12^3/_4$	LX4†	$8^1/_4$-$23^3/_8$		

▲ Mounting depth measured from circuit breaker mounting surface (control panel) to outside of enclosure door in inches.
† Types LT1, LT4, LX1, and LX4 include an 8" handle rather than a 6" handle.

Component Parts

Component parts kits are rated for NEMA Type 1, 3, 3R, 4, 4X, and 12 enclosures. All handle assemblies are painted (the handle is flat black and the base ring is silver).

Operating Mechanism (includes lockout)

Use With			3" Handle Assemblies Type 1, 3R, 12	Std. Handle Assemblies Type 1, 3R, 12	Operating Mechanism Includes Lockout	Standard Shaft (Support Bracket Not Required)		Long Shaft (Support Bracket Included)	
Circuit Breaker or Interrupter Type	No. of Poles	Frame Size (Amps)	Type	Type	Type	Mounting Depth■ Min.-Max.	Type	Mounting Depth■ Min.-Max.	Type
GJL	3	75 100	LH3	LH6	LG7	$5^1/_2$-$10^7/_{16}$	LS8	$5^1/_2$-21	LS12
FAL, FCL, FHL	2-3	100	LH3	LH6	LF1	$5^1/_2$-$10^7/_{16}$	LS8	$5^1/_2$-21	LS12
KAL, KCL, KHL	2-3	250	LH3	LH6	LK1	$6^1/_4$-$11^3/_{16}$	LS8	$6^1/_4$-$21^3/_4$	LS12
LAL, LHL, Q4L	2-3	400	3" handles are not recommended for use with these circuit breakers.	LH6	LL1	$6^5/_{16}$-$10^7/_8$	LS8	$6^5/_{16}$-$21^1/_2$	LS10
MEL, MXL	2-3	800		LH8	LM1	$7^3/_{16}$-$11^5/_8$	LS8	$7^3/_{16}$-$22^1/_4$	LS10
MAL, MHL	2-3	1000		LH8	LM1	$7^3/_{16}$-$11^5/_8$	LS8	$7^3/_{16}$-$22^1/_4$	LS10
NAL, NCL, NEL, NXL	2-3	1200		LH8	LX7	$8^1/_4$-$12^3/_4$	LS8	$8^1/_4$-$23^3/_8$	LS10

■ Mounting depth measured from circuit breaker mounting surface (control panel) to outside of enclosure door in inches.

IEC-Style Handle (for use with 9421LG8, see page 11)

NEMA Type 3 and 4 Handle Assemblies∗

Use With			Standard Handle Assemblies		Special 3" Version	
Circuit Breaker or Interrupter Type	No. of Poles	Frame Size (Amps)	NEMA Type 3, 4 (Painted) Type	NEMA Type 3, 4, 4X (Chrome Plated) Type	NEMA Type 3, 4 (Painted) Type	NEMA Type 3, 4, 4X (Chrome Plated) Type
GJL	3	75	LH46	LC46	LH43	LC43
FAL, FCL, FHL	2-3	100	LH46	LC46	LH43	LC43
KAL, KCL, KHL	2-3	250	LH46	LC46	LH43	LC43
LAL, LHL, Q4L	2-3	400	LH46	LC46	3" handles are not recommended for use with these circuit breakers.	
MEL, MXL	2-3	800	LH48	LC48		
MAL, MHL	2-3	1000	LH48	LC48		
NAL, NCL, NEL, NXL	2-3	1200	LH48	LC48		

∗ Due to gasketing, NEMA Type 3 & 4 handle assemblies are NOT trip indicating.

File E62922
CCN: DIHS2

Product Data Sheet

9421LS8

OPERATING MECHANISM STANDARD SHAFT NEMA

Technical Characteristics

For Use With	All 9421L Operating Mechanisms
Shaft Type	Standard

Shipping and Ordering

Category	21731 - Mechanism, Operating, Door Mounted, For Circuit Breakers, Type L
Discount Schedule	CP1
GTIN	00785901830184
Package Quantity	1
Weight	0.6 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	MX

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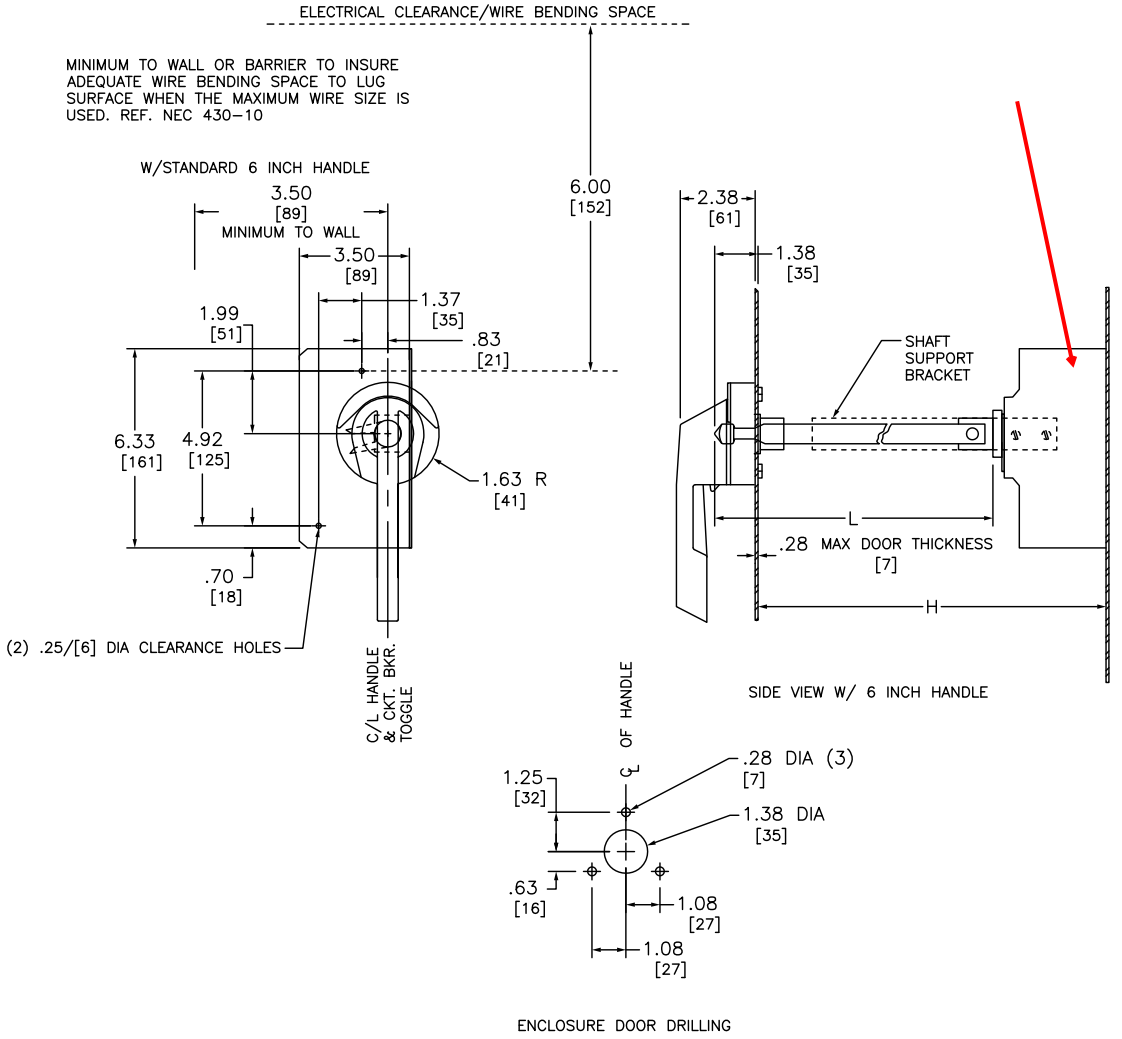
TYPE	HANDLE LENGTH (INCHES)	HANDLE CAT. NUM.	SHAFT TYPE	SHAFT CAT. NUM.
LJ1	6	LH6	STANDARD	LS8
LJ4	6	LH6	LONG	LS13

DIMENSION H W/STANDARD SHAFT		DIMENSION H W/LONG SHAFT	
MIN	MAX	MIN	MAX
5.50/[140]	10.75/[273]	5.50/[140]	21.38/[543]

SHAFT LENGTH FORMULA: L=H−3/[76]
MOUNTING DEPTH (H): MEASURED FROM THE CIRCUIT BREAKER MOUNTING SURFACE TO THE OUTSIDE OF THE ENCLOSURE DOOR.

IF THE SHAFT LENGTH IS GREATER THAN 10/[254] A SHAFT SUPPORT BRACKET MUST BE USED.



CATALOG NUMBER: 9421−LJ1, LJ4, LJ7
RATINGS: FOR USE W/POWERPACT H & J 3 POLE CIRCUIT BREAKER
UL FILE/CCN: E62922/DIHS2
MEETS STANDARDS: −
WEIGHT: −
WIRE SIZE: −
TERMINAL TORQUE: −
MOUNTING HWD: (2) M5 x .8 DIA SCREWS

OPERATING MECHANISM
CLASS 9421
TYPE LJ1, LJ4, LJ7
LZ250..., LZL250L...

SQUARE D
Schneider Electric

DWG# NO. 9422 LJ_OUTLINE_001

NOVEMBER 2005

UL 489 Listed 240 Vac C60 Circuit Breakers (AC)

A selected range of Multi-9 circuit breakers rated 240 V are UL 489 Listed. Unlike UL 1077 Supplementary Protectors, these UL 489 circuit breakers can be used for branch circuit protection as required by the National Electrical Code.

As shown in tables Table 5 and Table 6, the UL 489 Listed products are available in C and D curves. They include devices ranging from 0.5 to 35 A.

UL 489 Listed Multi 9 C60 Circuit Breakers

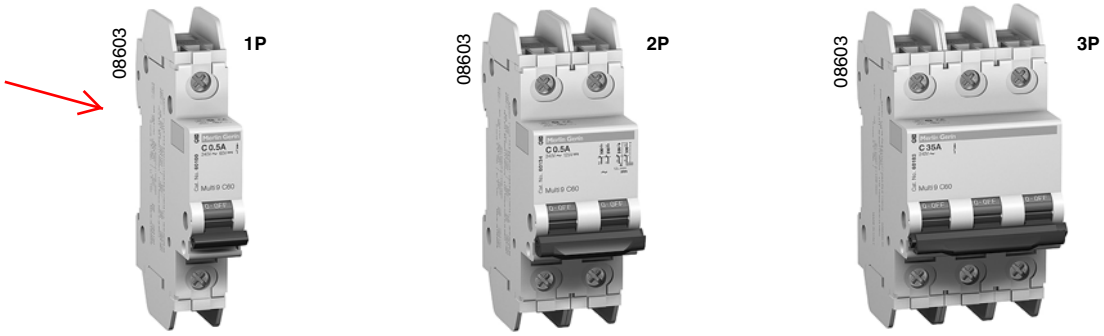


Table 4: Specifications for UL 489 240 V Listed C60N Circuit Breakers

High Voltage Withstand	6 kV	
Connector: Box Lug	Rating	UL 486A File No. E216919 (Use with Copper Wire Only)
	Connection	0.5–25 A: 14–4 AWG (2–25 mm^2) Cables Torque to 22 lb-in. (2.48 N•m) 30–35 A: 14–2 AWG (1–35 mm^2) Cables Torque to 31 lb-in. (3.52 N•m)
Connector: Ring Tongue	Use Single UL Listed or CSA Certified Insulated Ring Tongue Only	Screw dia. 0.2 in. (5 mm) Torque to 18 lb-in. (2.03 N•m)
	Max Ring Terminal Width	0.54 in. (14 mm)
Mounting	35 mm DIN rail	
Degree of Protection	Case	IP40 as per IEC 529
	Terminals	IP20
Temperatures	Calibration	25°C (77°F)
	Storage	-40 to 80°C (-40 to 176°F)
	Operating	-30 to 70°C (-22 to 158°F)
Plug-On Auxiliary Modules with Mechanical Linkage:	MN Undervoltage Trip	
	MX + OF Shunt Trip/Auxiliary Switch	
	OF Auxiliary Switch	
	SD Alarm Switch	
Tropicalization	Treatment 2	Relative Humidity: 95% at 131°F (55°C)
Number of Operating Cycles	Electrical (O-C)	6,000 load, 4,000 no-load
See specifications Table 2 for dimensions, weights and interrupting ratings		

Standard Features

- Fast closing: Allows increased withstand to the high inrush currents of some loads.
- Trip-free mechanism: Contacts cannot be held in the I-ON position when the C60 circuit breaker is tripped automatically.
- Positive indication of contact disconnect. Green mechanical indication on front face of circuit breaker shows that all poles are open.
- C curve: Overcurrent protection for all application types. Magnetic release operates from 7 to 10 times ampere rating (7 to 14 for DC applications).

- D curve: Overcurrent protection for loads with high inrush currents (motors, transformers). Magnetic release operates between 10 and 14 times ampere rating (no dc rating for D curve).
- Suitable for reverse feeding.
- Allows locking in O-OFF position using padlock attachment.

Connections

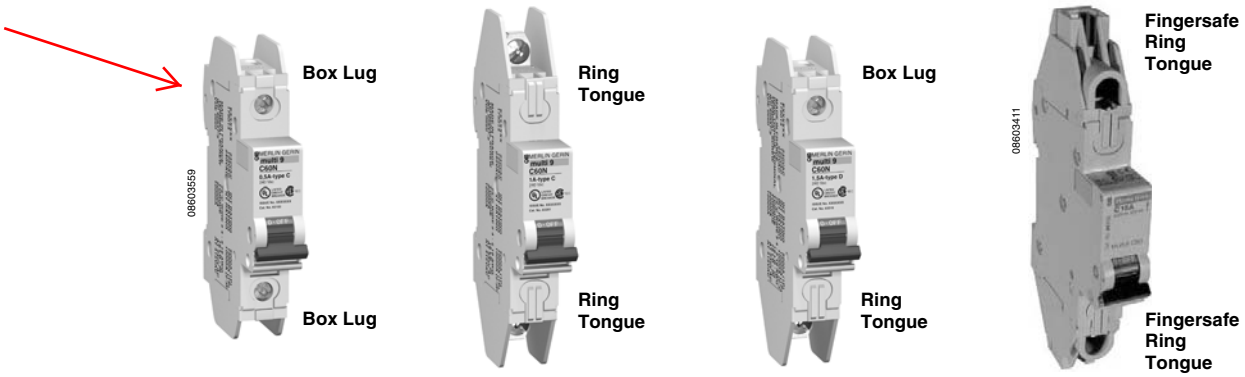
Three versions of field wiring connectors are available for the 240 Vac UL 489 Listed devices:

- Box lug, meeting UL 486A requirements
- Ring tongue terminal with 5 mm screw
- Ring Tongue terminals with Fingersafe (IP20) shrouds

The circuit breakers can be ordered with the following combinations of connectors:

- Line terminal box lug/load terminal box lug
- Line terminal ring tongue/load terminal ring tongue (for fingersafe version, add -F suffix to catalog number)
- Line terminal box lug/load terminal ring tongue

Figure 5: Connection Options for 240 Vac UL 489 Listed Devices



Standards

- UL 489 Circuit Breaker: File No. E215117
- Single pole 15–20 A is UL Listed as SWD (switching duty).
- 1-, 2-, and 3-pole 15–35 A are HID (high intensity discharge) rated.
- CSA C22.2 No. 5.1 Circuit Breakers: File No. 179014
- IEC 60947-2
- CE Marked

Catalog Numbers

Table 5: Catalog Numbers for C Curve, UL 489 Listed 240 Vac C60 Miniature Circuit Breakers (Box Lug and Ring Tongue Terminal Combinations)

Rating	1P			2P			3P		
	Box/Box	Ring/Ring[1]	Box/Ring	Box/Box	Ring/Ring[1]	Box/Ring	Box/Box	Ring/Ring[1]	Box/Ring
0.5 A	60100	60200	60300	60134	60234	60334	—	—	—
1 A	60101	60201	60301	60135	60235	60335	60168	60268	60368
1.5 A	60102	60202	60302	60136	60236	60336	60169	60269	60369
2 A	60103	60203	60303	60137	60237	60337	60170	60270	60370
3 A	60104	60204	60304	60138	60238	60338	60171	60271	60371
4 A	60105	60205	60305	60139	60239	60339	60172	60272	60372
5 A	60106	60206	60306	60140	60240	60340	60173	60273	60373
6 A	60107	60207	60307	60141	60241	60341	60174	60274	60374
7 A	60108	60208	60308	60142	60242	60342	60175	60275	60375
8 A	60109	60209	60309	60143	60243	60343	60176	60276	60376
10 A	60110	60210	60310	60144	60244	60344	60177	60277	60377
13 A	60111	60211	60311	60145	60245	60345	60178	60278	60378
15 A	60112	60212	60312	60146	60246	60346	60179	60279	60379
20 A	60113	60213	60313	60147	60247	60347	60180	60280	60380
25 A	60114	60214	60314	60148	60248	60348	60181	60281	60381
30 A	60115	60215	60315	60149	60249	60349	60182	60282	60382
35 A	60116	60216	60316	60150	60250	60350	60183	60283	60383

[1] IP-20 Fingersafe ring tongue terminals may be ordered with an F suffix (example: 60210F)

Table 6: Catalog Numbers for D Curve, UL 489 Listed 240 Vac C60 Miniature Circuit Breakers (Line/Load as Box Lug or Ring Tongue Terminals)

Rating	1P			2P			3P		
	Box/Box	Ring/Ring[1]	Box/Ring	Box/Box	Ring/Ring[1]	Box/Ring	Box/Box	Ring/Ring[1]	Box/Ring
0.5 A	60117	60217	60317	60151	60251	60351	—	—	—
1 A	60118	60218	60318	60152	60252	60352	60184	60284	60384
1.5 A	60119	60219	60319	60153	60253	60353	60185	60285	60385
2 A	60120	60220	60320	60154	60254	60354	60186	60286	60386
3 A	60121	60221	60321	60155	60255	60355	60187	60287	60387
4 A	60122	60222	60322	60156	60256	60356	60188	60288	60388
5 A	60123	60223	60323	60157	60257	60357	60189	60289	60389
6 A	60124	60224	60324	60158	60258	60358	60190	60290	60390
7 A	60125	60225	60325	60159	60259	60359	60191	60291	60391
8 A	60126	60226	60326	60160	60260	60360	60192	60292	60392
10 A	60127	60227	60327	60161	60261	60361	60193	60293	60393
13 A	60128	60228	60328	60162	60262	60362	60194	60294	60394
15 A	60129	60229	60329	60163	60263	60363	60195	60295	60395
20 A	60130	60230	60330	60164	60264	60364	60196	60296	60396
25 A	60131	60231	60331	60165	60265	60365	60197	60297	60397
30 A	60132	60232	60332	60166	60266	60366	60198	60298	60398
35 A	60133	60233	60333	60167	60267	60367	60199	60299	60399

[1] IP-20 Fingersafe ring tongue terminals may be ordered with an F suffix (example: 60210F)

NOTE: UL 489 Listed Multi 9 circuit breakers are calibrated at 25°C (77°F). Please refer to the rating tables (page 80) for applications at temperatures greater than 25°C (77°F).

NOTE: The NEC requires that the continuous load applied to the circuit breaker shall not exceed 80% of the circuit breaker ampere rating.

UL 489 Listed 480Y/277 Vac C60 Circuit Breakers (AC)

The UL 489 Listed 480Y/277 Vac Multi 9 C60 miniature circuit breakers can be used in 480Y/277 Vac systems. With amperages from 0.5 A to 20 A, they are ideal for fuse replacement, yet carry the UL 489 Listing that is required for branch circuit applications. See specifications on Table 2 for dimensions, weights, and interrupting ratings.

Table 7: Specifications for UL 489 Listed 480Y/277 Vac C60 Circuit Breakers

Interruption Rating	2P and 3P 1P	480Y/277 V @ 10kA 277 Vac @ 10kA
Amperage	0.5 A through 20 A	
Construction	1P, 2P and 3P	
Magnetic Trip Curves	C-curve D-curve	7 to 10 Times Ampere Rating 10 to 14 Times Ampere Rating
UL 486E Listed 2-Barrel Lug	18–16 AWG (1–1.5 mm^2), Cu Only Stranded Wire: 14–10 AWG (2–5 mm^2), Cu Only Solid or Stranded Wire	Torque to 7 lb-in (0.68 N•m) Torque to 14 lb-in (1.6 N•m)
Ring Tongue Screw	5 mm	Torque to 18 lb-in (2 N•m)
Plug-On Auxiliary Modules With Mechanical Linkage:	MN Undervoltage Trip MX + OF Shunt Trip/Auxiliary Switch OF Auxiliary Switch SD Alarm Switch	
Mounting	35 mm DIN Rail	
See selection Table 2 for dimensions, weights, and interrupting ratings.		

Benefits

- Satisfies customer's preferences to use circuit breakers instead of fuses.
- Eliminates costs of spare fuses, blown fuse indicators, additional wiring, etc.
- Reduces concerns and uncertainty of misapplying a UL 1077 supplementary protector where a UL 489 branch circuit breaker is required.
- Facilitates one common design for UL 489, CSA and IEC applications.
- Simplifies installation with a compact, DIN-mounted circuit breaker that accepts a wide range of accessories.
- Offers alternative terminations for ring terminals or cable.

Standard Features

- Fast closing: Allows increased withstand to the high inrush currents of some loads.
- Trip-free mechanism: Contacts cannot be held in the I-ON position when the circuit breaker is tripped automatically.
- Positive indication of contact disconnect. Green mechanical indication on front face of device shows that all poles are open.
- C curve: Overcurrent protection for all application types. Magnetic release operates from 7 to 10 times ampere rating. (7 to 14 for dc)
- D curve: Overcurrent protection for loads with high inrush currents (motors, transformers). Magnetic release operates between 10 and 14 times ampere rating (no dc rating for D curve).
- Suitable for reverse feeding
- Allows locking in O-OFF position using padlock attachment.

Connections

Two versions of field wiring connectors are available:

- Two-barrel lug with binding screws for two 18–10 AWG wires.
- Crimp-type ring tongue terminal for up to 8 AWG wire

Both of these terminals provide fingersafe ingress protection per IP20 of IEC EN60529. This feature reduces the potential of incidental contact with live circuit breaker components.

Standards

- UL 489 Listed
- CSA C22.2 No. 5.1
- IEC 60947-2
- CE Marked

Catalog Numbers

Table 8: Catalog Numbers for UL 489 Listed 480Y/277 V C60 Miniature Circuit Breakers (AC)

Rating	2-Barrel Wire Lug			Ring-Tongue Terminal		
	1P	2P	3P	1P	2P	3P
C-curve, 7–10 Times Ampere Rating						
0.5 A	MGN61300	—	—	MGN61366	—	—
1 A	MGN61301	MGN61312	MGN61323	MGN61367	MGN61378	MGN61389
2 A	MGN61302	MGN61313	MGN61324	MGN61368	MGN61379	MGN61390
3 A	MGN61303	MGN61314	MGN61325	MGN61369	MGN61380	MGN61391
4 A	MGN61304	MGN61315	MGN61326	MGN61370	MGN61381	MGN61392
5 A	MGN61305	MGN61316	MGN61327	MGN61371	MGN61382	MGN61393
6 A	MGN61306	MGN61317	MGN61328	MGN61372	MGN61383	MGN61394
8 A	MGN61307	MGN61318	MGN61329	MGN61373	MGN61384	MGN61395
10 A	MGN61308	MGN61319	MGN61330	MGN61374	MGN61385	MGN61396
15 A	MGN61309	MGN61320	MGN61331	MGN61375	MGN61386	MGN61397
20 A	MGN61310	MGN61321	MGN61332	MGN61376	MGN61387	MGN61398
D-curve, 10–14 Times Ampere Rating						
0.5 A	MGN61333	—	—	MGN61399	—	—
1 A	MGN61334	MGN61345	MGN61356	MGN61400	MGN61411	MGN61422
2 A	MGN61335	MGN61346	MGN61357	MGN61401	MGN61412	MGN61423
3 A	MGN61336	MGN61347	MGN61358	MGN61402	MGN61413	MGN61424
4 A	MGN61337	MGN61348	MGN61359	MGN61403	MGN61414	MGN61425
5 A	MGN61338	MGN61349	MGN61360	MGN61404	MGN61415	MGN61426
6 A	MGN61339	MGN61350	MGN61361	MGN61405	MGN61416	MGN61427
8 A	MGN61340	MGN61351	MGN61362	MGN61406	MGN61417	MGN61428
10 A	MGN61341	MGN61352	MGN61363	MGN61407	MGN61418	MGN61429
15 A	MGN61342	MGN61353	MGN61364	MGN61408	MGN61419	MGN61430
20 A	MGN61343	MGN61354	MGN61365	MGN61409	MGN61420	MGN61431

Standard Features	
Selectable Start Times	2, 5, 10, 15, 20, 25, or 30 s
Selectable Initial Torque	0%, 25%, 35%, and 65% of locked rotor torque
Selectable Current Limit	150%, 250%, 350%, and 450% of full load current
Selectable Kick Start — 450% FLA	0, 0.5, 1.0, or 1.5 s
Selectable Soft Stop	Off, 100%, 200%, or 300% of the start time setting when wired

Electrical Ratings

			UL/CSA/NEMA	IEC
Power Circuit	Rated Operation Voltage		200…480V AC 200…600V AC	200…480V~ — 400V~
	Rated Insulation Voltage		600V AC	500V~ — 500V~
	Dielectric Withstand		2200V AC	500V~
	Repetitive Peak		200…480V AC: 1400V 200…600V AC: 1600V	2500V~
	Operating Frequency		50/60 Hz	200…480V~: 1400V
	Utilization Category	1…37 A	—	500V~: 1600V
		43…60 A	—	50/60 Hz
		85 A	—	AC-53b: 3.5-15:3585
		108 A	—	AC-53b: 4.5-30:1770
		135 A	—	AC-53b: 4.5-30:3570
		201…251 A	—	AC-53b: 3.5-30: 1770
		317…480 A	—	AC-53b: 3.5-30: 1770
	Number of Poles		Equipment designed for 3-phase only	
	Rated Impulse Voltage		6 kV	
	DV/DT Protection		1000V/µs	
	Overvoltage Category		III	

			Type 1					
	SCPD Performance		Non-Time Delay		Thermal Magnetic Circuit Breaker		High Capacity Time Delay Class CC/J/L	
	SCPD List‡		Max. Standard Available Fault	Max. Standard Fuse (A)❄	Max. Standard Available Fault	Max. Circuit Breaker (A)	Max. Standard Available Fault	Max. Fuse (A)
Short Circuit Protection	Line Device Operational Current Rating (A)	3	5 kA	12	5 kA	12	70 kA	6
		9	5 kA	30	5 kA	30	70 kA	15
		16	5 kA	60	5 kA	60	42 kA	30
		19	5 kA	70	5 kA	70	42 kA	40
		25	5 kA	100	5 kA	100	42 kA	50
		30	5 kA	110	5 kA	110	42 kA	60
		37	5 kA	125	5 kA	125	42 kA	60
		43	10 kA	150	10 kA	150	70 kA	90
		60	10 kA	225	10 kA	225	70 kA	125
		85	10 kA	300	10 kA	300	70 kA	175
		108	18 kA	400	18 kA	300	70 kA	200
		135	18 kA	500	18 kA	400	70 kA	225
		201	18 kA	600	18 kA	600	70 kA	350
		251	30 kA	700	30 kA	700	70 kA	400
		317	30 kA	800	30 kA	800	69 kA	500
		361	42 kA	1000	30 kA	1000	69 kA	600
		480	42 kA	1200	30 kA	1200	69 kA	800
	Delta Device Operational Current Rating (A)	5.1	5 kA	12	5 kA	12	70 kA	6
		16	5 kA	30	5 kA	30	70 kA	15
		27.6	5 kA	60	5 kA	60	42 kA	30
		32.8	5 kA	70	5 kA	70	42 kA	40
		43	5 kA	100	5 kA	100	42 kA	50
		52	5 kA	110	5 kA	110	42 kA	60
		64	5 kA	125	5 kA	125	42 kA	60
		74	10 kA	250	10 kA	250	70 kA	150
		104	10 kA	400	10 kA	300	70 kA	200
		147	10 kA	400	10 kA	400	70 kA	200
		187	18 kA	600	18 kA	500	70 kA	300
		234	18 kA	700	18 kA	700	70 kA	400
		348	18 kA	1000	18 kA	1000	70 kA	600
		435	30 kA	1200	30 kA	1200	69 kA	800
		549	30 kA	1600	30 kA	1600	69 kA	1000
		625	42 kA	1600	30 kA	1600	69 kA	1200
		831	42 kA	1600	30 kA	1600	69 kA	1600

❄ Non-time delay fuses (K5).
‡ Consult local codes for proper sizing of short circuit protection.

Electrical Ratings				
			UL/CSA/NEMA	IEC
Control Circuit	Rated Operational Voltage (+10%, –15%)		100…240V AC, 24V AC/DC	100…240V~, 24V AC/DC
	Rated Insulation Voltage		250V	250V~
	Rated Impulse Voltage		—	4 kV
	Dielectric Withstand		1500V AC	2000V~
	Overvoltage Category		—	III*
	Operating Frequency		50/60 Hz	50/60 Hz
	Input onstate voltage minimum, during start (IN1, IN2)		85V AC, 19.2V DC / 19.2V AC	
	Input onstate current (IN1, IN2)		9.8 mA @120V AC/19.6 mA @ 240V AC, 7.3 mA @ 24V AC/DC	
	Input offstate voltage maximum (IN1, IN2)		40V AC, 17V DC / 12V AC	
	Input offstate current @ input offstate voltage (IN1, IN2)		<10 mA, <12 mA	
	Control Power with Fan, during start	3…37 A	215 mA @ 120V AC / 180 mA @ 240V AC, 800 mA @ 24V DC / 660 mA @ 24V AC	
		43…85 A	200 mA @ 120V AC / 100 mA @ 240V AC, 700 mA @ 24V AC/DC	
			Fan Power	**Control Power**
		108…135 A	20 VA	200 mA @ 120V AC / 120 mA @ 240V AC, 600 mA @ 24V AC/DC
		201…251 A	40 VA	
		317…480 A	60 VA	
	Control Power without Fan, during start	3…37 A	205 mA @ 120V AC / 145 mA @ 240V AC, 705 mA @ 24V DC / 580 mA @ 24V AC	

Steady State Heat Dissipation and Overload Current Range			
	Controller Rating (A)	Steady State Heat Dissipation (W)	Overload Current Range (A)
	3	11	1…3
	9	12	3…9
	16	14	5.3…16
	19	15	6.3…19
	25	17	9.2…27.7
	30	19	10…30
	37	24	12.3…37
	43	34	14.3…43
	60	50	20…60
	85	82	28.3…85
	108	62	27…108
	135	75	34…135
	201	129	67…201
	251	147	84…251
	317	174	106…317
	361	194	120…361
	480	239	160…480

Auxiliary Contacts			
		UL/CSA/NEMA	IEC
Rated Operational Voltage		250V AC/30V DC	250V~/30V DC
Rated Insulation Voltage		250V	250V~
Rated Impulse Voltage		—	4 kV
Dielectric Withstand		1500V AC	2000V~
Overvoltage Category		—	III*
Operating Frequency		50/60 Hz	50/60 Hz
Utilization Category		D300/D300	AC-15/DC
TB-97, -98 (OVLD/Fault)	Type of Control Circuit	Electromagnetic relay	
	Number of Contacts	1	
	Type of Contacts	Normally Open (N.O.)	
	Type of Current	AC/DC	
	Rated Operational Current (max.)	0.6 A @ 120V~ and 0.3 A @ 240V~	
	Conventional Thermal Current I_{th}	1 A	
	Make/Break VA	432/72	
TB-13, -14 (Normal/Up-to-Speed)	Type of Control Circuit	Electromagnetic relay	
	Number of Contacts	1	
	Type of Contacts	Normally Open (N.O.)	
	Type of Current	AC/DC	
	Rated Operational Current (max.)	0.6 A @ 120V~ and 0.3 A @ 240V~	
	Conventional Thermal Current I_{th}	1 A	
	Make/Break VA	432/72	

*Overvoltage category II, when either control or auxiliary circuit is wired to a SELV or PELV circuit.

Electrical Ratings			
Side-Mount Auxiliary Contacts			
		UL/CSA/NEMA	IEC
Rated Operational Voltage		250V AC/30V DC	250V AC/30V DC
Rated Insulation Voltage		250V	250V AC
Rated Impulse Voltage		—	4 kV
Dielectric Withstand		1500V AC	2000V AC
Overvoltage Category		—	III*
Operating Frequency		50/60 Hz	50/60 Hz
TB-23, -24 (Normal/Up-to-Speed) TB-33, -34 (Normal/Up-to-Speed)	Utilization Category	C300/R150	AC-15/DC-13
	Type of Control Circuit	Electromagnetic relay	
	Number of Contacts	1	
	Type of Contacts	Normally Open (N.O.)	
	Type of Current	AC/DC	
	Rated Operational Current (max.)	1.5 A @ 120V AC, 0.75A @ 240V AC, 1.17 A @ 24V DC	
	Conventional Thermal Current I_{th}	2.5 A	
	Make/Break VA	1800/180V AC, 28V DC (resistive)	
TB-11, -12 (Normal/Up-to-Speed)	Type of Control Circuit	B300/R300	AC-15/DC-13
	Type of Control Circuit	Electromagnetic relay	
	Number of Contacts	1	
	Type of Contacts	Normally Open (N.O.)	
	Type of Current	AC/DC	
	Rated Operational Current (max.)	3 A @ 120V AC, 1.5A @ 240V AC, 1.17 A @ 24V DC	
	Conventional Thermal Current I_{th}	5 A	
	Make/Break VA	3600/360 V AC, 28V DC (resistive)	

*Overvoltage category II, when either control or auxiliary circuit is wired to a SELV or PELV circuit.

Environmental	
Operating Temperature Range	-5…50 °C (23…122 °F) (open) -5…40 °C (23…104 °F) (enclosed)
Storage and Transportation Temperature Range	-25…85 °C (-13…185 °F)
Altitude	2000 m (6560 ft)
Humidity	5…95% (non-condensing)
Pollution Degree	2
Type of Protection	IP2X

Mechanical Ratings			
Resistance to Vibration	Operational		1.0 G Peak, 0.15 mm (0.006 in.) displacement
	Non-Operational		2.5 G Peak, 0.38 mm (0.015 in.) displacement
Resistance to Shock	Operational		15 G
	Non-Operational		30 G
Line Power Terminals	Cable Size Tightening Torque	3…37 A	2.5…25 mm2 (14…4 AWG) 2.3…2.8 N•m (20…25 in-lbs)
		43…85 A	2.5…95 mm2 (14…3/0 AWG) 11.3…12.4 N•m (100…110 in-lbs)
		108…135 A	23 N•m (200 in-lbs)
		201…251 A	Two M10 x 1.5 diameter holes per power pole
		317…480 A	Two M12 x 1.75 diameter holes per power pole
Load Power Terminals	Cable Size Tightening Torque	3…37 A	2.5…16 mm2 (14…6 AWG) 2.3…2.5 N•m (20…22.5 in-lbs)
		43…85 A	2.5…50 mm2 (14…1 AWG) 11.3…12.4 N•m (100…110 in-lbs)
		108…135 A	23 N•m (200 in-lbs)
		201…251 A	Two M10 x 1.5 diameter holes per power pole
		317…480 A	Two M12 x 1.75 diameter holes per power pole
Control Terminals	Cable Size Tightening Torque	All	0.2…2.5 mm2 (24…14 AWG) 0.5…0.9 N•m (4.4…8.0 in-lbs)

Other			
		UL/CSA/NEMA	IEC
EMC Emission Levels	Conducted Radio Frequency Emissions	—	Class A
	Radiated Emissions	—	Class A
EMC Immunity Levels	Electrostatic Discharge	4 kV Contact and 8 kV Air Discharge	8 kV Air Discharge
	Radio Frequency Electromagnetic Field	—	Per EN/IEC 60947-4-2
	Fast Transient	—	Per EN/IEC 60947-4-2
	Surge Transient	—	Per EN/IEC 60947-4-2

Type T MultiTap™ Universal Control Transformer

Features:

- Stocked in a wide variety of sizes
- Derives 120 or near 120V control power from a wide variety of supply voltages
- Compatible with Square D FINGERSAFE® Covers
- Compatible with Square D Control Power Fuse Kits
- Competitively priced with other universal control power transformers on the market
- Meets the following markings/approvals: UL, CUL, CSA, CE, NOM, TUV
- Manufactured in ISO9001-approved manufacturing facility

Universal Voltage Code D50:

- *Primary* 240/416/480/600V to *Secondary* 99/120/130V
- *Primary* 230/400/460/575V to *Secondary* 95/115/125V
- *Primary* 220/380/440/550V to *Secondary* 91/100/120V
- *Primary* 208/500V to *Secondary* 85/100/110V

Maximum application flexibility from a single unit, for any supply voltage level

The Type T MultiTap™ Universal Control Transformer allows 120V — or near 120V — control power from a wide variety of available source voltages. Broad voltage coverage allows the MultiTap Universal Control Transformer to meet a wide variety of applications regardless of the available voltage supply level. So you won't need to know the available supply voltage in order to select the best transformer solution to meet your application needs.

