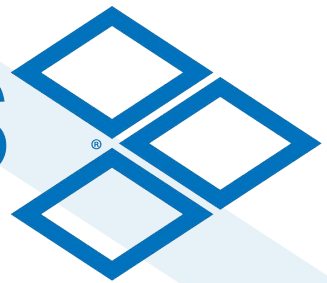


EFI REFERENCE NO: 93134
RAINBOW, CALIFORNIA (RMWD)
WEST LILAC PUMP STATION
WATER-SHED BOOSTER PUMP STATION
RE-SUBMITTAL 8-17-2023

EFI-SOLUTIONS

efi-solutions.com



EFI-SOLUTIONS

1311 N Maple St
PO Box 723
Centralia, IL 62801
(618) 533-1351



WARRANTY

EFI-SOLUTIONS (referred hereafter as EFI) warrants, to the original user, each product of its manufacture to be free from defects in material and workmanship for the period of twelve (12) months from the time the station is placed in operation for beneficial use, or twelve (12) months following the initial start-up of the station, or eighteen (18) months after delivery or twenty-four (24) months from notice of manufacturer completion, whichever occurs first, provided the product is properly installed, maintained and operated under normal conditions according to the manufacturer's instructions.

The obligation of EFI under this warranty is limited to correction without charge of any part or parts thereof which shall upon examination disclose to the manufacturer's satisfaction to have been originally defective. Correction of such defects by repair or replacement shall constitute fulfillment of all obligations by EFI.

EFI gives no warranty on products, components or parts supplied by others for installation within EFI equipment.

EFI shall not be liable for loss, damage or expense directly or indirectly from the use of its products or from any other cause.

This warranty is conditional and does not apply to any of the following items:

- 1) Items that must be replaced because of normal usage such as pump seals, packing, grease, oil, light bulbs, etc.
- 2) Items that have been started up by persons not authorized by EFI, or that have been altered or repaired outside of the manufacturer's factory without written authorization from EFI.
- 3) Products that are not started, checked and adjusted by an authorized EFI technician within eighteen (18) months from the date of shipment, unless special written instructions have been requested and received from EFI.

The product is subject to no expressed, implied or statutory warranty other than herein set forth, and no agent, representative or distributor of EFI has any authority to alter the terms of this warranty.

DATE OF SHIPMENT

DATE OF START-UP

FACTORY START-UP SERVICES AND WARRANTY SERVICE STATEMENT

Start-up Services and Warranty Services technicians shall be performed by a qualified EFI Representative.

1. Start-up Service and Warranty Services technicians shall either be employees of EFI or an EFI Authorized Service Center. Warranty may be void if work is done during this period by an unauthorized company/individual.
2. EFI's price, as proposed/sold, includes 1 trip(s) and 1 total man day(s) for manufacture's field start-up service with instructions. Additional days & travel, if required due to factors outside this scope, will be billed at EFI Technician's on-site/travel rate: \$1,600/day plus expenses and EFI Programmer's on-site/travel rate: \$1,800/day plus expenses.
3. One of, but limited to, the following factory direct employees or authorized service center will perform service as required on the new station and any ancillary equipment, if any, as provided by EFI.

<u>EMPLOYEE NAME</u>	<u>POSITION</u>	<u>SERVICE YEARS</u>
Charles Waggoner	Service Manager	28
Bob Day	Assistant Service Manager	17
Dave Carrie	Service Technician	08
Tom Reese	Service Technician	08
Cody Keen	Service Technician	08
Scott Moore	Service Technician	06
Lincoln Dickinson	Service Technician	05
Holden Elwood	Service Technician	04
Darren Probst	Service Technician	04
Kevin Musgrave	Service Technician	02
Gilbert Dixon	Service Technician	02

Phone: (618) 533-1351 **Fax:** (618) 533-1459 **E-mail:** service@efi-solutions.com

Dan Vandelloo	EFI-Solutions	(618) 339-3481
Kevin Cates	Applied Hydro Sales	(702) 222-0857
Tim Hovda	Engineered Solutions	(317) 973-1304

4. All Start-up Service Reports shall be attested to by Technician/Representative of Owner or Engineer.
5. Service reports shall be distributed to:
 - A. Manufacturer's File.
 - B. Engineer's File.
 - C. Contractor's File.

TO WHOM IT MAY CONCERN:

RETURN OF SUBMITTAL

EFI MUST HAVE WRITTEN SUBMITTAL APPROVAL RETURNED IN ORDER TO PROCEED WITH FABRICATION. THE APPROVAL PROCESS IS VITALLY IMPORTANT.

SUCTION PRESSURE 12-73 PSI per Flow Modeling

THIS SUBMITTAL IS BASED ON THE ASSUMPTION OF _____ PSI SUCTION.

WE CANNOT CONSIDER THE JOB APPROVED, OR PROCEED WITH MATERIAL RELEASE OR BEGIN CONSTRUCTION UNTIL SUCTION PRESSURE IS VERIFIED.

RETURN TO:

**EFI-SOLUTIONS
1311 N MAPLE ST
PO BOX 723
CENTRALIA, IL 62801
or
email rbrinkmann@efi-solutions.com**

TO THE BUYER OR ENGINEER

OPERATION AND MAINTENANCE MANUALS

PLEASE NOTE THAT TWO (2) OPERATION AND MAINTENANCE CDs WILL BE FORTHCOMING AFTER THE EQUIPMENT ON THIS ORDER HAS BEEN SHIPPED, INSTALLED AND STARTED UP. IF THE SPECIFIED NUMBER DOES NOT MEET YOUR NEEDS, ADDITIONAL COPIES ARE AVAILABLE AT AN ADDITIONAL FEE PER COPY.

RESUBMITTAL

PROJECT LOCATION: RAINBOW, CALIFORNIA

PROJECT NAME: WEST LILAC PUMP STATION

EFI PROJECT NUMBER: 93134

BID ITEM NUMBER:

EFI PART NAME: WATER-SHED BOOSTER PUMP STATION

EFI PART NUMBER: 93134-B-001.

OWNER PART NAME AND/OR NUMBER: RAINBOW MUNICIPAL WATER DISTRICT

SUBMITTAL DATE: AUGUST 17, 2023

MECHANICAL SECTION

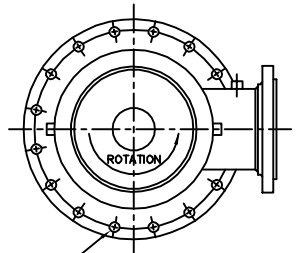
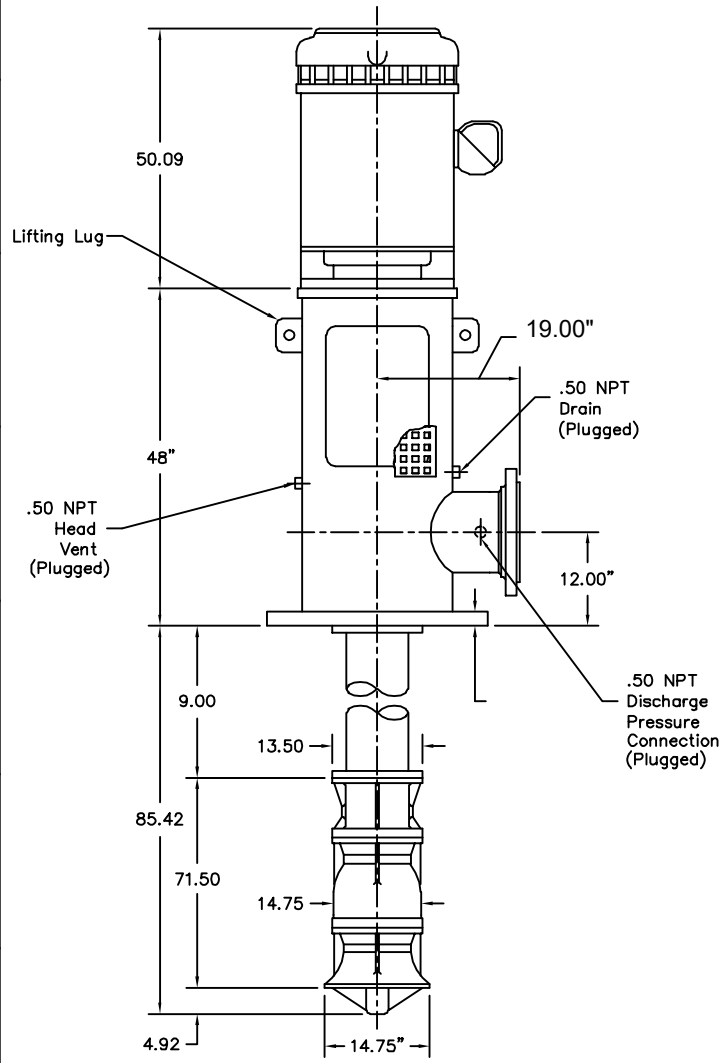
Project	West Lilac Pump Station			
	Rainbow Municipal Water District			
Location	Rainbow, California			
Engineer	Hoch Consulting			
Station Type	Water-Shed Booster Pump Station			
EFI JOB REFERENCE NO. 93134				
PLEASE REVIEW EACH COMPONENT & INITIAL IF ACCEPTABLE				
Part ID	Part Description	Long Description	Qty	INITIALS
15EMM 4 STAGE 250HP 1800RPM	FLOWSERVE 15EMM VERTICAL TURBINE PUMP	1,800 GPM @ 400 FT TDH Can Pump - Complete Pump Less Can (***Can Supplied by EFI***) NSF 61 Certification and Scope of Supply SEE FULL DESCRIPTION IN PUMP SECTION	3	
DHC HP BFV CL300 8"	DHC HP BUTTERFLY VALVE w/WORM GEAR HGO	DHC CLASS 300 FLANGED ENDS 450 PSI BI-DIRECTIONAL RATING DOUBLE OFFSET DESIGN A216 WCB BODY (6" & LARGER) A351 CF8M SS DISC (6" & LARGER) RTFE SEAT ON DISC, 17-4 SS SHAFT WORM GEAR w/HWPI	2	
DHC HP BFV CL300 12"	DHC HP BUTTERFLY VALVE w/WORM GEAR HGO	CLASS 300 FLANGED ENDS 450 PSI BI-DIRECTIONAL RATING DOUBLE OFFSET DESIGN A216 WCB BODY (6" & LARGER) A351 CF8M SS DISC (6" & LARGER) RTFE SEAT ON DISC, 17-4 SS SHAFT WORM GEAR w/HWPI	4	
DHC BFV CL125 12"	DHC BUTTERFLY VALVE w/HWGO WORM GEAR	DHC Class 150 Flanged, AWWA Double Offset Rubber Seated Butterfly Valve with 250 PSI Operating Pressure Body: A536 65-45-12 DI Disc: 316SS Seat: EPDM, Peroxide Cured Seat Retainer: 316SS Shaft: 17-4 PH SS Packing Gland: 304SS SAMBO AWWA Worm Gear Operator with Handwheel 12 mil Epoxy Interior & Exterior, RAL 5005 Blue Face to Face: AWWA C504 Short Body Flange Rating: ASME B16.1 CL 125 Flat Face Hydraulic Test: Bi-Direction Seat Leakage Test Body: 300 PSI Seat: 250 PSI Leakage Class: Zero Leakage	3	

W72AC-C09ZWXXXJ	BARD 6TON 460V 3PH 9kW HEAT BEIGE ECONOMIZER	<p>W - WALL MOUNT 72 - 6 TON CAPACITY A - AIR CONDITIONER w/RIGHT SIDE CONTROLS C - REVISION LEVEL (W42-W72) - - PLACEHOLDER C - 460 VOLT, 3 PHASE, 60 HZ 09 - KW WITH CIRCUIT BREAKER - ELECTRIC HEAT Z - (ECON-WD)FULL FLOW ECONOMIZER, ENTHALPY W - 1" MERV 2 PERMANENT FILTER X - STANDARD BEIGE, BAKED ENAMEL FINISH X - STANDARD SUPPLY OUTLET X - STANDARD COPPER/ALUMINUM COILS J - LAC AND ALARM RELAY (ALR)</p>	4	
SG5W	BARD SUPPLY AIR GRILL		4	
RFG5W	BARD RETURN GRILL W/FILTER		4	
PAD40C1AWT	PELONIS 40 PINT DEHUMIDIFIER	<p>Amperage 5.7 Application Residential Bucket Capacity 12.6 pint (US) Drain Type Gravity Drain Filter Type Washable Listing Agency Standards UL Manufacturer Warranty 3 year Maximum Noise Level 50 decibel Moisture Removal Capacity 40 Pints per Day Number of Speeds 2 Overall Depth 11.2 inch Overall Height 24.3 inch Overall Width 15.5 inch Plug Type 5-15P Voltage 115 Wattage 435 Weight 39.5 pound</p>	1	
MACROPOXY 646 COLOR: FLINT GRAY	SHERWIN WILLIAMS	EXTERIOR OF PIPE, SKID, METAL SURFACES	1	
ACROLON ULTRA COLOR: FLINT GRAY	SHERWIN WILLIAMS	PIPE AND VALVES EXTERIOR TOP COATING	1	
CE100740352	3M SCOTCHKOTE 134 RESIN	FUSION-BONDED EPOXY COATING - INTERIOR PIPE COATING	1	
UL XP-461 TDS	ULTIMATE LININGS	FLOOR COVERING	1	
UL KG 9000 FS TDS	ULTIMATE LININGS	DOOR AND DOOR FRAMES	1	
232.34	WIKA SS GAUGE	0-160PSI & 370'	4	
232.34	WIKA SS GAUGE	0-600PSI & 1400'	4	

GRATE 1515 1"THICK	MOLDED GRATING 1.0" THICK 1.5"x1.5"MECH		2	
815800	KONETA RUBBER DRAINAGE RUNNER 36" WIDE		1	
OZ1PBT	OZ LIFTING TROLLEY, 2000 LB	Load Capacity: 2000 lb. Fits Beam Height: 2-61/64" Fits Beam Flange W: 2-1/2" to 8" Min. Radius Curve: 39" Wheel Tread Dia.: 3" Wheel Material: Steel Head Room To Bail: 5-5/16" Standards: ANSI B30.10 / CE / AS 1418.2	1	
38EV05	DAYTON MANUAL CHAIN HOIST 2000LB CAPACITY	2000 LB CAPACITY, 10 FT LIFT, 1-7/64" HOOK OPENING	1	
8039T41	MCMASTER STEEL ROLLING PLATFORM LADDDER	Tread: Perforated Shape: Flat Height (A): 7'10" X Width (B): 29" X Depth (C): 40" Platform Height (D): 4'2" X Width (E): 24" Depth (F): 9 1/2" Tread: Perforated Maximum Climbing Height: 4'2" Number of Steps: 5 Capacity: 450 lbs. Ground Clearance Height: 4" Material: Powder-Coated Steel Color: Gray Wheel Configuration: Four Swivel Casters Brake Type: Weight Actuated Specifications MetL ANSI A14.7, OSHA Standards, CAL- OSHA Standards RoHS:RoHS 3 (2015/863/EU) compliant	1	
EW-50VM	BILCO VERSAMOUNT ACCESS HATCH	3' 3-3/8" X 3' 3-3/8" ALUMINUM VERSAMOUNT 11GA ALUMINUM COVER 11GA ALUMINUM FRAME 4" HIGH FRAME FOR CURB MOUNT REINF FOR 40PSF LIVE LOAD SPRING LATCH W/PADLOCK HASPS IN & OUT MILL FINISH COVER & FRAME ZINC PLATE STEEL & COMPOSITE HARDWARE BILCO PART# 0V0950001	3	

EFI FACTORY BUILT BUILDING	SEE MECHANICAL DESIGN DETAIL DRAWING NO. 93134-B-001. AND 93134-B-002. FOR STATION DIMENSIONS AND ORIENTATION			
WHITE FRP INTERIOR	NUDO		1	
WALSTONE	FULLERTON FINISH SIDING SYSTEM	COLOR OF MATERIAL - PLEASE VERIFY COLOR CHOICE AMBER LITE #A with WOODWARD BEIGE RESIN per RMWD	1	
MERIDIAN	MCELROY METAL ROOFING SYSTEM	GAUGE OF MATERIAL: 24 GA COLOR OF MATERIAL: PLEASE VERIFY COLOR CHOICE TO BE SURREY BEIGE per RMWD	1	
6070 DOOR/FRAME	6070 DOUBLE DOOR/FRAME	RIGHT HAND REVERSE ACTIVE - LEFT SIDE INACTIVE DOOR COLOR _____ ***Note to EFI SHOP - Door to have #YALE6100PANICEXIT panic bar installed on Right Side Active and Yale BAU546F Classroom Lever installed on Exterior*** GALVANEAL METAL DOOR(16GA), SCREW INSTALLED TOP CAP, NO WINDOW FRAME: 1-PIECE FRAME DRIP CAP PLEASE VERIFY COLOR CHOICE: TO BE SURREY BEIGE per RMWD	2	
3070 DOOR/FRAME	3070 SINGLE DOOR/FRAME	LEFT HAND REVERSE ACTION - INTERIOR MOUNTED DOOR - TO BE PAINTED WHITE ***Note for EFI SHOP- Door to have PART ID #24X24LITE kit installed, #YALE6100PANICEXIT panic bar installed"E-Room Side" and Yale BAU546F Classroom Lever installed"Pump Room Side" GALVANEAL METAL DOOR(16GA), SCREW INSTALLED TOP CAP, NO WINDOW FRAME: 1-PIECE FRAME DRIP CAP PLEASE VERIFY COLOR CHOICE: TO BE WHITE	1	
RECOMMENDED RIGGING/LIFT PLAN - MAIN BUILDING				
RECOMMENDED RIGGING/LIFT PLAN - 3:12 ROOF				
MECHANICAL DESIGN DETAIL DRAWING 93134-B-001.3				
MECHANICAL DESIGN DETAIL DRAWING 93134-B-002.3				

REVISIONS									
REV.	DESCRIPTION	EDC No	DATE	REF. ZONE	REV. D.	CRD.	APP.	P.L.	



Holes Match 20" X 150# ANSI Flange, Flange Holes Straddle Discharge ϕ

TOP VIEW

MOTOR

250	H.P.	Vertical	SOLID	Shaft
1800	R.P.M.	3	Phase	60
			Cycle	460
			Volts	
WP1	Enclosure	Mfg.	GE	

DISCHARGE HEAD - TYPE LF

LF	Discharge Head
12"	300# RF Discharge Flange-holes straddle vertical ϕ
Shaft Seal	MECHANICAL SEAL

COLUMN

12"	Column Pipe
2.19"	Diameter Open Lineshaft

PUMP

4	Stage	15EMM	Bowl	ENCLOSED	Impeller
---	-------	-------	------	----------	----------

MATERIALS

Bowls	CAST IRON
Impellers	BRONZE
Pump Shaft	416 S.S.
Bowl Brgs.	BRONZE
Head	STEEL

Driver Weight 1800 lbs. Pump Weight 692 lbs.
Pump will be shipped Assembled

CUSTOMER: ENGINEERED FLUID INC. END USER: RAINBOW MUNICIPAL WATER DIST.	FLOW: 1800 GPM HEAD: 400 FT RPM: 1775 S.G.: 1.0
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STATUS OF APPROVAL		CUSTOMER INFORMATION		OPERATING CONDITIONS	
Draft		ORDER NO. TTN-74250		DRAWN BY JLM DATE 7/11/23	
DRAWN BY JLM		DATE 7/11/23		DWG TITLE	
GENERAL ARRANGEMENT					
SIZE A2	DRAWING NO. TTN-JLM-74250			REV. A	
SCALE		UNITS INCHES	SHEET NO.		n/p



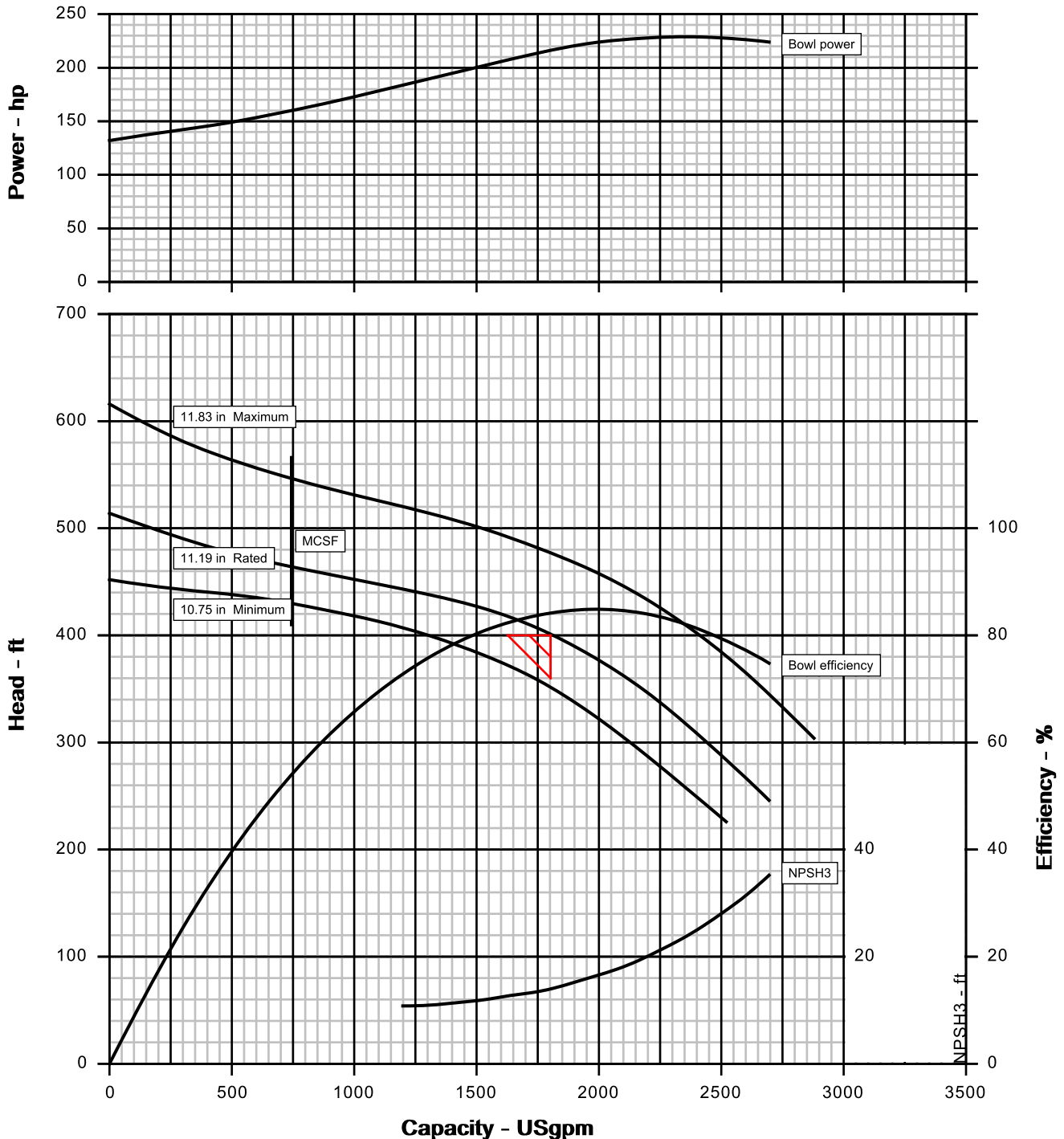
Pump size & type / Stages : 15EMM / 4
 Based on curve no. : EC-2377
 Impeller diameter : 11.19 in

Customer : ENGINEERED FLUID INC
 Item number : EFI Project #93134
 Service : -
 Flowserve reference : 4551407220
 Date : July 11, 2023

Capacity : 1,800.0 USgpm
 Head : 400.00 ft
 Density / Specific gravity : - / 1.000
 Pump speed : 1,775 rpm
 Ns / Nss (per eye) : 1,519 / 9,100 (US)
 Test tolerance : ANSI/HI 14.6 Grade 1U

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

Bowl performance shown below is corrected for materials, viscosity and construction.



Bowl head of 402.66 ft corresponds with 400 ft head at discharge flange adjusted for elevation and friction losses.

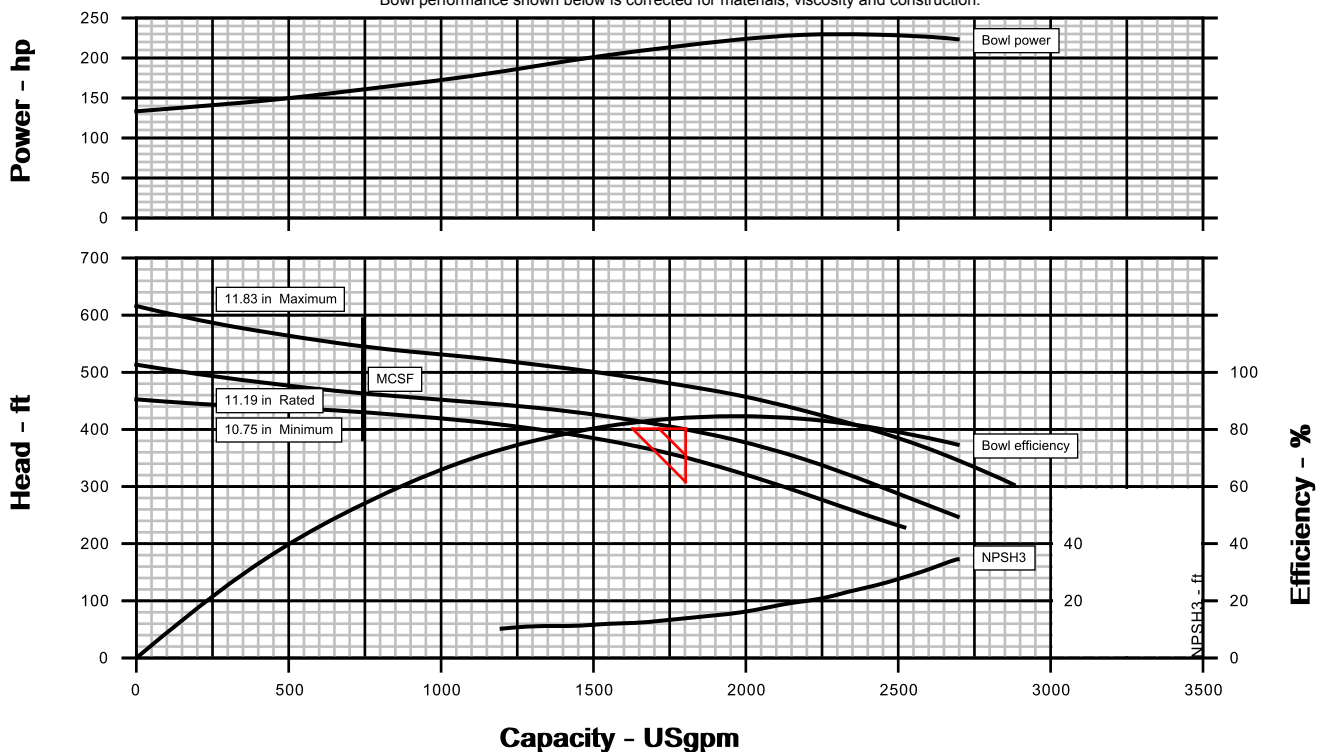
Customer	: ENGINEERED FLUID INC	Pump / Stages	: 15EMM / 4
Customer reference	: EFI Project #93134	Based on curve no.	: EC-2377
Item number	: EFI Project #93134	Flowserve reference	: 4551407220
Service	: -	Date	: July 11, 2023

Operating Conditions		Materials / Specification	
Capacity	: 1,800.0 USgpm	Material column code	: B30
Water capacity (CQ=1.00)	: -	Other Requirements Hydraulic selection : No specification Construction : NSF 61 Test tolerance : ANSI/HI 14.6 Grade 1U Driver Sizing : Max Power + 3% Seal configuration : Packing	
Normal capacity	: -		
Rated head @ Discharge flange	: 400.00 ft		
Water head (CH=1.00)	: -		
NPSH available (NPSHa) @ Suction flange	: 34.0 ft		
NPSHa less NPSH margin @ Impeller eye	: -		
Maximum suction pressure	: 0.0 psig		
Rated suction pressure	: 0.0 psig		
Liquid			
Liquid type	: Other		
Liquid description	: -		
Temperature / Specific gravity	: 60 °F / 1.000		
Viscosity / Vapor pressure	: 1.00 cSt / -		

Performance			
Pump speed	: 1,775 rpm	Impeller diameter	: Rated / Maximum / Minimum
NPSH required (NPSH3) @ Impeller eye	: 14.1 ft		: 11.19 in / 11.83 in / 10.75 in
Hydraulic power	: 183 hp	Impeller diameter ratio (rated/max)	: 94.6 %
Efficiency (Pump overall / Bowl) (CE=1.00)	: 84.3 % / 84.5 %	Maximum head at rated diameter	: 513.47 ft
Power (rated/max)	: 217 hp / 230 hp	Head rise to shut off	: 27.5 %
Driver power rating	: 250 hp / 186 kW	Total head ratio (rated / max) / (max / rated)	: 84.2 % / 118.8 %
Bowl pressure	: 222.3 psig	Flow at BEP	: 1,988.9 USgpm
(based on shut off @ cut dia/rated SG)		Flow as % of BEP	: 90.5 %
Maximum allowable	: 375.0 psig	Minimum continuous flow	: 748.0 USgpm
Bowl & column hydrotest	: 277.9 psig	Thrust - Rated flow / Rated suction	: 3,769.3 lbf
Dischg Head Dischg Region MAWP	: 440.0 psig	Max thrust - Shut off / Rated suction	: 4,719.0 lbf
Ns / Nss (per eye)	: 1,519 / 9,100 (US)	Min thrust - Runout flow / Max Suction	: 2,424.6 lbf
Suction Regions MAWP	: 285.0 psig	(A negative thrust value indicates an upthrust condition)	

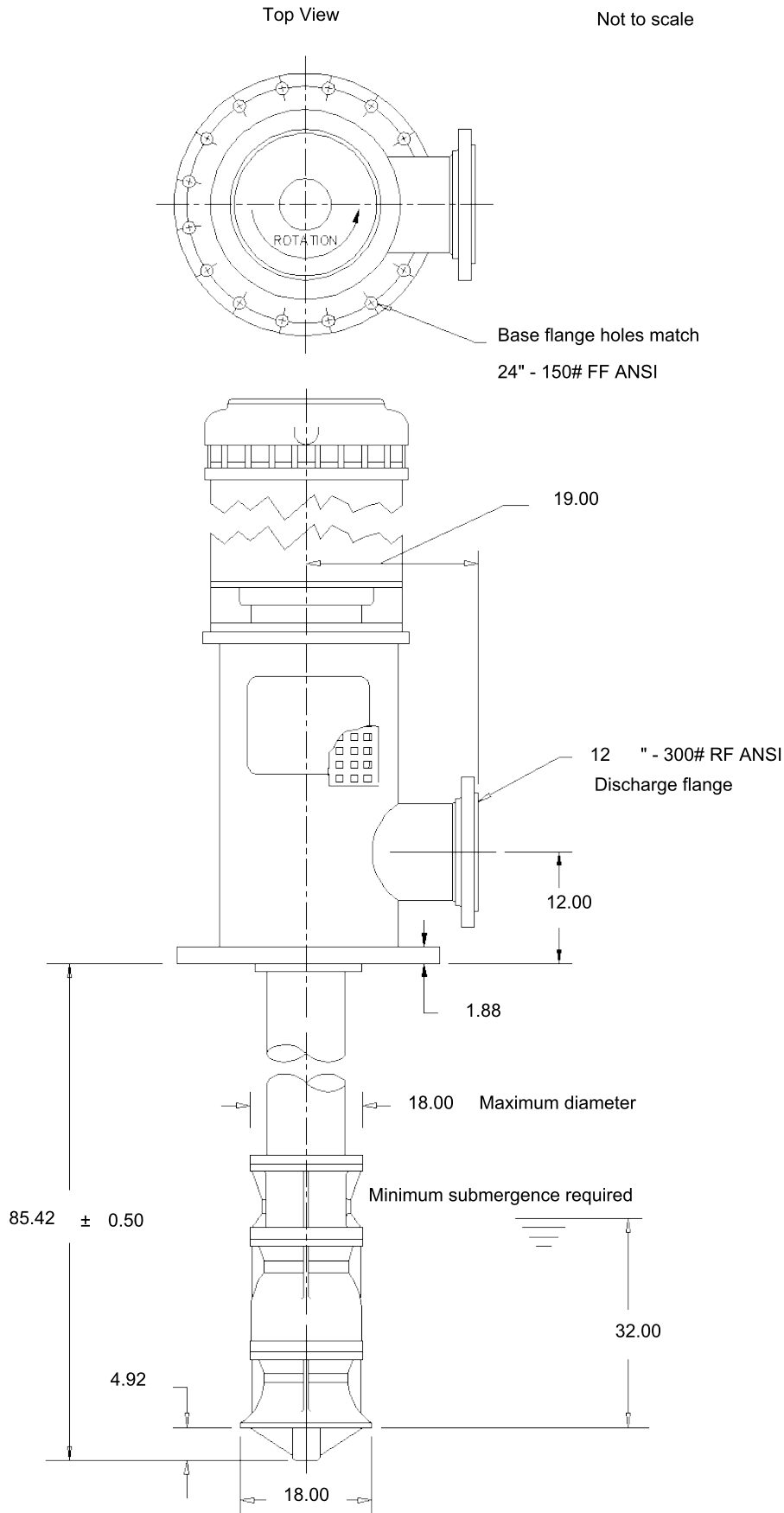
CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

Bowl performance shown below is corrected for materials, viscosity and construction.



