Weaver
CONSTRUCTION MANAGEMENT
3679 S Huron Street, Suite 404 Englewood, Colorado 80110
Phone: (303) 789-4111 FAX: (303) 789-4310

SUBMITTAL TRANSMITAL

August 31, 2012
WCM Sub No: 11211-001.A

PROJECT: **Harold Thompson Regional WRF**
Birdsall Rd.
Fountain, CO 80817
Job No. 2908

ENGINEER: **GMS, Inc.**
611 No. Weber St., #300
Colorado Springs, CO 80903
719-475-2935 Roger Sams

OWNER: **Lower Fountain Metropolitan Sewage Disposal District**
901 S. Santa Fe Ave.
Fountain, CO 80817
719-382-5303 James Heckman

CONTRACTOR: **Ambiente H2O Inc. (USEMCO)**
1500 W Hampden Ave., STE 5D
Sheridan, CO 80110
303-433-0364 Jane Harlow/ Bill Pinkston

SUBJECT: Resubmittal of NPW System – Above Grade Packaged Pump Station (NPP-1, NPP-2, NPP-3 and NPP-4)

SPEC SECTION: 11211: Packaged Pump Station

PREVIOUS SUBMISSION DATES: 7/23/12

DEVIATIONS FROM SPEC: ___ YES _X_ NO

CONTRACTOR'S STAMP: This submittal has been reviewed by Weaver Construction Management and, unless indicated otherwise, has been found to be in conformance with the intent of the contract documents.

Contractor's Stamp:	Engineer's Stamp:
Date: 8/31/12 Reviewed by: John Jacob (X) Reviewed Without Comments ( ) Reviewed With Comments	

ENGINEER'S COMMENTS:_____
_____

Weaver
CONSTRUCTION MANAGEMENT

PH 303-789-4111 3679 So. Huron St., Suite 404
FX 303-789-4310 Englewood, Colorado 80110

Project: HDTWRF **Submittal No.: 11211-001.A.**

Location: Fountain, CO

Supplier: USEMCO

Date: 8/31/12

Submittal 11211-01.A. NPW Packaged Pump Station NPP-1

Additional Submittal Review Comments:

1. **USECMO has provided a list of responses labeled "Response to GMS 8/20 Review Comments". Additionally, USEMCO has provided response to comment 6 in the attached email with additional comment to 10 in the same email.**
2. **Regarding Comment 10 response, we request GMS confirm line reactors are indeed required for the USECO drives. WCM will provide as requested. WCM will address with USEMCO the availability of section 16269.**
3. **We request GMS comments by 9/7/12.**

End of Review

RESUBMITTAL

LOCATION: Fountain, CO
CUSTOMER: Weaver Construction Management
ENGINEER: GMS
TYPE: Above Grade Water Booster
DATE: August 23, 2012
SERIAL: 7646

This equipment is designed to operate on 3 phase, 60 hertz, 277/480 volt, 4 wire electrical service. Please indicate if this is correct. Please verify that the utility service to this station is _____ amps.

Approved By: _____

Date: _____

Response to GMS 8/20 Review Comments

1. The electrical drawings have been revised to indicate a 480 Volt, 3-phase, 60HZ, 3-wire electrical service.
2. The hydropneumatic will be ASME 250 psi rated.
3. The inlet gauge has been changed to 0 – 15 psi.
4. Same as comment #1.
5. All electrical and control equipment will function properly at the specified ambient room temperatures.
6. The following revisions and comments apply to this comment:
    a. The controller will have a Low Suction pressure warning setpoint for future use.
    b. The controller will have a Low Suction pressure shutdown setpoint for future use.
    c. The controller will have a Low Suction pressure transmitter / switch configuration selection.
    d. A digital input has been added for remote on/off.
    e. A digital input has been indicated as spare.
    f. An analog input has been added for suction pressure.
    g. An analog input has been indicated as spare.
    h. A digital output has been added for system run status.
    i. Low suction pressure warning will be displayed on the touch screen as an alarm.
    j. Low suction pressure shutdown will be displayed on the touch screen as an alarm.
    k. The H2Pro controller is capable of monitoring the system power conditions. No backup power is provided so the alarm will not be displayed. A power on indicator light has been included to display the power status.
    l. Individual pump fail lights have been added.
    m. Individual pump run time meters have been added.
7. Dry contacts will only be provided for system run status and common alarm.
8. Noted.
9. Testing will be performed in accordance with Specification Section 11211
10. USEMCO does not have a specification for the variable frequency drives that call for line reactors.
11. The control panel main breaker has been changed to a 125A circuit breaker. Load calculations have been provided on drawing 7646 EMC1 revision A.

John Jacob

From: Rob Carlson [RCarlson@USEMCO.COM]
Sent: Friday, August 31, 2012 10:19 AM
To: John Jacob
Subject: FW: HDTWRF; Submittal 11211 Spec Section 16269
Attachments: 7646 EMC1B.pdf; 7646B.pdf

John,

Attached is the response from the electrical technician on this. We feel that the VFD spec called out is not applicable to the drives on this station. That spec also was not included in the Division 16 spec I was sent for bidding the project. We have added the line reactors but again do not feel that they are required for this application. So far the additional cost for adding these are being placed on USEMCO and I honestly am not very happy about that. It would be best if the engineer would agree that the line reactors are not needed for this and we remove them but I am not sure if they will.

Thanks,

Robert Carlson P.E.
Product Manager - Water Booster Division
USEMCO INC.
608-372-5911

From: Mike Harris
Sent: Friday, August 31, 2012 10:29 AM
To: Rob Carlson
Subject: RE: HDTWRF; Submittal 11211 Spec Section 16269

Comment #6

The USEMCO H2Pro controller will meet all the required specific operational and control capabilities as specified in section 11211, paragraphs 2.9.I.9 through 2.9.I.14.

Comment 6a has been addressed in the previous response.

Drawing changes to add the line reactors in NEMA 4X enclosures attached.

Michael Harris
Electrical Engineering Technician
USEMCO Inc.
1602 Rezin Rd
Tomah, WI 54660
Phone: 608-372-5911
Fax: 608-372-5016
mharris@usemco.com
www.usemco.com

From: Rob Carlson
Sent: Thursday, August 30, 2012 4:01 PM
To: Mike Harris
Subject: FW: HDTWRF; Submittal 11211 Spec Section 16269

#7646 Drive spec. Take a look at it and we will discuss. They are also looking for a formal E-mail response to submittal comment #6.

If it is just the line reactors I would respond that that spec section was not available at bid therefore we will not be providing. Any idea what the cost?

Robert Carlson P.E.
Product Manager - Water Booster Division
USEMCO INC.
608-372-5911

From: John Jacob [mailto:john@weavercm.com]
Sent: Thursday, August 30, 2012 3:52 PM
To: Rob Carlson
Subject: HDTWRF; Submittal 11211 Spec Section 16269

Rob,

Per our conversation, I have attached Section 16269 VFDs related to review comment 10. Please incorporate another response to this item when you address review comment 5. Paragraphs 2.9.I.9 through 2.9.I.14.

I would like a response by tomorrow if not Tuesday next week.

Thank you,

John Jacob
Project Manager
WEAVER CONSTRUCTION MANAGEMENT, INC.
PH: 303.789.4111 FAX: 303.789.4310
ADDRESS: 3679 S. Huron Street, Suite 404, Englewood, CO 80110 WEAVERCM.COM

PLEASE NOTE

The enclosed material, being submitted for your approval, was prepared with our best interpretation of the contract plans and specifications.

Without an approval of this submittal, USEMCO cannot order the equipment used in this station. If it can be at all avoided, we urge you not to request a resubmittal. USEMCO can do the best job of providing a timely delivery of this station if we are able to proceed with ordering of equipment. If this submittal cannot be approved in its entirety, then the explicit approval of certain equipment with long lead times is needed. The items with the longest lead times are: pumps & motors, valves, flowmeters, gas detectors, air conditioners, telemetry items and other electrical equipment. The explicit approval can be written in the returned submittal or by a letter. Return one copy of the submittal.

Your cooperation in this matter is sincerely appreciated.

#7646

GENERAL
Presented herein is descriptive information for your review detailing the station to be fabricated by USEMCO for the job indicated.

This station will be fabricated of highest quality materials to meet the requirements specified. The station shall be wired internally with provision for all necessary field wiring to complete the installation. A factory test of the unit will be made to insure proper operation.

PROTECTIVE COATINGS
All mill scale, rust, weld flux, or other foreign matter shall be removed from all steel surfaces by shot blasting. Protective coatings of the epoxy type shall be applied to all exterior surfaces in accordance with the Metal Coating System Bill of Material. A touch-up kit shall be provided for the coating materials.

Fountain, CO.
Job #7646
Description of Operation

This water booster pump skid contains four vertical multistage pumps with space provided for a future fifth pump. All pumps are operated from variable frequency drives (VFD) to maintain a constant discharge pressure. The electrical control panel will ship loose for mounting and interconnection by others.

The pump station controls operate the four pumps with the use of a *H2Pro* controller, a discharge pressure transmitter, a suction pressure switch, and a color touch screen operator interface panel. The *H2Pro* interfaces with the pump motors VFD using analog signals. The controls are designed to start the lead pump when the higher elevated distribution system pressure drops below an operator entered discharge pressure set point. The controls will automatically adjust the output speed of the pump to maintain a preset constant discharge pressure from the station. If required, the lag pump will be started and run in parallel with the lead pump. If the lead pump and lag pump running do not fulfill the system demands, the third pump will be started and run in parallel with the other two. If the lead pump, lag pump, and lag 2 pump running do not fulfill the system demands, the fourth pump will be started and run with the other three. Provision will be made to start the future fifth pump if the other four cannot maintain the required discharge pressure. A selector switch has been provided on the touch screen to select the lead pump or alternate automatically. When the system demands are met the pumps will be stopped in the reverse order that they were started.

A hand-off-automatic selector switch is provided for each pump. In the hand position the pump can be started, stopped and the pumps may be manually speed controlled from the VFD panel. In the off position the pump will be stopped. In the automatic position the pump will operate from the commands received from the *H2Pro* controller.

The color display on the touch screen operator interface panel provides status indicators, alarm lights, and control switches with graphics drawn on the screen. Elapsed time meters for each pump are also included on the operator interface panel.

A selectable pump alternating sequence is provided for the pumps through the operator interface panel. A pump may be sequenced to the opposite pump at the end of each pumping cycle. A pump may be alternated to the opposite pump every 24 hours, or one of the pumps may be designated on every cycle if this is desired.

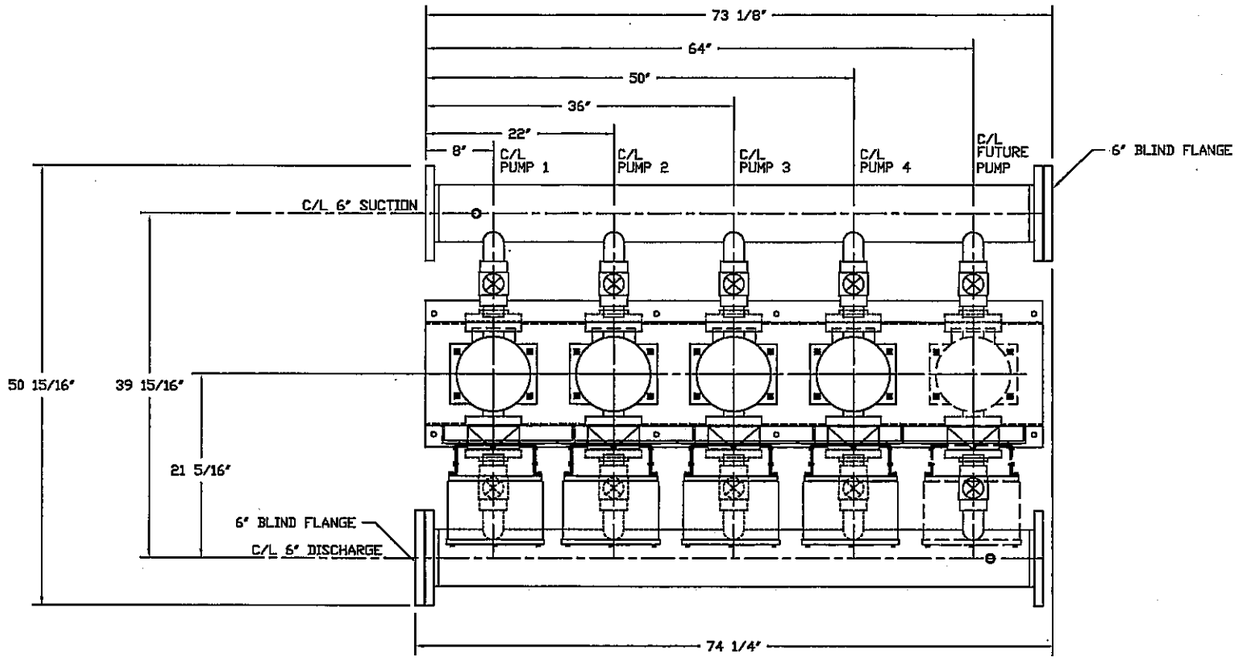
A low discharge pressure set point is provided to indicate an alarm if a sustained low discharge pressure is sensed. An alarm indicator on the operator interface panel will signal the low discharge pressure condition.

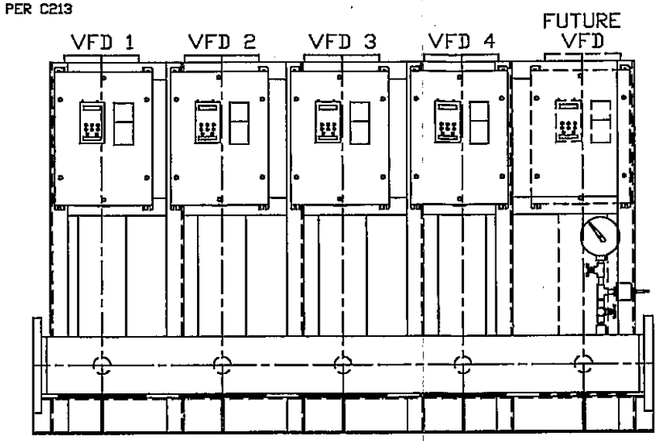
A low suction pressure switch has been included to shut down the pumps on an alarm condition. An alarm indicator on the control panel will signal the alarm condition. Pumps will resume operation when the suction pressure rises above the restore pressure switch setting.

If a called pump should fail to operate within the set time, the next pump will run in its place on each successive call. After the problem has been corrected and the pump failure manually reset, the pump will return to operation in its normal sequence.

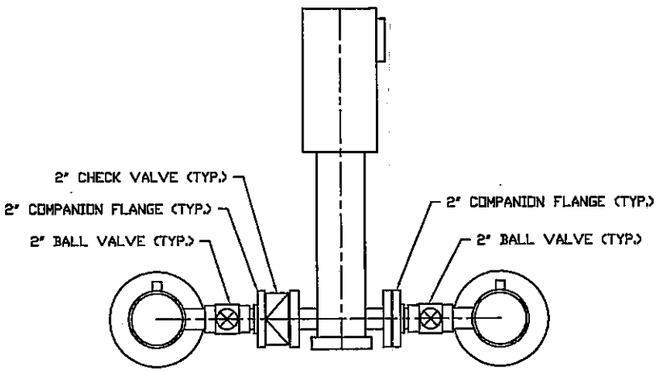
Telemetry dry contacts are provided for low suction, high discharge, low discharge, pump fail, common alarm, and transducer fail.

PAINT REQUIREMENTS:
APPLY 6 MILS EPOXY ENAMEL
INTERIOR OF PIPING
FUSION BONDED EPOXY COATED PER C213

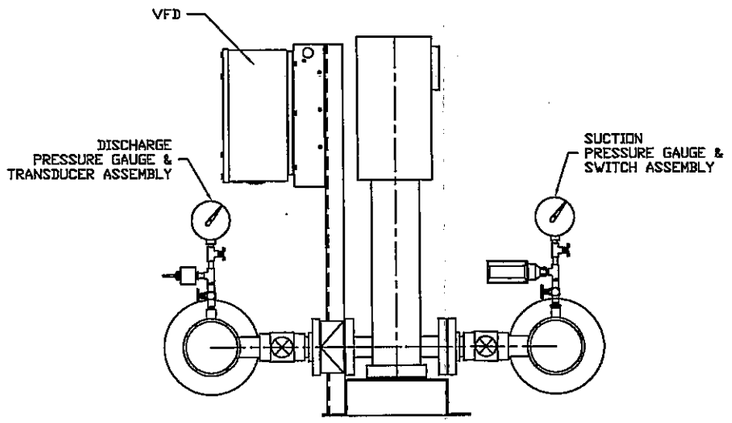


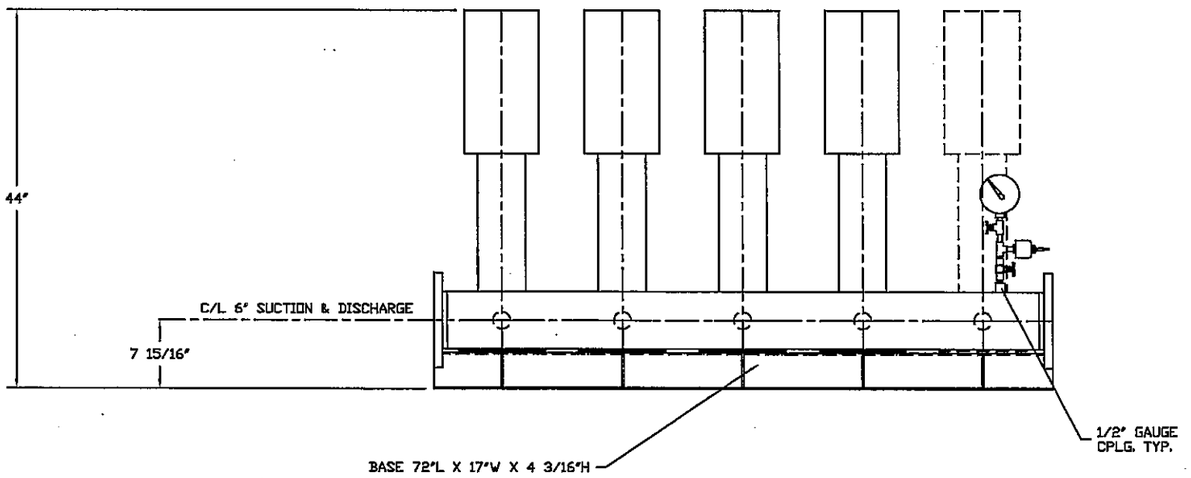


VFDS



PUMPS 1,2,3,4 & FUTURE





NOTE:
PIPE EXTERNAL TO STATION MUST BE INDEPENDENTLY SUPPORTED.

REV. NO.	REVISION	BY CHK'D	DATE
A	NAME CHANGE	TRM M.H.	8/22 12

DESIGNED BY:		DATE	
DRAWN BY:	TRM	DATE	6/11
CHECKED BY:	W.K.	DATE	12
SCALE		DWG. NO.	JOB NO. 7646

USEMCO
USEMCO INCORPORATED
P.O. BOX 550 (608) 372-5911 TOMAH WI. 54660
DESCRIPTION
FOUNTAIN, CO

CORROSION PROTECTION DATA SHEET

#7646

Shot blast all steel surfaces to SSPC-SP10 for near white blasting.

METAL COATING:

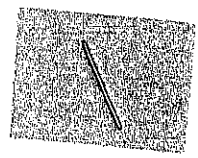
Apply two coats epoxy finish, 3 mils each, total 6 mils dry.

Manufacturer: Tnemec

Product: Series N69

NOTE: USEMCO's standard color for Tnemec Series N69 is Seahorse YB25. Other colors are available at an additional cost.

Interior of piping fusion bonded epoxy coated per AWWA C213 with IF1947T by Valspar.



Hi-Build Epoxoline II SERIES N69

Series V69 conforms with air pollution regulations limiting Volatile Organic Compounds (VOC) to a maximum of 250 grams/litre (2.08 lbs/gal). In areas requiring less than 100 grams/litre VOC, please refer to the Series L69 data sheet.

PRODUCT PROFILE

GENERIC DESCRIPTION Polyamidoamine Epoxy

COMMON USAGE An advanced generation epoxy for protection and finishing of steel and concrete. It has excellent resistance to abrasion and is suitable for immersion as well as chemical contact exposure. Contact your local Tnemec representative for a list of chemicals. This product can also be used for lining storage tanks that contain demineralized, deionized or distilled water.

COLORS Refer to Tnemec Color Guide. **Note:** Epoxies chalk with extended exposure to sunlight. Lack of ventilation, incomplete mixing, miscatalyzation or the use of heaters that emit carbon dioxide and carbon monoxide during application and initial stages of curing may cause yellowing to occur.

FINISH Satin

SPECIAL QUALIFICATIONS A two-coat system at 4.0-6.0 dry mils (100-150 dry microns) per coat passes the performance requirements of **MIL-C-4556E** for fuel storage.

PERFORMANCE CRITERIA Extensive test data available. Contact your Tnemec representative for specific test results.

COATING SYSTEM

PRIMERS **Steel:** Self-priming or Series 1, 27, 37H, 66, 90, 91-H_2O, 94-H_2O, 135, 161, 394, 530
Galvanized Steel and Non-Ferrous Metal: Self-priming or Series 66, 161
Concrete: Self-priming or 54-660, 130, 218, 219
CMU: Self-priming or 54-562, 54-660, 130, 216, 218, 219

TOPCOATS 46H-413, 66, L69, N69, 73, 84, 104, 113, 114, 161, 1070, 1071, 1072, 1074, 1074U, 1075, 1075U, 1077, 1078. Refer to COLORS on applicable topcoat data sheets for additional information. **Note:** The following recoat times apply for Series N69/V69: Immersion Service—Surface must be scarified after 60 days. Atmospheric Service—After 60 days, scarification or an epoxy tie-coat is required. Contact your Tnemec representative for specific recommendations.

SURFACE PREPARATION

STEEL **Immersion Service:** SSPC-SP10/NACE 2 Near-White Blast Cleaning
Non-Immersion Service: SSPC-SP6/NACE 3 Commercial Blast Cleaning

PRIMED STEEL **Immersion Service:** Scarify the Series 66, N69/V69 or 161 prime coat surface by abrasive blasting with fine abrasive before topcoating if it has been exterior exposed for 60 days or longer and N69/V69 is the specified topcoat.

GALVANIZED STEEL & NON-FERROUS METAL Surface preparation recommendations will vary depending on substrate and exposure conditions. Contact your Tnemec representative or Tnemec Technical Services.

CAST/DUCTILE IRON Contact your Tnemec representative or Tnemec Technical Services.

CONCRETE Allow new concrete to cure 28 days. For optimum results and/or immersion service, abrasive blast referencing SSPC-SP13/NACE 6, ICRI CSP 2-4 Surface Preparation of Concrete and Tnemec's Surface Preparation and Application Guide.

CMU Allow mortar to cure for 28 days. Level protrusions and mortar spatter.

PAINTED SURFACES **Non-Immersion Service:** Ask your Tnemec representative for specific recommendations.

ALL SURFACES Must be clean, dry and free of oil, grease, chalk and other contaminants.

TECHNICAL DATA

VOLUME SOLIDS* 67.0 ± 2.0% (mixed)

RECOMMENDED DFT 2.0 to 10.0 mils (50 to 255 microns) per coat. **Note:** MIL-C-4556E applications require two coats at 4.0-6.0 mils (100-150 microns) per coat. Otherwise, the number of coats and thickness requirements will vary with substrate, application method and exposure. Contact your Tnemec representative.

CURING TIME AT 5 MILS DFT
Without 44-700 Accelerator

Temperature	To Handle	To Recoat	Immersion
90°F (32°C)	4 hours	7 hours	6 days
80°F (27°C)	5 hours	8 hours	7 days
70°F (21°C)	7 hours	10 hours	7 days
60°F (16°C)	8 hours	12 hours	9 days
50°F (10°C)	12 hours	16 hours	12 days

Curing time varies with surface temperature, air movement, humidity and film thickness. **Note:** For faster curing and low-temperature applications, add No. 44-700 Epoxy Accelerator; see separate product data sheet.

VOLATILE ORGANIC COMPOUNDS*

N69: Unthinned	Thinned 10% No. 4 Thinner	Thinned 10% No. 60 Thinner	V69: Unthinned	Thinned 2.5%
2.40 lbs/gallon (285 grams/litre)	2.80 lbs/gallon (334 grams/litre)	2.80 lbs/gallon (335 grams/litre)	1.95 lbs/gallon (234 grams/litre)	2.08 lbs/gallon (250 grams/litre)

HAPS 2.40 lbs/gal solids | 3.25 lbs/gal solids | 2.40 lbs/gal solids | 2.00 lbs/gal solids | 2.30 lbs/gal solids

THEORETICAL COVERAGE* 1,074 mil sq ft/gal (26.4 m^2/L at 25 microns). See APPLICATION for coverage rates.

NUMBER OF COMPONENTS Two: Part A and Part B

PACKAGING 5 gallon (18.9L) pails and 1 gallon (3.79L) cans — Order in multiples of 2.

SERIES N69 Hi-Build Epoxoline II

TECHNICAL DATA continued

NET WEIGHT PER GALLON* N69: 13.67 ± 0.25 lbs (6.10 ± .11 kg) (mixed) V69: 14.01 ± 0.25 lbs (6.36 ± .11 kg) (mixed)

STORAGE TEMPERATURE Minimum 20°F (-7°C) Maximum 110°F (43°C)

TEMPERATURE RESISTANCE (Dry) Continuous 250°F (121°C) Intermittent 275°F (135°C)

SHELF LIFE Part A: 24 months; Part B: 12 months at recommended storage temperature.

FLASH POINT - SETA N69 & V69 Part A: 82°F (28°C) N69 Part B: 93°F (34°C) V69 Part B: 86°F (30°C)

HEALTH & SAFETY Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product. **Keep out of the reach of children.**

APPLICATION

COVERAGE RATES*

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m^2/Gal)
Suggested (1)	6.0 (150)	9.0 (230)	179 (16.6)
Minimum	2.0 (50)	3.0 (75)	537 (49.9)
Maximum	10.0 (250)	15.0 (375)	107 (10.0)

(1) Note: Roller or brush application requires two or more coats to obtain recommended film thickness. Also, Series N69 can be spray applied to an optional high-build film thickness range of 8.0 to 10.0 dry mils (205 to 255 dry microns) or 11.5 to 14.5 wet mils (209 to 370 wet microns). Allow for overspray and surface irregularities. Film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance.

MIXING

1. Start with equal amounts of both Parts A & B.
2. Using a power mixer, separately stir Parts A & B.
3. (For accelerated version. If not using 44-700, skip to No. 4.)
   Add four (4) fluid ounces of 44-700 per gallon of Part A while Part A is under agitation.
4. Add Part A to Part B under agitation, stir until thoroughly mixed.
5. Both components must be above 50°F (10°C) prior to mixing. For application of the unaccelerated version to surfaces between 50°F to 60°F (10°C to 16°C) or the accelerated version to surfaces between 35°F to 50°F (2°C to 10°C), allow mixed material to stand 30 minutes and restir before using.
6. For optimum application properties, the material temperature should be above 60°F (16°C).

Note: The use of more than the recommended amount of 44-700 will adversely affect performance.

POT LIFE

Without 44-700	15 hours at 50°F (10°C)	5 hours at 77°F (25°C)	3 hours at 100°F (38°C)
With 44-700	8 hours at 35°F (2°C)	4 hours at 77°F (25°C)	1 hour at 100°F (38°C)

THINNING Use No. 4 or No. 60 Thinner. For air spray, thin up to 10% or ¾ pint (380 mL) per gallon. For airless spray, roller or brush, thin up to 5% or ¼ pint (190 mL) per gallon. **Note:** When using Series V69, a maximum of 2.5% of No. 4 Thinner may be used to comply with VOC regulations.

SURFACE TEMPERATURE Minimum 50°F (10°C) Maximum 135°F (57°C)

The surface should be dry and at least 5°F (3°C) above the dew point. Coating will not cure below minimum surface temperature.

APPLICATION EQUIPMENT

Air Spray †

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	75-100 psi (5.2-6.9 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray †

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.015"-0.019" (380-485 microns)	3000-4800 psi (207-330 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.

† Spray application of first coat on CMU should be followed by backrolling.

Note: Application over inorganic zinc-rich primers: Apply a wet mist coat and allow tiny bubbles to form. When bubbles disappear in 1 to 2 minutes, apply a full wet coat at specified mil thickness.

Roller: Use 3/8" or 1/2" (9.5 mm or 12.7 mm) synthetic woven nap roller cover.

Brush: Recommended for small areas only. Use high quality natural or synthetic bristle brushes.

CLEANUP Flush and clean all equipment immediately after use with the recommended thinner or MEK.

*Values may vary with color.