In many applications, details such as the available supply voltage may be difficult to obtain and can often delay a project due to the lack of information. When using the MultiTap Universal Control Transformer, you only need to know the size requirements of the application. For designers working on export projects, this feature can be quite valuable.

MultiTap Universal Control Transformer units are available in sizes ranging from 50 through 3000 VA, and Square D stocks 50, 100, 150, 250, 350 and 500 VA versions.

Merlin Gerin
Modicon
Square D
Telemecanique
Schneider Electric Brands

SQUARE D
Schneider Electric

Figure 1

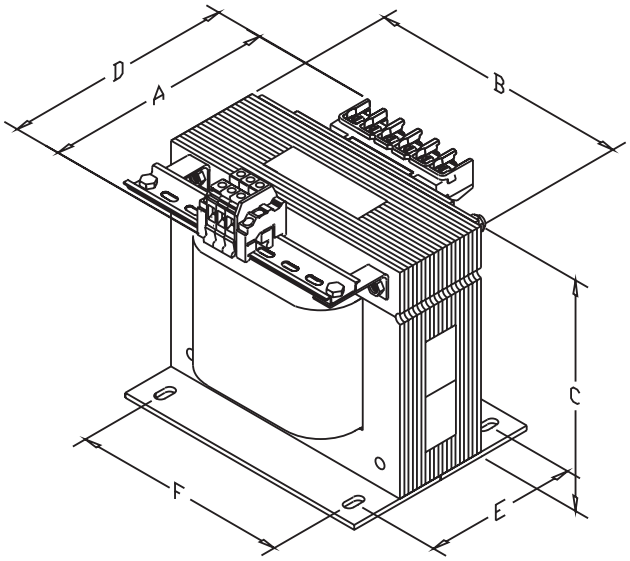
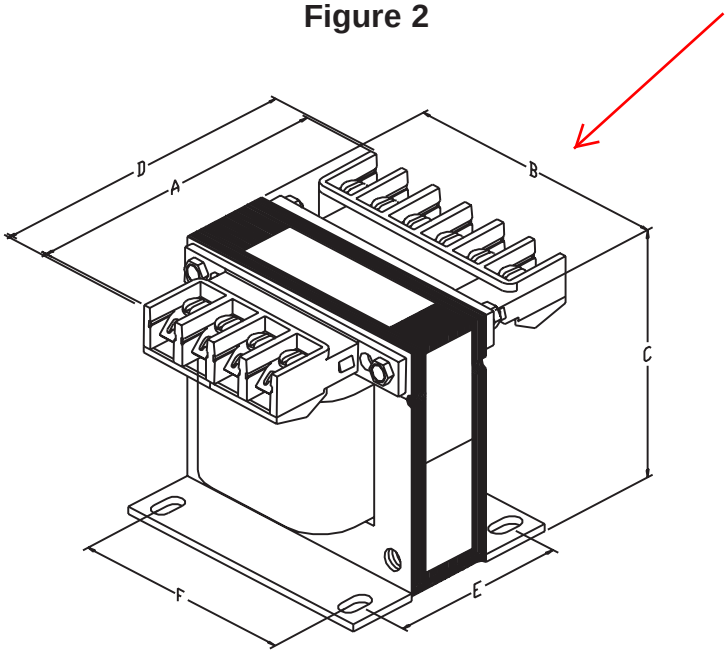


Figure 2



MultiTap™ Universal Control Transformer Dimensions

VA	A		B		C		E		F		Slots				
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	Figure
50	4.19	106.4	3.43	87.1	2.89	73.4	2.38	60.5	2.81	71.4	0.2	5.1 X	0.48	12.2	2
75	4.88	124.0	3.75	95.3	3.2	81.3	2.88	73.2	3.13	79.5	0.2	5.1 X	0.38	9.7	2
100	5.25	133.4	3.75	95.3	3.25	82.6	2.88	73.2	3.13	79.5	0.2	5.1 X	0.38	9.7	2
150	4.7	119.4	4.5	114.3	3.8	96.5	2.56	65.0	3.75	95.3	0.2	5.1 X	0.38	9.7	2
200	5.09	129.3	4.5	114.3	3.8	96.5	3	76.2	3.75	95.3	0.2	5.1 X	0.38	9.7	2
250	5.09	129.3	4.5	114.3	3.8	96.5	3	76.2	3.75	95.3	0.2	5.1 X	0.38	9.7	2
300	5.46	138.7	4.5	114.3	3.8	96.5	3.56	90.4	3.75	95.3	0.2	5.1 X	0.38	9.7	2
350	5.66	143.8	5.25	133.4	4.43	112.5	3.43	87.1	4.38	111.3	0.28	7.1 X	0.56	14.2	2
500	5.66	143.8	5.25	133.4	4.43	112.5	3.43	87.1	4.38	111.3	0.28	7.1 X	0.56	14.2	2
750	6.04	153.4	5.25	133.4	4.43	112.5	4.31	109.5	4.38	111.3	0.28	7.1 X	0.56	14.2	2
1000	5.81	147.6	7.06	179.3	6.16	156.5	4.13	104.9	5.81	147.6	0.28	7.1 X	0.56	14.2	2
1500	7.04	178.8	7.06	179.3	6.16	156.5	4.56	115.8	5.81	147.6	0.28	7.1 X	0.56	14.2	2
2000	6.86	174.2	9	228.6	8.46	214.9	4.63	117.6	7.63	193.8	0.44	11.2 X	0.69	17.5	2
3000	8.73	221.7	9	228.6	8.46	214.9	6.56	166.6	7.63	193.8	0.44	11.2 X	0.69	17.5	1

SQUARE D
Schneider Electric

Order Number 9070HO9901

Class CC Fuseblocks
600 Volt, 30 Amps

BC
Series

Catalog Symbol: BC Series
Class CC Fuseblocks
For use with Class CC Fuses (Bussmann LP-CC, KTK-R, and FRQ-R)
Ampere Rating: 1/10 to 30A
Voltage Rating: 600V
Withstand Rating: 200,000A RMS Sym.
Agency Information:
UL Listed, UL 512, Guide IZLT, File E14853
CSA Certified, C22.2 No. 39, Class 6225-01, File 47235
UL Flammability: 94VO
Materials: Base - Thermoplastic
Clips - Bright tin-plated bronze
DIN-RAIL Adapters: DRA-1 and DRA-2

Catalog Data

Amps	Poles	Terminal Type: Screw	Screw with Quick Connect*	Pressure Plate	Pressure Plate w/ Quick Connect*	Box Lug
1/10	1	BC6031S	BC6031SQ	BC6031P	BC6031PQ	BC6031B
to	2	BC6032S	BC6032SQ	BC6032P	BC6032PQ	BC6032B
30	3	BC6033S	BC6033SQ	BC6033P	BC6033PQ	BC6033B

Wire Range CU Only

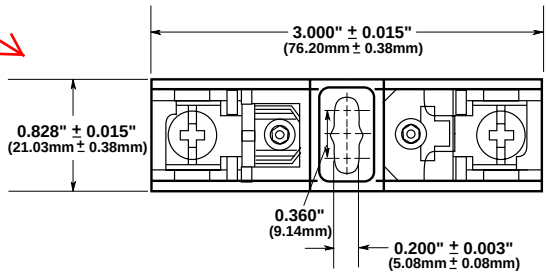
#10-#14 #10-#14 #10-#14 #10-#14 #6-#14

* QUICK CONNECT RATED FOR 20A MAXIMUM.

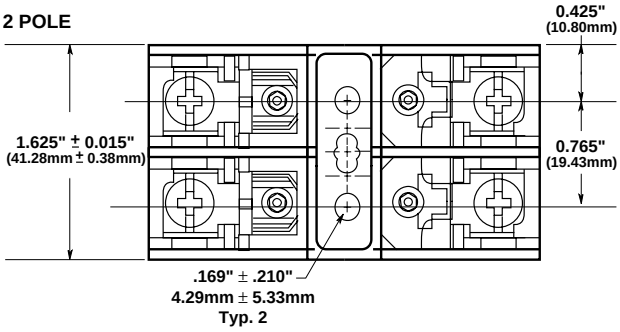
CE logo denotes compliance with European Union Low Voltage Directive (50-1000 Vac, 75-1500 Vdc). Refer to Data Sheet: 8002 or contact Bussmann Application Engineering at 636-527-1270 for more information.

Dimensional Data

1 POLE



2 POLE



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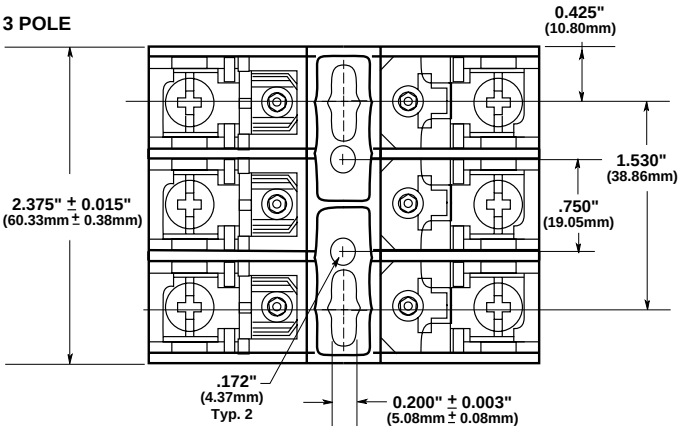
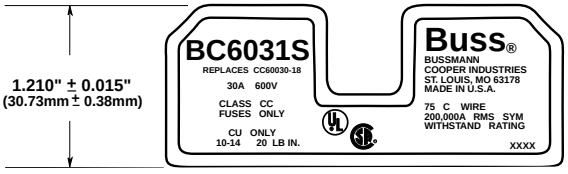


FUSEBLOCK LABEL (EXAMPLE SHOWN)



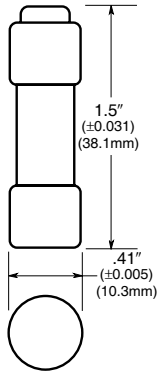
LIMITRON®

KTK-R

Fast-Acting Fuses

13/32" x 1-1/2", Class CC - 600 Volt, 1/10 - 30 Amps

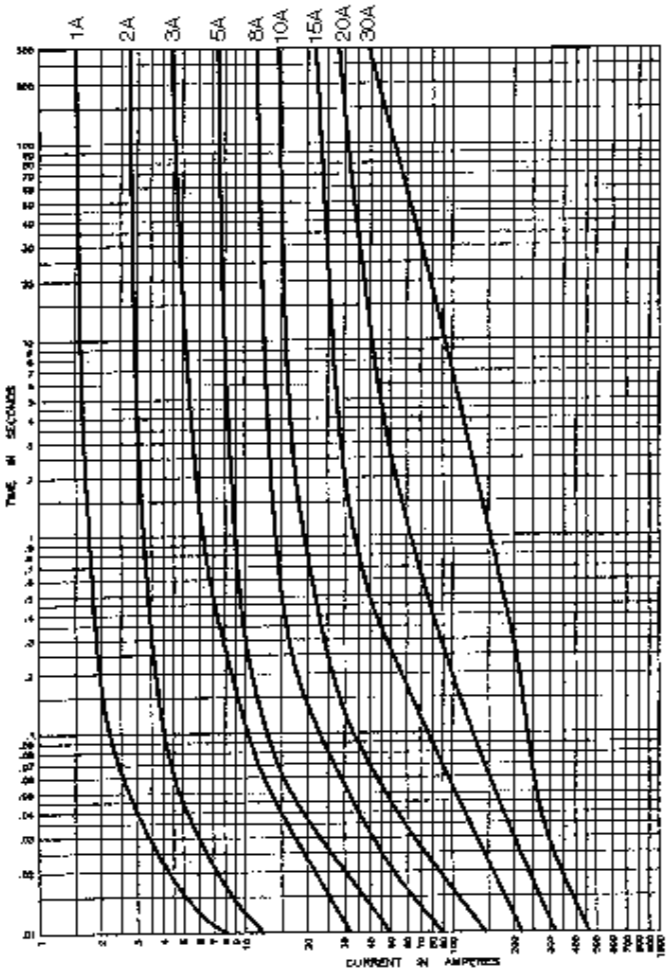
Dimensional Data



Catalog Symbol: KTK-R
Fast-Acting Branch Circuit Fuse:
1/10 TO 30A
Voltage Rating:
600Vac (or less): 0-30A
Interrupting Rating:
ac: 200,000A RMS Sym.
UL LIisted, STD. 248-4, Class CC,
(Guide #JDDZ, File #E4273)
CSA Certified, C22.2 NO. 248.4, (File #53787—Class #1422-02)

- LIMITRON® fast-acting fuse.
- Melamine tube. Nickel-plated brass endcaps.
- U.L. Listed for branch circuit protection.
- Rejection type; for both standard holders or those which reject other type fuses.

Time-Current Characteristic Curves–Average Melt



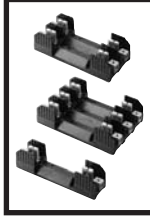
Electrical Ratings (Catalog Symbol and Amperes)

600Vac - UL Listed & C.S.A.			
KTK-R-1/10	KTK-R-6/10	KTK-R-3-1/2	KTK-R-10
KTK-R-1/8	KTK-R-3/4	KTK-R-4	KTK-R-12
KTK-R-2/10	KTK-R-1	KTK-R-5	KTK-R-15
KTK-R-1/4	KTK-R-1-1/2	KTK-R-6	KTK-R-20
KTK-R-3/10	KTK-R-2	KTK-R-7	KTK-R-25
KTK-R-4/10	KTK-R-2-1/2	KTK-R-8	KTK-R-30
KTK-R-1/2	KTK-R-3	KTK-R-9	–

Carton Quantity and Weight

Ampere Ratings	Carton Qty.	Weight* Lbs.	Kg.
1/10–30	10	.180	.082

*Weight per carton.



Recommended fuseblocks/fuseholders for Class CC 600V fuses
See Data Sheets listed below
- Open fuseblocks - 1105
- Finger-safe fuseholders - 1109, 1102, 1103, 1151
- Panel-mount fuseholders - 2114, 2113
- In-line fuseholders - 2126

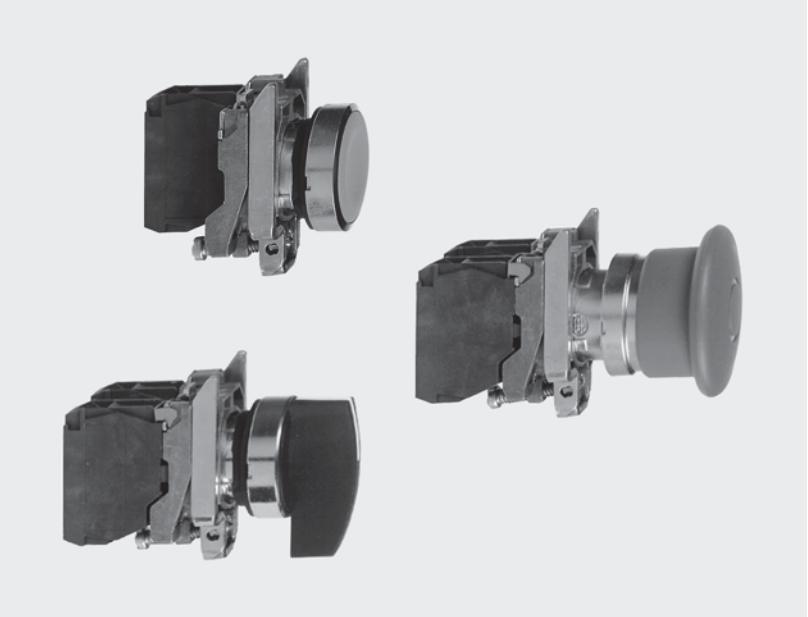
CE CE logo denotes compliance with European Union Low Voltage Directive (50-1000Vac, 75-1500Vdc). Refer to Data Sheet: 8002 or contact Bussmann Application Engineering at 636-527-1270 for more information.

Push Buttons and Operator Interface
Specifier's Guide
XB4 22 mm Die Cast Chrome Plated

Catalog

2005

File 9001



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a brand of Schneider Electric

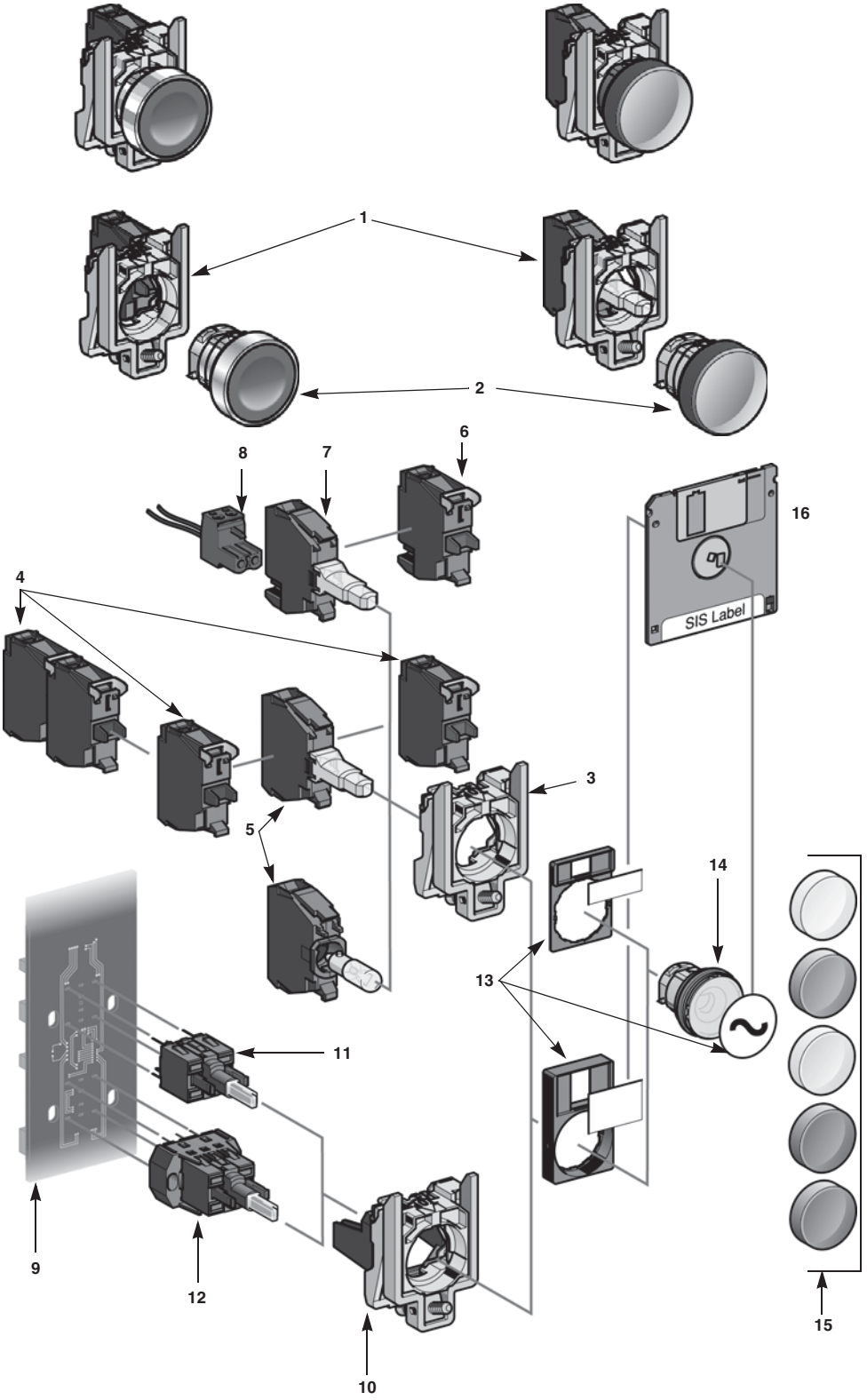
Telemecanique

Components for User Assembly ZB4B:

1 - Electrical Bodies (pre-assembled)
2 - Operator Heads (pre-assembled)

Component Parts and Accessories ZB:

3 - Mounting Collar – Standard (ZB4BZ009)
4 - Contact Blocks – Screw Clamp Terminal (ZBE10•, ZBE20•)
5 - Light Modules – Screw Clamp Terminal (ZBV•) for Protected LED and Ba9 Base Lamps
6 - Contact Blocks – Plug-in Connector (ZBE10•)
7 - Light Modules – Plug-in Connector (ZBV•) for Protected LED only
8 - 2 Pin Connector and Cables for Plug-in Connection Electrical Components (APE1•)
9 - Printed Circuit Board (PCB) Application (Typical)
10 - Mounting Collar – PCB Application (ZB4BZ009 + ZB4BZ079)
11 - Contact Blocks – PCB Application (ZBE70•, ZBE70•6)
12 - Light Modules – PCB Application (ZBV•7) for Protected LED only
13 - Legend Plates and Holders (ZBY•, ZBZ•)
14 - Operator Head (Illuminated or Non-Illuminated)
15 - Lenses for Pilot Lights (ZBV•) or Lenses for Illuminated Push Buttons (ZBW•)
16 - Labeling Software



Environment

Protective treatment standard version			"TH"
Ambient air temperature around the device	Storage		-40 to +158 °F (- 40 to +70 °C)
	Operation		-13 to +158 °F (- 25 to +70 °C) unless otherwise stated
Electric shock protection	Conforming to IEC 60536		Class I
Degree of protection	Conforming to IEC 60529		IP 65, unless otherwise stated IP 66, for booted push button heads
	Conforming to UL 50 and CSA C22.2 No. 94		Type 1, 2, 3, 4, 4X, 12, and 13, unless otherwise stated
Resistance to high pressure cleaner			1,015 psi (70 x 105 Pa-70 bars); distance: 3.94 in (0.1 m) Temperature: 131 °F (55 °C)
Mechanical shock protection	Conforming to EN 50102		Non illuminated heads: IK 03
			Illuminated heads: IK 05
Conforming to standards	CE Marked		IEC 60947-1, IEC/EN 60947-5-1, IEC 60947-5-4, EN 60947-1, JIS C 4520, UL 508, CSA C22.2 No. 14
Product certifications	UL Listed, CSA Certified File E164353 CCN NKCR File LR 44087 Class 3211 03 File E164353 CCN NKCR 2		Standard single contacts with screw clamp terminals: A600; Q600 Double contacts with screw clamp terminals: A600; Q600 Contacts with "Quick-Connect": A300; Q300 Light modules with screw clamp terminals JOYSTICK XD4-PA: A600; R300
	UL Recognized, CSA Certified		Standard single contacts for plug-in connector: A300; R300 Standard single contact for printed circuit board: B300; R300
	BV, RINA, LROS, DNV, GL (pending)		Standard single contacts and double contacts with screw clamp terminals
Terminal identification	Conforming to EN 50005 and EN 50013		

Characteristics of Operators and Contact Blocks

Mechanical Characteristics

Contact operation	N/C or N/O		Slow break
Positive operation	Conforming to IEC/EN 60947-5-1 Appendix K		All functions incorporating a N/C contact are positive opening operation
Operating travel (to change electrical state)	Push button		Changing N/C state: 0.06 in (1.5 mm) Changing N/O state: 0.11 in (2.6 mm) Total travel: 0.17 in (4.3 mm)
Operating force	Push button		Changing N/C state: 0.79 lbf (3.5 N) Changing N/O state: 0.85 lbf (3.8 N)
	Additional contact (extra to change state)		Single N/C contact: 0.45 lbf (2 N) Single N/O contact: 0.52 lbf (2.3 N)
			Double contact N/C: 0.76 lbf (3.4 N) Double contact N/O: 1.12 lbf (5 N) Double contact N/C + N/O: 1.03 lbf (4.6 N)
	Emergency stop with N/C + N/O Maintained mushroom head operators Momentary mushroom head operators		Standard push-pull: 10.12 lbf (45 N) Trigger action push-pull: 11.24 lbf (50 N)
			Standard turn to release and key release: 8.99 lbf (40 N) Trigger action turn to release and key release: 9.89 lbf (44 N)
Operating torque (to change electrical state)	Selector switches		N/O contact: 1.24 lb-in (0.14 N•m)
	Additional contact (extra)		N/O contact: 0.44 lb-in (0.05 N•m)
Mechanical durability (operating cycles)	Push button	Momentary	5 million
		Double-headed	1 million
		Push-push to release	500,000
	Selector switches	Non-illuminated	3 million
		Illuminated	1 million
	Toggle switches		500,000
	Emergency stop push button		300,000
	Joystick		1 million
	Standard blocks		5 million
	Low power switching power blocks		500,000
Vibration resistance	Conforming to IEC 60068-2-6		Frequency (2 to 500 Hz): 5 gn
Shock resistance	Conforming to IEC 60068-2-27		All functions except mushroom head push buttons– Half sine wave acceleration 11 ms: 50 gn Half sine wave acceleration 18 ms: 30 gn
			Mushroom head push buttons– Half sine wave acceleration 11 ms: 10 gn

Electrical Characteristics				
Cabling capacity	Conforming to IEC 60947-1	Screw and captive clamp terminals Min: 1 x 24 AWG (0.22 mm^2) without cable end 1 x 22 AWG (0.34 mm^2) for linking Max: 2 x 16 AWG (1.5 mm^2) with cable end 2 x 14 AWG without cable end Cross headed screw (Pozidrive type 1) slotted for flat 4 and 5.5 mm screwdriver Typical torque: 0.8 N•m (8.55 lb-in) Maximum torque: 1.2 N•m (10.7 lb-in)		
Contact material	Silver alloy (Ag/Ni)	Standard single and double blocks with screw clamp terminals Blocks for plug-in connector Standard blocks for printed circuit board connection		
	Gold flashed (Ag/Ni/Au)	Low power switching contact blocks with screw clamp terminals Low power switching contact blocks for printed circuit board connection		
Short-circuit protection	Conforming to IEC/EN 60947-5-1	Standard blocks with screw clamp terminals: 10 A (gG cartridge fuse conforming to IEC 60269-1) Blocks for plug-in connector: 4 A (gG fuse cartridge conforming to IEC 60269-1) Standard blocks for printed circuit board connection: 4 A (gG cartridge fuse conforming to IEC 60269-1)		
Rated insulation voltage	Conforming to IEC 60947-1	Standard blocks (single or double) with screw clamp terminals: Ui = 600 V, degree of pollution 3 Blocks for plug-in connector: Ui = 250 V, degree of pollution 3 Standard blocks for printed circuit board connection: Ui = 250 V, degree of pollution 3		
Rated impluse withstand voltage	Conforming to IEC 60947-1	Standard block (single or double) with screw clamp terminals: Uimp = 6 kV Blocks for plug-in connector: Uimp = 4 kV Standard blocks for printed circuit board connection: Uimp = 4 kV		
Rated operational characteristics Conforming to IEC/EN 60947-5-1	AC supply: Utilization category AC-15	Standard blocks (single or double) with screw clamp terminals: A600: Ue = 600 Vac and Ie = 1.2 A or Ue = 240 Vac and Ie = 3 A or Ue = 120 Vac and Ie = 6 A Continuous Thermal Current = 10 A Blocks for plug-in connector: A300: Ue = 120 Vac and Ie = 6 A or Ue = 240 Vac and Ie = 3 A Standard blocks for printed circuit board connection: B300: Ue = 120 Vac and Ie = 3 A or Ue = 240 Vac and Ie = 1.5 A		
	DC supply: Utilization category DC-13	Standard single or double blocks with screw clamp terminals: Q600: Ue = 600 Vdc and Ie = 0.1 A or Ue = 250 Vdc and Ie = 0.27 A or Ue = 125 Vdc and Ie = 0.55 A Continuous Thermal Current = 2.5 A Joystick XD4-PA: R300: Ue = 125 Vdc and Ie = 0.22 A or Ue = 250 Vdc and Ie = 0.1 A Blocks for plug-in connector: R300: Ue = 125 Vdc and Ie = 0.22 A or Ue = 250 Vdc and Ie = 0.1 A Standard blocks for printed circuit board connection: R300: Ue = 125 Vdc and Ie = 0.22 A or Ue = 250 Vdc and Ie = 0.1 A		
Rated operational characteristics	AC supply: Resistive load	Low power switching contact blocks with screw clamp terminals or for printed circuit board connection: Max: 24 V Max: 0.1 A		
Electrical durability Conforming to IEC/EN 60947-5-1 Appendix C Operating rate 3600 operating cycles/hour. Load factor: 0.5	AC supply for 1 million operating cycles, utilization category AC-15	Standard blocks for screw clamp terminals:		
		24 Vac	120 Vac	230 Vac
		4 A	3 A	2 A
		Standard double blocks with screw clamp terminal or plug-in connector:		
		24 Vac	120 Vac	230 Vac
		3 A	1.5 A	1 A
	DC supply for 1 million operating cycles, utilization category DC-13	Standard single blocks for screw clamp terminals:		
		24 Vdc	110 Vdc	
		0.5 A	0.2 A	
		Standard double blocks with screw clamp terminal or plug-in connector:		
		24 Vdc	110 Vdc	
		0.4 A	0.15 A	
Electrical reliability	Failure rate Conforming to IEC 60947-5-4			
	- In clean environment	Standard blocks: - at 17 V and 5 mA, $\lambda < 10^{-8}$ - at 5 V and 1 mA, $\lambda < 10^{-6}$ Low power switching contact blocks: - at 5 V and 1 mA, $\lambda < 10^{-8}$		
	- In dusty environment	Low power switching contact blocks only: at 5 V and 1 mA, $\lambda < 10^{-6}$		

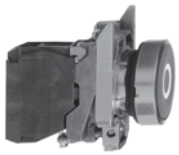
Characteristics of Light Modules

Mechanical Characteristics		
Vibration resistance	Conforming to IEC 60068-2-6	Frequency (12 to 500 Hz): 5 gn
Shock resistance	Conforming to IEC 60068-2-27	Half sine wave acceleration 11 ms: 50 gn Half sine wave acceleration 18 ms: 30 gn
Electrical Characteristics		
Cabling capacity	Conforming to IEC 60947-1	Screw and captive clamp terminals Min: 1 x 24 AWG (0.22 mm^2) without cable end 1 x 22 AWG (0.34 mm^2) for linking Max: 2 x 16 AWG (1.5 mm^2) with cable end
Rated insulation voltage	Conforming to IEC 60947-1	Direct supply pilot light modules (BA 9s bulbs): Ui = 250 V, degree of pollution 3 Pilot light modules with protected LED: Ui = 250 V, degree of pollution 3 Pilot light modules with transformer: Ui = 600 V, degree of pollution 3
Rated impluse withstand voltage	Conforming to IEC 60947-1	Direct supply pilot light modules (BA 9s bulbs): Uimp = 4 kV Pilot light modules with protected LED: Uimp = 4 kV Pilot light modules with transformer: Uimp = 6 kV

Specific Characteristics of Protected LED Light Modules Only

Voltage limits	Nominal voltage	24 V: 19.2 to 30 Vdc; 21.6 to 24.6 Vac 120 V: 102 to 132 Vac 240 V: 195 to 264 Vac
Current consumption	Applicable to all colors	24 Vac/Vdc supply blocks: 18 mA 120 Vac supply blocks: 14 mA 240 Vac supply blocks: 14 mA
Service life	At nominal voltage and at an ambient temperature of 77 °F (25 °C)	100,000 hours
Surge withstand	Conforming to IEC 61000-4-5	2/1 kV
Resistance to fast transients	Conforming to IEC 61000-4-4	2 kV
Resistance to electromagnetic fields	Conforming to IEC 61000-4-3	10 V/m
Resistance to electrostatic discharges	Conforming to IEC 61000-4-2	8/6 kV
Electromagnetic emission	Conforming to EN 55011	Class B

XB4BA31



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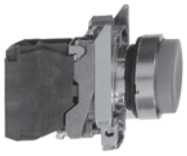
XB4BP51



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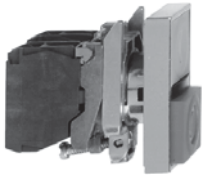
XB4BC21



XB4BL845

Non-Illuminated Push Buttons, Momentary (screw clamp terminal connections)

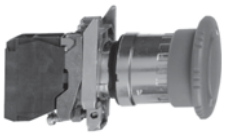
Shape of Head	Type of Push	Type of Contact		Marking	Color of Cap	Catalog Number
		N/O	N/C			
	Flush	1	–	–	Black	**XB4BA21** (ZB4BZ101 + ZB4BA2)
					Green	**XB4BA31** (ZB4BZ101 + ZB4BA3)
					Yellow	**XB4BA51** (ZB4BZ101 + ZB4BA5)
					Blue	**XB4BA61** (ZB4BZ101 + ZB4BA6)
		–	1	–	Red	**XB4BA42** (ZB4BZ102 + ZB4BA4)
	Flush	1	–	"I" (white)	Green	**XB4BA3311** (ZB4BZ101 + ZB4BA331)
	Flush	–	1	"O" (white)	Red	**XB4BA4322** (ZB4BZ102 + ZB4BA432)
	Flush with clear silicone boot (color of pusher unobscured)	1	–	–	Black	**XB4BP21** (ZB4BZ101 + ZB4BP2)
					Green	**XB4BP31** (ZB4BZ101 + ZB4BP3)
					Yellow	**XB4BP51** (ZB4BZ101 + ZB4BP5)
					Blue	**XB4BP61** (ZB4BZ101 + ZB4BP6)
		–	1	–	Red	**XB4BP42** (ZB4BZ102 + ZB4BP4)
	Extended	–	1	–	Red	**XB4BL42** (ZB4BZ102 + ZB4BL4)
	Mushroom head Ø 40 mm	1	–	–	Black	**XB4BC21** (ZB4BZ101 + ZB4BC2)

Two Button Push Buttons, Momentary (screw clamp terminal connections)

Shape of Head	Type of Push	Type of Contact		Degree of Protection	Catalog Number
		N/O	N/C		
	One flush green push (marked "I") One extended red push (marked "O")	1	1	IP 40	**XB4BL845** (ZB4BZ105 + ZB4BL8434)

XB4BT845

XB4BS9445



XB4BS542

Non-Illuminated Emergency Stop Mushroom Head Push Buttons, Ø 40 mm (Red)
(screw clamp terminal connections)

Shape of Head	Type of Push	Type of Contact			Catalog Number
		N/O	N/C		
	**Trigger action push-pull**	1	1		**XB4BT845** (ZB4BZ105 + ZB4BT84)
	**Trigger action turn to release**	1	1		**XB4BS8445** (ZB4BZ105 + ZB4BS844)
	**Trigger action Key release** (No. 455)	1	1		**XB4BS9445** (ZB4BZ105 + ZB4BS944)
	**Push-pull**	–	1		**XB4BT42** (ZB4BZ102 + ZB4BT4)
	**Turn to release**	–	1		**XB4BS542** (ZB4BZ102 + ZB4BS54)
	**Key release** (No. 455)	–	1		**XB4BS142** (ZB4BZ102 + ZB4BS14)

XB4BD33

XB4BJ33

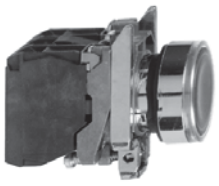
XB4BG33

Non-Illuminated Selector Switches and Key Switches (screw clamp terminal connections)

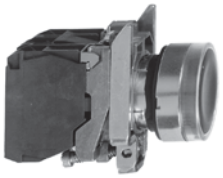
Shape of Head	Type of Operator	Type of Contact		Number and Type of Positions		Catalog Number
		N/O	N/C			
	**Standard lever, black**	1	–	2 - maintained		**XB4BD21** (ZB4BZ101 + ZB4BD2)
		1	1	2 - maintained		**XB4BD25** (ZB4BZ105 + ZB4BD2)
		2	–	3 - maintained		**XB4BD33** (ZB4BZ103 + ZB4BD3)
				3 - momentary to center		**XB4BD53** (ZB4BZ103 + ZB4BD5)
	**Extended lever, black**	1	–	2 - maintained		**XB4BJ21** (ZB4BZ101 + ZB4BJ2)
		2	–	3 - maintained		**XB4BJ33** (ZB4BZ103 + ZB4BJ3)
				3 - momentary to center		**XB4BJ53** (ZB4BZ103 + ZB4BJ5)
	**Key** (No. 455)	1	–	2 - maintained		**XB4BG21** (ZB4BZ101 + ZB4BG2)
						**XB4BG41** (ZB4BZ101 + ZB4BG4)
				2 - momentary to left		**XB4BG61** (ZB4BZ101 + ZB4BG6)
		2	–	3 - maintained		**XB4BG03** (ZB4BZ103 + ZB4BG0)
						**XB4BG33** (ZB4BZ103 + ZB4BG3)

The symbol ⚷ indicates key withdrawal position(s).