Bowl head of 402.66 ft corresponds with 400 ft head at discharge flange adjusted for elevation and friction losses.

Customer	: ENGINEERED FLUID INC	Pump / Stages	: 15EMM / 4
Customer reference	: EFI Project #93134	Based on curve no.	: EC-2377
Item number	: EFI Project #93134	Flowserve reference	: 4551407220
Service	: -	Date	: July 11, 2023
Construction		Driver Information	
Bowl construction / lined	: Flanged - Std Wall / Line...	Manufacturer	: Flowserve Choice
Impeller type	: Enclosed	Power / SF (Req' / Act')	: 250 hp / 186 kW / 1.0 / 1.15
Impeller fastening	: Colleted	Vertical shaft type	: Solid
Column construction	: Flanged	Driver type	: NEMA Electric Motor
Column flange spec'n	: Taneytown Specification	Frame size / Base dia	: 445
Column dia (nominal)	: 12.00 in	Enclosure	: WP1
Column pipe length	: 0.75 ft	Duty type	
Column section length	: 120.00 in	Efficiency type	
Lineshaft brg spacing	: 120.00 in	Hazardous area class	: -
Lineshaft diameter	: 2.19 in	Explosion 'T' rating	: -
Lineshaft coupling type	: Threaded coupling	Volts / Phase / Hz	: 460 / 3 / 60 Hz
Lineshaft bearings, qty	: 1	Amps-full load/locked rotor	: - / -
Lineshaft construction	: Open	Motor starting	using VFDs only
Lineshaft lubrication	: Pumpage	Insulation	: -
Disch size/rating/face	: 12 in / 300 lb ANSI / RF	Temperature rise	: -
"LF" - Fabricated / Above Grade Discharge / ANSI Base		Bearings / Lubrication	: - / -
Thrust stand size	: None supplied	Motor mounted by	: Customer
		Motor Thrust rating down/up	: 9,800.0 lbf / 2,940.0 lbf
Materials		Seal Information	
Bowl	: Cast Iron A48 CL30	Arrangement	: Open Lineshaft Packed Box
Impeller	: Bronze	Size	: -
Bowl bearing	: Bronze C84400	Manufacturer / Type	: - / Packing
Bowl shaft	: 416SS A582 Gr 416	Material code (Man'f/API)	: Graphite Fiberglass / -
Bowl wear ring	: None supplied	Gland material	: Cast iron
Impeller wear ring	: None supplied	Auxiliary seal device	: -
Column	: Steel A53 Type E GrB	Seal flush plan	: Plan 13
Lineshaft	: 416 stainless steel	Seal flush construction	: Tube
Bearing retainer		Paint and Package	
Lineshaft bearing	: Rubber Buna-N	Pump paint	: -
Lineshaft sleeve	: -	Support plate paint	: -
Discharge head	: Steel A53 Gr B/A36	Shipment type	: -
Support plate	: None supplied	Additional information	
Weights (Approx.)		Pit / sump depth	: -
Complete pump	: 692.0 lb	Pump length	: 7.12 ft
Mounting plate	: -	mounting surface to bell/strainer bottom	
Driver (net)	: 1,600.0 lb	Available well diameter	: -
Testing		Max dia below mtg surface	: 18.00 in
Hydrostatic test	: None		
Performance test	: None		
NPSH test	: None		
Notes			
-			
-			
-			
-			



Customer	: ENGINEERED FLUID INC	Pump size & type	: 15EMM	Drawing number	: -
Item number	: EFI Project #93134	Pump speed / Stages	: 1,775 rpm / 4	Date	: July 11, 2023
Service	: -	Flow / Head	: 1,800.0 USgpm / 400.00 ft	Certified by / Date	: -
Customer PO #	: -	Driver power / Frame	: 250 hp / 186 kW / 445	Seal type	: Packing
Flowserve reference	: 4551407220	Volts / Phase / Hz	: 460 / 3 / 60 Hz	Seal flush plan	: Plan 13

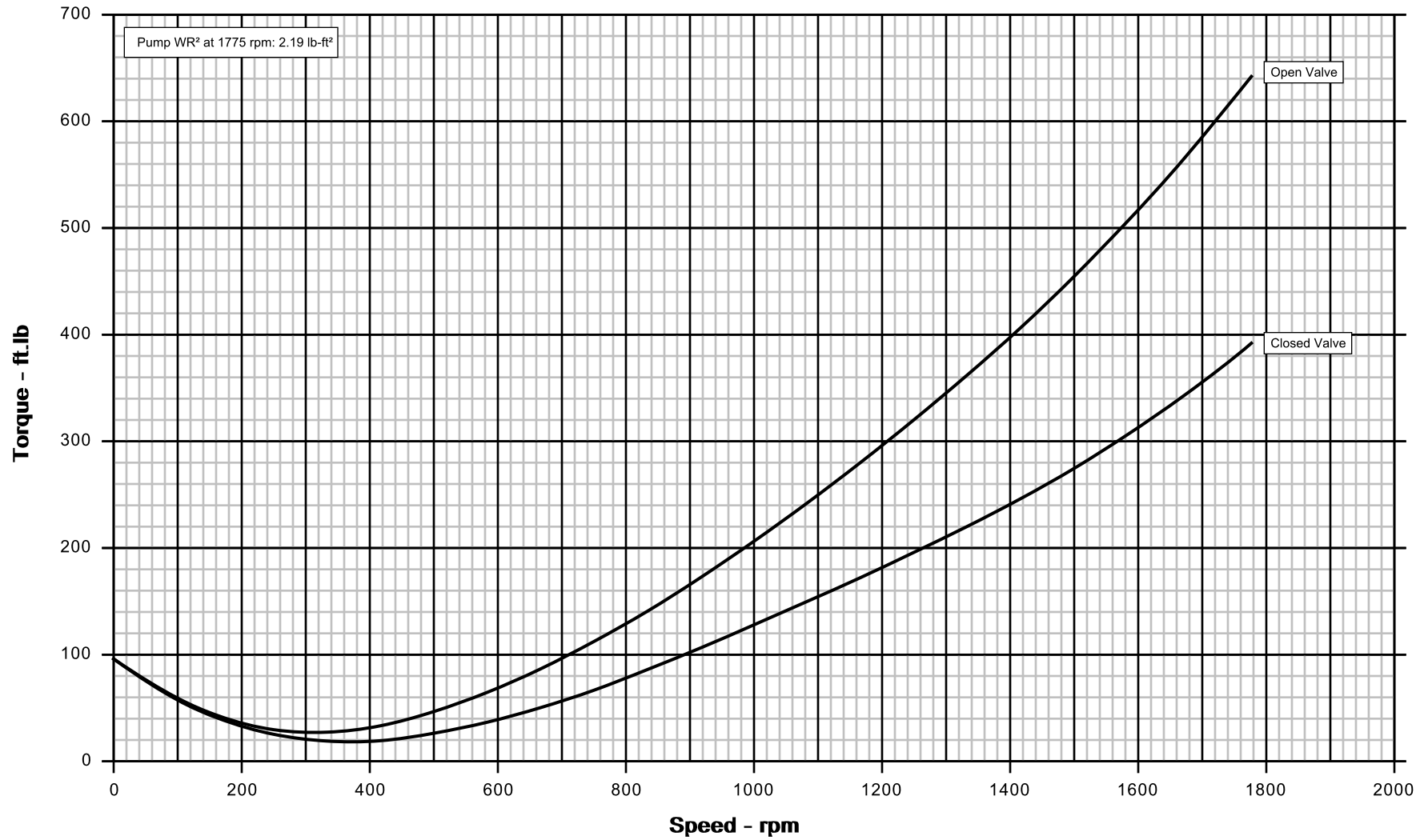
Customer : ENGINEERED FLUID INC
 Item number : EFI Project #93134
 Service : -
 Flowserve reference : 4551407220
 Pump size & type / Stages : 15EMM / 4
 Based on curve no. : EC-2377
 Impeller diameter : 11.19 in



Capacity : 1,800.0 USgpm
 Head : 400.00 ft
 Density / Specific gravity : - / 1.000
 Pump speed : 1,775 rpm
 Ns / Nss (per eye) : 1,519 / 9,100 (US)
 Pump WR² at 1,775 rpm : 2.19 lb-ft²
 Date : July 11, 2023

CURVES ARE APPROXIMATE. PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

Bowl performance shown below is corrected for materials, viscosity and construction.



Customer	: ENGINEERED FLUID INC	Pump / Stages	: 15EMM /4
Customer reference	: EFI Project #93134	Based on curve no.	: EC-2377
Item number	: EFI Project #93134	Flowserve reference	: 4551407220
Service	: -	Date	: July 11, 2023
Duty Conditions		Performance	
Quantity of pumps	: 3	Hydraulic power	: 183 hp
Liquid description	: -	Pump overall efficiency	: 84.3 %
Liquid type	: Other	NPSH3 @ Impeller eye	: 14.1 ft
Frequency	: 60 Hz	Rated brake power	: 217 hp
Flammable	: No	Maximum brake power	: 230 hp
Toxic	: No	Motor rating	: 250 hp / 186 kW
H2S	: No	Ns / Nss (per eye)	: 1,519 / 9,100 (US)
Rated flow	: 1,800.0 USgpm	MCSF	: 748.0 USgpm
Rated head	: 400.00 ft @ Discharge flange	Rated impeller diameter	: 11.19 in
NPSHa	: 34.0 ft @ Suction flange	Maximum impeller diameter	: 11.83 in
Viscosity	: 1.00 cSt	Minimum impeller diameter	: 10.75 in
Specific gravity	: 1.000	Maximum head	: 513.47 ft
Maximum suction pressure	: 0.0 psig @ Suction flange	Flow at BEP	: 1,988.9 USgpm
Rated suction pressure	: 0.0 psig	Flow as % of BEP	: 90.5 %
Maximum liquid temperature	: 60 °F	Rated/max diameter	: 94.6 %
Vapor pressure	: -	Head rise to shut off	: 27.5 %
Altitude	: -	Rated/max head	: 84.2 %
Static head	: -	Visc. capacity correction factor (CQ)	: 1.00
Pump length strategy used	: As required for NPSH and submergence	Visc. head correction factor (CH)	: 1.00
Can length strategy used	: As required for pump length	Visc. efficiency correction factor (CE)	: 1.00
Selection status			
Product line	: VTP Canned	Business unit	: Hastings
Pump speed	: 1,775 rpm	Selection status	: Acceptable
Working Pressure Limits		Flow Velocities and Nozzle Sizing	
Bowl assembly MRWP	: 222.3 psig	Nozzle sizing strategy based on	: Rated flow
Column assembly MRWP	: 222.3 psig	Discharge nozzle design flow	: 1,800.0 USgpm
Discharge region of discharge head MRWP	: 221.3 psig	Suction nozzle design flow	: 1,800.0 USgpm
Suction region MRWP	: 66.7 psig	Actual discharge inside diameter	: 12.09 in
Bowl assembly MAWP	: 375.0 psig	Actual suction inside diameter	: 13.25 in
Column assembly MAWP	: 392.0 psig	Actual calculated discharge velocity	: 5.03 ft/s
Discharge region of discharge head MAWP	: 440.0 psig	Actual calculated suction velocity	: 4.19 ft/s
Suction region MAWP	: 285.0 psig	Actual calculated column velocity	: 5.28 ft/s
		Actual calculated can velocity	: 2.58 ft/s
Hydrostatic Test Pressures (when purchased)		Additional Performance	
Bowl / Column Assemblies HTP	: 277.9 psig / 277.9 psig	Torque rating (max power)	: 13.0 hp/100 rpm
Discharge region of discharge head HTP	: 276.7 psig	Torque rating (rated power)	: 12.2 hp/100 rpm
Suction region hydrotest pressure	: 100.0 psig	Overall torque limit of pump shafts	: -
		Pump WR ² at 1,775 rpm	: 2.19 lb-ft ²
Materials			
Requested pump material	: B30	Open lineshaft bearing material	: Rubber Lineshaft Bearings
Selected pump material	: B30	Discharge head material	: Carbon Steel
Bowl material	: Cast Iron A48 CL30	Enclosed lineshaft bearing material	: None
First stage impeller material	: Bronze	Suction can material	: Carbon Steel
Upper stage impeller material	: Bronze		
Bowl wear ring material	: None	Sump & Submergence	
Impeller wear ring material	: None supplied	Combined bowl & column assembly length	: 7.12 ft
Bowl shaft material	: 416 stainless steel	Clearance from strainer/bearing hub to sump bottom	: 9.50 in
Bowl bearing material	: Bronze	Available submergence above bell lip	: 80.50 in
Column material	: Carbon steel	Req. min. submergence above bell lip	: 32.00 in
Lineshaft material	: 416 stainless steel	Clearance from bearing hub to can bottom	: 9.50 in

Customer	: ENGINEERED FLUID INC	Pump / Stages	: 15EMM /4
Customer reference	: EFI Project #93134	Based on curve no.	: EC-2377
Item number	: EFI Project #93134	Flowserve reference	: 4551407220
Service	: -	Date	: July 11, 2023
Performance Corrections			
Head Corrections		Efficiency Corrections	
Pump rated head at discharge flange	: 400.00 ft	Bowl efficiency after correction	: 84.5 %
Discharge pressure at discharge flange	: 173.2 psig	Pump overall efficiency	: 84.3 %
C/L discharge flange to mounting surface	: 12.00 in		
Rated suction pressure at suction flange	: 0.0 psig		
C/L can suction flange to mounting surface	: 14.00 in		
Discharge head friction loss	: 0.49 ft		
Column friction loss	: 0.01 ft		
Bowl head	: 402.66 ft		
Construction and Dimensions			
Bowl Assembly Construction		Bowl Assembly Dimensions	
Bowl construction	: Flanged - Std Wall	Bowl shaft diameter	: 2.19 in
Bowl lining	: Lined bowls	Bowl O.D.	: 14.75 in
Impeller design	: Enclosed	Bell O.D.	: 18.00 in
Impeller fastening	: Colleted	Bowl assembly length to bell lip	: 71.50 in
Qty of unbalanced, std design impellers	: 4	Suction bearing hub length below bell lip	: 4.92 in
Qty of balanced, std design impellers	: -	Impeller eye to bell lip	: 10.00 in
Qty of unbalanced, alt first stage impellers	: -	Upper stages impeller rated diameter	: 11.19 in
Qty of balanced, alt first stage impellers	: -	First stage impeller rated diameter	: 11.19 in
Column Assembly Construction		Column Assembly Dimensions	
Column construction	: Flanged	Column nominal diameter	: 12.00 in
Column wall description	: Factory Default Wall Thickness	Column wall thickness	: 0.3750 in
Lineshaft lubrication	: Open Lineshaft (Product Lube)	Column length	: 0.75 ft
Column flange rating	: FLS "Standard"	Max column segment length	: 120.00 in
Shaft split	: One piece shaft	Lineshaft diameter	: 2.19 in
Lineshaft coupling type	: Threaded coupling	Bearing span	: 120.00 in
Discharge Head Assembly Construction		Discharge Head Assembly Dimensions	
Discharge head design	: "LF" - Fabricated / Above Grade Di...	Discharge position	: Above mounting surface
Discharge head size	: 12.00 in	C/L shaft to discharge flange face	: 19.00 in
Discharge head flange spec./rating	: 300 lb ANSI/ASME B16.5 or B16.4...	C/L head discharge to mounting surface	: 12.00 in
Discharge flange size	: 12 in	Shaft diameter through stuffing box	: 2.19 in
Head shaft sealing method	: Packing	Suction position	: Below mounting surface
Driver shaft type	: Solid shaft driver	C/L shaft to can suction flange face	: 18.00 in
Solid shaft coupling type	: Non-spacer coupling	C/L can suction flange to mounting surface	: 14.00 in
Solid shaft coupling size	: 3WA/PA_S		
Can Assembly Construction		Can Assembly Dimensions	
Can scope of supply	: Canned pump complete with can	Can nominal diameter	: 24.00 in
Can base flange spec./rating	: 150 lb ANSI/ASME B16.5 or B16.4...	Can wall thickness	: 0.3750 in
Can wall description	: Factory Default Pipe Schedule	Can outside length	: 7.67 ft
Can drain type	: None	Can inside length	: 7.50 ft
Can suction flange spec./rating	: Full ANSI/ASME B16.5 or B16.47 C...	C/L can suction flange to mounting surface	: 14.00 in
Can suction flange size	: N/A	C/L shaft to can suction flange face	: 18.00 in
Thrust Data			
Thrust bearing location	: Thrust bearing supplied in the driver	Thrust with rated head/rated suction	: 3,769.3 lbf
Thrust stand selection method	: Use rated head & max suction	Thrust with shutoff head/rated suction	: 4,719.0 lbf
Thrust stand size	: None supplied	Thrust with runout head/rated suction	: 2,424.6 lbf
Thrust used for stand sizing	: 3,769.3 lbf	Thrust with rated head/max suction	: 3,769.3 lbf
Max thrust limit for this design	: 20,000.0 lbf	Thrust with shutoff head/max suction	: 4,719.0 lbf
Min thrust limit for this design	: -	Thrust with runout head/max suction	: 2,424.6 lbf

General Information for Integral Horsepower (IHP) Motors on Variable Frequency Drives (VFDs)

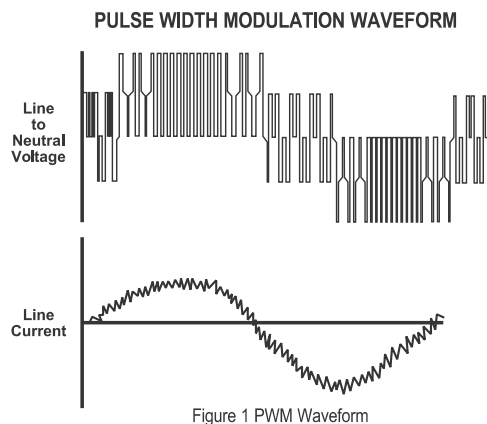
Variable Frequency Drives (VFD)

A VFD is a type of controller used to vary the speed of an electric motor. The VFD takes a fixed AC voltage and frequency and allows it to be adjusted in order to get different speeds from the motor. Motor speed can be varied by changing the frequency of the input power waveform. The equation below shows how the frequency affects the speed of a three phase induction motor.

$$\text{Speed} = \frac{120 * \text{Fundamental Input Frequency}}{\text{Number of Motor Poles}}$$

How does a VFD work?

A VFD takes the fixed frequency and voltage sine wave from the power grid or power station and puts it through a few steps in order to allow the VFD user to vary the frequency and in turn control the motor speed. First it rectifies the AC power into DC Power. Because of this step, a term commonly used instead of VFD is inverter. This only describes one step of what the VFD does to the power waveform. Once rectified into a DC voltage the drive sends the power through a set of transistors or switches. These switches can take the DC waveform and by opening and closing at certain speeds and durations can create an output waveform that mimics the sine wave that is required to drive a three phase electric motor. The output wave form is known as a Pulse Width Modulation (PWM) waveform because the waveform is created by multiple pulses of the switches at short intervals.



What variables should be considered when deciding whether to power a motor with a VFD?

VFD compatibility with motors is complex. As a result, many variables must be considered when determining the suitability of a particular motor for use with a VFD. These variables include:

- Torque requirements (Constant or Variable)
- Speed Range
- Line / System Voltage
- Cable length between the VFD and the motor
- Drive switching (carrier) frequency
- Motor construction

- VFD dv/dt - winding end turn differential in voltage versus differential in time
- High temperatures or high humidity
- Grounding system

Wider speed ranges, higher voltages, higher switching frequencies, insufficient grounding and increased cable lengths all add to the severity of the application and, therefore, the potential for premature motor failure.

How does a VFD affect the motor?

There are many things to consider when a motor is powered using a VFD or PWM power. When a motor is powered by a PWM waveform the motor windings very often see a large differential voltage, either from phase to phase or turn to turn. When the voltage differential becomes large enough it creates a reaction at the molecular level that converts available oxygen into O₃. This phenomenon is called partial discharge or corona. This reaction creates energy in the form of light and heat. This energy has a corrosive effect on the varnish used to protect the motor windings. PWM waveforms can also magnify shaft voltages which lead to arcing across the bearing and causing premature bearing failure. Corrective action must be taken to mitigate these issues that arise when using an electric motor with a VFD.

How do I protect the motor?

Nidec Motor Corporation (NMC) has developed specific motor designs to decrease the harmful affects that a VFD can have on a motor. NMC's INVERTER GRADE[®] insulation system is the first line of defense against corona and phase to phase faults that can be common when a motor is powered using a PWM waveform. The INVERTER GRADE[®] insulation system is standard on all of NMC's Inverter Duty products. Along with the INVERTER GRADE[®] insulation, thermostats are installed as a minimum protection against over heating the motor. Special consideration must also be given to bearings in motors powered by VFD's. In order to create a low resistance path to ground for built up shaft voltages a shaft grounding device can be used. On larger horsepower motors an insulated bearing system should be used in conjunction with the shaft grounding device when installed, to force the stray shaft voltages to ground. The bearing failures are more prominent on motors with thrust handling bearings. NMC has created an Inverter Duty vertical motor line that not only uses the INVERTER GRADE[®] insulation system, but that also comes standard with a shaft grounding device. On motors that are 100 HP and greater the thrust bearing is also insulated for additional protection.

What does "Inverter Duty" mean?

An Inverter Duty motor should describe a motor that helps mitigate potential failure modes of a motor that is powered by a VFD. Inverter duty motor windings should be able to withstand the voltage spikes per NEMA MG1 Part 31.4.4.2 and protect against overheating when the motor is run at slow speeds. On thrust handling bearings it is apparent that the bearings require additional protection. Inverter Duty vertical motors should have a shaft grounding device to protect the motor bearings from fluting due to voltage discharge through the bearing. On larger motors (100HP and larger) the shaft should also be electrically isolated from the frame in order to aid the shaft grounding ring in discharging the shaft voltages to ground.

*This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL[®] & CSA[®] listings where indicated.

Thermal Overloads and Single Phase Motors

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

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

Slow Speed Motors

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

690V Applications

Motors that are rated for 690VAC and that will be powered by 690VAC PWM VFDs require the use of an external filter to limit peak voltage spikes and the use of an INVERTER GRADE® motor. Where available, an alternative to using an output filter is to upgrade to a 2300V insulation system.

Low Voltage TITAN® Motors

When using 449 frame and larger motors on PWM type VFDs consider the use of an external filter and shielded motor cables designed for PWM power to minimize harmonic distortion and peak voltages at the motor terminals. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%).

Bearing Currents Related to PWM Waveforms

Protection of the motor bearings from shaft currents caused by common mode voltages is becoming a standard feature on Inverter Duty motor products. Some installations may be prone to a voltage discharge condition through the motor bearings called Electrical Discharge Machining (EDM) or fluting. Vertical HOLLOSHAFT and HOSTILE DUTY World Motor come with grounding devices installed as standard. EDM damage is related to characteristics of the PWM waveform, and the VFD programming, and installations factors.

Bearing Protection on Inverter Duty Vertical Motors

All U.S. MOTORS® brand "Inverter Duty" vertical products have a shaft grounding system that allows damaging shaft currents a low resistance path to ground. **Bearings on vertical motors fed by VFD power without this bearing protection are not covered under any warranty.** All other bearing failure is covered per NMC's standard warranty. An electric motor repair shop approved to service U.S. MOTORS® brand motors must verify that the cause of the bearing failure was not due to EDM damage.

Guideline For Insulated Anti-Friction Bearings

Bearing insulation is required to prevent circulating shaft currents which can damage bearings. Circulating shaft current can be caused by use of improper power and/or ground cables, improper grounding systems and higher switching frequencies. Finding and correcting the external condition(s) is the responsibility of the system designer or specifying engineer. To prevent circulating shaft current in motors with anti-friction bearings, Nidec Motor Corporation's standard practice is to insulate the non-drive end bearing.

Adjustable Speed Drives produce a common mode voltage condition. To interrupt common mode voltage on induction motors of all sizes, NEMA MG1-2018 Part 31 recommends insulating both bearings. In cases where both anti-friction bearings are insulated, the system designer or specifying engineer should determine whether to apply one or more of the following options to prevent or reduce shaft currents: sinewave filters, line reactors or mechanical devices, such as shaft grounding or an insulated half coupling. Motors with shaft grounding devices are not suitable for installation in hazardous locations unless housed in an enclosure suitable for the specified Division (or Zone), Class and Group(s).

Multiple Motors on a Single VFD

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

Grounding and Cable Installation Guidelines

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

Integrated Motor and Inverter

By integrating the motor and inverter at NMC's manufacturing facility, many of the motor compatibility problems are minimized or eliminated. During the manufacturing process, the motor is matched to the inverter characteristics which ensures the winding temperature and torque levels meet the design specification. Since the inverter output wiring to the motor is nearly eliminated, bearing currents are rarely experienced. When the unit is properly grounded, reducing the output cable lengths in conjunction with an inverter grade insulation system and low factory setting of the switching frequency of the inverter drive, results in low risk of voltage peaks produced by the PWM waveform.

Vertical Motors on VFDs

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

- Locked rotor and drive tripping caused by non-reversing-ratchet operation at low motor speeds. It is not recommended to operate motors at less than 1/4 of synchronous speed. If slow speeds are required contact NMC engineering.
- Unexpected / unacceptable system vibration and or noise levels caused by the torque pulsation characteristics of the PWM waveform, a system critical frequency falling inside the variable speed range of the process or the added harmonic content of the PWM waveform exciting a system component
- Application related problems related to the controlled acceleration/deceleration and torque of the motor on VFD power and the building of system pressure/ load.
- The impact the reduction of pump speed has on the down thrust reflected to the pump motor and any minimum thrust requirements of the motor bearings
- Water hammer during shutdown damaging the non-reversing ratchet

Humidity and Non-operational Conditions

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

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

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

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Warranty Guidelines for Integral Horsepower (IHP)* Motors on Variable Frequency Drives

Warranty Guidelines

The information in the following section refers to the motor and drive application guidelines and limitations for warranty.

Hazardous Location Motors

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

575 Volt Motors

575 volt motors can be applied on Inverters when output filters are used. Contact the drive manufacturer for filter selection and installation requirements.

Applying INVERTER GRADE® Insulated Motors on Variable Frequency Drives (2, 4, 6 pole)

The products within this catalog labeled “Inverter Duty” or “Vector Duty” are considered INVERTER GRADE® insulated motors. INVERTER GRADE® motors exceed the NEMA® MG-1 Part 31 standard. Nidec Motor Corporation provides a three-year limited warranty on all NEMA® frame INVERTER GRADE® insulated motors and allows long cable runs between the motor and the VFD (limited to 400 feet without output filters). Cable distance can be further limited by hot and humid environments and VFD manufacturers cable limits. These motors may be appropriate for certain severe inverter applications or when the factors relating to the end use application are undefined (such as spares).

Nidec Motor Corporation’s U.S. Motors® brand is available in the following INVERTER GRADE® insulated motors:

- Inverter Duty NEMA® frame motors good for 20:1 Variable Torque & 5:1 Constant Torque, including Vertical Type RUSI (10:1 V.T.)
- Inverter Duty motors rated for 20:1 Constant Torque
- ACCU-Torq® and Vector Duty Motors with full torque to 0 Speed or 5000:1
- 841 Plus® NEMA® Frame Motors

Applying Premium Efficient motors (that do not have INVERTER GRADE® insulation) on Variable Frequency Drives (2, 4, 6 pole)

Premium efficient motors without INVERTER GRADE insulation meet minimum NEMA® MG-1, Section IV, Part 31.4.4.2. These motors can be used with Variable Frequency Drives (with a reduced warranty period) under the following parameters:

- On NEMA® frame 447 and smaller motors, 20:1 speed rating on variable torque loads & 4:1 speed range on constant torque loads.
- On TITAN® 449 and larger frame motors, 10:1 speed rating on variable torque loads.

- On TITAN® frame motors, inquiry required for suitability on constant torque loads.

Cable distances are for reference only and can be further limited by hot and humid environments (refer to Table 1). Refer to specific VFD

Table 1 - Cable Distances			
Maximum Cable Distance VFD to Motor			
Switching Frequency	460 Volt	230 Volt	380 Volt
3 Khz	127 ft	400 ft	218 ft
6 Khz	90 ft	307 ft	154 ft
9 Khz	73 ft	251 ft	126 ft
12 Khz	64 ft	217 ft	109 ft
15 Khz	57 ft	194 ft	98 ft
20 Khz	49 ft	168 ft	85 ft

manufacturers cable limits. Refer to the Motor/ Inverter Compatibility page for special consideration of vertical motor bearings.

Warranty Period Clarifications and Exceptions

Standard Energy Efficient Exclusion

Applying Standard & Energy Efficient Motors on Variable Frequency Drives is not recommended. VFD related failures on standard and energy efficient motors will not be covered under warranty.

Vertical Motor Windings

Premium efficient vertical motors without INVERTER GRADE® insulation that are installed using the criteria described in this document and applied in the correct applications shall have a warranty while powered by a VFD for 12 months from date of installation or 18 months from date of manufacturing whichever comes first. See limited warranty page for horizontal motor warranty periods.

Bearing Exclusion for Thrust Handling Bearings

Bearings used in premium efficient vertical motors, and all thrust handling bearings, that are powered by VFDs without shaft grounding devices or insulated bearings (when required) will not be covered under any warranty for damages caused from being powered by a VFD. All other bearing failure is covered per NMC’s standard warranty. An electric motor repair shop approved to service U.S. MOTORS® brand motors must verify that the cause of the bearing failure was not due to Electrical Discharge Machining.

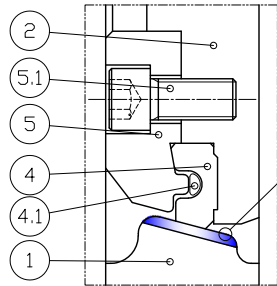
Medium Voltage and Slow Speed Considerations

Motors that are rated above 700 VAC or that are eight pole and slower require special consideration and installation and are not covered under the warranty guidelines in this document. Motors that are rated above 700VAC have special cable length and voltage differential issues that are specific to the VFD type and manufacture. The motor construction and cost may vary dramatically depending on the VFD topology and construction. Contact your NMC representative with VFD manufacturer name and model type for application and motor construction considerations. Motors that are designed eight pole and slower also require special installation and filters per the drive manufacturer.

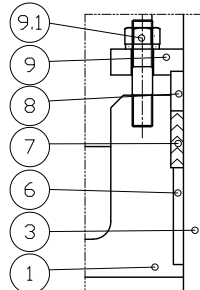
* This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL® & CSA® listings where indicated.

EFI submitted on "High Performance" DHV Butterfly Valves with a Seat Rating of 450 PSI and Body of 900 PSI. These higher pressure rated valves are Class 300 vs the Class 125 DHC bfvs there were being compared to. The materials EFI submitted for the DHC HP Class 300 valves are correct. Materials are different due to the higher pressure ratings. This was discussed in detail with Virgil Diaz at Southwest Valve & Equipment on 6-13-2023.