PRINTED IN USA
(YDAT067) N69

TNEMEC COMPANY INCORPORATED
6800 CORPORATE DRIVE, KANSAS CITY, MISSOURI 64120-1372 TEL: 1 800 TNEMEC 1 www.tnemec.com

valspar
if it matters, we're on it.®

Technical Data

1136 Fayette
North Kansas City, MO 64116
816-421-7400

Date: May 6, 2010

Product # IF1947T

Product Description: RED OXIDE EPOXY KEP35210P80 PN733976

Specifications			
Physical Properties:			
Chemical Type	EPOXY		
Specific Gravity	1.39 ± 0.05		
Theoretical Coverage	138.57 SQ FT/LB @ 1 MIL		
Other Information			
Film Properties		**Method**	
Recommended Film Thickness			3 - 20 MIL
Flexibility (Conical Mandrel)		ASTM D-522	PASS
Adhesion		ASTM D-3359	PASS
Gloss (60 degrees)		ASTM D-523	70 - 95 GU
Direct Impact		ASTM D-2794	40 - 160 IN-LBS
Cure Cycle	10 MINUTES @ 375F		
Appearance	SMOOTH		
Application	ELECTROSTATIC SPRAY		
Pretreatment:	All testing was performed on clean panels with appropriate pretreatment. Proper pretreatment will enhance performance of this product.		
Substrate:	BLASTED CAST IRON		

PUMP & MOTOR DESCRIPTION

Job Name: Fountain, CO

Job Number: 7646

Pump Manufacturer: Grundfos

Number of Pumps: 4
Type: Vertical Multi-Stage
Model: CR15-5

Pump Rating:
GPM: 90
TDH: 231
RPM: 3500

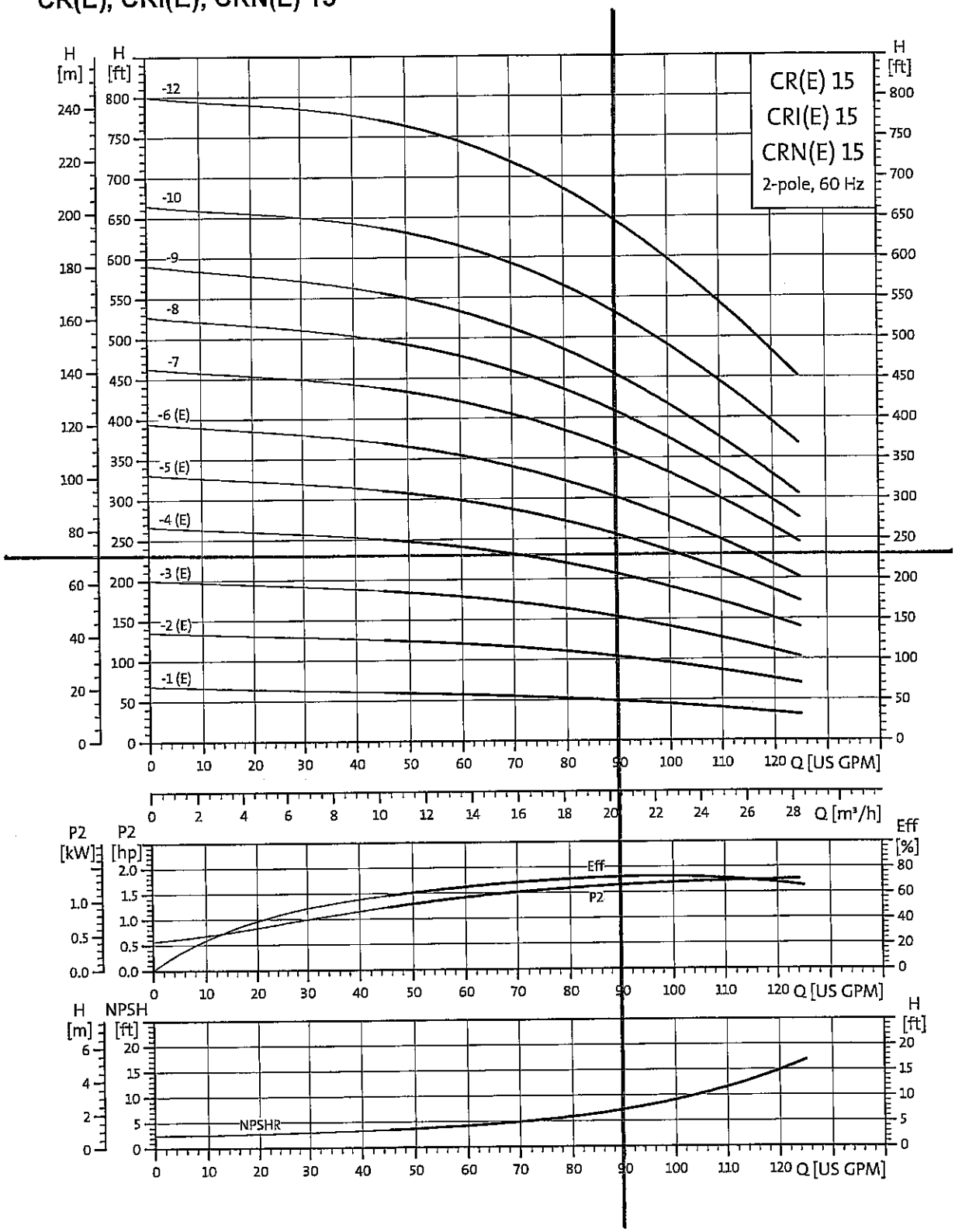
Construction Features:
Class 300 Flanged
Mechanical Seal

Motor Characteristics:
HP: 15 (derated to 10 HP)
RPM: 3500
Voltage: 208-230-460
Phase: 3
Hz: 60
Enclosure: TEFC
1.15 Service Factor
Class "F" Insulation
Suitable for Inverter Use

Revised 8/23/12

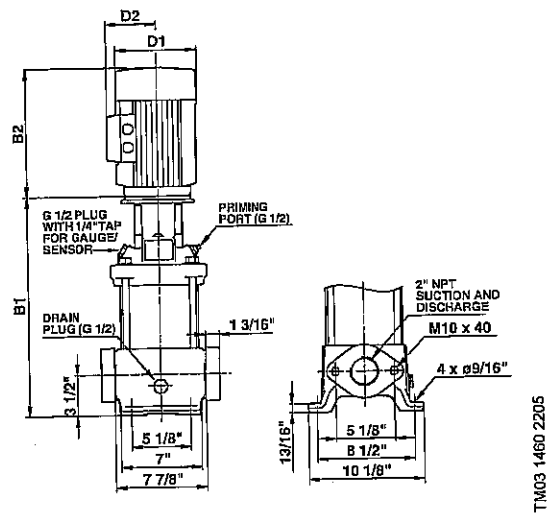
Performance curves

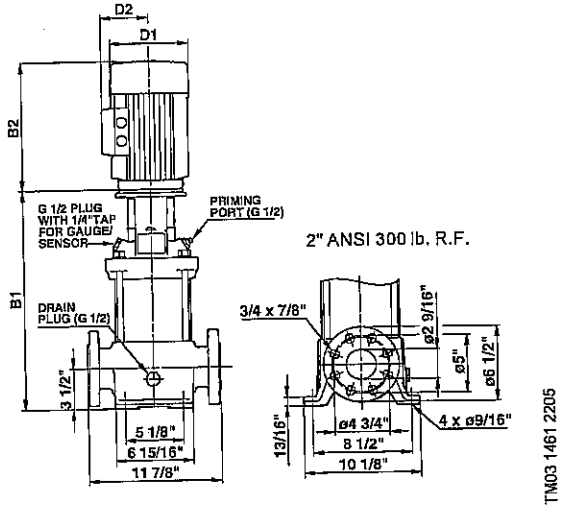
CR(E), CRI(E), CRN(E) 15



TM02 7222 2803

Technical data





Pump type	P2 [hp]	Ph.	Oval*	ANSI dimensions [inch] B1	TEFC D1	TEFC D2	TEFC B1+B2	ODP D1	ODP D2	ODP B1+B2	Ship Wt. [lbs.]	ANSI dimensions [inch] MLE D1	MLE D2	MLE B1+B2	Ship Wt. [lbs.]
CR(E) 15-1	2	1	•	16.46	7.19	5.73	29.02	-	-	-	139	-	-	-	-
		3	•	16.46	7.01	4.33	27.68	-	-	-	128	7.01	6.57	29.26	141
CR(E) 15-2	5	1	•	17.20	10.62	7.46	32.72	-	-	-	205	-	-	-	-
		3	•	17.20	8.66	5.28	32.71	-	-	-	201	8.66	7.40	30.00	194
CR(E) 15-3	7 1/2	1	•	19.29	10.22	7.62	34.82	-	-	-	223	-	-	-	-
		3	•	19.29	8.66	5.28	34.80	-	-	-	212	8.66	7.40	19.29	206
CR(E) 15-4	7 1/2	1	•	21.06	10.22	7.62	36.59	-	-	-	225	-	-	-	-
		3	•	21.06	8.66	5.28	36.57	-	-	-	214	8.66	7.40	34.37	227
CR(E) 15-5	10	1	•	22.83	10.23	10.30	38.90	-	-	-	342	-	-	-	-
		3	•	22.83	8.66	5.28	38.34	-	-	-	218	10.24	8.39	22.83	238
CR(E) 15-6	15	3	-	27.17	10.22	8.67	43.75	10.62	7.33	43.48	376	-	-	-	-
CR 15-7	15	3	-	28.94	10.22	8.67	45.52	10.62	7.33	45.25	407	-	-	-	-
CR 15-8	15	3	-	30.71	10.22	8.67	47.29	10.62	7.33	47.02	438	-	-	-	-
CR 15-9	20	3	-	32.48	10.22	8.67	49.06	11.50	8.92	52.17	445	-	-	-	-
CR 15-10	20	3	-	34.25	10.22	8.67	50.83	11.50	8.92	53.94	450	-	-	-	-
CR 15-12	25	3	-	37.17	12.94	11.52	56.99	11.50	8.94	57.98	505	-	-	-	-

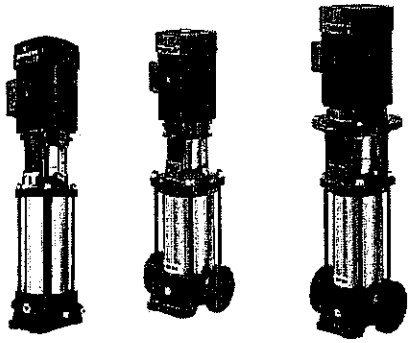
All dimensions in inches unless otherwise noted.

*Oval flanged pump B1 and B1+B2 dimension is equal to ANSI flanged pumps and weight is approximately 3 lbs. less.

• Available.

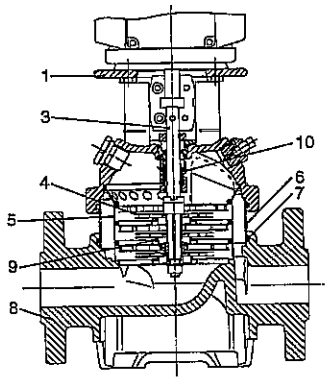
Construction

CR(E) 1s, 1, 3, 5, 10, 15 and 20



TM02 1198 0601 - GR7377 - GR7379

Sectional drawing



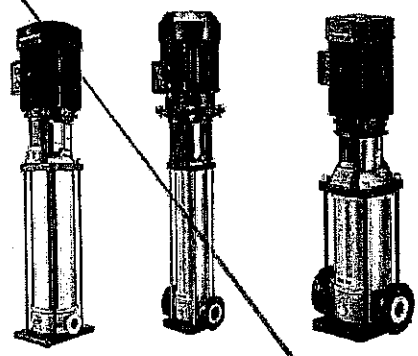
TM02 1194 1403

Materials: CR(E)

Pos.	Designation	Materials	AISI/ASTM
1	Pump head	Cast iron	A 48-30 B
3	Shaft	Stainless steel	AISI 316 [1] AISI 431 [2]
4	Impeller	Stainless steel	AISI 304
5	Chamber	Stainless steel	AISI 304
6	Outer sleeve	Stainless steel	AISI 304
7	O-ring for outer sleeve	EPDM or FKM	
8	Base	Cast iron	A 48-30 B
9	Neck ring	PTFE	
10	Shaft seal	Cartridge type	
	Bearing rings	Silicon carbide	
	Rubber parts	EPDM or FKM	
12	FJG flange	Cast iron	A 48-30 B

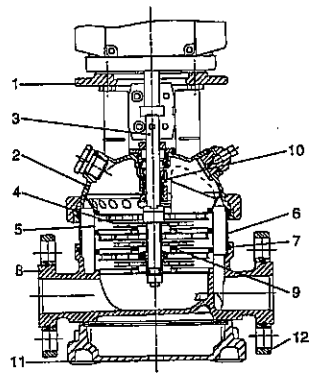
[1] CR(E) 1s, 1, 3, 5
[2] CR(E) 10, 15, 20
[3] Stainless steel available on request.
[4] CF 8M is cast equivalent of AISI 316 stainless steel.
[5] CRI(E)/CRN(E) 1s, 1, 3, 5
[6] CRN(E) 10, 15, 20
[7] CRI(E) 10, 15, 20

CRI(E), CRN(E) 1s, 1, 3, 5, 10, 15 and 20



TM02 1808 2001 - GR7373 - GR7375

Sectional drawing



TM03 2156 3805

Materials: CRI(E), CRN(E)

Pos.	Designation	Materials	AISI/ASTM
1	Pump head	Cast iron [3]	A 48-30 B
2	Pump head cover	Stainless steel	CF 8M[4]
3	Shaft	Stainless steel	AISI 316 [5] AISI 329 [6] AISI 431 [7]
8	Base	Stainless steel	CF 8M[4]
9	Neck ring	PTFE	
10	Shaft seal	Cartridge type	
11	Base plate	Cast iron [3]	A 48-30 B
	Bearing rings	Silicon carbide	
	Rubber parts	EPDM or FKM	
	CRI(E)		
4	Impeller	Stainless steel	AISI 304
5	Chamber	Stainless steel	AISI 304
6	Outer sleeve	Stainless steel	AISI 304
7	O-ring for outer sleeve	EPDM or FKM	
12	FGJ flange ring	Ductile iron [3]	A 65-45-12
	Oval flange	Stainless steel	AISI 316
	CRN(E)		
4	Impeller	Stainless steel	AISI 316
5	Chamber	Stainless steel	AISI 316
6	Outer sleeve	Stainless steel	AISI 316
7	O-ring for outer sleeve	EPDM or FKM	
12	FGJ flange ring	Ductile iron [3]	A 65-45-12

Motor data

Standard motors in the CR range

Motors used in the CR pump range are:

- Grundfos ML or MLE motors
- Grundfos specified Baldor® motors

The information in the tables below applies to following motors type and size:

Type	Phase	Motor range [HP]	Cooling method
ML	3	1/3 - 10	TEFC
Baldor	1	1/3 - 10	TEFC
	3	15 - 100	TEFC
	3	15 - 100	ODP
MLE	1	1/2 - 1 1/2	TEFC
	3	1 - 10	TEFC

Grundfos CR pumps are supplied with heavy-duty 2-pole, NEMA energy efficient C-frame motors built or selected to our rigid specifications. All CR pump motors have heavy-duty bearings for maximum thrust requirements.

It is not recommended that an off-the-shelf standard Baldor motor be used on a Grundfos pump. Ideally, the best motor choice would be the Grundfos specified motor.

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

Other motor types are available (i.e., Explosion proof, Mill and Chem duty, Premium Efficiency, etc.); consult local Grundfos company for more information.

Pumps supplied by Grundfos Canada are normally supplied with motors from other manufactures. 575 volt motors meet NEMA energy efficient standards. Dimensions and data will vary, contact local Grundfos company for more information.

All values are subject to change without notice.

TEFC motors

(Totally Enclosed Fan Cooled, constant speed)

HP	PH	Frame	S.F.	Voltage [V]	Mtr. Eff. [%]	Insul. class	KVA code	Full load current [A]	Service Factor current [A]	Start current [A]	Motor type
1/3	1	56C	1.35	115/230	55	B	K	6.0/3.0	7.6/3.8	28/14	Baldor
	3	56C	1.35	208-230/460	78.5	F	L	1.12-1.1/0.55	1.5-1.45/0.75	7.1-7.7/3.9	ML
1/2	1	56C	1.6	115/230	62	B	K	7.4/3.7	9.8/4.9	39/19.5	Baldor
	3	56C	1.25	208-230/460	78.5	F	K	1.64-1.55/0.78	2.0-1.9/0.95	9.7-10.1/5.1	ML
3/4	1	56C	1.25	115/230	66	B	K	9.6/4.8	11.4/5.7	56/28	Baldor
	3	56C	1.25	208-230/460	79	F	K	2.4-2.3/1.2	2.9-2.75/1.4	14.2-15/7.8	ML
1	1	56C	1.25	115/230	66	B	K	12/6.0	14.4/7.2	77/38.5	Baldor
	3	56C	1.25	208-230/460	80	F	J	3.25-3.35/1.68	4.0-3.9/1.95	19.2-21.8/10.9	ML
1 1/2	1	56C	1.3	115/208-230	71	B	K	17/9.5-8.6	20.4/11.3-10.2	106/58.6-53	Baldor
	3	56C	1.15	208-230/460	84	F	M	4.7-4.6/2.3	5.2-5.1/2.55	33.8-36.8/18.4	ML
2	1	56C	1.15	115/208-230	74	F	K	23/12.7-11.5	25.4/14.0-12.7	156/86-78	Baldor
	3	56C	1.15	208-230/460	85.5	F	G	5.7-5.4/2.7	6.55-6.1/3.05	46.2-48.6/24.3	ML
3	1	182TC	1.15	115/208-230	75	F	H	29/16-14.5	31.8/18-15.9	170/94-85	Baldor
	3	182TC	1.15	208-230/460	86.5	F	M	8.4-7.7/3.9	9.5-8.6/4.3	79.0-80.1/40.6	ML
5	1	213TCZ	1.15	208-230	80	F	J	24-22	27-25	188-170	Baldor
	3	182TC	1.15	208-230/460	88.5	F	L	13.8-13.0/6.5	15.6-14.6/7.3	124-129/64.4	ML
7 1/2	1	213TC	1.15	208-230	82	F	F	33.8-31	38.5-35.5	244-220	Baldor
	3	213TC	1.15	208-230/460	90	F	N	20.4-19.4/9.7	23-21.5/10.8	192-202/101	ML
10	1	213TC	1.15	230	85.5	F	F	40	46	284	Baldor
	3	213TC	1.15	208-230/460	90.2	F	L	26.5-25.5/12.8	30.5-28.5/14.5	239-252/127	ML
15	3	254TCZ	1.15	208-230/460	90.2	F	K	37.5-34/17	42.5-39/19.5	270-304/152	Baldor
20	3	254TCZ	1.15	208-230/460	90.2	F	K	47-46/23	53-52/26	355-412/206	Baldor
25	3	284TSCZ	1.15	230/460	91	F	J	56/28	64/32	498/249	Baldor
30	3	286TSCZ	1.15	230/460	91	F	G	70/35	78/39	450/225	Baldor
40	3	286TSC	1.15	230/460	91.7	F	G	88/44	102/51	614/307	Baldor
50	3	326TSCZ	1.15	230/460	93	F	G	110/55	128/64	746/393	Baldor
60	3	364TSCZ	1.15	230/460	93	F	G	134/67	154/77	918/459	Baldor
75	3	365TSCZ	1.15	230/460	93	F	G	166/83	188/94	1162/581	Baldor
100	3	405TSCZ	1.15	230/460	93.6	F	G	216/108	246/123	1422/711	Baldor

Baldor motor

TM02 7666 3803

ML motor

GR 7845

PIPING AND VALVE DATA SHEET

Job #7646

STATION INLET:

Size: 6" – Flanged
Material: Sch 40 Steel Pipe

Isolation Valve:
Type : Ball
Manufacturer: Nibco
Description: 2", threaded, lever operator, Model T585-70

Check Valve:
Type: Silent
Manufacturer: Val-Matic
Description: 2", wafer, Model 1402

Pressure Relief Valve: (Shipped Loose)
Type: Globe
Manufacturer: Cla-Val
Description: 3", Class 150 flanged, y-strainer, 20 to 200 PSI pilot range, Model 50G-01Y

Hydro-Pneumatic Tank: (Shipped Loose)
Manufacturer: Wessel
Description: 53 gallon, 250 PSI ASME, Model FXA200HP

STATION DISCHARGE

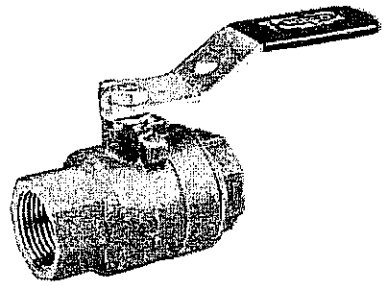
Size: 6" – Flanged
Material: Sch 40 Steel Pipe

600 PSI WWP Bronze Ball Valves

Fire Protection Valve • Two-Piece Body • Chrome Plated Ball • Blowout-Proof Stem • Reinforced PTFE Seats • Full Port

600 PSI/41.4 Bar Non-Shock Cold Water

Dezincification Resistant



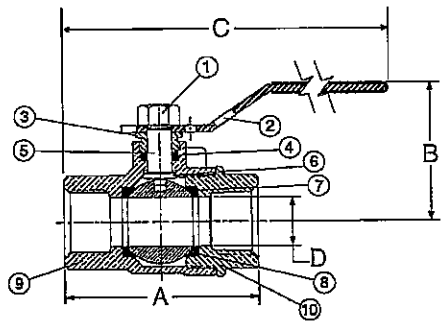
CONFORMS TO MSS SP-110

MATERIAL LIST

PART		SPECIFICATION
1.	Handle Nut	Zinc Plated Steel
2.	Handle	Zinc Plated Steel Clear Chromate Plastisol Coated
3.	Threaded Pack Gland	Brass ASTM B16 Alloy C36000
4.	Packing	PTFE
5.	Stem	Silicon Bronze ASTM B371 Alloy C69430 or ASTM B99 Alloy C65100
6.	Thrust Washer	Reinforced PTFE
7.	Ball	Brass ASTM B124 Alloy C37700 or ASTM B16 Alloy C36000 EACH with Hard Chrome Plate
8.	Seat Ring (2)	Reinforced PTFE
9.	Body	Cast Red Bronze ASTM B584 Alloy C84400
10.	Body End Piece	Cast Red Bronze ASTM B584 Alloy C84400

¼" and ⅜" size only has A304 stainless steel grounding washer.

T-585-70
Threaded



T-585-70
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		B		C		D Port		Weight		Box	Master
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Qty.	Ctn. Qty.
¼	8	2.00	51	1.75	44	5.00	127	.38	10	.45	.20	10	100
⅜	10	2.00	51	1.75	44	5.00	127	.38	10	.45	.20	10	100
½	15	2.44	62	1.88	48	5.19	132	.50	13	.64	.29	10	100
¾	20	2.94	75	2.25	57	6.25	159	.75	19	1.33	.60	5	50
1	25	3.34	85	2.38	60	6.44	164	1.00	25	1.79	.81	5	20
1¼	32	4.19	106	3.00	76	6.75	171	1.25	32	2.17	.99	5	20
1½	40	4.72	120	3.16	80	9.06	230	1.25	32	3.27	1.49	5	10
2	50	5.16	131	3.50	89	9.25	235	2.00	51	5.09	2.31	2	8

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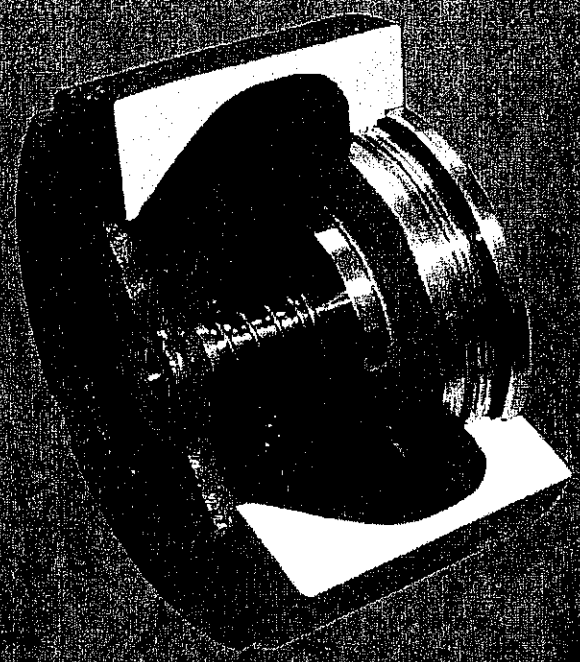
SHHH... SHHH...

SHOCK-PROOF PIPING SYSTEMS

FM APPROVED

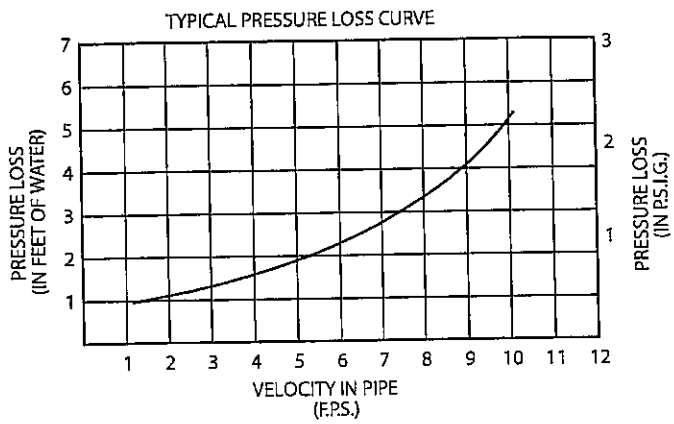


1400 SERIES

WAFER STYLE with VAL-MATIC® Silent Check Valves

Designed and engineered for silent operation with low head loss in a compact wafer body. Specially designed spring controls the closure of Val-Matic Silent Check Valves. . . closing valve disc in advance of flow reversal, thereby reducing the potential for water hammer and damaging shock normally associated with valve shut-off.

Tear-Drop Contour allows streamline flow and combined with Full Pipe Size Area of Inner Body assures minimal pressure drop.



NOTE: For specific valve size pressure loss curve.... See Drawing Number 1404.

VAL-MATIC SILENT CHECK VALVES ARE ENGINEERED FOR SILENT OPERATION / LOW HEAD LOSS *Plus* . . .

- Shortest Feasible Face-to-Face Dimensions
- Lightweight, Space-Saving Wafer Design
- Easily Replaceable Parts
- Functions Equally Well in All Positions
- Simple Flange-Supported Installation
- Cast Iron Body/Bronze or Stainless Steel Trim
- Metal to Metal Seating Standard - Optional Resiliant Seating Available

NOTE:

1. **Recommended for Liquid Service Only.**
2. **Flanged Globe Style Valves also Available in 2 1/2" through 42" . . . See Val-Matic Bulletin 1800.**

VAL-MATIC®

VAL-MATIC VALVE & MANUFACTURING CORP.