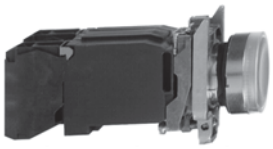
Illuminated Push Buttons, Momentary, Flush



XB4BW33B5



XB4BW34G5



XB4BW3545

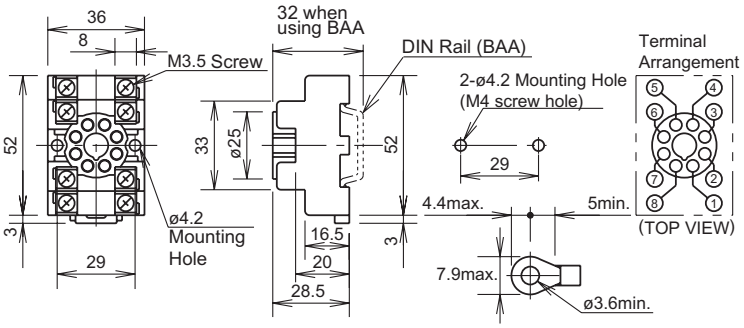
Shape of Head	Description	Type of Contact N/O	Type of Contact N/C	Supply Voltage	Color of Push	Catalog Number
Screw clamp terminal connections						
	**Protected LED**	1	1	24 Vac/Vdc	White	**XB4BW31B5** (ZB4BW0B15 + ZB4BW313)
					Green	**XB4BW33B5** (ZB4BW0B35 + ZB4BW333)
					Red	**XB4BW34B5** (ZB4BW0B45 + ZB4BW343)
					Yellow	**XB4BW35B5** (ZB4BW0B55 + ZB4BW353)
					Blue	**XB4BW36B5** (ZB4BW0B65 + ZB4BW363)
				110-120 Vac	White	**XB4BW31G5** (ZB4BW0G15 + ZB4BW313)
					Green	**XB4BW33G5** (ZB4BW0G35 + ZB4BW333)
					Red	**XB4BW34G5** (ZB4BW0G45 + ZB4BW343)
					Yellow	**XB4BW35G5** (ZB4BW0G55 + ZB4BW353)
					Blue	**XB4BW36G5** (ZB4BW0G65 + ZB4BW363)
	Direct supply for BA 9s 2.4 W max. bulb Not included	1	1	≤ 250 Vac/Vdc	White	**XB4BW3165** (ZB4BW065 + ZB4BW31)
					Green	**XB4BW3365** (ZB4BW065 + ZB4BW33)
					Red	**XB4BW3465** (ZB4BW065 + ZB4BW34)
					Yellow	**XB4BW3565** (ZB4BW065 + ZB4BW35)
	**Transformer type** 1.2 VA, 6 V secondary. BA 9s incandescent bulb included	1	1	110-120 Vac 50/60 Hz	White	**XB4BW3135** (ZB4BW035 + ZB4BW31)
					Green	**XB4BW3335** (ZB4BW035 + ZB4BW33)
					Red	**XB4BW3435** (ZB4BW035 + ZB4BW34)
					Yellow	**XB4BW3535** (ZB4BW035 + ZB4BW35)
				230-240 Vac 50/60 Hz	White	**XB4BW3145** (ZB4BW045 + ZB4BW31)
					Green	**XB4BW3345** (ZB4BW045 + ZB4BW33)
					Red	**XB4BW3445** (ZB4BW045 + ZB4BW34)
					Yellow	**XB4BW3545** (ZB4BW045 + ZB4BW35)

SR Series: DIN Rail Snap-Mount Sockets

SR2P Sockets

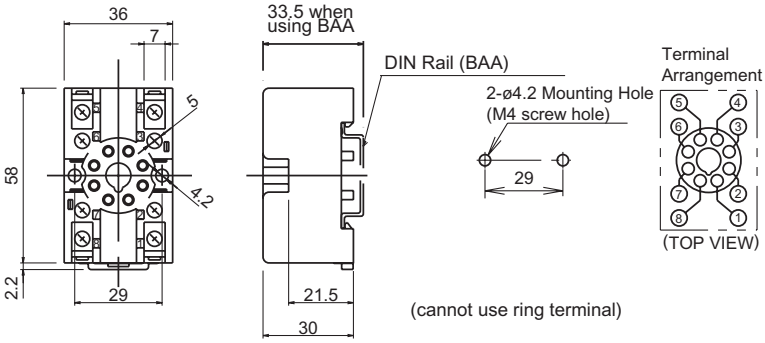
SR2P-05

Style	8-pin octal, snap-mount/surface mount
Terminal/Torque	M3.5 screws with captive wire clamp (9 - 11.5 in•lbs)
Wire Size	Maximum up to 2–#12AWG
Electrical Rating	300V, 10A
Compatible Relay	RR2P
Compatible Timer	RTE-P1, GT3 (8-pin), GT5P, GE1A
Hold-Down Spring	SR2B-02F1 (for RR2P)
Hold-Down Clip	SFA-203 (for timers only, except GE1A)



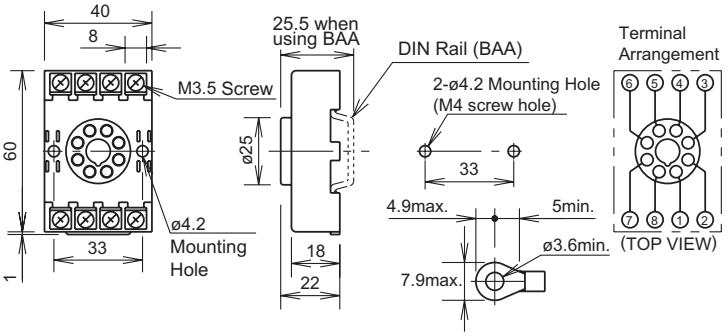
SR2P-05C Fingersafe

Style	8-pin octal, snap-mount/surface mount
Terminal/Torque	M3.5 screws with captive wire clamp, fingersafe (9 - 11.5 in•lbs)
Wire Size	Maximum up to 2–#12AWG
Electrical Rating	300V, 10A
Compatible Relay	RR2P
Compatible Timer	RTE-P1, GT3 (8-pin), GT5P, GE1A
Hold-Down Spring	SR2B-02F1 (for RR2P)
Hold-Down Clip	SFA-203 (for timers only, except GE1A)



SR2P-06

Style	8-pin octal, snap-mount/surface mount
Terminal/Torque	M3.5 screws with captive wire clamp (9 - 11.5 in•lbs)
Wire Size	Maximum up to 2–#12AWG
Electrical Rating	300V, 10A
Compatible Relay	RR2P
Compatible Timer	RTE-P1, GT3 (8-pin), GT5P, GE1A
Hold-Down Spring	SR2B-02F1 (for RR2P)
Hold-Down Clip	SFA-202 (for timers only, except GE1A)



1. For socket mounting accessories, see page F-29.
2. For hold-down clip/spring selections, see page F-4.

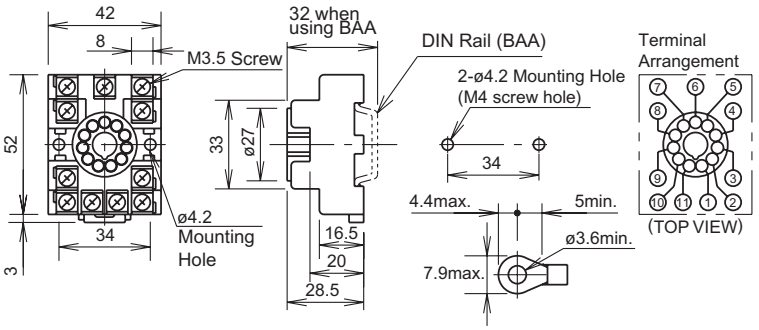
All dimensions are in mm.

F Sockets

SR3P Sockets

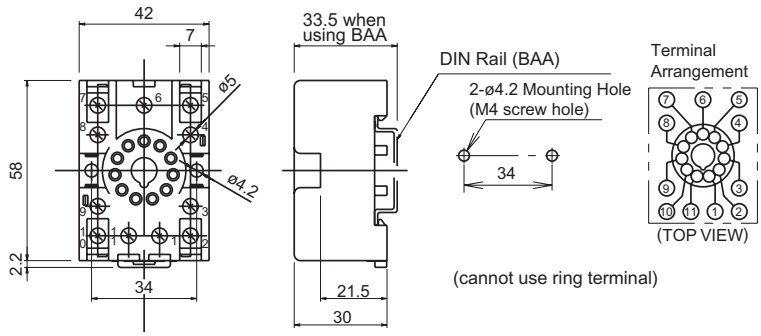
SR3P-05

Style	11-pin octal, snap-mount/surface mount
Terminal/Torque	M3.5 screws with captive wire clamp **(9 - 11.5 in•lbs)**
Wire Size	Maximum up to 2–#12AWG
Electrical Rating	300V, 10A
Compatible Relay	RR3PA, RR2KP
Compatible Timer	GT3 (11-pin), RTE-P2
Hold-Down Spring	SR3B-02F1 for RR3P; SR3P-06F3 for RR2KP
Hold-Down Clip	SFA-203 (Timers)



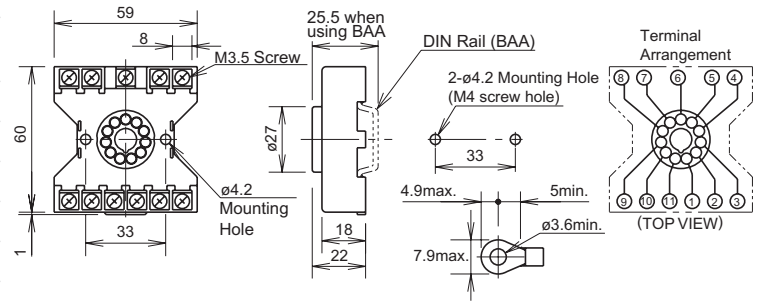
SR3P-05C Fingersafe

Style	11-pin octal, snap-mount/surface mount
Terminal/Torque	M3.5 screws with captive wire clamp, fingersafe **(9 - 11.5 in•lbs)**
Wire Size	Maximum up to 2–#12AWG
Electrical Rating	300V, 10A
Compatible Relay	RR3PA, *RR2KP (*latching relay)
Compatible Timer	GT3 (11-pin), RTE-P2
Hold-Down Spring	SR3B-02F1 for RR3PA; SR3P-06F3 for RR2KP
Hold-Down Clip	SFA-203 (Timers)



SR3P-06

Style	11-pin octal, snap-mount/surface mount
Terminal/Torque	M3.5 screws with captive wire clamp **(9 - 11.5 in•lbs)**
Wire Size	Maximum up to 2–#12AWG
Electrical Rating	300V, 10A
Compatible Relay	RR3PA, *RR2KP (*latching relay)
Compatible Timer	GT3 (11-pin), RTE-P2
Hold-Down Spring	SR3B-02F1 for RR3PA; SR3P-06F3 for RR2KP
Hold-Down Clip	SFA-202 (Timers)



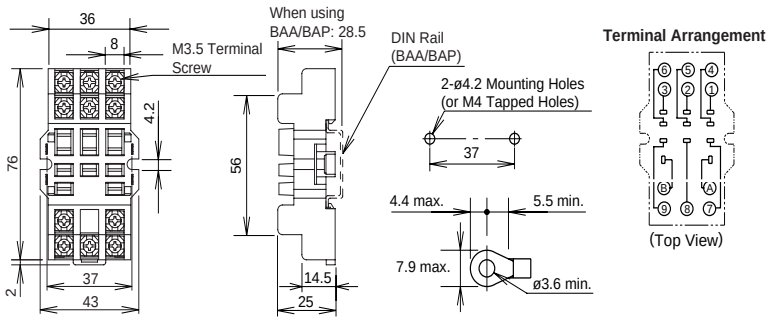
1. For socket mounting accessories, see page F-29.
2. For hold-down clip/spring selections, see page F-4.

All dimensions are in mm.

SR3B Sockets

SR3B-05

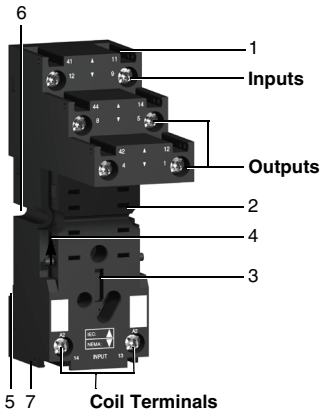
Style	11-blade, snap-mount/surface mount
Terminal/Torque	M3.5 screws with captive wire clamp (9 - 11.5 in•lbs)
Wire Size	Maximum up to 2–#12AWG
Electrical Rating	300V, 15A (10A)* (*denotes CSA rating)
Compatible Relay	RR1BA, RR2BA, RR3B
Compatible Timer	RTE-B
Hold-Down Spring	SR3B-02F1 (relays)
Hold-Down Clip	SFA-202 (relays and timers)



All dimensions are in mm.

F Sockets

1. For socket mounting accessories, see page F-29.
2. For hold-down clip/spring selections, see page F-4.



Sockets with Separate Contact Terminals

1. Box lug connector.
2. Eight, eleven, or fourteen female contacts for the relay pins.
3. Location for protection modules.
4. Locking components for plastic and metal hold-down clips.
5. Locating slot for mounting on DIN rail.
6. Two mounting holes for panel mounting.
7. Location for bus jumpers (see mounting on sockets on page 11).

NOTE: The inputs and outputs are separated from the relay coil terminals.

General characteristics

Conforming to standards		IEC/EN 61810-1 (iss. 2), UL 508, CSA C22-2 n° 14
Product certifications		cULus File E164862 CCN NLDX, NLDX7; cURus File E164862 CCN NLDX2, NLDX8; CSA pending; CE; RoHS compliant
Ambient air temperature around the device	Storage	-40—185 °F (-40—85 °C)
	Operation	-40—131 °F (-40—55 °C)
Vibration resistance	Conforming to IEC/EN 60068-2-6	> 6 gn (10–50 Hz)
Degree of protection	Conforming to IEC/EN 60529	IP 40
Shock resistance conforming to IEC/EN 60068-2-27	Opening	10 gn
	Closing	5 gn
Protection category (see page 38)		RT I
Mounting position		Any

Insulation characteristics

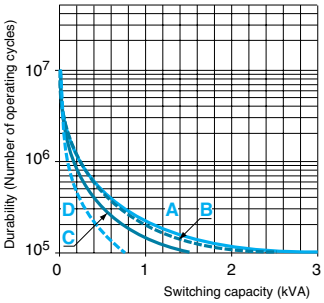
Rated insulation voltage (Ui)		250 V (IEC), 300 V (UL, CSA)
Rated impulse withstand voltage (Uimp)		3.6 kV (1.2/50 µs)
Dielectric strength (rms voltage)	Between coil and contact	2,500 Vac
	Between poles	2,500 Vac
	Between contacts	1,500 Vac

Contact characteristics

Relay type			**RXM2AB●●●**	**RXM3AB●●●**	**RXM4AB●●●**	**RXM4GB●●●**
Number and type of contacts (see page 12)			DPDT	3PDT	4PDT	4PDT
Contact materials			AgNi			AgAu–Bifurcated
Conventional thermal current (Ith)	For ambient temperature ≤ 131 °F (55 °C)		12 A	10 A	6 A	3 A
Rated operational current	Conforming to IEC in utilization category AC-1	N.O.	12 A	10 A	6 A	2 A
		N.C.	6 A	5 A	3 A	1 A
	Conforming to UL Resistive @277 Vac, hp @120 Vac		12 A, 1/2 hp	10 A, 1/3 hp	8 A, 1/3 hp	3 A, 1/16 hp
Maximum operating rate In operating cycles/hour	No load		18,000			
	Under load		1,200			
Switching voltage	Maximum		250 Vac/Vdc			
Switching capacity	Minimum		10 mA on 17 V			2 mA on 5 V
	Maximum		3,000 VA	2,500 VA	1,500 VA	750 VA
Utilization coefficient			20%			
Mechanical durability in millions of operating cycles			10			
Electrical durability in millions of operating cycles	Resistive load		0.1			

Electrical durability of contacts

Resistive load AC



A=RXM2AB●●● B=RXM3AB●●● C=RXM4AB●●● D=RXM4GB●●●

Coil characteristics

Average consumption		AC	1.2 VA
		DC	0.9 W
Drop-out voltage threshold		AC	⩾ 0.15 Uc
		DC	⩾ 0.1 Uc
Operating time (response time)	Between coil energization and making of the N.O. contact	AC	20 ms
		DC	20 ms
	Between coil de-energization and making of the N.C. contact	AC	20 ms
		DC	20 ms

Coil voltage Uc			**12 V**	**24 V**	**48 V**	**110 V**	**120 V**	**125 V**	**220 V**	**230 V**	**240 V**
Relay coil voltage codes			**JD**	**BD**	**ED**	**FD**	**—**	**GD**	**MD**	**—**	**—**
DC	Average resistance at 68 °F (20 °C) ± 10%		160 Ω	650 Ω	2,600 Ω	11,000 Ω	—	11,000 Ω	14,000 Ω	—	—
	Operating voltage limits	Min.	9.6 V	19.2 V	38.4 V	88 V	—	100 V	176 V	—	—
		Max.	13.2 V	26.4 V	52.8 V	121 V	—	138 V	242 V	—	—
Relay coil voltage codes			**—**	**B7**	**E7**	**—**	**F7**	**—**	**M7**	**P7**	**U7**
AC	Average resistance at 68 °F (20 °C) ± 15%		—	180 Ω	770 Ω	—	4,430 Ω	—	15,000 Ω	15,000 Ω	15,500 Ω
	Operating voltage limits	Min.	—	19.2 V	38.4 V	—	96 V	—	176 V	184 V	192 V
		Max.	—	26.4 V	52.8 V	—	132 V	—	242 V	253 V	264 V

Socket characteristics

Socket type		**RXZE2S108M**	**RXZE2S111M**	**RXZE2S114M**	**RXZE2M114**	**RXZE2M114M**
Relay types used		**RXM2●●●●●**	**RXM3●●●●●**	**RXM4●●●●●**	**RXM2●●●●●**[1] **RXM4●●●●●**	**RXM2●●●●●**[1] **RXM4●●●●●**
Product certifications		cURus File E172326 CCN SWIV2, SWIV8; CSA (pending); CE; RoHS compliant				
Conventional thermal current (Ith)		12 A	10 A			
Degree of protection	Conforming to IEC/EN 60529	IP 20				
Connection	Solid wire without cable end	1 conductor: AWG 20–12 (0.5–2.5 mm^2) 2 conductors: AWG 20–14 (0.5–1.5 mm^2)				
	Flexible wire with cable end	1 conductor: AWG 24–14 (0.2–2.5 mm^2) 2 conductors: AWG 24–16 (0.2–1.5 mm^2)				
	Flexible wire without cable end	1 conductor: AWG 24–14 (0.2–2.5 mm^2) 2 conductors: AWG 24–16 (0.2–1.5 mm^2)				
Maximum tightening torque		5.3 lbf-in (0.6 N●m) (M3 screw)				
Contact terminal arrangement		Separate			Mixed	
Bus jumper Ith: 5 A		Yes			No	

[1] When mounting relay RXM2●●●●● on socket RXZE2M●●●●, the thermal current must not exceed 10 A.

RXM●AB2F7

Miniature relays with lockable test button, without LED (sold in lots of 10)

	Number and type of contacts - Thermal current (Ith)										
	DPDT - 12 A			3PDT - 10 A			4PDT - 6 A				
Coil Voltage	Catalog Number	Weight		Catalog Number	Weight		Catalog Number	Weight	
		lb.	kg		lb.	kg		lb.	kg
12 Vdc	**RXM2AB1JD**	0.082	0.037	**RXM3AB1JD**	0.084	0.038	**RXM4AB1JD**	0.080	0.036
24 Vdc	**RXM2AB1BD**	0.082	0.037	**RXM3AB1BD**	0.084	0.038	**RXM4AB1BD**	0.080	0.036
48 Vdc	**RXM2AB1ED**	0.082	0.037	**RXM3AB1ED**	0.084	0.038	**RXM4AB1ED**	0.080	0.036
110 Vdc	**RXM2AB1FD**	0.082	0.037	**RXM3AB1FD**	0.084	0.038	**RXM4AB1FD**	0.080	0.036
220 Vdc	**—**	—	—	**—**	—	—	**RXM4AB1MD**	0.080	0.036
24 Vac	**RXM2AB1B7**	0.082	0.037	**RXM3AB1B7**	0.084	0.038	**RXM4AB1B7**	0.080	0.036
48 Vac	**RXM2AB1E7**	0.082	0.037	**RXM3AB1E7**	0.084	0.038	**RXM4AB1E7**	0.080	0.036
120 Vac	**RXM2AB1F7**	0.082	0.037	**RXM3AB1F7**	0.084	0.038	**RXM4AB1F7**	0.080	0.036
230 Vac	**RXM2AB1P7**	0.082	0.037	**RXM3AB1P7**	0.084	0.038	**RXM4AB1P7**	0.080	0.036
240 Vac	**—**	—	—	**—**	—	—	**RXM4AB1U7**	0.080	0.036
Miniature relays with lockable test button, with LED (sold in lots of 10)									
12 Vdc	**RXM2AB2JD**	0.082	0.037	**RXM3AB2JD**	0.084	0.038	**RXM4AB2JD**	0.080	0.036
24 Vdc	**RXM2AB2BD**	0.082	0.037	**RXM3AB2BD**	0.084	0.038	**RXM4AB2BD**	0.080	0.036
48 Vdc	**RXM2AB2ED**	0.082	0.037	**RXM3AB2ED**	0.084	0.038	**RXM4AB2ED**	0.080	0.036
110 Vdc	**RXM2AB2FD**	0.082	0.037	**RXM3AB2FD**	0.084	0.038	**RXM4AB2FD**	0.080	0.036
125 Vdc	**—**	—	—	**—**	—	—	**RXM4AB2GD**	0.080	0.036
24 Vac	**RXM2AB2B7**	0.082	0.037	**RXM3AB2B7**	0.084	0.038	**RXM4AB2B7**	0.080	0.036
48 Vac	**RXM2AB2E7**	0.082	0.037	**RXM3AB2E7**	0.084	0.038	**RXM4AB2E7**	0.080	0.036
120 Vac	**RXM2AB2F7**	0.082	0.037	**RXM3AB2F7**	0.084	0.038	**RXM4AB2F7**	0.080	0.036
230 Vac	**RXM2AB2P7**	0.082	0.037	**RXM3AB2P7**	0.084	0.038	**RXM4AB2P7**	0.080	0.036

RXM4GB2F7

Miniature relays with low level contacts, without LED (sold in lots of 10)

Number and type of contacts - Thermal current (Ith)			
4PDT - 3 A			
Coil Voltage	Catalog Number	Weight	
		lb.	kg
12 Vdc	**RXM4GB1JD**	0.080	0.036
24 Vdc	**RXM4GB1BD**	0.080	0.036
48 Vdc	**RXM4GB1ED**	0.080	0.036
110 Vdc	**RXM4GB1FD**	0.080	0.036
24 Vac	**RXM4GB1B7**	0.080	0.036
48 Vac	**RXM4GB1E7**	0.080	0.036
120 Vac	**RXM4GB1F7**	0.080	0.036
230 Vac	**RXM4GB1P7**	0.080	0.036

Miniature relays with low level contacts, with LED (sold in lots of 10)

Number and type of contacts - Thermal current (Ith)			
4PDT - 3 A			
Coil Voltage	Catalog Number	Weight	
		lb.	kg
12 Vdc	**RXM4GB2JD**	0.080	0.036
24 Vdc	**RXM4GB2BD**	0.080	0.036
48 Vdc	**RXM4GB2ED**	0.080	0.036
110 Vdc	**RXM4GB2FD**	0.080	0.036
24 Vac	**RXM4GB2B7**	0.080	0.036
48 Vac	**RXM4GB2E7**	0.080	0.036
120 Vac	**RXM4GB2F7**	0.080	0.036
230 Vac	**RXM4GB2P7**	0.080	0.036
240 Vac	**RXM4GB2U7**	0.080	0.036


RXZ E2M114M with relay RXM4AB2P7TQ

Miniature relays with lockable test button, without LED (sold in lots of 100)

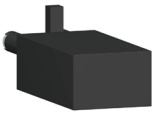
Coil Voltage	Number and type of contacts - Thermal current (Ith)					
	DPDT - 12 A			4PDT - 6 A		
	Catalog Number	Weight		Catalog Number	Weight	
		lb.	kg		lb.	kg
12 Vdc	—	—	—	**RXM4AB1JDTQ**	0.080	0.036
24 Vdc	**RXM2AB1BDTQ**	0.082	0.037	**RXM4AB1BDTQ**	0.080	0.036
48 Vdc	—	—	—	**RXM4AB1EDTQ**	0.080	0.036
110 Vdc	—	—	—	**RXM4AB1FDTQ**	0.080	0.036
220 Vdc	—	—	—	**RXM4AB1MDTQ**	0.080	0.036
24 Vac	**RXM2AB1B7TQ**	0.082	0.037	**RXM4AB1B7TQ**	0.080	0.036
48 Vac	—	—	—	**RXM4AB1E7TQ**	0.080	0.036
120 Vac	**RXM2AB1F7TQ**	0.082	0.037	**RXM4AB1F7TQ**	0.080	0.036
230 Vac	**RXM2AB1P7TQ**	0.082	0.037	**RXM4AB1P7TQ**	0.080	0.036
Miniature relays with LED (sold in lots of 100)						
24 Vdc	—	—	—	**RXM4AB2BDTQ**	0.080	0.036
24 Vac	**RXM2AB2B7TQ**	0.082	0.037	**RXM4AB2B7TQ**	0.080	0.036
230 Vac	**RXM2AB2P7TQ**	0.082	0.037	**RXM4AB2P7TQ**	0.080	0.036


RXZ E2S114M with relay RXM4AB2F7TQ

Sockets (sold in lots of 10)

Contact terminal arrangement	Connection	Relay type	Catalog Number	Weight	
				lb.	kg
Mixed	Screw clamp terminals	RXM2●●●● [1] RXM4●●●●	**RXZE2M114** [2]	0.11	0.048
	Box lug connector	RXM2●●●● [1] RXM4●●●●	**RXZE2M114M** [2]	0.12	0.056
Separate	Box lug connector	RXM2●●●●	**RXZE2S108M** [3]	0.13	0.058
		RXM3●●●●	**RXZE2S111M** [2]	0.15	0.066
		RXM4●●●●	**RXZE2S114M** [2]	0.15	0.070

[1] When mounting relay RXM2●●●●● on socket RXZE2M●●●●, the thermal current must not exceed 10 A.
[2] Thermal current Ith: 10 A
[3] Thermal current Ith: 12 A


RXM 041●●7

Protection modules (sold in lots of 20)

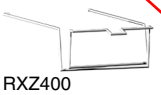
Description	Voltage	For use with	Catalog Number	Weight	
				oz.	g
Diode	6–250 Vdc	All sockets	**RXM040W**	0.11	3.0
RC circuit	24–60 Vac	All sockets	**RXM041BN7**	0.35	10.0
	110–240 Vac	All sockets	**RXM041FU7**	0.35	10.0
Varistor	6–24 Vac/Vdc	All sockets	**RXM021RB**	1.06	30.0
	24–60 Vac/Vdc	All sockets	**RXM021BN**	1.06	30.0
	110–240 Vac/Vdc	All sockets	**RXM021FP**	1.06	30.0


REXL4●●

Timing relays

Description	For use with	Catalog Number	Weight	
			lb.	kg
2 timed DPDT contacts (function A—On-delay)	Sockets RXZ E●●●●●	**REXL2●●** [4]	0.09	0.042
4 timed 4PDT contacts (function A—On-delay)		**REXL4●●** [4]	0.09	0.042

[4] Please refer to the *Zelio® Time - Timers* catalog (9050CT0001R2/05).


RXZ400

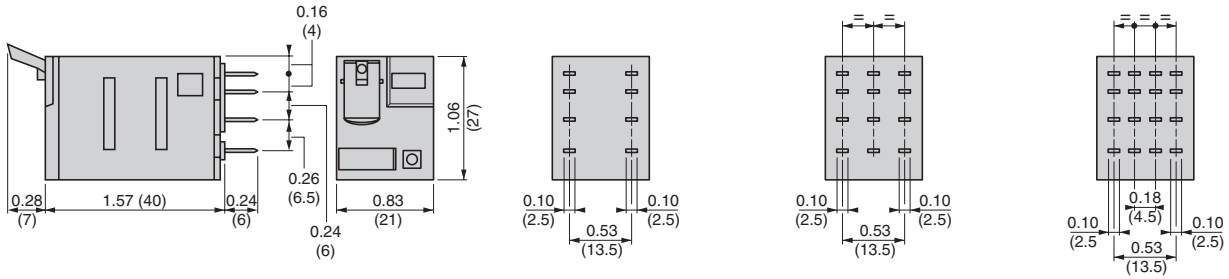
Accessories (sold in lots of 10)

Description	For use with	Catalog Number	Weight	
			oz.	g
Metal hold-down clip	All sockets	**RXZ400**	0.04	1.0
Plastic hold-down clip	All sockets	**RXZR335**	0.18	5.0
Bus jumper, 2-pole (Ith: 5 A)	All sockets with separate contacts	**RXZS2**	0.18	5.0
Mounting adapter for DIN rail [5]	All relays	**RXZE2DA**	0.14	4.0
Mounting adapter for mounting directly to a panel	All relays	**RXZE2FA**	0.07	2.0
Clip-in markers	All relays (sheet of 108 markers)	**RXZL520**	2.82	80.0
	All sockets except RXZE2M114	**RXZL420**	0.04	1.0

[5] Test button becomes inaccessible.

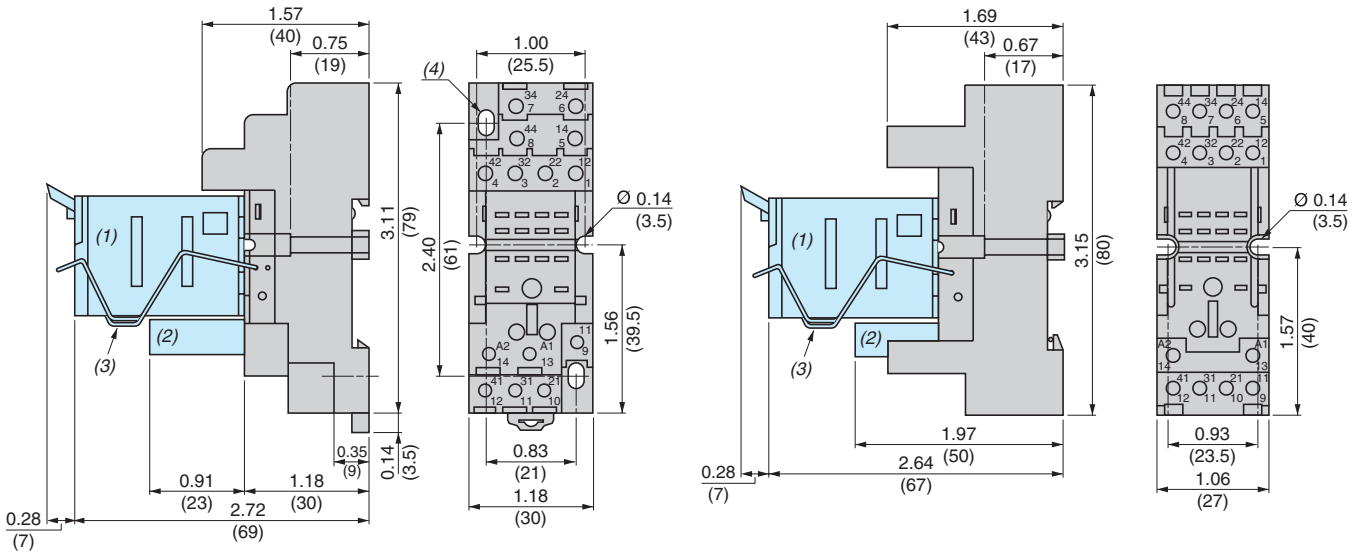
Relays

RXM●●●●●●	RXM2	RXM3	RXM4
Common view	Pin side view		

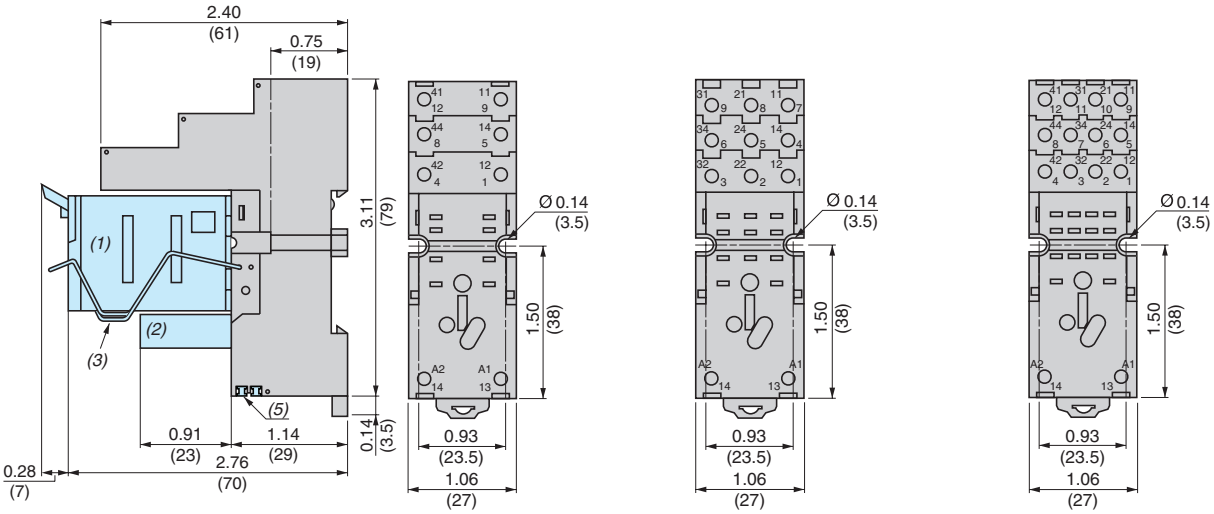


Sockets

RXZE2M114	RXZE2M114M



RXZE2S●●●●	RXZE2S108M	RXZE2S111M	RXZE2S114M
Common side view	Pin side view		



(1) Relays
(2) Add-on protection module
(3) Hold-down clip
(4) 2 elongated holes Ø 0.14 x 0.26 (3.5 x 6.5)
(5) 2 bus jumpers

Dimensions = Inches / (mm)

Barriers and Isolators

Intrinsically Safe Zener Diode Barriers

Intrinsically Safe Galvanic Isolators

Description

For applications involving sensor use in hazardous locations,
Rockwell Automation offers a line of Intrinsic Safety Zener Diode Barriers and Galvanic Isolators. Both are economical solutions for instrumentation and control systems in hazardous locations as defined by NEC article 500 and CEC Part I, Section 18.

Zener diode barriers are *passive* protective interface assemblies that limit the amount of energy (voltage and current) that enters a hazardous area in the event of a fault (i.e., overvoltage, shorted field wiring). The energy is limited to an amount that would not be sufficient to ignite the potentially explosive atmosphere. Designed in a slim 1/2 inch wide housing, each barrier contains zener diodes that limit the voltage while a resistor prevents excessive current from being transferred to the hazardous area. In the barriers offered by Rockwell Automation, a replaceable fuse is used to protect the barrier from miswiring and transients.