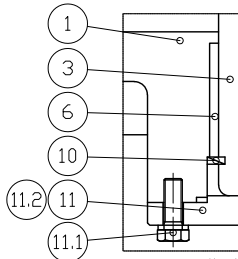
No.	PART NAME	MATERIAL	Q'TY	REMARK	No.	PART NAME	MATERIAL	Q'TY	REMARK
9	PACKING GLAND	A240 Gr.304	1		1	BODY	A216 WCB	1	+STELLITE #6 OVERLAY
9.1	GLAND BOLT/NUT	A2-70(S.S304)	1SET		2	DISC	A351 CF8M	1	
10	SHAFT RING	B584 C83600	1		3	SHAFT	A564 Gr.630	1	
11	END COVER	A36(SS275)	1		3.1	KEY	A564 Gr.630	1	
11.1	END COVER BOLT	A2-70(S.S304)	1SET		4	SEAT	R-PTFE	1	
11.2	END COVER GASKET	PTFE	1		4.1	SEAT O-RING	VITON	1	
12	TAPER PIN	A564 Gr.630	1SET		5	SEAT RETAINER	A240 Gr.316	1	
13	TOP FLANGE	A36(SS275)	1		5.1	RETAINER BOLT	A4-70(S.S316)	1SET	
13.1	TOP FLANGE BOLT	A2-70(S.S304)	1SET		6	BODY BUSH	B584 C83600	2	
14	GEAR BOX	ASS'Y	1		7	V-PACKING	PTFE	1SET	
14.1	GEAR BOX BOLT	A2-70(S.S304)	1SET		8	PACKING BUSH	A276 Gr.304	1	



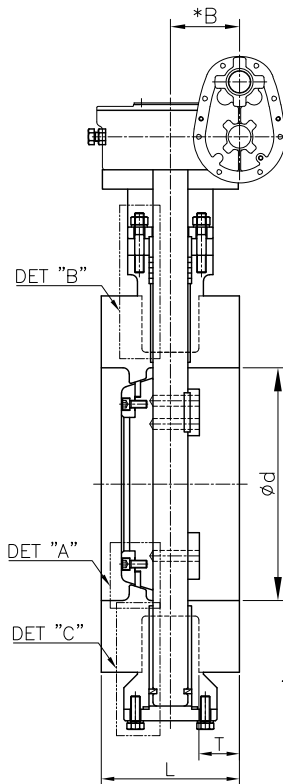
DETAIL "A"



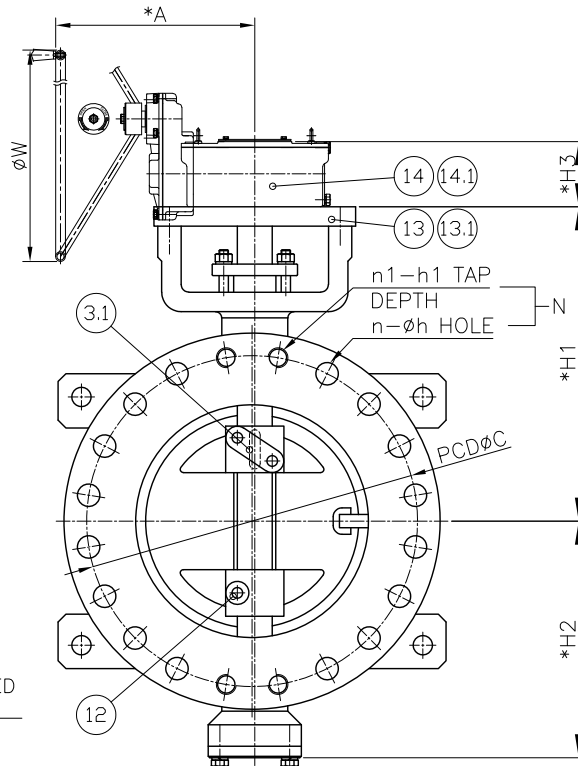
DETAIL "B"



DETAIL "C"



PREFERRED FLOW



B'fly valves installed within the Pump Station.

NOTE

- COATING(HOLIDAY FREE)-INTERNAL&EXTERNAL AMERLOCK 2 Min.12mils(COLOR:BLUE RAL 5005)

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
23.03.21		FOR APPROVAL	S.G. JANG	S.G. LEE	B.J. LEE
BASIC DESIGN		REF. API 609 CATEGORY B			
FACE TO FACE		API 609 CAT'B SHORT PATTERN CL.150 or CL.300			
FLANGE RATING		ASME B16.5 CL.300 FLAT FACE			
TEST	CODE	AWWA C504 (Bi-Direction)			
	HYDRO.(WATER)	BODY	900 psi	SEAT	450 psi
	AIR	BODY	-	SEAT	-
LEAKAGE CLASS		ZERO LEAKAGE			
FLUID		-			
DESIGN PRESSURE		450 psi			
DESIGN TEMPERATURE		100°F			

D.H.C. DAEHAN CONTROL Co.,Ltd.

TITLE	BFV DOUBLE FLANGE F.F CL.300 NPS 8, 16			SCALE	N/S
	DOUBLE OFFSET TEFLON SEAT DESIGN WORM GEAR BOX OP'			UNIT	inch
PROJECT	-			PRO-JECTION	
	-			DATE	2023. 03. 21
SIGNATURE	PREPARED	CHECKED	APPROVED	DWG No.	BTDC4-F0000-T2G-A00-00
				PAGE No.	- / - PAGE
	23.03.21	23.03.21	23.03.21		

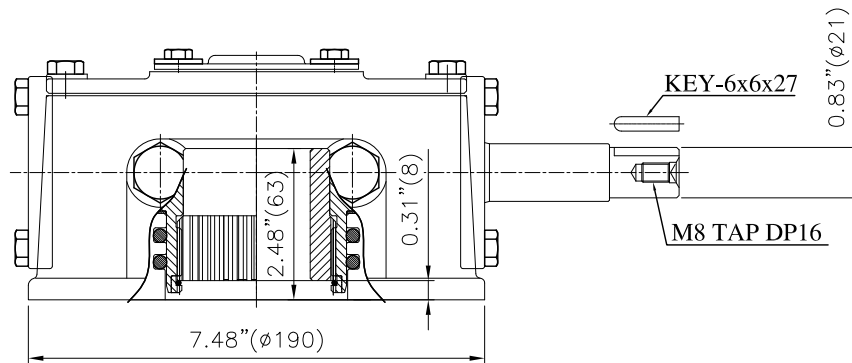
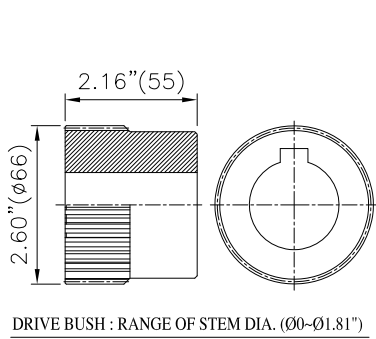
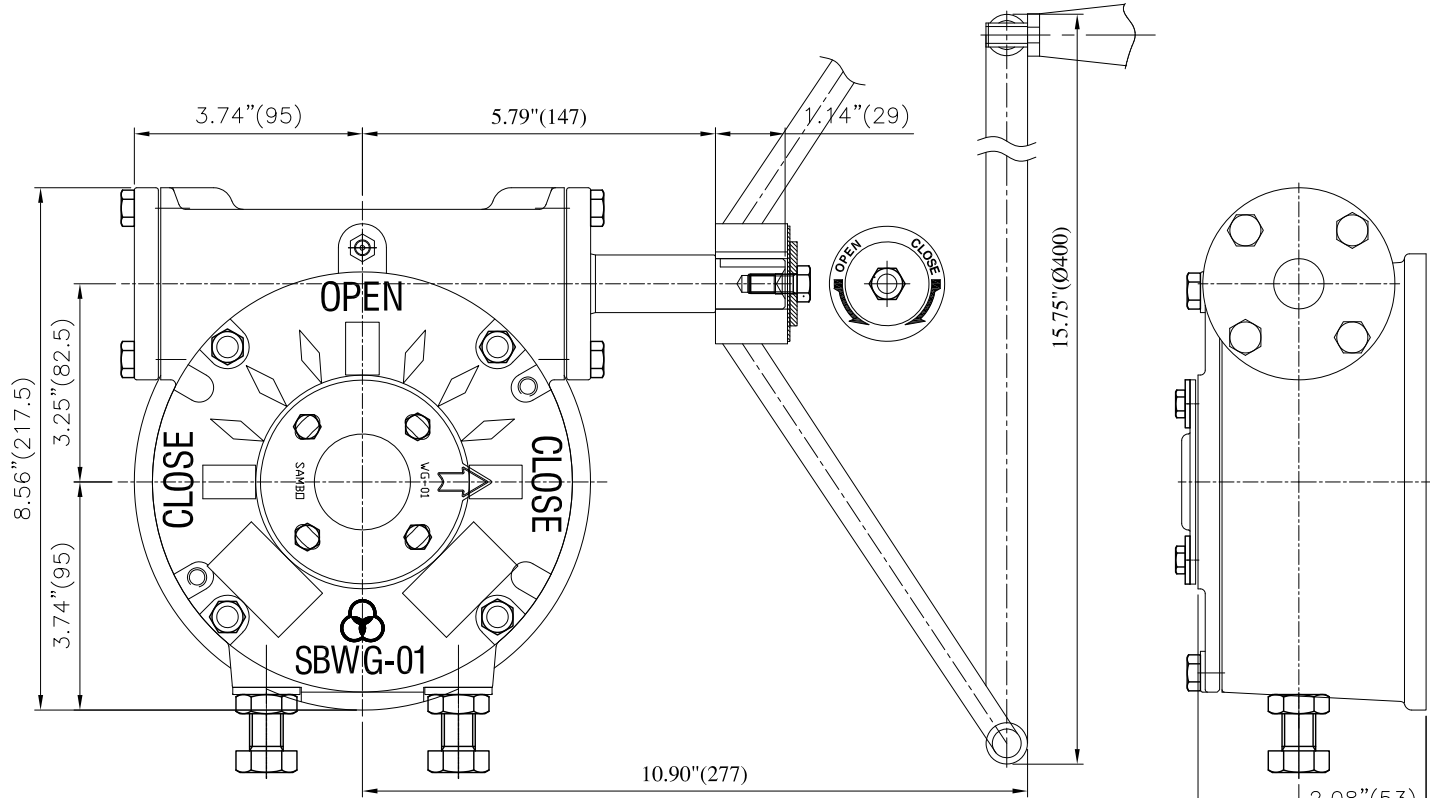
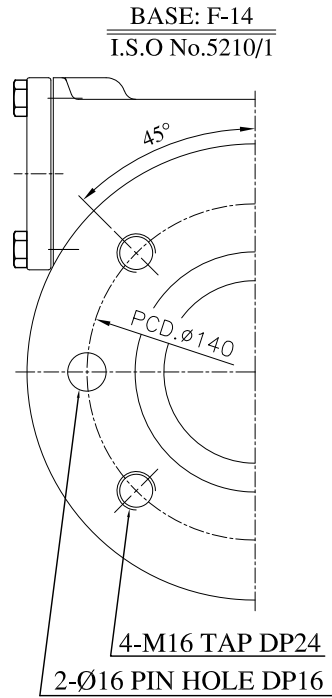
DIMENSIONS (inch)											Q'TY				
SIZE	Ød	FLANGE					*H1	*H2	*H3	L		*A	*B	ØW	
DIAMETER	PCDØC	n - Øh HOLE	n1 - h1 TAP DEPTH	N	T										
200	8"	Ø7.87"	Ø13.00"	8 - Ø1.00"	4 - 7/8"*9UNC 1.20"	12	1.56"	12.60"	9.84"	3.74"	6.00"	10.90"	3.25"	Ø15.75"	1
400	16"	Ø15.75"	Ø22.50"	16 - Ø1 3/8"	4 - 1 1/4"*8UN 1.57"	20	2.19"	19.69"	14.96"	5.71"	8.50"	17.32"	6.02"	Ø24.80"	4

* REFERENCE DIMENSION

WORM GEAR BOX
SBWG-01

"NEW TYPE"

UNIT \ SPEC'	TYPE	GEAR RATIO	Max.Output TORQUE	Mechanical Advantage ±10%	RANGE OF STEM DIA.	WEIGHT
SBWG-01	WORM	44 : 1	2000(Nm) 1475(Ft.lbf)	15.1	∅0 ~ ∅1.81"	29(1b)



NPS 8

WORM GEAR ASSEMBLY
HORIZONTAL INPUT

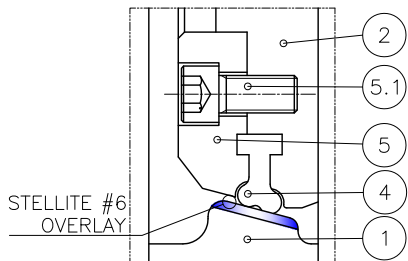
dwg No. S-WG04A/14WH

B	DSGN'D	J.Y.KANG
A	CHK'D	2015.04.01
Rev.	Date	

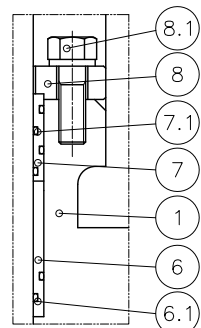
SAMBO INDUSTRIAL
KWAEBUP-DONG, SASANG-GU, BUSAN, KOREA
Http://www.sambo21.com

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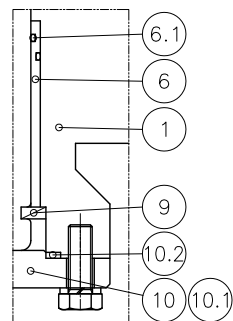
EFI submitted on "High Performance" DHV Butterfly Valves with a Seat Rating of 450 PSI and Body of 900 PSI. These higher pressure rated valves are Class 300 vs the Class 125 DHC bfv's there were being compared to. The materials EFI submitted for the DHC HP Class 300 valves are correct. Materials are different due to the higher pressure ratings. This was discussed in detail with Virgil Diaz at Southwest Valve & Equipment on 6-13-2023.



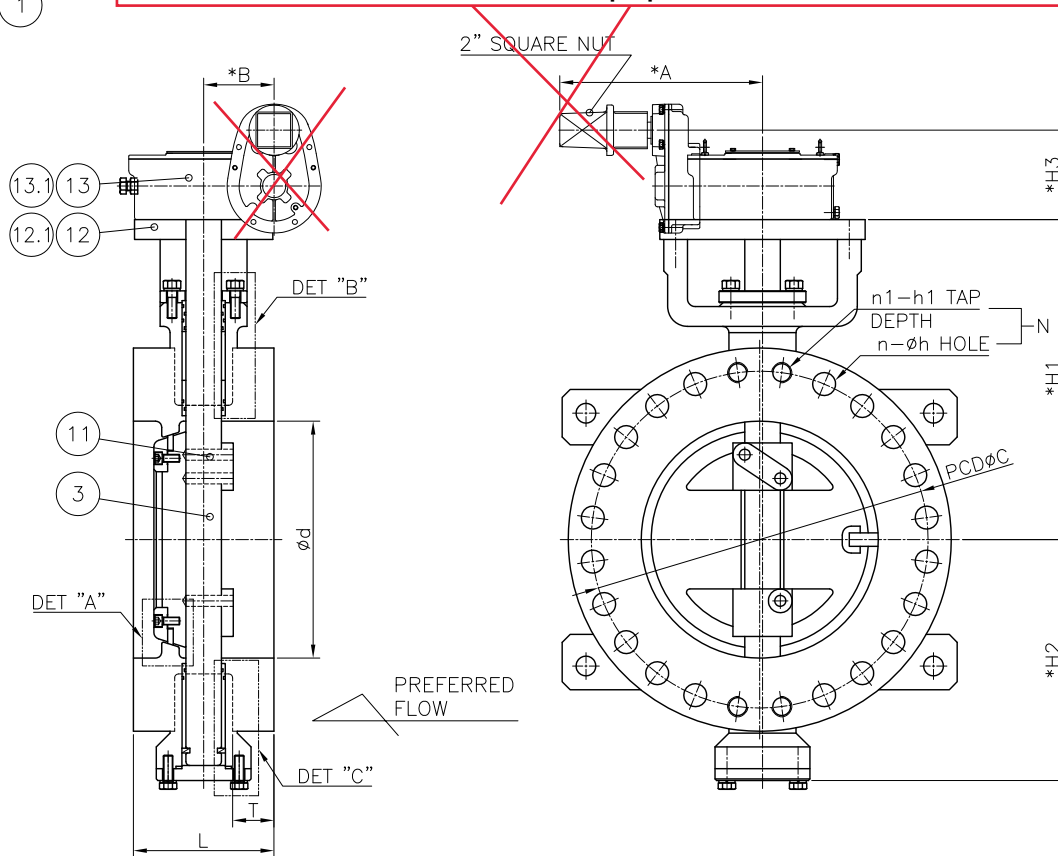
DETAIL "A"



DETAIL "B"



DETAIL "C"



* REFERENCE DIMENSION

DIMENSIONS (inch)														
SIZE	Ød	FLANGE					*H1	*H2	*H3	L	*A	*B	Q'TY	
		PCDØC	n - Øh HOLE	n1 - h1 TAP DEPTH	N	T								
300	12"	Ø11.81"	Ø17.75"	12 - Ø1.25"	4 - 1 1/8" * 8UN 1.38"	16	1.94"	16.53"	12.60"	4.90"	7.00"	12.62"	3.82"	1
450	18"	Ø17.71"	Ø24.75"	20 - Ø1.38"	4 - 1 1/4" * 8UN 1.77"	24	2.31"	22.84"	16.93"	7.64"	8.74"	14.96"	6.02"	1

No.	PART NAME	MATERIAL	Q'TY	REMARK
1	BODY	A216 WCB	1	+STELLITE #6
2	DISC	A351 CF8M	1	
3	SHAFT	A564 Gr.630	1	
4	SEAT	EPDM	1	PEROXIDE CURE
5	SEAT RETAINER	A240 Gr.316	1	
5.1	RETAINER BOLT	A4-70(S.S316)	1SET	
6	BODY BUSH	B584 C83600	2	
6.1	BUSH O-RING	EPDM	2SET	
7	O-RING HOLDER	B584 C83600	1	
7.1	HOLDER O-RING	EPDM	1SET	
8	PACKING GLAND	A240 Gr.304	1	
8.1	GLAND BOLT	A2-70(S.S304)	1SET	
9	SHAFT RING	B584 C83600	1	
10	END COVER	A36(SS275)	1	
10.1	END COVER BOLT	A2-70(S.S304)	1SET	
10.2	END COVER GASKET	EPDM	1	
11	TAPER PIN	A564 Gr.630	1SET	
12	TOP FLANGE	A36(SS275)	1	
12.1	TOP FLANGE BOLT	A2-70(S.S304)	1SET	
13	GEAR BOX	ASS'Y	1	
13.1	GEAR BOX BOLT	A2-70(S.S304)	1SET	

NOTE

- 1. BURIED TYPE VALVE
- 2. NSF EPOXY COAT Min. 12mils (RAL 5005)

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
22.05.18		FOR APPROVAL	S.G JANG	S.G LEE	B.J LEE
BASIC DESIGN		Ref. API 609 CATEGORY B			
FACE TO FACE		API 609 CAT'B SHORT PATTERN CL.150 or CL.300			
FLANGE RATING		ASME B16.5 CL.300 FLAT FACE			
TEST	CODE	MAKER'S STANDARD (Bi-Direction)			
	WATER	BODY	675 psi	SEAT	450 psi
	AIR	BODY	-	SEAT	-
LEAKAGE CLASS		ZERO LEAKAGE			
FLUID		-			
DESIGN		450 psi @ 100°F			
PRESSURE @ TEMP.		-			

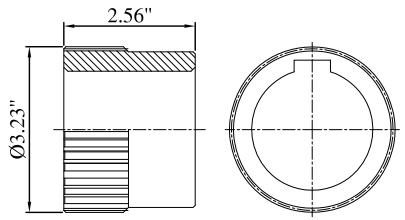
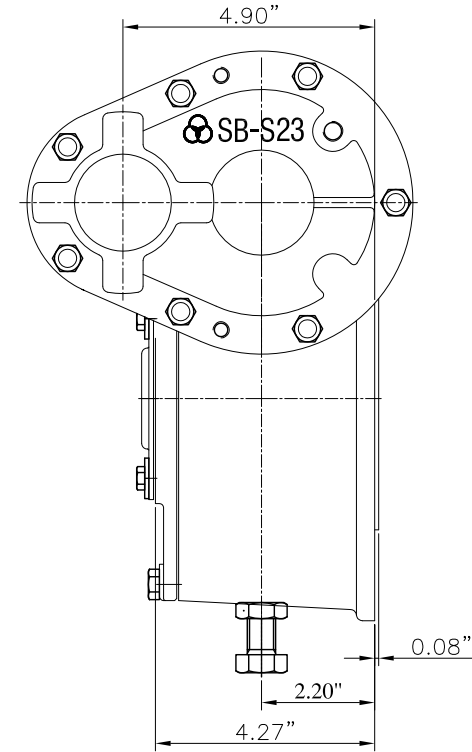
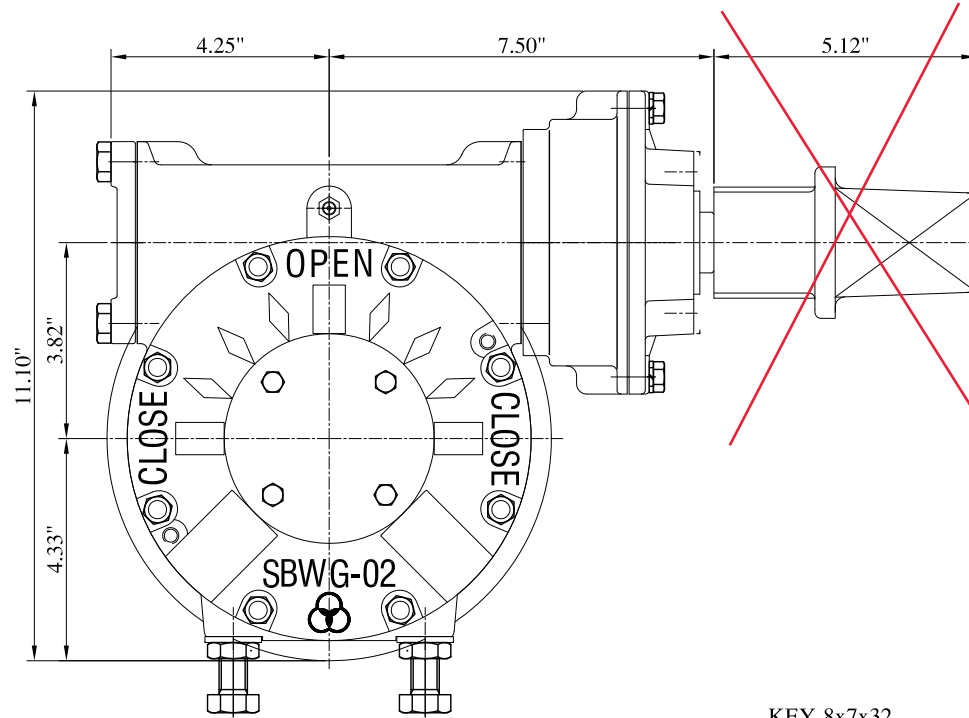
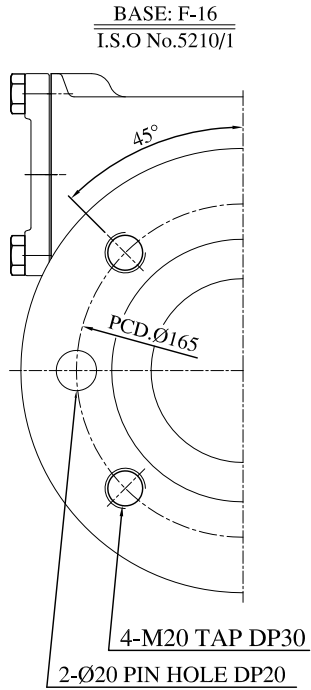
D.H.C. DAEHAN CONTROL Co.,Ltd.

TITLE	BFV DOUBLE FLANGE TYPE CL.300 NPS 12, 18			SCALE	N/S
	DOUBLE OFFSET RUBBER SEAT DESIGN			UNIT	mm
WORM GEAR OP'			PRO-JECTION		
PROJECT			DATE	2022. 05. 18	
SIGNATURE	PREPARED	CHECKED	APPROVED	DWG No.	BTDC4-F0000-R2G-A00-00
				PAGE No.	- / - PAGE
	22.05.18	22.05.18	22.05.18		

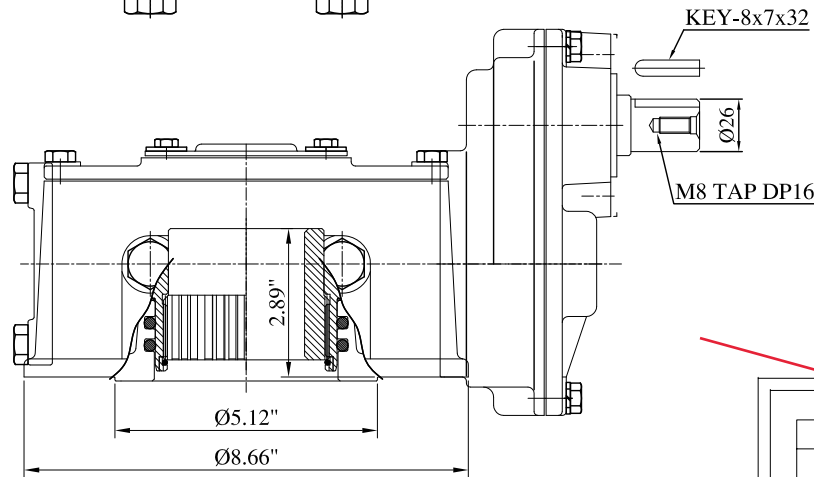
WORM GEAR BOX
SBWG-02-1S

”NEW TYPE”

MODEL	SPEC.	UNIT	GEAR RATIO	T.GEAR RATIO	Max.Output TORQUE	Mechanical Advantage ±10%	RANGE OF STEM DIA.	WEIGHT
SBWG-02-1S	WORM		48 : 1	122 : 1	2800(Nm) △ 2065(Ft.lbf)	△ 37.1	∅0 ~ ∅60	25(Kg)
	HELICAL		2.53 : 1					



DRIVE BUSH : RANGE OF STEM DIA. (∅0 ~ ∅2.36")



~~BURIED TYPE~~

WORM GEAR ASSEMBLY
HORIZONTAL INPUT WITH SINGLE
REDUCTION GEAR ATTACHMENT

dwg No. S-WG05B/16WH

B	DSGN'D	J.Y.KANG
A	CHK'D	
Rev.	Date	

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Http://www.sambo21.com

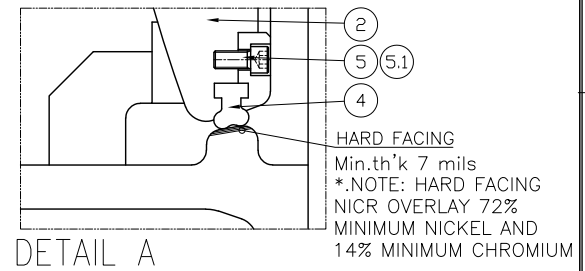
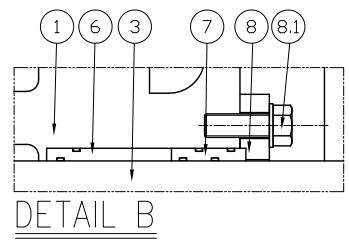
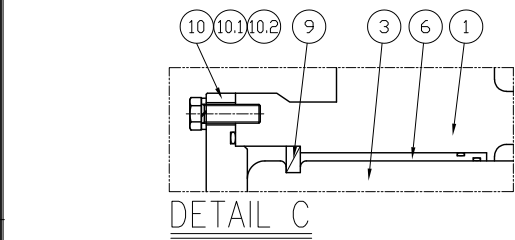
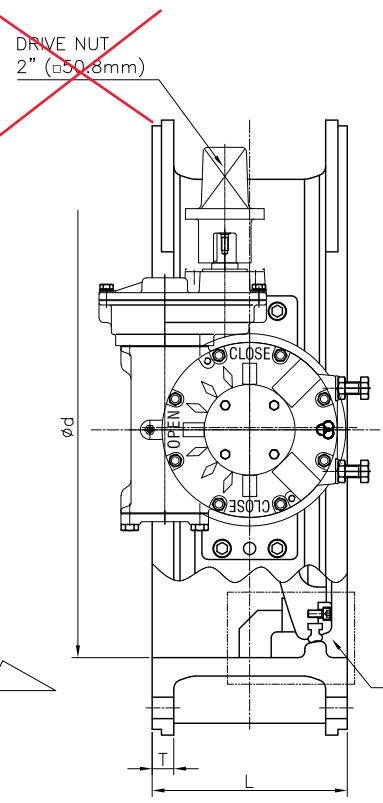
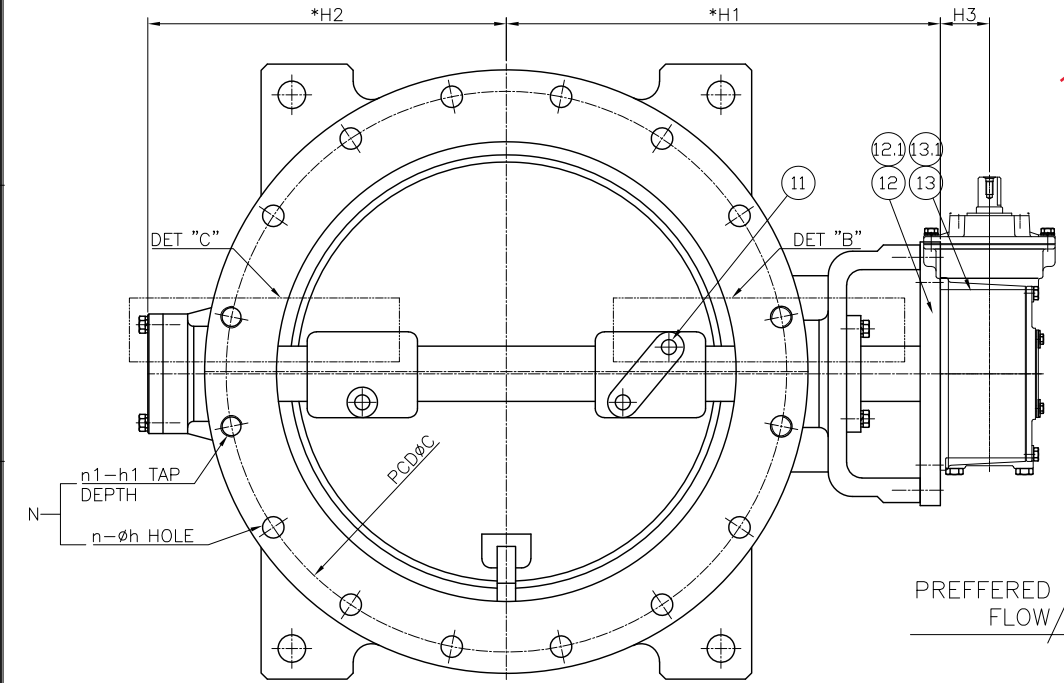
A

NO	DESCRIPTION	MAT'	QUANTITY		WEIGHT(KG)		REMARK'S
			PERSET	TOTAL	PERONE	TOTAL	
1	BODY	A536 Gr.65-45-12	1				+HARD FACING
2	DISC	A536 Gr.65-45-12	1				
3	SHAFT	A564 Gr.630	1				
4	DISC SEAT	EPDM	1				PEROXIDE CURE
5	BODY SEAT RETAINER	A240 Ty.316	1				
5.1	RETAINER BOLT	A4-70(S.S316)	1SET				
6	BODY BUSH	B150 C63000	2				WITH O-RING(EPDM)
7	O-RING HOLDER	B150 C63000	1				WITH O-RING(EPDM)
8	PACKING GLAND	A240 Ty.304	1				
8.1	GLAND BOLT	A4-70(S.S316)	1SET				
9	SHAFT RING	B150 C63000	1				
10	END COVER	A36(SS400)	1				
10.1	END COVER BOLT	A4-70(S.S316)	1				
10.2	END COVER GASKET	EPDM	1				
11	TAPER PIN	A564 Gr.630	1SET				
12	TOP FLANGE	A36(SS400)	1				
12.1	TOP FLANGE BOLT	A4-70(S.S316)	1SET				
13	GEAR BOX	ASS'Y	1				
13.1	GEAR BOX BOLT	A4-70(S.S316)	1SET				

NOTE

- FACE TO FACE : AWWA C504 SHORT BODY
- FLANGE RATING : ASME B16.1 CL.125 FLAT FACE
- HYDRAULIC TEST : BI-DIRECTION SEAT LEAKAGE TEST
 BODY : 300 psi
 SEAT : PRE. DIRECTION-250 psi
 REV. DIRECTION-250 psi
- LEAKAGE CLASS : ZERO LEAKAGE
- BURIED SERVICE WORM GEAR BOX

16 Mills Amerlock 400 Interior/Exterior



*REFERENCE Dimension

SIZE		DIMENSIONS (inch)										Q'TY
DIAMETER	ød	FLANGE					*H1	*H2	H3	L		
		PCDøC	N	n1-h1 TAP DEPTH	n-øh HOLE	T						
250	10"	9.84	14.25	12	4-7/8" *9UNC 0.98	8-ø1.00	1.10	13.60	10.00	1.60	8.00	1
300	12"	11.81	17.00	12	4-7/8" *9UNC 1.18	8-ø1.00	1.25	15.75	12.20	2.08	8.00	5
400	16"	15.74	21.25	16	4-1" *8UN 1.38	12-ø1.125	1.44	18.11	13.80	2.20	8.00	2

REFERENCE DWG. APPROVAL DWG. FINAL DWG.

3 of 4

REV	DATE	REVISIONS & DESCRIPTION	DRAWN	CHEC'D	ENGR	APPR'D
1	20.01.29	FOR APPROVAL	Y.J.H	J.S.G	-	L.B.J

D.H.C. DAEHAN CONTROL CO.,LTD.