905 RIVERSIDE DR. • ELMHURST, IL 60126 • P: 630-941-7600 • F: 630-941-8042
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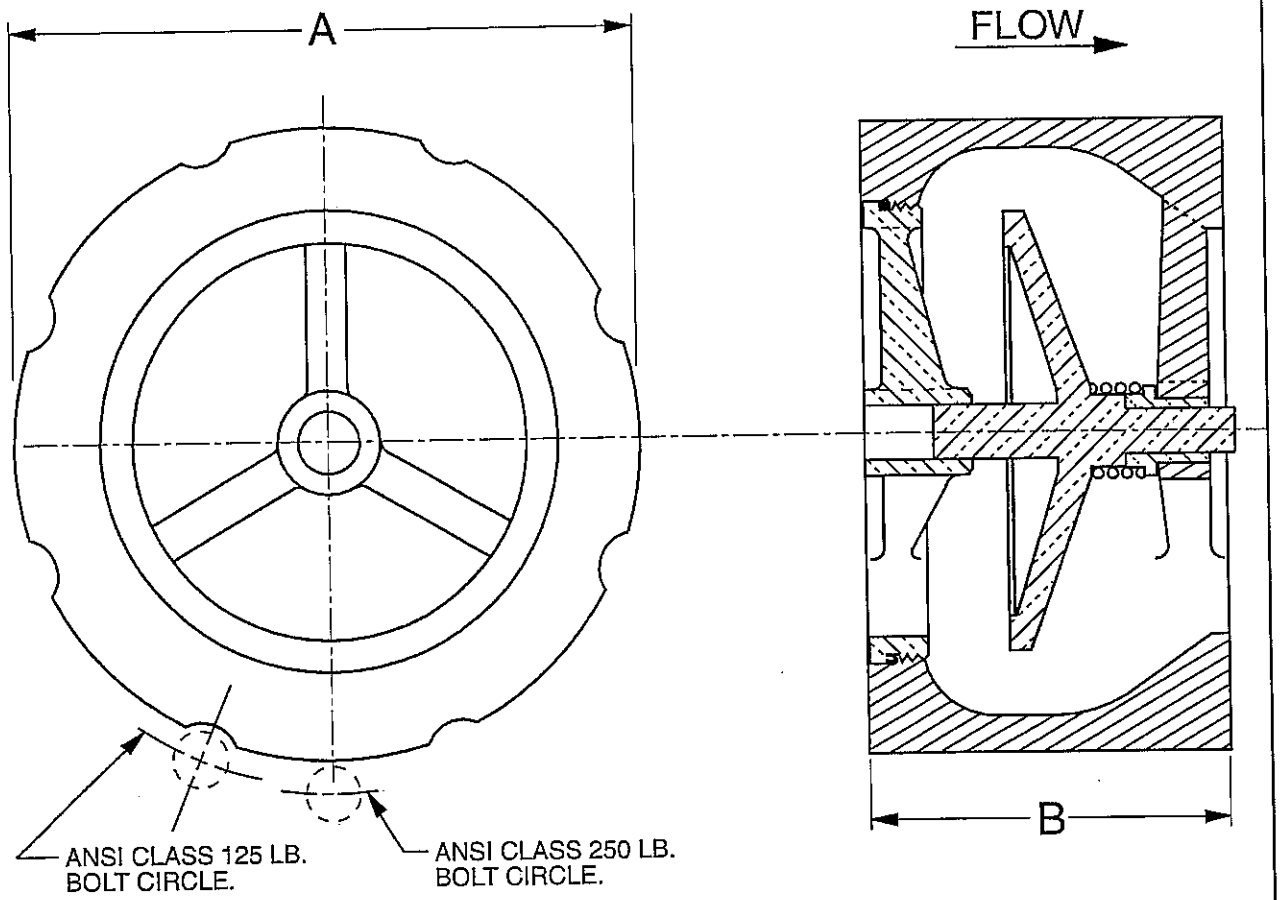

FM APPROVED

VALVE SIZE	MODEL* NO.	ANSI CLASS	CWP (P.S.I.)	A	B	WEIGHT LBS.
2	1402A	125/250	400	4 1/4	2 5/8	6
2 1/2	1425A	125/250	400	5	2 7/8	7
3	1403A	125/250	400	5 3/4	3 1/8	11
4	1404A	125/250	400	7	4	18
5	1405A	125/250	400	8 3/4	4 3/4	29
6	1406A	125/250	400	9 3/4	5 1/2	41
8	1408A	125	200	13 3/8	6 1/2	80
8	1458A	250	400	13 3/8	6 1/2	86
10	1410A	125	200	16	8 1/4	129
10	1460A	250	400	16	8 1/4	137

*MODEL NUMBERS REFLECT BRONZE TRIM

NOTE: (1) Refer to Drawing SS-120 for pressure and temperature limitations.
(2) Additional materials and pressure classifications available.
(3) All stainless steel valves available.

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VAL-MATIC VALVE & MANUFACTURING CORP.
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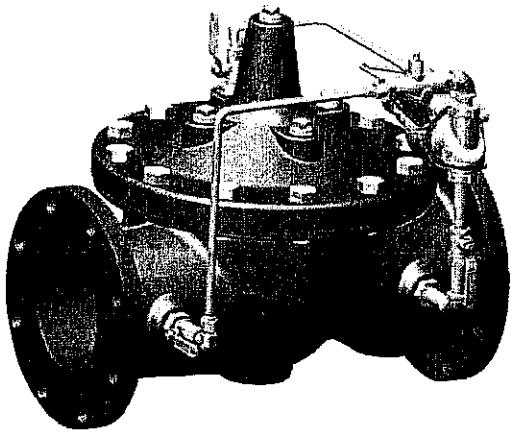
CLA-VAL™

—MODEL— **50-01** (Full Internal Port)

~~650-01~~ (Reduced Internal Port)

Pressure Relief & Pressure Sustaining Valve



- **Accurate Pressure Control**
- **Optional Check Feature**
- **Fast Opening to Maintain Line Pressure**
- **Slow Closing to Prevents Surges**
- **Completely Automatic Operation**

The Cla-Val Model 50-01/650-01 Pressure Relief Valve is a hydraulically operated, pilot-controlled, modulating valve designed to maintain constant upstream pressure within close limits. This valve can be used for pressure relief, pressure sustaining, back pressure, or unloading functions in a by-pass system.

In operation, the valve is actuated by line pressure through a pilot control system, opening fast to maintain steady line pressure but closing gradually to prevent surges. Operation is completely automatic and pressure settings may be easily changed.

If a check feature is added, and a pressure reversal occurs, the downstream pressure is admitted into the main valve cover chamber, closing the valve to prevent return flow.

Schematic Diagram

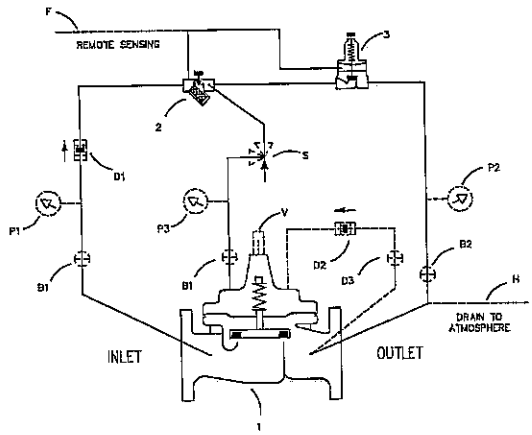
Item Description

1 Hytrol (Main Valve)
2 X42N-2 Strainer & Needle Valve
3 CRL Pressure Relief Control

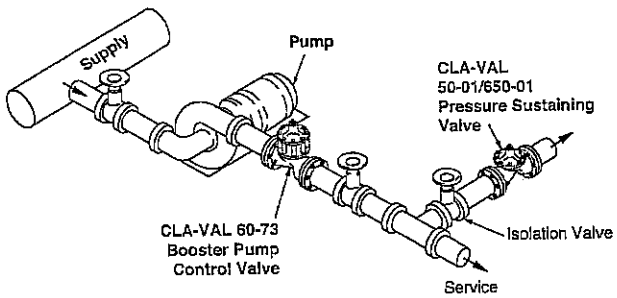
Optional Features

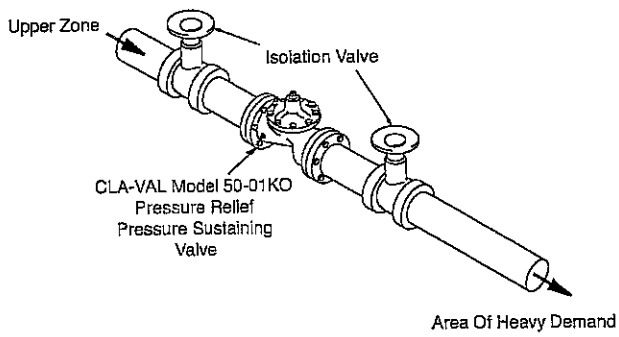
Item Description

B CK2 (Isolation Valve)
D Check Valves with Isolation Valve
F Remote Pilot Sensing
H Drain to Atmosphere
P X141 Pressure Gauge
S CV Speed Control (Opening)
V X101 Valve Position Indicator



Typical Applications





Pressure Relief Service

This fast opening, slow closing relief valve provides system protection against high pressure surges on pump start up and pump shut down by dissipating the excess pressure to a safe location.

Pressure Sustaining Service

When installed in a line between an upper zone and a lower area of heavy demand, the valve acts to maintain desired upstream pressure to prevent "robbing" of the upper zone. Water in excess of pressure setting is allowed to flow to an area of heavy demand, control is smooth, and pressure regulation is positive.

CLA-VAL™

Model 50-01 (Uses Basic Valve Model 100-01)

Pressure Ratings (Recommended Maximum Pressure - psi)

Valve Body & Cover		Pressure Class				
		Flanged			Grooved	Threaded
Grade	Material	ANSI Standards*	150 Class	300 Class	300 Class	End‡ Details
ASTM A536	Ductile Iron	B16.42	250	400	400	400
ASTM A216-WCB	Cast Steel	B16.5	285	400	400	400
ASTM B62	Bronze	B16.24	225	400	400	400

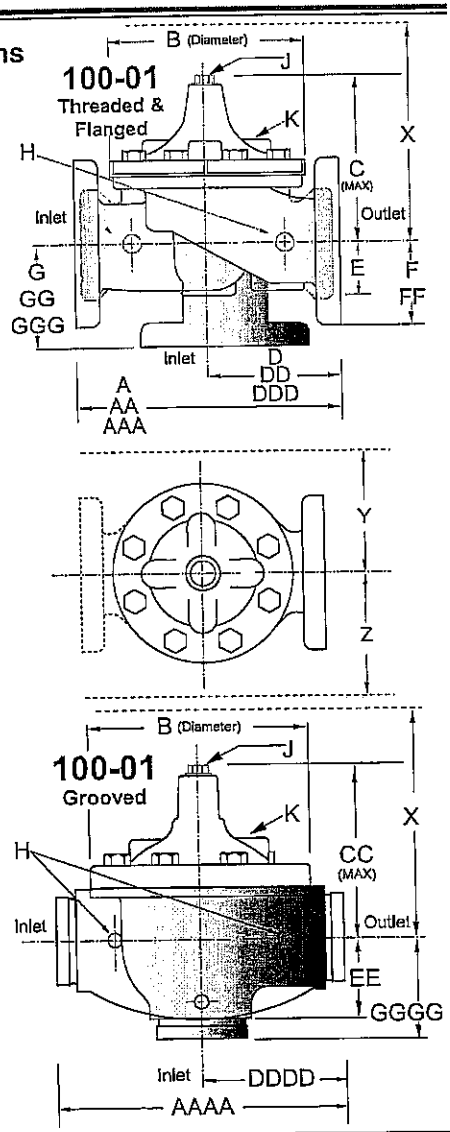
Note: * ANSI standards are for flange dimensions only.
Flanged valves are available faced but not drilled.
‡ End Details machined to ANSI B2.1 specifications.
Valves for higher pressure are available; consult factory for details

Materials

Component	Standard Material Combinations		
Body & Cover	Ductile Iron	Cast Steel	Bronze
Available Sizes	1" - 36"	1" - 16"	1" - 16"
Disc Retainer & Diaphragm Washer	Cast Iron	Cast Steel	Bronze
Trim: Disc Guide, Seat & Cover Bearing	Bronze is Standard Stainless Steel is Optional		
Disc	Buna-N® Rubber		
Diaphragm	Nylon Reinforced Buna-N® Rubber		
Stem, Nut & Spring	Stainless Steel		

For material options not listed, consult factory.
Cla-Val manufactures valves in more than 50 different alloys.

Dimensions (In inches)



Model 50-01 Dimensions (In inches)

Valve Size (Inches)	1	1 1/4	1 1/2	2	2 1/2	3	4	6	8	10	12	14	16	18	20	24	30	36
A Threaded	7.25	7.25	7.25	9.38	11.00	12.50	—	—	—	—	—	—	—	—	—	—	—	—
AA 150 ANSI	—	—	8.50	9.38	11.00	12.00	15.00	20.00	25.38	29.75	34.00	39.00	41.38	46.00	52.00	61.50	63.00	76.00
AAA 300 ANSI	—	—	9.00	10.00	11.62	13.25	15.62	21.00	26.38	31.12	35.50	40.50	43.50	47.64	53.62	63.24	64.50	76.00
AAAA Grooved End	—	—	8.50	9.00	11.00	12.50	15.00	20.00	25.38	—	—	—	—	—	—	—	—	—
B Dia.	5.62	5.62	5.62	6.62	8.00	9.12	11.50	15.75	20.00	23.62	28.00	32.75	35.50	41.50	45.00	53.16	56.00	66.00
C Max.	5.50	5.50	5.50	6.50	7.56	8.19	10.62	13.38	16.00	17.12	20.88	24.19	25.00	39.06	41.90	43.93	54.60	61.50
CC Max. Grooved End	—	—	4.75	5.75	6.88	7.25	9.31	12.12	14.62	—	—	—	—	—	—	—	—	—
D Threaded	3.25	3.25	3.25	4.75	5.50	6.25	—	—	—	—	—	—	—	—	—	—	—	—
DD 150 ANSI	—	—	4.00	4.75	5.50	6.00	7.50	10.00	12.69	14.88	17.00	19.50	20.81	—	—	30.75	—	—
DDD 300 ANSI	—	—	4.25	5.00	5.88	6.38	7.88	10.50	13.25	15.56	17.75	20.25	21.62	—	—	31.62	—	—
DDDD Grooved End	—	—	—	4.75	—	6.00	7.50	—	—	—	—	—	—	—	—	—	—	—
E	1.12	1.12	1.12	1.50	1.69	2.06	3.19	4.31	5.31	9.25	10.75	12.62	15.50	12.95	15.00	17.75	21.31	24.56
EE Grooved End	—	—	2.00	2.50	2.88	3.12	4.25	6.00	7.56	—	—	—	—	—	—	—	—	—
F 150 ANSI	—	—	2.50	3.00	3.50	3.75	4.50	5.50	6.75	8.00	9.50	10.50	11.75	15.00	16.50	19.25	22.50	25.60
FF 300 ANSI	—	—	3.06	3.25	3.75	4.13	5.00	6.25	7.50	8.75	10.25	11.50	12.75	15.00	16.50	19.25	24.00	25.60
G Threaded	1.88	1.88	1.88	3.25	4.00	4.50	—	—	—	—	—	—	—	—	—	—	—	—
GG 150 ANSI	—	—	4.00	3.25	4.00	4.00	5.00	6.00	8.00	8.62	13.75	14.88	15.69	—	—	22.06	—	—
GGG 300 ANSI	—	—	4.25	3.50	4.31	4.38	5.31	6.50	8.50	9.31	14.50	15.62	16.50	—	—	22.90	—	—
GGGG Grooved End	—	—	—	3.25	—	4.25	5.00	—	—	—	—	—	—	—	—	—	—	—
H NPT Body Tapping	.375	.375	.375	.375	.50	.50	.75	.75	1	1	1	1	1	1	1	1	2	2
J NPT Cover Center Plug	.25	.25	.25	.50	.50	.50	.75	.75	1	1	1.25	1.5	2	1.5	1.5	1.5	2	2
K NPT Cover Tapping	.375	.375	.375	.375	.50	.50	.75	.75	1	1	1	1	1	1	1	1	2	2
Stem Travel	0.4	0.4	0.4	0.6	0.7	0.8	1.1	1.7	2.3	2.8	3.4	4.0	4.5	5.1	5.63	6.75	7.5	8.5
Approx. Ship Wt. Lbs.	15	15	15	35	50	70	140	285	500	780	1165	1600	2265	2982	3900	6200	7703	11720
X Pilot System	11	11	11	13	14	15	17	29	31	33	36	40	40	43	47	68	79	85
Y Pilot System	9	9	9	9	10	11	12	20	22	24	26	29	30	32	34	39	40	45
Z Pilot System	9	9	9	9	10	11	12	20	22	24	26	29	30	32	34	39	42	47

Note: The top two flange holes on valve size 36 are threaded to 1 1/2"-6 UNC.

50-01 Valve Selection	100-01 Pattern: Globe (G), Angle (A), End Connections: Threaded (T), Grooved (GR), Flanged (F) Indicate Available Sizes																		
	Inches	1	1¼	1½	2	2½	3	4	6	8	10	12	14	16	18	20	24	30	36
	mm	25	32	40	50	65	80	100	150	200	250	300	350	400	450	500	600	750	900
Basic Valve 100-01	Pattern	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G	G	G, A	G	G
	End Detail	T	T	T, F, Gr*	T, F, Gr	T, F, Gr*	T, F, Gr	F, Gr	F, Gr*	F, Gr*	F	F	F	F	F	F	F	F	F
Suggested Flow (gpm)	Maximum	55	93	125	210	300	460	800	1800	3100	4900	7000	8400	11000	14000	17000	25000	42000	50000
	Maximum Surge	120	210	280	470	670	1000	1800	4000	7000	11000	16000	19000	25000	31000	39000	56500	63000	85000
Suggested Flow (Liters/Sec)	Maximum	3.5	6	8	13	19	29	50	113	195	309	442	530	694	883	1073	1577	2650	3150
	Maximum Surge	7.6	13	18	30	42	63	113	252	441	693	1008	1197	1577	1956	2461	3560	3975	5360

100-01 Series is the full internal port Hytrol.

*Globe Grooved Only

~~650-01~~ Valve Selection	100-20 Pattern: Globe (G), Angle (A), End Connections: Flanged (F) Indicate Available Sizes														
	Inches	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
	mm	80	100	150	200	250	300	350	400	450	500	600	750	900	1000	1200
Basic Valve 100-20	Pattern	G	G, A	G, A	G, A	G	G	G	G	G	G	G	G	G	G	G
	End Detail	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
Suggested Flow (gpm)	Maximum	260	580	1025	2300	4100	6400	9230	9230	16500	16500	16500	28000	33500	33500	33500
	Maximum Surge	440	990	1760	3970	7050	11000	15900	15900	28200	28200	28200	56500	58600	58600	58600
Suggested Flow (Liters/Sec)	Maximum	16	37	65	145	258	403	581	581	1040	1040	1040	1764	2115	2115	2115
	Maximum Surge	28	62	111	250	444	693	1002	1002	1777	1777	1777	3560	3700	3700	3700

100-20 Series is the reduced internal port size version of the 100-01 Series.

Pilot System Specifications

Adjustment Ranges

0 to 75 psi Max.
20 to 105 psi
20 to 200 psi *
100 to 300 psi

*Supplied unless otherwise specified.
Other ranges available, please consult factory.

Temperature Range

Water: to 180°F

Materials

Standard Pilot System Materials

Pilot Control: Bronze ASTM B62
Trim: Stainless Steel Type 303
Rubber: Buna-N® Synthetic Rubber
Tubing & Fitting: Copper and Bronze

Optional Pilot System Materials

Pilot Systems are available with optional Aluminum, Stainless Steel or Monel materials.

When Ordering, Please Specify

1. Catalog No. 50-01 or No. 650-01
2. Valve Size
3. Pattern - Globe or Angle
4. Pressure Class
5. Threaded or Flanged
6. Trim Material
7. Adjustment Range
8. Desired Options
9. When Vertically Installed

CLA-VAL

PO Box 1325 Newport Beach CA 92659-0325
Phone: 949-722-4800 • Fax: 949-548-5441

CLA-VAL CANADA
4687 Christie Drive
Beamsville, Ontario
Canada L0R 1B4
Phone: 905-563-4963
Fax: 905-563-4040

CLA-VAL EUROPE
Chemin dés Mesanges 1
CH-1032 Romanel/
Lausanne, Switzerland
Phone: 41-21-643-15-55
Fax: 41-21-643-15-50

www.cla-val.com

E-50-01/650-01 (R-11/2011)

Represented By:

FXA Hydro-pneumatic Tank

Wesselect

Precharged, (125# ASME) Replaceable Bladder

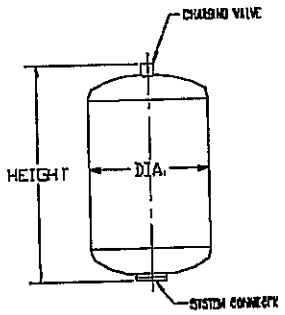
wessels company
Detroit, MI

SUBMITTAL

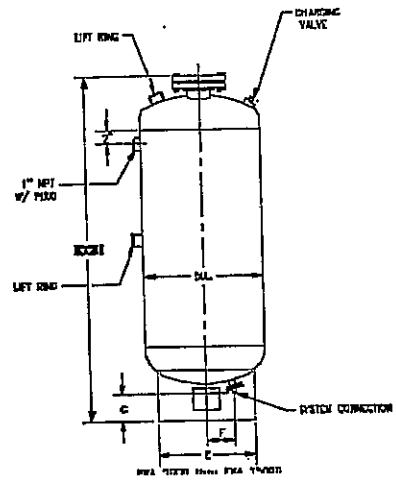
JOB	REPRESENTATIVE	
REFERENCE NO.	ORDER NO.	DATE
ENGINEER	SUBMITTED BY	DATE
CONTRACTOR	APPROVED BY	DATE

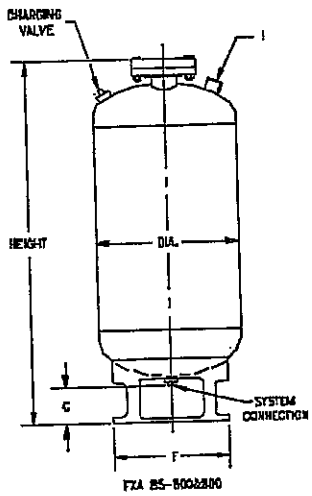
Factory Precharge is 30 PSI

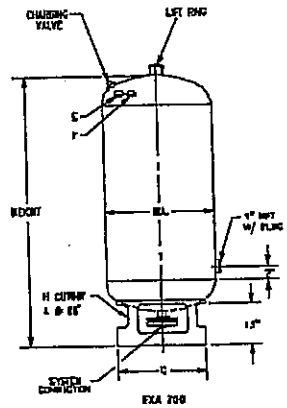
Model no.	Tank Vol. gal.	Dimensions (inches) Diam.	Ht.	Sys. conn. (in.)	Ship wt. lbs.
FXA 35	10	12	25	3/4	40
FXA 50	13	14	25	3/4	50
FXA 85	23	16	37	1	90
FXA 130	35	20	37	1	125
FXA 200	53	24	43	1 1/2	210
FXA 300	79	24	55	1 1/2	225
FXA 400	106	30	49	1 1/2	300
FXA 500	132	30	57	2	330
FXA 600	158	30	65	2	360
FXA 700	185	30	80	1 1/2	600
FXA 800L	211	32	76	2	475
FXA 1000	264	36	87	3	735
FXA 1200	317	36	98	3	745
FXA 1400	370	36	111	3	900
FXA 1600	422	48	84	3	1210
FXA 2000	528	48	97	3	1305
FXA 2500	660	48	114	4	1430
FXA 3000L	792	48	134	4	1575
FXA 3000S	792	60	93	4	2169
FXA 4000	1056	60	115	4	2638
FXA 5000	1320	60	138	4	3246
FXA 7500	1980	72	140	4	4080
FXA 10000	2640	72	172	4	4920
FXA 15000	3963	72	243	4	6000



FXA 35 and FXA 50







FXA 700

MATERIALS OF CONSTRUCTION	
Shell	Steel
Bladder	FDA OK- Heavy Duty Butyl

Typical Specification

Furnish and install, as shown on the plans, Wessels Model FXA _____ ASME Precharged Bladder Hydro-pneumatic Tank. Each tank will be supplied with a heavy duty butyl replaceable bladder. The tank shall have NPT system connections and a .302" - 32 charging valve (standard tire valve) to facilitate the on-site carging of the tank to meet system requirements. The tank must be constructed in accordance with section VIII of the ASME Boiler and Pressure Vessel Code.

MODEL NO. ORDERED _____ QTY. _____

DESIGNED, CONSTRUCTED AND STAMPED PER ASME SECTION VIII

MAXIMUM OPERATING CONDITIONS	
Max. Temp.	240 ° F
Working Pressure	~~425 PSIG*~~

* 200 & 250 PSIG available

PRESSURE GAUGES

Job #7646

INLET OR SUCTION

Number Furnished: 1
Face Diameter: 4 ½"
Manufacturer: Aschroft
Range: 0-15 PSI
Model: 1279 ASL
Element Type: Bourdon Tube
Material: Phosphor Bronze
Case Material: Black Phenolic
Special Provisions: Brass Cock and Needle Valve, Glycerin Filled

DISCHARGE

Number Furnished: 1
Face Diameter: 4 ½"
Manufacturer: Aschroft
Range: 0-200 PSI
Model: 1279 ASL
Element Type: Bourdon Tube
Material: Phosphor Bronze
Case Material: Black Phenolic
Special Provisions: Brass Cock and Needle Valve, Glycerin Filled

ASHCROFT®

Duragauge® Pressure Gauge Type 1279, Grade 2A (±0.5%)

- *Exclusive Teflon coated 400 series stainless steel rotary movement for longer life*
- *Patented Duratube™ with "Welded-Tube" construction controls stress for longer life*
- *Exclusive "Round Cap Tip" construction lowers stresses for longer life*
- *Easily adjustable, self-locking micrometer pointer*
- *New **PLUS!**™ Performance Option:*
  - *Liquid-filled performance in a dry gauge*
  - *Fights vibration and pulsations without liquid-filled headaches*
  - *See page 174 for details*
  - *Order as option XLL*

Type 1279 Duragauge® pressure gauge is offered in 4½" phenolic case for superior chemical and heat resistance. Solid-front case design with blow-out back for safety. Dry, liquid-filled, hermetically sealed or ***PLUS!*** options available. Field convertible to liquid-fill with conversion kit (detailed on page 170). All case styles provide full temperature compensation.

BOURDON SYSTEM SELECTION

Ordering Code	Bourdon Tube & Tip Material[1] (all joints TIG welded except "A")	Socket Material	Tube Type	Range Selection Limits (psi)	NPT Conn.[2]
A	Grade A Phosphor Bronze Tube-Brass Tip, Silver Brazed	Brass	C-Tube	12/1000	¼, ½
B	4130 alloy steel	1019 steel	C-Tube	15/1500	¼,½
			Helical	2000/5000	¼,½
R	316L stainless steel	1019 steel	C-Tube	12/1500	¼,½
			Helical	2000/20,000	¼,½
S	316L stainless steel	316 stainless steel	C-Tube	12/1500	¼,½
			Helical	2000/20,000	¼,½
P[3]	K Monel	Monel 400	C-Tube	15/1500	¼,½
			Helical	2000/30,000	¼,½[4]

(1) For selection of the correct bourdon system material, see the media application table on page 178.
(2) Other connections available on application.
(3) Use for applications where NACE standard MR-01-75 is specified.
(4) 30,000 psi range supplied with ¼ high pressure connection, ½ NPT optional.

STANDARD RANGES

Pressure psi	Compound psi
0/15	30"Hg/15 psi
0/30	30"Hg/30 psi
0/60	30"Hg/60 psi
0/100	30"Hg/100 psi
0/160	30"Hg/150 psi
0/200	30"Hg/300 psi
0/300	
0/400	**Vacuum**
0/600	30/0 in.Hg
0/800	34/0 ftH₂O
0/1000	
0/1500	
0/2000	
0/3000	
0/5000	**NOTE:**
0/10,000	**Equivalent standard**
0/20,000	**kg/cm², and kPa metric**
0/30,000	**ranges are available.**

TO ORDER THIS 1279 DURAGAUGE:

Select:	45	1279	RS*	04L	XXX	0/2000 psi

1. Dial size–4½"
2. Case type–1279
   Ring–threaded reinforced polypropylene
3. Bourdon system selection ordering code
4. Connection–¼ NPT (02), ½ NPT (04), Lower (L), Back (B)
5. Optional features–see page 108
6. Standard pressure range
7. Accessories–see pages 165-171

(*) "S" denotes solid front case design

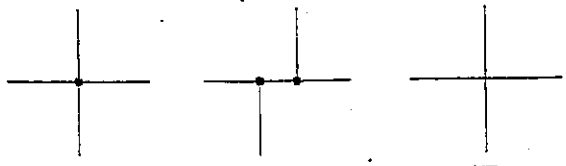
Reference Bulletin DU-1

MADE IN U.S.A.