The principle of a keyed fuse assembly has been employed. In case of a fault due to overvoltage, polarity misconnection or transients, only the protective keyed fuse assembly needs to be replaced.

The replacement of the fuse assembly can be done by the user at the job site. The barriers do not have to be returned to the manufacturer for replacement.

Intrinsically Safe or Galvanic Isolators are *active* protective interface assemblies that limit the amount of energy allowed to enter a hazardous area under fault conditions. Sometimes called Transformer Isolated Barriers, they separate intrinsically safe wiring from non-intrinsically safe wiring through the use of the same isolation coils found in power transformers. Galvanic isolators, unlike zener diode barriers, do not require grounding—therefore they may reduce ground loop problems as well as installation and maintenance costs. The slim 3/4 inch wide housing on DC models also conserves valuable mounting space. DIP switches provide convenient programming of output and diagnostic functions while multiple LEDs provide visual indication of module and circuit status.

Rockwell Automation zener diode barriers and galvanic isolators are DIN Rail mountable and designed primarily for use with intrinsically safe proximity sensors and photoelectrics. All Rockwell Automation barriers and isolators are UL Listed, FM Certified, CSA and CE Marked for all applicable directives.

Intrinsically Safe Zener Diode Barriers

Features

- Replaceable fuse
- Low internal resistance
- Short-circuit protected
- Reverse polarity protection
- Slim 1/2 inch wide housing
- UL Listed, FM, CSA and PTB Certified, and CE Marked for all applicable Directives

Specifications

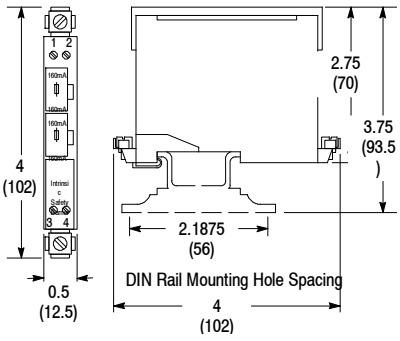
Environmental	
Certifications	UL, FM, CSA PTB, and CE Marked for all applicable directives
Operating Temperature [C (F)]	+20…+60° (-4…+140°)
Vibration	55 Hz (1.5 mm amplitude)
Shock	20 g
Relative Humidity	0…95% (noncondensation)
Electrical	
Leakage Current	≤1 µA
Protection Type	Reverse polarity (protected by replaceable fuse), over-voltage (protected by replaceable fuse), and short-circuit (incorporated)
Replaceable Fuse Rating	160 A
Operating Frequency	≤100 kHz @ Isc > 50 mA; ≤50 kHz @ Isc ≤0.50 mA
Short Circuit Protection	Incorporated
Mechanical	
Material	Polyamide
Mounting Location	Nonhazardous or Class 1, Division 2 or Zone 2/Zone 22 locations
I.S. Connections for	Class I, II, III; Div 1 and 2; Groups A-G and Zones 0, 1, 2, 20, 21, 22; Group IIC and IIB
Enclosure Rating	IP40 (IEC529)

Compatible Sensors

Photoelectrics

Sensor Style	Sensing Mode	Connection Type	Cat. No.	
			Sensor	Barriers Used†
9000 Through Beam Photoelectric	Emitter	2 m Cable	42GRL-9540	897H-S120
		4-Pin Micro	42GRL-9540-QD	
		4-Pin Mini	42GRL-9540-QD1	
	Receiver	2 m Cable	42GRR-9500	897H-S214 or 897H-S150
		4-Pin Micro	42GRR-9500-QD	
		4-Pin Mini	42GRR-9500-QD1	
5000 Photoelectric	Retroreflective	Screw Terminals	42DRU-5500	897H-S120 or 897H-S140 or 897H-S150
	Polarized Retroreflective		42DRU-5700	
	Standard Diffuse		42DRP-5500	
	Fiber Optic		42DRA-5500	

Approximate Dimensions [mm (in.)]



Proximities

Sensor Style	Barrel Diameter	Shielding	Cat. No.	
			Sensor	Barriers Used†
Stainless Steel Face and Barrel Proximity Sensor	12 mm	Shielded	871TM-DR2ENE12-⊗	897H-S214 or 897H-S120
		Unshielded	871TM-DR4ENE12-⊗	
	18 mm	Shielded	871TM-DR2ENE18-⊗	
		Unshielded	871TM-DR4ENE18-⊗	
	30 mm	Shielded	871TM-DR2ENE30-⊗	
		Unshielded	871TM-DR4ENE30-⊗	

⊗ Replace symbol with desired termination. A2 for 2 meter PVC cable and D4 for 4-pin micro QD.

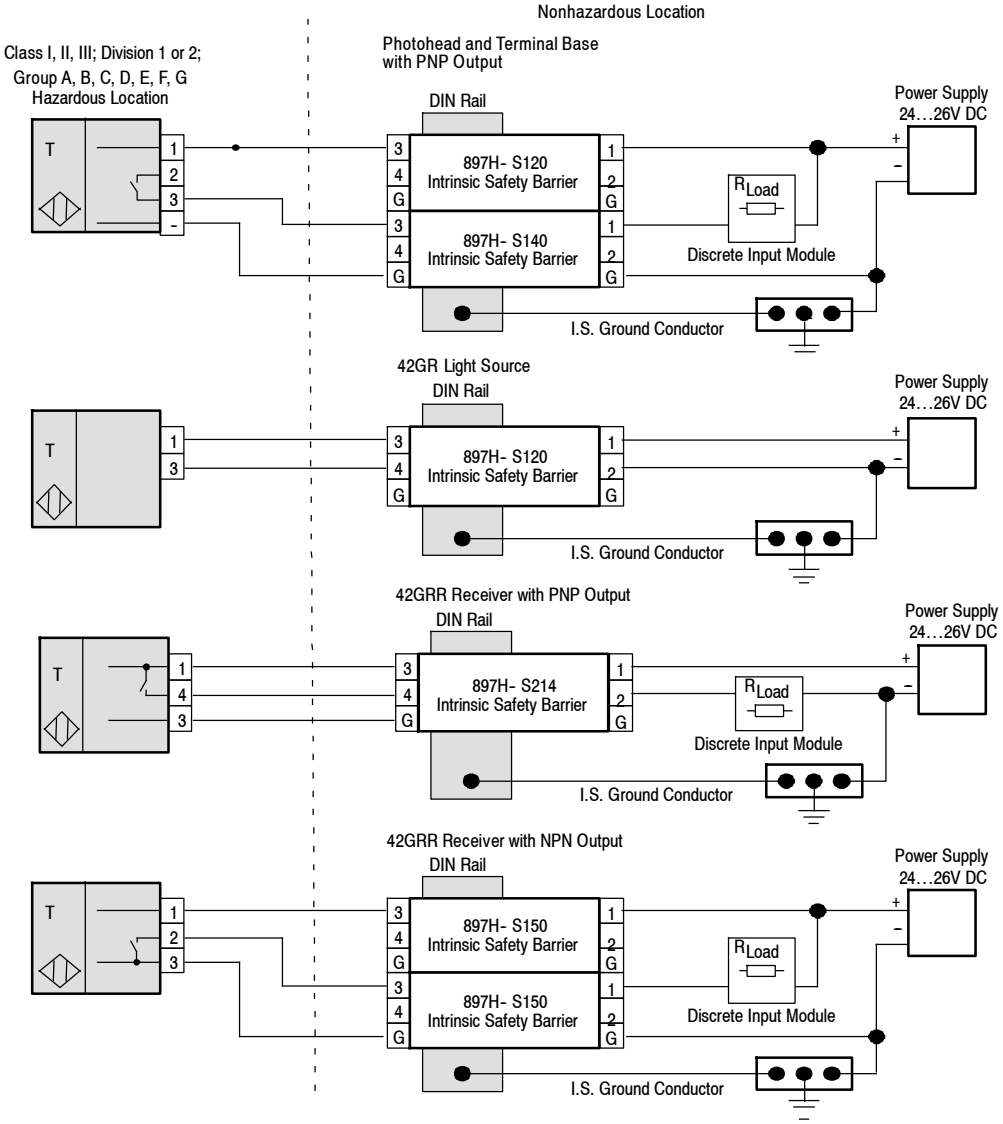
Intrinsically Safe Zener Diode Barriers

Product Selection

Rated Voltage	Internal Resistance	Classification	FM Entity Parameters: Supply Voltage, Max.	FM Entity Parameters: Current, Max.	FM Entity Parameters: Power, Max.	FM Entity Parameters: Permissible External Capacity	FM Entity Parameters: Permissible External Inductance, Max.	ATEX Certified Stahl Part No.	Cat. No.
24V DC	286…319 ohms	A, B, E	28V	100 mA	700 Mw	0.083 µF	1.6 mH	9001/01-280-100-101	**897H-S120**
		D, F, G				0.65 µF	11 mH		
	0 ohms	A, B, E				0.083 µF	1.6 mH	9001/03-280-000-101	**897H-S140**
		D, F, G				0.65 µF	230 mH		
	599…666 ohms	A, B, E				0.083 µF	1.6 mH	9001/01-280-050-101	**897H-S150**
		D, F, G				0.65 µF	230 mH		
	269…290 ohms	A, B,E				0.083 µF	1.6 mH	9002/13-280-110-001	**897H-S214**
		D, F, G				0.65 µF	230 mH		
	321…356 ohms	A, B				0.083 µF	1.6 mH	9002/11-280-186-001	**897H-S233**
		D, F, G				0.65 µF	230 mH		
Replacement Fuse Assembly									**897H-F160**

Note: Safety Parameters stated above are per input.

Typical Wiring Diagram



MotorSaver®
THREE-PHASE ELECTRIC MOTOR PROTECTOR

INSTALLATION INSTRUCTIONS FOR SYMCOM'S MOTORSAVER®
MODEL 460

DANGER!

HAZARDOUS VOLTAGES MAY BE PRESENT DURING INSTALLATION.
Electrical shock can cause death or serious injury.
Installation should be done by qualified personnel following all national, state and local electrical codes.

BE SURE POWER IS DISCONNECTED PRIOR TO INSALLATION!
FOLLOW NATIONAL, STATE, AND LOCAL CODES!
READ THESE INSTRUCTIONS ENTIRELY BEFORE INSTALLATION!

! WARNING !

UNEXPECTED OUTPUT ACTUATION CAN OCCUR.
Use hard-wired safety interlocks where personnel and/or equipment hazards exist.
Failure to follow this instruction can result in death, injury or equipment damage.

The Model 460 MotorSaver® is an auto ranging voltage monitor designed to protect three-phase motors regardless of size. The MotorSaver® is used on 190-480 VAC, 50 to 60 Hz motors to protect from damage caused by single phasing, low voltage, high voltage, phase reversal, and voltage unbalance.

CONNECTIONS

1. Mount the MotorSaver® in a convenient location in or near the motor control panel. If the location is wet or dusty, the MotorSaver® should be mounted in a NEMA 4 or 12 enclosure. The MotorSaver® can be mounted to a back panel using two #6 or #8 x 5/8 screws or can be snapped onto a DIN rail.
2. Connect L1, L2 and L3 on the MotorSaver's terminal strip to the LINE SIDE of the motor starter. (See Figure No. 1).
3. Connect the output relay to the circuitry to be controlled. For motor control, connect the normally open contact in series with the magnetic coil of the motor starter as shown in Figure No. 1. For alarm operation, connect the normally closed contact in series with the control circuit as shown in Figure No. 2.

SymCom Inc
Motor Protection & Controls Since 1974
2880 North Plaza Drive, Rapid City, SD 57702 • (800) 843-8848

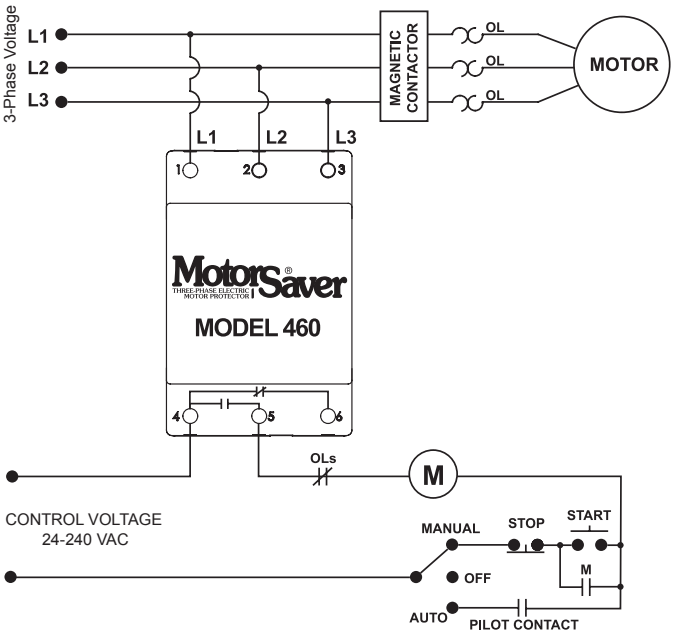


FIGURE NO. 1: CONTROL WIRING DIAGRAM

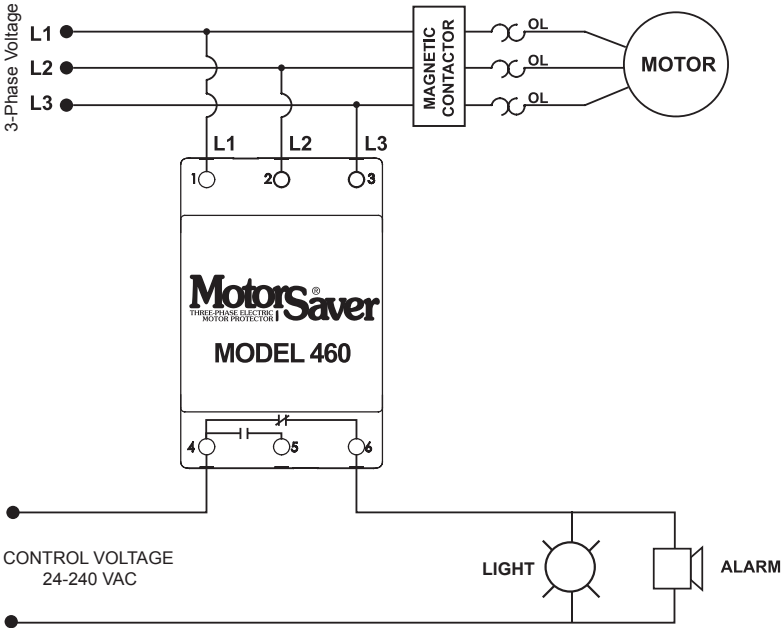
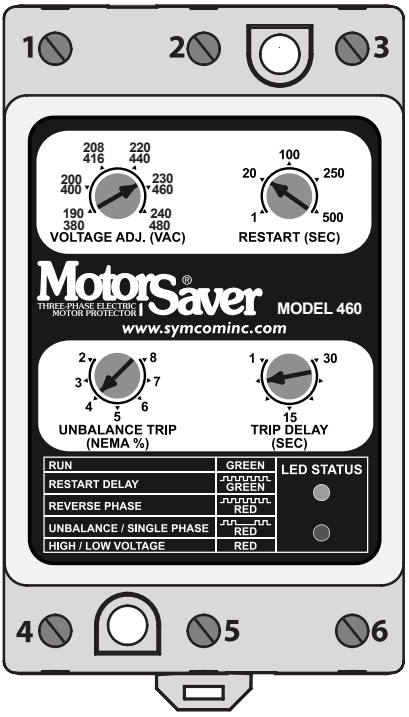


FIGURE NO. 2: ALARM WIRING DIAGRAM

SETTINGS



1. Line voltage adjustment: Rotate the **"VOLTAGE ADJ. (VAC)"** to the nominal three-phase line voltage feeding the motor to be protected.
2. Restart delay adjustment: Rotate the **"RESTART (SEC)"** adjustment to the desired position. The restart delay is the time between MotorSaver® seeing acceptable voltage and the MotorSaver® closing its output contacts. For compressor applications, the restart delay should be set for the approximate time it takes for the head pressure to bleed off of the compressor. For other applications, the restart delay is typically set between 2 and 10 seconds.
3. Trip delay adjustment: Rotate the **"TRIP DELAY (SEC)"** adjustment to the desired setting. This adjustment does not affect the trip delay on phasing faults. Typically, the trip delay adjustment is set between 1 and 5 seconds. In areas where voltage fluctuations are frequent, the trip delay adjustment may be set greater than 10 seconds.
4. Voltage unbalance adjustment: Rotate the **"UNBALANCE TRIP (NEMA%)"** adjustment to the desired unbalance trip level. The NEMA MG1 standard does not recommend operating a motor above 1% voltage unbalance without derating the motor. The NEMA MG1 standard also recommends against operating a motor above a 5% voltage unbalance under any circumstances. SymCom recommends consulting the motor manufacturer for specific tolerances.

$$\text{Percent Unbalance} = \frac{\text{Maximum Deviation from the Average}}{\text{Average}} \times 100$$

Example: The measured line-to-line voltages are 203, 210, and 212.

$$\text{Average} = \frac{203 + 210 + 212}{3} = 208.3$$

The maximum deviation from the average is the largest difference between the average voltage (208.3) and any one voltage reading.

208.3 - 203 = 5.3 210 - 208.3 = 1.7 212 - 208.3 = 3.7

The maximum deviation from the average is 5.3.

$$\frac{5.3}{208.3} \times 100 = 2.5\% \text{ Unbalance}$$

POWER-UP

Turn on the 3∅ power to the motor. The MotorSaver's green RUN light will blink during the RESTART delay. After the RESTART delay, the MotorSaver® will energize its output contacts and the green RUN light will illuminate. If the contacts do not energize and the RUN light does not illuminate, see the TROUBLESHOOTING section.

DIAGNOSTIC INDICATOR LIGHTS	
RUN	GREEN
RESTART DELAY	 GREEN
REVERSE PHASE	 RED
UNBALANCE / SINGLE PHASE	 RED
HIGH / LOW VOLTAGE	RED

CONGRATULATIONS!!
YOU HAVE JUST INSTALLED THE FINEST MOTOR PROTECTION AVAILABLE!!

TROUBLESHOOTING

SYMPTOM	LIGHT PATTERN	SOLUTION
No lights are on. The unit seems completely dead.	N / A	Measure the three line-to-line voltages. If any of the voltages are below 150 VAC, the MotorSaver® does not have enough power to operate its internal electronics. This may occur on a single-phased system. If the voltages are correct, call SymCom at 1-800-843-8848 or 1-605-348-5580.
Red light is blinking (on initial power up).	 RED	Turn off the three-phase power. Swap any two leads powering the MotorSaver® (L1, L2, or L3). There is a 50-50 chance of connecting L1, L2, and L3 correctly the first time. Re-apply the three-phase power.
Red light is blinking (after the motor has been previously running).	 RED	The incoming lines have been reverse phased. The MotorSaver® is preventing the motor from running backwards. Correct the phase sequence.
Red light is blinking in this pattern.	 RED	The voltage is unbalanced or single-phased. Measure the incoming line voltages and calculate the % unbalance. If the voltage unbalance does not exceed the % unbalance reset value, call SymCom at 1-800-843-8848 or 1-605-348-5580.
Red light is on steady.	RED	The voltage is out of tolerance. Measure the three line-to-line voltages. Calculate the average of the three voltages. If the average is 7% above or below the nominal voltage as selected by the LINE VOLTAGE ADJUST, the MotorSaver® is functioning properly. If the voltage is within ±7% of the selected line voltage, call SymCom at 1-800-843-8848 or 1-605-348-5580.
Green light blinks and motor is not running.	 GREEN	The MotorSaver® is in restart delay.
Green light is on steady, but motor does not start.	GREEN	The MotorSaver® is in run mode. Ensure other control devices are allowing the motor to start. Check control circuit for loose wires or malfunctioning switches.

Any questions or comments call SymCom at 1-800-843-8848 or 1-605-348-5580

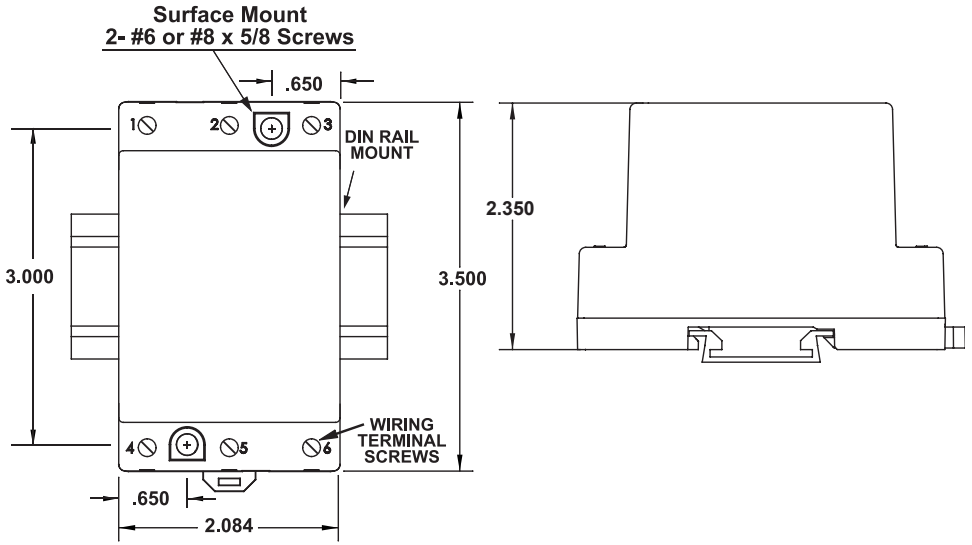
SPECIFICATIONS

3 - Phase Line Voltage	190 - 480 VAC
Frequency	50* - 60 Hz
Low Voltage (% of setpoint)	
Trip	90% ± 1%
Reset	93% ± 1%
High Voltage (% of setpoint)	
Trip	110% ±1%
Reset	107% ±1%
Voltage Unbalance (NEMA)	
Trip	2 - 8% Adjustable
Reset	Trip Setting minus 1% (5 - 8%)
	Trip Setting minus 0.5% (2 - 4%)
Trip Delay Time	
Low, High, and Unbalanced Voltage	1 - 30 Seconds Adjustable
Single-phasing faults (>25% UB)	1 Second Fixed
Restart Delay Time	
After a fault or complete power loss	1 - 500 Seconds Adjustable
Output Contact Rating - SPDT	
Pilot Duty	480 VA @ 240 VAC
General Purpose	10 A @ 240 VAC
Power Consumption	6 Watts (maximum)
Weight	14 oz
Enclosure	Polycarbonate
Terminal	
Torque	6 Inch-Pounds Max.
Wire AWG	12 - 20 AWG
Safety Marks	
UL	UL508 (File # E68520)
CE	IEC 60947-6-2
Standards Passed	
Electrostatic Discharge (ESD)	IEC 1000-4-2, Level 3, 6 kv contact, 8 kv air
Radio Frequency Immunity, Radiated	159 MHz, 10 V/m
Fast Transient Burst	IEC 1000-4-4, Level 3, 3.5 kv input power and controls

*NOTE: 50 Hz will increase all delay timers by 20%

Surge	
IEC	IEC 1000-4-5, Level 3, 4kv line-to-line; Level 4, 4kv line-to-ground
ANSI / IEEE	C62.41 Surge and Ring Wave Compliance to a level of 6kv line-to-line
Hi-potential Test	Meets UL508 (2 x rated V +1000V for 1 minute)
Environmental	
Temperature Range	Ambient Operating: -20° - 70° C (-4° - 158°F) Ambient Storage: -40° - 80° C (-40° - 176°F)
Class of Protection	IP20, NEMA 1 (Finger Safe)
Relative Humidity	10-95%, non-condensing per IEC 68-2-3

DIMENSIONS



SymCom warrants its microcontroller based products against defects in material or workmanship for a period of five (5) years* from the date of manufacture. All other products manufactured by SymCom shall be warranted against defects in material and workmanship for a period of two (2) years from the date of manufacture. For complete information on warranty, liability, terms, and conditions, please refer to the SymCom Terms and Conditions of Sale document.

CVX surge protective device

Contents

Description **Page**

Product application 1
General description 2
Features, functions, and benefits. 2
Optional features 2
Standards and certifications 2
Product specifications 3
Product ordering guidelines. 4

Product application

Eaton's CVX050 and CVX100 surge protective devices (SPDs) protect electronic equipment from damaging transients. These units are suitable for medium and low exposure level applications that require cost-effective, high quality system protection including:

- Residential/small business
- Light industrial
- Light commercial
- Service entrance and branch panel protection
- OEM applications
- Control panels

Powering Business Worldwide

General description

CVX050/100

With over two decades of experience in the surge suppression industry and extensive R&D initiatives, Eaton is considered a world leader in SPD manufacturing. All of Eaton's products are manufactured in an ISO 9001:2000 and ISO 14001 certified facility.

Eaton's CVX050/100 models are rugged, cost-effective, high-quality SPDs that feature self-protected metal oxide varistors (MOVs) that eliminate the failure characteristics of standard metal-oxide-varistors. The self-protected MOV is a fail-safe device that monitors the status of the metal-oxide disk and disconnects itself from the power system when the disk is approaching breakdown.

The CVX050/100 is easy to install adjacent or even internal to electrical equipment. When installing an SPD in a retrofit environment, it is important to mount the device as close to the electrical equipment as possible. Keep the wiring (lead length) between the electrical equipment and SPD as short as possible, and twist or wire tie the conductors together to reduce the wire's impedance factor.

Features, functions, and benefits

- Large diameter, self-protected metal oxide varistors provide long life and fail-safe operation
- Rated 50 kA (CVX050) or 100 kA (CVX100) peak surge current
- Wide range of voltage applications from 100 to 600 Vac
- Rugged NEMA® 4X (IP56) enclosure
- LED monitoring of each phase
- Wiring systems: Single-phase, split-phase, three-phase wye, three-phase delta or three-phase high leg delta
- #10 AWG (6mm^2) stranded wire included
- ¾-inch threaded conduit fitting included
- 5 year free-replacement warranty

Optional features

- Available external mounting feet

Standards and certifications

- UL® 1449 3rd Edition for surge suppression devices
- CSA® and CE marked
- Vibration tested to IEC 60255-21-1 and IEC 60255-21-2

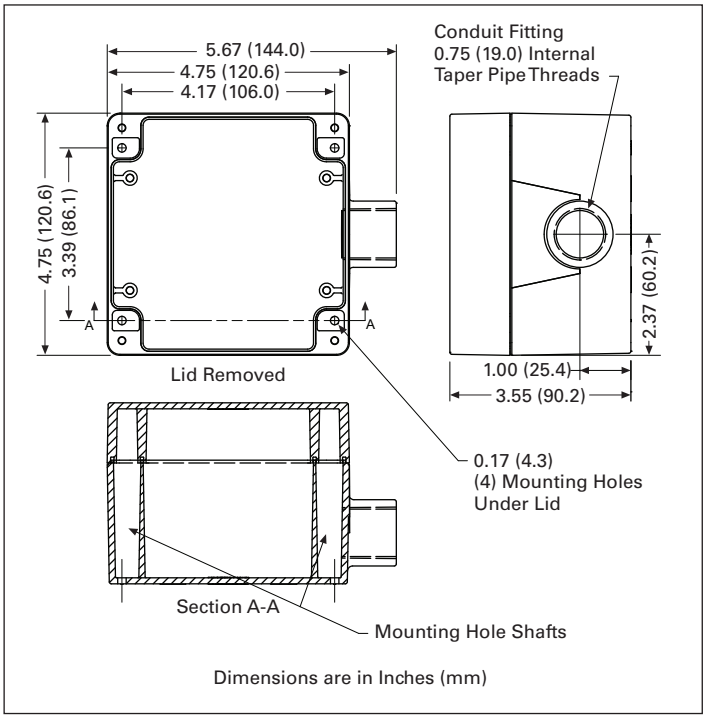


Figure 1. Standard Dimensions

Product specifications

Table 1. CVX050/100 Model Specifications

Description	Specification
Peak kA per phase	50, 100
Peak kA per mode	50
Nominal discharge current	20 kA ①
Short-circuit current rating	100 kA
Single-phase voltages	200, 208, 220, 230, 240, 277, 380, 400, 440, 460, 480
Split-phase voltages	100/200, 110/220/ 120/240
High leg delta voltages	240
Wye system voltages	100/175, 110/190, 120/208, 127/220, 220/380, 230/400, 240/415, 277/480, 305/525, 347/600
Delta system voltages	200, 208, 220, 230, 240, 380, 400, 415, 440, 480, 525, 600
Input power frequency	47–420 Hz (50/60 Hz typical)
Protection modes	Single-phase: L-N, N-G, L-G Split-phase: L-N, N-G, L-G, L-L High leg delta: L-N, N-G, L-G, L-L, H-N, H-G, H-L Wye: L-N, N-G, L-G, L-L Delta: L-G, L-L
Number of ports	1
Specific energy	100 kJ/Ohm
Weight	≈2.0 lbs (1.0 kg)
Operating temperature	–13°F (–25°C) to +140°F (+60°C)
Vibration tested	IEC 60255-21-1 and IEC 60255-21-2

① 480L, 600D, and 600Y units rated 10 kA In.

Table 2. CVX050/100 Voltage Ratings

Model	System Configuration	Nominal System Voltage	MCOV				UL 1449-3 VPR ①			
			L-L	L-N	L-G	N-G	L-L	L-N	L-G	N-G
CVX050										
230L	Single-phase two-wire + ground	200, 208, 220, 230, 240, 277	—	320	640	320	—	1200	1200	1200
480L	Single-phase two-wire + ground	380, 400, 440, 460, 480	—	550	1100	550	—	1800	4000	1800
240S	Split-phase three-wire + ground	100/200, 110/220, 120/240	300	150	300	150	1200	700	1200	800
208Y	Three-phase wye (star) four-wire + ground	100/175, 110/190, 120/208, 127/220	300	150	300	150	1200	700	1200	800
480Y	Three-phase wye (star) four-wire + ground	220/380, 230/400, 240/415, 277/480	640	320	640	320	2500	1200	2000	1200
600Y	Three-phase wye (star) four-wire + ground	305/525, 347/600	840	420	840	420	2500	1500	2500	1500
240D	Three-phase delta three-wire + ground	200, 208, 220, 230, 240	640	—	320	—	2000	—	1200	—
240H	Three-phase high leg delta	240	300	150	150	640	1500	700	1200	700
480D	Three-phase delta three-wire + ground	380, 400, 415, 440, 480	1100	—	550	—	3000	—	1800	—
600D	Three-phase delta three-wire + ground	525, 600	1100	—	700	—	3000	—	2500	—
CVX100										
230L	Single-phase two-wire + ground	200, 208, 220, 230, 240, 277	—	320	320	320	—	1200	1200	1200
480L	Single-phase two-wire + ground	380, 400, 440, 460, 480	—	550	550	550	—	1800	1800	1800
240S	Split-phase three-wire + ground	100/200, 110/220, 120/240	300	150	150	150	1200	700	800	700
208Y	Three-phase wye (star) four-wire + ground	100/175, 110/190, 120/208, 127/220	300	150	150	150	1000	600	700	700
480Y	Three-phase wye (star) four-wire + ground	220/380, 230/400, 240/415, 277/480	640	320	320	320	1800	1200	1200	1200
600Y	Three-phase wye (star) four-wire + ground	305/525, 347/600	840	420	420	420	2500	1500	1500	1500
240D	Three-phase delta three-wire + ground	200, 208, 220, 230, 240	640	—	320	—	1800	—	1200	—
240H	Three-phase high leg delta	240	300	150	150	150	1200	700	700	700
480D	Three-phase delta three-wire + ground	380, 400, 415, 440, 480	1100	—	550	—	3000	—	1800	—

① UL 1449 3rd Edition VPR (voltage protection rating) test environment: All tests performed with 6-inch lead length, positive polarity.

Product ordering guidelines

CVX 050 230L

Per Phase Peak Surge Current
050 = 50 kA
100 = 100 kA

Configuration and Voltage Ranges (Vac)
230L = Single-phase—200, 208, 220, 230, 240, 277
480L = Single-phase—380, 400, 440, 460, 480
240S = Split-phase—100/200, 110/220, 120/240
240H = Three-phase high leg delta—120/240
208Y = Three-phase wye (star)—100/174, 110/190, 120/208, 127/220
480Y = Three-phase wye (star)—220/380, 230/400, 240/415, 277/480
600Y = Three-phase wye (star)—305/525, 347/600
240D = Three-phase delta—200, 208, 220, 230, 240
480D = Three-phase delta—380, 400, 415, 440, 480
600D = Three-phase delta—525, 600 (600D available in 50 kA only)

CVX050/100 accessories

Table 3. CVX050/100 Accessories

Description	Catalog Number
External mounting feet	**MNTGFTX**

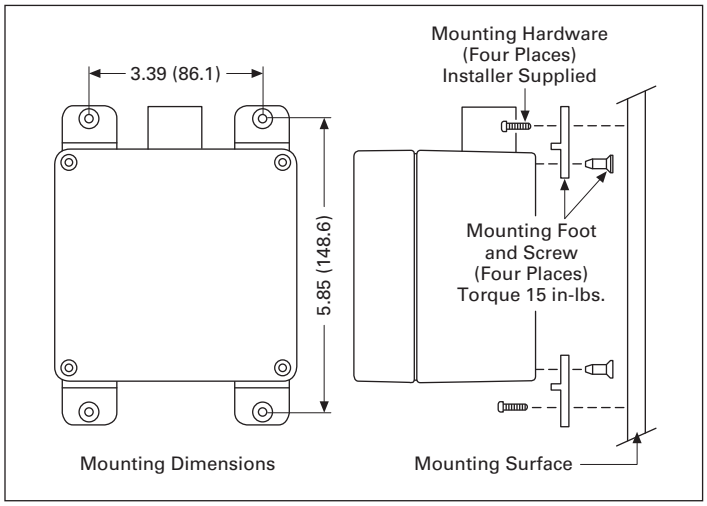


Figure 2. Wall Mounting with External Mounting Feet

Eaton Corporation
Electrical Sector
1111 Superior Ave.
Cleveland, OH 44114
United States
877-ETN-CARE (877-386-2273)
Eaton.com

Printed in USA
Publication No. TD01005002E / Z11434
August 2011

Powering Business Worldwide

idec

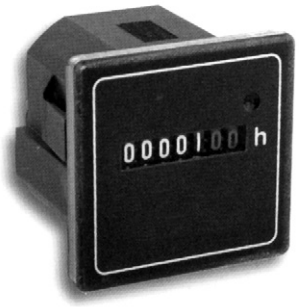
Timer Selection Guide

Series Model	RTE	GT3A	GT3D	GT3F
Appearance	NEW! 			
Mode of Operation	ON-delay Interval OFF-delay One-shot Cycle Signal OFF delay Signal ON/OFF delay	ON-delay Interval OFF-delay One-shot Cycle (off first) Cycle (on first) Signal OFF delay Signal ON/OFF delay	ON-delay Interval One-shot One-shot ON delay Cycle Signal OFF delay Signal ON/OFF delay	True OFF-delay
Time Range	0.1 second to 600 hrs	0.05 second to 180 hrs	0.01 second to 99.9 hrs	0.05 to 600 seconds
Contact Configuration	DPDT	SPDT, DPDT	SPDT, DPDT	SPDT, DPDT
Repeat Accuracy	±0.25% maximum	±0.2% maximum	±0.3% maximum	±0.4% maximum
Contact Load Rating (resistive)	10A, 240V AC	SPDT: 3A, 250V AC DPDT: 5A, 240V AC	SPDT: 3A, 250V AC DPDT: 5A, 240V AC	5A, 250V AC
Available Operating Voltage	120-240V AC 12V DC 24V AC/DC	100 to 240V AC 12V DC 24V AC/DC	100 to 240V AC 12V DC 24V AC/DC	100 to 240V AC 24V AC/DC
Approvals	UL Listed TUV CSA CE	UL recognized TUV CSA CE	UL recognized TUV CSA CE	UL recognized TUV CSA CE

Appearance					
Mode of Operation	Star-Delta	Sequential start ON-delay Recycler & instantaneous Recycler OFF start Recycler ON start Interval Interval ON delay Sequential interval	ON-delay	ON-delay	ON-delay
Time Range	Star side: 0.05s to 100s Star-delta Switching Time: 0.05, 0.1, 0.25, 0.5 seconds	0.1s to 6 hrs	0.1s to 10 hrs	0.1s to 10 minutes	0.1s to 1 hour
Contact Configuration	SPST-NO	DPDT	SPDT, DPDT	SPDT	DPDT, 4PDT
Repeat Accuracy	±0.2% maximum	±0.2% maximum	±0.2% maximum	±0.2% maximum	±0.2% maximum
Contact Load Rating (resistive)	5A, 250V AC/30VDC	3A, 250V AC 5A, 120V AC/30V DC	5A, 240V AC	5A, 250V AC	5A, DPDT: 250V AC 3A, 4PDT: 250V AC
Available Operating Voltage	100 to 240V AC	100 to 240V AC 12V DC 24V AC/DC	24V AC/DC 110 to 120V AC 220 to 240V AC	100 to 120V AC 200 to 240V AC 12V DC 24V DC	100 to 120V AC 200 to 240V AC 12V DC 24V DC 24V AC
Approvals	UL recognized TUV CSA CE	UL Listed cUL TUV CE	UL Listed cUL TUV Rheinland CE	UL recognized TUV CSA CE	UL recognized TUV CSA CE

AC and DC Hour Meters

Hour meters show run time of machines, equipment, and other devices. When you need accurate information for testing, maintenance or warranty purposes, choose from a wide range of Control Dynamics AC, DC or Vibration hour meters.