SCALE: N/A DATE: 2020. 01. 29

PLANT: _____ FACILITY: _____ DIM: inch PRO-ACTION:

TITLE: DHC BFV DOUBLE FLANGE F.F CL.125-10,12,16" DOUBLE OFFSET RUBBER SEAT DESIGN WORM GEAR OP

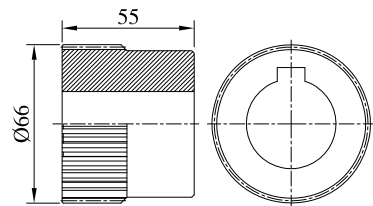
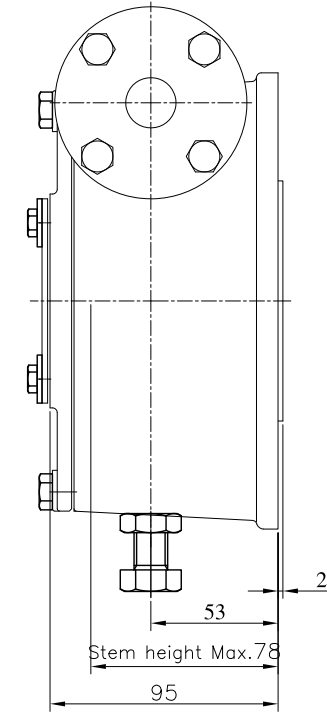
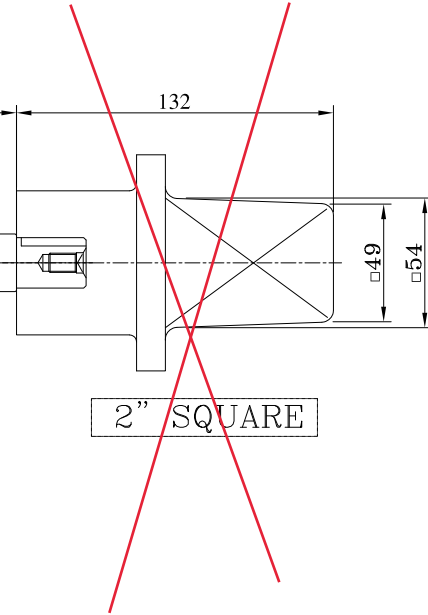
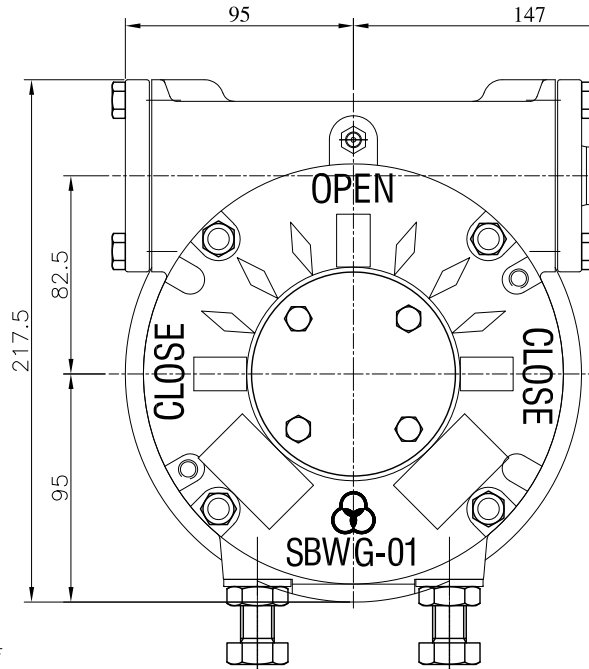
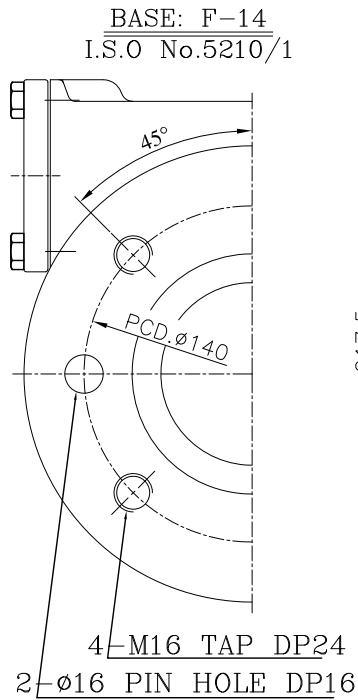
DHC No: DHC-BD1R-L200129-F0000-A00

Drawn	Checked	Reviewed	Approved	Drawn	Checked	Reviewed	Approved
Y.J.H	J.S.G	-	L.B.J	Y.J.H	J.S.G	-	L.B.J
Date				Date			
	20.01.29	20.01.29	-	20.01.29	20.01.29	-	20.01.29

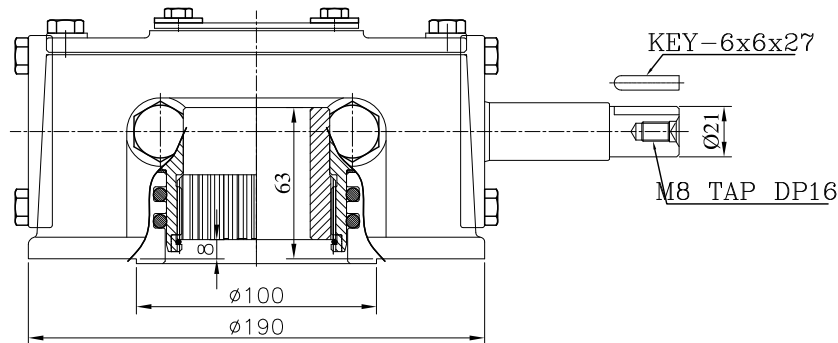
SHEET No: 1 / 2 SHEET

WORM GEAR BOX
SBWG-01

UNIT	SPEC'	TYPE	GEAR RATIO	Max.Output TORQUE	Mechanical Advantage $\pm 10\%$	RANGE OF STEM DIA.	WEIGHT
SBWG-01		WORM	44 : 1	2000(Nm) 1475(Ft.lbf)	14.5	$\phi 0 \sim \phi 46$	13(Kg)



DRIVE BUSH : RANGE OF STEM DIA. ($\phi 0$ - $\phi 46$)



#150-12''

dwg No. S-WG04A/14WH

WORM GEAR ASSEMBLY
HORIZONTAL INPUT

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KWAEBUP-DONG, SASANG-GU, BUSAN, KOREA
Http://www.sambo21.com

Rev.	Date	APP'D	A
A	2015.01.28	CHK'D	
B		DSGN'D	
		J.Y.KANG	

AMERLOCK® 2 / SIGMACOVER™ 2

DESCRIPTION

Two-component, high solids epoxy coating

PRINCIPAL CHARACTERISTICS

- Low-temperature curing down to 0°C (32°F)
- High performance self priming universal epoxy
- High solids, low VOC
- Surface tolerant and abrasion resistant
- Compatible with prepared, damp surfaces
- Good adhesion on most existing coatings
- Good resistance to splash and spillage of chemicals
- Meets NSF Standard 61 for tanks, pipes, valves and fittings (US manufacturing only)
- Proven coating as a bulk rail lining and DTM exterior coating

COLOR AND GLOSS LEVEL

- Standard primer colors and custom colors
- Semi-gloss

Note: Epoxy coatings will chalk and fade with exposure to sunlight. Light colors are prone to ambering to some extent. Note that product tinted to custom colors are not recommended for immersion service. Only use factory grind batches for immersion

BASIC DATA AT 10°C (50°F)

Data for mixed product	
Number of components	Two
Mass density	1.4 kg/l (11.7 lb/US gal)
Volume solids	85 ± 2%
VOC (Supplied)	Directive 1999/13/EC, SED: max. 114.0 g/kg max. 163.0 g/l (approx. 1.4 lb/US gal) EPA Method 24: 1.5 lb/US gal (180.0 g/l)
Temperature resistance (Continuous)	To 120°C (250°F)
Temperature resistance (Intermittent)	To 175°C (350°F)
Recommended dry film thickness	100 - 200 µm (4.0 - 8.0 mils)
Theoretical spreading rate	8.5 m ² /l for 100 µm (341 ft ² /US gal for 4.0 mils)
Dry to touch	6 hours
Overcoating Interval	See overcoating tables



AMERLOCK® 2 / SIGMACOVER™ 2

Data for mixed product

Shelf life	Base: at least 36 months when stored cool and dry Hardener: at least 24 months when stored cool and dry
-------------------	--

Notes:

- See ADDITIONAL DATA – Spreading rate and film thickness
- See ADDITIONAL DATA – Overcoating intervals
- See ADDITIONAL DATA – Curing time
- For compliance with regulations which require VOC less than 100 g/L, AMERLOCK 2 VOC can be specified interchangeably
- AMERLOCK 2 VOC is available only in US and Canada
- Intermittent temperature resistance should be less than 5% of the time, and maximum 24 hours
- Temperature resistance is in atmospheric condition. Please contact your PPG representative for immersion condition.

RECOMMENDED SUBSTRATE CONDITIONS AND TEMPERATURES

- Coating performance is proportional to the degree of surface preparation. Remove all loose paint, mill scale, and rust. The surface to be coated must be dimensionally stable, dry, clean and free of grease, oil, and other foreign materials. When proper abrasive blast surface preparation is not practical, surfaces should be chipped clean and wire brushed to bare, clean material

Carbon steel

- For immersion service: steel; blast cleaned to ISO-Sa2½ (SSPC SP-10)
- For atmospheric service, abrasive blast to ISO-Sa2½ or minimum SSPC SP-6, power tool cleaned to ISO-St3 (SSPC SP-3) or hand tool cleaned to ISO-St2 (SSPC SP-2) or ultra high pressure water jet to SSPC SP WJ-2(L) / NACE WJ-2(L)

Concrete / Masonry

- Remove grease, oil and other penetrating contaminants according to ASTM D4258
- Abrade the surface per ASTM D4259 to remove all chalk and surface glaze or laitance. Achieve surface profile - ICRI CSP 3 to 5
- Fill voids as necessary with AMERCOAT 114 A epoxy filler
- Maximum recommended moisture transmission rate is 3 lbs / 1,000 ft² / 24 hours by moisture transmission test (ASTM F1869, calcium chloride test or by ASTM D4263, plastic sheet test)
- Alternatively, ASTM D4944 (Calcium Carbide Gas method) can be used, moisture content should not exceed 4%

Galvanized steel

- Remove oil or soap film with detergent or emulsion cleaner
- Lightly abrasive blast with a fine abrasive in accordance with SSPC SP-16 guidelines to achieve a profile of 40 - 75 µm (1.5 - 3.0 mils). When light abrasive blasting is not possible, galvanizing can be treated with a suitable zinc phosphate conversion coating
- Galvanizing that has had at least 12 months of exterior weathering may be coated after power washing to remove all contaminants and white rust



AMERLOCK® 2 / SIGMACOVER™ 2

Non-ferrous metals and stainless steel

- Remove all rust, dirt, moisture, grease or other contaminants from the surface
- Lightly abrasive blast with a fine abrasive in accordance with SSPC SP-16 guidelines to achieve a profile of 40 - 100 µm (1.5 - 4.0 mils)

Aged coatings and repairs

- Aged suitable coating must be dry and free from any contamination
- For single-pack coatings, extra precautions are necessary

Substrate temperature

- Substrate temperature during application and curing should be between 0°C (32°F) and 50°C (122°F)
- Substrate temperature during application and curing should be at least 3°C (5°F) above dew point

SYSTEM SPECIFICATION

- Primers: Direct to substrate; DIMETCOTE Series, AMERCOAT 68 Series, AMERLOCK 2 / 400 Series, SIGMAZINC Series, AMERCOAT Epoxies and SIGMA Epoxies
- Topcoats: AMERCOAT 450 Series, SIGMADUR Series, SIGMACOVER Epoxies, AMERCOAT Epoxies, AMERSHIELD and PSX 700

Note: Please contact your PPG representative if using an alternate primer

INSTRUCTIONS FOR USE

Mixing ratio by volume: base to hardener 50:50 (1:1)

- The paint should be stirred well before use, preferably by means of a mechanical mixer, to ensure homogeneity
- Add hardener to base and continue stirring until homogeneous

Induction time

Mixed product induction time	
Mixed product temperature	Induction time
0°C (32°F)	45 minutes
10°C (50°F)	30 minutes
15°C (59°F)	20 minutes
20°C (68°F)	10 minutes
Above 23°C (73°F)	None

Pot life

2 hours at 10°C (50°F)

Note: See ADDITIONAL DATA – Pot life



AMERLOCK® 2 / SIGMACOVER™ 2

Air spray

Recommended thinner

THINNER 91-92 FOR GLOBAL, THINNER 91-34 (AMERCOAT 8) FOR NSF/ANSI 61, THINNER 91-82 (AMERCOAT T10) for NON NSF/ANSI 61 and $\leq 90^{\circ}\text{F}$ (32°C), THINNER 21-25 (AMERCOAT 101) for NON NSF/ANSI 61 and $> 90^{\circ}\text{F}$ (32°C)

Volume of thinner

0 - 10%, depending on required thickness and application conditions

Airless spray

Recommended thinner

THINNER 91-92 FOR GLOBAL, THINNER 91-34 (AMERCOAT 8) FOR NSF/ANSI 61, THINNER 91-82 (AMERCOAT T10) for NON NSF/ANSI 61 and $\leq 90^{\circ}\text{F}$ (32°C), THINNER 21-25 (AMERCOAT 101) for NON NSF/ANSI 61 and $> 90^{\circ}\text{F}$ (32°C)

Volume of thinner

0 - 5%, depending on required thickness and application conditions

Nozzle orifice

Approx. 0.48 mm (0.019 in)

Nozzle pressure

15.0 - 18.0 MPa (approx. 150 - 180 bar; 2176 - 2611 p.s.i.)

Brush/roller

- Apply evenly using a well-loaded brush or roller
- Application by brush or roller will provide approximately 80 μm (3.1 mils) DFT in a single-coat application

Cleaning solvent

THINNER 90-53, THINNER 90-58 (AMERCOAT 12) OR THINNER 21-06 (AMERCOAT 65)

ADDITIONAL DATA

Spreading rate and film thickness	
DFT	Theoretical spreading rate
100 μm (4.0 mils)	8.5 m^2/l (341 $\text{ft}^2/\text{US gal}$)
125 μm (5.0 mils)	6.8 m^2/l (273 $\text{ft}^2/\text{US gal}$)
200 μm (8.0 mils)	4.3 m^2/l (170 $\text{ft}^2/\text{US gal}$)

AMERLOCK® 2 / SIGMACOVER™ 2

Overcoating interval for DFT up to 200 µm (8.0 mils)					
Overcoating with...	Interval	5°C (41°F)	10°C (50°F)	20°C (68°F)	30°C (86°F)
itself and various two-pack epoxy coatings	Minimum	24 hours	12 hours	6 hours	3 hours
	Maximum	1 month	1 month	1 month	1 month
urethane and PSX	Minimum	24 hours	12 hours	6 hours	3 hours
	Maximum	14 days	14 days	7 days	4 days

Notes:

- Surface should be dry and free from any contamination
- A detergent wash with PREP 88, SIGMARITE 88 or equivalent is required prior to application of topcoats after 30 days of exposure
- If maximum recoat time has been exceeded, roughen surfaces
- Alkyd coatings and waterborne acrylic coatings should be applied after the film is dry to handle and not greater than three times dry to handle time
- Maximum recoating time is highly dependent upon actual surface temperature - not simply air temperatures. Sun-exposed or otherwise heated surface will shorten the maximum recoat window

Curing time for DFT up to 200 µm (8.0 mils)		
Substrate temperature	Dry to handle	Full cure
0°C (32°F)	38 hours	21 days
10°C (50°F)	14 hours	7 days
20°C (68°F)	5 hours	4 days
30°C (86°F)	3 hours	3 days

Note: Adequate ventilation must be maintained during application and curing (please refer to INFORMATION SHEETS 1433 and 1434)

Pot life (at application viscosity)	
Mixed product temperature	Pot life
0°C (32°F)	4 hours
10°C (50°F)	2 hours
20°C (68°F)	1 hour
30°C (86°F)	30 minutes

Product Qualifications

- NORSOK M501 Rev. 5, System 7 Subsea surfaces
- Compliant with USDA Incidental Food Contact Requirements
- NFPA Class A for Flame Spread and Smoke Development
- Qualified for ANSI/NSF Standard 61 (potable water). For NSF application instructions, please visit the following website: <http://www.nsf.org/certified-products-systems/>
- AWWA D102-06 ICS #1, #2, #3, #5
- Nuclear Service Level 2 (ANSI N 5.12 and ASTM D5144)
- LEED's compliant for Anti-corrosive Paint category



AMERLOCK® 2 / SIGMACOVER™ 2

SAFETY PRECAUTIONS

- For paint and recommended thinners see INFORMATION SHEETS 1430, 1431 and relevant Material Safety Data Sheets
- This is a solvent-borne paint and care should be taken to avoid inhalation of spray mist or vapor, as well as contact between the wet paint and exposed skin or eyes

WORLDWIDE AVAILABILITY

It is always the aim of PPG Protective and Marine Coatings to supply the same product on a worldwide basis. However, slight modification of the product is sometimes necessary to comply with local or national rules/circumstances. Under these circumstances an alternative product data sheet is used.

REFERENCES

• CONVERSION TABLES	INFORMATION SHEET	1410
• EXPLANATION TO PRODUCT DATA SHEETS	INFORMATION SHEET	1411
• SAFETY INDICATIONS	INFORMATION SHEET	1430
• SAFETY IN CONFINED SPACES AND HEALTH SAFETY, EXPLOSION HAZARD – TOXIC HAZARD	INFORMATION SHEET	1431
• SAFE WORKING IN CONFINED SPACES	INFORMATION SHEET	1433
• DIRECTIVES FOR VENTILATION PRACTICE	INFORMATION SHEET	1434
• CLEANING OF STEEL AND REMOVAL OF RUST	INFORMATION SHEET	1490
• SPECIFICATION FOR MINERAL ABRASIVES	INFORMATION SHEET	1491
• SURFACE PREPARATION OF CONCRETE (FLOORS)	INFORMATION SHEET	1496
• RELATIVE HUMIDITY – SUBSTRATE TEMPERATURE – AIR TEMPERATURE	INFORMATION SHEET	1650

WARRANTY

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AMERLOCK® 2 / SIGMACOVER™ 2

DESCRIPTION

Two-component, high solids epoxy coating

PRINCIPAL CHARACTERISTICS

- Low-temperature curing down to 0°C (32°F)
- High performance self priming universal epoxy
- High solids, low VOC
- Surface tolerant and abrasion resistant
- Compatible with prepared, damp surfaces
- Good adhesion on most existing coatings
- Good resistance to splash and spillage of chemicals
- Meets NSF Standard 61 for tanks, pipes, valves and fittings (US manufacturing only)
- Proven coating as a bulk rail lining and DTM exterior coating

COLOR AND GLOSS LEVEL

- Standard primer colors and custom colors
- Semi-gloss

Note: Epoxy coatings will chalk and fade with exposure to sunlight. Light colors are prone to ambering to some extent. Note that product tinted to custom colors are not recommended for immersion service. Only use factory grind batches for immersion

BASIC DATA AT 10°C (50°F)

Data for mixed product	
Number of components	Two
Mass density	1.4 kg/l (11.7 lb/US gal)
Volume solids	85 ± 2%
VOC (Supplied)	Directive 1999/13/EC, SED: max. 114.0 g/kg max. 163.0 g/l (approx. 1.4 lb/US gal) EPA Method 24: 1.5 lb/US gal (180.0 g/l)
Temperature resistance (Continuous)	To 120°C (250°F)
Temperature resistance (Intermittent)	To 175°C (350°F)
Recommended dry film thickness	100 - 200 µm (4.0 - 8.0 mils)
Theoretical spreading rate	8.5 m ² /l for 100 µm (341 ft ² /US gal for 4.0 mils)
Dry to touch	6 hours
Overcoating Interval	See overcoating tables



AMERLOCK® 2 / SIGMACOVER™ 2

Data for mixed product

Shelf life	Base: at least 36 months when stored cool and dry Hardener: at least 24 months when stored cool and dry
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Notes:

- See ADDITIONAL DATA – Spreading rate and film thickness
- See ADDITIONAL DATA – Overcoating intervals
- See ADDITIONAL DATA – Curing time
- For compliance with regulations which require VOC less than 100 g/L, AMERLOCK 2 VOC can be specified interchangeably
- AMERLOCK 2 VOC is available only in US and Canada
- Intermittent temperature resistance should be less than 5% of the time, and maximum 24 hours
- Temperature resistance is in atmospheric condition. Please contact your PPG representative for immersion condition.

RECOMMENDED SUBSTRATE CONDITIONS AND TEMPERATURES

- Coating performance is proportional to the degree of surface preparation. Remove all loose paint, mill scale, and rust. The surface to be coated must be dimensionally stable, dry, clean and free of grease, oil, and other foreign materials. When proper abrasive blast surface preparation is not practical, surfaces should be chipped clean and wire brushed to bare, clean material

Carbon steel

- For immersion service: steel; blast cleaned to ISO-Sa2½ (SSPC SP-10)
- For atmospheric service, abrasive blast to ISO-Sa2½ or minimum SSPC SP-6, power tool cleaned to ISO-St3 (SSPC SP-3) or hand tool cleaned to ISO-St2 (SSPC SP-2) or ultra high pressure water jet to SSPC SP WJ-2(L) / NACE WJ-2(L)

Concrete / Masonry

- Remove grease, oil and other penetrating contaminants according to ASTM D4258
- Abrade the surface per ASTM D4259 to remove all chalk and surface glaze or laitance. Achieve surface profile - ICRI CSP 3 to 5
- Fill voids as necessary with AMERCOAT 114 A epoxy filler
- Maximum recommended moisture transmission rate is 3 lbs / 1,000 ft² / 24 hours by moisture transmission test (ASTM F1869, calcium chloride test or by ASTM D4263, plastic sheet test)
- Alternatively, ASTM D4944 (Calcium Carbide Gas method) can be used, moisture content should not exceed 4%

Galvanized steel

- Remove oil or soap film with detergent or emulsion cleaner
- Lightly abrasive blast with a fine abrasive in accordance with SSPC SP-16 guidelines to achieve a profile of 40 - 75 µm (1.5 - 3.0 mils). When light abrasive blasting is not possible, galvanizing can be treated with a suitable zinc phosphate conversion coating
- Galvanizing that has had at least 12 months of exterior weathering may be coated after power washing to remove all contaminants and white rust



AMERLOCK® 2 / SIGMACOVER™ 2

Non-ferrous metals and stainless steel

- Remove all rust, dirt, moisture, grease or other contaminants from the surface
- Lightly abrasive blast with a fine abrasive in accordance with SSPC SP-16 guidelines to achieve a profile of 40 - 100 µm (1.5 - 4.0 mils)

Aged coatings and repairs

- Aged suitable coating must be dry and free from any contamination
- For single-pack coatings, extra precautions are necessary

Substrate temperature

- Substrate temperature during application and curing should be between 0°C (32°F) and 50°C (122°F)
- Substrate temperature during application and curing should be at least 3°C (5°F) above dew point

SYSTEM SPECIFICATION

- Primers: Direct to substrate; DIMETCOTE Series, AMERCOAT 68 Series, AMERLOCK 2 / 400 Series, SIGMAZINC Series, AMERCOAT Epoxies and SIGMA Epoxies
- Topcoats: AMERCOAT 450 Series, SIGMADUR Series, SIGMACOVER Epoxies, AMERCOAT Epoxies, AMERSHIELD and PSX 700

Note: Please contact your PPG representative if using an alternate primer

INSTRUCTIONS FOR USE

Mixing ratio by volume: base to hardener 50:50 (1:1)

- The paint should be stirred well before use, preferably by means of a mechanical mixer, to ensure homogeneity
- Add hardener to base and continue stirring until homogeneous

Induction time

Mixed product induction time	
Mixed product temperature	Induction time
0°C (32°F)	45 minutes
10°C (50°F)	30 minutes
15°C (59°F)	20 minutes
20°C (68°F)	10 minutes
Above 23°C (73°F)	None

Pot life

2 hours at 10°C (50°F)

Note: See ADDITIONAL DATA – Pot life



AMERLOCK® 2 / SIGMACOVER™ 2

Air spray

Recommended thinner

THINNER 91-92 FOR GLOBAL, THINNER 91-34 (AMERCOAT 8) FOR NSF/ANSI 61, THINNER 91-82 (AMERCOAT T10) for NON NSF/ANSI 61 and $\leq 90^{\circ}\text{F}$ (32°C), THINNER 21-25 (AMERCOAT 101) for NON NSF/ANSI 61 and $> 90^{\circ}\text{F}$ (32°C)

Volume of thinner

0 - 10%, depending on required thickness and application conditions

Airless spray

Recommended thinner

THINNER 91-92 FOR GLOBAL, THINNER 91-34 (AMERCOAT 8) FOR NSF/ANSI 61, THINNER 91-82 (AMERCOAT T10) for NON NSF/ANSI 61 and $\leq 90^{\circ}\text{F}$ (32°C), THINNER 21-25 (AMERCOAT 101) for NON NSF/ANSI 61 and $> 90^{\circ}\text{F}$ (32°C)

Volume of thinner

0 - 5%, depending on required thickness and application conditions

Nozzle orifice

Approx. 0.48 mm (0.019 in)

Nozzle pressure

15.0 - 18.0 MPa (approx. 150 - 180 bar; 2176 - 2611 p.s.i.)

Brush/roller

- Apply evenly using a well-loaded brush or roller
- Application by brush or roller will provide approximately 80 μm (3.1 mils) DFT in a single-coat application

Cleaning solvent

THINNER 90-53, THINNER 90-58 (AMERCOAT 12) OR THINNER 21-06 (AMERCOAT 65)

ADDITIONAL DATA

Spreading rate and film thickness	
DFT	Theoretical spreading rate
100 μm (4.0 mils)	8.5 m^2/l (341 $\text{ft}^2/\text{US gal}$)
125 μm (5.0 mils)	6.8 m^2/l (273 $\text{ft}^2/\text{US gal}$)
200 μm (8.0 mils)	4.3 m^2/l (170 $\text{ft}^2/\text{US gal}$)

AMERLOCK® 2 / SIGMACOVER™ 2

Overcoating interval for DFT up to 200 µm (8.0 mils)					
Overcoating with...	Interval	5°C (41°F)	10°C (50°F)	20°C (68°F)	30°C (86°F)
itself and various two-pack epoxy coatings	Minimum	24 hours	12 hours	6 hours	3 hours
	Maximum	1 month	1 month	1 month	1 month
urethane and PSX	Minimum	24 hours	12 hours	6 hours	3 hours
	Maximum	14 days	14 days	7 days	4 days

Notes:

- Surface should be dry and free from any contamination
- A detergent wash with PREP 88, SIGMARITE 88 or equivalent is required prior to application of topcoats after 30 days of exposure
- If maximum recoat time has been exceeded, roughen surfaces
- Alkyd coatings and waterborne acrylic coatings should be applied after the film is dry to handle and not greater than three times dry to handle time
- Maximum recoating time is highly dependent upon actual surface temperature - not simply air temperatures. Sun-exposed or otherwise heated surface will shorten the maximum recoat window

Curing time for DFT up to 200 µm (8.0 mils)		
Substrate temperature	Dry to handle	Full cure
0°C (32°F)	38 hours	21 days
10°C (50°F)	14 hours	7 days
20°C (68°F)	5 hours	4 days
30°C (86°F)	3 hours	3 days

Note: Adequate ventilation must be maintained during application and curing (please refer to INFORMATION SHEETS 1433 and 1434)

Pot life (at application viscosity)	
Mixed product temperature	Pot life
0°C (32°F)	4 hours
10°C (50°F)	2 hours
20°C (68°F)	1 hour
30°C (86°F)	30 minutes

Product Qualifications

- NORSOK M501 Rev. 5, System 7 Subsea surfaces
- Compliant with USDA Incidental Food Contact Requirements
- NFPA Class A for Flame Spread and Smoke Development
- Qualified for ANSI/NSF Standard 61 (potable water). For NSF application instructions, please visit the following website: <http://www.nsf.org/certified-products-systems/>
- AWWA D102-06 ICS #1, #2, #3, #5
- Nuclear Service Level 2 (ANSI N 5.12 and ASTM D5144)
- LEED's compliant for Anti-corrosive Paint category



AMERLOCK® 2 / SIGMACOVER™ 2

SAFETY PRECAUTIONS

- For paint and recommended thinners see INFORMATION SHEETS 1430, 1431 and relevant Material Safety Data Sheets
- This is a solvent-borne paint and care should be taken to avoid inhalation of spray mist or vapor, as well as contact between the wet paint and exposed skin or eyes

WORLDWIDE AVAILABILITY

It is always the aim of PPG Protective and Marine Coatings to supply the same product on a worldwide basis. However, slight modification of the product is sometimes necessary to comply with local or national rules/circumstances. Under these circumstances an alternative product data sheet is used.

REFERENCES

• CONVERSION TABLES	INFORMATION SHEET	1410
• EXPLANATION TO PRODUCT DATA SHEETS	INFORMATION SHEET	1411
• SAFETY INDICATIONS	INFORMATION SHEET	1430
• SAFETY IN CONFINED SPACES AND HEALTH SAFETY, EXPLOSION HAZARD – TOXIC HAZARD	INFORMATION SHEET	1431
• SAFE WORKING IN CONFINED SPACES	INFORMATION SHEET	1433
• DIRECTIVES FOR VENTILATION PRACTICE	INFORMATION SHEET	1434
• CLEANING OF STEEL AND REMOVAL OF RUST	INFORMATION SHEET	1490
• SPECIFICATION FOR MINERAL ABRASIVES	INFORMATION SHEET	1491
• SURFACE PREPARATION OF CONCRETE (FLOORS)	INFORMATION SHEET	1496
• RELATIVE HUMIDITY – SUBSTRATE TEMPERATURE – AIR TEMPERATURE	INFORMATION SHEET	1650

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Submittal Data Cover Sheet

Series: 60 Series: Pump Control Valve
Model: 60-11: Pump Control Valve
Job/Project Name: EFI Project# 93134 "West Lilac PS" (Hutton)
Description: Size 12" 60-11 Pump Control Valves – Class 300, All SST Internals (PU not included),
 PET Internal Disc, CSM11HC Solenoid, All SST Pilot, Epoxy Coated, (1) DPDT - (1)
 SPDT X105L2W. 120VAC, ETO.TRIM RIGHT SIDE.
Quotation No.: KC-1265 Rev2

Company: EFI Solutions	Contact: Ryan Brinkmann
Engineering Firm:	Address: 1221 N Elm St
Project Engineer:	City/State/Zip: Centralia Illinois 62801

Fluid to be handled
 Water

Main Valve

Valve Size 12	Main Valve Body & Cover Ductile Iron ASTM A-536	End Details Ductile Iron ANSI B16.42 Class 300
Base Valve 100-03 Powercheck	Main Valve Trim Stainless Steel	Pressure Rating 250/350 Class @ 400 psi Max
Quantity 3	Valve Pattern Globe	Elastomers (Max Temperature 180°F) Buna-N® Synthetic Rubber

Fusion Bonded Epoxy Coating
 Standard 8-10 mil

Main Valve Notes:
 Main Valve Disc Material - Polyethylene
 Main Valve Diaphragm Washer & Disc Retainer - Stainless Steel

Pilot System

Tubing & Fittings
 303 Rigid Stainless Steel

Pilot System Configuration
 Material: SST with SST Trim
 Mounting: Right Hand Pilot
 System Mount
 (standard)

Solenoids

Voltages 120/60 VAC	Solenoid 1 CSM-11HC 4-Way Solenoid
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Features and Options

[✓] Y Pattern Strainer (Y)

[✓] Pilot System Isolation Valves (B)

[✓] Closing Speed Control (C)

[✓] Opening Speed Control (S)

Limit Switch

X105L2W - Dual Position Weather Proof

Warranty

[Waterworks Warranty](#)

Submittal Notes

- Station Suction Pressure range 12-73 PSI • Station Discharge Pressure range 168-192 PSI
- Turbine Pump design = 1800 GPM @ 400' TDH
- Flowserve Turbine Pump has a Maximum of 511' TDH @ Shutoff. This = 220 PSI
- Max. Suction Pressure @ No Flow is modeled at 73 PSI. 73 PSI + 220 PSI = 293 PSI.
This is what can be measured at the Inlet of the Closed CLA-VAL Pump Control Valve.