Consult factory for guidance in product selection
Phone (203) 378-8281, FAX (203) 385-0499 or
visit our web site at www.ashcroft.com

DRESSER
Measurement

ELECTRIC CONTROL SYMBOLS



ELECTRICAL CONNECTION

NO CONNECTION

GROUND

DISCONNECT

CIRCUIT BREAKER

NORMALLY OPEN

NORMALLY CLOSED

RELAY CONTACTS

TRANSFORMER

CURRENT TRANSFORMER

OVERLOAD

THREE POSITION SELECTOR SWITCH

START

STOP

E STOP

NORMALLY OPEN

NORMALLY CLOSED

MUSHROOM HEAD

PUSHBUTTONS

NORMALLY CLOSED

NORMALLY OPEN

LIMIT SWITCHES

TOGGLE SWITCH

NORMALLY CLOSED

NORMALLY OPEN

PRESSURE SWITCHES

NORMALLY CLOSED

NORMALLY OPEN

FLOAT SWITCHES

HEATING TYPE

COOLING TYPE

THERMOSTATS

METER

NORMALLY CLOSED

NORMALLY OPEN

TIMER CONTACTS

NORMALLY CLOSED

NORMALLY OPEN

FLOW SWITCHES

SOLENOID VALVE

MOTOR STARTER COIL

TIME DELAY

CONTROL RELAY

RUN TIME METER

INDICATOR LIGHT

PUSH TO TEST LIGHT

FLASHER

LETTER INDICATES COLOR

R - RED
G - GREEN
A - AMBER
W - WHITE
B - BLUE
Y - YELLOW

120 VOLT

GROUND FAULT

RECEPTACLES

SINGLE PHASE MOTOR

THREE PHASE MOTOR

DIM GLOW

RESISTOR

WIRE COLOR CODING

BK - BLACK
W - WHITE
R - RED
YL - YELLOW
GY - GRAY
BL - BLUE
GN - GREEN
OR - ORANGE
BR - BROWN
PK - PINK

ALARM HORN

ALARM BUZZER

ALARM BELL

FLUORESCENT LIGHT

TERMINAL BLOCK

FUSE

HEATER

USEMCO

USEMCO INCORPORATED

P.O. BOX 550 (608) 372-5911 TOMAH WI. 54660

SYMBOLS

MECHANICAL NOTES PAGE

Job #7646

4 Copies of Operation & Maintenance Manuals

EQUIPMENT TO BE INSTALLED BY OTHERS

1 each – Pressure Relief Valve 3"
1 each – Hydro-pneumatic Tank, 53 gallon

TOUCH-UP PAINT:

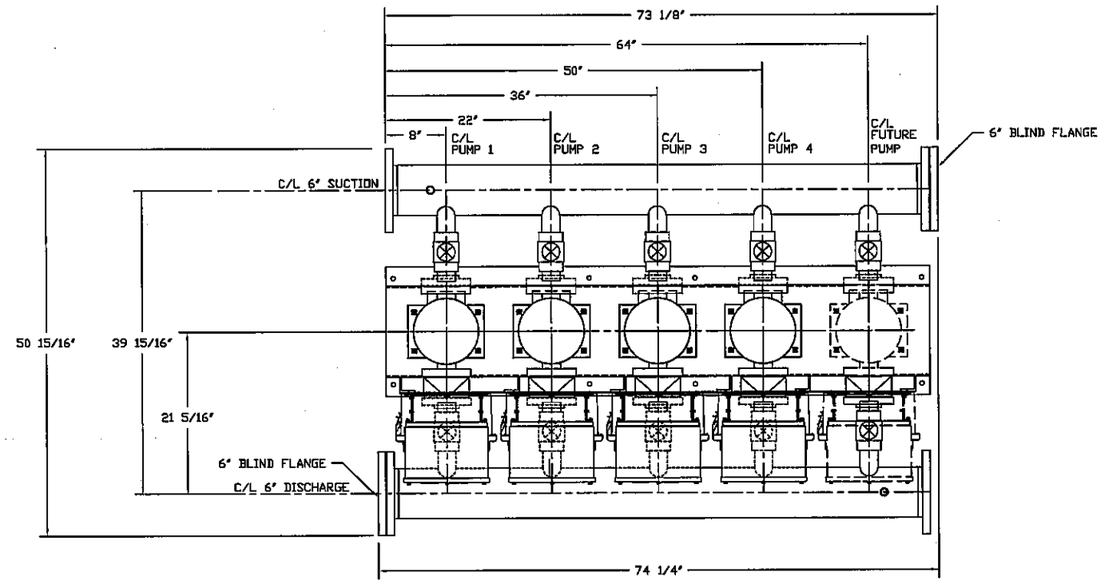
2 Pints Epoxy Finish Coat

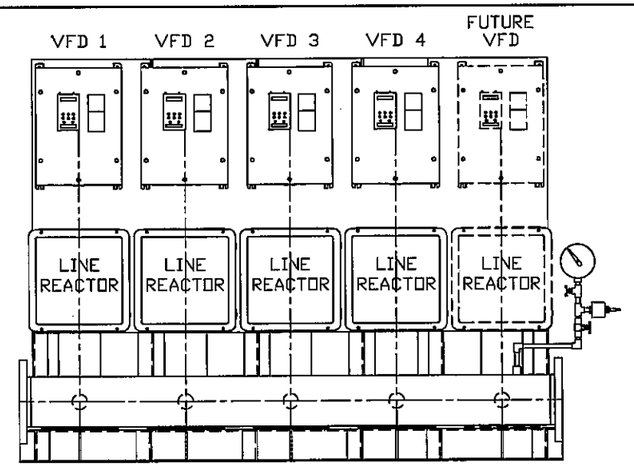
SPARE PARTS:

4 Sets – Pump Gaskets (O-Rings)
4 each – Mechanical Seal Assembly
Please Note: Grunsdfos CR15-5 do not have wear rings; the pump bearings are incorporated into the mechanical seal assemblies.

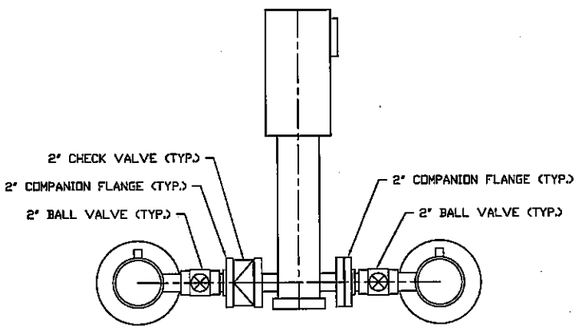
Revised 7/23/12

PAINT REQUIREMENTS:
APPLY 6 MILS EPOXY ENAMEL
INTERIOR OF PIPING
FUSION BONDED EPOXY COATED PER C213

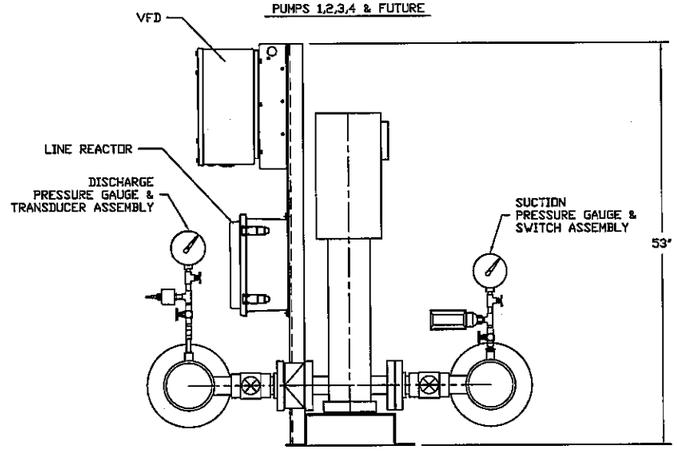


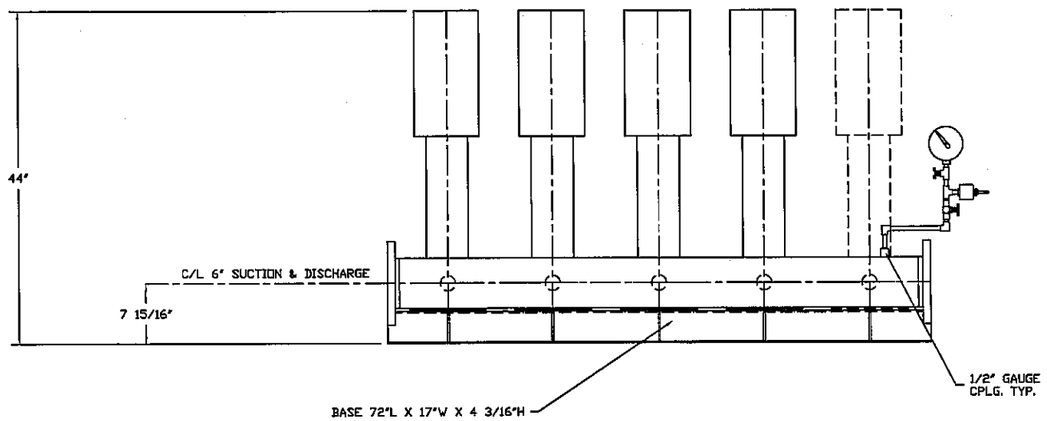


VFDS & LINE REACTORS



PUMPS 1,2,3,4 & FUTURE



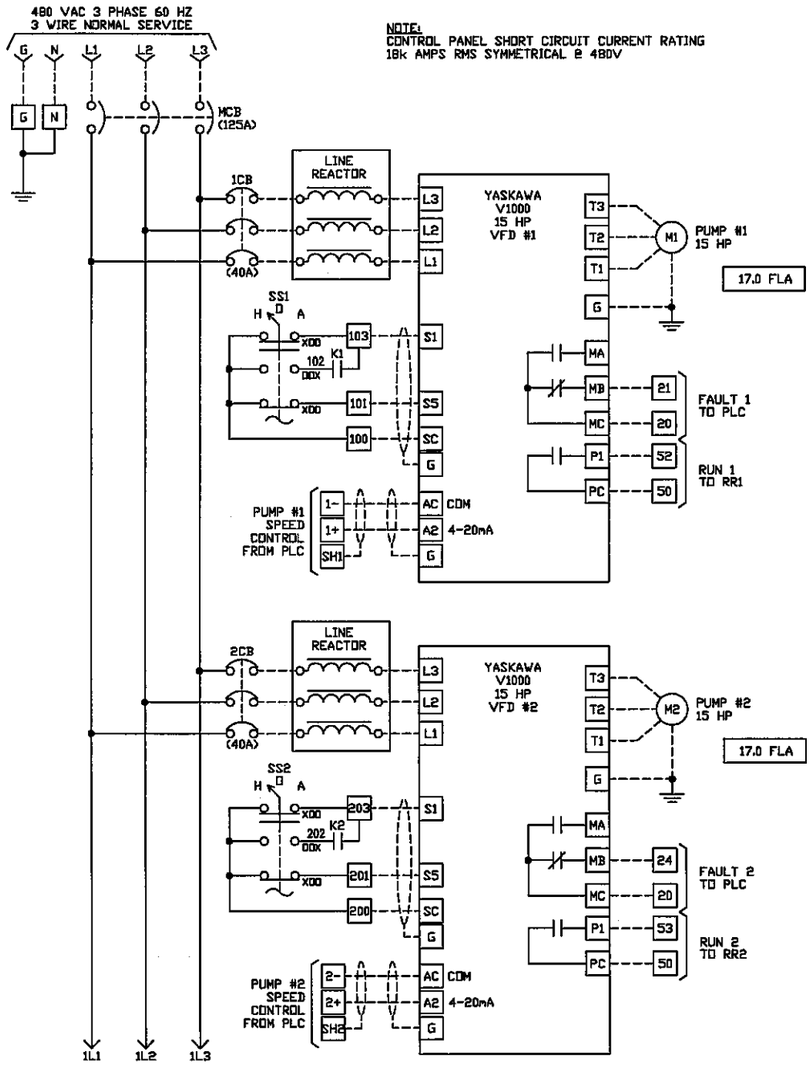


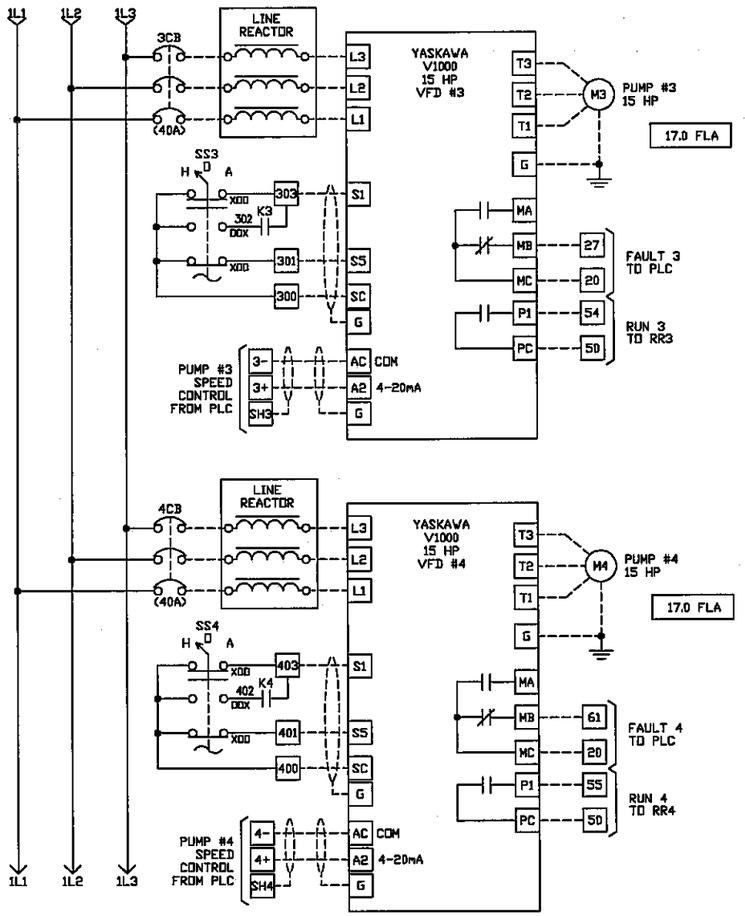
NOTE:
PIPE EXTERNAL TO STATION MUST BE INDEPENDENTLY SUPPORTED.

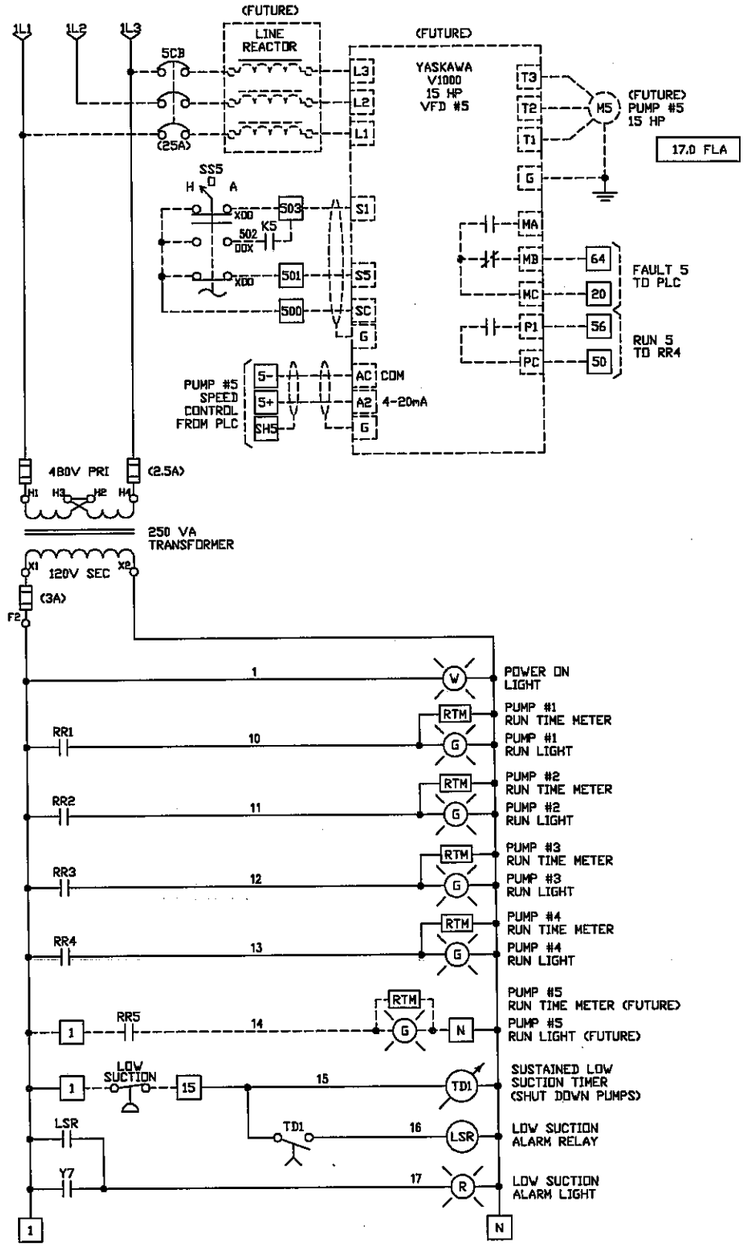
REV. NO.	REVISION	BY CHK'D	DATE
		TRM	8/22
A	NAME CHANGE	M.H.	12
		TRM	8/31
B	ADDED LINE REACTORS	M.H.	12

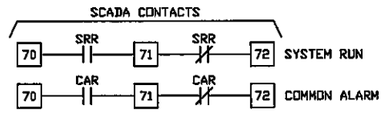
DESIGNED BY:	DATE
DRAWN BY: TRM	DATE 6/11
CHECKED BY: W.K.	DATE 12
SCALE	

USEMCO
USEMCO INCORPORATED
P.O. BOX 550 (608) 372-5911 TOMAH WI. 54660
DESCRIPTION
FOUNTAIN, CO
DWG. NO.
JOB NO. 7646









LOAD CALCULATIONS BASED ON 2011 NEC 409.21.C
LARGEST BREAKER + FLA OF ADDITIONAL PUMPS + 125% OF HEATING LOADS + ADDITIONAL LOADS.

PUMP 1 BREAKER = 40A
PUMP 2 VFD NORMAL DUTY RATING = 23A
PUMP 3 VFD NORMAL DUTY RATING = 23A
PUMP 4 VFD NORMAL DUTY RATING = 23A
PUMP 5 VFD NORMAL DUTY RATING = 23A (FUTURE)
OTHER LOADS = 2.5A (CONTROL)

40A + 23A + 23A + 23A + 23A + 2.5A = 111.5A TOTAL
AN ADDITIONAL 23A NEEDS TO BE ADDED IF THE FUTURE PUMP IS INSTALLED.

COLOR CODING	
BLACK	- LINE AND LOAD
RED	- AC CONTROL
BLUE	- DC CONTROL
WHITE	- NEUTRAL
GREEN	- GROUND
YELLOW	- INTERCONNECTING
LT. BLUE	- INTRINSICALLY SAFE

NOTES:
1. CONTROL PANEL SHALL BEAR SERIALIZED U.L. 508A LABEL.
2. VARIABLE FREQUENCY DRIVES MOUNTED ON THE PUMP SKID.
3. VARIABLE FREQUENCY DRIVES AND MOTORS ARE DERATED FOR AN ELEVATION OF 5393 FT ABOVE SEA LEVEL.

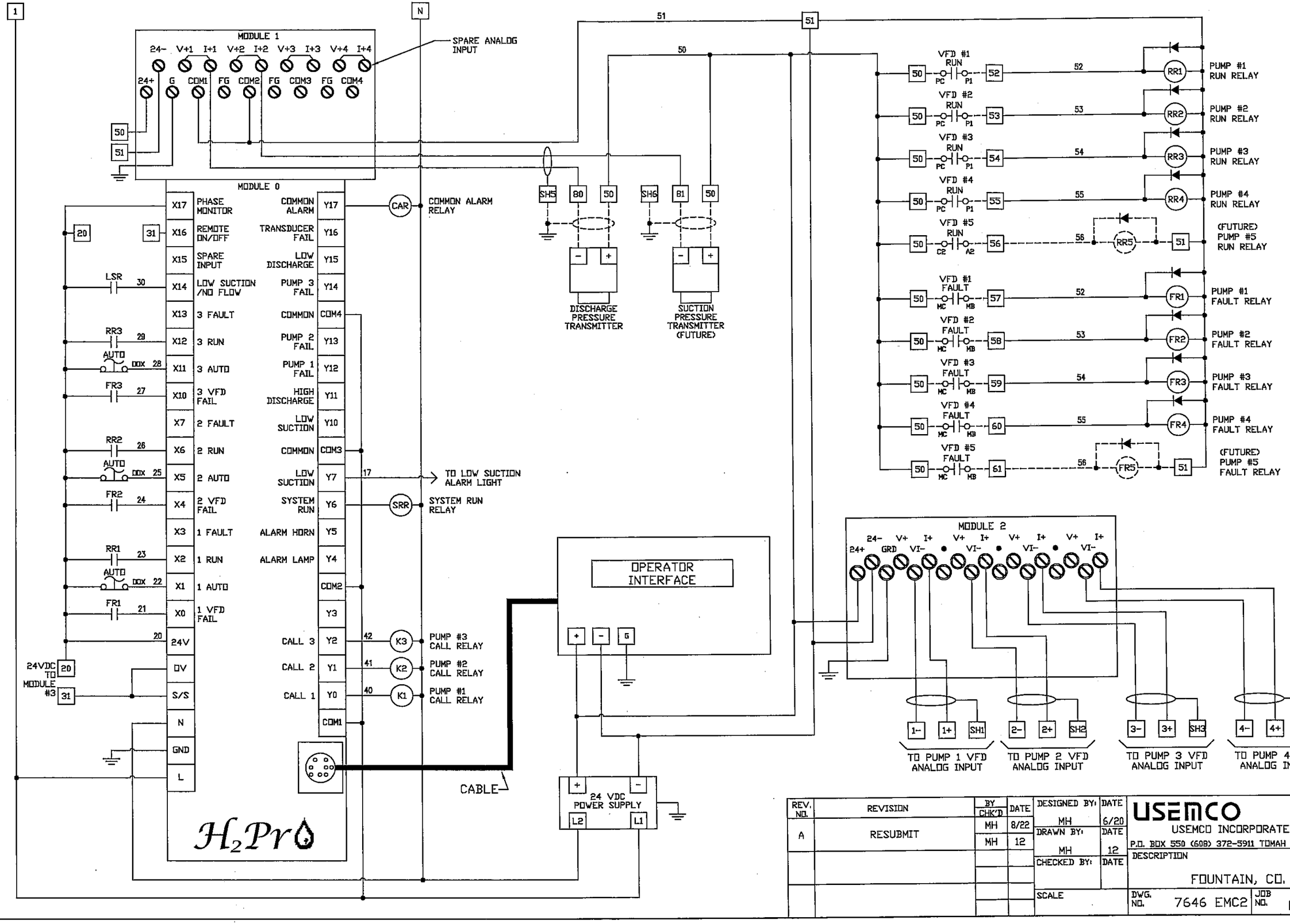
REV. NO.	REVISION	BY CHK'D	DATE
A	RESUBMIT	MH	8/22
		MH	12
B	ADDED LINE REACTORS	MH	8/31
		MH	12

DESIGNED BY: MH	DATE 6/20
DRAWN BY: MH	DATE 12
CHECKED BY:	DATE
SCALE	

USEMCO
USEMCO INCORPORATED
P.O. BOX 550 (608) 372-5911 TOMAH WI. 54660

DESCRIPTION
FOUNTAIN, CO.

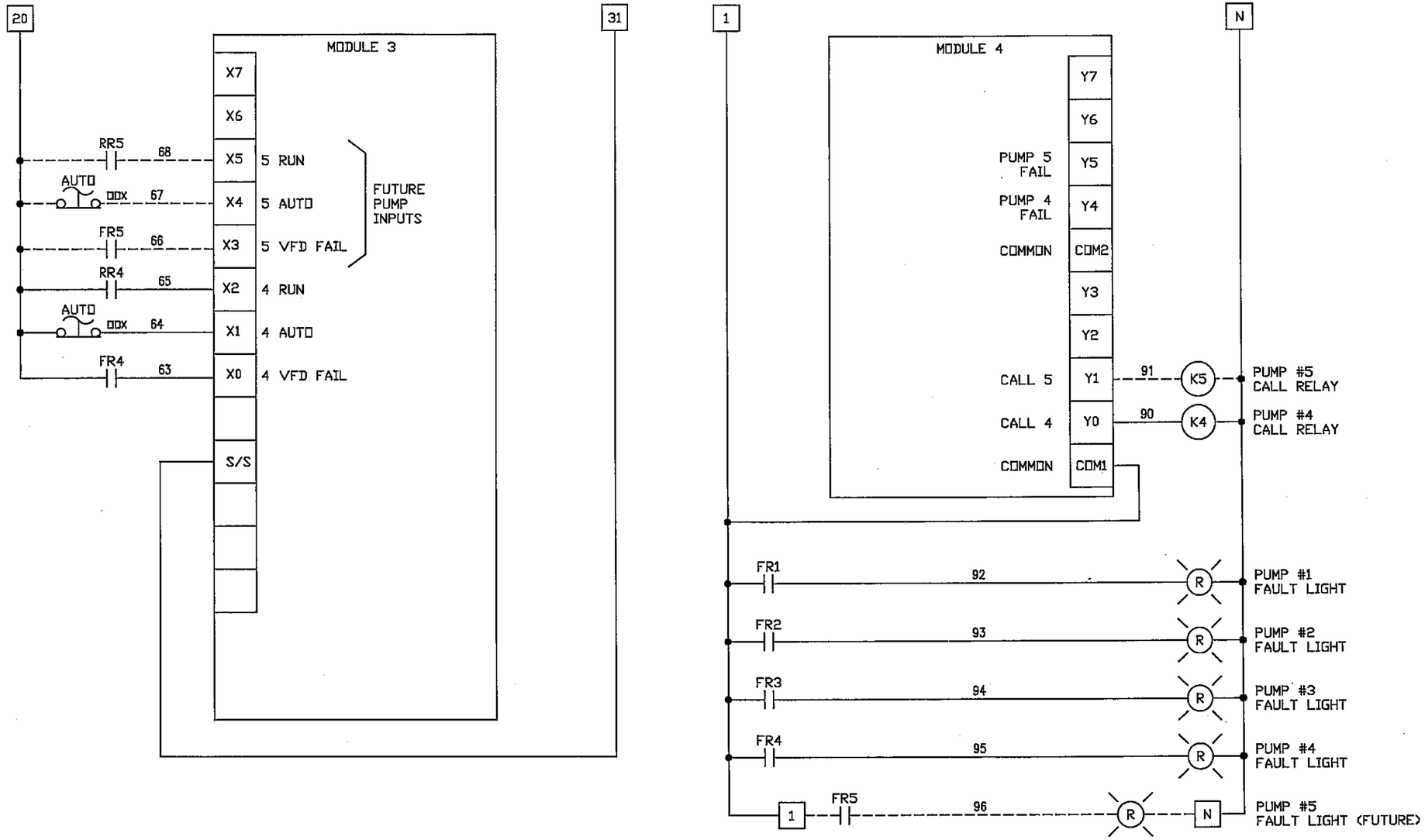
DWG. NO. 7646 EMC1
JOB NO. PS7646



REV. NO.	REVISION	BY CHK'D	DATE
A	RESUBMIT	MH	8/22
		MH	12

DESIGNED BY: MH DATE 6/20
DRAWN BY: MH DATE 12
CHECKED BY: DATE
SCALE

USEMCO
USEMCO INCORPORATED
P.O. BOX 550 (608) 372-5911 TOMAH WI. 54660
DESCRIPTION
FOUNTAIN, CO.
DWG. NO. 7646 EMC2
JOB NO. PS7646



REV. NO.	REVISION	BY CHK'D	DATE
A	RESUBMIT	MH	8/22
		MH	12

DESIGNED BY: MH	DATE 6/20
DRAWN BY: MH	DATE 12
CHECKED BY:	DATE
SCALE	

USEMCO

USEMCO INCORPORATED

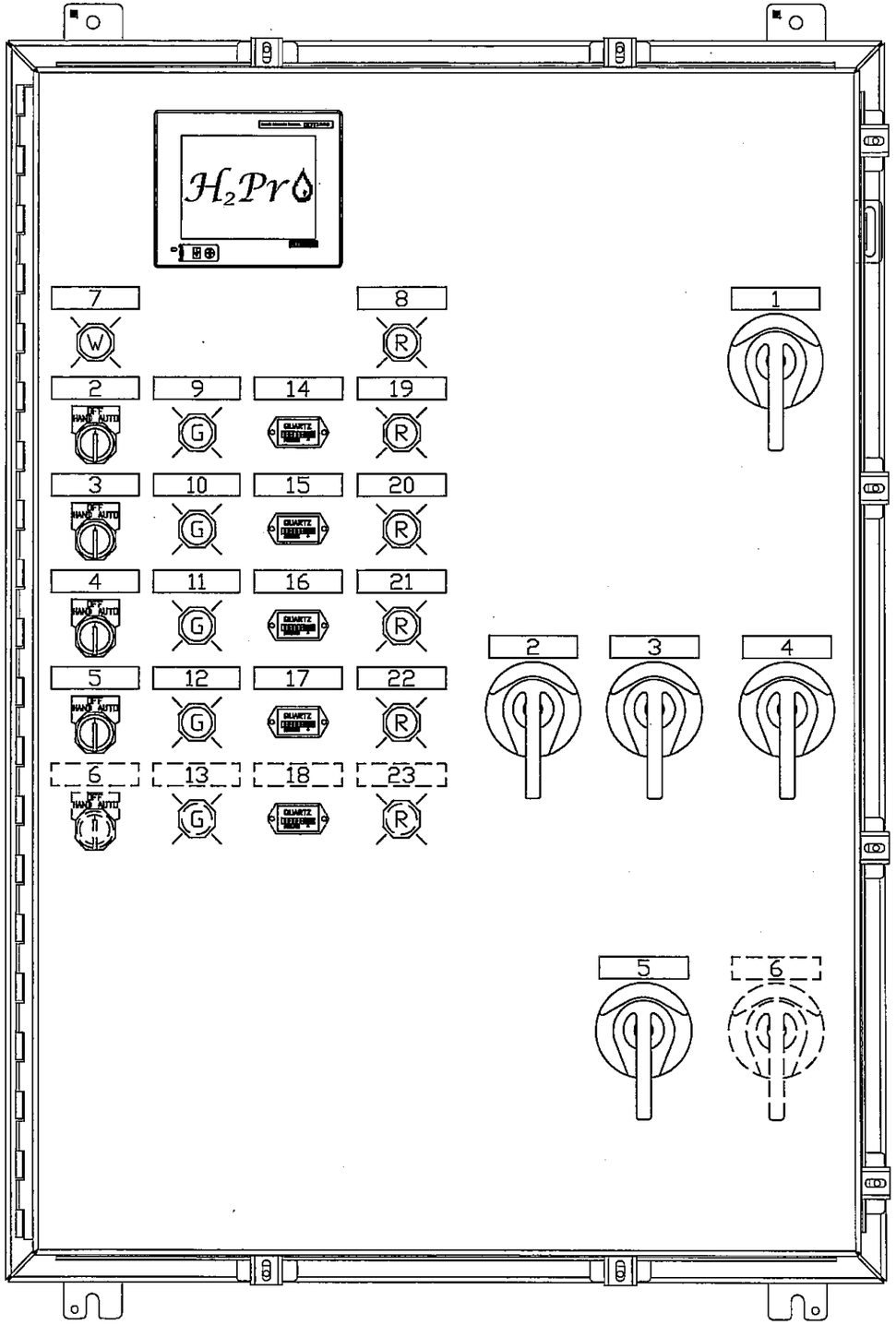
P.O. BOX 550 (608) 372-5911 TOMAH WI. 54660

DESCRIPTION

FOUNTAIN, CO.