	AC Models DC Models	HMA 460 HMD 460	HMA 470 HMD 470	HMA 300 HMD 300
AC	**Voltages**	24, 120, 240, 400VAC	24, 120, 240, 400VAC	24, 120, 240VAC
AC	**Frequency**	50Hz, 60Hz	50Hz, 60Hz	50Hz, 60Hz
AC	**Counting Range**	99,999.99 hours	99,999.99 hours	99,999.99 hours
AC	**Number of Digits**	5 integers, 2 decimals	5 integers, 2 decimals	5 integers, 2 decimals
AC	**Operating Temperature**	–12° to 176°F (–25° to 80°C)	–12° to 176°F (–25° to 80°C)	–12° to 158°F (–25° to 70°C)
AC	**Power Consumption**	8mA	8mA	8mA
DC	**Voltages**	6-30VDC, 10-80VDC	6-30VDC, 10-80VDC	6-12VDC, 12-36VDC, 36-80VDC
DC	**Counting Range**	999,999.9 hours	999,999.9 hours	999,999.9 hours
DC	**Number of Digits**	6 integers, 1 decimal	6 integers, 1 decimal	6 integers, 1 decimal
DC	**Operating Temperature**	–2° to 158°F (–20° to 70°C)	–2° to 158°F (–20° to 70°C)	12° to 131°F (–10° to 55°C)
DC	**Power Consumption**	9mA	9mA	9mA
AC & DC	**Protection**	IP 40 front side IP 20 terminals	IP 65 front side IP 00 terminals	IP 40 front side IP 00 terminals
AC & DC	**Front Dimensions**	1.89”x1.89” (48x48mm)	Ø2.28” (Ø58mm) Ø2.83” (Ø72mm)	1.42”x0.95” (36x24mm)
AC & DC	**Front Bezels**	2.05”x2.05”, 2.17”x2.17”, 2.83”x2.83” (52x52, 55x55, 72x72, Ø80mm)	Ø2.87” & 3.14” (Ø72 & Ø80mm)	1.89”x0.95”, 2.13”x1.14”, 1.89”x1.89” (48x24, 54x29, 48x48mm)
AC & DC	**Special Protection**	IP 65 front side IP 20 terminals	IP 67 front side IP 00 terminals	IP 65 front side (transp. housing) IP 00 terminals
AC & DC	**Approval**	CE mark, UL recognized	CE mark, UL recognized	CE mark, UL recognized
AC & DC	**Connection**	1/4” spade, screw clamp	1/4” spade, screw clamp	1/4” spade, screw clamp
AC & DC	**Mounting Options**	Flush with retainer bracket or metal clamp DIN rail	Flush with metal clamp or 3 screw front Ø2.83” and Ø3.14” (Ø72 and 80mm)	Flush with retainer clamp Cutout 1/3”x0.84” (33x22mm) or 3 screw front Ø2.83” (Ø72mm)

Control Dynamics LLC
www.controldynamicsllc.com
(551) 206-4517 • (914) 263-8970 • info@controldynamicsllc.com

Specification Grade Ground Fault Circuit Interrupters

2-Pole, 3-Wire Grounding
20A Feed-Through Rating
15A 125V
20A 125V

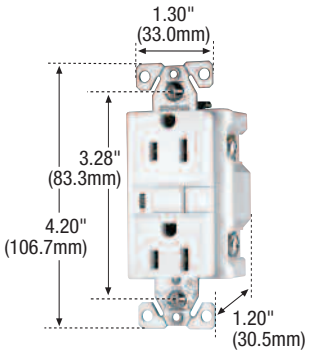
Specification Grade GFCI

FEATURES

- UL Listed, fully compliant with all latest UL 943 (4th edition) Class A GFCI, UL 498 requirements.
- ShockSentry™ lock-out function protects from miswired line-load connections and GFCI circuitry damage.
- Large visual indicator light provides quick visual reference of a tripped or "end of life" condition.
- When downstream receptacles are wired from load side, a 20 amp feed through rating offers full protection.
- Trip threshold (5ma+/-1ma) and response time (0.025 sec.) meet Class A requirements.
- Compact design provides maximum wiring room in "grounded box" applications.
- Maximum wiring flexibility is provided with 8 separate backwiring holes that accept up to #10 AWG stranded or solid wire.
- Ground screw backwiring clamp for fast, secure termination.
- Terminal screws are backed out, staked, and ready to wire.
- Device and wallplate mounting screws are captive, speeding installation time.
- Longer, wider "bridged" strap provides 40% more contact area with wallboard, virtually eliminating floating installations.
- Color-matched and recessed Test & Reset buttons provide uniform appearance.
- Matching thermoplastic wallplate included.
- GFCI with Auto Ground eliminates the need for a bonding jumper in grounded metal enclosures and provides a redundant measure of ground continuity where a jumper is used.
- Durable chemical and impact-resistant thermoplastic construction.

Back and Side-Wire with Unbreakable Wallplate

Rating A	V/AC	NEMA	Description	Color	Catalog No.** W/Std Plate	W/Midi Plate
15	125	5-15R	GFCI Receptacle	Almond	VGF15A	VGF15A-M
				Black	VGF15BK	–
				Brown	VGF15B	–
				Gray	VGF15GY	–
				Ivory	VGF15V	VGF15V-M
				Light Almond	VGF15LA	VGF15LA-M
				White	VGF15W	VGF15W-M
20	125	5-20R	GFCI Receptacle	Almond	VGF20A	–
				Black	VGF20BK	–
				Brown	VGF20B	–
				Gray	VGF20GY	–
				Ivory	VGF20V	–
				Light Almond	VGF20LA	–
				White	VGF20W	

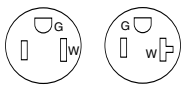


VGF15

Auto Ground GFCI, Back and Side-Wire with Standard Size Unbreakable Wallplate

Rating A	V/AC	NEMA	Description	Color	Catalog No.**
15	125	5-15R	GFCI Receptacle w/ Auto Ground	Ivory	VGF15V-AG
				White	VGF15W-AG
20	125	5-20R	GFCI Receptacle w/ Auto Ground	Ivory	VGF20V-AG
				White	VGF20W-AG

**Replaces XGF Series.



5-15R **5-20R**

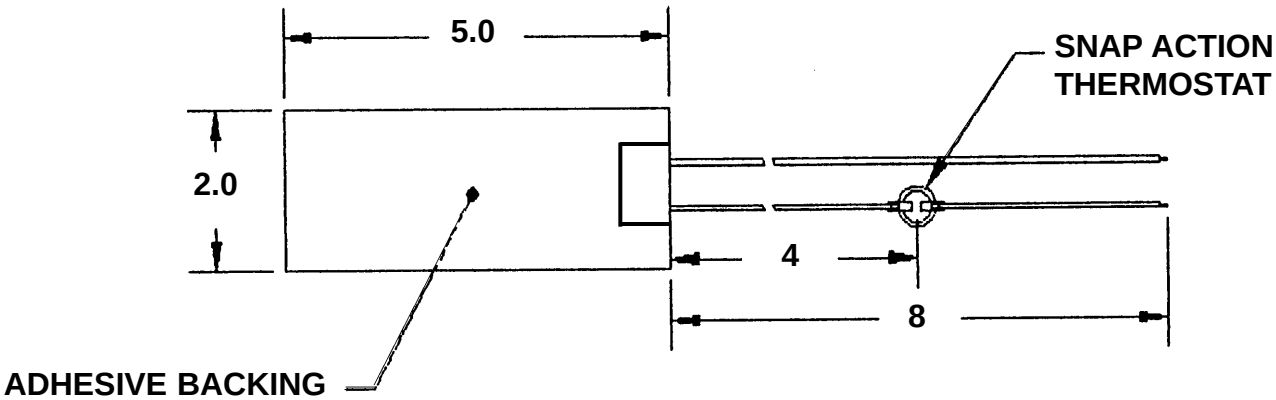
TESTING & CODE COMPLIANCE
· cULus Listed (file no. E60120). Meets all UL 943 (GFCI) and UL 498 (Receptacles) requirements and applicable CSA requirements.
· NOM Certified

MATERIAL CHARACTERISTICS
Meets flammability requirements per UL94, V2 rated. Temperature Rating: -35°C to 66°C.

HI-HEAT INDUSTRIES, INC.

256 Hanover Road, Lewistown, MT 59437
406-538-7411 • Info@hiheat.com

E020050A2 - Heater Assembly



CLOSE @ 32°F ± 10 (22-42°F)
OPEN @ 50°F ± 5 (55-45°F)

NOTES:
HEATING ELEMENT: SILICONE RUBBER W/ ETCHED STAINLESS STEEL ELEMENT
120 VOLT, 50 WATTS
U/L FILE # E95403
CATEGORY # KS0T2

Thermostat Serie FLZ

Pfannenberg
ELECTRO-TECHNOLOGY FOR INDUSTRY

Mechanical bi-metallic thermostat for temperature in enclosures. Suitable for Pfannenberg Filterfans® and heaters and also for monitoring temperature.

Different models available fitted with either change-over contact with neutral position, NCC or NOC. Function at increasing temperature. AS-i slave module also available.

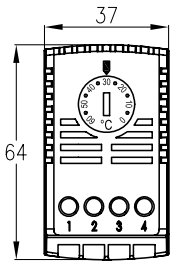
IP 20 — Level of protection

50 Hz / 60 Hz — suitable for both 50 Hz and 60 Hz

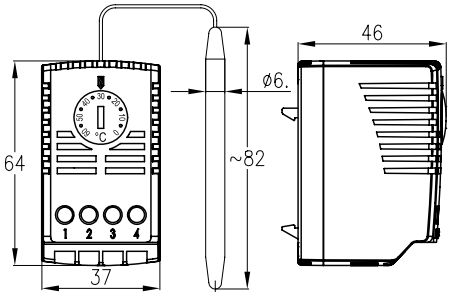
AC DC

Technical data:	FLZ 510	FLZ 520	FLZ 530	FLZ 550 AS-i
Type of contact	change over switch with spring contact	NCC with spring contact	NOC with spring contact	integrated AS-i bus slave
Available setting ranges	- 20 °C (- 4 °F) ... + 40 °C (+ 104 °F) 0 °C (+32 °F) ... + 60 °C (+ 140 °F) + 20 °C (+ 68 °F) ... + 80 °C (+ 176 °F)			-10°C (+14°F) ... +60°C (+140°F)
Max. breaking capacity, value in brackets inductive load at cos(phi) = 0,6	NCC: 100-250V AC/10(2)A NOC: 100-250V AC/5(2)A DC: max. 30W	240V AC / 10(2) A 120V AC / 15(2) A DC: max. 30W		< 20 mA 26,5 V ... 31,6 V AS-i profile: S-BA
Breaking temperature difference	1K: thermal return 3K: without thermal return 7K: capillary sensor	< 7K		1 - 4K
Tolerance for switching point	+/- 3K	+/- 4K		+/- 2K
Sensor	bimetal or remote sensor with 1,5 m capillary	bimetal		NTC
Connection	0,5 - 2,5 mm² screw clamps			1,3 mm DC Jack
Colour	RAL 7035 - light grey			
Weight	75 g	50 g	50 g	55 g
System of protection	IP20			
Working / storage temperature range	– 20 °C (- 4 °F) ... + 80 °C (+ 176 °F)			-25°C (-13°F) ... +80°C (+176°F)
Mounting method	snap fastening for 35 mm profile bars in accordance with EN 60715 (FLZ 520/530: for Pfannenberg Exhaust Filter PFA 3000 too) FLZ 550 AS-i not for headfirst mounting			
Approvals	UL approval applied for	UL approval		AS-i

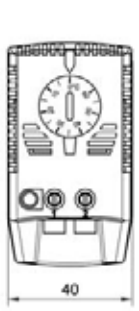
FLZ 510

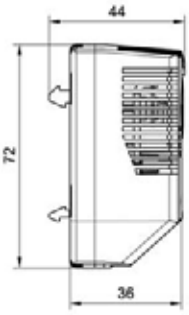


FLZ 510
capillary sensor

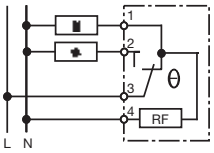


FLZ 520 / FLZ 530 / FLZ 550-AS-i

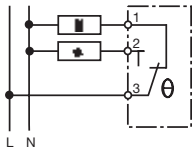




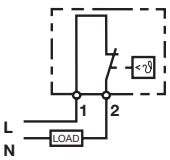
FLZ 510 1K



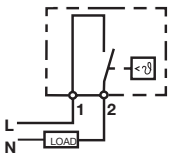
FLZ 510 3K / 7K



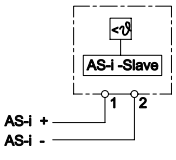
FLZ 520
NCC



FLZ 530
NOC



FLZ 550 AS-i



SIEMENS

SIRIUS
Thermistor-Motorschutz-Auslösegerät
Thermistor Motor Protection Tripping Unit
Déclencheur pour protection de moteur par thermistances
Disparador para protección de motor por termistores
Dispositivo di rilevazione del termistore di protezione del motore
Disparador para proteção de motor por termistores
Termistör motor koruma açma cihazı
Отключающий прибор защиты двигателя на терморезисторах
热敏电阻 – 电动机保护装置 – 脱扣装置

3RN10

Betriebsanleitung | **Operating Instructions** | **Instructions de service** | **Instructivo** | **Istruzioni operative**
Instruções de Serviço | **İşletme kılavuzu** | **Инструкция по эксплуатации** | **使用说明**

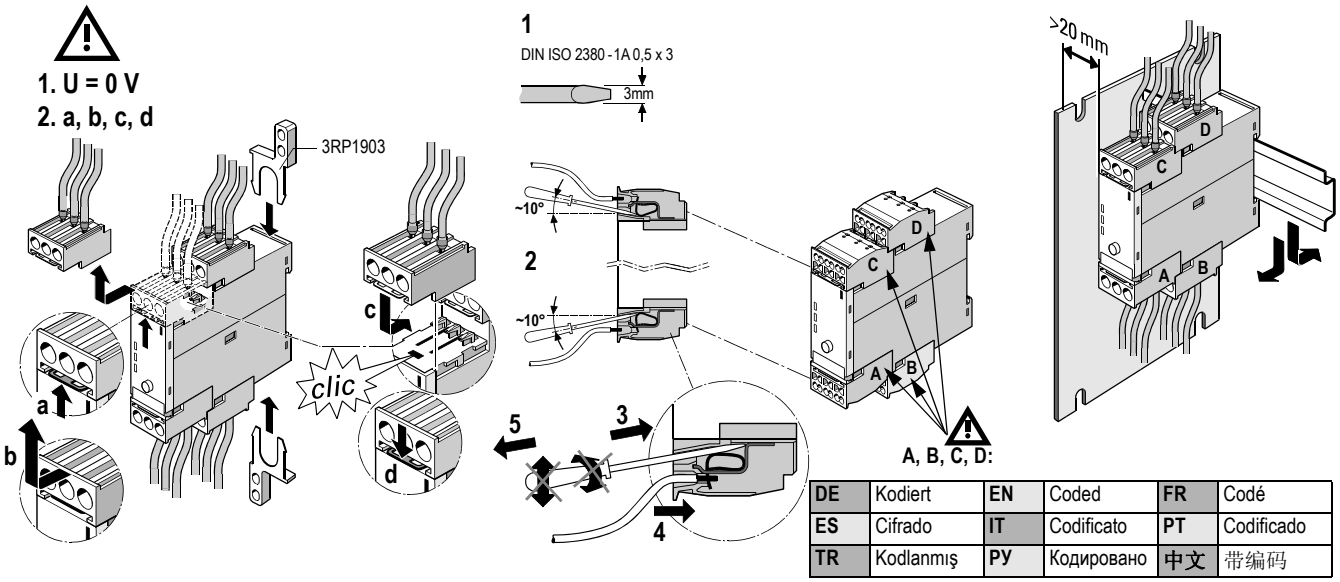
	Deutsch	English	Français
	Vor der Installation, dem Betrieb oder der Wartung des Geräts muss diese Anleitung gelesen und verstanden werden.	Read and understand these instructions before installing, operating, or maintaining the equipment.	Ne pas installer, utiliser ou intervenir sur cet équipement avant d'avoir lu et assimilé les présentes instructions et notamment les conseils de sécurité et mises en garde qui y figurent.
	⚠ GEFAHR	**⚠ DANGER**	**⚠ DANGER**
	Gefährliche Spannung. **Lebensgefahr oder schwere Verletzungsgefahr.** Vor Beginn der Arbeiten Anlage und Gerät spannungsfrei schalten.	**Hazardous voltage.** **Will cause death or serious injury.** Turn off and lock out all power supplying this device before working on this device.	**Tension électrique** **Danger de mort ou risque de blessures graves.** Mettre hors tension avant d'intervenir sur l'appareil.
	VORSICHT	**CAUTION**	**PRUDENCE**
	Eine sichere Gerätefunktion ist nur mit zertifizierten Komponenten gewährleistet!	Reliable functioning of the equipment is only ensured with certified components.	La sécurité de fonctionnement de l'appareil n'est garantie qu'avec des composants certifiés.

	Español	Italiano	Português
	Leer y comprender este instructivo antes de la instalación, operación o mantenimiento del equipo.	Leggere con attenzione queste istruzioni prima di installare, utilizzare o eseguire manutenzione su questa apparecchiatura.	Ler e compreender estas instruções antes da instalação, operação ou manutenção do equipamento.
	⚠ PELIGRO	**⚠ PERICOLO**	**⚠ PERIGO**
	Tensión peligrosa. **Puede causar la muerte o lesiones graves.** Desconectar la alimentación eléctrica antes de trabajar en el equipo.	**Tensione pericolosa.** **Può provocare morte o lesioni gravi.** Scollegare l'alimentazione prima di eseguire interventi sull'apparecchiatura.	**Tensão perigosa.** **Perigo de morte ou ferimentos graves.** Desligue a corrente antes de trabalhar no equipamento.
	PRECAUCIÓN	**CAUTELA**	**CUIDADO**
	El funcionamiento seguro del aparato sólo está garantizado con componentes certificados.	Il funzionamento sicuro dell'apparecchiatura è garantito soltanto con componenti certificati.	O funcionamento seguro do aparelho apenas pode ser garantido se forem utilizados os componentes certificados.

	Türkçe	Русский	中文
	Cihazın kurulumundan, çalıştırılmasından veya bakıma tabi tutulmasından önce, bu kılavuz okunmuş ve anlanmış olmalıdır.	Перед установкой, вводом в эксплуатацию или обслуживанием устройства необходимо прочесть и понять данное руководство.	安装、使用和维修本设备前必须先阅读并理解本说明。
	⚠ TEHLİKE	**⚠ ОПАСНО**	**⚠ 危险**
	Tehlikeli gerilim. **Ölüm tehlikesi veya ağır yaralanma tehlikesi mevcuttur.** Çalışmalara başlamadan önce, sistemin ve cihazın enerjisini kesiniz.	**Опасное напряжение.** **Опасность для жизни или возможность тяжелых травм.** Перед началом работ отключить подачу питания к установке и к устройству.	**危险电压。** **可能导致生命危险或重伤危险。** 操作设备时必须确保切断电源。
	ÖNEMLİ DİKKAT	**ОСТОРОЖНО**	**警告**
	Cihazın güvenli çalışması ancak sertifikalı bileşenler kullanılması halinde garanti edilebilir.	Безопасность работы устройства гарантировано только при использовании сертифицированных компонентов.	只有使用经过认证的部件才能保证设备的正常运转！

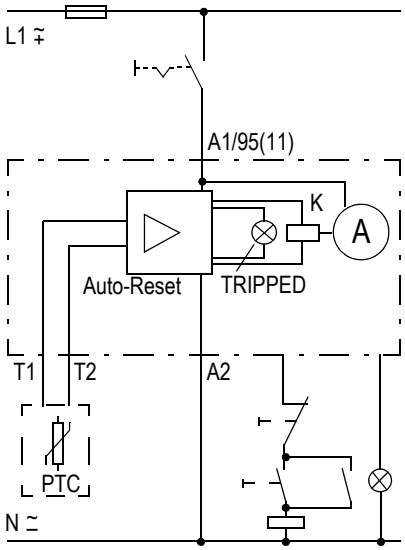
Technical Assistance: Telephone: +49 (0) 911-895-5900 (8°° - 17°° CET) Fax: +49 (0) 911-895-5907
E-mail: technical-assistance@siemens.com
Internet: www.siemens.de/lowvoltage/technical-assistance
Technical Support: Telephone: +49 (0) 180 50 50 222

GWA 4NEB 630 1181-70 DS 03 Last update: 25 April 2007
Bestell-Nr. / Order No.: 3ZX1012-0RN10-1AA1

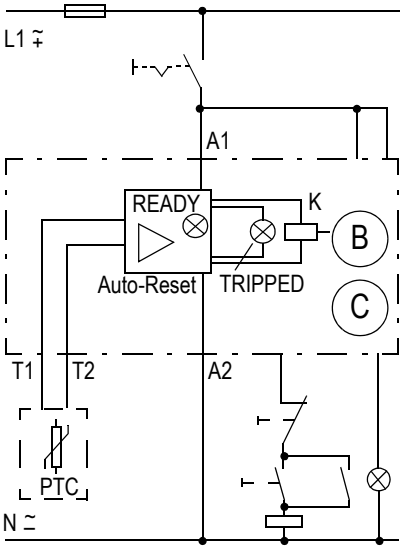


DE	Kodiert	**EN**	Coded	**FR**	Codé
ES	Cifrado	**IT**	Codificato	**PT**	Codificado
TR	Kodlanmış	**РУ**	Кодировано	**中文**	带编码

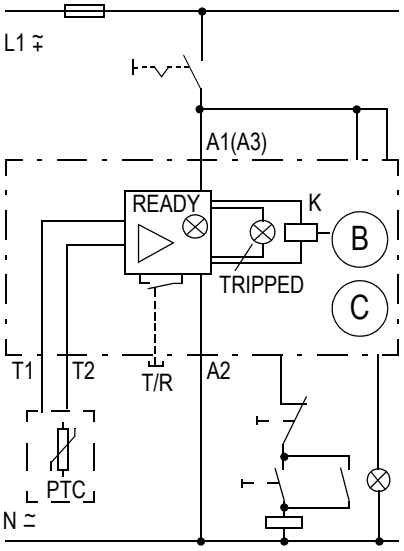
3RN1000



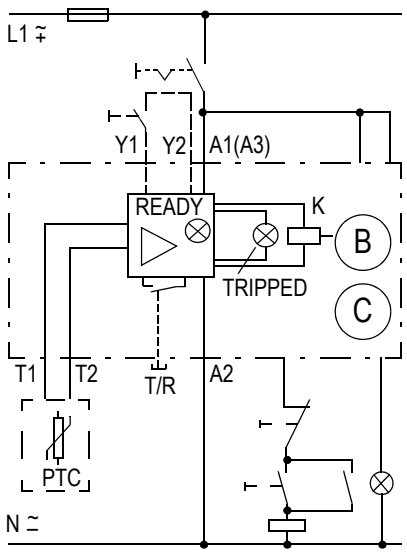
3RN1010



3RN1011 / 3RN1014

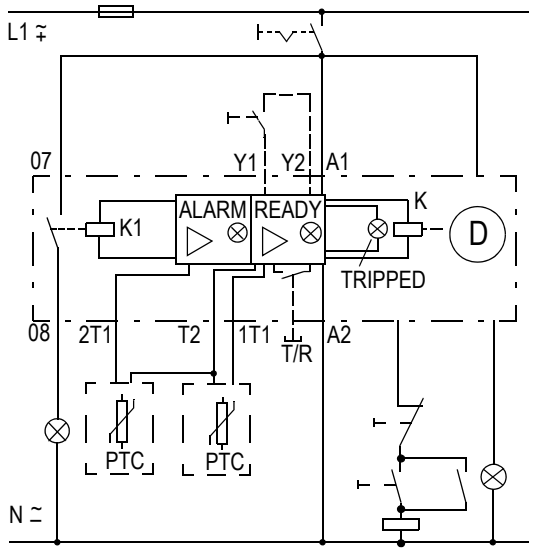


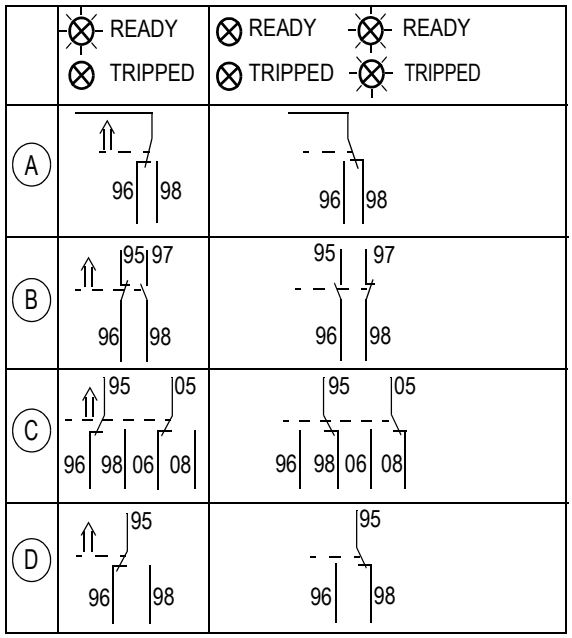
3RN1012: Ⓑ Ⓒ **/ 3RN1013:** Ⓒ

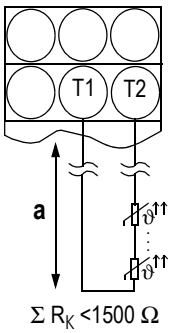


	READY TRIPPED	READY TRIPPED READY TRIPPED
A	96 98	96 98
B	95 97 96 98	95 97 96 98
C	95 05 96 98 06 08	95 05 96 98 06 08
D	95 96 98	95 96 98

3RN1022

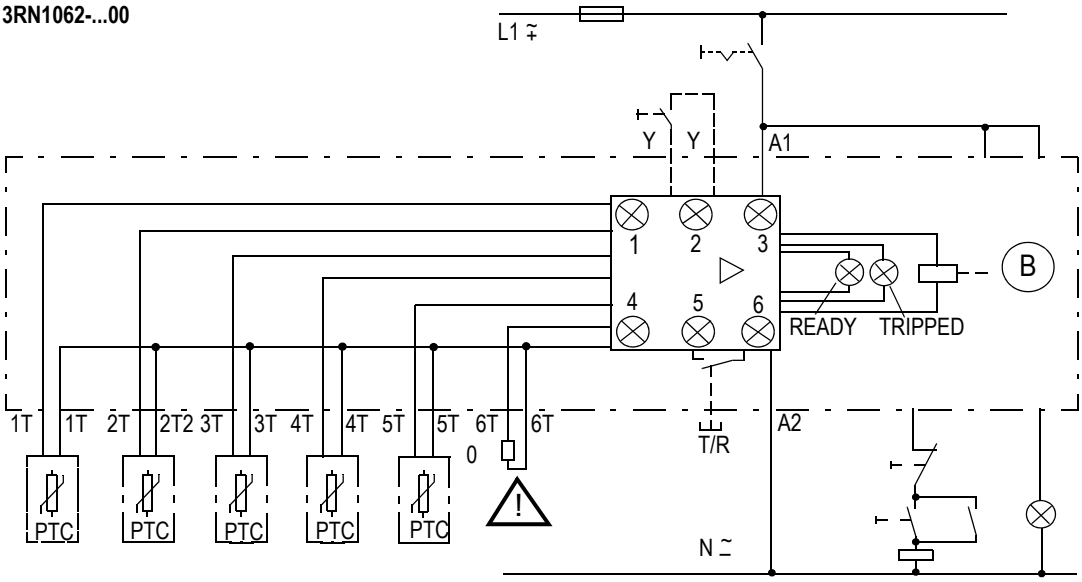






		3RN1000 3RN1010 3RN1011-.C 3RN1012-.C 3RN1014 3RN1022 3RN1062	3RN1011-.B 3RN1011-.G 3RN1012-.B 3RN1012-.G 3RN1013
a	mm^2 2,5 1,5 0,5	m 2 x 2800 2 x 1500 2 x 500	m 2 x 250 2 x 150 2 x 50

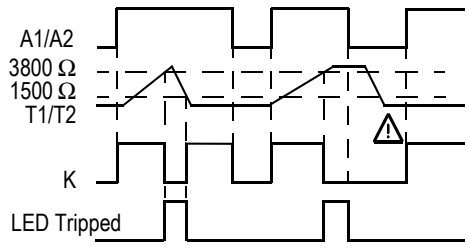
3RN1062-...00



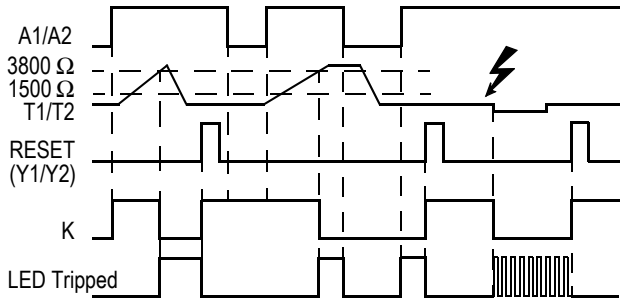
DE	⚠	**siehe Hinweise im Katalog und EG-Baumusterprüfbescheinigung PTB01 ATEX 3218;**
EN		**see notes in catalog and EC type-examination certificate PTB01 ATEX 3218;**
FR		**voir remarques dans catalogue et certificat d'approbation CE de modèle PTB01 ATEX 3218 ;**
ES		**ver las notas en el catálogo y el certificado de examen CE de tipo PTB01 ATEX 3218;**
IT		**Vedi le avvertenze nel Catalogo e il certificato di prova CE del modello PTB01 ATEX 3218;**
PT		**Ver indicações no catálogo e no certificado de exame CE de tipo PTB01 ATEX 3218;**
TR		**Bkz. Katalog bilgileri ve PTB01 ATEX 3218 AB Tip Kontrol Sertifikası;**
РУ		**см. указания в Каталоге и ЕС-Свидетельство испытаний промышленных образцов PTB01 ATEX 3218;**
中文		**请见目录中的提示及 EC - 类型 - 检测证明 PTB01 ATEX 3218;**

3RN1000
3RN1010

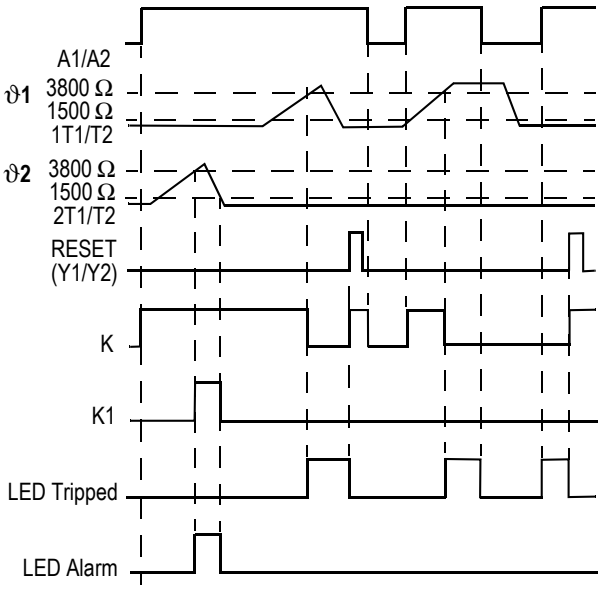
AUTO-RESET



3RN1013-...01

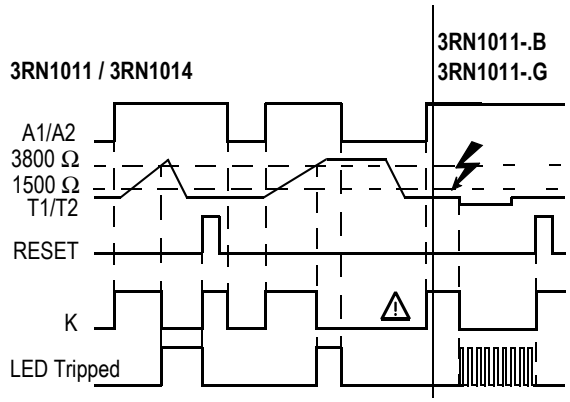


3RN1022



3RN1011 / 3RN1014

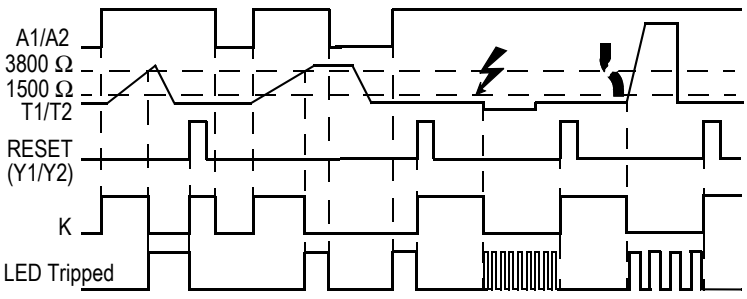
3RN1011-.B
3RN1011-.G



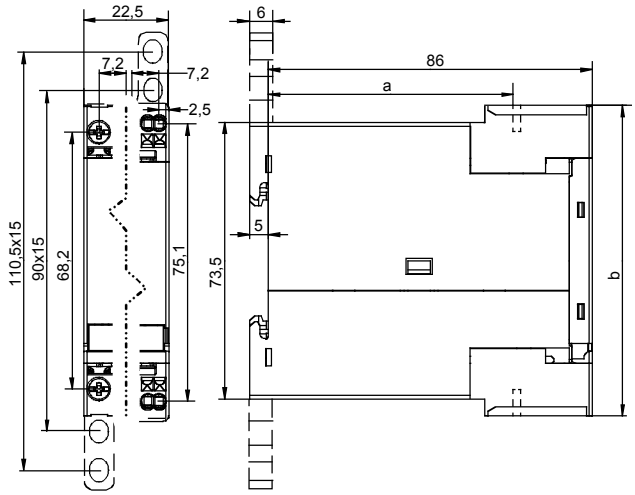
3RN1012
3RN1013
3RN1062

3RN1012-.B
3RN1012-.G
3RN1013

3RN1013-...00
3RN1013-...10

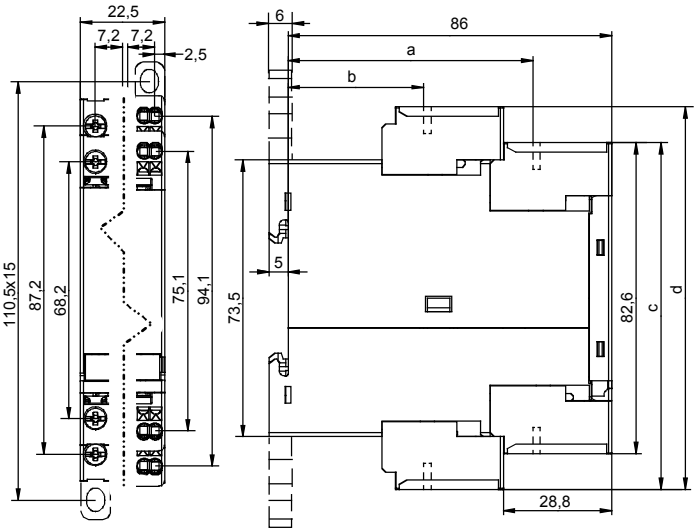


3RN1000



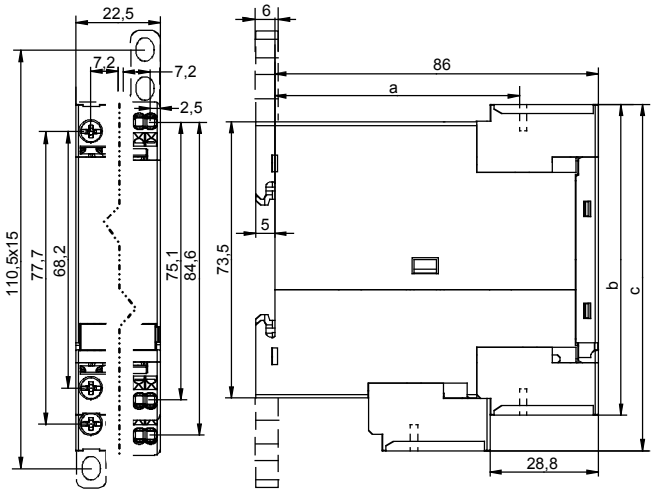
	a	b
3RN1000-1...	65	82,6
3RN1000-2...	—	84,4