60 Series

(100-03 Main Valve)

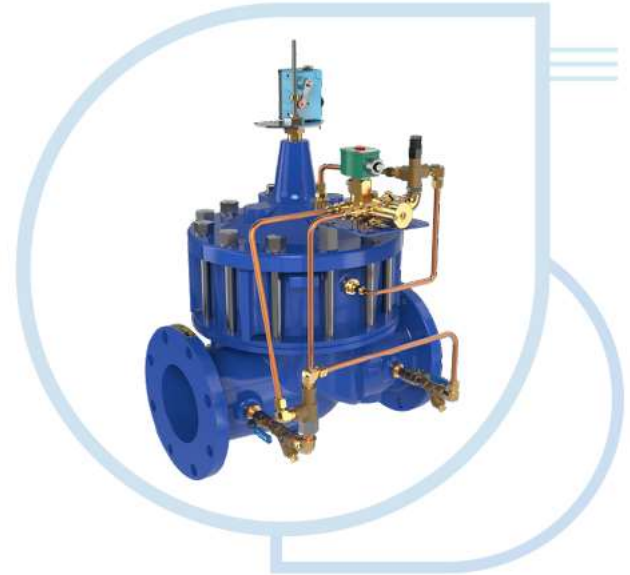
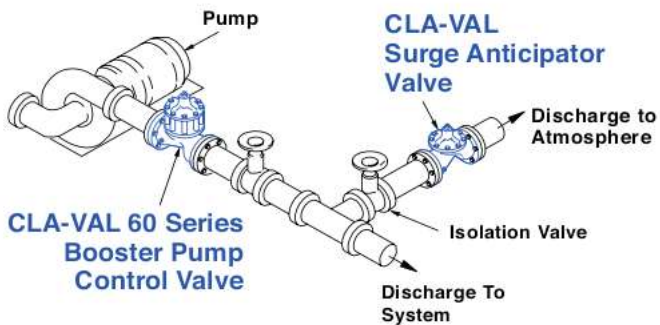
BOOSTER PUMP CONTROL VALVE

PRODUCT FEATURES

- Completely Automatic Operation
- Easy Adjustment and Maintenance
- Fully Supported Frictionless Diaphragm
- Meets NSF/ANSI 372 Lead Reduction Mandate

MAIN FUNCTION

- The CLA-VAL 60 SERIES is a pilot operated valve designed for installation on the discharge of booster pumps to eliminate pipeline surges caused by the starting and stopping of the pump. The pump starts against a closed valve.
- When the pump is started, the solenoid control is energized, and the valve begins to open slowly, gradually increasing line pressure to full pumping head. When the pump is signaled to shut-off, the solenoid control is de-energized and the valve begins to close slowly, gradually reducing flow while the pump continues to run. When the valve is closed, a limit switch assembly, which serves as an electrical interlock between the valve and the pump, releases the pump starter and the pump stops.
- Should a power failure occur, a built-in lift-type check valve closes the moment flow stops, preventing reverse flow regardless of solenoid or diaphragm assembly position.



SYSTEM SOLUTIONS

- CLA-VAL offers system solutions to prevent cavitation, noise, corrosion, mineral build-up, flow metering, and electronic valve control, to name a few solutions.
- Optional features including but not limited to; solenoid shut-off, check feature, return flow, and remote sensing.
- Contact CLA-VAL for full line of options!

TYPICAL APPLICATIONS

- The CLA-VAL 60 Series should be installed as shown to help prevent pipeline surges during pump starting and stopping. A Cla-Val 52 Series Surge Anticipator Valve is recommended for power failure protection. Use the PC-22D Electronic Pump Control Panel for applications where electronic control and integration with SCADA is desired.

CLA-VAL Company

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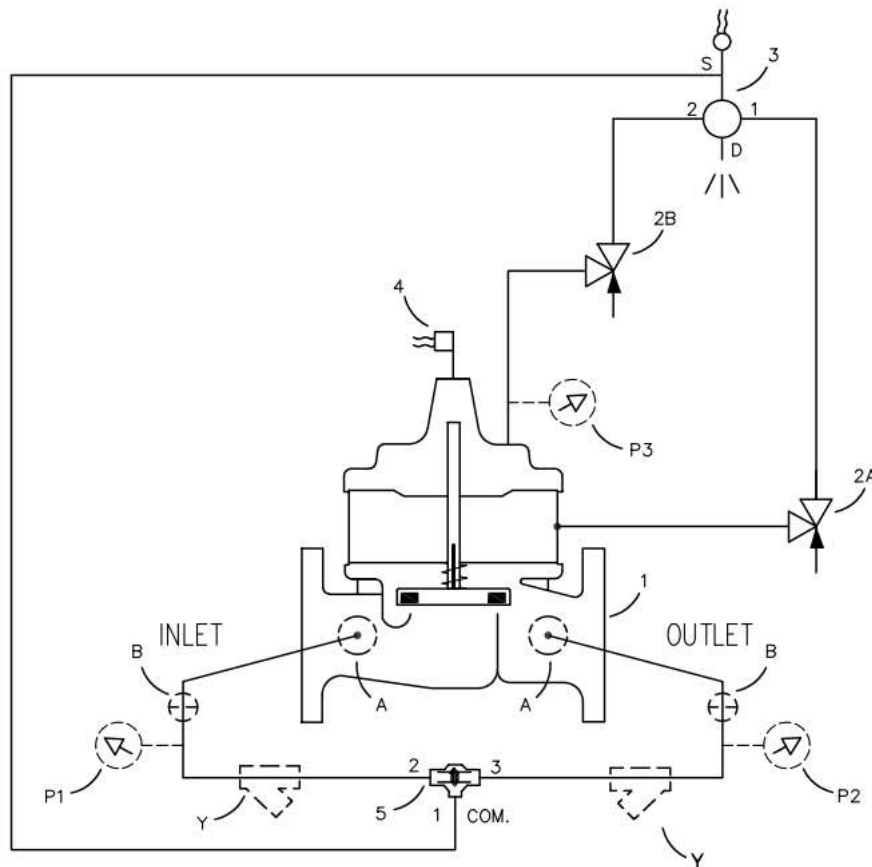
info@cla-val.com

M-60 Series (R-03/2021)





Model 60-11 PUMP CONTROL VALVE



NO.	BASIC COMPONENTS	QTY
1	100-03 POWERCHECK MAIN VALVE	1
2	CV FLOW CONTROL	2
3	CSM11-A2-2 SOLENOID CONTROL	1
4	X105LCW SWITCH ASSEMBLY	1
5	CVS-1 SHUTTLE VALVE	1

NO.	OPTIONAL FEATURES	QTY
A	X46A FLOW CLEAN STRAINER	2
B	CK2 COCK (ISOLATION VALVE)	2
P	X141 PRESSURE GAUGE ASSEMBLY	3
Y	X43 "Y" STRAINER	2

CLA-VAL Company

www.cla-val.com

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Model 60-11 (Rev. C 01/2010)





Model 60-11 PUMP CONTROL VALVE

SOLENOID CONTROL FEATURE

Second control (3) is a direct acting, 4-way solenoid control that changes position when the coil is energized or de-energized.

This applies or relieves pressure in the cover chamber or powerunit chamber of the main valve providing the operation shown in the following table:

SOLENOID CONTROL (3)			MAIN VALVE COVER CHAMBER	MAIN VALVE POWERUNIT CHAMBER	MAIN VALVE (1) POSITION
POSITION	PORTS CONNECTED				
ENERGIZED	1 & S	2 & D	PRESSURE RELIEVED	PRESSURE APPLIED	OPEN
DE-ENERGIZED	1 & D	2 & S	PRESSURE APPLIED	PRESSURE RELIEVED	CLOSED

OPENING SPEED CONTROL

Flow control (2B) controls the opening speed of the main valve. Turn the adjusting stem clockwise to make the main valve open slower.

DUAL ASSEMBLY FEATURE

When main valve (1) inlet pressure exceeds outlet pressure, shuttle valve (5) shifts interconnecting ports 1 and 2. When main valve (1) outlet pressure exceeds inlet pressure, shuttle valve (5) shifts interconnecting ports 1 and 3. This directs the highest pressure into the pilot system.

CLOSING SPEED CONTROL

Flow control (2A) controls the closing speed of the main valve. Turn the adjusting stem clockwise to make the main valve close slower.

CHECK VALVE FEATURE

The main valve (1) has an integral check feature. When outlet pressure exceeds inlet pressure, the main valve closing preventing reverse flow.

SWITCH ASSEMBLY FEATURE

Switch assembly (4) is actuated by a stem extension attached to the main valve stem. The switch assembly is factory adjusted to actuate a single-pole, double-throw switch when the main valve is almost closed. When the main valve starts to open, the spring loaded switch actuating lever is released and returns the switch to its normal position.



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Model 60-11 (Rev. C 01/2010)



Model 60-11

PUMP CONTROL VALVE

OPTIONAL FEATURE

- Suffix A (Flow Clean Strainer)** A self-cleaning strainer is installed in the main valve inlet body boss which protects the pilot system from foreign particles.
- Suffix B (Isolation Valves)** CK2 cocks (B) are used to isolate the pilot system from main line pressure. These valves must be open during normal operation.
- Suffix P (Pressure Gauge)** Pressure gauges (P) provide pressure reading in the inlet, outlet and cover connections.
- Suffix Y (Y-Strainer)** Two Y-pattern strainers are installed in the pilot supply line to protect the pilot system from foreign particles. The strainer screens must be cleaned periodically.

OPERATION CHECKLIST

- System valves open upstream and downstream.
- Air removed from the main valve cover and pilot system at all high points.
- CK2 cocks (B) open during normal operation (optional feature).
- Periodic cleaning of strainer (Y) is recommended (optional feature).
- Correct voltage to solenoid control (3).
- CV flow controls (2A) & (2B) open at least 4 turns.

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Model 60-11 (Rev. C 01/2010)



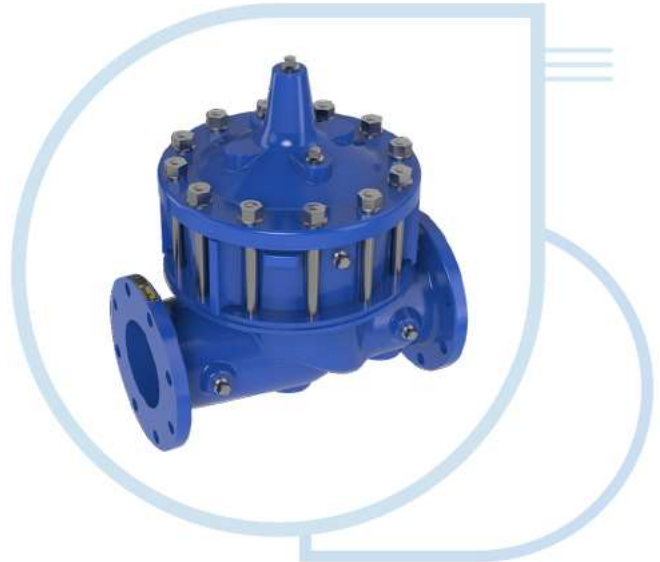


Cla-Val 100-03

MAIN VALVE

PRODUCT FEATURES

- The Cla-Val Model 100-03 Powercheck Valve is a hydraulically operated diaphragm valve with a built-in check feature to prevent return flow. Available in globe or angle pattern, it consists of four major components: body, intermediate chamber, diaphragm assembly, and cover. The diaphragm assembly is the only moving part.
- The diaphragm assembly is guided top and center by a precision machined stem and utilizes a non-wicking diaphragm of nylon fabric bonded with synthetic rubber.
- When a pressure reversal occurs, the valve will immediately close, preventing reverse flow thru the valve. The split stem will allow the disc retainer assembly to check closed regardless of the position of the diaphragm.



SPECIFICATIONS

Available sizes

Pattern	Threaded	Flanged
Globe	2½" - 3" 65 - 80mm	2½" - 16" 65 - 400mm
Angle	2½" - 3" 65 - 80mm	2½" - 16" 65 - 400mm

Operating Temp. Range

Fluids
-40° to 180° F

Pressure Ratings (Recommended Maximum Pressure - psi)

Valve Body & Cover		Pressure Class				
		Flanged	Grooved	Threaded	End-Details	
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
UNS 87850	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

CLA-VAL Company

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S-100-03 (R-03/2021)





Cla-Val 100-03

MAIN VALVE

Materials

Component	Standard Material Combinations		
Body & Cover	Ductile Iron	Cast Steel	Bronze
Available Sizes	2½" - 16" 65 - 400mm	2½" - 16" 65 - 400mm	2½" - 16" 65 - 400mm
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.			

FUNCTIONAL DATA

Valve Size		Inches	2½	3	4	6	8	10	12	14	16
		mm.	65	80	100	150	200	250	300	350	400
C _v Factor	Globe Pattern	Gal./Min. (gpm.)	85	115	200	440	770	1245	1725	2300	2940
		Litres/Sec. (l/s.)	20	28	48	106	185	299	414	552	706
	Angle Pattern	Gal./Min. (gpm.)	101	139	240	541	990	1575	2500*	3060*	4200*
		Litres/Sec. (l/s.)	24	33	58	130	238	378	600	734	1008
Equivalent Length of Pipe	Globe Pattern	Feet (ft.)	53	85	116	211	291	347	467	422	503
		Meters (m.)	16	26	35	64	89	106	142	129	154
	Angle Pattern	Feet (ft.)	37	58	80	139	176	217	222*	238*	247*
		Meters (m.)	12	18	25	43	54	66	68	73	75
K Factor	Globe Pattern		4.6	6.0	5.9	6.2	6.1	5.8	6.1	5.0	5.2
	Angle Pattern		3.3	4.1	4.1	4.1	3.7	3.6	2.9	2.8	2.6
Liquid Displaced from Cover Chamber When Valve Opens	Fl. Oz		—	—	—	—	—	—	—	—	—
	U.S. Gal.		.04	.08	.17	.53	1.26	2.51	4.0	6.5	9.6
	ml		163	303	643	—	—	—	—	—	—
	Litres		—	—	—	2.0	4.8	9.5	15.1	24.6	36.2

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S-100-03 (R-03/2021)



Cla-Val 100-03

MAIN VALVE

C_v Factor

Formulas for computing C_v Factor, Flow (Q) and Pressure Drop (ΔP):

$$C_v = \frac{Q}{\sqrt{\Delta P}} \quad Q = C_v \sqrt{\Delta P} \quad \Delta P = \left(\frac{Q}{C_v}\right)^2$$

K Factor (Resistance Coefficient)

The Value of K is calculated from the formula: $K = \frac{894d^4}{C_v^2}$
(U.S. system units)

Equivalent Length of Pipe

Equivalent lengths of pipe (L) are determined from the formula: $L = \frac{Kd}{12f}$
(U.S. system units)

Fluid Velocity

Fluid velocity can be calculated from the following formula: $V = \frac{.4085 Q}{d^2}$
(U.S. system units)

Where:

C_v = U.S. (gpm) @ 1 psi differential at 60° F water
or

= (l/s) @ 1 bar (14.5 PSIG) differential
at 15° C water

d = inside pipe diameter of Schedule 40 Steel Pipe (inches)

f = friction factor for clean, new Schedule 40 pipe
(dimensionless) (from Cameron Hydraulic Data,
18th Edition, P 3-119)

K = Resistance Coefficient (calculated)

L = Equivalent Length of Pipe (feet)

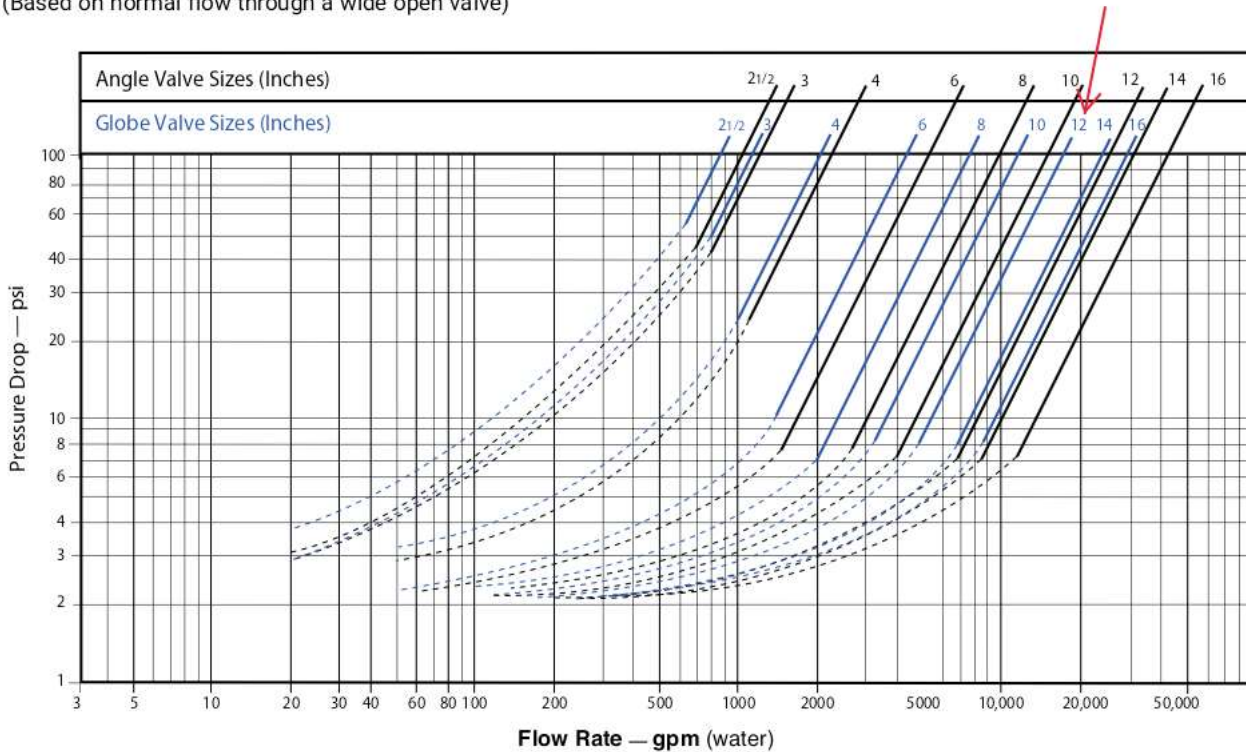
Q = Flow Rate in U.S. (gpm) or (l/s)

V = Fluid Velocity (feet per second) or (meters per second)

ΔP = Pressure Drop in (psi) or (bar)

FLOW CHART

(Based on normal flow through a wide open valve)



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S-100-03 (R-03/2021)

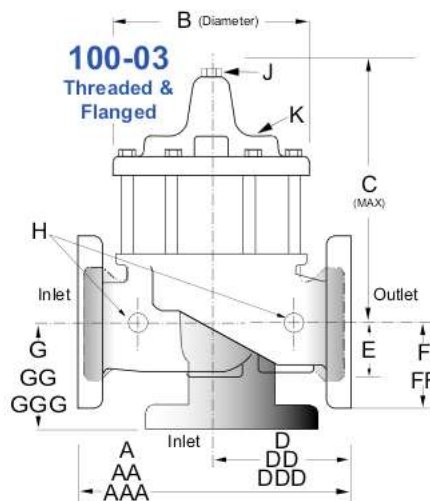




Cla-Val 100-03

MAIN VALVE

DIMENSIONS (INCHES)



Valve Size (Inches)	2 1/2	3	4	6	8	10	12	14	16
A Threaded	11.00	12.50	—	—	—	—	—	—	—
AA 150 ANSI	11.00	12.00	15.00	20.00	25.38	29.75	34.00	39.00	41.38
AAA 300 ANSI	11.62	13.25	15.62	21.00	26.38	31.12	35.50	40.50	43.50
B Diameter	8.00	9.12	11.50	15.75	20.00	23.62	28.00	32.75	35.50
C Maximum	10.31	11.19	14.25	18.44	21.81	23.38	29.31	32.12	35.00
D Threaded	5.50	6.25	—	—	—	—	—	—	—
DD 150 ANSI	5.50	6.00	7.50	10.00	12.69	14.88	17.00	19.50	20.69
DDD 300 ANSI	5.81	6.63	7.81	10.50	13.19	15.56	17.75	20.25	21.75
E	1.69	2.06	3.19	4.31	5.31	9.25	10.75	12.62	15.50
F 150 ANSI	3.50	3.75	4.50	5.50	6.75	8.00	9.50	10.50	11.75
FF 300 ANSI	3.75	4.13	5.00	6.25	7.50	8.75	10.25	11.50	12.75
G Threaded	4.00	4.50	—	—	—	—	—	—	—
GG 150 ANSI	4.00	4.00	5.00	6.00	8.00	8.62	13.75	14.88	15.69
GGG 300 ANSI	4.31	4.38	5.31	6.50	8.50	9.31	14.50	15.62	16.50
H NPT Body Tapping	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00
J NPT Cover Center Plug	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.50	2.00
K NPT Cover Tapping	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00
Stem Travel	0.70	0.80	1.10	1.70	2.30	2.80	3.40	4.00	4.50
Approx. Ship Weight (lbs)	65	95	190	320	650	940	1675	2460	3100

Cla-Val recommends that an inspection be performed on our products annually. The inspection should include both a visual and functional test of the main valve/component and the pilot system. The inspection ensures that no damage or premature wear occurred due to velocity, pressure, or foreign matter within the fluid that may have exceeded the valve's design. Please consult the maintenance manual for specific information on the model. Manuals are available for download at Cla-Val.com, as well as contact information for a company representative.

Accurate record-keeping is a best practice for any preventative maintenance program, and Cla-Val strongly recommends this action through an asset management program. Cla-Val provides a free asset management tool, **Link2Valves™**, Link2Valves - Cla-Val (cla-val.com), to assist in preventative maintenance record-keeping and scheduling.



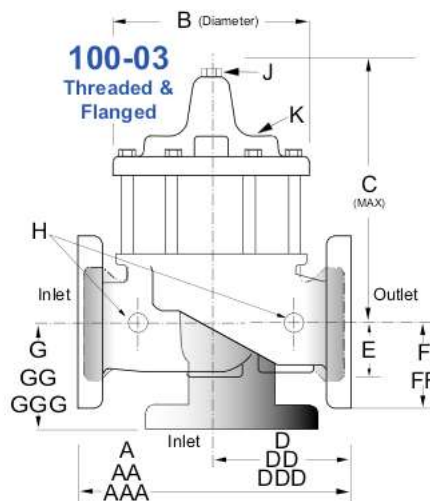
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 www.cla-val.com
 info@cla-val.com
 S-100-03 (R-03/2021)



Cla-Val 100-03

MAIN VALVE

DIMENSIONS (MM)



Valve Size (Inches)	65	80	100	150	200	250	300	350	400
A Threaded	279	318	—	—	—	—	—	—	—
AA 150 ANSI	279	305	381	508	645	756	864	991	1051
AAA 300 ANSI	295	337	397	533	670	790	902	1029	1105
B Diameter	203	232	292	400	508	600	711	832	902
C Maximum	262	284	362	468	554	594	744	816	889
D Threaded	140	159	—	—	—	—	—	—	—
DD 150 ANSI	140	152	191	254	322	378	432	495	526
DDD 300 ANSI	148	168	198	267	335	395	451	514	552
E	43	52	81	109	135	235	273	321	394
F 150 ANSI	89	95	114	140	171	203	241	267	298
FF 300 ANSI	95	105	127	159	191	222	260	292	324
G Threaded	102	114	—	—	—	—	—	—	—
GG 150 ANSI	102	102	127	152	203	219	349	378	399
GGG 300 ANSI	110	111	135	165	216	236	368	397	419
H NPT Body Tapping	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00
J NPT Cover Center Plug	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.50	2.00
K NPT Cover Tapping	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00
Stem Travel	18	20	28	43	58	71	86	102	114
Approx. Ship Weight (lbs)	30	43	86	145	295	426	760	1116	1406

Cla-Val recommends that an inspection be performed on our products annually. The inspection should include both a visual and functional test of the main valve/component and the pilot system. The inspection ensures that no damage or premature wear occurred due to velocity, pressure, or foreign matter within the fluid that may have exceeded the valve's design. Please consult the maintenance manual for specific information on the model. Manuals are available for download at Cla-Val.com, as well as contact information for a company representative.

Accurate record-keeping is a best practice for any preventative maintenance program, and Cla-Val strongly recommends this action through an asset management program. Cla-Val provides a free asset management tool, **Link2Valves™**, Link2Valves - Cla-Val (cla-val.com), to assist in preventative maintenance record-keeping and scheduling.

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S-100-03 (R-03/2021)





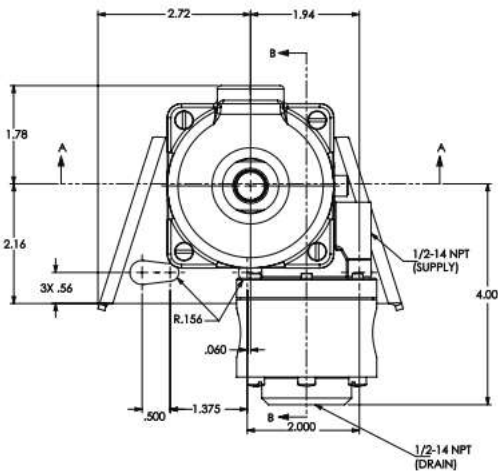
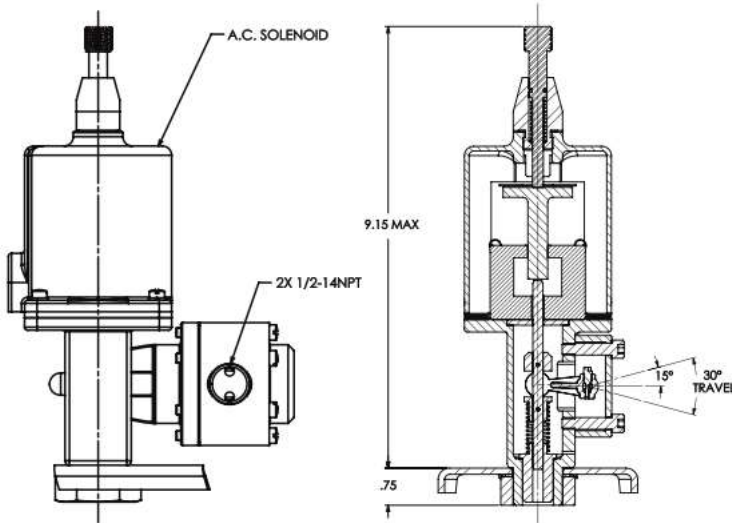
Model CSM-11HC

HIGH CAPACITY SOLENOID CONTROL WITH MANUAL OPERATOR

PRODUCT FEATURES

Cla-Val CSM-11HC is a direct-acting solenoid valve for use in four-way and three-way applications. They are continuous duty type controls which assures positive and dependable operation over the entire pressure range.

DIMENSIONS



SPECIFICATIONS

- Solenoid Enclosure:** General Purpose, NEMA Type 3
- Size (Fluid Connect):** 1/2" NPT Supply Port and 1/2" NPT Connector Ports
- Operating Media:** Water, air, gas
- Coil Insulation:** Class A (molded)
- Operating Pressure:** 300 psi Max.
- Temperature:** Water to 150°F Max.
- Standard Materials (Fluid Contact):** Bronze, Stainless Steel and Monel*
Aluminum Body—Stainless Steel Trim

Volts (AC 60 Hz)	Amperes		Coil Resistance
	Holding	Inrush	Ohms
24	2.88	25.4	0.5
120	.575	5.1	14.1
208	.330	2.93	40
240	.288	2.54	58
440	.156	1.38	174
480	.143	1.27	233

Volts (AC 50 Hz)	Amperes		Coil Resistance
	Holding	Inrush	Ohms
110	.48	4.6	15.7
220	.24	2.3	66
240	.22	2.1	88

***Optional Materials Available**
 Fluid Contact 316SS
 All Metal Parts 316SS

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 S-CSM-11HC (R-01/2021)

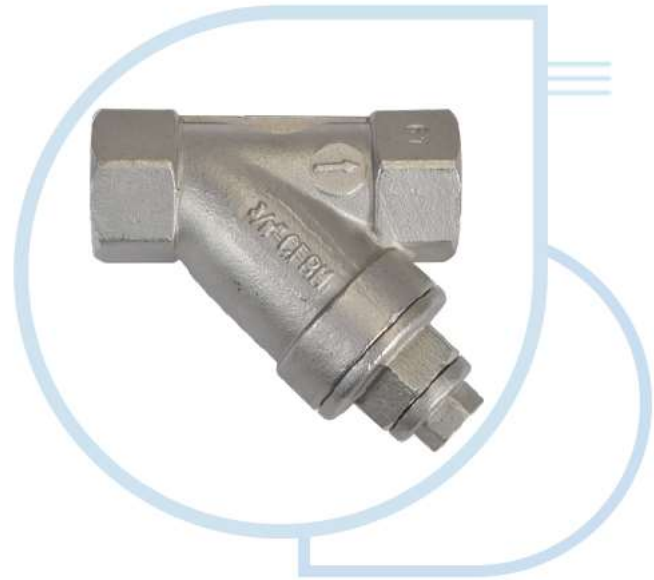


Model X43 "Y" STRAINER

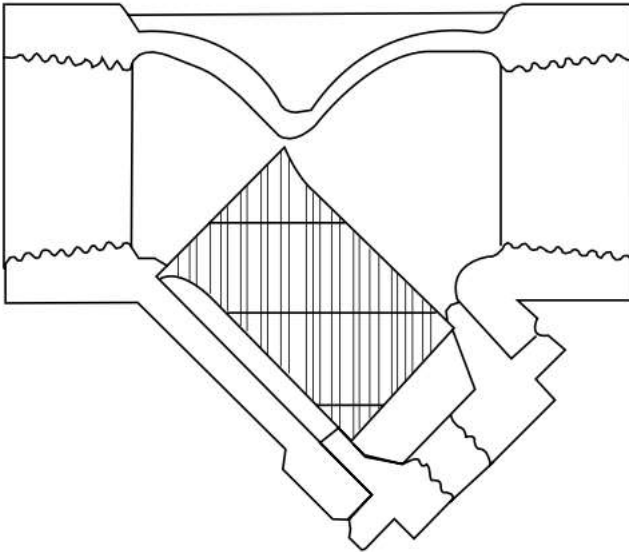
PRODUCT FEATURES

- Stainless Steel Body
- Blow-off Connection Standard
- Stainless Steel Mesh Screen

Model X43 'Y' Strainers are in-line strainers intended to be installed for protection of pilot systems. These strainers are constructed of corrosion resistant materials. All sizes have blow-off connections ready for field hook-up.



DIMENSIONS



SPECIFICATIONS

PART	MATERIAL
Body:	316 Stainless Steel
Screen:	316 Stainless Steel
Gasket:	Non-Asbestos Fiber
Ends:	Threaded ANSI/ASME B1.20 1
Maximum working pressure:	400 psi
Temperature range:	33°F to 180°F
Screen:	Standard screen size is 60 mesh perforated stainless steel
Optional:	Blowdown Ball Valve (see Model X43A)

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Sub-X43 (R-05/2019)



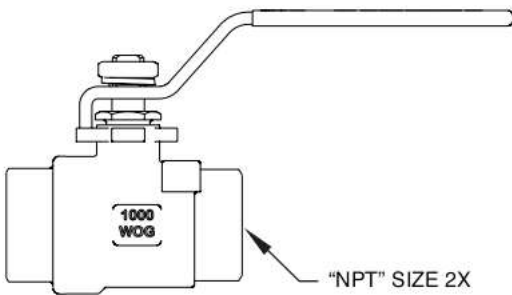
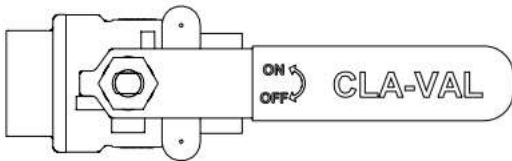
Model CK2 ISOLATION VALVE

PRODUCT FEATURES

- The Cla-Val Model CK2 is a ball valve used for isolating components within the pilot system.



DIMENSIONS



SPECIFICATIONS

- Size:** 3/8" thru 2" NPT Threaded
- Temperature Range:** 33°F to 180°F
- Standard Materials**
 - Body:** Stainless Steel
 - Handle & Nut:** Stainless Steel
 - Ball Seal:** RPTFE
- Ends:** Threaded ANSI/ASME B1.20 1
- Pressure Ratings:** 400 psi

CLA-VAL Company

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info@cla-val.com

S-CK2 (R-01/2022)





Model CV FLOW CONTROL

PRODUCT FEATURES

Cla-Val CV Control is an adjustable restriction which acts as a needle valve when flow is in the direction of the stem. When flow is in the reverse direction, the port area opens fully to allow unrestricted flow. When installed in the control system of a Cla-Val automatic valve, it can be arranged to function as either an opening or closing speed control.

SPECIFICATIONS

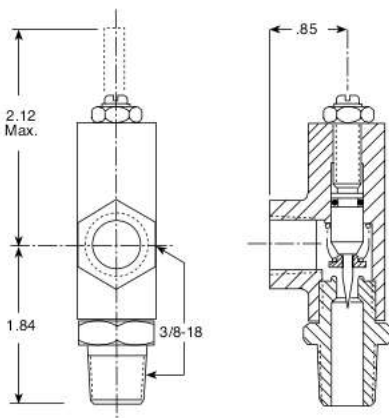
- Sizes:** 3/8", 1/2", 3/4", 1" NPT
- Temperature Range:** 250°F Max.
- Standard Materials*:**
 - Housing: 3/8" Bronze ASTM B61
1/2", 3/4", 1" Stainless Steel 316
 - Trim: Stainless Steel
- Pressure Rating:** 400 psi Max.