DWG. NO. 7646 EMC2

JOB NO. PS7646



NEMA 4X STAINLESS STEEL ENCLOSURE
42"H X 30"W X 10"DP

NAMEPLATE LEGEND

1. MAIN
2. PUMP 1
3. PUMP 2
4. PUMP 3
5. PUMP 4
6. PUMP 5 (FUTURE)
7. POWER ON
8. LOW SUCTION
9. PUMP 1 RUN
10. PUMP 2 RUN
11. PUMP 3 RUN
12. PUMP 4 RUN
13. PUMP 5 RUN (FUTURE)
14. PUMP 1 RTM
15. PUMP 2 RTM
16. PUMP 3 RTM
17. PUMP 4 RTM
18. PUMP 5 RTM (FUTURE)
19. PUMP 1 FAIL
20. PUMP 2 FAIL
21. PUMP 3 FAIL
22. PUMP 4 FAIL
23. PUMP 5 FAIL (FUTURE)

NOTE: SPACE ONLY PROVIDED FOR FUTURE PUMP 5 POWER AND CONTROLS

REV. NO.	REVISION	BY CHK'D	DATE

DESIGNED BY: MH	DATE 6/20
DRAWN BY: MH	DATE 12
CHECKED BY:	DATE
SCALE	

USEMCO

USEMCO INCORPORATED

P.O. BOX 550 (608) 372-5911 TOMAH WI. 54660

DESCRIPTION

FOUNTAIN, CO.

DWG. NO. 7646 PNL

JOB NO. PS7646

Bill of Materials

No.	Description	Unit	Status
PS7646	Fountain, CO	EA	Certified

Number	Description	Unit	Quantity
	Operation 20 CUT OUT PANEL		
421494.07	BAR GROUND KIT SQD PK7GTA	EA	1.00
421498.2	NEUTRAL ASSEMBLY SQD SN12125	EA	1.00
421726	BREAKER 3 PL SQD HDL 36040 25 KA @ 240 VAC 18 KA @ 480 VAC 14 KA @ 600 VAC	EA	4.00
421739	BREAKER 3 PL SQD JDL 36200 25 KA @ 240 VAC 18 KA @ 480 VAC 14 KA @ 600 VAC	EA	1.00
422339.10	RELAY 10A IDEC RH2B-U-AC120V	EA	7.00
422339.11	RELAY 10A IDEC RH2B-U-DC24V	EA	8.00
423381.022	POWER SUPPLY IDEC 60 WATT SLIM LINE PS5R-SD24 2.5 AMPS @ 24VDC REGULATED	EA	1.00
423419	BLOCK TERMINAL ENTRELEC-GRAY ENTRELEC PART #115 116.07	EA	5.00
423419.0	BLOCK TERMINAL ENTRELEC-BLUE ENTRELEC PART #125 116.01	EA	55.00
423419.1	BLOCK TERMINAL ENTRELEC-GN/YL ENTRELEC PART #165 113.16 ELECTRICALLY GROUNDED TO DIN RAIL	EA	3.00
423419.2	BLOCK TERMINAL ENTRELEC-YELLOW ENTRELEC PART #105 116.16	EA	12.00
423419.40	END STOP ENTRELEC-GRAY BAM2 ENTRELEC PART #206 351.16	EA	6.00
423419.5	END SECTION COVER ENTRELEC FEM6 ENTRELEC PART #118 368.16	EA	3.00
423440.5	BLOCK 1PL LINE #400 LOAD #2 MARATHON #1441560 1 LINE 8 LOAD	EA	1.00
423480.2	SOCKET RD 8 PIN IDEC SR2P-06	EA	1.00
423484	SOCKET MIDGET 2P IDEC SH2B-05	EA	15.00

425012.00	TIMER 120VAC DIVERSIFIED TBC-120-ABA ON DELAY - 1.0 to 1023 SECONDS	EA	1.00
425204.3	RTM REDINGTON 120VAC #722-0001 2-HOLE RECTANGULAR 90-264VAC 1/4" SPADE TERMINALS HOURS & 1/10'S NEMA 4X WHEN USED WITH 5003-010 GASKET KIT.	EA	4.00
425204.4	GASKET REDINGTON #5003-010 FOR USE WITH REDINGTON 722-0001 METER	EA	4.00
425370	TRNSFMR 250VA HEVI-DUTY #E250 W/FB2X FUSE HOLDER SBE ENCAPSULATED SERIES	EA	1.00
426187	FUSE 250V TIME-DELAY 3 AMP 10,000 A.I.R. 1-1/2" LONG x 13/32" DIAMETER (BUSSMANN FNM-3) (LITTELFUSE FLM-3) (FERRAZ-SHAWMUT TRM-3)	EA	1.00
426215.005	FUSE 500V TIME-DELAY 2-1/2 AMP 10,000 A.I.R. 1-1/2" LONG x 13/32" DIAMETER (BUSSMANN FNQ-2-1/2) (LITTELFUSE FLQ-2-1/2) (FERRAZ-SHAWMUT ATQ-2-1/2)	EA	2.00
426520	BLOCK FUSE MARATHON 6M30A2SQ	EA	1.00
428905.1	WIRE DUCT BASE 1.5" x 3" PANDUIT F1.5 x 3 LG6 OR TYTON SL-1.5 x 3G	FT	7.00
428908.1	WIRE DUCT COVER 1.5" PANDUIT C1.5LG6 OR TYTON TC1.5G	FT	7.00
429094.02	DECAL USEMCO 2 7/16"x7 1/8" MATERIAL: .002 WHITE MYLAR W/378 ADHESIVE	EA	1.00
429094.04	DECAL USEMCO 2"x3" MADE IN USA	EA	1.00
429105	DECAL USEMCO LIMITED WARRANTY 1 YEAR 3" X 4.75" WHITE BACKGROUND BLACK LETTERS	EA	1.00
429118.40	WARNING SIGN BRADY #94913 WARNING: ARC FLASH HAZARD APPROPRIATE PPE REQUIRED FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY REFER TO NFPA 70E	EA	1.00
432360.1	PLC, MITSU, FX3U, DC/RELAY FX3U-32MR/ES 16 DC IN AND 16 RELAY OUT	EA	1.00
432371	PLC, MITSU, 4 ANALOG IN FX2N-4AD	EA	1.00
432372	PLC, MITSU, 2 ANALOG OUT FX2N-2DA	EA	1.00
432373	PLC, MITSU, 4 ANALOG OUT FX2N-4DA	EA	1.00
432376	PLC, MITSU, 8 REL OUT FX2N-8EYR-ES/UL	EA	1.00

432377	PLC, MITSU, 8 DC IN FX2N-8EX-ES/UL	EA	1.00
432390.1	PLC, MITSU, GOT 1000 CABLE GT01-C30R4-8P REPLACES FX-50DU-CAB0	EA	1.00
432395.1	PLC, MITSU, 5.7 OIT 256 COLOR GT1155-QSBD GOT1000 SERIES 5.7" 256 COLOR TOUCHSCREEN QVGA STN, DC 320 x 240 DOTS	EA	1.00
445121.2	DIODE 1A 100V MOTOROLA 1N4002/E3/54 OR MOUSER 625-1N4002GP-E3/54	EA	8.00
461993	LEGEND PLATE SQD 9001 KN 360 HAND OFF AUTO HAND OFF AUTO	EA	4.00
462849.3	ENCL N4X SNGL HOF A42H3010SSLP	EA	1.00
463219	ENCL BP HOF A42P30	EA	1.00
469004	LUG ALUM SOLDERLESS MAX. #2 ILSCO TA-2, BLACKBURN ADR-2, BURNDY KA2U OR EQUAL	EA	7.00
469005.0020	LUG POWER KIT SQD #PDC6JD4 (6) 14-4 AWG (3) LUGS PER KIT	EA	1.00
470620	SWITCH SEL 3 SQD 9001 KS-43B	EA	4.00
472002	SHAFT STANDARD SQD 9421 LS8	EA	5.00
472006	OPERATING MECH SQD 9421 LJ7 FOR H AND J FRAMES	EA	5.00
472008.21	HANDLE DOOR SQD 9421 LC46	EA	5.00
472080	BLOCK CONTACT SQD 9001 KA1 ONE NORMALLY OPEN AND CLOSED	EA	8.00
480150.1	LIGHT SQD TRANS 9001 KP1R9	EA	5.00
480151.1	LIGHT SQD TRANS 9001 KP1G9	EA	4.00
480151.5	LIGHT SQD TRANS 9001 KP1W9	EA	1.00

Operation 180 PACK 1 - INSTALL, GAUGES, FILTER PIPING

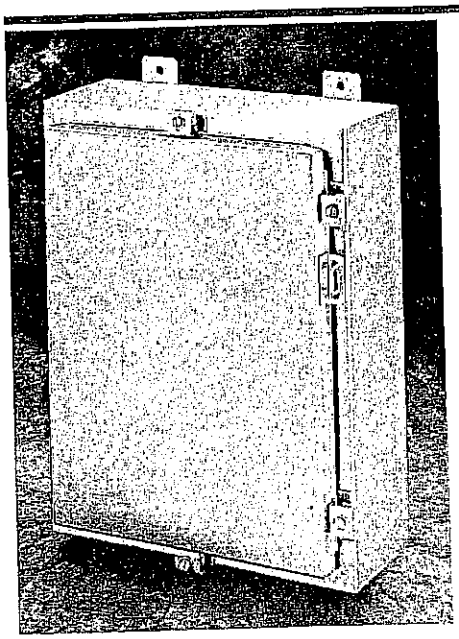
470004.70	SWITCH PRESSURE A-B #836-C6J 30" VAC to 100 PSI NEMA 4 RATING	EA	1.00
470027.12	PRESSURE TRANSMITTER SETRA 256 2561-200P-G-2M-11 (0-200) RANGE: 0-200 PSIG PRESSURE FITTING: 1/4" NPT EXCITATION: 24VDC OUTPUT: 4-20 mA	EA	1.00

2561-200P-G-2M-11 (0-200)

Operation 190 ROUGH IN & WIRE

420370.410	VFD 15HP 480V YASKAWA V1000 #CIMR-VU4A0023GAA NEMA 4X RATED	EA	4.00

Stainless Steel Type 4X Enclosures



Application

Provides unmatched protection for housing electrical components in highly corrosive environments. This enclosure is used in indoor and outdoor settings that are frequently wet or have constant exposure to water, other liquids, or contaminants.

A wide variety of Type 316L stainless steel enclosures are available for applications requiring the additional protection of Type 316L material.

See Chapter 11, EMC Enclosures, for information on a related EMC-shielded product.

Construction

- 14 gauge Type 304 or Type 316L stainless steel bodies and doors
- Seams continuously welded and ground smooth, no holes or knockouts
- Seamless foam-in-place gasket assures watertight and dust-tight seal
- Rolled lip around three sides of door and all sides of enclosure opening excludes liquids and contaminants
- Stainless steel door clamp assembly assures watertight seal
- Hasp and staple for padlocking
- Door removed by pulling stainless steel continuous hinge pin
- Data pocket is high-impact thermoplastic
- Collar studs provided for mounting optional panels
- Exterior hardware on Type 316L stainless steel enclosures matches enclosure material

Finish

Enclosures are unpainted. Door, sides, top, and bottom have smooth #4 brushed finish.

Industry Standards

UL 508A, 508, File No. E61997: Type 3R, Type 4, Type 4X, and Type 12
NEMA/EEMAC Type 3, Type 3R, Type 4, Type 4X, Type 12, and Type 13
JIC standard EGP-1-1967
CSA File No. LR42186: Type 4, Type 4X, and Type 12
IEC 60529, IP66
Meets Type 3RX requirements

Accessories

See Chapter 12, General Accessories.

Electrical Interlocks
Fast Operating Clamp Assembly
Lighting Packages
Panel Support Kit
Panels (see order number table)
Rack Mounting Angle Kit
Swing-Out Panel Kit
Terminal Block Kit Assembly
Thermal Accessories
Window Kit

Modification Services Program

You can customize this product to your unique requirements by specifying from these options:

- Enclosure height, width, depth
- Holes and cutouts in body, doors, subpanels
- Tapped holes in subpanels
- Fasteners, mounting channel in enclosure and subpanel
- Mounting (adds and deletes)
- Doors
- Subpanels
- Thermal management (louvers, fans, filters)
- Windows
- Standard accessories
- Drip shield

For details, see Modification Services at hoffmanonline.com.
To order, contact your local Hoffman sales representative.

NOTE: For information about modifications outside the scope of the Modification Services program, contact your Hoffman sales representative.

Stainless Steel Type 4X Enclosures

Standard Sizes Stainless Steel Type 4X Enclosures (Cont.)

Catalog Number Type 304	Catalog Number Type 316L	Enclosure Size A x B x C	* Steel Panel Catalog Number	* Stainless Steel Panel Catalog Number	Panel Size D x E	F	Clamps qty	Data Pocket
A36H2408SSLP	A36H2408SS6LP	36.00 x 24.00 x 8.00 (914 x 610 x 203)	A36P24	A36P24SS6	33.00 x 21.00 (838 x 533)	3.00 (76)	5	Large
A36H3008SSLP	A36H3008SS6LP	36.00 x 30.00 x 8.00 (914 x 762 x 203)	A36P30	A36P30SS6	33.00 x 27.00 (838 x 686)	3.00 (76)	7	Large
A42H3608SSLP	A42H3608SS6LP	42.00 x 36.00 x 8.00 (1067 x 914 x 203)	A42P36	A42P36SS6	39.00 x 33.00 (991 x 838)	3.00 (76)	8	Large
A48H3608SSLP	A48H3608SS6LP	48.00 x 36.00 x 8.00 (1219 x 914 x 203)	A48P36	A48P36SS6	45.00 x 33.00 (1143 x 838)	3.00 (76)	8	Large
A20H1610SSLP	A20H1610SS6LP	20.00 x 16.00 x 10.00 (508 x 406 x 254)	A20P16	A20P16SS6	17.00 x 13.00 (432 x 330)	3.00 (76)	4	Small
A24H2010SSLP	A24H2010SS6LP	24.00 x 20.00 x 10.00 (610 x 508 x 254)	A24P20	A24P20SS6	21.00 x 17.00 (533 x 432)	3.00 (76)	5	Small
A30H2410SSLP	A30H2410SS6LP	30.00 x 24.00 x 10.00 (762 x 610 x 254)	A30P24	A30P24SS6	27.00 x 21.00 (686 x 533)	3.00 (76)	5	Large
A36H2410SSLP	A36H2410SS6LP	36.00 x 24.00 x 10.00 (914 x 610 x 254)	A36P24	A36P24SS6	33.00 x 21.00 (838 x 533)	3.00 (76)	5	Large
A36H3010SSLP	A36H3010SS6LP	36.00 x 30.00 x 10.00 (914 x 762 x 254)	A36P30	A36P30SS6	33.00 x 27.00 (838 x 686)	3.00 (76)	7	Large
A42H3010SSLP	A42H3010SS6LP	42.00 x 30.00 x 10.00 (1067 x 762 x 254)	A42P30	A42P30SS6	39.00 x 27.00 (991 x 686)	3.00 (76)	8	Large
A48H3610SSLP	A48H3610SS6LP	48.00 x 36.00 x 10.00 (1219 x 914 x 254)	A48P36	A48P36SS6	45.00 x 33.00 (1143 x 838)	3.00 (76)	8	Large
A24H2412SSLP	A24H2412SS6LP	24.00 x 24.00 x 12.00 (610 x 610 x 305)	A24P24	A24P24SS6	21.00 x 21.00 (533 x 533)	3.00 (76)	5	Small
A30H2412SSLP	A30H2412SS6LP	30.00 x 24.00 x 12.00 (762 x 610 x 305)	A30P24	A30P24SS6	27.00 x 21.00 (686 x 533)	3.00 (76)	5	Large
A36H3012SSLP	A36H3012SS6LP	36.00 x 30.00 x 12.00 (914 x 762 x 305)	A36P30	A36P30SS6	33.00 x 27.00 (838 x 686)	3.00 (76)	7	Large
A36H3612SSLP	A36H3612SS6LP	36.00 x 36.00 x 12.00 (914 x 914 x 305)	A36P36	A36P36SS6	33.00 x 33.00 (838 x 838)	3.00 (76)	7	Large
A48H3612SSLP	A48H3612SS6LP	48.00 x 36.00 x 12.00 (1219 x 914 x 305)	A48P36	A48P36SS6	45.00 x 33.00 (1143 x 838)	3.00 (76)	8	Large
A60H3612SSLP	A60H3612SS6LP	60.00 x 36.00 x 12.00 (1524 x 914 x 305)	A60P36	A60P36SS6	57.00 x 33.00 (1448 x 838)	3.00 (76)	9	Large
A30H2416SSLP	A30H2416SS6LP	30.00 x 24.00 x 16.00 (762 x 610 x 406)	A30P24	A30P24SS6	27.00 x 21.00 (686 x 533)	3.00 (76)	5	Large
A36H3016SSLP	A36H3016SS6LP	36.00 x 30.00 x 16.00 (914 x 762 x 406)	A36P30	A36P30SS6	33.00 x 27.00 (838 x 686)	3.00 (76)	7	Large
A48H3616SSLP	A48H3616SS6LP	48.00 x 36.00 x 16.00 (1219 x 914 x 406)	A48P36	A48P36SS6	45.00 x 33.00 (1143 x 838)	3.00 (76)	8	Large
A60H3616SSLP	A60H3616SS6LP	60.00 x 36.00 x 16.00 (1524 x 914 x 406)	A60P36	A60P36SS6	57.00 x 33.00 (1448 x 838)	3.00 (76)	9	Large

Millimeter dimensions ( ) are for reference only; do not convert metric dimensions to inch.

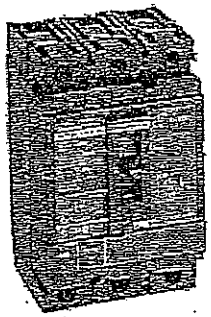
* Panels must be ordered separately. Optional aluminum and composite panels are available for many sizes. See General Accessories.

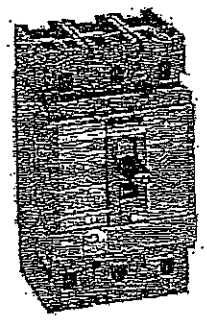
NOTE: Panels have a formed flange along any side that is longer than 21.00 in. (564mm). Panel A24P20 has a flange on all four sides.

H- and J-frame Thermal-magnetic Molded Case
150 and 250 Ampere Frame—Class 611

www.SquareD.com
For the most up-to-date information


HD and HG 2-pole


H-frame


J-frame

H-frame 150 A Thermal-magnetic (600 Vac) Factory Sealed Trip Unit Suitable for Reverse Connection▲

Current Rating @ 40° C	AC Magnetic Trip Setting		D Interrupting		G Interrupting		J Interrupting		L Interrupting		Terminal Wire Range
	Hold	Trip	Catalog Number	Price	Catalog Number	Price	Catalog Number	Price	Catalog Number	Price	
2-pole, 600 Vac 50/60 Hz											
15	350	750	HDL26015		HGL26015		HJL26015		HLL26015		AL150HD #14–#3/0 AWG Cu or Al
20	350	750	HDL26020		HGL26020		HJL26020		HLL26020		
25	350	750	HDL26025		HGL26025		HJL26025		HLL26025		
30	350	750	HDL26030		HGL26030		HJL26030		HLL26030		
35	400	850	HDL26035		HGL26035		HJL26035		HLL26035		
40	400	850	HDL26040		HGL26040		HJL26040		HLL26040		
45	400	850	HDL26045		HGL26045		HJL26045		HLL26045		
50	400	850	HDL26050		HGL26050		HJL26050		HLL26050		
60	800	1450	HDL26060		HGL26060		HJL26060		HLL26060		
70	800	1450	HDL26070		HGL26070		HJL26070		HLL26070		
80	800	1450	HDL26080		HGL26080		HJL26080		HLL26080		
90	800	1450	HDL26090		HGL26090		HJL26090		HLL26090		
100	900	1700	HDL26100		HGL26100		HJL26100		HLL26100		
110	900	1700	HDL26110		HGL26110		HJL26110		HLL26110		
125	900	1700	HDL26125		HGL26125		HJL26125		HLL26125		
150	900	1700	HDL26150		HGL26150		HJL26150		HLL26150		
3-pole, 600 Vac 50/60 Hz											
15	350	750	HDL36015		HGL36015		HJL36015		HLL36015		AL150HD #14–#3/0 AWG Cu or Al
20	350	750	HDL36020		HGL36020		HJL36020		HLL36020		
25	350	750	HDL36025		HGL36025		HJL36025		HLL36025		
30	350	750	HDL36030		HGL36030		HJL36030		HLL36030		
35	400	850	HDL36035		HGL36035		HJL36035		HLL36035		
40	400	850	HDL36040		HGL36040		HJL36040		HLL36040		
45	400	850	HDL36045		HGL36045		HJL36045		HLL36045		
50	400	850	HDL36050		HGL36050		HJL36050		HLL36050		
60	800	1450	HDL36060		HGL36060		HJL36060		HLL36060		
70	800	1450	HDL36070		HGL36070		HJL36070		HLL36070		
80	800	1450	HDL36080		HGL36080		HJL36080		HLL36080		
90	800	1450	HDL36090		HGL36090		HJL36090		HLL36090		
100	900	1700	HDL36100		HGL36100		HJL36100		HLL36100		
110	900	1700	HDL36110		HGL36110		HJL36110		HLL36110		
125	900	1700	HDL36125		HGL36125		HJL36125		HLL36125		
150	900	1700	HDL36150		HGL36150		HJL36150		HLL36150		

▲ See page 6-57 for circuit breakers with field interchangeable trip units

J-frame 250 A Thermal-magnetic (600 Vac) Factory Sealed Trip Unit Suitable for Reverse Connection✖

Current Rating @ 40° C	AC Magnetic Trip Setting		D Interrupting		G Interrupting		J Interrupting		L Interrupting		Terminal Wire Range
	Low	High	Catalog Number	Price	Catalog Number	Price	Catalog Number	Price	Catalog Number	Price	
2-pole, 600 Vac 50/60 Hz											
150	750	1500	JDL26150		JGL26150		JJL26150		JLL26150		AL175JD #1/0–4/0 AWG Al or Cu
175	875	1750	JDL26175		JGL26175		JJL26175		JLL26175		
200	1000	2000	JDL26200		JGL26200		JJL26200		JLL26200		AL250JD #3/0–350 kcmil Al or Cu
225	1125	2250	JDL26225		JGL26225		JJL26225		JLL26225		
250	1250	2500	JDL26250		JGL26250		JJL26250		JLL26250		
3-pole, 600 Vac 50/60 Hz											
150	750	1500	JDL36150		JGL36150		JJL36150		JLL36150		AL175JD #1/0–4/0 AWG Al or Cu
175	875	1750	JDL36175		JGL36175		JJL36175		JLL36175		
200	1000	2000	JDL36200		JGL36200		JJL36200		JLL36200		AL250JD #3/0–350 kcmil Al or Cu
225	1125	2250	JDL36225		JGL36225		JJL36225		JLL36225		
250	1250	2500	JDL36250		JGL36250		JJL36250		JLL36250		

✖ See page 6-57 for circuit breakers with field interchangeable trip units.

H- and J-frame Termination Options

F = No Lugs (includes terminal nut kit)★
L = Lugs both ends
M = Lugs "ON" end Terminal Nut Kit "Off" end
P = Lugs "OFF" end Terminal Nut Kit "On" end
N = Plug-in✦
D = Drawout✦
S = Rear Connected ✦

✦ For N,D, and S pricing, add termination pricing on page 6-58 to price.
★ Add TS suffix for circuit breaker without terminal nut kit.


Plug-in


Drawout

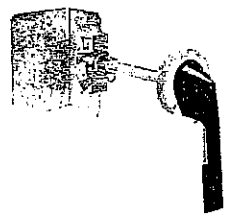

Rear Connected


I-Line©

Table 7.39: H- and J-Frame Interrupting Ratings

Voltage	Interrupting Rating			
	D	G	J	L
240 Vac	25 kA	65 kA	100 kA	125 kA
480 Vac	18 kA	35 kA	65 kA	100 kA
600 Vac	14 kA	18 kA	25 kA	50 kA

DE2 | | Discount Schedule



9421 Type L Circuit Breaker Mechanism

Type L Circuit Breaker Mechanisms

Type L door-mounted, variable depth operating mechanisms feature heavy duty, all metal construction with trip indication. All mechanisms 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 enclosure when the door is closed. (The 3" handle accepts one padlock.) Complete kits are rated for NEMA Type 1, 3R, and 12 enclosures. They include a handle assembly, operating mechanism, and shaft assembly.

Table 8.41: Complete Kits

Complete Kit Does Not Include Circuit Breaker — Use With			Includes: Operating Mechanism, Standard 6 in. Handle, Standard Shaft Kit			Includes: Operating Mechanism, Standard 6 in. Handle, Long Shaft Kit			Includes: Operating Mechanism, Short 3 in. Handle, Long Shaft Kit		
Circuit Breaker or Interrupter Type	No. of Poles	Frame Size (A)	Type	$ Price	Mounting Depth ▲ Min. – Max.	Type	$ Price	Mounting Depth ▲ Min. – Max.	Type	$ Price	Mounting Depth ▲ Min. – Max.
NSF, PowerPact™ H and J	2–3	250	LJ1		5-1/2–10-3/4	LJ4		5-1/2–21-3/8	LJ3		5-1/2–21-3/8
PowerPact D and L	2–3	600	LD1		7-1/4–12-1/16	LD4		7-1/4–22-5/8	3 in. handles are not recommended for use with these circuit breakers.		
PowerPact M and P♦	3	1200	LW1■		7-3/16–11-5/8	LW4■		7-3/16–22-1/4			

▲ Mounting depth measured in inches from circuit breaker mounting surface (control panel) to outside of enclosure door.
■ Type LW1 and LW4 include an 8 in. handle (9421LHP8) rather than a 6 in. handle.
♦ These circuit breaker operating mechanisms must use the 9421LHP** or LCP** handles only.

Table 8.42: Component Parts

Use With			3 in. Handle Assemblies, Type 1, 3R, 12		Standard 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 (A)	Type	$ Price	Type	$ Price	Type	$ Price	Mounting Depth ▲ Min. – Max.	Type	$ Price	Mounting Depth ▲ Min. – Max.	Type	$ Price
NSF, PowerPact H & J	2–3	250	LH3▼		LH6▼		LJ7		5-1/2–10-1/4	LS8		5-1/2–21-3/8	LS13	
PowerPact D & L	2–3	600	★	—	LH6▼		LD7		7-1/4–12-1/16	LS8		7-1/4–22-5/8	LS13	
PowerPact M & P♦	3	1200	★	—	LHP8▼		LW7		7-3/16–11-5/8	LS8		7-3/16–22-1/4	LS10	

▲ Mounting depth measured in inches from circuit breaker mounting surface (control panel) to outside of enclosure door.
■ Type LW1 and LW4 include an 8 in. handle (9421LHP8) rather than a 6 in. handle.
♦ These circuit breaker operating mechanisms must use the 9421LHP** or LCP** handles only.
★ 3 in. handles are not recommended for use with these circuit breakers.
▼ For a red handle and yellow bezel, add suffix RY to catalog number, e.g., 9421LH6RY.

New!