3RN1010-.B / 3RN1010-.G / 3RN1011 / 3RN1012 / 3RN1013 / 3RN1014 / 3RN1022



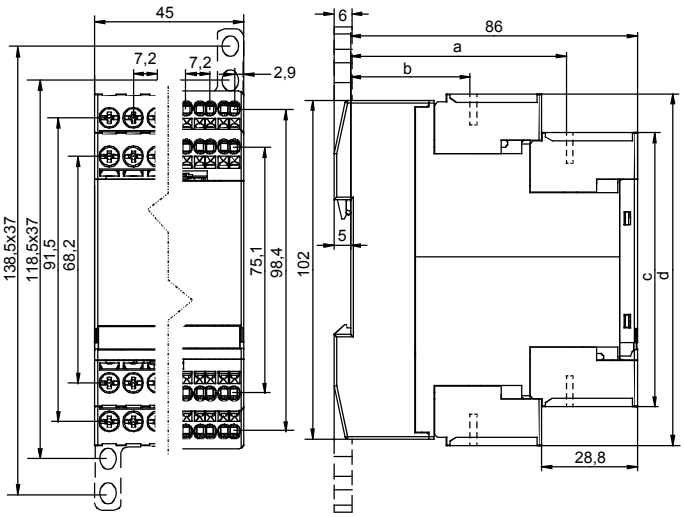
	a	b	c	d
3RN10..-1...	65	36	92,2	101,6
3RN10..-2...	—	—	93,9	103,4

3RN1010-.C



	a	b	c
3RN1010-1C..	65	82,6	92,2
3RN1010-2C..	—	84,4	93,9

3RN1062



	a	b	c	d
3RN1062-1...	65	36	82,6	105,9
3RN1062-2...	—	—	84,4	107,7

	3RN10..-1...	**3RN10..-2...**
∅ 5 ... 6 mm / PZ2	0,8 ... 1,2 Nm 7 to 10.3 lbf.in.	—
10	1 x 0,5 ... 4,0 mm² 2 x 0,5 ... 2,5 mm²	2 x 0,25 ... 1,5 mm²
10	2 x 0,5 ... 1,5 mm² 1 x 0,5 ... 2,5 mm²	2 x 0,25 ... 1,5 mm²
10	—	2 x 0,25 ... 1,5 mm²
AWG	2 x 20 to 14	2 x 24 to 16

DE	Abmessungen in mm
EN	Dimensions in mm
FR	Dimensions en mm
ES	Dimensiones en mm
IT	Dimensioni in mm
PT	Dimensões em mm
TR	Ebatlar mm cinsinden
РУ	Размеры в мм
中文	尺寸

⚠ ACHTUNG	⚠ NOTICE	⚠ IMPORTANT
Das Thermistor-Motorschutz-Auslösegerät 3RN10 wurde als Gerät der Klasse A gebaut. Der Gebrauch dieses Produkts in Wohnbereichen könnte zu Funkstörungen führen.	The 3RN10 thermistor motor protection tripping unit has been designed for class A equipment. Use of the product in domestic environments can cause radio interference.	Le déclencheur pour protection de moteur par thermistances 3RN10 est conçu en tant qu'appareil de classe A. L'utilisation de ce produit dans le domaine résidentiel pourrait entraîner des perturbations radioélectriques.
⚠ ATENCIÓN	**⚠ ATTENZIONE**	**⚠ ATENÇÃO**
El disparador para protección de motor por termistores 3RN10 ha sido diseñado para equipos de clase A. El uso de este producto en entorno doméstico puede ocasionar radiointerferencias.	Il dispositivo di rilevazione del termistore di protezione del motore 3RN10 è stato costruito come apparecchio della classe A. L'uso in area domestica potrebbe essere causa di radiodisturbi.	O disparador para proteção de motor por termistores 3RN10 foi construído como dispositivo da classe A. A operação deste dispositivo em áreas residenciais pode causar radiointerferências.
⚠ DİKKAT	**⚠ ВНИМАНИЕ**	**⚠ 警告**
Termistör motor koruma açma cihazı 3RN10, A sınıfı cihaz olarak yapılmıştır. Bu ürünün oturulan mekanlarda kullanımı parazitlere yol açabilir.	Отключающий прибор защиты двигателя на терморезисторах 3RN10 был разработан в качестве прибора класса А. Применение данного продукта в жилых зонах может привести к радиопомехам.	热敏电阻－电动机保护装置－脱扣装置 3RN10 被造成 A 级装置。此产品在居住范围的使用会产生无线电干扰。

Bestell-Nr./Order No.: 3ZX1012-0RN10-1AA1
Printed in the Federal Republic of Germany

HydroRanger 200

Overview

HydroRanger 200 is an ultrasonic level controller for up to six pumps, and provides control, differential control, and open channel flow monitoring.

Benefits

- Monitors wet wells, weirs and flumes
- Digital communications with built-in Modbus RTU via RS-485
- Compatible with SmartLinx system and Dolphin Plus configuration software
- Single or dual point level monitoring
- 6 relays standard
- Anti-grease ring / tide mark build-up
- Differential amplifier transceiver for common mode noise rejection and improved signal-to-noise ratio
- Wall and panel mounting options

Application

For water authorities, municipal water and wastewater plants, HydroRanger 200 is an economical, low-maintenance solution delivering control efficiency and productivity needed to meet todays exacting standards. It offers single- or dual-point monitoring with 6 relays standard, as well as digital communications with built-in Modbus RTU via RS-485.

HydroRanger 200 is compatible with Dolphin Plus, allowing for PC configuration and set-up. Sonic Intelligence® advanced echo-processing software provides increased reading reliability.

HydroRanger 200 uses proven continuous ultrasonic echo ranging technology to monitor water and wastewater of any consistency up to 15 m (50 ft) in depth. Achievable resolution is 0.1% with accuracy to 0.25% of range. Unlike contacting devices, HydroRanger 200 is immune to problems caused by suspended solids, harsh corrosives, grease or silt in the effluent, reducing downtime.

The HydroRanger 200 is available in wall or panel mounting versions.

Technical specifications

Mode of Operation	
Measuring principle	Ultrasonic level measurement
Measuring range	0.3 to 15 m (1 to 50 ft)
Input	
Analog	0 to 20 mA or 4 to 20 mA, from alternate device, scaleable
Discrete	10 to 50 V DC switching level Logical 0 = < 0.5 V DC Logical 1 = 10 to 50 V DC Max. 3 mA
Output	
Echomax® Transducer	44 kHz
Ultrasonic transducer	Compatible transducers: ST-H and Echomax series XPS-10/10F, XPS 15/15F, XCT-8, XCT-12 and XRS-5
Relays	Rating 5 A at 250 V AC, non-inductive 4 Form A / 2 Form C
mA output	0 to 20 mA or 4 to 20 mA
- Max. load	750 Ω, isolated
- Resolution	0.1% of range
Accuracy	
Error in measurement	0.25% of range or 6 mm (0.24"), whichever is greater
Resolution	0.1% of measuring range[1] or 2 mm (0.08"), whichever is greater
Temperature compensation	• -50 to +150 °C (-58 to 302 °F) • Integral temperature sensor in transducer • External TS-3 temperature sensor • Programmable fixed temperature values
Temperature error	
• Sensor	0.09% of range
• Fixed temperature value	0.17% / °C deviation from programmed value
Rated operating conditions	
Installation conditions	
Location	Indoor / outdoor
Installation category	II
Pollution degree	4
Ambient conditions	
Ambient temperature (housing)	-20 to +50 °C (-5 to 122 °F)
Design	
Weight	
• wall mount	1.37 kg (3.02 lbs)
• panel mount	1.50 kg (3.31 lbs)
Material (housing)	Polycarbonate
Degree of protection (housing)	
• wall mount	IP65 / Type 4X / NEMA 4X
• panel mount	IP54 / Type 3 / NEMA 3

Cable

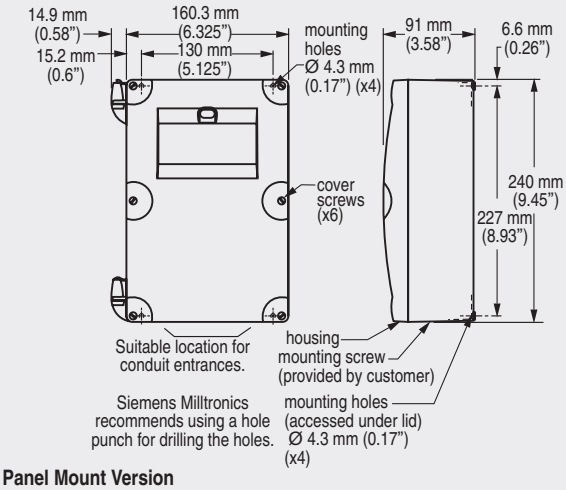
Transducer and mA output signal	2-core copper conductor, twisted, with shield and drain conductor, 300 Vrms, 0.5 to 0.75 mm² (22 to 18 AWG), nomianl capacitance between adjacent conductors @ 1kHz = 62.3 pF/m (10 pF/ft), nominal capacitance between conductor and shield @ 1 kHz = 108.3 pF/m (33 pF/ft)(Belden® 8760 or equivalent is acceptable).
Max. separation between transducer and transceiver	365 m (1200 ft)
Displays and controls	100 x 40 mm (4 x 1.5") multi-block LCD with backlighting
Programming	Programming using hand-held programmer or via PC with Dolphin Plus software
Power supply	
AC version	100 to 230 V AC ± 15%, 50 / 60 Hz, 36 VA (17 W)
DC version	12 to 30 V DC (20 W)
Certificates and approvals	CE[2)], FM, $CSA_{NRTL/C}$, UL listed CSA Class I, Div. 2, Group A, B, C and D, Class II, Div.2, Group F and G, Class III (wall mount only)
Communication	• RS-232 with Modbus RTU or ASCII via RJ-11 connector • RS-485 with Modbus RTU or ASCII via terminal strips • Optional: SmartLinx® cards or RS-485 modem kit

1) Program range is defined as the empty distance to the face of the transducer plus any range extension.

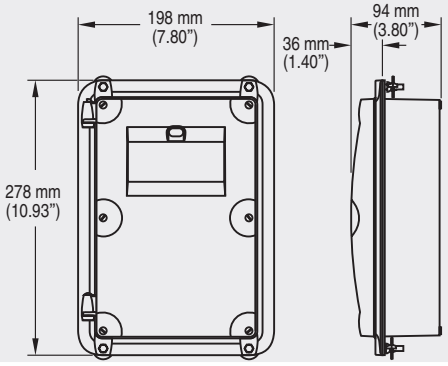
2) EMC performance available upon request.

Dimensional drawings

Wall Mount Version



Panel Mount Version

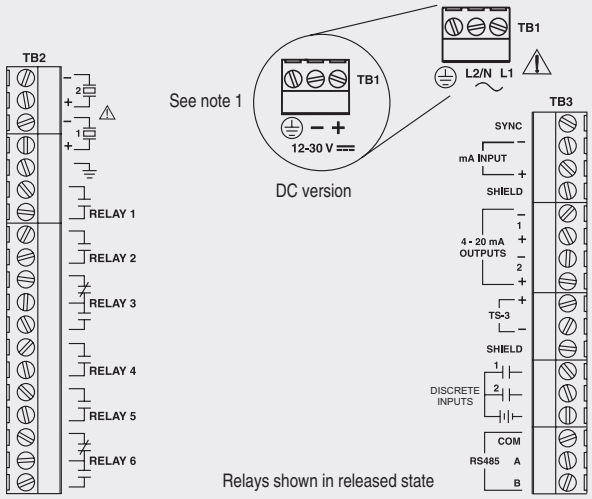


HydroRanger 200 dimensions

5

HydroRanger 200

Schematics



Notes

1. Use 2-core copper wire, twisted, with shield, for expansion up to 365 m (1200 ft.). Route cable in grounded metal conduit, separate from other cables.
2. Verify that all system components are installed in accordance with instructions.
3. Connect all cable shields to the HydroRanger 200 Shield Connections. Avoid differential ground potentials by not connecting cable shields to ground (earth) anywhere else.
4. Keep exposed conductors on shielded cables as short as possible to reduce noise on the line caused by stray transmissions and noise pickup.

HydroRanger 200 connections

Ordering data

		Order No.
Siemens Milltronics HydroRanger 200 Ultrasonic level controller for up to six pumps that provides control, differential control, and open channel flow monitoring	C)	**7ML5034-**
Mounting		
Wall mount, standard version		**1**
Wall mount, 4 entries, M20		**2**
Panel mount (CE, CSA$_{US/C}$, FM, UL)		**3** ←
Power supply		
100 to 230 V AC		**A** ←
12 to 30 V DC		**B**
Number of measurement points		
Single point version		**A** ←
Dual point version		**B**
Communication (SmartLinx)		
Without module		**0** ←
SmartLinx® Allen-Bradley® Remote I/O module		**1**
SmartLinx PROFIBUS DP module		**2**
SmartLinx DeviceNet™ module See SmartLinx product page on page 4/111 ff. for more information.		**3**
Approvals		
General Purpose CE, FM, CSA$_{US/C}$, UL listed		**1** ←
CSA Class I, Div. 2, Group A, B, C and D; Class II, Div 2, Group F and G; Class III (for wall mount applications only)		**2**
Instruction Manual		
English Note: The instruction manual should be ordered as a separate line on the order.	C)	**7ML1998-5FC01**
Other Instruction Manuals		
SmartLinx Allen-Bradley Remote I/O, English	C)	**7ML1998-1AP03**
SmartLinx PROFIBUS DP, English	C)	**7ML1998-1AQ03**
SmartLinx PROFIBUS DP, German	C)	**7ML1998-1AQ32**
SmartLinx PROFIBUS DP, French	C)	**7ML1998-1AQ12**
SmartLinx DeviceNet, English Note: The appropriate SmartLinx instruction manual should be ordered as a seperate line on the order.	C)	**7ML1998-1BH02**
Accessories		
Hand-held programmer		**7ML1830-2AM**
Tag, stainless steel, 12 x 45 mm, one text line, suitable for enclosure	C)	**PBD-45000486**
M20 cable gland kit (6 M20 cable glands, 6 M20 nuts, 3 stop plugs)		**7ML1830-1GM**
TS-3 Temperature Sensor -- see TS-3 pricing sheet on page 4/76		
Spare Parts		
Power Supply Board (100 to 230 V AC)	C)	**PBD-51035590**
Power Supply Board (12 to 30 V DC)	C)	**PBD-51035592**
Display Board	C)	**PBD-51035606**

®Modbus is a registered trademark of Schneider Electric.
®Belden is a registered trademark of Belden Wire and Cable Company.
®Allen-Bradley is a registered trademark of Rockwell Automation.
™DeviceNet is a trademark of Open DeviceNet Vendor Association (ODVA)
C) Subject to export regulations AL: N, ECCN: EAR99.

True level control with Echomax transducers

Siemens' Echomax® ultrasonic transducers give you trouble-free, reliable performance. Siemens complete line of transducers is the logical choice for monitoring levels of liquids, slurries and solids in a wide range of industries. Our transducers are robust. They are impervious to dust, moisture, vibrations, flooding and extreme temperatures. Non-contacting ultrasonic technology means no material build-up, no corrosion and no down-time and they are easy to install and virtually maintenance free.

With every transducer you purchase, you also get:

- Sonic Intelligence® – when paired with a Siemens controller our field-proven echo processing algorithms guarantee the most reliable performance available
- Unmatched beam angle – stronger pulse and sensitivity in a compact beam make our ultrasonics transducers the most accurate in the industry
- Million in one – our products have the field experience of over a million points of level built into every device
- Global network – sales and support in your neighborhood. Our extensive global coverage means you get sales and support when and where you need it.

	XRS-5	ST-H	XPS-10 (standard and F models*)	XPS-15 (standard and F models*)	XPS-30	XPS-40	XCT-8	XCT-12	XLT-30	XLT-60
Applications	Liquids	Liquids	Liquids/solids	Liquids/solids	Liquids/solids	Liquids/solids	Liquids/solids	Liquids/solids	Solids	Solids
Temp.	Standard	Standard	Standard	Standard	Standard	Standard	High temp.	High temp.	High temp.	High temp.
Max. range	8 m (26 ft)	10 m (33 ft)	10 m (33 ft)	15 m (50 ft)	30 m (100 ft)	40 m (130 ft)	8 m (26 ft)	12 m (40 ft)	30 m (100 ft)	60 m (200 ft)
Min. range	0.3 m (1 ft)	0.3 m (1 ft)	0.3 m (1 ft)	0.3 m (1 ft)	0.6 m (2 ft)	0.9 m (3 ft)	0.6 m (2 ft)	0.6 m (2 ft)	0.9 m (3 ft)	1.8 m (6 ft)
Max. temp	65 °C (149 °F)	CSA/FM model: 73 °C (163 °F) ATEX model: 60 °C (140 °F)	95 °C (203 °F)	95 °C (203 °F)	95 °C (203 °F)	95 °C (203 °F)	145 °C (293 °F) Sanitary: 125 °C (260 °F)	145 °C (293 °F)	150 °C (300 °F)	150 °C (300 °F)
Min. temp	-20 °C (-4 °F)	CSA/FM model: -40 °C (-40 °F) ATEX model: -20 °C (-5 °F)	-40 °C (-40 °F)	-40 °C (-40 °F)	-40 °C (-40 °F)	-40 °C (-40 °F)	-40 °C (-40 °F)	-40 °C (-40 °F)	-40 °C (-40 °F)	-40 °C (-40 °F)
Typical Applications	• Flumes • Weirs • Filterbeds	• Chemical storage • Liquid tanks	• Dusty solids • Slurries • Liquids	• Deep wet wells • Solids	• Powders • Pellets • Solids	• Powders • Pellets • Solids	• Hot acids • Slurries • Food	• Hot liquids • Slurries	• Clinker • Coal bunkers	• Clinker • Coal bunkers
Frequency	44 kHz	44 kHz	44 kHz	44 kHz	30 kHz	22 kHz	44 kHz	44 kHz	22 kHz	13 kHz
Beam angle -3db	10°	12°	12°	6°	6°	6°	12°	6°	5°	5°
Process connection	1" NPT or R 1" BSPT, EN 10226	2" NPT or R 2" BSPT or G 2" BSPP	1" NPT or R 1" BSPT, EN 10226 F: 1" NPT	1" NPT or R 1" BSPT, EN 10226 F: 1" NPT	R 1.5" BSPT Universal thread 1.5" NPT	R 1.5" BSPT Universal thread 1.5" NPT	1" NPT or R 1" BSPT, EN 10226	1" NPT or R 1" BSPT, EN 10226	1" NPT	1" NPT
Enclosure	• PVDF copolymer and CSM face **Option** • Flange with PTFE facing	• ETFE • PVDF	• PVDF **Option** • PTFE face with CPVC flange	• PVDF **Option** • PVDF with CPVC Flange • PTFE face with CPVC flange	• PVDF **Option** • PVDF with CPVC flange • PTFE face with CPVC flange	PVDF	• PVDF **Option** • DERAKANE® flange; PTFE face with universal PVDF flange	• PVDF **Option** • DERAKANE flange. PTFE face with universal PVDF flange	• Aluminum • 304 stainless steel • Polyester • Silicone	• Aluminum • 304 stainless steel • Polyester • Silicone
Compatible with Siemens Milltronics ultrasonic controllers										
SITRANS LU	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SITRANS LUC500	✓	✓	✓	✓			✓	✓		
Hydro-Ranger 200	✓	✓	✓	✓			✓	✓		
MultiRanger 100/200	✓	✓	✓	✓			✓	✓		
OCM III	✓									

All Siemens Milltronics transducers have one or more of the following approvals: CE, CSA, FM, ATEX, SAA, ABS, and Lloyd's Register of Shipping.
*FM approved. Echomax is a registered trademark of Siemens Milltronics Process Instruments Inc. DERAKANE® is a registered trademark of Ashland Inc.

7ML1996-5KQ03
Printed in Canada

PS5R Standard Series — Switching Power Supplies

Key features of the PS5R standard series include:

- Wide Power Range: 7.5W-240W
- Universal Input:
  7.5W-75W:85-264V AC/105-370V DC
  100W:100-120V AC/200-240V AC
  (Selectable) 240-370V DC
  120W-240W:85-264V AC/105-370V AC
- Fused Input
- Overcurrent/Overvoltage Protection
- Power Factor Correction (75W, 120W, 240W models)
  EN61000-3-3
  EN61000-3-2
- Voltage adjustment + 10%
- Spring-up Screw Terminal, IP20 (finger-safe)
- DIN rail or Panel Surface Mount
- Approvals:
  CE marked
  UL 508 Listed
  UL, c-UL
  TÜV approved
  EMC Directives: EN50081-2
  EN50082-2
  EN61000-6-2
  LVD EN60950:2000

UL 508 Listed
File # E177168

Cert. No.
BL980213332392

Part Numbers

Part Number	Item	Watts	Rated Voltage	Rated Current
PS5R-A05		7.5	5V DC	1.5A
PS5R-A12			12V DC	0.6A
PS5R-A24			24V DC	0.3A
PS5R-B05		15	5V DC	2.5A
PS5R-B12			12V DC	1.2A
PS5R-B24			24V DC	0.6A
PS5R-C12		30	12V DC	2.5A
PS5R-C24			24V DC	1.3A
PS5R-D24		50	24V DC	2.1A
PS5R-Q24		75	24V DC	3.1A
PS5R-E24		100	24V DC	4.2A
PS5R-F24		120	24V DC	5A
PS5R-G24		240	24V DC	10A

L

Power Supplies

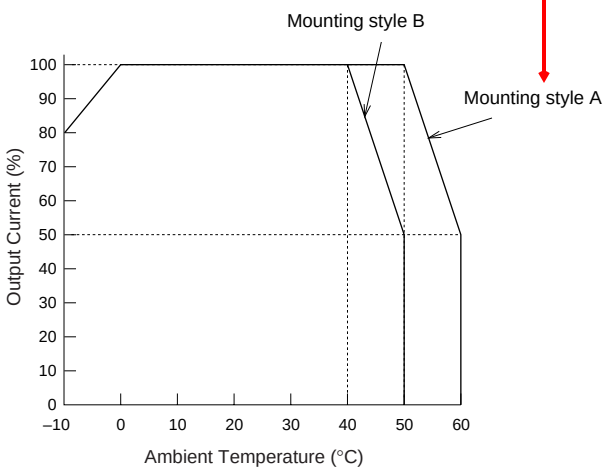
Specifications

Specifications										
	Part Numbers	5VDC output	PS5R-A05	PS5R-B05*	—	—		—		—
		12VDC output	PS5R-A12	PS5R-B12	PS5R-C12	—		—		—
		24VDC output	PS5R-A24	PS5R-B24	PS5R-C24	PS5R-D24	PS5R-Q24	PS5R-E24	PS5R-F24	PS5R-G24
	Output Capacity		7.5W	15W	30W	50W	75W	100W	120W	240W
	Input	Input Voltage (single-phase, 2-wire)	100 to 240VAC nominal (85 to 264V AC), 50/60Hz (47 to 63Hz) 110 to 340VDC nominal (105 to 370VDC)					100 to 120VAC, 50/60Hz 200 to 240VAC, 50/60Hz (jumper selectable) 240 to 370VDC	100 to 240VAC, 50/60Hz, 110 to 340VDC	
		Input Current (typical)	0.17A at 100VAC	0.3A at 100VAC	0.68A at 100VAC	1.15A at 100VAC	1.1A	2.5A at 100VAC 1.5A at 200VAC	1.8A	4A at 100VAC
		Internal Fuse Rating	2A	2A	3.15A	3.15A	3.15A	4A	4A	6.3A
		Inrush Current	50A maximum (at cold start at 200V AC)				70A maximum (at cold start at 230V AC)	50A maximum (at cold start at 200V AC)	70A maximum (at cold start at 230V AC)	
		Leakage Current (at no load)	0.75mA maximum (60Hz, measured in conformance with UL, CSA, VDE)							
		Typical Efficiency	69% at 5V 73% at 12V 75% at 24V	69% at 5V 75% at 12V 79% at 24V	75% at 12V 75% at 24V	79% at 24V	83% at 24V DC	85% at 24V	83% at 24V DC	83% at 24V
		Overvoltage Protection	Outputs turns off at 105% (typical)							
	Output	Voltage and Current Ratings	5V, 1.5A 12V, 0.6A 24V, 0.3A	5V, 2.5A 12V, 1.2A 24V, 0.6A	12V, 2.5A 24V, 1.3A	24V, 2.1A	24V, 3.1A	24V, 4.2A	24V, 5A	24V, 10A
		Voltage Adjustments	±10% (V.ADJ screw on top)							
		Output Holding Time	20ms minimum (at full rated input and output)							
		Rise Time	200ms maximum (at full rated input and output)							150ms max.
		Line Regulation	0.4% maximum							
		Load Regulation	1.5% maximum							
		Fluctuation due to Ambient Temperature Change	0.05% maximum							
		Ripple Voltage	2% peak to peak maximum (including noise)							
		Overload Protection	120% typical (Zener-limiting)		120% typical, auto reset					
	Operation Indicator		LED							
	Parallel Operation		PS5R-A	PS5R-B	PS5R-C	PS5R-D	PS5R-Q	PS5R-E	PS5R-F	PS5R-G
			No				Yes	No	Yes	
	Dielectric Strength		Between input and output terminals: 3,000V AC, 1 minute Between input terminals and housing: 2,000V AC, 1 minute Between output terminal and housing: 500V AC, 1 minute							
	Insulation Resistance		Between input and output terminals/input terminals and housing: 100MΩ minimum (500V DC megger)							
	Operating Temperature		–10 to +60°C (14° to 140°F) (see derating curves)							
	Storage Temperature		–30 to +85°C (-22° to 185°F)							
	Operating Humidity		20 to 90% relative humidity (no condensation)							
	Vibration Resistance		45m/s^2, 10 to 55Hz, 2 hours on each of 3 axes				10 to 50Hz, 0.75mm p-p, 2 hrs on each of 3 axes			
	Shock Resistance		300m/s^2(30G), 3 shocks in each of 6 directions							
	Approvals		Conforms to EMC Directives EN50081-2 & EN50082-2. LVD Directive EN60529 — Certified to EN60950. UL508 listed. UL, c-UL, TUV approved. CE marked. EN61000-3-2							
	Weight		150g	170g	360g	390g	800g	600g	1200g	2000g
	Termination		Spring-up, fingersafe terminals with captive M3.5 screws							
	IP protection		IP20 (finger safe)							
	Dimensions H x W x D (mm)		75 x 45 x 70	75 x 45 x95	75 x 90 x 95	75 x 90 x 95	120 x 85 x 140	75 x 145 x 95	120 x 115 x140	120 x 200x 140
	Dimensions H x W x D (inches)		2.95 x 1.77 x 2.76	2.95 x 1.77 x 3.74	2.95 x 3.54 x 3.74	2.95 x 3.54 x 3.74	4.72 x 3.35 x 5.52"	2.95 x 5.71 x 3.74"	4.72 x 4.53 x 5.52	4.72 x 7.87 x 5.51

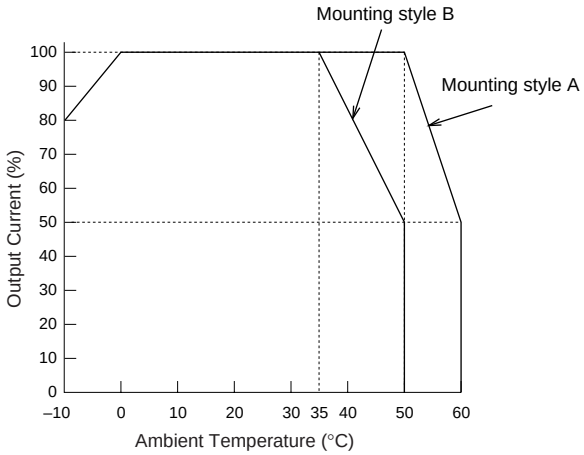
1. *For dimensional drawings, see page L-12.*
2. *For usage instructions, see page L-11.*
3. **12.5W for 5VDC model.*

Temperature Derating Curves

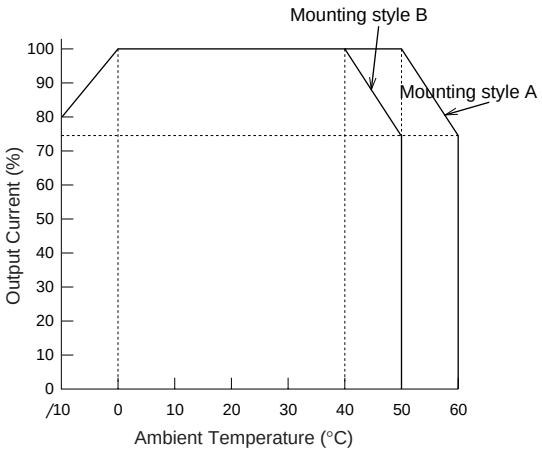
PS5R-A/B



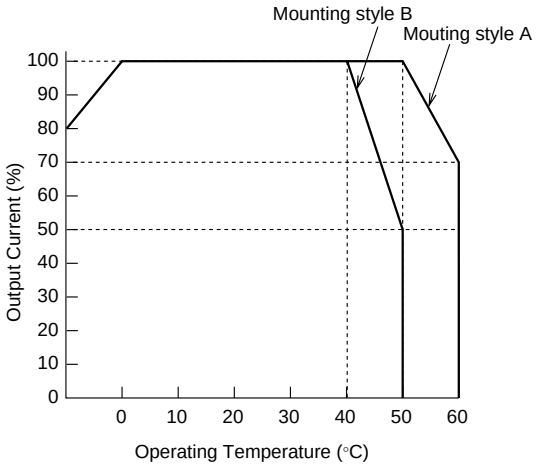
PS5R-C/D



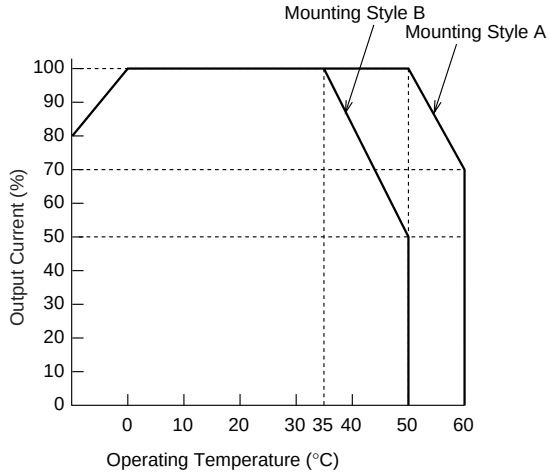
PS5R-E



PS5R-Q

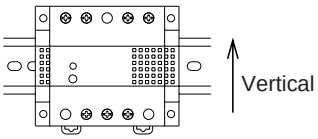


PS5R-F/G



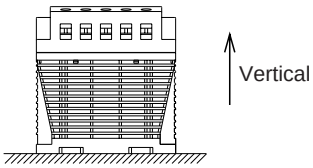
A Mounting

Mounting Style A
(standard)



B Mounting

Mounting Style B
(Facing upward)



L

Power Supplies

Accessories

Part Numbers: PS5R Accessories

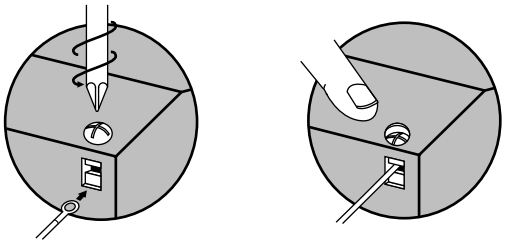
Appearance	Description	Part Number
	DIN rail (1000mm)	BNDN1000
	DIN rail end clip	BNL5

Installation Instructions

Time-Saving Spring-up Terminals

The innovative terminals on the PS5R series use a special, spring-loaded screw. This makes installation as easy as pushing down and turning with a screwdriver. Installation time is cut in half since the screws do not need to be backed out to install wiring. The screws are held captive once installed and are 100% finger-safe. Screw terminals accept bare wire or ring or fork connectors.

1. Insert the wire connector into the slot on the side of the power supply.
2. Using a Phillips screwdriver, push down and turn the screw.

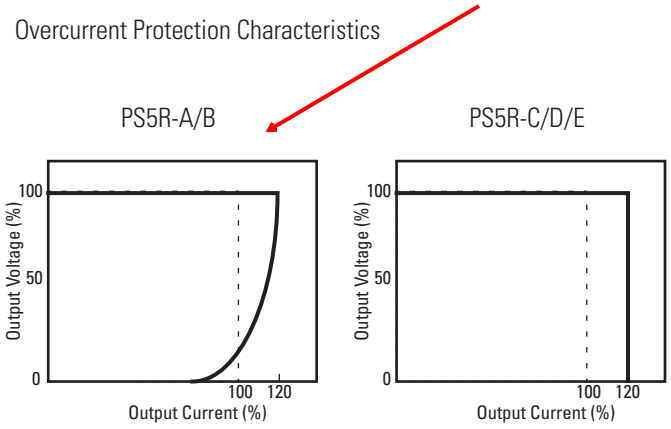


The wire is now connected, and the screw terminal is finger-safe!

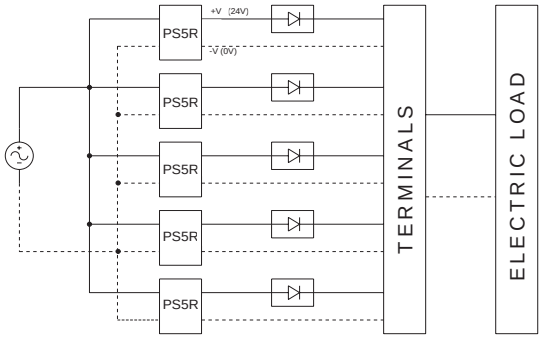
Front Panel (terminals)

Terminal	Name	Description
V. ADJ	Voltage adjustment	Adjusts within ±10%; turn clockwise to increase output voltage
DC ON	Operation indicator	Green LED is lit when output voltage is on
+V, –V	DC output terminals	+V: Positive output terminal –V: Negative output terminal
⏚	Frame ground	Ground this terminal to reduce high-frequency currents caused by switching
L, N	Input terminals	Accept a wide range of voltages and frequencies (no polarity at DC input)
NC	No con-nection	Do *not* insert wires here, as this may damage the power supply

Overcurrent Protection Characteristics



Parallel Operation



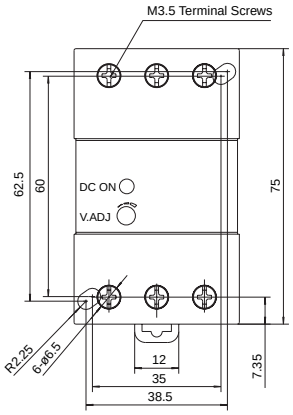
Parallel operation only recommended for PS5R-Q24, PS5R-F24 and PS5R-G24.