*Optional Materials Available

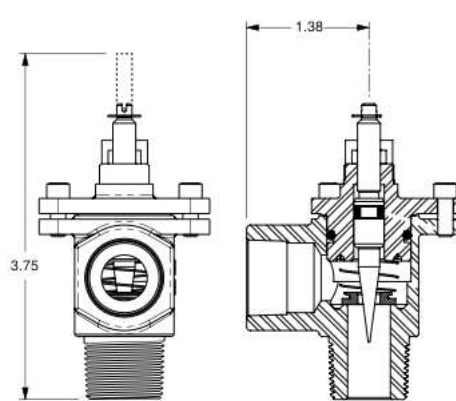


DIMENSIONS

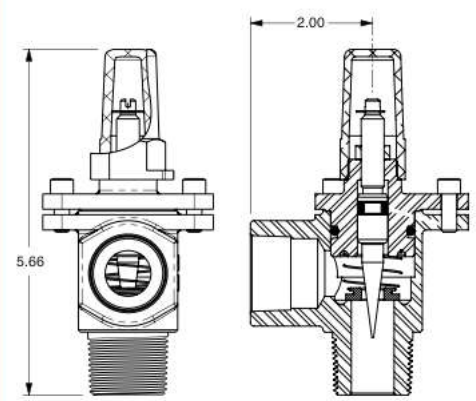
3/8" - CV Flow Control



1/2" - CV Flow Control



3/4" and 1" - CV Flow Control



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S-CV (R-03/2021)



Model CV FLOW CONTROL

PRODUCT FEATURES

Cla-Val CV Control is an adjustable restriction which acts as a needle valve when flow is in the direction of the stem. When flow is in the reverse direction, the port area opens fully to allow unrestricted flow. When installed in the control system of a Cla-Val automatic valve, it can be arranged to function as either an opening or closing speed control.

SPECIFICATIONS

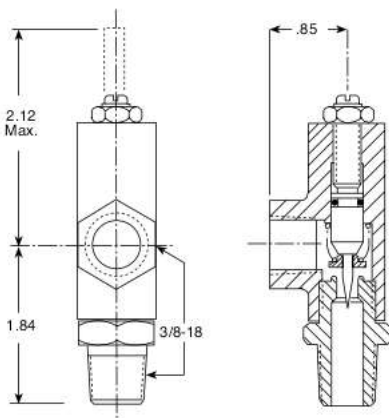
- Sizes:** 3/8", 1/2", 3/4", 1" NPT
- Temperature Range:** 250°F Max.
- Standard Materials*:**
 - Housing: 3/8" Bronze ASTM B61
1/2", 3/4", 1" Stainless Steel 316
 - Trim: Stainless Steel
- Pressure Rating:** 400 psi Max.

*Optional Materials Available

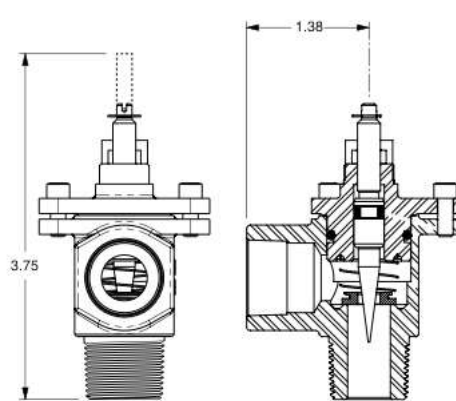


DIMENSIONS

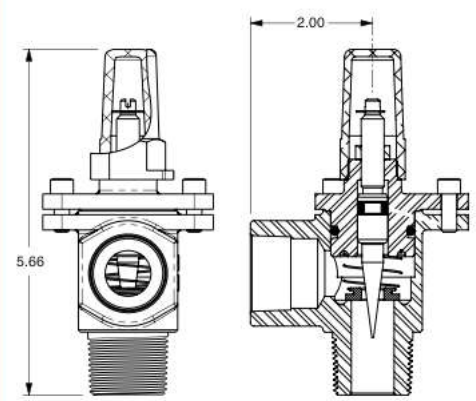
3/8" - CV Flow Control



1/2" - CV Flow Control



3/4" and 1" - CV Flow Control



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 S-CV (R-03/2021)

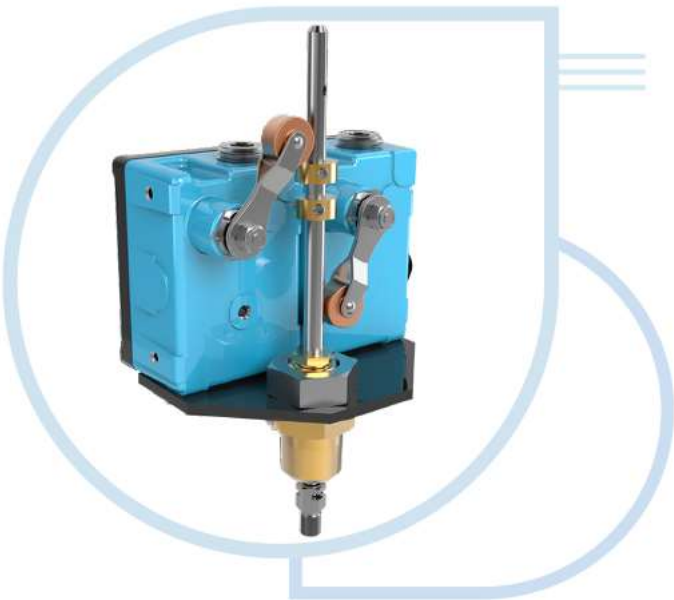


Model X105L2

LIMIT SWITCH ASSEMBLY

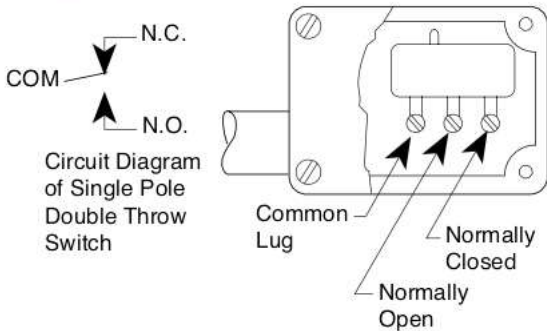
PRODUCT FEATURES

Cla-Val Model X105L2 Limit Switch Assembly is a rugged, dependable and positive acting switch assembly actuated by the opening or closing of a Cla-Val control valve on which it is mounted. The single pole, double throw micro switch can be connected either to open or to close an electrical circuit when actuated. By loosening the allen screw on the actuating collar and raising or lowering the collar on the stem, the X105L is easily adjusted to signal that the valve has fully reached the desired position (open or closed).

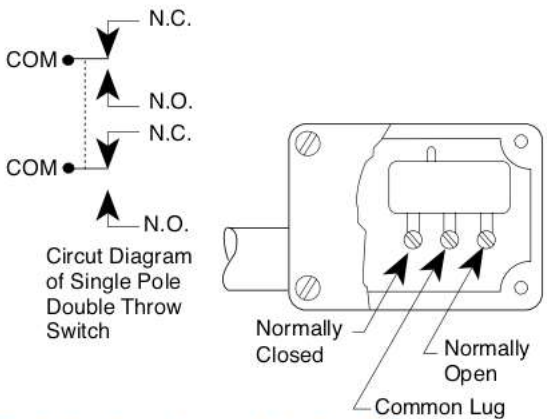


INSTALLATION

Single Pole Double Throw Switch



Double Pole Double Throw Switch



Switches shown in unactivated position.

SPECIFICATIONS

- Standard Materials*:** Aluminum switch housing
Steel bracket and brass adapter
Stainless steel stem
- Electrical:** 1/2" Conduit connection
- Switch Type:** SPDT UL, File No. E12252,
CSA Certified, File No. LR57325
Weather proof
NEMA 1,3,4, and 13
- Switch Rating:** UL/CSA rating: L96
15 amp. 125, 250, or 480 volts AC
1/2 amp. 125 volts DC
1/4 amp. 250 volts DC
- Switch Options:** DPDT switches available on request
UL/CSA Rating: L59, 10 amps

Explosion proof micro switches are
NEMA 1,7, and 9
UL Listed, File No. E14274 and CSA
Certified, File No. LR57324: Class I,
Group C and D and Class II, Group
E, F and G.

*Optional Materials Available

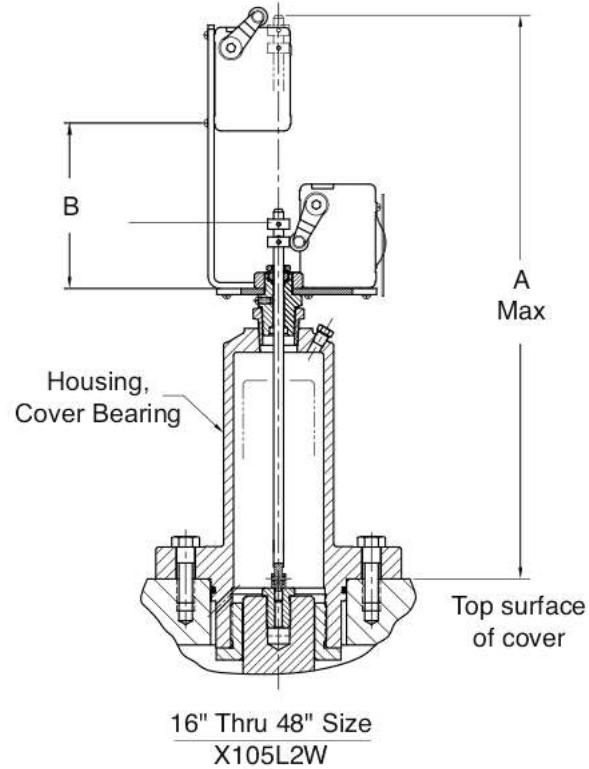
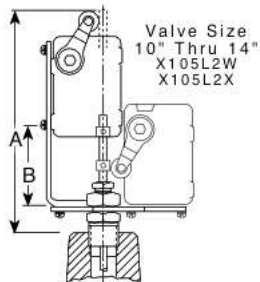
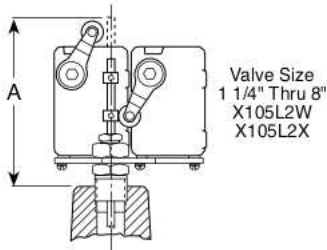
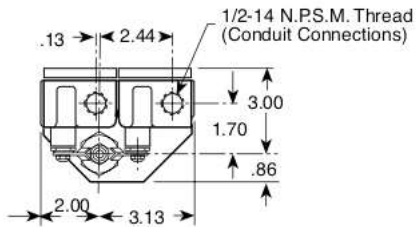
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S-X105L2 (R-01/2021)



Model X105L2

LIMIT SWITCH ASSEMBLY

DIMENSIONS



Basic Valve 100-01	1 1/4	1 1/2	2	2 1/2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
Dimension "A"	10.19	10.19	7.16	7.16	7.43	7.00	6.69	6.91	9.88	9.59	9.16	10.78	10.78	18.23	19.10	35.07	36.07	36.07	36.07
Dimension "B"							1.69	1.69	2.44	2.94	2.94	2.94	2.94	4.32	5.19	8.40	8.40	8.40	8.40
Basic Valve 100-20					3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
Dimension "A"					7.16	7.34	7.00	6.69	6.91	9.88	9.59	9.59	10.78	10.78	10.78	11.30	35.07	36.07	36.07
Dimension "B"								1.69	1.69	2.44	2.94	2.94	2.94	2.94	2.94	5.19	8.40	8.40	8.40

CATALOG NO.	ACTUATION POSITION	SWITCH ENCLOSURE
X105L2W	Dual	Weather Proof
X105L2X	Dual	Explosion Proof

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info@cla-val.com
 S-X105L2 (R-01/2021)



CLA-VAL WARRANTY

3 Year Warranty on Cla-Val Quality Products

This is a Limited Warranty



Automatic valves and controls as manufactured by Cla-Val are warranted for three years from date of shipment against manufacturing defects in material and workmanship that develop in the service for which they are designed, provided the products are installed and used in accordance with all applicable instructions and limitations issued by Cla-Val. Electronic components manufactured by Cla-Val are warranted for one year from the date of shipment.

We will repair or replace defective material, free of charge which is returned to our factory, transportation charges prepaid, provided that after inspection the material is found to have been defective at time of shipment. The warranty is expressly conditioned on the purchaser's giving Cla-Val immediate written notice upon discovery of the defect.

Components used by Cla-Val, but manufactured by others, are warranted only to the extent of that manufacturer's guarantee.

This warranty shall not apply if the product has been altered or repaired by others, and Cla-Val shall make no allowance or credit for such repairs or alterations unless authorized in writing by Cla-Val.

Disclaimer of Warranties & Limitation of Liability

The foregoing warranty is exclusive and in lieu of all other warranties and representations whether expressed, implied, oral or written, including but not limited to, any implied warranties or merchantability or fitness for a particular purpose. All such other warranties and representations are hereby cancelled.

Cla-Val shall not be liable for any incidental or consequential loss, damage or expense arising directly or indirectly from the use of the product. Cla-Val shall not be liable for any damages or charges for labor or expense in making repairs or adjustments to the product. Cla-Val shall not be liable for any damages or charges sustained in the adaptation or use of its engineering data and services.

No representative of Cla-Val may change any of the foregoing or assume any additional liability or responsibility in connection with the product.

The liability of Cla-Val is limited to material replacements F.O.B. Newport Beach, California.

CLA-VAL

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visit www.cla-val-latinamerica.com for Spanish literature





Submittal Data Cover Sheet

Series: 50 Series: Pressure Relief Valve
Model: 50-01: Pressure Relief Valve
Job/Project Name: EFI Project# 93134 "West Lilac PS" (Hutton) PRV
Description: Size 8" 50-01 Relief Valve -Class 300 Flanged, Angle Pattern, CRL Ranged 100-300psi, All SST Internals, All SST Pilot, Inlet Pressure Gauge, Epoxy Coated, X105LCW.
Quotation No.: KC- 1265 Rev2

Company: EFI Solutions	Contact: Ryan Brinkmann
Engineering Firm:	Address: 1221 N Elm St
Project Engineer:	City/State/Zip: Centralia 62801

Main Valve

Valve Size 8	Main Valve Body & Cover Ductile Iron ASTM A-536	End Details Ductile Iron ANSI B16.42 Class 300
Base Valve 100-01 Hytrol	Main Valve Trim 316 Stainless Steel	Pressure Rating 250/350 Class @ 400 psi Max
Quantity 1	Valve Pattern Angle	Elastomers (Max Temperature 180°F) Buna-N® Synthetic Rubber
Fusion Bonded Epoxy Coating Standard 8-10 mil		Stem Option Dura Kleen Stem
Main Valve Notes: Main Valve Diaphragm Washer & Disc Retainer - Stainless Steel		

Pilot System

Tubing & Fittings 303 Rigid Stainless Steel	Hydraulic Pilots CRL Pilot	Spring Range(s) 100-300 PSI
Pilot System Configuration		
Material: SST with SST Trim		
Mounting: Right Hand Pilot System Mount (standard)		
Pilot System Notes: All Stainless Steel Pilot System		

Features and Options

<input checked="" type="checkbox"/> Pilot System Isolation Valves (B)	Pressure Gauges (P)
<input checked="" type="checkbox"/> X42N-2 – Strainer and Needle Valve	Inlet: Pressure Gauge
	Limit Switch
	X105LCW - CL Position Weather Proof

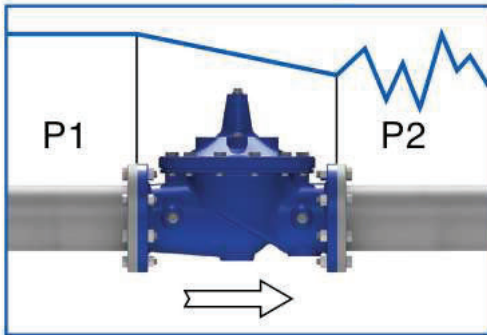
Warranty Waterworks Warranty

PRESSURE RELIEF & PRESSURE SUSTAINING

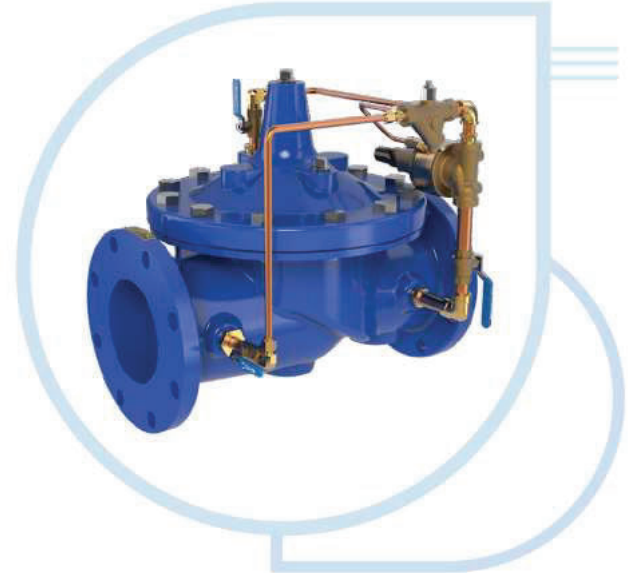
PRODUCT FEATURES

- Completely Automatic Operation
- Easy Adjustment and Maintenance
- Fully Supported Frictionless Diaphragm
- Meets NSF/ANSI 372 Lead Reduction Mandate

MAIN FUNCTION



The CLA-VAL 50 SERIES Pressure Relief 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. This valve can be used for pressure relief, pressure sustaining, back pressure, or unloading functions in a bypass system.

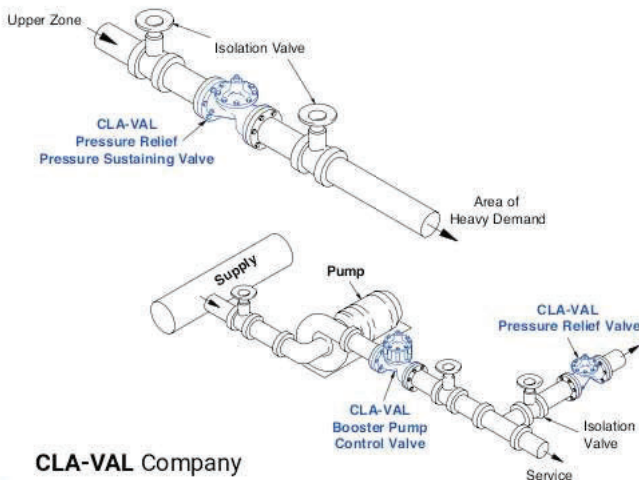


SYSTEM SOLUTIONS

- CLA-VAL offers system solutions to prevent cavitation, noise, corrosion, mineral build-up, flow metering, and electronic valve control, to name a few solutions.
- Optional features including but not limited to; solenoid shut-off, check feature, return flow, and remote sensing.
- Contact CLA-VAL for full line of options!

TYPICAL APPLICATIONS

- The CLA-VAL 50 SERIES is a fast opening, slow closing relief valve that provides system protection against high pressure surges on pump start up and pump shut down by dissipating the excess pressure to a safe location.
- The CLA-VAL 50 Series is 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.



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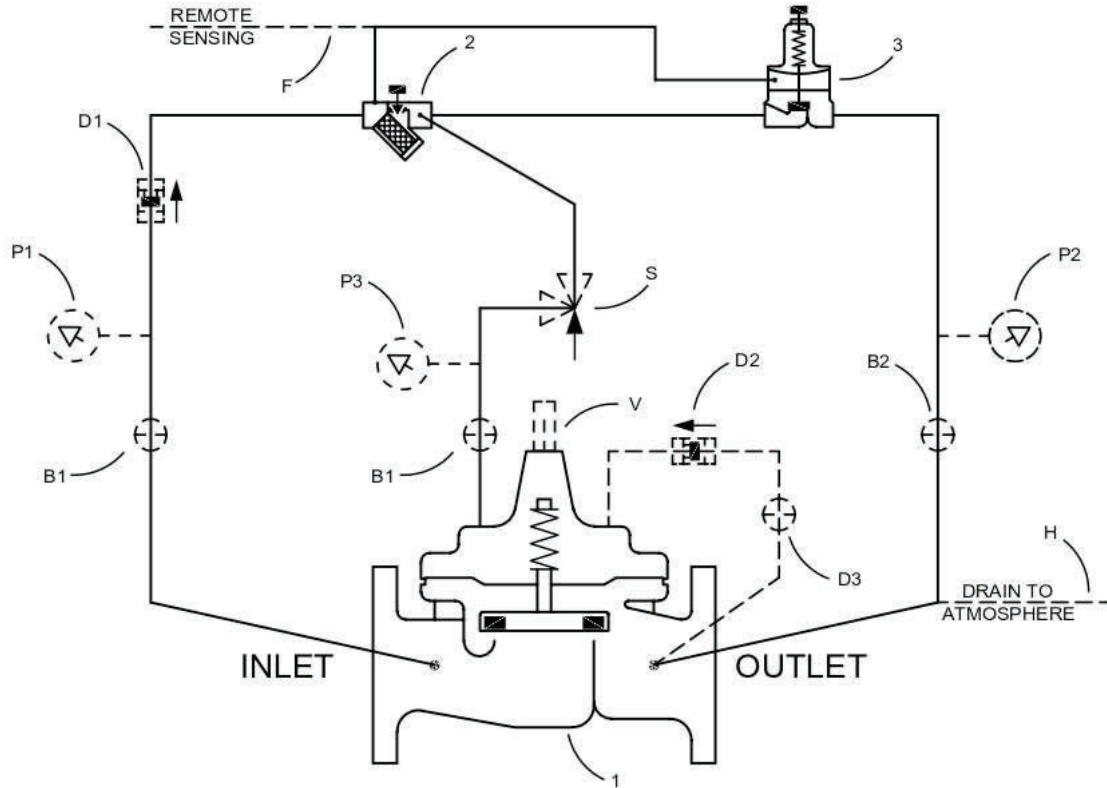
M-50 Series (R-03/2021)



Model 50-01

PRESSURE RELIEF VALVE

(Equipped With Closing Speed Control)



NO.

BASIC COMPONENTS

QTY

1	100-01 HYTROL MAIN VALVE	1
2	X42N-2 STRAINER & NEEDLE VALVE	1
3	CRL/CRL60 PRESSURE RELIEF CONTROLV	1

NO.

OPTIONAL FEATURES

QTY

B	CK2 COCK (ISOLATION VALVES)	3
D	CHECK VALVES WITH COCK	1
F	REMOTE PILOT SENSING	
H	DRAIN TO ATMOSPHERE	
P	X141 PRESSURE GAUGE ASSEMBLY	3
S	CV FLOW CONTROL (OPENING)	1
V	X101 VALVE POSITION INDICATOR	1

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Model 50-01 (R-02/2021)





Model 50-01

PRESSURE RELIEF VALVE

(Equipped With Closing Speed Control)

PRESSURE RELIEF FEATURE

Pressure relief control (3) is a normally closed control that responds to main valve inlet pressure changes. An increase in inlet pressure tends to open control (3) and a decrease in inlet pressure tends to close control (3). This causes main valve cover pressure to vary and the main valve modulates (opens and closes) maintaining a relatively constant pressure at the main valve inlet. When inlet pressure is lower than the set point of control (3), control (3) closes. This pressurizes the main valve cover chamber and the main valve closes.

Pressure relief control (3) adjustment: turn the adjusting screw clockwise to increase the setting.

CLOSING SPEED CONTROL

Needle valve (2) controls the closing speed of the main valve. Turn the adjusting stem clockwise to make the main valve close slower. Do not close valve (2) completely or the main valve will not close. (Suggested initial setting of needle valve is 1/4 to 1/2 turn open.)

OPTIONAL FEATURE

- Suffix B (Isolation Valves)** Isolation Valves (B1) and (B2) are used to isolate the pilot system from main line pressure. These valves must be open during normal operation.
- Suffix D (Check Valves with Isolation Valves)** When outlet pressure is higher than inlet pressure, check valve (D2) opens and check valve (D1) closes. This directs the higher outlet pressure into the main valve cover and the main valve closes.
- Suffix F (Remote Pilot Sensing)** Pilot sensing pressure is obtained from a point upstream of the main valve inlet. (Pilot sensing pressure is obtained from the main valve inlet if suffix (F) is not specified.)

- Suffix H (Atmospheric Drain)** Pilot system drain line is discharged to atmosphere. (Pilot system drain line is connected to the main valve outlet boss if suffix (H) is not specified.)
- Suffix P (Pressure Gauge)** Pressure gauges (P1), (P2), and (P3) provide pressure reading in the inlet, outlet, and cover connections.
- Suffix S (Opening Speed Control)** Flow control (S) controls the opening speed of the main valve. Turn the adjusting stem clockwise to make the main valve open slower.
- Suffix V (Valve Position Indicator)** Valve position indicator (V) displays a visual position of the main valve stem.

OPERATION CHECKLIST

- System valves open upstream and downstream.
- Air removed from the main valve cover and pilot system at all high points.
- Periodical cleaning of strainer (2) is recommended.
- Flow control (S) open at least 4 turns (optional feature).
- Isolation valves (B1), (B2), and (D3) open (optional feature).

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Model 50-01 (R-02/2021)



Cla-Val 100-01

MAIN VALVE

PRODUCT FEATURES

- Cla-Val Model 100-01 Hytrol Valve is a hydraulically operated, diaphragm actuated, valve. It consists of three major components: body, diaphragm assembly, and cover. The diaphragm assembly is the only moving part.
- The diaphragm assembly is guided top and bottom by a precision machined stem. It utilizes a non-wicking diaphragm of nylon fabric bonded with synthetic rubber.
- Model 100-01 is used in system applications, such as, remote control, pressure regulation, solenoid operation, rate of flow control, liquid level control or check valve operation. Applications are unlimited.



SPECIFICATIONS

Available sizes

Pattern	Threaded	Flanged	Grooved End
Globe	3/8" - 3" 10 - 80mm	1 1/2" - 36" 40 - 900mm	1 1/2" - 8" 40 - 200mm
Angle	1" - 3" 25 - 80mm	1 1/2" - 16" & 24" 40 - 400mm & 600mm	1 1/2" - 6" 40 - 150mm

Operating Temp. Range

Fluids
-40° to 180° F

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
UNS 87850	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

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S-100-01 (R-02/2021)





Cla-Val 100-01

MAIN VALVE

Materials

Component	Standard Material Combinations		
Body & Cover	Ductile Iron	Cast Steel	Bronze
Available Sizes	3/8" - 36" 10 - 900mm	1" - 16" 25 - 400mm	1" - 16" 25 - 400mm
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.

FUNCTIONAL DATA

Valve Size	Inches	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"		
	mm	10	15	20	25	32	40	50	65	80	100	150	200	250	300	350	400	450	500	600	750	900		
C _v Factor	Globe Pattern	Gal./Min.(gpm)	1.8	6	8.5	13.3	20	30	32	54	85	115	200	440	770	1245	1725	2300	3130	4463	5345	7655	10150	14020
	Angle Pattern	Litres/Sec. (l/s)	.11	.38	.54	.84	1.26	1.89	2	3.4	5.4	7.3	13	28	49	79	109	145	198	282	337	483	640	885
Equivalent Length of Pipe	Globe Pattern	Feet (ft)	25	7	16	23	10	19	37	51	53	85	116	211	291	347	467	422	503	612	595	628	1181	2285
	Angle Pattern	Meters (m)	7.6	2.2	4.8	7.1	3.1	5.7	12	15.5	16	26	35	64	89	106	142	129	154	187	181	192	360	696
K Factor	Globe Pattern	Feet (ft)	—	—	—	—	9.0	28	46	40	37	58	80	139	176	217	222*	238*	247*	—	—	372*	—	—
	Angle Pattern	Meters (m)	—	—	—	—	2.8	8.7	14	12	11	18	25	43	54	66	68	73	75	—	—	113	—	—
Suggested Flow (gpm)	Minimum		0.3	0.5	1	1	1	1	2	2	4	10	15	35	50	70	95	120	150	275	450	650		
	Maximum		19.0	33.0	55	55	93	125	210	300	460	800	1800	3100	4500	7000	8400	11000	14000	17000	25000	42000	50000	
	Max. Surge		42.0	75.0	120	120	210	280	470	670	1000	1800	4000	7000	11000	16000	19000	25000	31000	35000	56500	63000	85000	
Suggested Flow (l/s)	Minimum		0.02	0.03	0.03	0.03	0.03	0.06	0.09	0.13	0.25	0.63	0.95	2.2	3.2	4.4	6.0	7.6	9.5	17.4	28.4	41.0		
	Maximum		1.2	2.1	3.5	3.5	6	8	13	19	29	50	113	195	309	442	530	694	883	1073	1577	2650	3150	
	Max. Surge		2.7	4.7	7.6	7.6	13	18	30	42	63	113	252	441	693	1008	1199	1577	1956	2461	3560	3975	5360	
Liquid Displaced from Cover Chamber When Valve Opens	Fl. Oz.		.12	.34	.34	.70	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	U.S. Gal.		—	—	—	.02	.02	.02	.03	.04	.08	.17	.53	1.26	2.51	4.0	6.5	9.6	11	12	29	42	90	
	ml		3.5	10.1	10.1	20.7	75.7	75.7	121	163	303	643	—	—	—	—	—	—	—	—	—	—	—	—
	Litres		—	—	—	—	—	—	—	—	—	—	2.0	4.8	9.5	15.1	24.6	36.2	41.6	45.4	109.8	159	340	

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S-100-01 (R-02/2021)



Cla-Val 100-01

MAIN VALVE

C_v Factor

Formulas for computing C_v Factor, Flow (Q) and Pressure Drop (ΔP):

$$C_v = \frac{Q}{\sqrt{\Delta P}} \quad Q = C_v \sqrt{\Delta P} \quad \Delta P = \left(\frac{Q}{C_v}\right)^2$$

K Factor (Resistance Coefficient)

The Value of K is calculated from the formula: $K = \frac{894d^4}{C_v^2}$
(U.S. system units)

Equivalent Length of Pipe

Equivalent lengths of pipe (L) are determined from the formula: $L = \frac{Kd}{12f}$
(U.S. system units)

Fluid Velocity

Fluid velocity can be calculated from the following formula: $V = \frac{.4085 Q}{d^2}$
(U.S. system units)

Where:

C_v = U.S. (gpm) @ 1 psi differential at 60° F water
or

= (l/s) @ 1 bar (14.5 PSIG) differential
at 15° C water

d = inside pipe diameter of Schedule 40 Steel Pipe (inches)

f = friction factor for clean, new Schedule 40 pipe
(dimensionless) (from Cameron Hydraulic Data,
18th Edition, P 3-119)

K = Resistance Coefficient (calculated)

L = Equivalent Length of Pipe (feet)

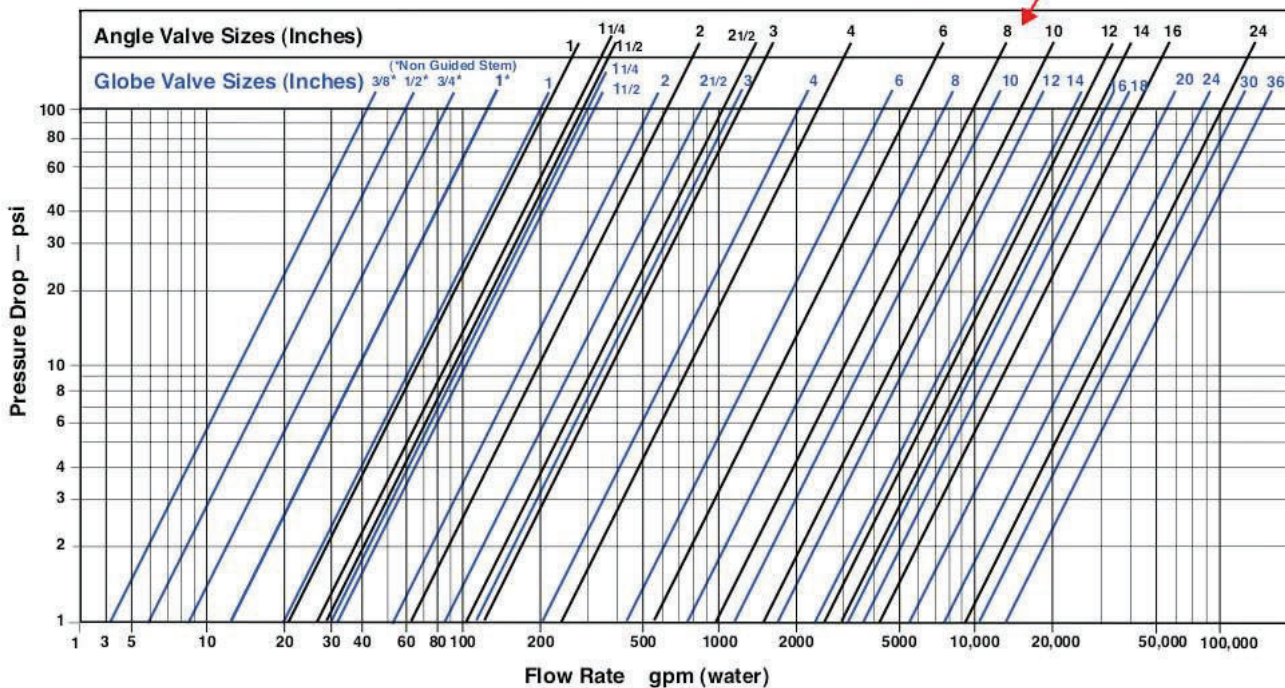
Q = Flow Rate in U.S. (gpm) or (l/s)

V = Fluid Velocity (feet per second) or (meters per second)

ΔP = Pressure Drop in (psi) or (bar)

FLOW CHART

(Based on normal flow through a wide open valve)



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S-100-01 (R-02/2021)

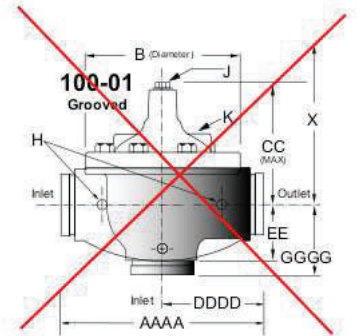
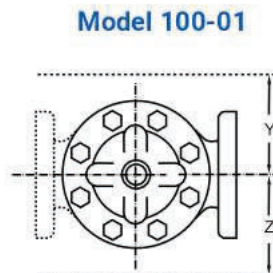
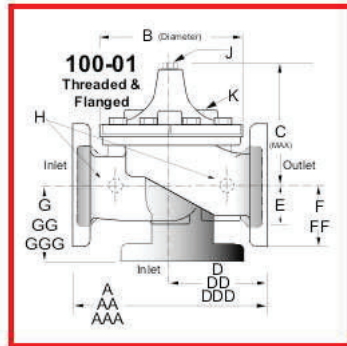
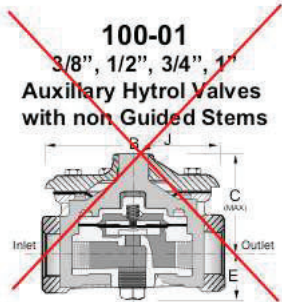




Cla-Val 100-01

MAIN VALVE

DIMENSIONS (INCHES)



Valve Size (Inches)	3/8"	1/2"	3/4"	1"	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	2.75	3.50	3.50	5.12	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	72.75	—
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	74.75	—
AAAA Grooved End	—	—	—	—	—	—	8.50	9.00	11.00	12.50	15.00	20.00	25.38	—	—	—	—	—	—	—	—	—	—
B Diameter	2.50	3.12	3.12	4.38	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 Maximum	2.33	5.88	5.88	6.25	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	59.00	
CC Maximum 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	1.25	0.88	0.88	1.63	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	28.50	
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	30.00	
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	—	0.125	0.125	0.25	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	
J NPT Cover Center Plug	0.125	0.125	0.125	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.50	2.00	1.00	1.00	1.00	2.00	2.00	
K NPT Cover Tapping	—	0.125	0.125	0.25	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	
Stem Travel	—	—	—	—	0.40	0.40	0.40	0.60	0.70	0.80	1.10	1.70	2.30	2.80	3.40	4.00	4.50	5.10	5.63	6.75	7.50	8.50	
Approx. Ship Weight (lbs)	3	3	8	8	15	15	15	35	50	70	140	285	500	780	1165	1600	2265	2982	3900	6200	7703	11720	
Approx. X Pilot System	—	—	—	—	11	11	11	13	14	15	17	29	31	33	36	40	40	43	47	68	79	85	
Approx. Y Pilot System	—	—	—	—	9	9	9	9	10	11	12	20	22	24	26	29	30	32	34	39	40	45	
Approx. Z Pilot System	—	—	—	—	9	9	9	9	10	11	12	20	22	24	26	29	30	32	34	39	42	47	

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S-100-01 (R-02/2021)



Cla-Val 100-01

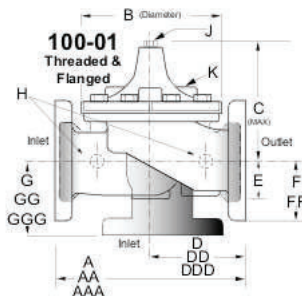
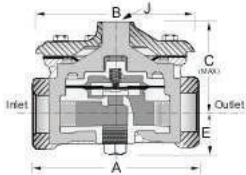
MAIN VALVE

- Note:** The top two flange holes on valve size 36 are threaded to 1 1/2"-6 UNC.
- *Non Guided Stem Auxiliary Hytrol Controls
 - †18 inch and larger 100-01 series Hytrol valves are equipped with flange feet for safety and convenience. Consult Cla-Val representative for details.