3 in. Handle Assembly

Table 8.43: NEMA Type 4 and 4X Handle Assemblies

Use With			Standard Handle Assemblies				Special 3 in. Version			
			NEMA Type 1, 3R, 4, 4X, 12 (Painted)		NEMA Type 1, 3R, 4, 4X, 12 (Chrome Plated)		NEMA Type 1, 3R, 4, 4X, 12 (Painted)		NEMA Type 1, 3R, 4, 4X, 12 (Chrome Plated)	
Circuit Breaker or Interrupter Type	No. of Poles	Frame Size (A)	Type	$ Price	Type	$ Price	Type	$ Price	Type	$ Price
NSF, PowerPact H and J	2–3	250	LH46		LC46		LH43		LC43	
PowerPact D and L	2–3	600	LH46		LC46		3 in. handles are not recommended for use with these circuit breakers.			
PowerPact M and P	3	1200	LHP48		LCP48					

Standard Handle Assembly

Table 8.44: Auxiliary and Alarm Switches for PowerPact™ Circuit Breakers ▲

Description	H- and J-Frame	$ Price	D- and L-Frame	$ Price	M- and P-Frame	$ Price
1 Auxiliary Switch 1a 1b	S29450		S29450		S29450	
2 Auxiliary Switch 2a 2b	2 x S29450		2 x S29450		2 x S29450	
3 Auxiliary Switch 3a 3b	—	—	3 x S29450		3 x S29450	

▲ Discount Schedule: DE2

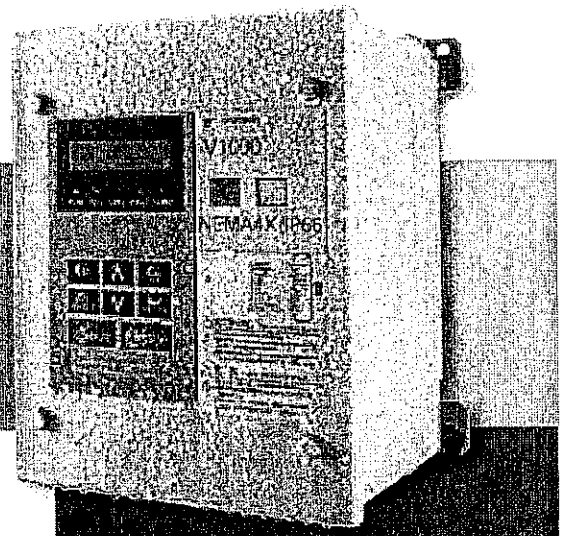
NOTE: The location of the accessory in the circuit breaker determines its function.

YASKAWA

V1000-4X

1/8 to 25 HP

NEMA 4X Current Vector Microdrive



Washdown - Dust Tight!

The V1000-4X is a version of the standard V1000 in an integral enclosure that meets NEMA type 4X/12 *indoor use requirements*, UL type 4X/12 standards, and the IP66 rating of IEC 60529. This enclosure provides the protection required in tough washdown or dust-tight environments, common in Food and Beverage Processing, Packaging, Metal Machining, Woodworking, Pumping, Refrigeration, and Printing. The enclosure is epoxy-coated to protect against the harmful effects of sanitizing chemicals commonly used in food industries.

200-240VAC Single Phase 50/60 Hz

Model Number CIMR-VU□□GAA		BA0001	BA0002	BA0003	BA0006	BA0010	BA0012
Motor Capacity (HP)	ND	1/4	1/4	3/4	1	3	3
	HD	1/8	1/4	1/2	1	2	3
Output Current A (rms)	ND	1.2	1.9	3.3	6.0	9.6	12.0
	HD	0.8	1.6	3.0	5.0	8.0	11.0

200-240VAC Three Phase 50/60 Hz

Model Number CIMR-VU□□GAA		2A0001	2A0002	2A0004	2A0006	2A0010	2A0012	2A0020	2A0030	2A0040	2A0056	2A0069
Motor Capacity (HP)	ND	1/4	1/4	3/4	1	3	3	5	10	10	20	25
	HD	1/8	1/4	1/2	1	2	3	3	7.5	10	15	20
Output Current A (rms)	ND	1.2	1.9	3.5	6.0	9.6	12.0	19.6	30	40	56	69
	HD	0.8	1.6	3.0	5.0	8.0	11.0	17.5	25	33	47	60

380-480VAC Three Phase 50/60 Hz

Model Number CIMR-VU□□GAA		4A0001	4A0002	4A0004	4A0005	4A0007	4A0009	4A0011	4A0018	4A0023	4A0031	4A0038
Motor Capacity (HP)	ND	1/2	1	2	3	4	5	7.5	10	15	20	25
	HD	1/2	3/4	2	3	3	4	5	10	10	15	20
Output Current A (rms)	ND	1.2	2.1	4.1	5.4	6.9	8.8	11.1	17.5	23	31	38
	HD	1.2	1.8	3.4	4.8	5.5	7.2	9.2	14.8	18	24	31

Options*

- 120 VAC Interface
- Network Communications: Profibus-DP, DeviceNet, EtherNet/IP, Modbus TCP/IP

* Although the V1000-4X is compatible with most V1000 options, those options may not be waterproof. These options require special consideration regarding proper wiring techniques, including cable glands.

Features

- NEMA Type 4X/IP66 enclosure
- Corrosion-resistant
- Current vector control, open loop
- RoHS compliance
- On-line tuning
- Induction motor (IM) or permanent magnet synchronous motor (PM) operation
- Function Block Diagram (FBD) programming via DriveWorksEZ™
- Starting torque of 200% at 0.5 Hz
- Removable terminal block with parameter backup function
- "One-touch" copy function with verify
- Super-fast 2 ms scan cycle with dual CPU
- EN954-1 Safety Cat. 3, Stop Cat. 0
- Increased vibration resistance, from 20 Hz to 50 Hz (0.65G)
- 1 in 10,000 failure rate
- Swing PWM function to decrease noise at low carrier frequencies
- Pre-maintenance function
- Modbus communication
- MTBF: 28 years
- Short Circuit Current Rating (SCCR): 30kA rms symmetrical
- Common programming with all other Yaskawa drives

Yaskawa America, Inc. | Tel: 1-800-YASKAWA (927-5292) | www.yaskawa.com
Drives & Motion Division

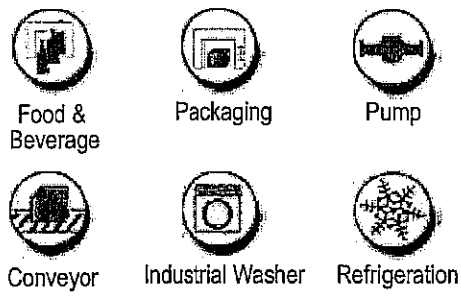
YASKAWA

V1000-4X
1/8 to 25 HP

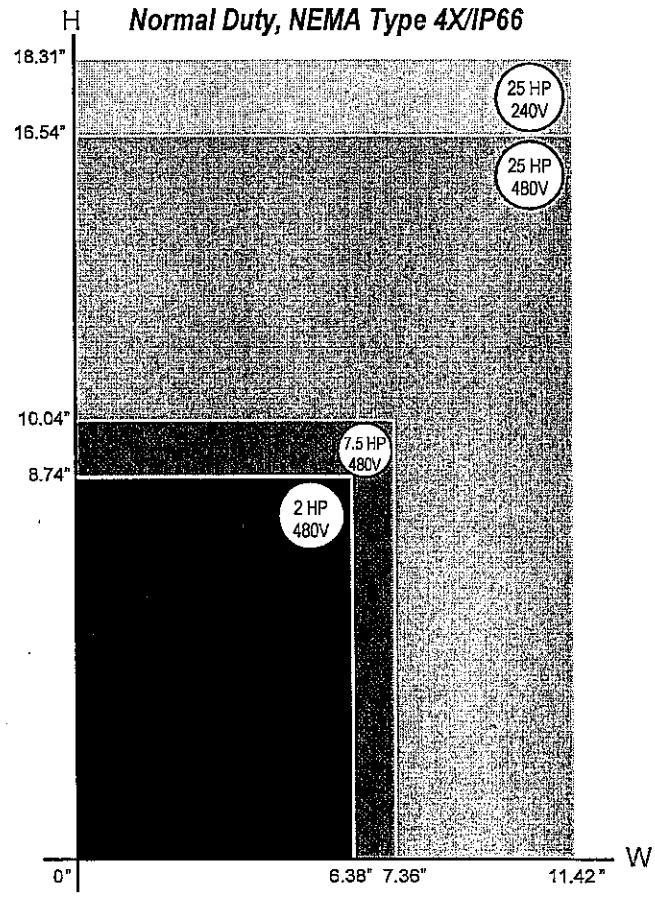
Specifications

Item	Specification
Overload Capacity	150% Overload for 60 sec. (Heavy Duty)
	120% Overload for 60 sec. (Normal Duty)
Output Frequency	0~400 Hz (higher frequencies available with custom software)
Control Methods	Open Loop Current Vector Control, V/f Control, PM Open Loop Vector Control
	Simple closed loop speed control available
Protective Design	NEMA Type 4X/IP66 (dust/water-proof)
Braking Transistor	Standard in all models
Braking Torque	20 - 40% increase with intelligent high-slip braking function
KEB Function	Uses mechanical energy to continue operation during momentary power failure, standard
Overvoltage Function	Prevention function for die-cushion in a hydraulic mechanical press and other applications
Maintenance	Elapsed timer assists in preventative maintenance for cooling fan, capacitors, and transistors
	Easily replaceable cooling fan
Global Certification	CE, UL, cUL, RoHS, TUV
Available I/O	(7) multi-function digital inputs
	(1) hardwire baseblock
	(2) multi-function analog inputs
	(1) multi-function pulse input
	(1) multi-function relay output
	(2) multi-function photo-coupler outputs
	(1) multi-function 0-10 Vdc analog output
	(1) multi-function pulse output
Network Communication	Standard: RS-422/485 MODBUS 115 kbps
	Optional: DeviceNet, EtherNet/IP, Profibus-DP, Modbus TCP/IP
Keypad Operator	Standard LED 5 digit display
	Optional multi-lingual, full-text remote LCD

Major Applications



Size Comparison



Not drawn to scale

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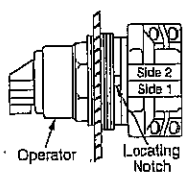
Drives & Motion Division

Non-Illuminated 3 Position Selector Switch Operators – UL Types 4, 13/NEMA Types 4, 13

For use in hazardous locations – See Page 16-78.
Legend plate and contact block not included unless noted.



Top View

CONTACT BLOCK REQUIRED					1 — Contact Closed 0 — Contact Open								
Contact Block Position	Quantity and Type		Mount on Side		Center ↑ Left Right	Center ↑ Left Right	Center ↑ Left Right	Center ↑ Left Right	Center ↑ Left Right	Center ↑ Left Right	Center ↑ Left Right	Center ↑ Left Right	Center ↑ Left Right
KA1 or KA2	KA3		KA1 or KA2	KA3 #2	1 0 0	1 0 0	0 0 1	1 0 0	1 0 0	1 0 0	1 0 0	0 1 0	1 1 0
				KA2 #2	0 1 1	0 0 1	0 1 0	0 1 0	0 0 1	0 1 1	0 1 1	1 0 0	0 0 1
KA1 or KA2	KA3		KA1 or KA2	KA3 #1	0 0 1	1 0 0	0 0 1	1 0 0	0 1 0	0 0 1	1 0 1	0 0 1	0 1 1
				KA2 #1	1 1 0	0 0 1	0 1 0	0 1 0	0 0 1	1 0 0	0 1 0	0 1 0	1 0 0
CAM					B	C	D	E	F	G	J	L	M
Non-Illuminated Operators					Type	Type	Type	Type	Type	Type	Type	Type	Type
Manual Return													
Operator Only ✖													
Without Knob					KS42	KS43	KS44	KS45	KS46	KS47	KS49	KS401	KS402
With Standard Black Knob					KS42B	KS43B	KS44B	KS45B	KS46B	KS47B	KS49B	KS401B	KS402B
With Other Color Knob (See Table) ▲					KS42▲	KS43▲	KS44▲	KS45▲	KS46▲	KS47▲	KS49▲	KS401▲	KS402▲
Key Operated with E10 Key (Code 4 through 10) ●♦					KS42K●	KS43K●	KS44K●	KS45K●	KS46K●	KS47K●	KS49K●	KS401K●	KS402K●
With Contact Block(s)													
With Standard Black Knob (See Table for Other Colors, Replace B in Type Number with Other Color Code)													
With 1 KA1 on side #2 (H13)					KS42BH13	KS43BH13	KS44BH13	KS45BH13	KS46BH13	KS47BH13	KS49BH13	KS401BH13	KS402BH13
With 1 KA1 on side #1 (H1)					KS42BH1	KS43BH1	KS44BH1	KS45BH1	KS46BH1	KS47BH1	KS49BH1	KS401BH1	KS402BH1
With 1 KA1 on side #1 and 1 KA1 on side #2 (H2)					KS42BH2	KS43BH2	KS44BH2	KS45BH2	KS46BH2	KS47BH2	KS49BH2	KS401BH2	KS402BH2
Spring Return from Left to Center													
Operator Only ✖													
Without Knob					KS62	KS63	KS64	KS65	KS66	KS67	KS69	KS601	KS602
With Standard Black Knob					KS62B	KS63B	KS64B	KS65B	KS66B	KS67B	KS69B	KS601B	KS602B
With Other Color Knob (See Table) ▲					KS62▲	KS63▲	KS64▲	KS65▲	KS66▲	KS67▲	KS69▲	KS601▲	KS602▲
Key Operated with E10 Key (Code 5, 6 or 9 only) ●♦					KS62K●	KS63K●	KS64K●	KS65K●	KS66K●	KS67K●	KS69K●	KS601K●	KS602K●
Spring Return From Right to Center													
Operator Only ✖													
Without Knob					KS72	KS73	KS74	KS75	KS76	KS77	KS79	KS701	KS702
With Standard Black Knob					KS72B	KS73B	KS74B	KS75B	KS76B	KS77B	KS79B	KS701B	KS702B
With Other Color Knob (See Table) ▲					KS72▲	KS73▲	KS74▲	KS75▲	KS76▲	KS77▲	KS79▲	KS701▲	KS702▲
Key Operated with E10 Key (Code 4, 5 or 7 Only) ●♦					KS72K●	KS73K●	KS74K●	KS75K●	KS76K●	KS77K●	KS79K●	KS701K●	KS702K●
Spring Return Both Sides to Center													
Operator Only ✖													
Without Knob					KS52	KS53	KS54	KS55	KS56	KS57	KS59	KS501	KS502
With Standard Black Knob					KS52B	KS53B	KS54B	KS55B	KS56B	KS57B	KS59B	KS501B	KS502B
With Other Color Knob (See Table) ▲					KS52▲	KS53▲	KS54▲	KS55▲	KS56▲	KS57▲	KS59▲	KS501▲	KS502▲
Key Operated with E10 Key (Code 5 Only) ●♦					KS52K5	KS53K5	KS54K5	KS55K5	KS56K5	KS57K5	KS59K5	KS501K5	KS502K5

✖ These operators can be ordered complete with contact blocks – for maximum block usage – see Page 16-84. Add the "H" number chosen from Page 16-79 to the end of the operator type number and add the cost of the "H" number to the operator cost.
EXAMPLE: KS43K6(61.00)+H13(KA1-SIDE 2)(19.00)=KS43K6H13(80.00).

▲ Add the color code as chosen from knob color table at right.
EXAMPLE: KS43▲ with a green gloved hand knob = KS43FG

● Add the key withdrawal code from key withdrawal code table below.
EXAMPLE: KS43K● that the key can be withdrawn in the right position only = KS43K6

♦ All key operated devices are furnished as standard with Square D number E10 (key only part no. is 2941101100, $4.40 per key). The following 20 additional key changes are available at no extra cost:
E11-E13, E16, E21-E26, E28-E33, CH501, CH674, SR251, T107.
Occasionally it is desirable to have several devices with dissimilar key changes, but all operable by a single master key. The following key changes with master keying provisions are available at $7.30 additional per device.

Key No.	Total Key Changes Available	Master Key Part No.
E36 thru E60	25	2941151990

EXAMPLE: For individual key, not master keyed an E29 is chosen. The type number is KS43K6E29.
All key operators come standard with 2 keys. Replacement keys can be purchased by specifying the key part number at $4.40 per key.

3-Position Switches

● Code				● Code			
4	Yes	No	No	8	Yes	No	Yes
5	No	Yes	No	9	No	Yes	Yes
6	No	No	Yes	10	Yes	Yes	Yes
7	Yes	Yes	No				

Selector Switch Knobs


Standard Knob


Gloved Hand Knob

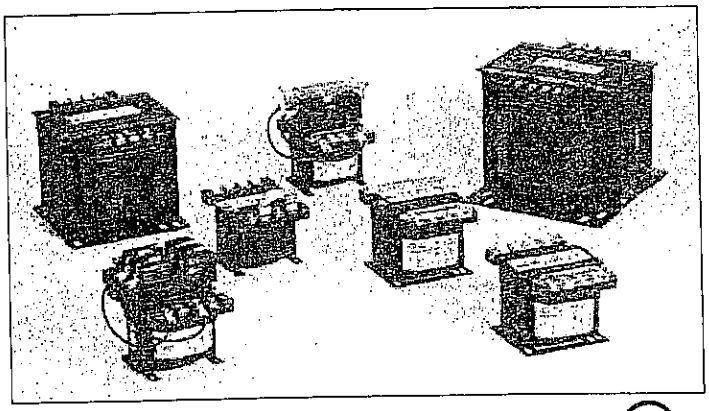

Coin Operated

Color	▲ Knob Code	Type	▲ Knob Code	Type	▲ Knob Code	Type
Black	B	B11	FB	B25	TB	B18
Red	R	R8	FR	R24	TR	R16
Green	G	G8	FG	G24	TG	G16
Yellow	Y	Y8	FY	Y24	TY	Y16
Orange	S	S11	FS	S25	–	–
Blue	L	L8	FL	L24	TL	L16
White	W	W8	FW	W24	–	–
Amber	A	A8	FA	A24	–	–
Clear	C	C8	FC	C24	TC	C16

For additional information, reference: Catalog Number 9001CT9701 or D-Fax™ #1548 and #1549.

The SBE - Encapsulated Series

The SBE Encapsulated industrial control transformers are epoxy encapsulated to seal the transformer windings against moisture, dirt and industrial contaminants. Extra deep, molded terminal barriers reduce the chance of electrical failure as the result of arcing or frayed lead wires. The rugged construction and proven reliability of the SBE design is uniquely suited for all industrial environments.



c UL us
E77014

Features

- 50 - 1000 VA, 50/60 Hz – suitable for worldwide applications.
- Interleaved copper windings reduce I^2R losses and maximize efficiency.
- 55°C Rise, 105°C insulation system to minimize heat
- Epoxy encapsulated to protect cores and coils against moisture, dirt, and other contaminants.
- Meets or Exceeds NEMA Standard ST 1 and ANSI C89.1 for load inrush capability.
- Integrally molded, flame retardant (IEC 707/ISO Class 1210) Terminal Blocks provide greater terminal contact area and improved conductivity.
- Heavy gauge steel mounting plate
- Mounting dimensions are compatible with similar control transformers.
- ***Secondary fuse holders (FB2X) included for 13/32 x 1½ cartridges (fuses not included).***
- ***Factory–installed fuse holders are available (See W, WA & WB options).***
- 10 year warranty

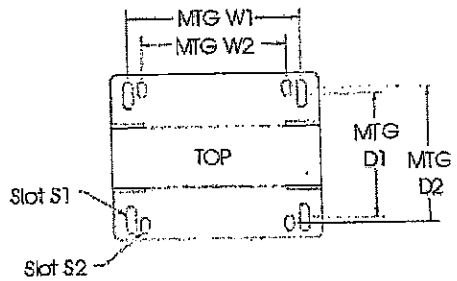
Related Products

- Linear Power Supplies
- DIN Rail DC Power Supplies
- Constant Voltage Transformers
- Line Reactors

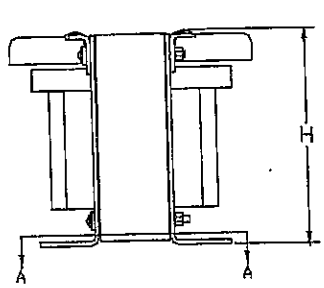
Accessories

Catalog Number	Description
FBP	Primary "CC" Rejection Type Fuse Holder (Finger Safe covers not available)
FB2	Secondary Fuse Holder only (Glass or Ceramic, ¼" x 1¼" fuse)
FB2X	Secondary Fuse Holder only included where applicable. Not sold separately. (Midget Cartridge Type, 13/32" x 1½" fuse)
FBPC1	Primary "CC" Rejection Type Fuse Holder and Finger Safe Cover Kit
IP20	IEC Touchproof Cover Kit
SBEDIN	IEC Fuse Holder Adaptor Kit
W	Factory installed Primary Fuse Holder with Midget Type (no covers)
WA	Factory installed Fuse Holder with Glass/Ceramic Type and Covers
WB	Factory installed Fuse Holder with Midget Type and Covers

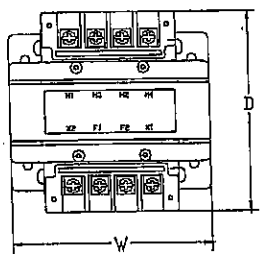
SBE Mounting Profiles



Mounting Dimensions



Profile



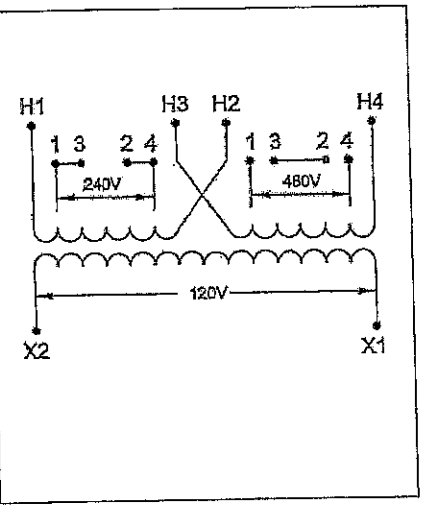
Top View

SBE Encapsulated Series Selection Tables

Group 2 – 220 x 440 Volt Primary, 110 Volt Secondary, 50/60 Hz
230 x 460 Volt Primary, 115 Volt Secondary, 50/60 Hz
240 x 480 Volt Primary, 120 Volt Secondary, 60 Hz

c UL us
E77014

VA	Catalog Number	Height (inch)	Width (inch)	Depth (inch)	Mtg Width W1 / W2	Mtg Depth D1 / D2	Slot Size (inches) S1 / S2	Approx. Ship Weight lbs (kg)
50	E050	2.72	3.01	3.99	2.51 / NA	2.02 / NA	.20 x .33 / .20 x .33	3 (1.36)
75	E075	2.96	3.39	4.36	2.81 / 2.50	2.10 / NA	.20 x .50 / .20 x .50	4 (1.82)
100	E100	2.96	3.39	4.61	2.81 / 2.50	2.37 / NA	.20 x .50 / .20 x .50	5 (2.27)
150	E150	3.89	4.5	4.48	3.74 / 3.12	2.56 / 2.87	.20 x .65 / .20 x .33	8 (3.64)
200	E200	3.89	4.5	4.79	3.74 / 3.12	2.87 / 3.18	.20 x .65 / .20 x .33	10 (4.55)
250	E250	3.89	4.5	5.21	3.74 / 3.12	3.29 / 3.61	.20 x .65 / .20 x .33	11 (5.00)
300	E300	4.53	5.25	4.66	4.38 / 3.75	3.10 / NA	.31 x .71 / .31 x .71	12 (5.45)
350	E350	4.53	5.25	5.07	4.38 / 3.75	3.54 / NA	.31 x .71 / .31 x .71	15 (6.82)
500	E500	4.53	5.25	5.75	4.38 / 3.75	4.33 / NA	.31 x .85 / .31 x .85	19 (8.64)
750	E750	5.56	6.38	6.93	5.32 / 4.37	4.25 / 5.75	.31 x .85 / .31 x .85	31 (14.09)
1000	E1000	5.56	6.38	7.36	5.32 / 4.37	4.68 / 6.18	.31 x .85 / .31 x .85	36 (16.36)



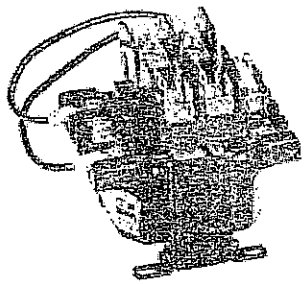
Note: Includes FB2X Secondary fuse holder.

Group 2A – Factory Installed Primary Fuse Holder Class "CC" and:
W – Secondary Fuse Holder (Midget Cartridge, 13/32" x 1½" fuse) supplied, no covers
WA – Secondary Fuse Holder (Glass or Ceramic – Type 3AG, ¼" x 1¼" fuse type)
WB – Secondary Fuse Holder (Midget Cartridge, 13/32" x 1½" fuse)

c UL us
E77014

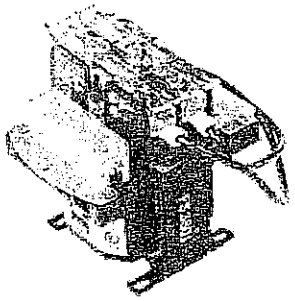
VA	Primary Fuse Holder Class "CC"			Dimensions						
	W Option – Midget Type Catalog Number	WA Option – Type 3AG w/ Covers Catalog Number	WB Option – Midget Type w/ Covers Catalog Number	Height (inch)	Width (inch)	Depth (inch)	Mtg Width W1 / W2	Mtg Depth D1 / D2	Slot Size (inches) S1 / S2	Approx. Ship Weight lbs (kg)
50	E050W	E050WA	E050WB	4.18	3.01	3.99	2.51 / NA	2.02 / NA	.20 x .33 / .20 x .33	3 (1.36)
75	E075W	E075WA	E0750WB	4.41	3.39	4.36	2.81 / 2.50	2.10 / NA	.20 x .50 / .20 x .50	4 (1.82)
100	E100W	E100WA	E100WB	4.41	3.39	4.61	2.81 / 2.50	2.37 / NA	.20 x .50 / .20 x .50	5 (2.27)
150	E150W	E150WA	E150WB	5.36	4.5	4.48	3.74 / 3.12	2.56 / 2.87	.20 x .65 / .20 x .33	8 (3.64)
200	E200W	E200WA	E200WB	5.36	4.5	4.79	3.74 / 3.12	2.87 / 3.18	.20 x .65 / .20 x .33	10 (4.55)
250	E250W	E250WA	E250WB	5.36	4.5	5.21	3.74 / 3.12	3.29 / 3.61	.20 x .65 / .20 x .33	11 (5.00)
300	E300W	E300WA	E300WB	5.99	5.25	4.66	4.38 / 3.75	3.10 / NA	.31 x .71 / .31 x .71	12 (5.45)
350	E350W	E350WA	E350WB	5.99	5.25	5.07	4.38 / 3.75	3.54 / NA	.31 x .71 / .31 x .71	15 (6.82)
500	E500W	E500WA	E500WB	5.99	5.25	5.75	4.38 / 3.75	4.33 / NA	.31 x .85 / .31 x .85	19 (8.64)
750	E750W	E750WA	E750WB	7.01	6.38	6.93	5.32 / 4.37	4.25 / 5.75	.31 x .85 / .31 x .85	31 (14.09)
1000	E1000W	E1000WA	E1000WB	7.01	6.38	7.36	5.32 / 4.37	4.68 / 6.18	.31 x .85 / .31 x .85	36 (16.36)

Notes: WA and WB suffix include Finger Safe covers. Fuses not included. W option for secondary fusing requires assembly (FB2 sold separately).