L

Power Supplies

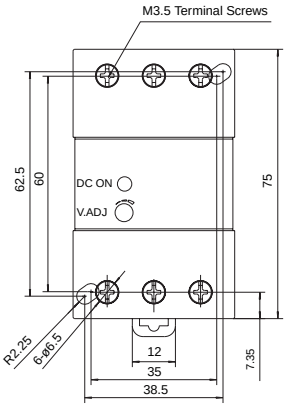
Dimensions

PS5R-A (7.5W)



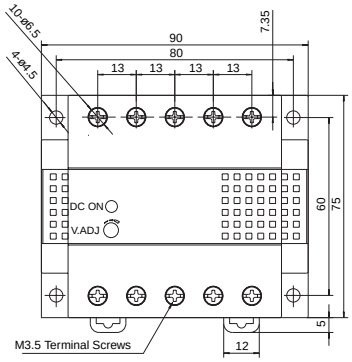
Height 75.0 mm
Width 45.0 mm
Depth 70.0 mm

PS5R-B (15W)



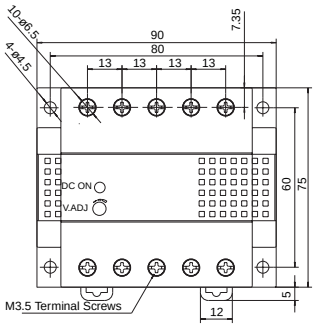
Height 75.0 mm
Width 45.0 mm
Depth 95.0 mm

PS5R-C (30W)



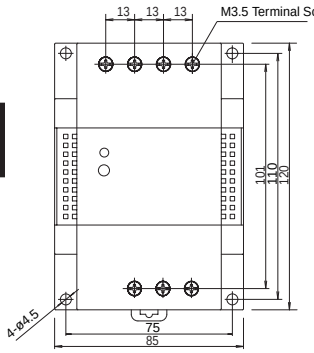
Height 75.0 mm
Width 90.0 mm
Depth 95.0 mm

PS5R-D (50W)



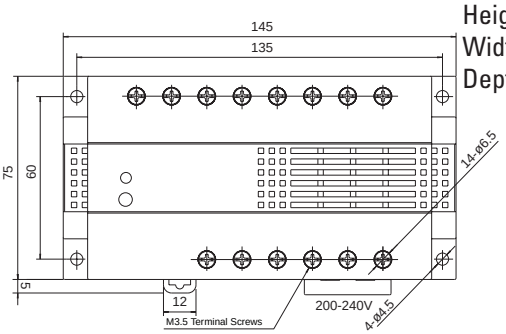
Height 75.0mm
Width 90.0mm
Depth 95.0mm

PS5R-Q (75W)



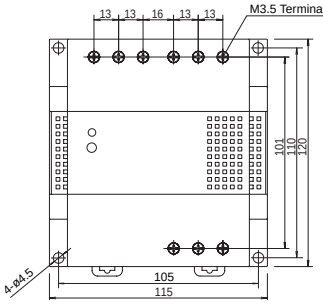
Height 120.0 mm
Width 85.0 mm
Depth 140.0 mm

PS5R-E (100W)



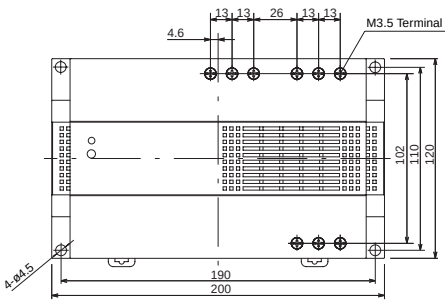
Height 75.0 mm
Width 145.0 mm
Depth 95.0 mm

PS5R-F (120W)



Height 120.0 mm
Width 115.0 mm
Depth 140.0 mm

PS5R-G (240W)



Height 120.0mm
Width 200.0mm
Depth 140.0mm

L

Power Supplies

FEDERAL SIGNAL CORPORATION

Streamline® Low Profile Strobe Light

Models LP3S, LP3E, LP3M

PERFECT SIZE MEETS SUPERIOR PERFORMANCE

- LP3S and LP3M are available in 12-48VDC, 120VAC and 240VAC; LP3E in 120VAC
- Surface mount, Edison mount, or integrated 1/2-inch NPT pipe mount
- Five dome colors
- Screw-on lens provides easy access
- Low profile — Model LP3S is only 5" high
- Type 4X, IP66 enclosure
- PLC and triac compatible
- UL and cUL Listed, CSA Certified and CE Approved*

* CE Approval for S and M models only.

Federal Signal introduces the Model LP3 low profile strobe light. This Type 4X strobe is available in five colors: Amber, Blue, Clear, Green and Red.

The LP3 is offered in three mounting configurations: the LP3S features a three-hole surface mount — ideal for control panels and other flat or flush surfaces; the LP3E features a standard A-19 medium Edison screw-in base; the LP3M features a 1/2" NPT male pipe mount and 18' wire leads.

Both the LP3S and LP3M include a surface gasket to completethe Type 4X installation. An optional dome guard is available for use with the LP3M when installed flush with a panel. All LP3 units feature a unique threaded screw-on lens to provide for tool free wiring and strobe tube replacement. The strobe tube is rated for 7,000 hours.

LP3 comes in three voltage variations: 12-48VDC, 120VAC and 240VAC. The state-of-the-art strobe mechanism produces 2.2 joules of energy, while drawing relatively low amperage.

StreamLine® strobes feature high-quality, long-life strobe tubes which are designed to reduce tungsten build-up for longer lamp maintenance cycles. Careful consideration is given to the relationship between tube shape and lens design for maximum light output. StreamLine products make use of surface mount technology, which provides a more powerful light in a much smaller package. The high-quality dry-electrolyte capacitor used in StreamLine products runs cooler than those used in many competitive strobes, resulting in a more reliable product that won't fail due to overheating.

Model	Voltage	Operating Current	Flash Rate/ Minute	Joule Output	Candela Peak[1]	Candela ECP[2]
LP3 __-012/048_*__**	12-48VDC	0.44-0.10 amps	65-95	2.2	175,000	51.5
LP3 __-120_*__**	120VAC	0.10 amps	65-95	2.2	175,000	51.5
LP3 __-240_*__**	240VAC	0.07 amps	65-95	2.2	175,000	51.5

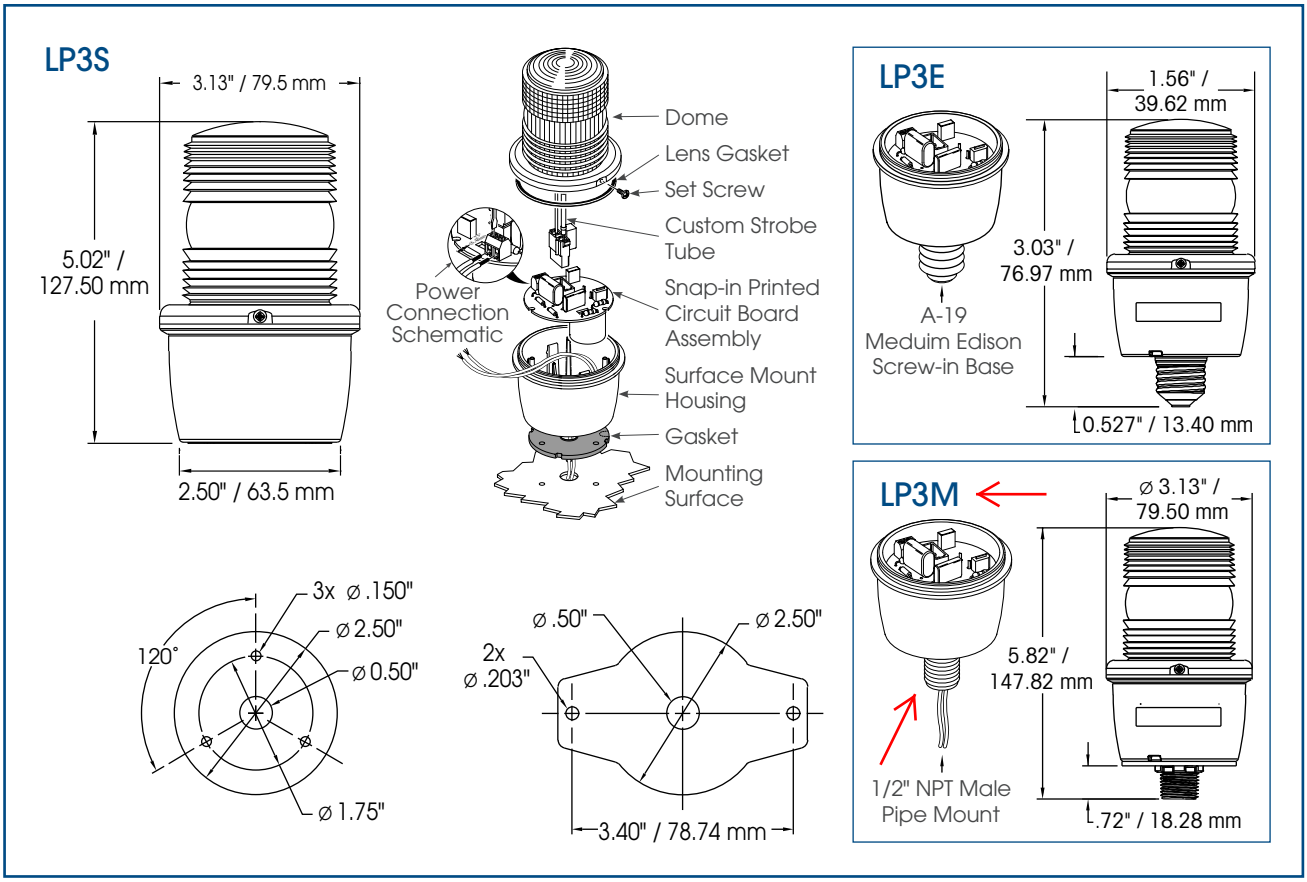
*** Indicates Mounting Style: (S) Surface Mount, (E) Edison A-19 Screw-in Base or (M) Male Pipe Mount*

** Indicates color: (A) Amber, (B) Blue, (C) Clear, (G) Green or (R) Red*

5 yr FEDERAL SIGNAL WARRANTY

[1] Peak candela is the maximum light intensity generated by a flashing light during its light pulse
[2] ECP (Effective Candela) is the intensity that would appear to an observer if the light were burning steadily

STREAMLINE® LOW PROFILE STROBE LIGHT (LP3S/LP3E/LP3M)



SPECIFICATIONS

Lamp Life:	7,000 Hours	7,000 Hours
Light Source:	Strobe tube	Strobe tube
Operating Temperature:	-31°F to 150°F	-35°C to 66°C
Net Weight:	7.3 oz.	206.96 g
Shipping Weight:	8.5 oz.	240.98 g
Diameter:	3.125"	7.94 cm
Height (from bottom):		
LP3S	5.0"	12.7 cm
LP3E	6.1"	15.5 cm
LP3M	5.8"	14.7 cm

HOW TO ORDER

- Specify model, voltage and color
- Optional Accessories:
  Wire/Dome Guard (LP3G)
  for LP3S and LP3M
- Please refer to Model Number Index LP3 (E.M) beginning on page 371

REPLACEMENT PARTS

Description	***Part Number***	***Description***	***Part Number***
Dome, Amber	K8589063A	PC Assembly, 12-48VDC	K2001316B
Dome, Blue	K8589063A-01	PC Assembly, 120VAC	K2001317B
Dome, Clear	K8589063A-02	PC Assembly, 240VAC	K2001317B-01
Dome, Green	K8589063A-03	Gasket, Lens	K8589013A
Dome, Red	K8589063A-04	Gasket, Base LP3S	K8589011A
Strobe Tube	K149130A		

FEDERAL SIGNAL

Model LP3G Wire Guard for the Models LP3M, LP3S, and LP3T StreamLine® Strobe Light

Installation Instructions

2561892A
REV. A 410
Printed in U.S.A.

Contents

Installing the Wire Guard 1
With the Models LP3M and LP3S Strobe Light 1
With the Model LP3T Strobe Light.....2
Obtaining Service, Assistance, and Parts.....7
Returning the Product for Credit.....8

Figures

Figure 1 LP3M, LP3S, and LP3T mounting dimensions..... 3
Figure 2 LP3M surface-mounted with wire guard..... 4
Figure 3 LP3S surface-mounted with wire guard..... 5
Figure 4 LP3T surface-mounted with wire guard..... 6

Installing the Wire Guard

The Model LP3G Wire Guard is used with the Models LP3M, LP3S, LP3T surface mounted strobe lights. These instructions supplement, and do not replace, the installation instructions for each of these models. Before installing the wire guard, follow the installation instructions included with the strobe light. Installer-supplied #10 (5 mm) screws of the appropriate length are required to mount the wire guard.

With the Models LP3M and LP3S Strobe Light

The wire guard for Models LP3M and LP3S includes two rubber washers (Figure 2 on page 4 and Figure 3 on page 5). For instructions on mounting and wiring the strobe light, see doc. No. 2561531 (LP3M) or doc. No. 2561456 (LP3S and LP3T).

To install the wire guard over the light:

1. If the strobe light is already installed, remove the light to avoid damaging it when drilling holes for the wire guard.
2. To mark the locations of the mounting holes, use the wire guard as a template or use the dimensions shown in Figure 1 on page 3.
3. Drill or punch out the holes marked on the mounting surface.
4. Mount the strobe light according the instructions included with it (doc. No. 2561531 or 2561456).
5. Center a rubber washer, included with the wire guard, on each mounting hole (Figures 1 and 2).
6. If wires are routed through the side of the strobe light, route them through the wire guard.
7. Place the wire guard on the rubber washers and align the mounting holes.
8. Secure the wire guard to the mounting location with user-supplied #10 (5 mm) screws of the appropriate length.
9. Complete the wiring according to the instructions included with the LP3M or LP3S strobe light.

Figure 1 LP3M, LP3S, and LP3T mounting dimensions

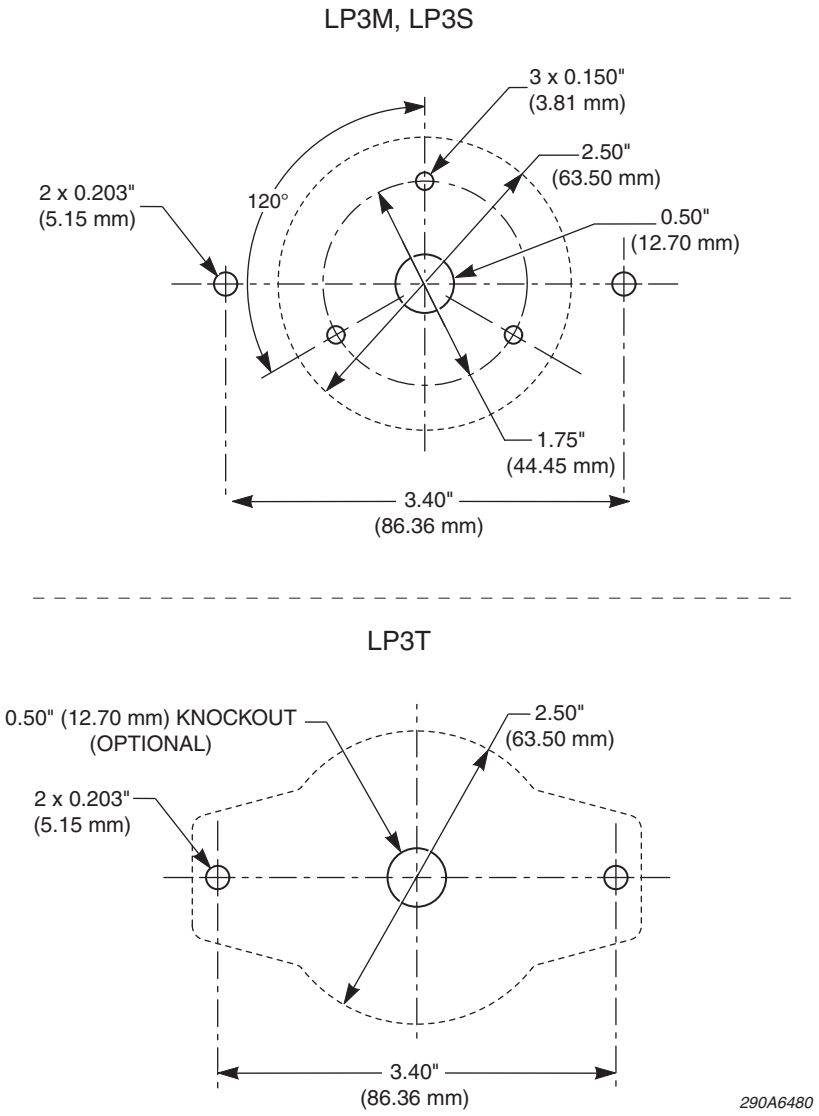
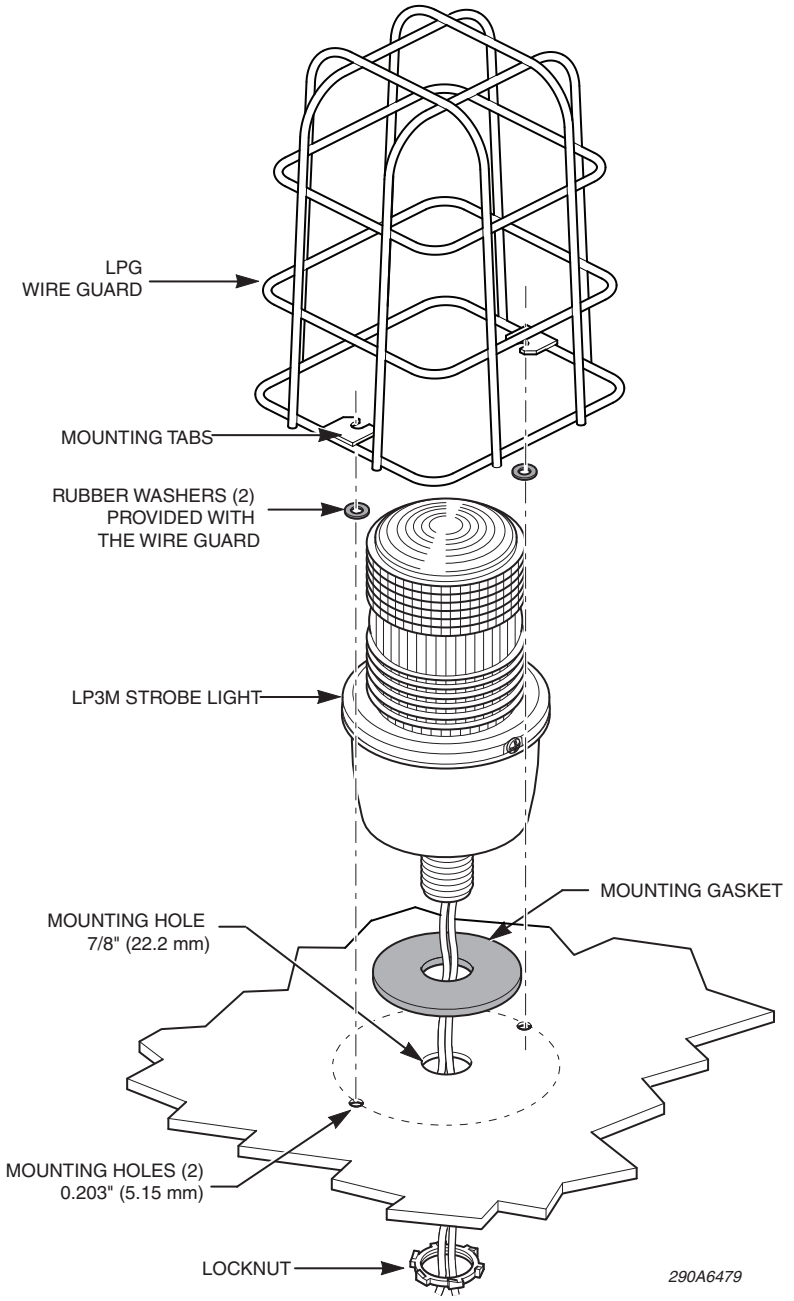


Figure 2 LP3M surface-mounted with wire guard



NEMA Type Terminal Blocks
Box Lug Termination

CLASS 9080		TYPE GM6	TYPE GR6	TYPE GR6T
		 High Density Block	 Without Test Probe Adapter	 With Test Probe Adapter
Maximum Voltage Rating		600	600	600
Maximum Amperage Ratingv ✭	UL	30	60	60
	CSA	30	60	60
Wire Range		#22 to #10 AWG	#22 to #8 AWG	#22 to #8 AWG
Maximum Wire Combination		1 - #10 1 - #12 1 - #14 1 or 2 - #16 1 or 2 - #18 1 to 5 - #20 1 to 8 - #22	1 - #8 1 - #10 1 to 3 - #12 1 to 4 - #14 1 to 4 - #16 1 to 5 - #18 1 to 8 - #20 1 to 10 - #22	1 - #8 1 - #10 1 to 3 - #12 1 to 4 - #14 1 to 4 - #16 1 to 5 - #18 1 to 8 - #20 1 to 10 - #22
Wire Type		Solid or Stranded Copper Wire	Solid or Stranded Copper Wire	Solid or Stranded Copper Wire
Density - Sections per foot		51	34	34
Approx. Dimensions (D)x(H)x(W)		1.72 x 1.82 x .235 inches 44 x 46 x 6 mm	1.72 x 1.82 x .35 inches 44 x 46 x 9 mm	1.72 x 1.82 x .35 inches 44 x 46 x 9 mm
Block Material		Nylon		
Busbar Material		Tin Plated Brass	N/A	N/A
Screw Material		Steel with Zinc Plating and Chromate Film		
Box Lug Material		Zinc Plated Steel	Copper	
Temperature Rating		-40 to 257° F -40 to 125° C	-40 to 257° F -40 to 125° C	-40 to 257° F -40 to 125° C
Flammability Rating		UL94V2	UL94V2	UL94V2
Recommended Screw Tightening Torque		7-8 lbf-in 0.8-0.9 N-m	18-20 lbf-in 2.1-2.3 N-m	18-20 lbf-in 2.1-2.3 N-m
Listings		File E60616 Guide XCFR2	File LR62144 Class 6228 01	
FINGERSAFE® per DIN 57470		YES	YES	YES
Block: Natural (White)		GM6	GR6	GR6T
Black		GMB6	GRB6	
Blue		GML6	GRL6	
Green		GMG6	GRG6	
Grey		GME6	GRE6	
Orange		GMS6	GRS6	
Red		GMR6	GRR6	
Yellow		GMY6	GRY6	
End Barrier		GM6B	GM6B	GM6B
6 Foot Assembly		GM6296BC	GR6204BC	
Mounting Track: ▲				
DIN 3 :	0.5 meter long	MH320	MH320	MH320
	1.0 meter long	MH339	MH339	MH339
	2.0 meter long	MH379	MH379	MH379
Standard:	3 Foot Long	GH136	GH136	GH136
Snap-Off:	3 Foot Long	GH236	GH236	GH236
High Rise:	3 Foot Long	GH336	GH336	GH336
End Clamps:	Screw-in	GH10	GH10	GH10
	Slip-in	GH11	GH11	GH11
	DIN 3 End Clamp	MHA10	MHA10	MHA10
Jumpers: 2 pole		GH700	GH72	GH72
6 pole		GH710	GH73	GH73
Fanning Strip			GH52	GH52
Cover			GH62	GH62
Vinyl Marking Strip		GH220	GH220	GH220
Sheets of Blank Marking Tabs			GH200	GH200
Sheets of Marked Tabs			GH210	GH210
Marking Strip End Plug		GH60	GH60	GH60

▲ For additional mounting track, see page 8.

✭ These maximum current values assume the use of insulated copper conductors with 75° C temperature rating, and are calculated based on NEC Article 310, Table 310-16. In most cases this value is the maximum ampacity of that wire or combination of wires (as listed in the above table) which has the greatest current carrying capacity. The actual allowable current for a particular application is dependent upon the number, size, insulation class and other characteristics of the wires used.

Type 4 Wall-Mount Enclosures

Continuous Hinge with Clamps, Type 4

Specifications

- 16 or 14 gauge steel (see table)
- Seams continuously welded and ground smooth
- External wall-mounting brackets
- Formed external flanges around all sides of enclosure opening
- Stainless steel door clamps on three sides of door
- Removable heavy gauge stainless steel continuous hinge pin
- Hasp and staple provided for padlocking
- Data pocket is high-impact thermoplastic
- Collar studs provided for mounting optional panels
- Bonding provision on door

Finish

ANSI 61 gray polyester powder paint inside and out

Accessories

Industrial Corrosion Inhibitors, page 1248
Fast-Operating Clamp-Cover Junction Box Clamp, page 1243
Incandescent Light Package, page 1259
Compact Cooling Fans, page 1142
Steel and Stainless Steel Window Kits, page 1217

Modification and Customization

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

Bulletin: A4

Industry Standards

UL 508A Listed; Type 4, 12, 13; File No. E61997
cUL Listed per CSA C22.2 No. 94; Type 4, 12, 13; File No. E61997

NEMA/EEMAC Type 3, 4, 12, and 13
CSA, File No. 42186: Type 4 and 12
IEC 60529, IP66

Application

These single-door enclosures feature a hinged door with clamps on three sides to create a secure seal in indoor or outdoor environments. The gray polyester powder finish inside and out provides enhanced corrosion protection in outdoor applications.

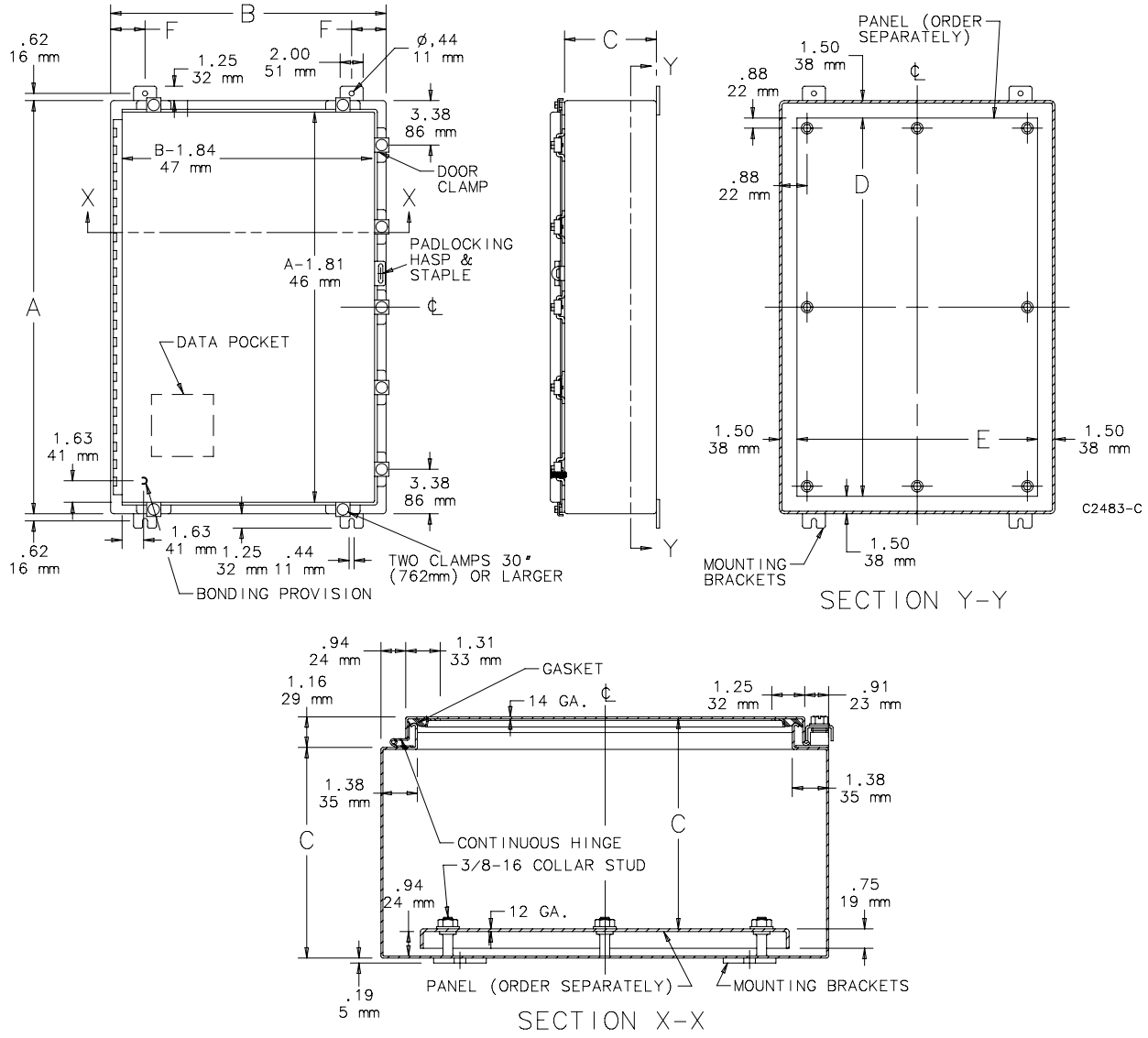
Standard Product

Catalog Number	AxBxC (in.)	AxBxC (mm)	Body Gauge	Panel	Conductive Panel	Panel Size D x E (in.)	Panel Size D x E (mm)	F (in.)	F (mm)	Number of Clamps	Data Pocket
A16H12ALP	16.00 x 12.00 x 6.00	406 x 305 x 152	16	A16P12	A16P12G	13.00 x 9.00	330 x 229	1.25	32	4	Small
A16H16ALP	16.00 x 16.00 x 6.00	406 x 406 x 152	16	A16P16	A16P16G	13.00 x 13.00	330 x 330	3.00	76	4	Small
A16H20ALP	16.00 x 20.00 x 6.00	406 x 508 x 152	16	A20P16	A20P16G	17.00 x 13.00	432 x 330	3.00	76	4	Small
A20H16ALP	20.00 x 16.00 x 6.00	508 x 406 x 152	16	A20P16	A20P16G	17.00 x 13.00	432 x 330	3.00	76	4	Small
A20H20ALP	20.00 x 20.00 x 6.00	508 x 508 x 152	16	A20P20	A20P20G	17.00 x 17.00	432 x 432	3.00	76	4	Small
A24H12ALP	24.00 x 12.00 x 6.00	610 x 305 x 152	16	A12P24	A12P24G	9.00 x 21.00	229 x 533	1.25	32	5	Small
A24H16ALP	24.00 x 16.00 x 6.00	610 x 406 x 152	16	A24P16	A24P16G	21.00 x 13.00	533 x 330	3.00	76	5	Small
A24H20ALP	24.00 x 20.00 x 6.00	610 x 508 x 152	16	A24P20	A24P20G	21.00 x 17.00	533 x 432	3.00	76	5	Small
A24H24ALP	24.00 x 24.00 x 6.00	305 x 305 x 152	16	A24P24	A24P24G	21.00 x 21.00	533 x 533	3.00	76	5	Small
A30H20ALP	30.00 x 20.00 x 6.00	762 x 508 x 152	14	A30P20	A30P20G	27.00 x 17.00	686 x 432	3.00	76	5	Small
A30H24ALP	30.00 x 24.00 x 6.00	762 x 610 x 152	14	A30P24	A30P24G	27.00 x 21.00	686 x 533	3.00	76	5	Large
A36H24ALP	36.00 x 24.00 x 6.00	914 x 610 x 152	14	A36P24	A36P24G	33.00 x 21.00	838 x 533	3.00	76	5	Large
A16H12BLP	16.00 x 12.00 x 8.00	406 x 305 x 203	16	A16P12	A16P12G	13.00 x 9.00	330 x 229	1.25	32	4	Small
A20H16BLP	20.00 x 16.00 x 8.00	508 x 406 x 203	16	A20P16	A20P16G	17.00 x 13.00	432 x 330	3.00	76	4	Small
A20H20BLP	20.00 x 20.00 x 8.00	508 x 508 x 203	16	A20P20	A20P20G	17.00 x 17.00	432 x 432	3.00	76	4	Small
A20H24BLP	20.00 x 24.00 x 8.00	508 x 610 x 203	16	A24P20	A24P20G	21.00 x 17.00	533 x 432	3.00	76	4	Small
A24H20BLP	24.00 x 20.00 x 8.00	610 x 508 x 203	16	A24P20	A24P20G	21.00 x 17.00	533 x 432	3.00	76	5	Small
A24H24BLP	24.00 x 24.00 x 8.00	610 x 610 x 203	16	A24P24	A24P24G	21.00 x 21.00	533 x 533	3.00	76	5	Small
A24H30BLP	24.00 x 30.00 x 8.00	610 x 762 x 203	14	A30P24	A30P24G	27.00 x 21.00	686 x 533	3.00	76	7	Small
A30H20BLP	30.00 x 20.00 x 8.00	762 x 508 x 203	14	A30P20	A30P20G	27.00 x 17.00	686 x 432	3.00	76	5	Small
A30H24BLP	30.00 x 24.00 x 8.00	762 x 610 x 203	14	A30P24	A30P24G	27.00 x 21.00	686 x 533	3.00	76	5	Large
A30H30BLP	30.00 x 30.00 x 8.00	762 x 762 x 203	14	A30P30	A30P30G	27.00 x 27.00	686 x 686	3.00	76	7	Large
A36H24BLP	36.00 x 24.00 x 8.00	914 x 610 x 203	14	A36P24	A36P24G	33.00 x 21.00	838 x 533	3.00	76	5	Large
A36H30BLP	36.00 x 30.00 x 8.00	914 x 762 x 203	14	A36P30	A36P30G	33.00 x 27.00	838 x 686	3.00	76	7	Large
A42H30BLP	42.00 x 30.00 x 8.00	1,067 x 762 x 203	14	A42P30	A42P30G	39.00 x 27.00	991 x 686	3.00	76	8	Small
A42H36BLP	42.00 x 36.00 x 8.00	1,067 x 914 x 203	14	A42P36	A42P36G	39.00 x 33.00	991 x 838	3.00	76	8	Large
A48H36BLP	48.00 x 36.00 x 8.00	1,219 x 914 x 203	14	A48P36	A48P36G	45.00 x 33.00	1143 x 838	3.00	76	8	Large
A60H36BLP	60.00 x 36.00 x 8.00	1,524 x 914 x 203	14	A60P36	A60P36G	57.00 x 33.00	1448 x 838	3.00	76	9	Large
A20H16CLP	20.00 x 16.00 x 10.00	508 x 406 x 254	14	A20P16	A20P16G	17.00 x 13.00	432 x 330	3.00	76	4	Small
A24H20CLP	24.00 x 20.00 x 10.00	610 x 508 x 254	14	A24P20	A24P20G	21.00 x 17.00	533 x 432	3.00	76	5	Small
A30H24CLP	30.00 x 24.00 x 10.00	762 x 610 x 254	14	A30P24	A30P24G	27.00 x 21.00	686 x 533	3.00	76	5	Large
A36H30CLP	36.00 x 30.00 x 10.00	914 x 762 x 254	14	A36P30	A36P30G	33.00 x 27.00	838 x 686	3.00	76	7	Large
A48H30CLP	48.00 x 30.00 x 10.00	1,219 x 762 x 254	14	A48P30	A48P30G	45.00 x 27.00	1143 x 686	3.00	76	8	Small