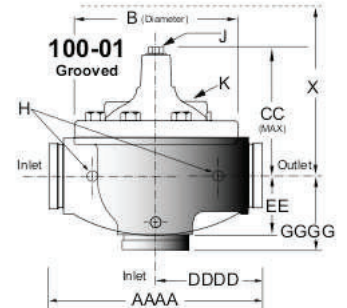
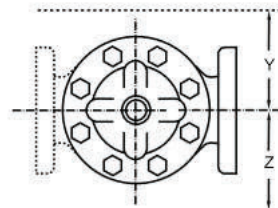
Cla-Val Control Valves operate with maximum efficiency when mounted in horizontal piping with the main valve cover UP, however, other positions are acceptable. Due to component size and weight of 8 inch and larger valves, installation with cover UP is advisable. We recommend isolation valves be installed on inlet and outlet for maintenance. Adequate space above and around the valve for service personnel should be considered essential. A regular maintenance program should be established based on the specific application data. However, we recommend a thorough inspection be done at least once a year. Consult factory for specific recommendations.

DIMENSIONS (INCHES)

100-01
10mm, 15mm, 20mm, 25mm
Auxillary Hytrol Valves
with non Guided Stems



Model 100-01



CLA-VAL Company

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S-100-01 (R-02/2021)





Cla-Val 100-01

MAIN VALVE

Valve Size (mm)	10*	15*	20*	25*	25	32	40	50	65	80	100	150	200	250	300	350	400	450	500	600	750	900	
A Threaded	70	89	89	130	184	184	184	238	279	318	—	—	—	—	—	—	—	—	—	—	—	—	—
AA 150 ANSI	—	—	—	—	—	—	216	238	279	305	381	508	645	756	864	991	1051	1168	1321	1562	1600	1848	—
AAA 300 ANSI	—	—	—	—	—	—	229	254	295	337	397	533	670	790	902	1029	1105	1210	1326	1606	1638	1899	—
AAAA Grooved End	—	—	—	—	—	—	216	228	279	318	381	508	645	—	—	—	—	—	—	—	—	—	—
B Diameter	64	80	80	111	143	143	143	168	203	232	292	400	508	600	711	832	902	1054	1143	1350	1422	1676	—
C Maximum	59	149	149	159	140	140	140	165	192	208	270	340	406	435	530	614	635	992	1064	1116	1387	1499	—
CC Maximum Grooved End	—	—	—	—	—	—	120	146	175	184	236	308	371	—	—	—	—	—	—	—	—	—	—
D Threaded	—	—	—	—	83	83	83	121	140	159	—	—	—	—	—	—	—	—	—	—	—	—	—
DD 150 ANSI	—	—	—	—	—	—	102	121	140	152	191	254	322	378	432	495	528	—	—	781	—	—	—
DDD 300 ANSI	—	—	—	—	—	—	108	127	149	162	200	267	337	395	451	514	549	—	—	803	—	—	—
DDDD Grooved End	—	—	—	—	—	—	121	—	152	191	—	—	—	—	—	—	—	—	—	—	—	—	—
E	32	23	23	42	29	29	29	38	43	52	81	110	135	235	273	321	394	329	381	451	541	624	—
EE Grooved End	—	—	—	—	—	—	52	64	73	79	108	152	192	—	—	—	—	—	—	—	—	—	—
F 150 ANSI	—	—	—	—	—	—	64	76	89	95	114	140	171	203	241	267	298	381	419	489	572	724	—
FF 300 ANSI	—	—	—	—	—	—	78	83	95	105	127	159	191	222	260	292	324	381	419	489	610	762	—
G Threaded	—	—	—	—	48	48	48	83	102	114	—	—	—	—	—	—	—	—	—	—	—	—	—
GG 150 ANSI	—	—	—	—	—	—	102	83	102	102	127	152	203	219	349	378	399	—	—	560	—	—	—
GGG 300 ANSI	—	—	—	—	—	—	102	89	110	111	135	165	216	236	368	397	419	—	—	582	—	—	—
GGGG Grooved End	—	—	—	—	—	—	83	—	108	127	—	—	—	—	—	—	—	—	—	—	—	—	—
H NPT Body Tapping	—	0.125	0.125	0.25	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
J NPT Cover Center Plug	0.125	0.125	0.125	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.50	2.00	1.00	1.00	1.00	1.00	2.00	2.00
K NPT Cover Tapping	—	0.125	0.125	0.25	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
Stem Travel	—	—	—	—	10	10	10	15	18	20	28	43	58	71	86	102	114	130	143	171	190	216	—
Approx. Ship Weight (kgs)	1.4	1.4	1.4	6	7	7	7	16	23	32	64	129	227	354	528	726	1027	1353	1769	2812	3494	5316	—
Approx. X Pilot System	—	—	—	—	280	280	280	331	356	381	432	737	788	839	915	1016	1016	1093	1194	1728	2007	2159	—
Approx. Y Pilot System	—	—	—	—	229	229	229	229	254	280	305	508	559	610	661	737	762	813	864	991	1016	1143	—
Approx. Z Pilot System	—	—	—	—	229	229	229	229	254	280	305	508	559	610	661	737	762	813	864	991	1067	1194	—

Note: The top two flange holes on valve size 900mm are threaded to 1 1/2"-6 UNC.

***Non Guided Stem Auxiliary Hytrol Controls**
 1450mm and larger 100-01 series Hytrol valves are equipped with flange feet for safety and convenience. Consult Cla-Val representative for details.

Cla-Val Control Valves operate with maximum efficiency when mounted in horizontal piping with the main valve cover UP, however, other positions are acceptable. Due to component size and weight of 8 inch and larger valves, installation with cover UP is advisable. We recommend isolation valves be installed on inlet and outlet for maintenance. Adequate space above and around the valve for service personnel should be considered essential. A regular maintenance program should be established based on the specific application data. However, we recommend a thorough inspection be done at least once a year. Consult factory for specific recommendations.



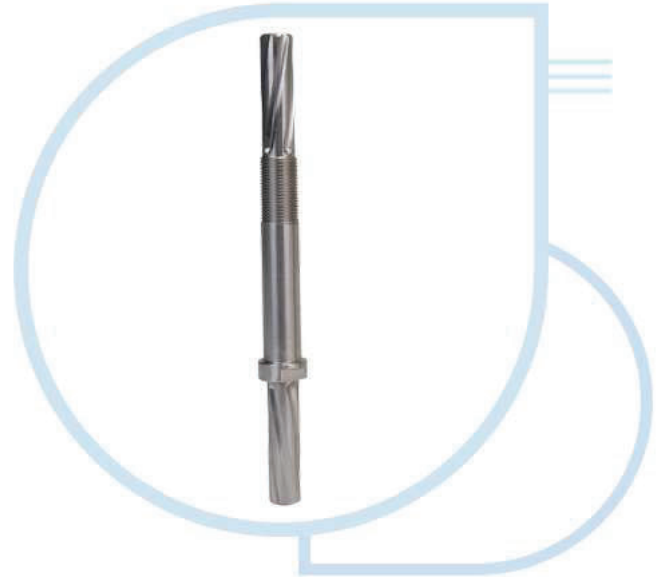
CLA-VAL Company
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info@cla-val.com
 S-100-01 (R-02/2021)



Dura-kleen stem

PRODUCT FEATURES

- The Dura-Kleen Stem is a minimal maintenance stem designed to keep the valve operating when valve stem build-up occurs under conditions such as high lime content, hard water (high calcium), or secondary and tertiary effluent discharge. The Dura-Kleen Stem is ideally suited to those valve applications with high-pressure differentials.



SPECIFICATIONS

Material:

- 316 Stainless Steel
- 303 Stainless Steel
- Monel



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Sub-Dura-Kleen (R-02/2019)



Model CRL PRESSURE RELIEF CONTROL VALVE

PRODUCT FEATURES

Cla-Val Model CRL Pressure Relief Control Valve is direct-acting, spring loaded, diaphragm type relief valve. Often used as pilot controls for Cla-Val Hytrol valves, they can also be used as self-contained pressure relief valves.

When the controlling pressure exceeds the spring setting, the disc is lifted off its seat, permitting flow through the control. When control pressure drops below the spring setting, the spring forces the control back to its normally closed position. The controlling pressure is applied to the chamber beneath the diaphragm through an external tube on the CRL.

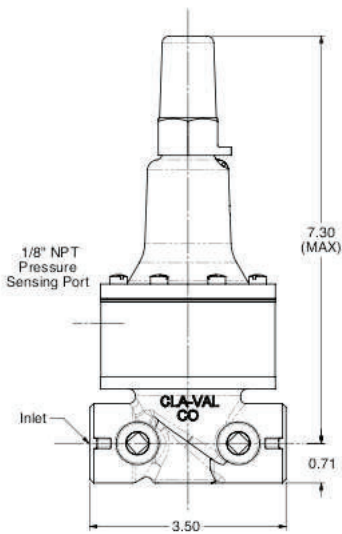


DIMENSIONS

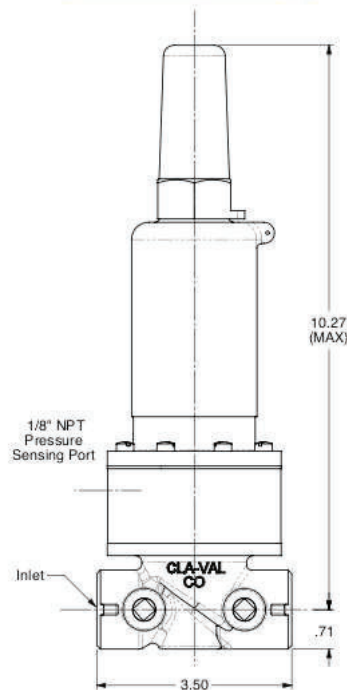
0 to 75 psi Design

20 to 105 psi Design

20 to 200 psi Design



100 to 300 psi Design



SPECIFICATIONS

- Size: 1/2" & 3/4" NPT Threaded
- Temperature Range: Water, Air: to 180°F Max.
- Standard Materials*
 - Body & Cover: Stainless Steel 303
 - Trim: Stainless Steel 303
 - Rubber: Buna-N® Synthetic Rubber
- Pressure Ratings: Stainless steel 400 psi Max.

*Optional Materials Available

ADJUSTMENT RANGES

- psi: 0 - 75
- 20 - 105
- 20 - 200
- 100 - 300

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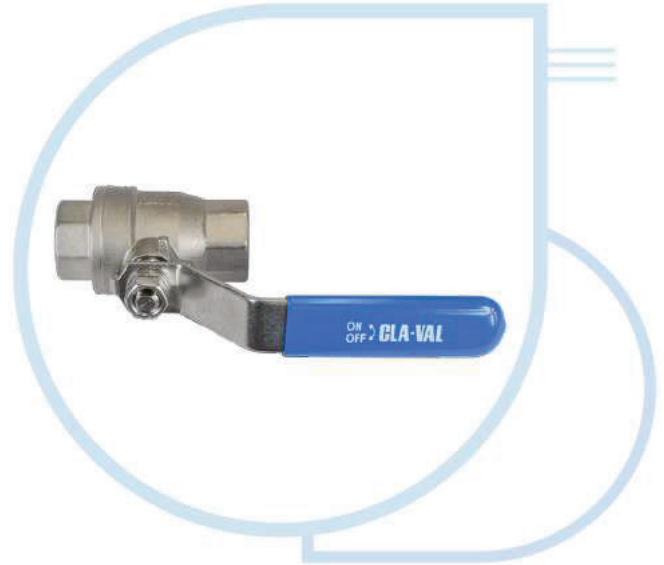
S-CRL-SST (R-07/2021)



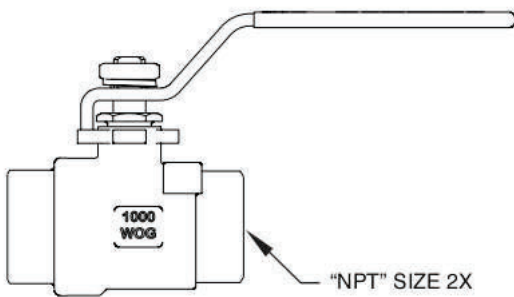
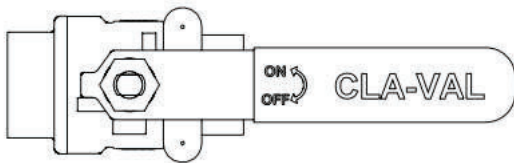
Model CK2 ISOLATION VALVE

PRODUCT FEATURES

- The Cla-Val Model CK2 is a ball valve used for isolating components within the pilot system.



DIMENSIONS



SPECIFICATIONS

- Size:** 3/8" thru 2" NPT Threaded
- Temperature Range:** 33°F to 180°F
- Standard Materials**
 - Body:** Stainless Steel
 - Handle & Nut:** Stainless Steel
 - Ball Seal:** RPTFE
- Ends:** Threaded ANSI/ASME B1.20 1
- Pressure Ratings:** 400 psi

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S-CK2 (R-01/2022)

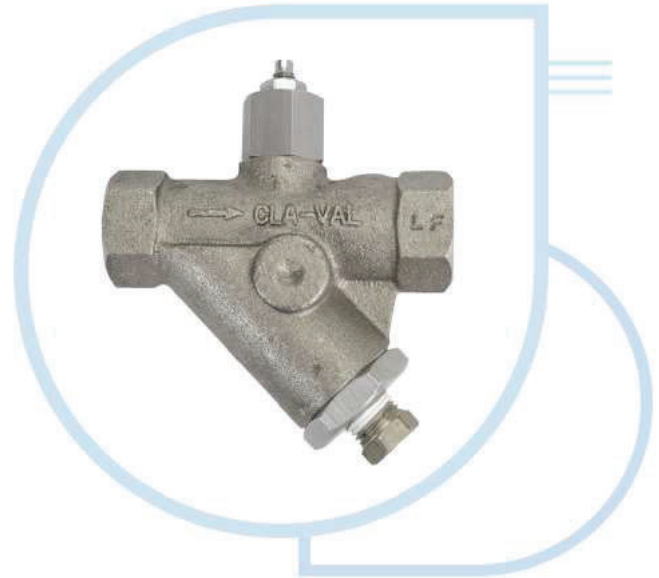




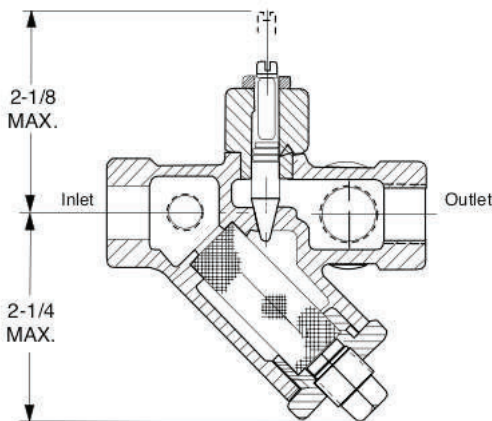
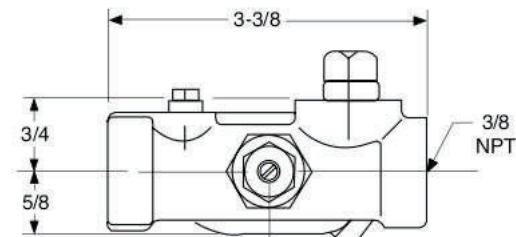
Model X42N-2 STRAINER AND NEEDLE VALVE ASSEMBLY

PRODUCT DESCRIPTION

- The Cla-Val Model X42N-2 Strainer and Needle Valve Assembly consists of a wye type body with a removable, heavy mesh screen.
- The X42N-2 also has an integrated adjustable needle assembly creating a restriction area and closing speed adjustment for the main valve operation.



DIMENSIONS



SPECIFICATIONS

- Size:** 3/8" NPT Threaded
- Temperature Range:** Water: to 180°F Max.
- Standard Materials**
 - Body:** 316 Stainless Steel
 - Trim:** 316 Stainless Steel
 - Screen:** 316 Stainless Steel (60 mesh)
 - Rubber:** Buna-N® Synthetic Rubber
- Pressure Ratings:** 400 psi

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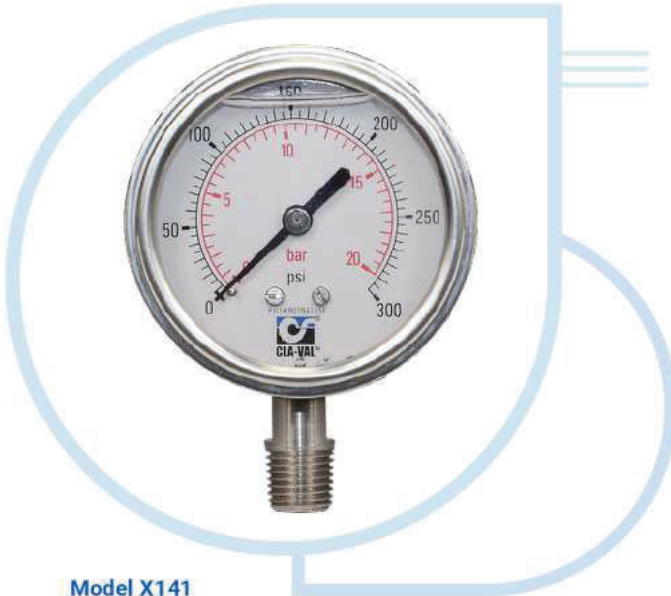
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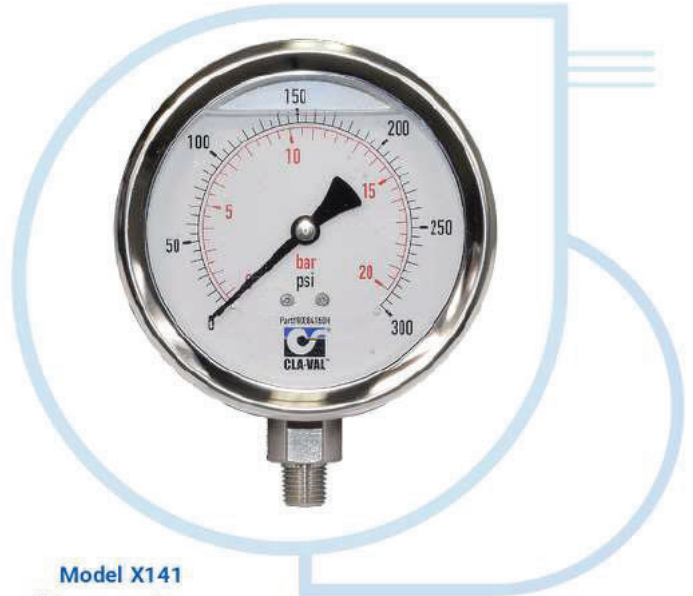
S-X42N-2-SST (R-08/2021)



Model X141 PRESSURE GAUGE



Model X141
2-1/2" Pressure Gauge



Model X141
4" Pressure Gauge

PRODUCT FEATURES

- Cla-Val Model X141 Pressure Gauge Option consists of glycerin-filled pressure gauges. Cla-Val gauges are waterproof, shock resistant, and fully enclosed with a stainless steel case and bronze wetted parts. Ambient temperature ratings are -4 Degrees F to +140 Degrees F (-20 Degrees C to +60 Degrees C).
- All gauges have dual scale (PSI/BAR) and are supplied with a 1/4" NPT bottom connection.

PRESSURE RANGES

Specifications:

X141 Gauge Assembly (2 1/2" Diameter Dial)

Pressure Range*

- 0 - 60 psi
- 0 - 100 psi
- 0 - 200 psi
- 0 - 300 psi
- 0 - 400 psi

Specifications:

X141 Gauge Assembly (4" Diameter Dial)

Pressure Range*

- 0 - 60 psi
- 0 - 100 psi
- 0 - 200 psi
- 0 - 300 psi
- 0 - 400 psi



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Sub-X141 (R-03/2019)

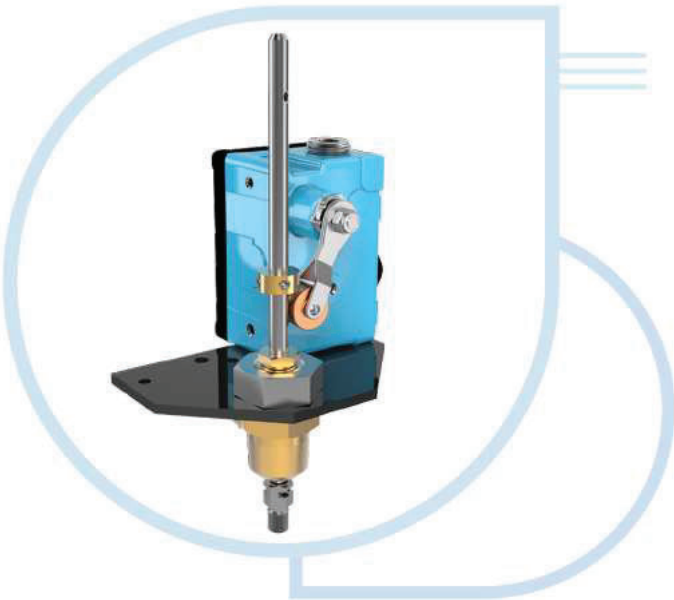


Model X105L

LIMIT SWITCH ASSEMBLY

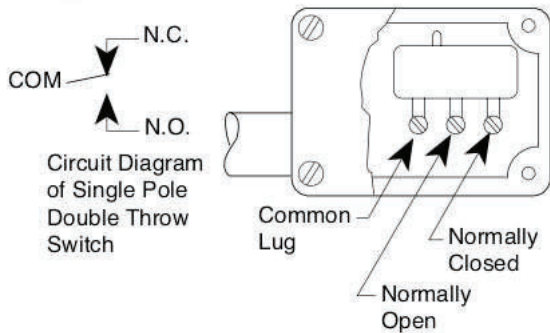
PRODUCT FEATURES

Cla-Val Model X105L Limit Switch Assembly is a rugged, dependable and positive acting switch assembly actuated by the opening or closing of a Cla-Val control valve on which it is mounted. The single pole, double throw micro switch can be connected either to open or to close an electrical circuit when actuated. By loosening the allen screw on the actuating collar and raising or lowering the collar on the stem, the X105L is easily adjusted to signal that the valve has fully reached the desired position (open or closed).

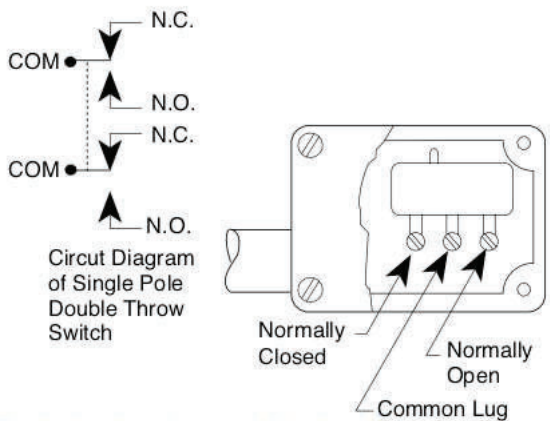


INSTALLATION

Single Pole Double Throw Switch



Double Pole Double Throw Switch



Switches shown in unactivated position.

SPECIFICATIONS

- Standard Materials*:** Aluminum switch housing
Steel bracket and brass adapter
Stainless steel stem
 - Electrical:** 1/2" Conduit connection
 - Switch Type:** SPDT UL, File No. E12252,
CSA Certified, File No. LR57325
Weather proof
NEMA 1,3,4, and 13
 - Switch Rating:** UL/CSA rating: L96
15 amp. 125, 250, or 480 volts AC
1/2 amp. 125 volts DC
1/4 amp. 250 volts DC
 - Switch Options:** DPDT switches available on request
UL/CSA Rating: L59, 10 amps
- Explosion proof micro switches are NEMA 1,7, and 9
UL Listed, File No. E14274 and CSA Certified, File No. LR57324: Class I, Group C and D and Class II, Group E, F and G.

*Optional Materials Available

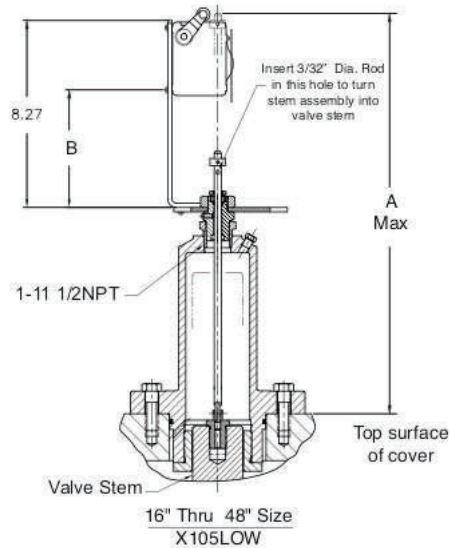
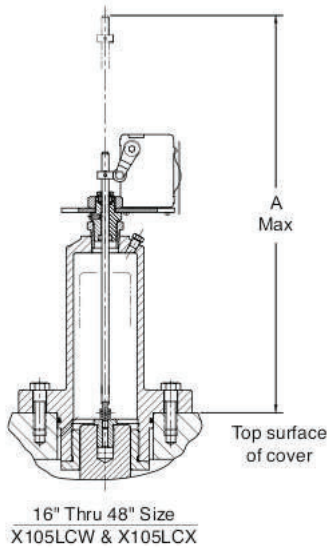
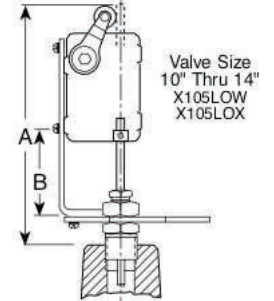
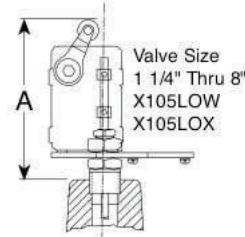
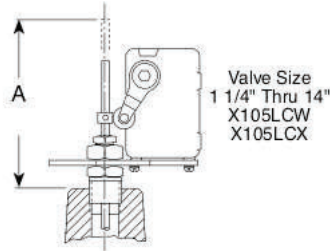
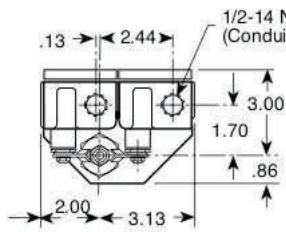
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info@cla-val.com
S-X105L (R-01/2021)



Model X105L

LIMIT SWITCH ASSEMBLY

DIMENSIONS



Basic Valve 100-01	1 1/4	1 1/2	2	2 1/2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
Dimension "A"	10.19	10.19	7.16	7.16	7.43	7.00	6.69	6.91	9.88	9.59	9.16	10.78	10.78	18.23	19.10	35.07	36.07	36.07	36.07
Dimension "B"							1.69	1.69	2.44	2.94	2.94	2.94	2.94	4.32	5.19	8.40	8.40	8.40	8.40
Basic Valve 100-20					3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
Dimension "A"					7.16	7.34	7.00	6.69	6.91	9.88	9.59	9.59	10.78	10.78	10.78	11.30	35.07	36.07	36.07
Dimension "B"								1.69	1.69	2.44	2.94	2.94	2.94	2.94	2.94	5.19	8.40	8.40	8.40

CATALOG NO.	ACTUATION POSITION	SWITCH ENCLOSURE
X105LCW	Valve Closed	Weather Proof
X105LCX	Valve Closed	Explosion Proof
X105LOW	Valve Open	Weather Proof
X105LOX	Valve Open	Explosion Proof

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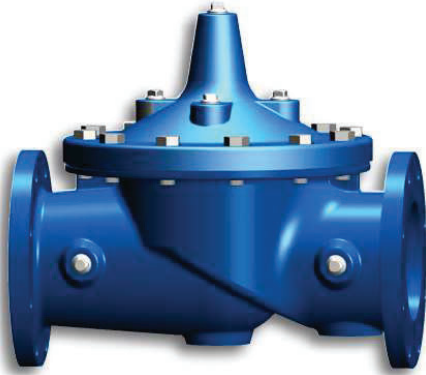
S-X105L (R-01/2021)



CLA-VAL WARRANTY

3 Year Warranty on Cla-Val Quality Products

This is a Limited Warranty



Automatic valves and controls as manufactured by Cla-Val are warranted for three years from date of shipment against manufacturing defects in material and workmanship that develop in the service for which they are designed, provided the products are installed and used in accordance with all applicable instructions and limitations issued by Cla-Val. Electronic components manufactured by Cla-Val are warranted for one year from the date of shipment.