SBE Control Transformer without Covers - *W Option*

Option
W

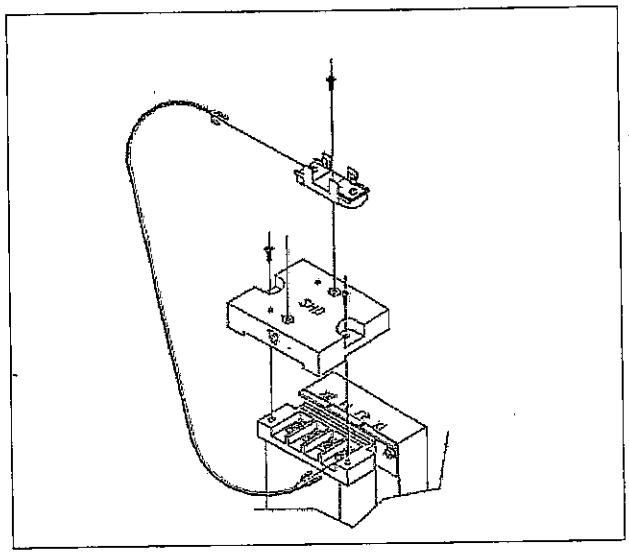


SBE Control Transformer with Covers - *WA & WB Option*

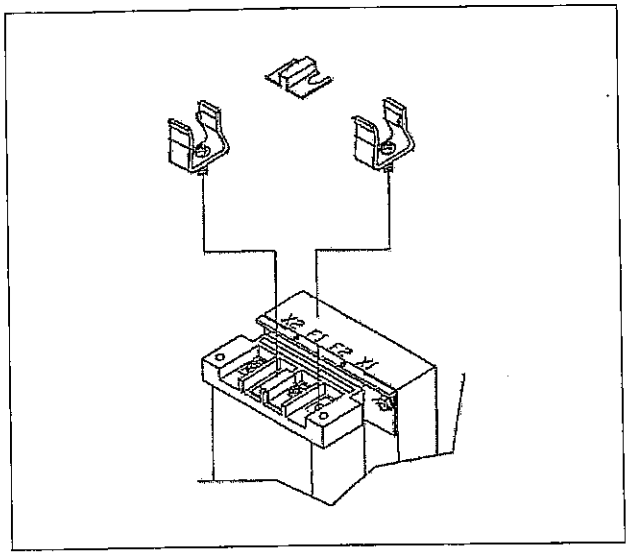
Option	Secondary Fusing	
WA	Glass/Ceramic - Type 3AG (FB2)	
WB	Midget Type (FB2X)	

SBE Additional Accessories - continued

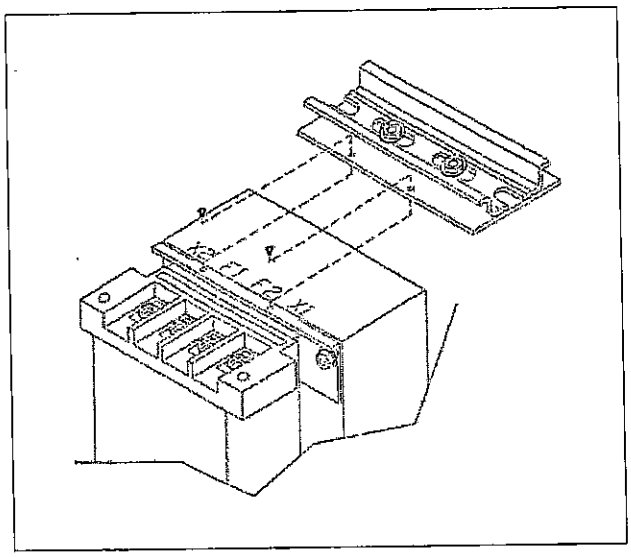
FB2 Fuse Block - Secondary Side



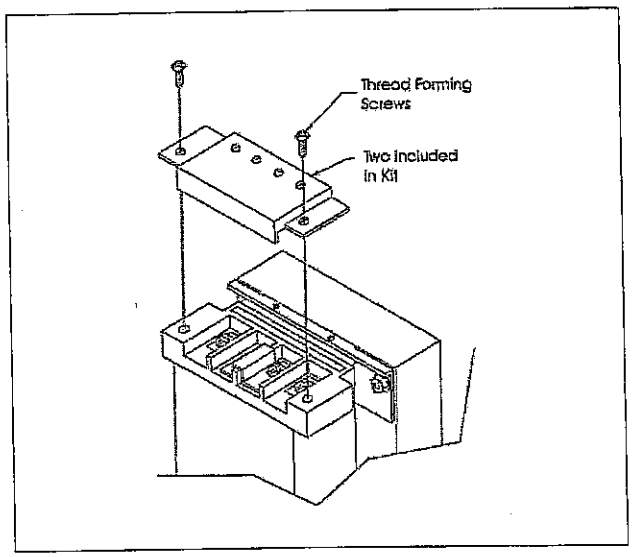
FB2X Fuse Block - Secondary Side



SBE DIN Circuit Breaker Mounting

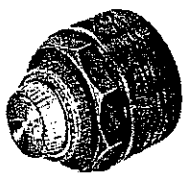


IP20 Terminal Covers (Two Covers Per Kit)



Push Buttons
Type K – 30.5mm
Heavy Duty Pilot Lights

Class 9001
Pilot Lights – UL Types 4, 13/NEMA Type 4 & 13
For use in hazardous locations — See page 14-79.
Legend Plates Not Included

Description	Voltage	Style	With Red Fresnel Color Cap	With Green Fresnel Color Cap	With Other Color Cap	Price	Without Color Cap	Price
 Standard Pilot Light (Plastic fresnel Color Cap Shown)	110-120V, 50-60 Hz 220-240V, 50-60 Hz 24-28VAC-DC For Other Voltages See Table (1)	Transformer Transformer Full Voltage Transformer, Flashing or LED (3) Full Voltage, Neon or Resistor (4)	KP1R31 KP7R31 KP35R31 KP(1)R31 KP(1)R31	KP1G31 KP7G31 KP35G31 KP(1)G31 KP(1)G31	KP1(2) KP7(2) KP35(2) KP(1)(2) KP(1)(2)		KP1 KP7 KP35 KP(1) KP(1)	
 Push To Test Pilot Light (Glass Color Cap Shown)	110-120V, 50-60 Hz 220-240V, 50-60 Hz 24-28VAC-DC For Other Voltages See Table (1)	Transformer Transformer Full Voltage Transformer, Flashing or LED (3) Full Voltage, Neon or Resistor (4)	KT1R31 KT7R31 KT35R31 KT(1)R31 KT(1)R31	KT1G31 KT7G31 KT35G31 KT(1)G31 KT(1)G31	KT1(2) KT7(2) KT35(2) KT(1)(2) KT(1)(2)		KT1 KT7 KT35 KT(1) KT(1)	
 Remote Test Pilot Light (Glass Color Cap Shown)	120VAC Only 24-28VAC Only For Other Voltages See Table (1) (5)	Resistor (5) Full Voltage (5) Full Voltage or Resistor (5)	KTR38R31 KTR35R31 KTR(1)R31	KTR38G31 KTR35G31 KTR(1)G31	KTR38(2) KTR35(2) KTR(1)(2)		KTR38 KTR35 KTR(1)	
 Pilot Light For Intrinsically Safe Circuits (NEMA 4X)	Intrinsically safe equipment must not release electrical or thermal energy capable of igniting certain explosive or combustible hazardous atmospheres, for which the equipment has been tested. These pilot lights are intrinsically safe when used with a suitable approved barrier or barrier relay (Class 8501 Type TO from pages 19-22 and 19-23). These pilot lights are Factory Mutual (FM approved). Consult your local Square D Sales Office for further details. These pilot lights are fully encapsulated – there are no replaceable parts – except for the SK40 ring nut. Use KN100 series plastic legend plates as shown on pages 14-81 and 14-82.		KP44R	KP44G	KP44Y (Yellow Color Cap)		—	—

Operating Voltage Range	Nominal Current	
20-30V AC/DC	25ma.	V max. = 32V I max. = 165 ma.

(1) Add the voltage assembly code as chosen from voltage assembly code table on page 14-63.
EXAMPLE: KT(1)R31 with a 60VAC red LED voltage=KT37LRR31.
(2) Add the color code as chosen from the color cap table. EXAMPLE: KP1(2) with a blue fresnel cap = KP1L31
(3) The color cap must be the same color as the LED voltage chosen, i.e., green LED use a green color cap.
(4) On neon voltages use clear color caps only.
(5) On remote test pilot lights use only full voltage or resistor voltage assembly codes. Do not choose LED, neon or transformer codes. For AC use only.

Push-To-Test Ground Detector Pilot Light
(Contact Block Included – But NOT Legend Plate or Color Cap)

Used in pairs to indicate a grounded condition in a control circuit fed from a grounded center-tapped transformer. The Type KT50 is commonly used in press control circuits, and fulfills the requirements of the ground detector called for in ANSI B11.1 (1971), Par. E3.6.5. Consult local Square D Sales Office for proper application.

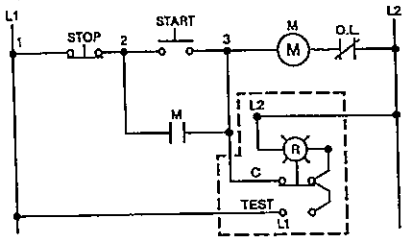
Voltage and Frequency	Type	Price
110-120 V., 50-60 Hz.	KT50	$108.00

Color	(2) Plastic Fresnel	(2) Plastic Domed	(2) Glass
Amber	A31	A9	A6
Blue	L31	L9	L6
Clear	C31	C9	C6
Green	G31	G9	G6
Red	R31	R9	R6
White	W31	W9	W6
Yellow	Y31	Y9	Y6

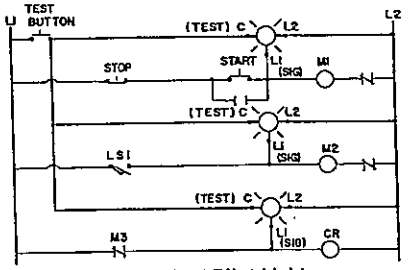
For Basic Operators . . . . . Page 14-84
For Boots . . . . . Page 14-83
For Lamps . . . . . Page 14-77
For Legend Plates . . . . . Pages 14-81 – 14-82
For Light Modules . . . . . Page 14-77
For Outline Dimensions . . . . . Pages 14-92 – 14-93
For Replacement Parts . . . . . Page 14-86
For Ring Nuts . . . . . Page 14-87

Voltage Assembly Codes
See Page 14-63

Typical Wiring Diagrams

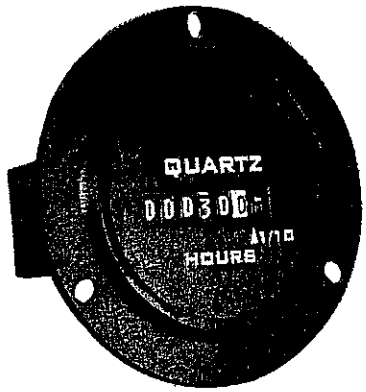


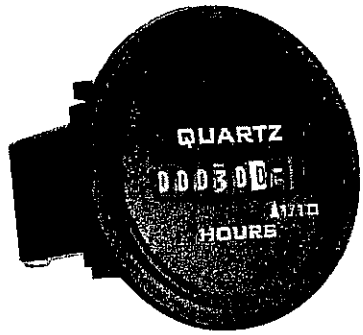
Push-To-Test Pilot Light

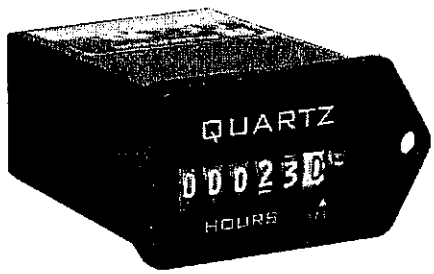


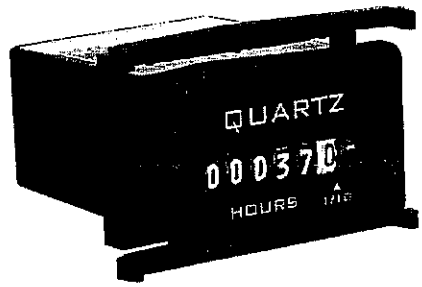
Remote Test Pilot Light

CP1 | Discount Schedule









Description

The Redington Model 722 provides an AC Hour Meter with an operating range of 90-264VAC 50/60 Hz. You no longer require two separate meters, one for 115VAC and one for 230VAC. Models are available in the standard industry housings, 2-Hole Rectangular, Flush-Rectangular, Flush-Round and 3-Hole Round. Its quartz time base insures accurate long-term time keeping. The Totally Sealed case protects against the environment and provides years of reliable service. All models are NEMA 4X,12 rated when mounted with optional gasket.

Features

- Operating voltage 90-264VAC 50/60Hz
- Totally Sealed
- UL/cUL Recognized, CE & RoHS Compliant
- 6 Figure, 99999.9
- Quartz accuracy

Options

- Wire leads
- Gasket kit (for NEMA 4X, 12 rating)
- Custom lens
- Terminals up, down, straight

Specifications

Figures:	6 - digits, 0.14" [3.6mm] 99999.9 Hours and idicator - white on black Decimal - black on white
Reset:	Non-reset
Voltage:	90-264VAC
Frequency:	50/60Hz
Power:	1 watt max.
Mounting:	Clip or mounting holes
Termination:	¼" [6.3mm] spade terminals
Weight:	~2 oz [57 g]
Accuracy:	± 0.02% over entire range

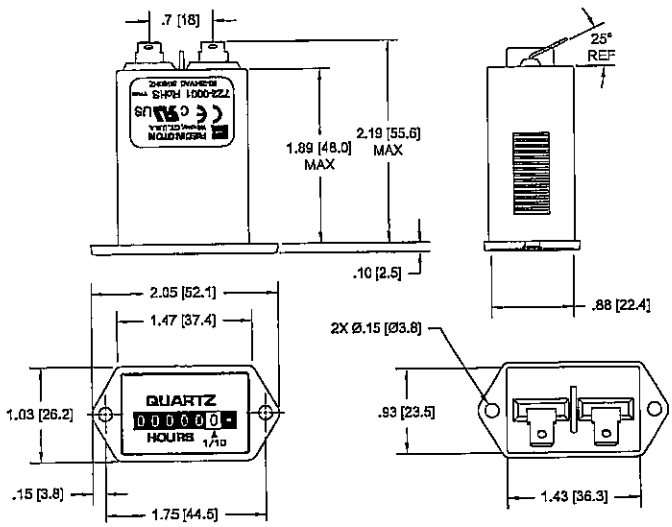
Case Material:	Black polymer
Lens Material:	Polymer
Agency Approvals:	UL/cUL Recognized, CE & RoHS Compliant, SAE & NEMA 4X, 12 Compliant
Environmental:	Totally Sealed
Front Panel:	NEMA 4X, 12 rated with optional gasket
Temperature:	-40°F to +185°F [-40°C to + 85°C]
Humidity:	95% (SAE J1378)
Vibration:	10-80 Hz. 20g max. (SAE J1378)
Shock:	55g @ 9 - 13msec (SAE J1378)

Models	Description
722-0001	2-Hole Rectangular, 90-264VAC 50/60Hz, ¼" [6.3mm] spade terminals, hours & 1/10's
722-0002	Flush-Rectangular, 90-264VAC 50/60Hz, ¼" [6.3mm] spade terminals, hours & 1/10's
722-0003	Flush-Round, 90-264VAC 50/60Hz, ¼" [6.3mm] spade terminals, hours & 1/10's
722-0004	3-Hole Round, 90-264VAC 50/60Hz, ¼" [6.3mm] spade terminals, hours & 1/10's
5003-009	NEMA 4X, 12 Gasket for Model 722-0002
5003-010	NEMA 4X, 12 Gasket for Model 722-0001
5003-011	NEMA 4X, 12 Gasket for Model 722-0004
5003-012	NEMA 4X, 12 Gasket for Model 722-0003

* All items are normally in factory stock

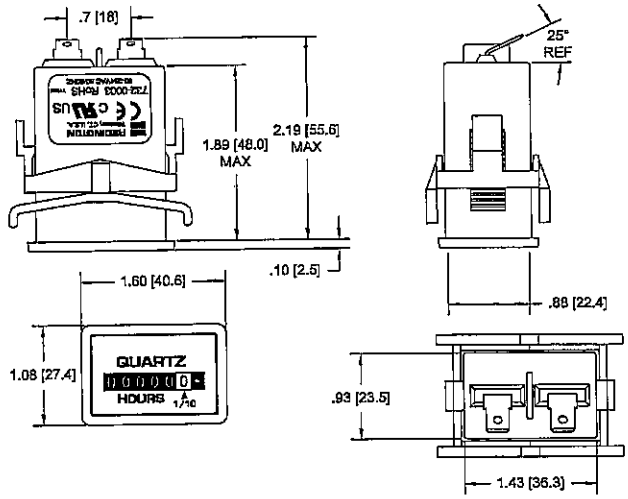
Dimensions

2-Hole



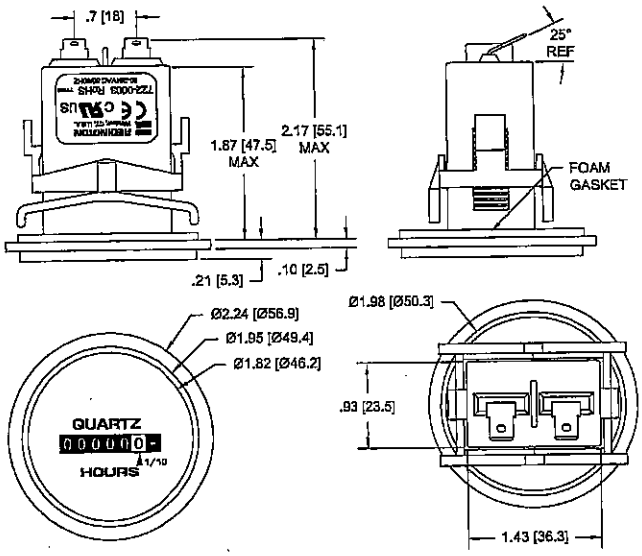
Panel Opening: 1.45" X 0.95" [36.8 X 24.1]

Flush-Rectangular



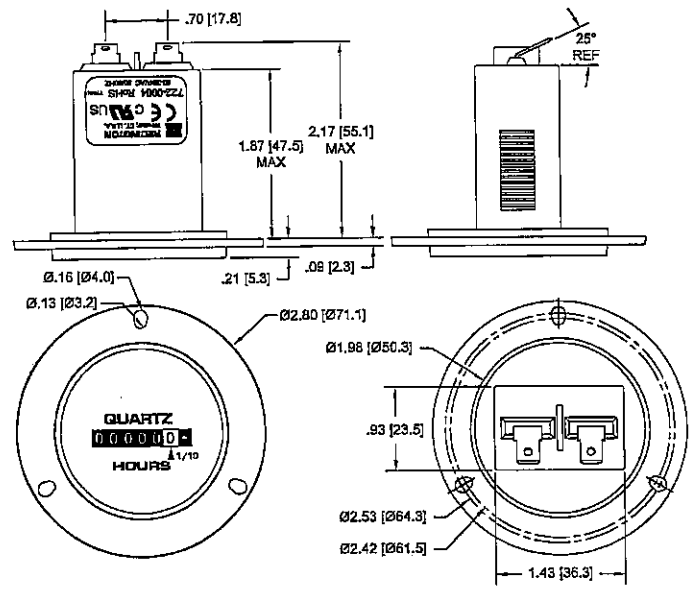
Panel Opening: 1.45" X 0.95" [36.8 X 24.1]
Panel Thickness: 0.03 to 0.63 [0.76 to 16.00]

Flush-Round



Panel Opening: 2.0" [50.6]
Panel Thickness: 0.40 [10.2] Max.

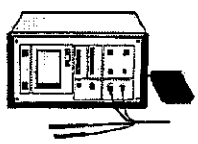
3-Hole Round



Panel Opening: 2.0" [50.6]

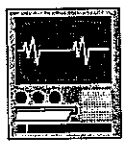
Applications

Medical Equipment

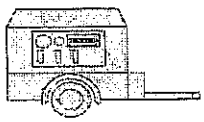


Control Panels

Test Equipment



Generators



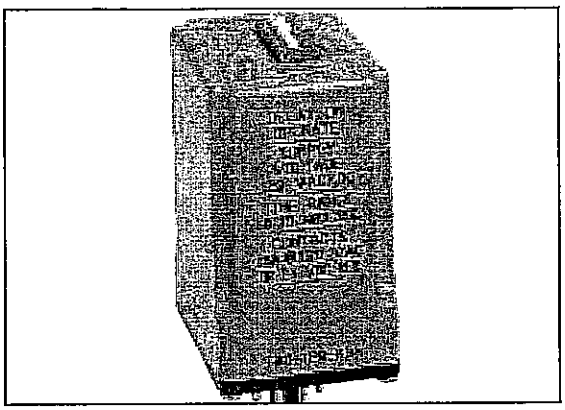
Office Equipment

TIME DELAY RELAYS

TBC SERIES

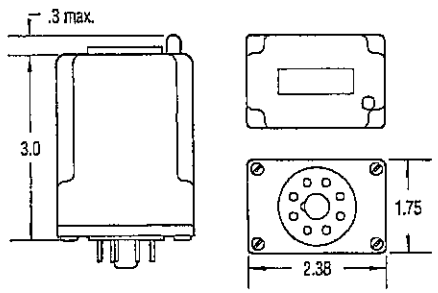
DIVERSIFIED ELECTRONICS

On-Delay DIP Switch



DIMENSIONS

INCHES



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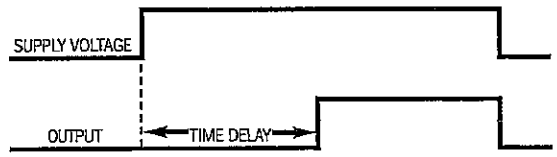
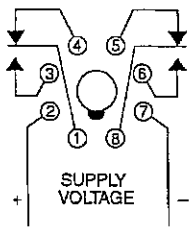


OPERATION

The time delay begins when supply voltage is applied to the input. Upon completion of the delay period, the relay energizes. Reset during or after the delay period is accomplished by removal of the supply voltage. The TBC Series will not false transfer if supply voltage is removed prior to completion of the delay period. A fast recycle time permits accurate, high speed, continuous operation.

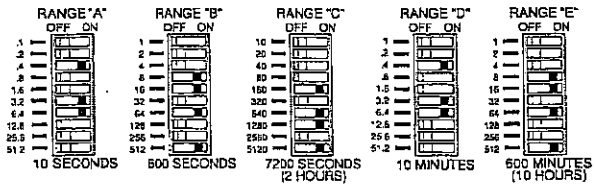
WIRING DIAGRAM



DPDT Octal Plug-in

RB-08/PF083A

DIP SWITCH OPERATION



Digital selection of the time delay is accomplished by the use of ten (10) binary switches, each marked with a time increment. The time periods, of which there are five (5) ranges, represented by each switch in the ON position is added together to obtain the desired time delay. No more trial-by-error adjustments.

ORDERING INFORMATION

TBC-XXX-X XA

CONTROL VOLTAGE
12-D = 12 Volts DC
24-A = 24 Volts AC/DC
48-D = 48 Volts DC
120-A = 120 Volts AC/DC
240-A = 240 Volts AC

TIME DELAY RANGE
A = 0.1 to 102.3 Seconds in 0.1 Sec. Increments
B = 1.0 to 1,023 Seconds in 1.0 Sec. Increments
C = 10 to 10,230 Seconds in 10 Sec. Increments
D = 0.1 to 102.3 Minutes in 0.1 Min. Increments
E = 1.0 top 1,023 Minutes in 1.0 Min. Increments

SPECIFICATIONS

SUPPLY VOLTAGE: 12, 24, 48, 120 or 240 VAC, 50/60 Hz; or DC; ±10%

TIME DELAY RANGE: See Ordering Information.

ACCURACIES:
- Setting: ±2% or ±50 milliseconds; whichever is greater
- Repeat: ±0.1% or ±8.3 milliseconds; whichever is greater

RESET TIMES
- Before Time Out: 100 milliseconds
- After Time Out: 50 milliseconds

OUTPUT RATING: 10 A @ 250 VAC or 24 VDC, resistive

TEMPERATURES
- Operate: 32° to 131°F (0° to +55°C)
- Storage: -49° to 185°F (-45° to +85°C)

FALSE TRANSFER: No

REVERSE POLARITY PROTECTED: Yes

POWER REQUIRED: 3 VA, approximately

DUTY CYCLE: Continuous

LIFE EXPECTANCY
- Mechanical: 10 million operations, minimum
- Electrical: 100,000 Operations @ rated load

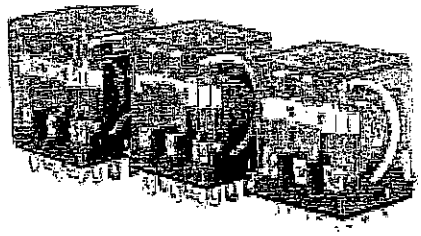
INDICATORS: LED glows when relay is energized.

ISOLATION: 1,500 volts, input/output

RH Series Compact Power Relays

Key features

- SPDT through 4PDT, 10A contacts
- Compact power type relays
- Miniature power relays with a large capacity
- 10A contact capacity
- Compact size saves space



Part Number Selection

Contact	Model	Part Number: Blade Terminal	Part Number: PCB Terminal	Coil Voltage Code (Standard Stock in bold)
SPDT 	Standard	RH1B-U ☐	RH1V2-U ☐	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH1B-UL ☐	—	
	With Check Button	RH1B-UC ☐	—	
	With Indicator and Check Button	RH1B-ULC ☐	—	
	Top Bracket Mounting	RH1B-UT ☐	—	
	With Diode (DC coil only)	RH1B-UD ☐	RH1V2-UD ☐	DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH1B-ULD ☐	—	**DC12V**, **DC24V**, DC48V, DC110V
DPDT 	Standard	RH2B-U ☐	[redacted]	AC6V, AC12V, **AC24V**, **AC110-120V**, **AC220-240V** DC6V, **DC12V**, **DC24V**, DC48V, DC100-110V
	With Indicator	RH2B-UL ☐	RH2V2-UL ☐	
	With Check Button	RH2B-UC ☐	—	
	With Indicator and Check Button	RH2B-ULC ☐	—	
	Top Bracket Mounting	RH2B-UT ☐	—	
	With Diode (DC coil only)	RH2B-UD ☐	RH2V2-UD ☐	DC6V, **DC12V**, **DC24V**, DC48V, DC100-110V
	With Indicator and Diode (DC coil only)	RH2B-ULD ☐	RH2V2-ULD ☐	
3PDT 	Standard	RH3B-U ☐	RH3V2-U ☐	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH3B-UL ☐	RH3V2-UL ☐	
	With Check Button	RH3B-UC ☐	—	
	With Indicator and Check Button	RH3B-ULC ☐	—	
	Top Bracket Mounting	RH3B-UT ☐	—	
	With Diode (DC coil only)	RH3B-UD ☐	—	DC6V, DC12V, DC24V, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH3B-ULD ☐	—	
4PDT 	Standard	RH4B-U ☐	RH4V2-U ☐	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH4B-UL ☐	RH4V2-UL ☐	
	With Check Button	RH4B-UC ☐	—	
	With Indicator and Check Button	RH4B-ULC ☐	—	
	Top Bracket Mounting	RH4B-UT ☐	—	
	With Diode (DC coil only)	RH4B-UD ☐	RH4V2-UD ☐	DC6V, DC12V, DC24V, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH4B-ULD ☐	—	

⚠ PCB terminal relays are designed to mount directly to a circuit board without any socket.

Ordering Information
When ordering, specify the Part No. and coil voltage code:
(example) **RH3B-U** **AC120V**
Part No. — Coil Voltage Code

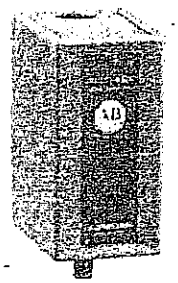
Description

Bulletin 836 Pressure Controls are designed for general industrial use to control and detect pressure. Allen-Bradley Bulletin 836 Pressure Controls can be used in pneumatic and hydraulic systems. Pressure controls use copper alloy or stainless steel bellows. The design and high quality components provide long life operation with air, water, oil, non-corrosive liquids, vapors, gases, and some corrosive liquids or gases. Pressure controls feature snap action precision switches equipped with silver contacts. The straight in-line and relatively friction-free construction provides accurate and consistent operation regardless of the angle at which the controls are mounted. Pressure controls are designed for easy adjustment of both trip and reset pressures. Allen-Bradley Bulletin 836 Pressure Controls are used in many types of industries and applications. They can be used to control pneumatic systems, maintaining preset pressures between two values. Pressure controls can be used to detect overpressures of gases or liquids to protect machines, processes, and personnel. They can also be used to detect low pressures to protect equipment from loss of coolants and lubrication. Bulletin 836 Pressure Controls are offered in a variety of styles to meet a wide range of applications. The devices are available in Type 1, 4 & 13, 4X, 7 & 9 and 4 & 13 combined and Open Type without enclosure for panel mounting. Pressure controls have a wide variety of contact modifications to meet most control circuit requirements. The controls have adjustable pressure ranges from 30 in. mercury vacuum...900 psi with corresponding differentials. Accessories and modifications are available to tailor the device to meet most application requirements.

Applications

- Air Compressors
- Compressed Air Monitor Systems
- Liquid Level Control
- Vacuum Transfer Systems
- High Pressure Alert
- Low Pressure Alert
- Monitor Low and High Pressure

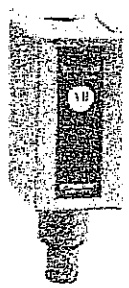
Style A — Small Size, Internal Copper Alloy Bellows



Style A

- Independently adjustable range and differential
- 7/16-20 SAE flare for 1/4 in. copper tubing connection
- Adjustable Operating Range — 30 in. mercury vacuum...375 psi
- Maximum Line Pressure — up to 750 psi
- Occasional Surge Pressure — up to 850 psi

Style C — Wider Ranges, External Bellows



Style C

- Independently adjustable range and differential
- 1/4 in N.P.T. female pipe connection
- 3/8 in N.P.T. female pipe connection (836-C1 and 836-C1A only)

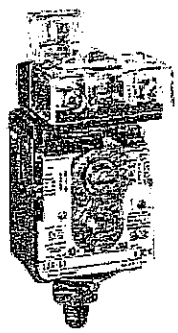
Copper Alloy Bellows

- Adjustable Operating Range — 30 in. mercury vacuum...900 psi
- Maximum Line Pressure — up to 1300 psi
- Occasional Surge Pressure — up to 1600 psi

Type 316 Stainless Steel Bellows

- Adjustable Operating Range — 30 in. mercury vacuum...375 psi
- Maximum Line Pressure — up to 650 psi
- Occasional Surge Pressure — up to 650 psi

Refrigeration Controls - See page 13-17



Style H

- High Pressure Refrigeration Controls

Style L

- Low Pressure Refrigeration Controls

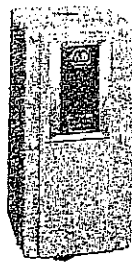
Style P

- High Pressure Definite Purpose Controls

Note: psi = pounds per square inch gauge pressure

Pressure Controls

Style C External Bellows — Copper Alloy



Style C External Bellows — Copper Alloy, Type 4 & 13

Style C External Bellows — Copper Alloy, Type 1 With Pilot Light Option

Style C External Bellows — Copper Alloy Bellows* With 1/4 in. N.P.T. Female Pipe Connection

Standard Pressure Controls shipped from the factory are set at the maximum operating range and minimum differential.