Type 4 Wall-Mount Enclosures

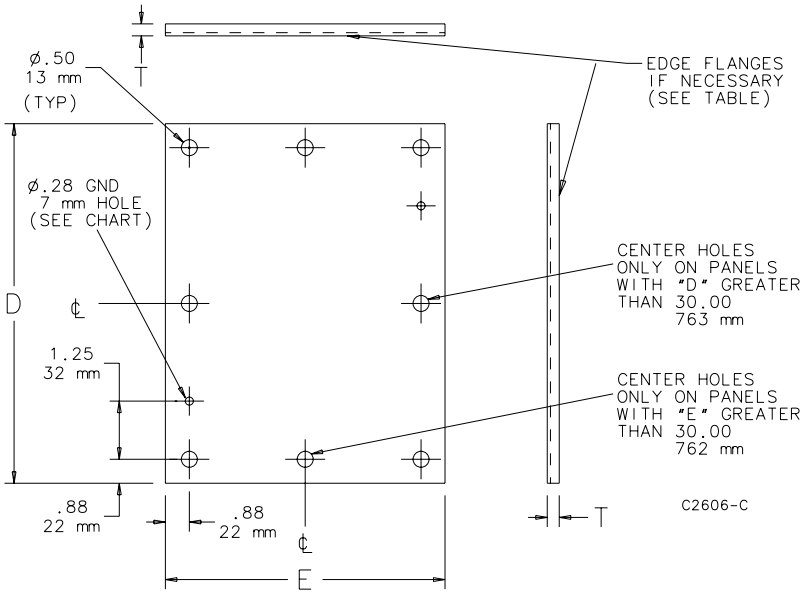
Catalog Number	AxBxC (in.)	AxBxC (mm)	Body Gauge	Panel	Conductive Panel	Panel Size D x E (in.)	Panel Size D x E (mm)	F (in.)	F (mm)	Number of Clamps	Data Pocket
A48H36DLP	48.00 x 36.00 x 12.00	1,219 x 914 x 305	14	A48P36	A48P36G	45.00 x 33.00	1143 x 838	3.00	76	8	Large
A60H36CLP	60.00 x 36.00 x 10.00	1,524 x 914 x 254	14	A60P36	A60P36G	57.00 x 33.00	1448 x 838	3.00	76	9	Large
A30H24DLP	30.00 x 24.00 x 12.00	762 x 610 x 305	14	A30P24	A30P24G	27.00 x 21.00	686 x 533	3.00	76	5	Large
A36H30DLP	36.00 x 30.00 x 12.00	914 x 762 x 305	14	A36P30	A36P30G	33.00 x 27.00	838 x 686	3.00	76	7	Large
A48H36CLP	48.00 x 36.00 x 10.00	1,219 x 914 x 254	14	A48P36	A48P36G	45.00 x 33.00	1143 x 838	3.00	76	8	Large
A36H30FLP	36.00 x 30.00 x 16.00	914 x 762 x 406	14	A36P30	A36P30G	33.00 x 27.00	838 x 686	3.00	76	7	Large
A48H36FLP	48.00 x 36.00 x 16.00	1,219 x 914 x 406	14	A48P36	A48P36G	45.00 x 33.00	1143 x 838	3.00	76	8	Large
A60H36FLP	60.00 x 36.00 x 16.00	1,524 x 914 x 406	14	A60P36	A60P36G	57.00 x 33.00	1448 x 838	3.00	76	9	Large

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



Panels for Enclosures

Catalog Number	Material	Panel Size D x E (in.)	Panel Size D x E (mm)	Panel Gauge or Thickness	Edge Flanges	T (in.)	T (mm)	Number of Holes
A42P42G	Conductive steel	39.00 x 39.00	991 x 991	12 ga.	4	0.75	19	8
A48P24	Painted steel	45.00 x 21.00	1143 x 533	12 ga.	2	0.75	19	6
A48P24G	Conductive steel	45.00 x 21.00	1143 x 533	12 ga.	2	0.75	19	6
A48P30	Painted steel	45.00 x 27.00	1143 x 686	12 ga.	4	0.75	19	6
A48P30G	Conductive steel	45.00 x 27.00	1143 x 686	12 ga.	4	0.75	19	6
A48P36	Painted steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36G	Conductive steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36SS6	Stainless Steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36AL	Aluminum	45.00 x 33.00	1143 x 838	0.10 in./3 mm	4	0.75	19	8
A48P42	Painted steel	45.00 x 39.00	1143 x 991	12 ga.	4	0.75	19	8
A48P42G	Conductive steel	45.00 x 39.00	1143 x 991	12 ga.	4	0.75	19	8
A48P48	Painted steel	44.00 x 44.00	1118 x 1118	10 ga.	4	0.88	22	8
A48P48G	Conductive steel	44.00 x 44.00	1118 x 1118	10 ga.	4	0.88	22	8
A54P42	Painted steel	50.00 x 38.00	1270 x 965	12 ga.	4	0.75	19	8
A54P42G	Conductive steel	50.00 x 38.00	1270 x 965	10 ga.	4	0.75	19	8
A60P24	Painted steel	57.00 x 21.00	1448 x 533	12 ga.	4	0.75	19	6
A60P24G	Conductive steel	57.00 x 21.00	1448 x 533	12 ga.	4	0.75	19	6
A60P30	Painted steel	57.00 x 27.00	1448 x 686	12 ga.	4	0.75	19	6
A60P30G	Conductive steel	57.00 x 27.00	1448 x 686	12 ga.	4	0.75	19	6
A60P36	Painted steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36G	Conductive steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36SS6	Stainless Steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36AL	Aluminum	57.00 x 33.00	1448 x 838	0.10 in./3 mm	4	0.75	19	8
A60BFP42	Painted steel	56.00 x 38.00	1422 x 965	10 ga.	4	0.88	22	10
A60BFP42G	Conductive steel	56.00 x 38.00	1422 x 965	10 ga.	4	0.88	22	10
A60P48	Painted steel	56.00 x 44.00	1422 x 1118	10 ga.	4	0.88	22	12
A60P48G	Conductive steel	56.00 x 44.00	1422 x 1118	10 ga.	4	0.88	22	12
A60P60	Painted steel	56.00 x 56.00	1422 x 1422	10 ga.	4	0.88	22	10
A60P60G	Conductive steel	56.00 x 56.00	1422 x 1422	10 ga.	4	0.88	22	10
A72P36	Painted steel	69.00 x 33.00	1753 x 838	12 ga.	4	0.75	19	8
A72P36G	Conductive steel	69.00 x 33.00	1753 x 838	12 ga.	4	0.75	19	8
A72P60	Painted steel	68.00 x 56.00	1727 x 1422	10 ga.	4	0.88	22	12
A72P60G	Conductive steel	68.00 x 56.00	1727 x 1422	10 ga.	4	0.88	22	12
A72P72	Painted steel	68.00 x 68.00	1727 x 1727	10 ga.	4	0.88	22	10
A72P72G	Conductive steel	68.00 x 68.00	1727 x 1727	10 ga.	4	0.88	22	10



Door Stop Kit

Designed for use on most standard Hoffman Type 4 and 12 enclosures to secure the door in the open position. Enclosures must have a "B" dimension of 16.00 inches (406mm) or more and a door which opens horizontally. Door Stop Kit can be mounted at the top or bottom of the door opening after drilling two small holes in the body of the enclosure and two small holes in the door. The angle of the door is easily adjusted by means of a wingnut, and the stop arm slides neatly out of the way when the door is closed. All parts are zinc plated.

Maintains UL/CSA Type 4 and Type 12 if properly installed in a Hoffman enclosure.

Catalog Number
ADSTOPK

NOTE: Door Stop Kit is not intended for use on CONCEPT® window door enclosures, or enclosures configured with a swing-out panel or swing-out rack frame.

Large Enclosure Door Stop Kit

Designed for use with Bulletin A4, A12, A21, A26, A27, A28, A30 and A34 large enclosures to secure the door in the 90 degree open position. Door Stop Kit can be mounted at the top or bottom of the door opening after drilling two small holes in the door and enclosure. All parts are zinc plated.

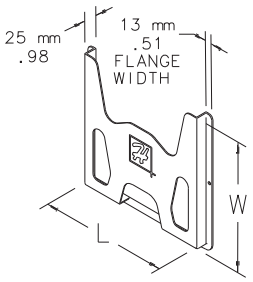
Maintains UL/CSA Type 4 and Type 12 if properly installed in a Hoffman enclosure.

Catalog Number	Description
ALGDSTOP2	Large Enclosure Door Stop Kit

Data Pocket

Provides a convenient place to store wiring diagrams, operation manuals, and other documentation inside the enclosure. Adhesive-backed pockets mount inside the solid enclosure cover. Mounting hardware included. Thermoplastic pockets are dark gray and have cut-away areas for easy inspection of contents.

Catalog Number	Description	Fits A x B	L	W
ADP1	Small pocket	508 x 406 and 610 x 610	152 (6.00)	152 (6.00)
ADP2	Large pocket	762 x 610	305 (12.00)	305 (12.00)

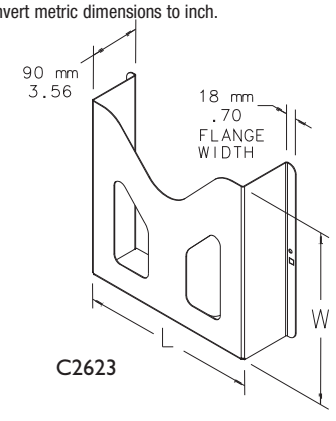


Metal Data Pocket

3-inch deep Metal Data Pocket provides a convenient place to store wiring diagrams, operation manuals, and other documentation inside the enclosure. Large enough to store 3-ring binders. Mounting hardware is included. Painted white and has cut away areas for easy inspection of contents.

Catalog Number	Fits A x B	L	W
ADP3	≥30.00 x 24.00 (≥762 x 610)	12.00 (305)	12.00 (305)

Millimeter dimensions ( ) are for reference only; do not convert metric dimensions to inch.



Mounting Kits

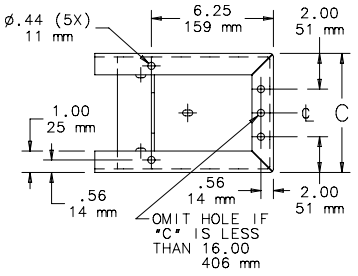
Floor Stand Kit

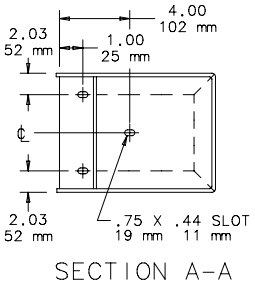
Steel Floor Stand (kit includes two stands)

Kits are easily installed on most wall-mounted Hoffman enclosures. Can also be used to elevate Hoffman free-standing enclosures. To install, drill holes in the bottom of the enclosure and bolt the floor stands to the enclosure. It is not necessary to remove the wall-mounting brackets from the enclosure. Each kit includes two stands. Two sets of floor stands are recommended for enclosures larger than double door free-standing enclosures. 12 gauge steel floor stand has a ANSI 61 gray polyester powder finish over phosphatized surfaces. Stainless steel floor stand is Type 304. Special heights, depths, materials, and finishes can be provided on custom order. Consult factory for information.

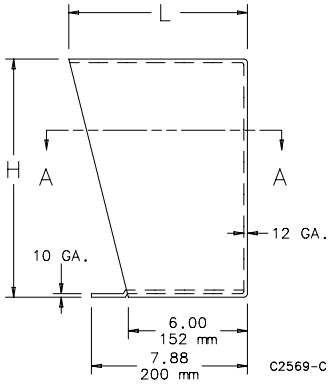
Product maintains UL/CSA Type 4 and Type 12 when properly installed on Hoffman Type 4 or Type 12 enclosures.

Catalog Number	Material	H (in.)	H (mm)	C (in.)	C (mm)	L (in.)	L (mm)
AFK0608	Steel	6	152	8.06	205	7.06	179
AFK0610	Steel	6	152	10.06	256	7.06	179
AFK0612	Steel	6	152	12.06	306	7.06	179
AFK0618	Steel	6	152	18.06	459	7.06	179
AFK1208	Steel	12	305	8.06	205	8.12	206
AFK1210	Steel	12	305	10.06	256	8.12	206
AFK1212	Steel	12	305	12.06	306	8.12	206
AFK1216	Steel	12	305	16.06	408	8.12	206
AFK1218	Steel	12	305	18.13	461	8.12	206
AFK1220	Steel	12	305	20.06	510	8.12	206
AFK1808	Steel	18	457	8.06	205	9.17	233
AFK1810	Steel	18	457	10.06	256	9.17	233
AFK1812	Steel	18	457	12.06	306	9.17	233
AFK1816	Steel	18	457	16.06	408	9.17	233
AFK2408	Steel	24	610	8.06	205	10.23	260
AFK2410	Steel	24	610	10.06	256	10.23	260
AFK2412	Steel	24	610	12.06	306	10.23	260
AFK2416	Steel	24	610	16.06	408	10.23	260
AFK1208SS	Stainless Steel	12	305	8.06	205	9.09	231
AFK1210SS	Stainless Steel	12	305	10.06	256	9.09	231
AFK1212SS	Stainless Steel	12	305	12.06	306	9.09	231
AFK1216SS	Stainless Steel	12	305	16.06	408	9.09	231
AFK1218SS	Stainless Steel	12	305	18.06	459	9.09	231
AFK1224SS	Stainless Steel	12	305	24.06	611	9.09	231
AFK2410SS	Stainless Steel	24	610	10.06	256	9.09	231
AFK2412SS	Stainless Steel	24	610	12.06	306	9.09	231

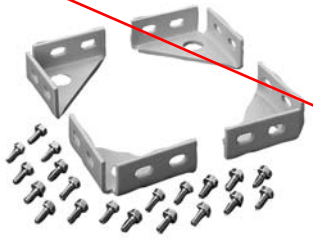




SECTION A–A



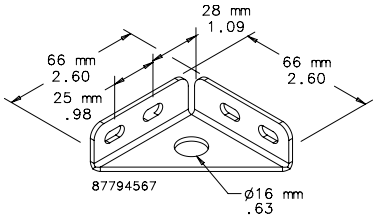
PROLINE® Frame Floor Mounting Bracket



Provides a structural method of bolting a PROLINE® frame to the floor. Fits all frame sizes. Made of 12 gauge steel with plated finish. Kit includes four brackets and mounting hardware.

NOTE: Not for use on colocation frames, which include welded-in floor mounting brackets.

Catalog Number	Description
PFBK	PROLINE Frame Floor Mounting Bracket



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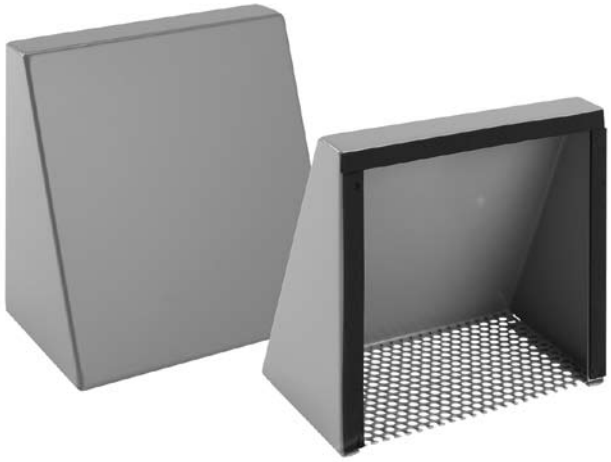
Type 3R Fan Shroud Kit



Application

Fan shroud kits are available for outdoor enclosure applications requiring Type 3R protection from falling rain, sleet, and snow. Fan shroud kits include two fan shrouds, gasketing, and mounting hardware. These fan shrouds can be used over any opening that fits the shroud size.

Catalog Number	Compact Cooling (muffin) Fans			Cooling and Exhaust Fan Packages		Filter Fan Packages		
	4 in.	6 in.	10 in.	TFP4_	TFP6_	SF05_	SF09_	SF10_
T4S3R	•							
T6S3R	•	•				•		
T10S3R	•	•	•	•	•	•	•	•
T4S3RSS	•							
T6S3RSS	•	•				•		
T10S3RSS	•	•	•	•	•	•	•	•

Features

- Shrouds are easily installed over appropriately sized openings using the supplied hardware and gasket
- Two fan shrouds per package to manage intake and exhaust ventilation

Construction

- 16 gauge mild steel or Type 304 stainless steel
- Perforated ventilation screen
- Pressure-sensitive adhesive-backed gasket and mounting hardware

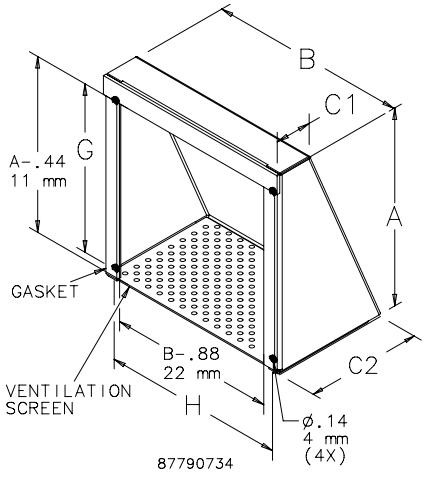
Finish

ANSI 61 gray polyester powder coating over mild steel; smooth #4 brushed finish on stainless steel.

Industry Standards

Maintains UL/cUL Type 3R rating when properly installed on UL/cUL Type 3R enclosure.

UL 508A Listed, File No. E61997: Type 3R
cUL CSA C22.2 No. 94, File No. E61997: Type 3R
NEMA/EEMAC Type 3R
IEC 60529, IP22



Standard Sizes Type 3R Fan Shroud Kit

Catalog Number	Material	A (in.)	A (mm)	B (in.)	B (mm)	C1 (in.)	C1 (mm)	C2 (in.)	C2 (mm)	G (in.)	G (mm)	H (in.)	H (mm)
T4S3R	Steel	6.00	152	6.00	152	1.44	37	4.69	119	4.69	119	5.25	133
T6S3R	Steel	8.00	203	8.00	203	1.44	37	4.69	119	6.69	170	7.25	184
T10S3R	Steel	12.00	305	12.00	305	1.44	37	4.71	120	10.69	272	11.25	286
T4S3RSS	Stainless Steel	6.00	152	6.00	152	1.44	37	4.69	119	4.69	119	5.25	113
T6S3RSS	Stainless Steel	8.00	203	8.00	203	1.44	37	4.69	119	6.69	170	7.25	184
T10S3RSS	Stainless Steel	12.00	305	12.00	305	1.44	37	4.71	120	10.69	272	11.25	286

Hoffman®
A Pentair Company

HOFFMAN
2100 Hoffman Way, Anoka, MN 55303-1745 USA
(763) 422-2211 • Fax (763) 422-2600 • www.hoffmanonline.com
Customer Service (763) 422-2211

Lighting

Fluorescent Lighting Package

These low-profile light packages are available with either a manual or a door-activated switch. On door-activated switches, the circuit is closed (activates the light) when the enclosure door is opened. Each light comes with a pre-wired terminal block for easy connection to electric supply, in either 115 volt or 230 volt models. An easy to remove, non-yellowing white plastic lens cover provides protection against bulb breakage (fluorescent bulb not included). All 115 volt models come standard with a 9 amp convenience outlet. Standard mounting hardware and brackets included. Body finish is light gray RAL 7035 polyester powder paint.

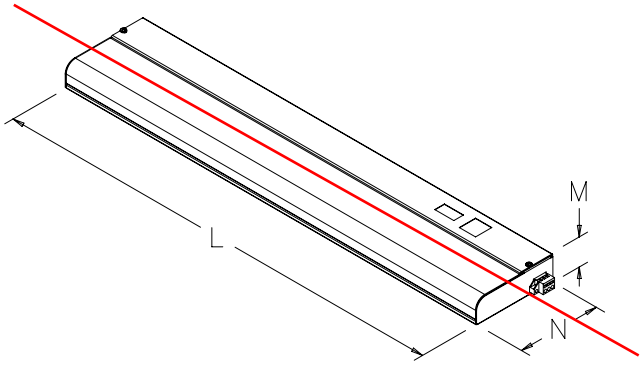
Underwriters' Laboratories Inc. listed:

UL 508 Component Recognized File No. E229434

cUL Component Recognized C22.2 No. 14 File No. E229434

Maintains Type 4 and Type 12 when properly installed in a Hoffman enclosure.

Optional accessories include a mounting bracket kit designed specifically for Hoffman PROLINE® disconnect enclosure applications and easy to mount "remote" manual and door-activated switches with mounting bracket. Accept the following standard bulbs, which are not included with light package: F8T5, F15T8, F18T8, or F40T12.



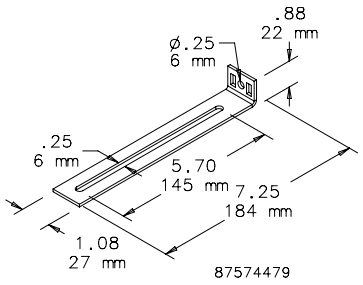
Catalog Number	Description	VAC	Hz	Amps	Convenience Outlet	L (in.)	L (mm)	M (in.)	M (mm)	N (in.)	N (mm)
ALF16D12R	Door switch	115	60	0.16	Yes	12.30	312	1.38	42	4.59	140
ALF16M12R	Manual switch	115	60	0.16	Yes	12.30	312	1.38	42	4.59	140
ALF16D18R	Door switch	115	60	0.35	Yes	18.10	460	1.38	42	4.59	140
ALF16M18R	Manual switch	115	60	0.35	Yes	18.10	460	1.38	42	4.59	140
	Manual switch, 6 ft. power cord[a]	115	60	0.35	Yes	18.10	460	1.38	42	4.59	140
ALF25D18R	Door switch	230	50	0.30	No	18.10	460	1.84	56	5.25	160
ALF25M18R	Manual switch	230	50	0.30	No	18.10	460	1.84	56	5.25	160
ALF16D24R	Door switch	115	60	0.35	Yes	24.10	612	1.38	42	4.59	140
ALF16M24R	Manual switch	115	60	0.35	Yes	24.10	612	1.38	42	4.59	140
ALF16M48R	Manual switch	115	60	0.65	Yes	48.00	1219	1.84	56	5.25	160

[a] Corded light is listed to UL/cUL 153 standard.

Mounting Bracket Kit for Fluorescent Light Package

Kit simplifies mounting light package in Hoffman PROLINE® disconnect enclosures. Includes brackets, all mounting hardware, and complete instructions.

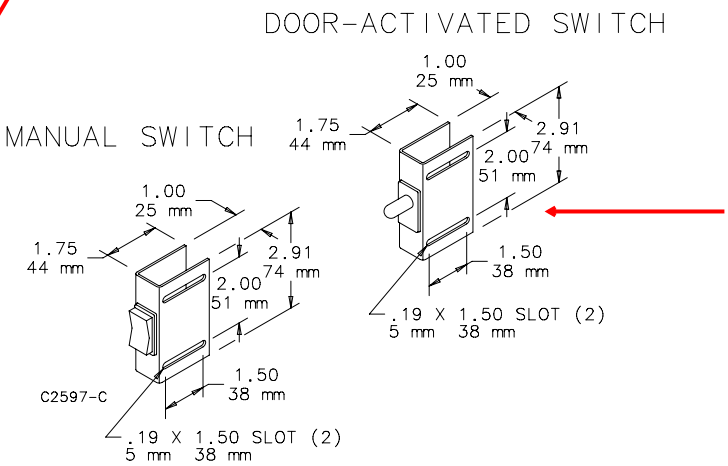
Catalog Number	Description
PDLFBRKT	Mounting Bracket Kit



Switches

Remote switches for these light packages.

Catalog Number	Description
ALFSWM	Manual switch
ALFSWD	Door-activated switch



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AC Axial Fan & Blower

*All products are **RoHS** compliant.

SUNON®

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Sunon AC Axial Fan & Blower

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Certification

Safety

VDE-Reg-Nr.1350

Alveolate Motor AC fan series with automatic motor-wire wrapping technology ensures stable performance of high wind volume, low acoustic noise, also available with functions of dual spinning rate, and thermal cutout.

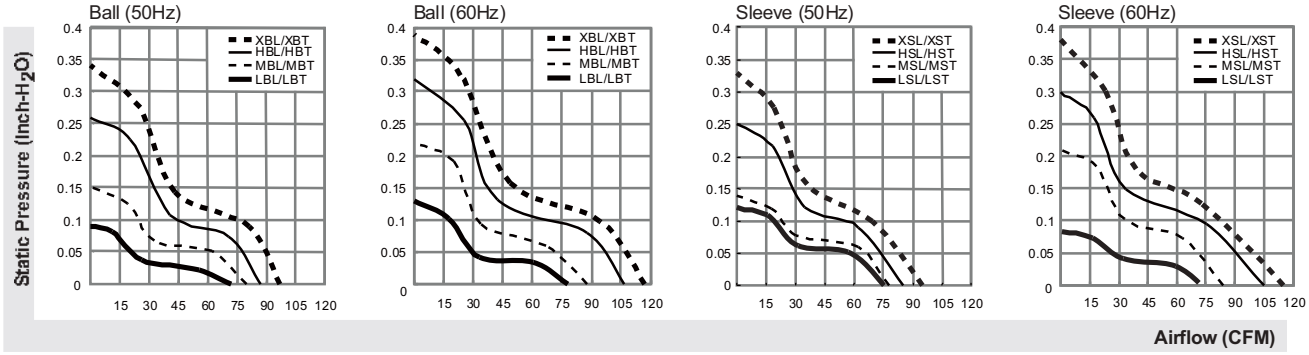
SUNON-A late Motor VS. Traditional Shaded-Pole Motor

SUNON-Alveolate Motor	Traditional Shaded-Pole Motor
1. The Alveolate Motor is equipped with sta ting stator coils and working ones. The sta ting coils form a low starting voltage with the capacitors. For example, an 115VAC (the fixed voltage) A la .	1. T Traditional Shaded-Pole Motor, designed with single-wire wrapping, is started by "the starting copper" and cannot be sta th low voltage. A 5V Traditional Shaded-Pole motor will need more than 80VAC to run, 20VAC more than the Alveola
2. The coils do not produce high temperature and consumes less electricity. The temperature is normally a °. Therefore, the motor is alw ta le and reliable.	2. The Traditional Shaded-Pole Motor consumes electricity twice as much as the Alveola . It is not reliable because the temperature is usually higher than 70°C.
3. The Thermal Cutout can protect the motor.	. The Thermal Cutout is an option.
4. The motor has a large torsion to produce high wind pressure and wind volume.	4. General wind pressure and wind volume.
5.The motor is equipped with the third wire, ready to comply with the customer's systems.	5. Without the third wire.

70-117 CFM

Model	P/N	Bearing (● VAPO ○ BALL ◉ Sleeve)	Rating Voltage (VAC)	Freq. (Hz)	Power Current (AMP)	Power Consumption (WATTS)	Speed (RPM)	Air Flow (CFM)	Static Pressure (Inch-H_2O)	Noise (dBA)	Weight (g)
SP100A	1123XSL.GN	◉	115	50/60	0.26/0.24	22/20	2700/3100	95/115	0.33/0.38	44/49	550
SP100A	1123XST.GN	◉	115	50/60	0.26/0.24	22/20	2700/3100	95/115	0.33/0.38	44/49	550
SP101A	1123HSL.GN	◉	115	50/60	0.21/0.18	20/18	2550/2900	85/105	0.25/0.30	43/48	550
SP101A	1123HST.GN	◉	115	50/60	0.21/0.18	20/18	2550/2900	85/105	0.25/0.30	43/48	550
SP102A	1123MSL.GN	◉	115	50/60	0.17/0.16	15/15	2400/2600	78/84	0.14/0.21	33/38	550
SP102A	1123MST.GN	◉	115	50/60	0.17/0.16	15/15	2400/2600	78/84	0.14/0.21	33/38	550
SP103A	1123LSL.GN	◉	115	50/60	0.11/0.13	11/11	2200/2000	76/70	0.12/0.08	38/36	550
SP103A	1123LST.GN	◉	115	50/60	0.11/0.13	11/11	2200/2000	76/70	0.12/0.08	38/36	550
SP100A	1123XBL.GN	○	115	50/60	0.26/0.24	22/20	2850/3150	97/117	0.34/0.39	45/50	550
SP100A	1123XBT.GN	○	115	50/60	0.26/0.24	22/20	2850/3150	97/117	0.34/0.39	45/50	550
SP101A	1123HBL.GN	○	115	50/60	0.21/0.18	20/18	2750/3050	87/107	0.26/0.32	45/50	550
SP101A	1123HBT.GN	○	115	50/60	0.21/0.18	20/18	2750/3050	87/107	0.26/0.32	45/50	550
SP102A	1123MBL.GN	○	115	50/60	0.17/0.16	16/15	2500/2700	80/88	0.15/0.22	35/40	550
SP102A	1123MBT.GN	○	115	50/60	0.17/0.16	16/15	2500/2700	80/88	0.15/0.22	35/40	550
SP103A	1123LBL.GN	○	115	50/60	0.13/0.11	11/11	2150/2300	72/78	0.09/0.13	37/39	550
SP103A	1123LBT.GN	○	115	50/60	0.13/0.11	11/11	2150/2300	72/78	0.09/0.13	37/39	550

Frame : Aluminum alloy



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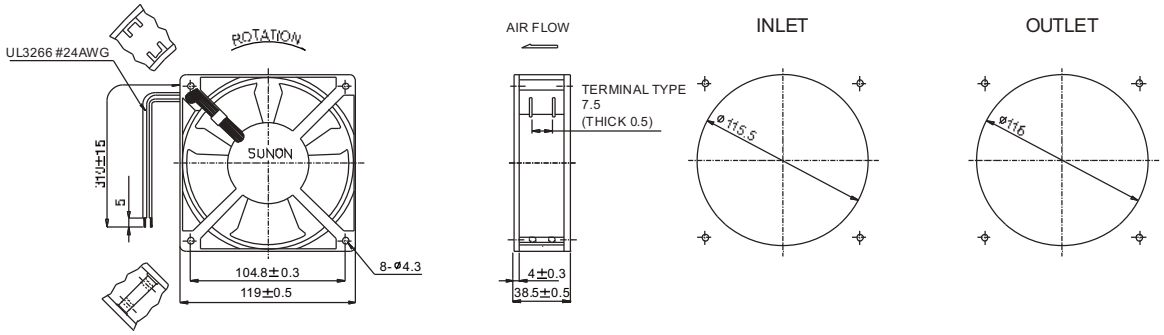

*All model could be customized on voltage or any other requirements to fit your need.
*Specifications subject to change without notice. Please Visit SUNON web site at http://www.sunon.com for update information.

Headquarters:
Sunonwealth Electric Machine Industry Co., Ltd.
No. 30, Lane 296, Hsin Ya Road, Chien-Chen District, Kaohsiung,Taiwan
TEL : +886-7-8135888
FAX :+886-7-8230505/8230606/8231010
URL: http://www.sunon.com
E-mail: sunon@email.sunon.com.tw

Sunon Inc. (U.S.A.)
1075 West Lambert Road Suite A, Brea, California 92821, U.S.A
TEL : +1-714-255-0208
FAX :+ 1-714-255-0802
URL : http://www.sunonusa.com
E-mail : info@sunon.com

Sunon SAS (Europe)
Parc Medicis, 66, Ave Des Pepinieres 94832, Fresnes Cedex-France
TEL : +33-1-46154515
FAX : +33-1-46154510
URL: http://www.sunoneurope.com
E-mail : info@sunoneurope.com

Sunon Corporation (Japan)
Stork Minami Otsuka 4Fl.33-1, 2 Chome,
Minami Otsuka Toshimaku, Tokyo, Japan 170-0005
TEL : +81-3-5395-3069
FAX: +81-3-5395-3080
URL: http://www.sunon.co.jp
E-mail : info@sunon.co.jp

Sunon Technologies Pte Ltd. (Singapore)
10 Toh Guan Road, #03-08 TT International Tradepark, Singapore 608838
TEL : +65-6795-0300
FAX :+65-6795-0600
E-mail : info@sunon.com.sg

Sunonwealth Electric Machine Industry (HK) Ltd. (Hong Kong)
1210 Grand City Plaza, 1 Sai Lau Kok Road, Tsuen Wan, Hong Kong, China
TEL : + 852-24-111-388
FAX : + 852-24-050-707
E-mail : info@sunon.com.hk

Sunon Shanghai Office (Shanghai, China)
TEL : +86-021-54070116
FAX :+86-021-54070116
URL: http://www.sunon.com.cn

Sunon Shen Zhen Office (Shen Zhen, China)
TEL : +86-755-26880688
FAX :+86-755-26880288
E-mail : info@sunon.com.cn

Sunon Guangzhou Office (Guangzhou, China)
TEL : +86-20-87788928
FAX :+86-20-87786786

2007/08/30 (114-4)

SDU Series, DIN Rail AC UPS

The SDU DIN Rail UPS combines an industry leading compact design with a wide operation temperature range and unique installation options. The SDU series provides economical protection from damaging impulses and power interruptions. These units include easy to wire screw terminations for critical devices needing battery back up such as computer based control systems.

UL 1778
Ind. Application
E179213

Features

- Lightweight, compact industrial design
- Wide operation temperature range (0-50°C)
- Cold start capability
- Phone/dataline surge protection
- Software and cable included for easy installation
- Simulated sinewave output
- RS232 Communication Port
- USB Communication Port (optional)
- Form C Dry Contact Relay (optional)
- Panel/Wall mounting brackets (optional)
- Remote turn-on and shut-off capabilities NEW
- Limited two-year warranty

Approvals

- 120V models are UL1778 recognized for industrial applications without derating.
  - No derating required in UL508 applications.
- 230V models are CE marked.

Applications

- Programmable Logic Controllers
- Factory Automation
- Robotics
- Conveying Equipment
- Computer-based Control Systems

Related Products

- Portable MCR Power Conditioners
- STV Surge Protective Devices
- SDN DIN Rail Power Supplies
- STFV Plus Active Tracking® Filters

Selection Table

Capacity (VA/W)	Catalog Number	Volts, Frequency In/Out	Typical Back–up Time (minutes)*	Input/Output Connections	Approx. Ship Weight – lbs (kg)
500/300	**SDU 500**	120 Vac, 50/60 Hz	4	IP20 touch proof, screw terminals. Wire range: 10 ~ 24 AWG.	10.7 (4.7)
850/510	**SDU 850**		2		11.4 (5.0)
500/300	**SDU 500-5**	230 Vac, 50/60 Hz	4		11.5 (5.2)
850/510	**SDU 850-5**		2		11.9 (5.4)

* At full load.

SDU Accessories

Catalog Number	Description	Approx. Ship Weight – lbs (kg)
RELAYCARD-SDU	Dry contact I/O relay box, IP20 touch proof screw terminals, wire size range 12~22 AWG (IEC 2.5mm); N.O./N.C. form "C" contact. Relay contact signal for "On Battery", "Low Battery" and "UPS Shutdown".	1.0 (0.45)
UPSMON-USB	RS232 to USB adapter cable	1.0 (0.45)
SDU-PMBRK	Mounting brackets to secure UPS to wall, back of panel or enclosure.	1.0 (0.45)

Specifications

Catalog Number	SDU 500	SDU 850	SDU 500-5	SDU 850-5
Capacity (VA/Watts)	500/300	850/510	500/300	850/510
Load Power Factor	0.6			
Dimensions – inches (mm)				
Unit (H x W x D)	4.88 x 11.1 x 4.55 (124 x 281 x 116)			
Weight – lbs (kg)	10.7 (4.7)	11.4 (5.0)	11.5 (5.2)	11.9 (5.4)
Input Parameters				
Voltage	120 V (+10%, -20%)		230 V (+/- 20%)	
Frequency	50 +/- 5 Hz or 60 Hz +/- 6 Hz (auto sensing)			
Output AC Parameters				
Voltage (Battery Mode)	Step sinewave			
	+/- 5%			
Frequency (On Battery)	50 or 60 Hz			
	+/- 0.3 Hz			
Overload Protection	UPS automatic shutdown if overload exceeds 105% of nominal at 20 seconds, 120% at 10 seconds, 130% at 3 seconds			
Short Circuit	UPS output cut off immediately			
Battery Parameters				
Battery Type	Sealed, non-spillable, maintenance-free lead acid batteries			
Transfer Time	4 - 6 ms typical			
Back–up Time* (minutes)	4.5/18	2.5/10	4.5/18	2.5/10
Recharge Time	8 hours to 90% capacity after full discharge			
Environmental				
Operating Temperature	32°F to 122°F (0°C to 50°C)			
Storage Temperature	5°F to 140°F (-15°C to 60°C)			
Relative Humidity	1% to 95%, non-condensing			
Ambient Operation	1-95% humidity non-condensing, 0-50°C up to 5,000 ft. (1500m)			
Audible Noise	< 40dBA (1 meter from surface)			
Standards				
Safety	UL 1778 Recognized components for industrial applications in accordance with UL508 without derating. CAN/CSA C22.2 No 107.1-01. Overvoltage Category 3, pollution degree 3. FCC Part 15, Subpart B, Class A		CE Marked; LVD: EN62040-1-1; EMC: EN50091-2, EN61000-3-2, EN61000-3-3, IEC60801-2, IEC60801-3, IEC60801-4, IEC61000-2-2.	
Elevation	5000 ft. without derating			
Shock & Vibration	According to the International Safe Transit Association standard ISTA 2A.			
Mounting	To be mounted on DIN TS35/7.5 or TS35/15 rail system. Chassis mounting permissible via optional brackets. Unit handles normal shock and vibration of industrial use and transportation without coming off rail.			

* At full load/half load.