Pressure Specifications				Enclosure Type		
Adjustable Operating Range (in. Hg Vacuum to psi)†	Adjustable Differential (psi) (Approximate Mid-Range Values)	Maximum (psi)		Open Type (Without Enclosure)	Type 1	Type 4 & 13
		Line Pressure	Occasional Surge Pressure‡	Cat. No.	Cat. No.	Cat. No.
12 in. Vacuum...8➢	0.2...2.5§	25	30	836-C1	836-C1A	—
30 in. Vacuum...10	0.4...6§	65	75	836-C2	836-C2A	836-C2J
0.8...30	0.4...6	80	80	836-C3	836-C3A	836-C3J
30 in. Vacuum...45	1...12§	175	190	836-C4	836-C4A	836-C4J
2...80	1...12	190	210	836-C5	836-C5A	836-C5J
30 in. Vacuum...100	2...25§	300	375	836-C6	836-C6A	836-C6J
4...150	2...25	300	375	836-C7	836-C7A	836-C7J
6...250	4...45	500	650	836-C8	836-C8A	836-C8J
35...375	6...80	900	1200	836-C9	836-C9A	836-C9J
50...500	12...115	1300	1600	836-C10	836-C10A	836-C10J
50...650	16...115	1300	1600	836-C11	836-C11A	836-C11J
200...900	25...115	1300	1600	836-C12	836-C12A	836-C12J

Style C External Bellows — Copper Alloy Bellows* With 1/4 in. N.P.T. Female Pipe Connection

Standard Pressure Controls shipped from the factory are set at the maximum operating range and minimum differential.

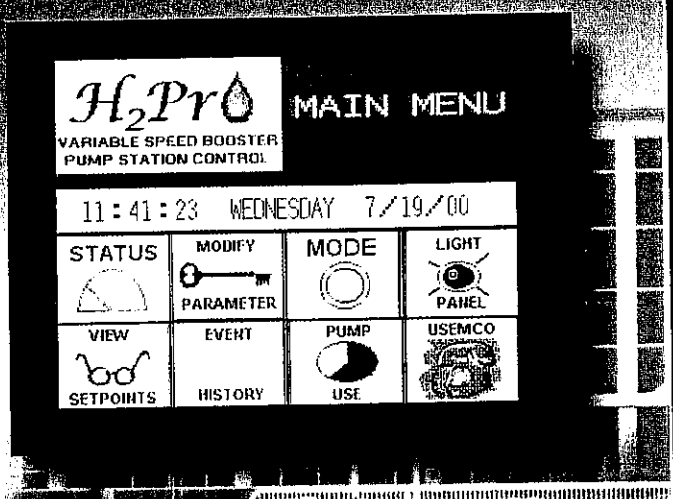
Pressure Specifications				Enclosure Type	
Adjustable Operating Range (in. Hg Vacuum to psi)†	Adjustable Differential (psi) (Approximate Mid-Range Values)	Maximum (psi)		Type 4X	Type 7 & 9 and 4 & 13≑
		Line Pressure	Occasional Surge Pressure‡	Cat. No.	Cat. No.
12 in. Vacuum...8➢	0.2...2.5§	25	30	—	—
30 in. Vacuum...10	0.4...6§	65	75	836-C2S	836-C2E
0.8...30	0.4...6	80	80	836-C3S	836-C3E
30 in. Vacuum...45	1...12§	175	190	836-C4S	836-C4E
2...80	1...12	190	210	836-C5S	836-C5E
30 in. Vacuum...100	2...25§	300	375	836-C6S	836-C6E
4...150	2...25	300	375	836-C7S	836-C7E
6...250	4...45	500	650	836-C8S	836-C8E
35...375	6...80	900	1200	836-C9S	836-C9E
50...500	12...115	1300	1600	836-C10S	836-C10E
50...650	16...115	1300	1600	836-C11S	836-C11E
200...900	25...115	1300	1600	836-C12S	836-C12E

* Copper alloy bellows may be used on water or air, and other liquids or gases not corrosive to this alloy.
† For applications where settings approach 0 psi, select a control that has an adjustable range that goes into vacuum.
‡ Transients (pulses) can occur in a system prior to reaching a steady-state condition. Surge pressures within published values generated during start-up or shut-down of a machine or system, not exceeding 8 times in a 24 hour period, are negligible.
§ To determine differential in inches of mercury vacuum multiply value in table by 2.036 (or approximately 2).
≑ The combined Type 7 & 9 and 4 & 13 Hazardous Gas and Dust service enclosure is supplied with special gasket and O-ring seal to diminish/exclude moisture, fluids, and dust from entering the enclosure. Enclosures rated 7 & 9 only are not designed to restrict moisture from entering the enclosure, which is common to outdoor service. Enclosure is Rated for the Following Environments:
CLASS I Groups C,D
CLASS II Groups E,F,G
CLASS III
➢ With 3/8 in. N.P.S.F. female pipe connection.

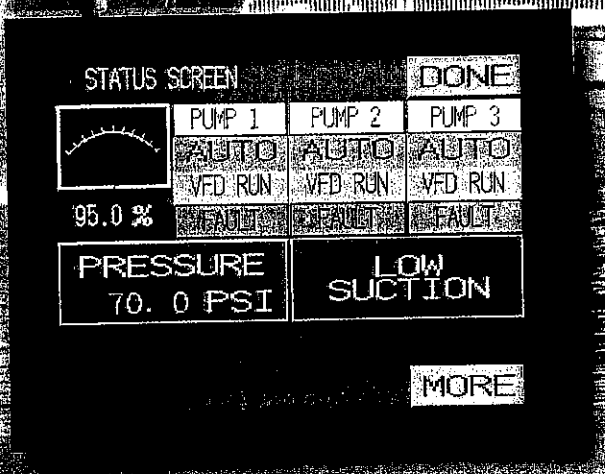
USEMCO

H_2ProO®

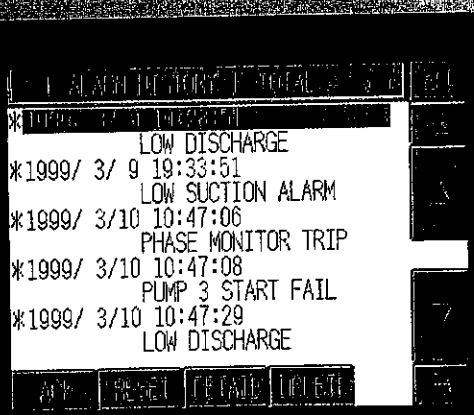
Variable Speed Touch Screen Pump Controller



Screen navigation designed for field personnel. Manuals are not necessary to make changes in the system or record data.



Instantly check the parameters and condition of the entire system or individual pumps. Discharge, Suction Pressures; pump speeds, and flow events.



Keeps the operator informed of alarms and other events such as high flow pump exercise cycles, and tests. As many as ninety-nine events can be displayed.

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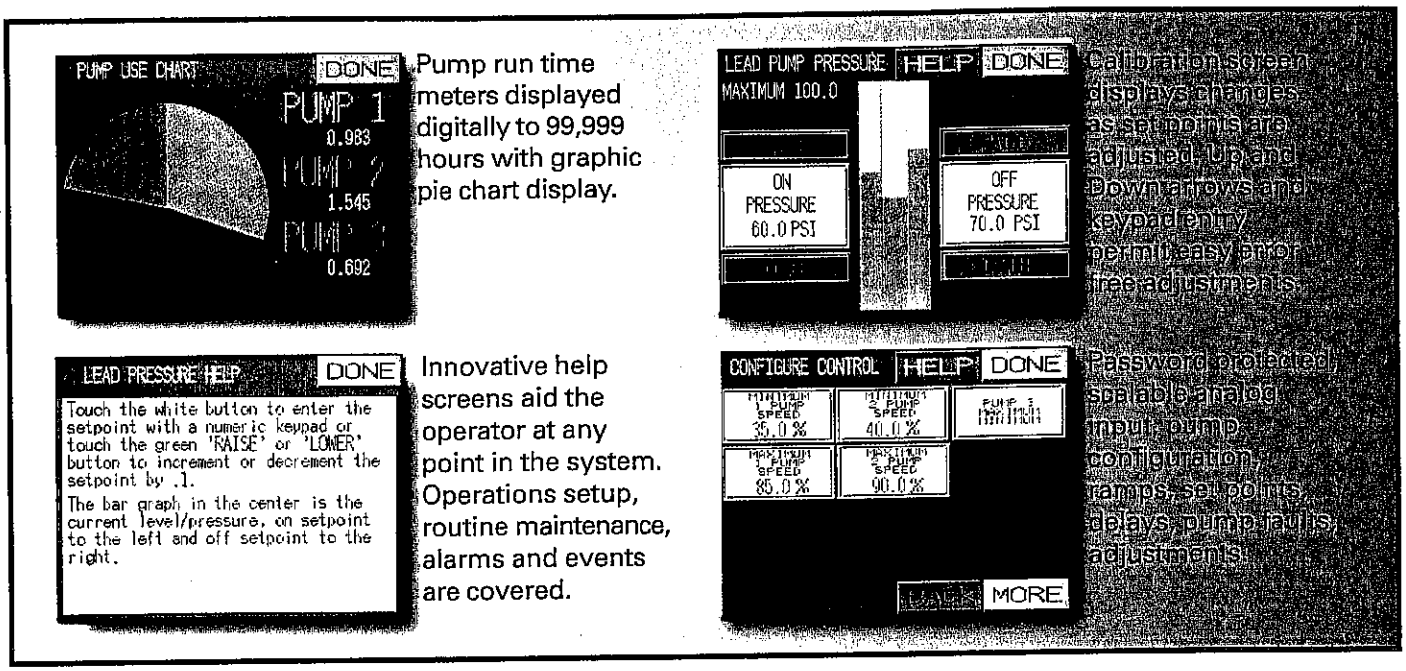


Features:

- UL Approved
- User enabled clock/calendar for time based control
- Alarm relays for lamp or horn
- Dry Telemetry Contacts
  - Low Suction / No Flow
  - High Discharge
  - Pumps Failed
  - Common Alarm
- Password Protected
- High and Low Level Alarms and Timers
- Pump On, Off and Start Fail Timers
- Minimum Run Timers
- Low Suction Pressure Alarm and Timer

Factory/Field Configuration

- Suction Transducer (4-20 mA)
- Flow Meter (4-20 mA or pulse input)
- Remote Transducer
- Suction pressure switch or no flow switch
- SCADA ready
- Scaling for Discharge, Suction Transducers and Flow Meter
- Selectable Pump Alternating Sequence
  - Every Start
  - Every 24 Hours
  - Manual
- Jockey Pump Configuration
- High Capacity Pump Configuration
  - Weekly Exercising
  - Run during low suction
  - Service pumps disabled during run

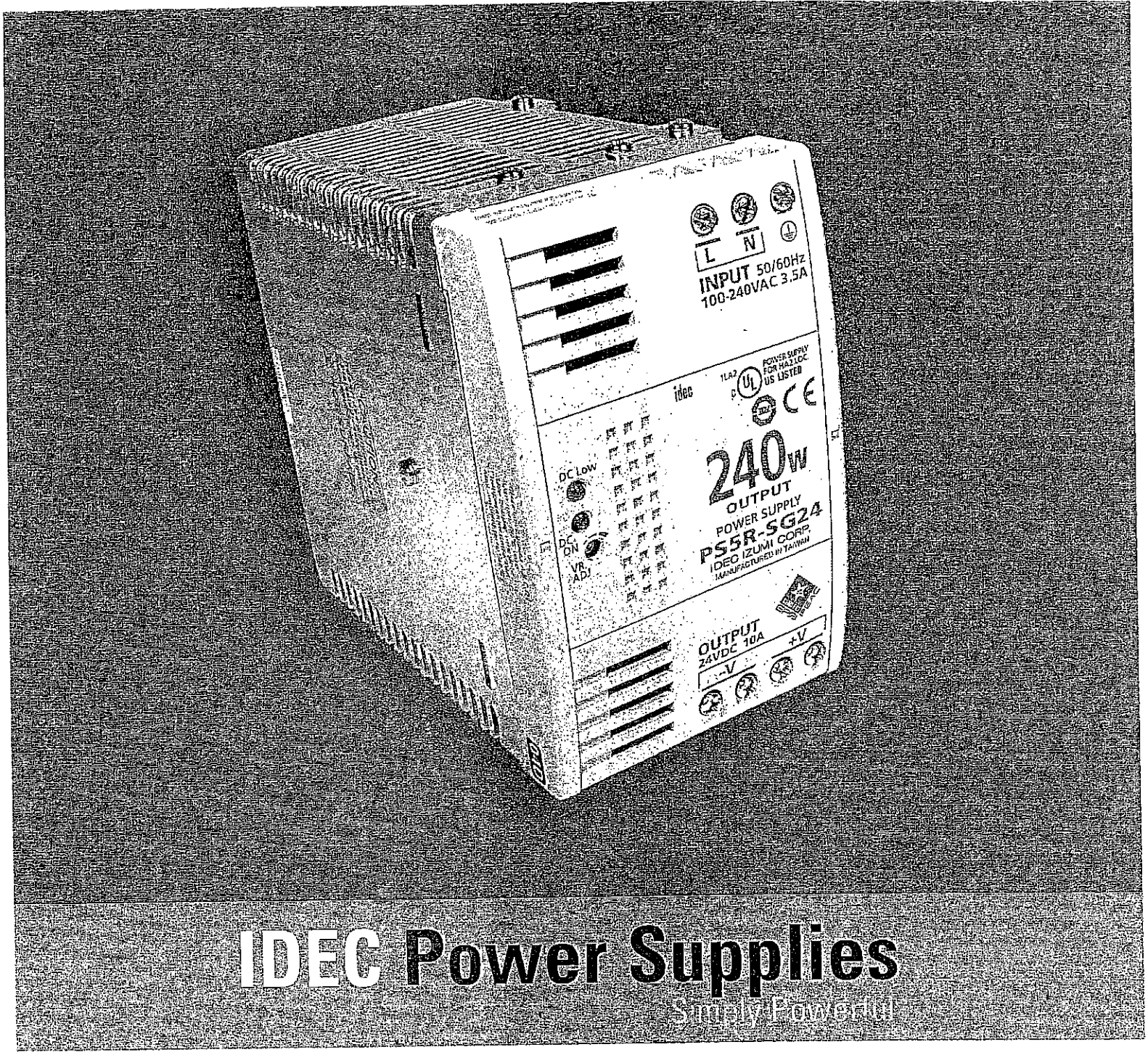
Touch Screen Display

- Discharge Pressure
- Suction Pressure
- Pump Run Times
- Flow
- Time Delays
- Alarms
- Set Points

USEMCO®

P.O. Box 550,
Tomah, Wisconsin 54660
Phone: 608-372-5911
Fax: 608-372-5016
www.usemco.com

Represented By:



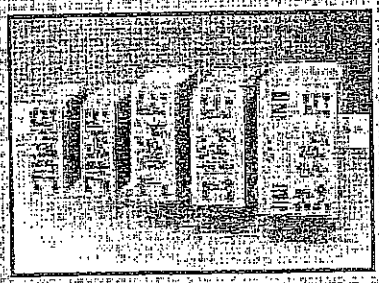
IDEC Power Supplies

Simply Powerful

Smart Products. Simple Solutions.

idec

Slim Line Key Features



- Lightweight and Compact in size
- Wide Power Range: 30W – 240W
- Universal Input:
  30W to 90W: 85-264V AC/100-370V DC
  120W and 240W: 85-264V AC/100-350V DC
- Power Factor Correction (EN61000-3-2) for 60W to 240W
- Meets SEMI F47 Sag Immunity (120W & 240W only)
- Approved for Class 1, Div. 2 Hazardous Locations
- Overcurrent protection, auto-reset
- Overvoltage protection, shut down
- Spring-up Screw Terminal type, IP20
- DIN rail or Panel Surface Mount
- Approvals:
  CE Marked
  TUV
  c-UL, UL 508
  UL 1310 (PS5R-SC, -SD)
  UL 1604
  EN 50178:1997
  LVD: EN60950:2000
  EMC Directive EN61204-3:2000
  (EMI: Class B, EMS: Industrial)

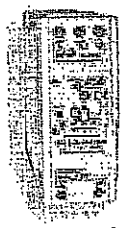
PS5R Slim Line

30 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-SC12	12V DC	2.5A
PS5R-SC24	24V DC	1.3A

60 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-SD24	24V DC	2.5A



90 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-SE24	24V DC	3.75A

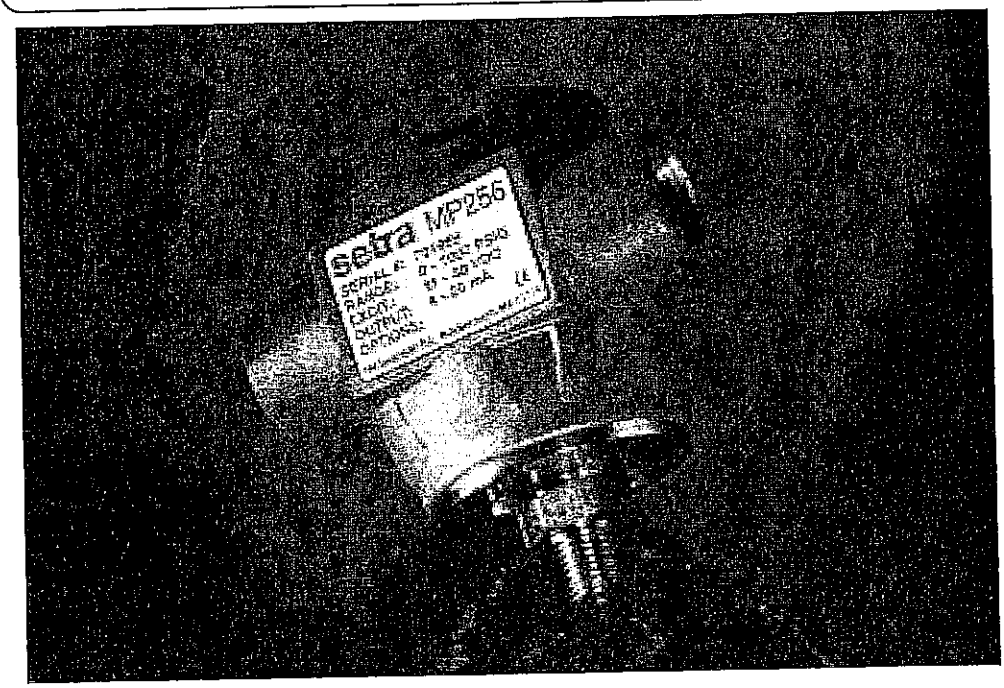
120 Watt Power Supply

Part Number	Rated Voltage	Rated Current
PS5R-SF24	24V DC	5A

Model 256

Gauge Pressure Transducer

Ranges: 0-2 to 0-10000 PSI
0-1.6 to 0-700 BAR
Corrosive Liquids or Gases



Setra's Model 256 industrial pressure transducer is one of the most rugged and reliable sensors available. The Model 256 is packaged in a die-cast aluminum enclosure that is specifically designed for NEMA4/IP65 service. Setra's robust capacitive design is resistant to environmental effects, such as shock, vibration, temperature and EMI/RFI. Setra's all stainless steel sensing element does not require isolation from corrosive media.

Superior mechanical and thermal stability is achieved through Setra's patented variable capacitance sensor. Its fundamentally simple design features an insulated electrode plate fastened to the center of the sensor diaphragm, which forms a variable capacitor. As pressure increases or decreases, the capacitance changes. This change in capacitance is detected and converted to a linear analog signal by Setra's custom ASIC based circuit, producing an output signal proportional to applied pressure.

Available in a wide variety of gauge pressure ranges, the 256 also features adjustable potentiometers for zero and span settings.

Only 3.6" high x 4.0" wide, the Model 256 is designed for compact installations. The removable cover provides easy access to the internal terminal strip for wiring. Installation is quick and easy with 1/2 inch internal threaded conduit ports for electrical termination.

PSI Pressure

Ranges	Proof Pressure	Burst Pressure
0-2	4	250
0-5	10	250
0-10	20	500
0-25	100	500
0-50	150	750
0-100	300	1000
0-250	500	2000
0-500	1000	3000
0-1000	2000	5000
0-3000	4500	7500
0-5000	7500	10000
0-10000	12000	12500

Bar Pressure

Ranges	Proof Pressure	Burst Pressure
0-1.6	6	40
0-4	10	50
0-6	18	60
0-10	30	80
0-16	32	130
0-25	50	170
0-40	80	240
0-60	120	300
0-100	200	400
0-250	380	550
0-400	600	800
0-700	800	1350

NOTE: Setra quality standards are based on ANSI-Z540-1.
The calibration of this product is NIST traceable.
U.S. Patent nos. 3859575, 4054833

Applications

- Process Control
- Chemical Processing
- Agricultural Irrigation Systems
- Natural Gas Pipeline Monitoring
- Grain Processing
- Industrial Pressure Monitoring

Benefits

- Low Cost
- High Accuracy
- NEMA 4/IP65
- Wide Operating Temperature Range
- Compatible with a Wide Range of Gases or Liquids
- Corrosive Resistant All Stainless Steel Wetted Parts
- Choice of Voltage or Current Output
- Operates on Low Cost Unregulated Power Supply
- Meets CE Conformance Standards

When it comes to a product to rely on - choose the Model 256. When it comes to a company to trust - choose Setra - an ESOP (Employee Owned) Company.

ISO 9001 Certified

Visit Setra Online:
http://www.setra.com

Setra

800-257-3872

159 Swanson Rd., Boxborough, MA 01719/Telephone: 978-263-1400/Fax: 978-264-0292

Model 256 Specifications

Performance Data

	Ranges 25 PSI and Higher	Ranges Less Than 25 PSI
Accuracy RSS* (at constant temp)	±0.13% FS	±0.25% FS
Non-Linearity, BFSL	±0.10% FS	±0.22% FS
Hysteresis	0.08% FS	0.10% FS
Non-Repeatability	0.02% FS	0.05% FS
Thermal Effects**		
Compensated Range °F	-4 to +176	-4 to +176
Compensated Range °C	-20 to +80	-20 to +80
Zero Shift %FS/100°F	±1.0	±2.0
Zero Shift %FS/50°C	±0.9	±1.8
Span Shift %FS/100°F	±1.5	±1.5
Span Shift %FS/50°C	±1.4	±1.4
Long Term Stability	0.5% FS/YR	0.5% FS/YR
Warm-up Shift	±0.1% FS total	±0.1% FS total

*RSS of Non-Linearity, Hysteresis and Non-Repeatability.
**Units calibrated at nominal 70°F. Maximum thermal error computed from this datum.

Environmental Data

Temperature	
Operating °F (°C)	-40 to +260 (-40 to +125)
Storage °F (°C)	-40 to +260 (-40 to +125)
Shock	200g
Vibration	20g
Environmental Protection	NEMA 4/IP65

*Operating temperature limits of the electronics only.
Pressure media temperatures may be considerably higher or lower.

Physical Description

Case	Die-Cast Aluminum
Electrical Connections	Two 1/2" internal conduit ports
Pressure Fitting	1/4" NPT external
Weight	13.4 ounces

Pressure Media

Liquids or gases compatible with 17-4 PH Stainless Steel.*

*Note: Hydrogen not recommended for use with 17-4 PH Stainless Steel.

Specifications subject to change without notice.
Application of some available options may impact standard specifications.

Electrical Data (Voltage)

Circuit	3-Wire (Exc, Out, Com)
Excitation	9 to 30 VDC
Output*	0.1-5.1 VDC**
Output Impedance	100 Ohms
Power Consumption	0.15 Watts

*Calibrated into a 50K ohm load, operable into a 5000 ohm load or greater.
**Zero output factory set to within ±25 mV.
**Span (Full Scale) output factory set to within ±50 mV.

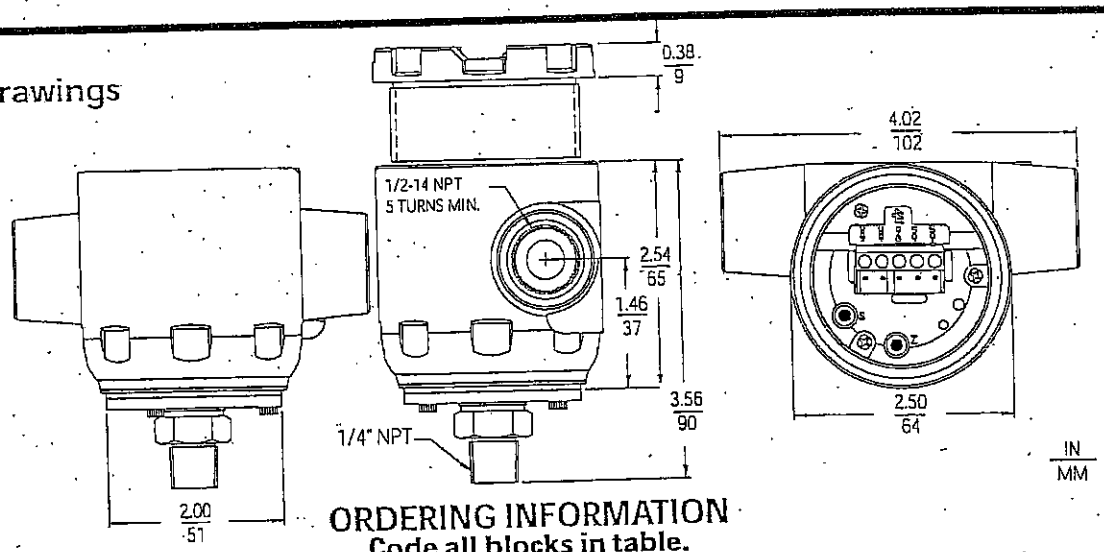
Electrical Data (Current)

Circuit	2-Wire
Output*	4-20 mA**
External Load	0 to 800 Ohms

Minimum supply voltage (VDC) = 9 + 0.02 x (Resistance of receiver plus line).
Maximum supply voltage (VDC) = 30 + 0.004 x (Resistance of receiver plus line).

*Calibrated at factory with a 24 VDC loop supply voltage and a 250 ohm load.
**Zero output factory set to within ±0.08 mA.
**Span (Full Scale) output factory set to within ±0.16 mA.

Outline Drawings



ORDERING INFORMATION

Code all blocks in table.

Example: Part No. 2561500PG2M11 for a 256 Transducer, 0 to 500 PSIG Range, 1/4" NPT Pressure Fitting, 4-20 mA Output.

2 5 6 1 — [ ][ ][ ][ ] — G — [ ][ ] — [ ][ ] — [ ]

Model
2561 = 256

Ranges

002P = 2 PSI	1R6B = 1.6 Bar
005P = 5 PSI	004B = 4 Bar
010P = 10 PSI	006B = 6 Bar
025P = 25 PSI	010B = 10 Bar
050P = 50 PSI	016B = 16 Bar
100P = 100 PSI	025B = 25 Bar
250P = 250 PSI	040B = 40 Bar
500P = 500 PSI	060B = 60 Bar
600P = 600 PSI	100B = 100 Bar
10CP = 1000 PSI	160B = 160 Bar
30CP = 3000 PSI	250B = 250 Bar
50CP = 5000 PSI	400B = 400 Bar
10KP = 10000 PSI	700B = 700 Bar

Pressure
G = Gauge

Pressure Fitting
2M = 1/4" NPT (M)
4M = 1/2" NPT (M)

Output
11 = 4-20 mA
22 = 0.1-5.1 VDC

Optional
C = Calibration Certificate

Please contact factory for versions not shown.

SSP256 Rev.D 07/11/00

159 Swanson Road, Boxborough, MA 01719/Tel: 978-263-1400;
Toll Free: 800-257-3872; Fax: 978-264-0292; Email: sales@setra.com

ELECTRICAL NOTES PAGE

Job Name: Fountain, CO.

Job #7646

All conduits in station to be:

Liquidtight flexible non-metallic.

Manufacturing Notes:

The pump station shall be UL labeled as a packaged pumping system. The label shall be attached to the piping of the station. All conduit, wire, and electrical components within the station shall be UL listed or recognized and installed according to the NEC.

Control panel ships loose with the station for customer mounting and connection.

Control panel shall be U.L. 508 Listed.

All control wiring in the panels shall be 16-gauge stranded MTW.

All analog instrument wiring shall be 18-gauge shielded cable.

Low voltage instrument wiring shall not be run in the same raceway (wire-way or conduit) with AC power wiring.

Wire numbers required.