We will repair or replace defective material, free of charge which is returned to our factory, transportation charges prepaid, provided that after inspection the material is found to have been defective at time of shipment. The warranty is expressly conditioned on the purchaser's giving Cla-Val immediate written notice upon discovery of the defect.

Components used by Cla-Val, but manufactured by others, are warranted only to the extent of that manufacturer's guarantee.

This warranty shall not apply if the product has been altered or repaired by others, and Cla-Val shall make no allowance or credit for such repairs or alterations unless authorized in writing by Cla-Val.

Disclaimer of Warranties & Limitation of Liability

The foregoing warranty is exclusive and in lieu of all other warranties and representations whether expressed, implied, oral or written, including but not limited to, any implied warranties or merchantability or fitness for a particular purpose. All such other warranties and representations are hereby cancelled.

Cla-Val shall not be liable for any incidental or consequential loss, damage or expense arising directly or indirectly from the use of the product. Cla-Val shall not be liable for any damages or charges for labor or expense in making repairs or adjustments to the product. Cla-Val shall not be liable for any damages or charges sustained in the adaptation or use of its engineering data and services.

No representative of Cla-Val may change any of the foregoing or assume any additional liability or responsibility in connection with the product.

The liability of Cla-Val is limited to material replacements F.O.B. Newport Beach, California.

CLA-VAL

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VENT-O-MAT AIR VALVES ARE DESIGNED TO FULFILL FOUR FUNCTIONS NAMELY:
 LARGE VOLUME AIR DISCHARGE - PIPELINE FILLING
 PRESSURIZED AIR DISCHARGE - PIPELINE OPERATING
 AIR INTAKE (VACUUM BREAKING) PIPELINE DRAINING
 SURGE PROTECTION - RAPID FILLING OR COLUMN SEPARATION

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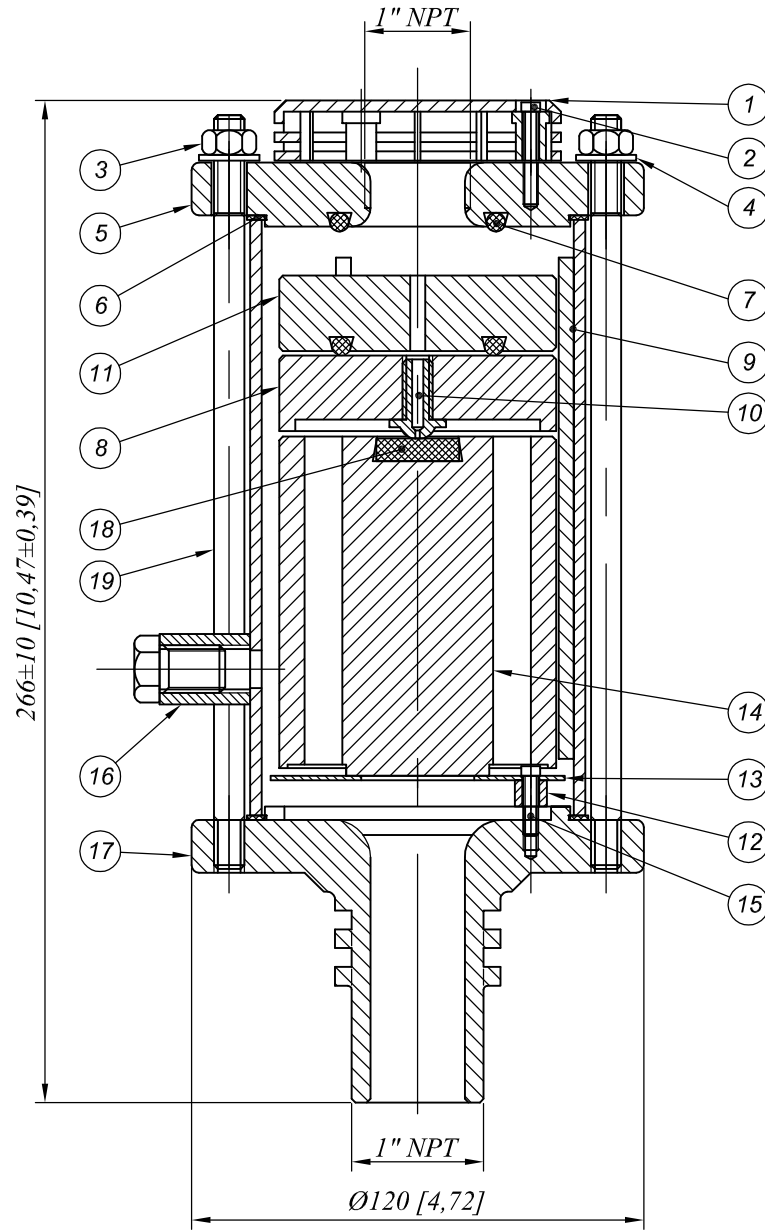
TITLE:
DN25 (1") - PN25 VENT-O-MAT
RBX SERIES DBL ACTING AIR VALVE

DRAWN: NVDW DATE: 2014/05/19 CHECKED: D.D. DATE: 2014/05/19

SCALE: 1:2 A4

PROJECTION: 1 ST. ANGLE 3 RD. ANGLE

REV.	DATE	SIGN	DESCRIPTION



NOTE:
 1. DIMENSIONS IN BRACKETS ARE IN INCHES
 2. OPERATING PRESSURE MIN. 7PSI TO MAX 363 PSI

DN mm (in)	MODEL No.	WEIGHT ±kg (lbs)		
25 (1")	025 RBX 2521	5 (11)		
ITEM	QTY	DESCRIPTION	MATERIAL	
1	1	25 RBX TOP COVER	ABS POLYLAC PA 737	TYPE: 025 RBX 2521 025RBX25BCS4FC1Ye DRG No./GA REF No. SHEET: 1 OF 1
2	3	TOP COVER SCREWS	S/STEEL 304	
3	4	M8 HEX NUT	S/STEEL 304	
4	4	M8 WASHER	S/STEEL 304	
5	1	25 RBX UPPER FLANGE	CAST S/STEEL 304	
6	2	25 RBX BARREL SEAL	TEADIT NA 1002	
7	2	35 x 5 O-RING SEAL	E.P.D.M.	
8	1	25 RBX UPPER FLOAT	WHITE HDPE	
9	1	25 RBX BARREL	S/STEEL 304	
10	1	025 RBX NOZZLE	S/STEEL 316	
11	1	25 RBX ANTI SHOCK FLOAT	WHITE HDPE	
12	3	25 RBX BAFFLE SPACER	ABS POLYLAC PA 737	
13	1	25 RBX BAFFLE PLATE	S/STEEL 316	
14	1	25 RBX LOWER FLOAT	WHITE HDPE	
15	3	BAFFLE PLATE SCREWS	S/STEEL 316	
16	1	½" NPT SOCKET WITH PLUG	S/STEEL 304	
17	1	25 RBX LOWER FLANGE	CAST S/STEEL 304	
18	1	25 RBX NOZZLE SEAT	E.P.D.M.	
19	4	25 RBX TIE RODS	S/STEEL 304	

RBX: Ordering Guide & Test Specifications

TEST SPECIFICATION

All air release valves supplied shall be subjected to the following testing procedures in the order laid down:

(A) A high pressure strength and leak test whereby the valve is filled with water and pressurized to 1.5 times the rated working pressure which shall be held for a period of 2 minutes. Any leaking, weeping or sweating shall be reason for rejection.

(B) A low head leak test whereby the valve is filled with water and pressurized to a maximum of 0.5 bar (7.3 psi) using a visible water column connected to the test rig. The valve shall be rejected if leak tightness is not maintained for 2 minutes.

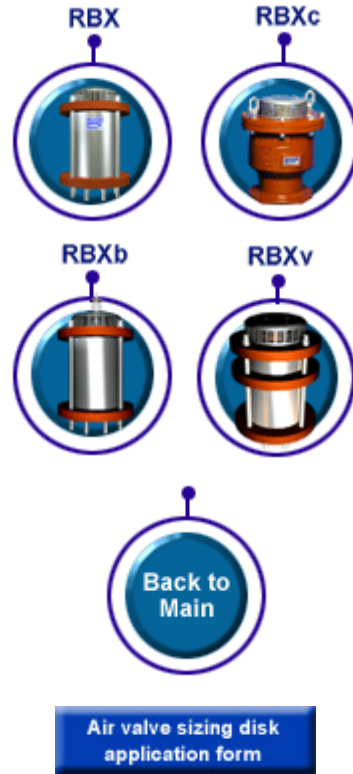
(C) Every tenth air release valve of the same size and pressure rating must be subjected to a small orifice function test - "DROP TEST" - whereby the valve is filled with water, pressurized to above rated working pressure and isolated from the test rig by closure of an isolating valve. A chamber in the test rig immediately prior to the isolating valve must be filled with compressed air at a pressure equal to that being maintained in the air release valve. The isolating valve is then opened so as to allow the air to rise in the air release valve without the pressure dropping lower than 2 - 3 bar (29 - 44 psi) above rated working pressure of the air release valve. The "DROP TEST" is then carried out by slowly bleeding off the pressure through a suitable cock until rated working pressure is reached and the float drops away from the orifice to allow discharge. Failure of the air release valve to function in the manner described will be reason for rejection.

On request the manufacturer shall provide batch certificates of test compliance which shall be cross referenced to serial numbers indelibly marked onto the identity label of each valve.

IMPORTANT NOTE: It is impossible to inject air into an incompressible liquid, air injection can only be achieved if the liquid can be displaced which implies that the pressure in the test rig must be reduced to atmospheric, and absolutely nothing is proven by discharge through the small orifice of the air release valve at atmospheric pressure. "DROP TESTING" in this manner is not acceptable.

Water Valves

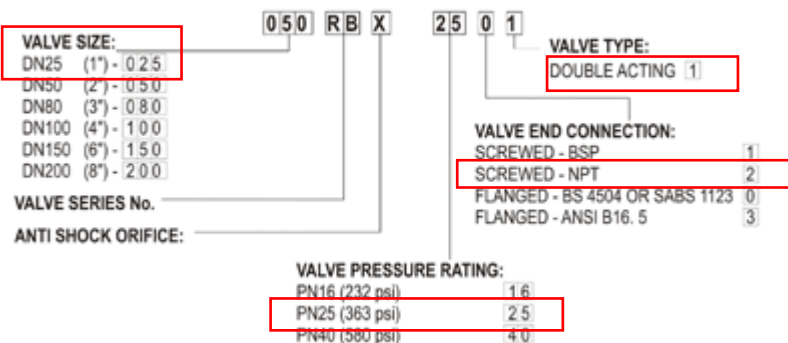
Air Valves



Ordering Guide

[Zoom In](#)

ORDERING GUIDE



Note: 1. DN250 (10") and DN300 (12") valves are available on

RBX: Dn25 (1") & Dn50 (2")

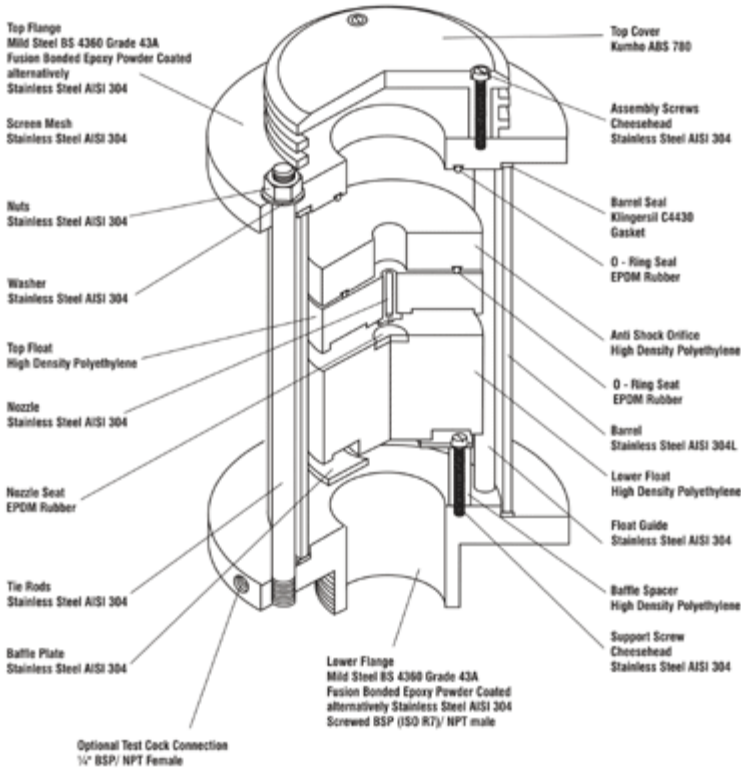
COMPONENT DESCRIPTION & MATERIAL SPECIFICATIONS

- SERIES RBX

DN25 (1") & DN50(2") - Screwed

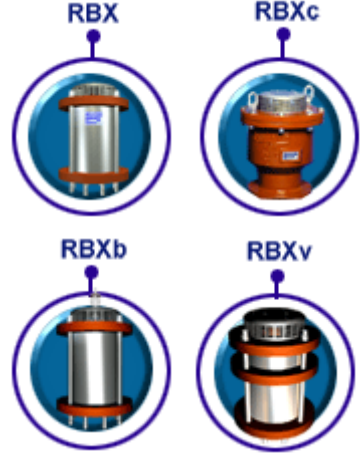
Type: Series RBX - Double Orifice (Small & Large Orifice) with Anti Shock Orifice Mechanism. **End Connection:** Screwed BSP (ISO R7)/ NPT Male

Nominal Sizes: DN25 (1") DN50 (2") **Model No's:** RBX 2511 & 2521 RBX 4011 & 4021 **Pressure Ratings:** PN25 (363 psi) PN40 (580 psi)



Water Valves

Air Valves



Air valve sizing disk application form

- [Operation](#)
- [Recommended Installation Arrangements](#)
- [Component Description & Material Specifications](#)

- [Dn25 \(1"\) & Dn50 \(2"\)](#)
- [Dn80 \(3"\) & Dn100 \(4"\)](#)
- [Dn150 \(6"\) & Dn200 \(8"\)](#)

General Specifications

- [Dn25 \(1"\) & D50 \(2"\)](#)
- [Dn80 \(3"\) & Dn100 \(4"\)](#)
- [Dn150 \(6"\) & Dn200 \(8"\)](#)

Selection & Positioning

- [Surge and WaterHammer Protection](#)
- [Small Orifice Discharge Performance](#)

Why Vent-O-Mat

- [Purchase Specifications](#)
- [Ordering Guide & Test Specifications](#)

Air/Vacuum Valves



Clean Water



Wastewater

Operational Highlights:

- Exhausts large quantities of air at system start-up
- Provides pipeline vacuum protection
- Responds to loss of pressure during power failures, line breaks and intentional drainage
- Fully complies with AWWA C512

Product Features:

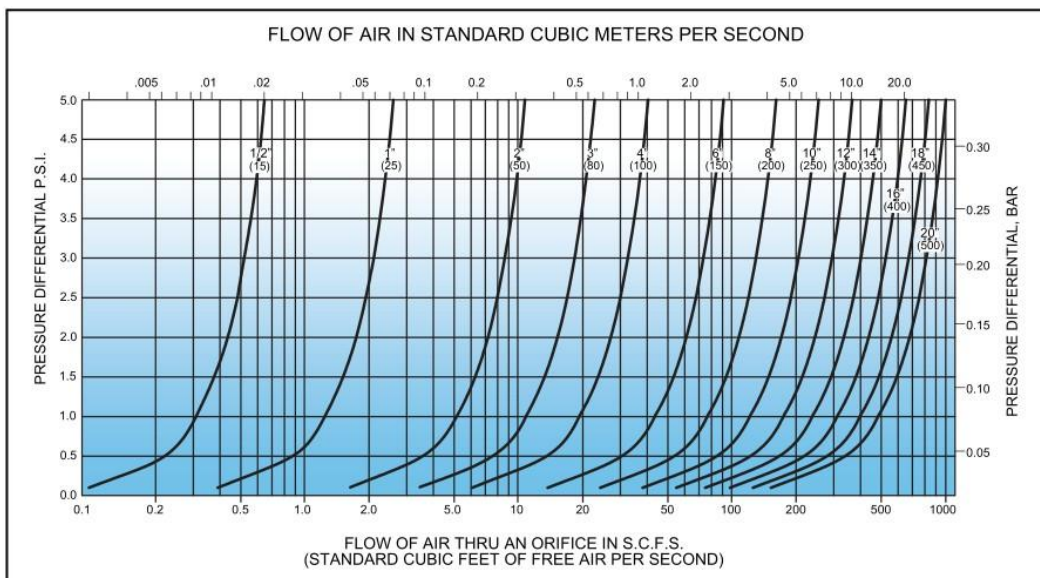
- Unconditionally guaranteed stainless steel floats
- Stainless steel 316 internal trim
- Exclusive high/low pressure resilient seating
- Full pipe size inlets and outlets provide maximum protection
- Non-clog design minimizes need for backwashing

Optional Accessories:

- Outlet hood with screen (prevents debris from entering valves)
- Flanged outlets on sizes 8 inch & smaller
- Ball and plug isolation valves (allows valve maintenance)
- Inflow Preventer on outlet (stops flood water and resulting contamination from entering pipeline)
- Backwash kit (for severe wastewater applications)

MATERIALS OF CONSTRUCTION		
COMPONENT	STANDARD	OPTIONAL
Body, Cover and Baffle	Cast Iron ASTM A126 Class B Class 125 and 250 Ductile Iron ASTM A536 Grade 65-45-12	Carbon Steel ASTM A216 Grade WCB Stainless Steel ASTM A351 Grade CF8M
Trim	Type 316 Stainless Steel	_____
Seal	Buna-N	EPDM or Viton
Coating	Universal Acrylic Primer (external)	Non-Stick Fusion Bonded Epoxy (internal & external)

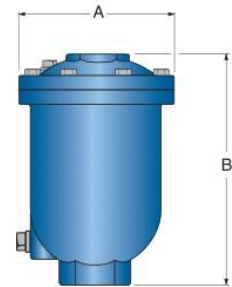
VENTING CAPACITY OF AIR/VACUUM VALVE ORIFICES



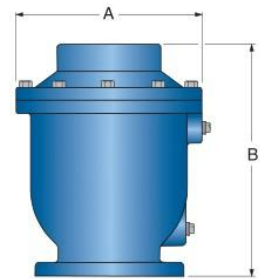
Air/Vacuum Valves

WATER AIR/VACUUM VALVES					
Inlet Size	Outlet Size	Model Number*	CWP PSI	Dimensions (Inches)	
				A	B
1/2" NPT	1/2" NPT	100S	300	6.13	7.00
1" NPT	1" NPT	101S	300	7.00	9.68
2" NPT	2" NPT	102S	300	9.50	12.00
3" NPT	3" NPT	103S	300	9.50	12.00
4" Flg	4" NPT	104S 154S	125lb - 150 250lb - 300	11.50	16.38
6" Flg	6" NPT	106S 156S	125lb - 150 250lb - 300	14.00	18.63
8" Flg	8" NPT	108S 158S	125lb - 150 250lb - 300	17.25	21.63
10" Flg	10" Flg	110F 160F	125lb - 150 250lb - 300	20.25	24.50
12" Flg	12" Flg	112F 162F	125lb - 150 250lb - 300	24.00	30.00
14" Flg	14" Flg	114F 164F	125lb - 150 250lb - 300	27.00	29.50
16" Flg	16" Flg	116F 166F	125lb - 150 250lb - 300	30.50	35.19
20" Flg	20" Flg	120F 170F	125lb - 150 250lb - 300	38.25	42.06

*NSF 61 & 372 Certified

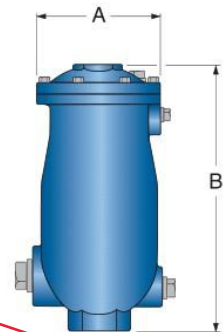


100S - 103S
Air/Vacuum Valves



104S - 170F
Air/Vacuum Valves

WASTEWATER AIR/VACUUM VALVES					
Inlet Size	Outlet Size	Model Number	CWP PSI	Dimensions (Inches)	
				A	B
2" NPT	1" NPT	301A	150	7.00	15.06
2" NPT	2" NPT	302A	150	9.50	17.44
3" NPT	3" NPT	303A	150	9.50	17.44
4" Flg	4" NPT	304	150	11.50	36.63
6" Flg	6" NPT	306	150	14.00	36.38
8" Flg	8" NPT	308	150	17.25	40.13



301A - 308
Wastewater Air/Vacuum Valves

76F-100-A SERIES

Stainless Steel Full Port Ball Valve

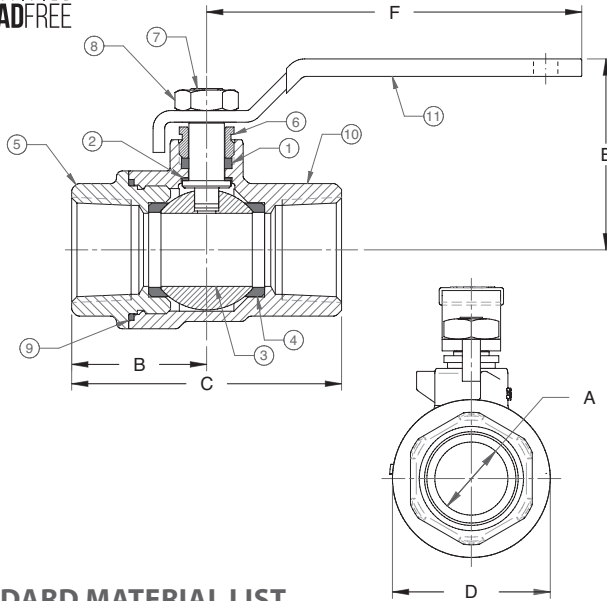
Female NPT Thread, 1/4"-3" 1000 CWP (psig), Cold Non-Shock. (See referenced P/T chart)
 150 psig Saturated Steam.
 Vacuum Service to 29 inches Hg.
 MSS SP-110 compliant.



FEATURES

- Investment cast components
- Reinforced seats
- Blow-out-proof stem design
- Adjustable packing gland
- Stainless Steel lever and nut

- Fire safe to API 607 (requires -24 suffix)
- Meets NACE MR0175 (2000) & MR0103 (2012)
- CSA CGA 3.16-M88 (Requires "GS" suffix)
- NSF/ANSI 61 Section 8, Annex G (1/4" to 2")
- NSF-372, Drinking Water System Components - Lead Content (1/4" to 2")



OPTIONS AVAILABLE: (More information in Section J)

- Minimum quantities apply
- To specify an option, replace the "01" standard suffix with the suffix of the option.
- To specify multiple options, replace the "01" suffix with the desired suffixes in the numerical order shown below. NOTE: Not all suffixes can be combined together.

(SUFFIX)	OPTION	SIZES
-01	Standard Configuration	All
-P -01-	BSPP (Parallel) Thread Connection	1/2" to 2"
-T -01-	BSPT (Tapered) Thread Connection	1/2" to 3"
-02-	Stem Grounded	1/2" to 3"
-04-	2.25" Stem Extension (Carbon Steel, Zinc Plated)	1/2" to 2"
-08-	90° Reversed Stem	1/2" to 2"
-11-	Therma-Seal™ Insulating Tee Handle	1/4" to 2"
-14-	Side Vented Ball (Uni-Directional)	3/8" to 3"
-24-	Graphite packing, PTFE body seal, RPTFE bearing (Fire Safe API 607, 6th edition, ISO 10497:2010)	1/2" to 3"
-27-	SS Latch-Lock Lever & Nut	1/4" to 3"
-30-	Cam-Lock and Grounded	1/2" to 2"
-32-	SS Tee Handle & Nut	1/2" to 2"
-39-	SS Hi-Rise Locking Wheel Handle, SS Nut	1/2" to 2"
-40-	Cyl-Loc and Grounded	1/2" to 2"
-44-	Seal Welded	1/4" to 3"
-45-	Less Lever & Nut	1/2" to 3"
-46-	Latch Lock Lever - Lock in Closed Position Only	1/2" to 2"
-47-	SS Latch Lock Oval Handle	1/2" to 2"
-48-	SS Oval Handle (No Latch) & Nut	1/4" to 2"
-49-	No Lubrication. Assembled Dry.	1/2" to 3"
-56-	Multifill Seats & Packing	1/2" to 3"
-57-	Oxygen Cleaned	1/4" to 3"
-60-	Static Grounded Ball & Stem	1/2" to 3"
-GS	CSA CGA 3.16	All

STANDARD MATERIAL LIST

PART	MATERIAL
1 Stem packing	MPTFE
2 Stem bearing	RPTFE
3 Ball	A276-316SS (1/4" to 2", except 1.25") A276-316SS or A351-CF8M stainless (1.25") A351-CF8M stainless (3")
4 Seat (2)	RPTFE
5 Retainer	ASTM A276-316SS (1/4" & 3/8") ASTM A351-CF8M stainless (1/2" to 3")
6 Gland	A276-316 Stainless Steel
7 Stem	A276-316 Stainless Steel
8 Lever nut	304 Stainless Steel
9 Body Seal	RPTFE (1/2" to 3")
10 Body	A351-CF8M
11 Lever and grip	SS w/vinyl

PRODUCT NUMBER	SIZE	A	B	C	D	E	F	WT.
76F-101-01	1/4"	0.37	0.95	1.91	1.12	1.60	3.85	0.47
76F-102-01	3/8"	0.37	0.95	1.91	1.12	1.60	3.85	0.44
76F-103-01A	1/2"	0.50	1.21	2.35	1.27	1.73	3.85	0.57
76F-104-01A	3/4"	0.81	1.39	2.77	1.62	1.96	3.85	0.91
76F-105-01A	1"	1.00	1.67	3.34	2.00	2.27	4.75	1.38
76F-106-01A	1.25"	1.25	1.96	3.92	2.73	3.21	7.77	4.17
76F-107-01A	1.5"	1.50	2.05	4.10	2.92	3.31	7.77	4.69
76F-108-01A	2"	2.00	2.37	4.74	3.75	3.69	7.77	6.90
76F-100-01A	3"	3.00	3.70	7.40	5.68	5.23	10.00	22.40

* LEAD FREE: The wetted surfaces of this product shall contain no more than 0.25% lead by weighted average. Complies with Federal Public Law 111-380. ANSI 3rd party approved and listed.

**FOR PRESSURE/TEMPERATURE RATINGS,
REFER TO PAGE M-12, GRAPH NO. 8**

FLOW DATA

For Apollo® Ball Valves

The listed Cv "factors" are derived from actual flow testing, in the Apollo® Ball Valve Division, Conbraco Industries, Inc., Pageland, South Carolina. These tests were completed using standard "off the shelf" valves with no special preparation and utilizing standard schedule 40 pipe. It should be understood that these factors are for the valve only and also include the connection configuration. The flow testing is done utilizing water as a fluid media and is a direct statement of the gallons of water flowed per minute with a 1 psig pressure differential across the valve/connection unit. Line pressure is not a factor. Because the Cv is a factor, the formula can be used to estimate flow of most media for valve sizing.

FLOW OF LIQUID

$$Q = C_v \sqrt{\frac{\Delta P}{SpGr}}$$

$$\text{or } \Delta P = \frac{(Q)^2 (SpGr)}{(C_v)^2}$$

Where:

Q = flow in US gpm
 ΔP = pressure drop (psig)
 SpGr = specific gravity at flowing temperature
 Cv = valve constant

FLOW OF GAS

$$Q = 1360 C_v \sqrt{\frac{(\Delta P) (P_2)}{(SpGr) (T)}}$$

$$\text{or } \Delta P = \frac{5.4 \times 10^{-7} (SpGr) (T) (Q)^2}{(C_v)^2 (P_2)}$$

Where:

Q = flow in SCFH
 ΔP = pressure drop (psig)
 SpGr = specific gravity (based on air = 1.0)
 P₂ = outlet pressure-psia (psig + 14.7)
 T = (temp. °F + 460)
 Cv = valve constant

CAUTION: The gas equation shown, is valid at very low pressure drop ratios. The gas equation is **NOT** valid when the ratio of pressure drop (ΔP) to inlet pressure (P1) exceeds 0.02.

NOTE: Only use the gas equation shown if (P1-P2)/P1 is less than 0.02.

Cv FACTORS FOR APOLLO VALVES

VALVE	SIZE (IN.)														
	1/4	3/8	1/2	3/4	1	1.25	1.5	2	2.5	3	4	6	8	10	12
70B-140 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
70-100/200 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
70-300/400 Series	--	--	15	30	43	48	84	108	--	--	--	--	--	--	--
70-600 Series	2.3	4.5	5.4	12	14	21	34	47	--	--	--	--	--	--	--
70-800 Series	8.4	7.2	15	30	43	48	84	--	--	--	--	--	--	--	--
71-AR Series	--	--	--	30	43	48	84	108	190	370	--	--	--	--	--
71-100/200 Series	--	--	--	30	43	48	84	108	190	370	--	--	--	--	--
72-100/900 Series	--	--	26	48	65	125	170	216	--	--	--	--	--	--	--
73A-100 Series	8.4	7.2	15	30	43	48	84	108	--	--	--	--	--	--	--
73-300/400 Series	--	--	26	48	65	125	170	216	--	--	--	--	--	--	--
74-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
75-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
76-AR Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
76F-100 Series	8.1	15	15	51	68	125	177	389	--	--	--	--	--	--	--
76FJ-100 Series	8.1	15	15	51	68	125	177	389	--	--	--	--	--	--	--
76FK-100 Series	8.1	15	15	51	68	125	177	389	--	--	--	--	--	--	--
76-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	--	--	--	--	--
76-300/400 Series	--	--	26	48	65	125	170	216	--	--	--	--	--	--	--
76-600 Series	2.3	4.5	5.4	12	14	21	34	47	--	--	--	--	--	--	--
76J-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	--	--	--	--	--
76J-AR Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
76K-100 Series	8.4	7.2	15	30	43	48	84	108	190	370	--	--	--	--	--
76K-AR Series	8.4	7.2	15	30	43	48	84	108	190	370	670	--	--	--	--
7K-100 Series	--	--	15	51	68	125	177	389	503	--	--	--	--	--	--
77-AR Series	8.1	15	15	51	68	125	177	389	--	--	--	--	--	--	--
77C-100/200 Series	4.5	7.2	16	36	68	125	177	389	503	--	--	--	--	--	--
77D-140 Series	4.5	7.2	16	36	68	125	177	389	--	--	--	--	--	--	--

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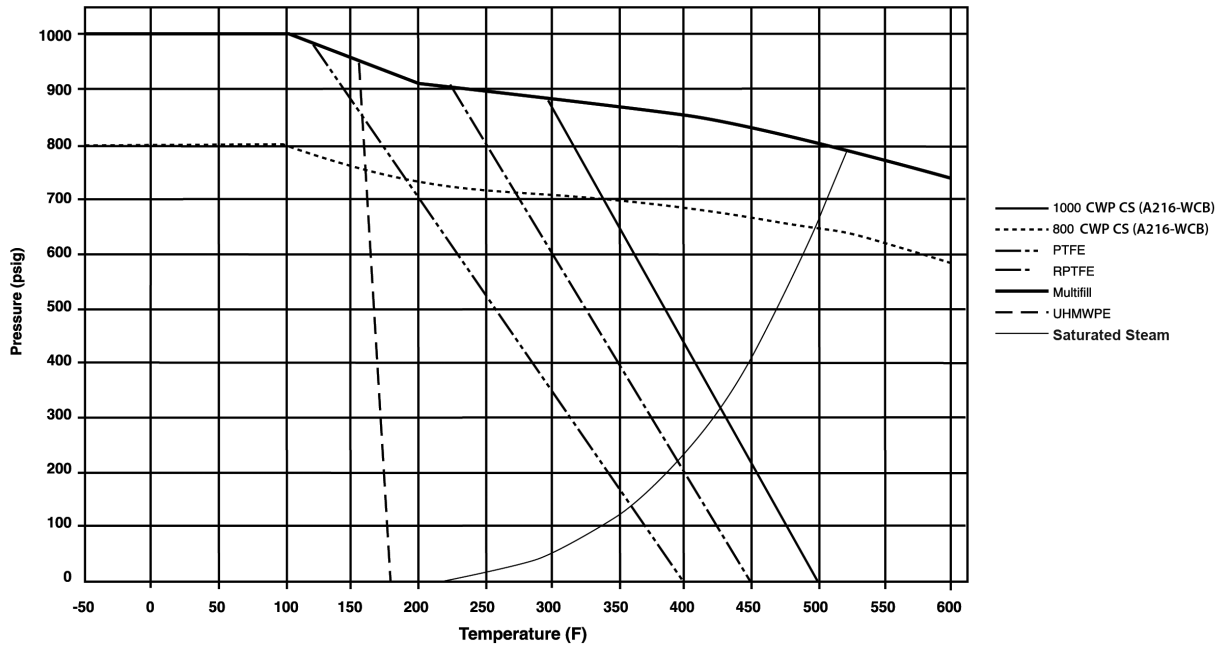


PRESSURE TEMPERATURE RATINGS

1000 CWP

(CS) ASTM A216-WCB

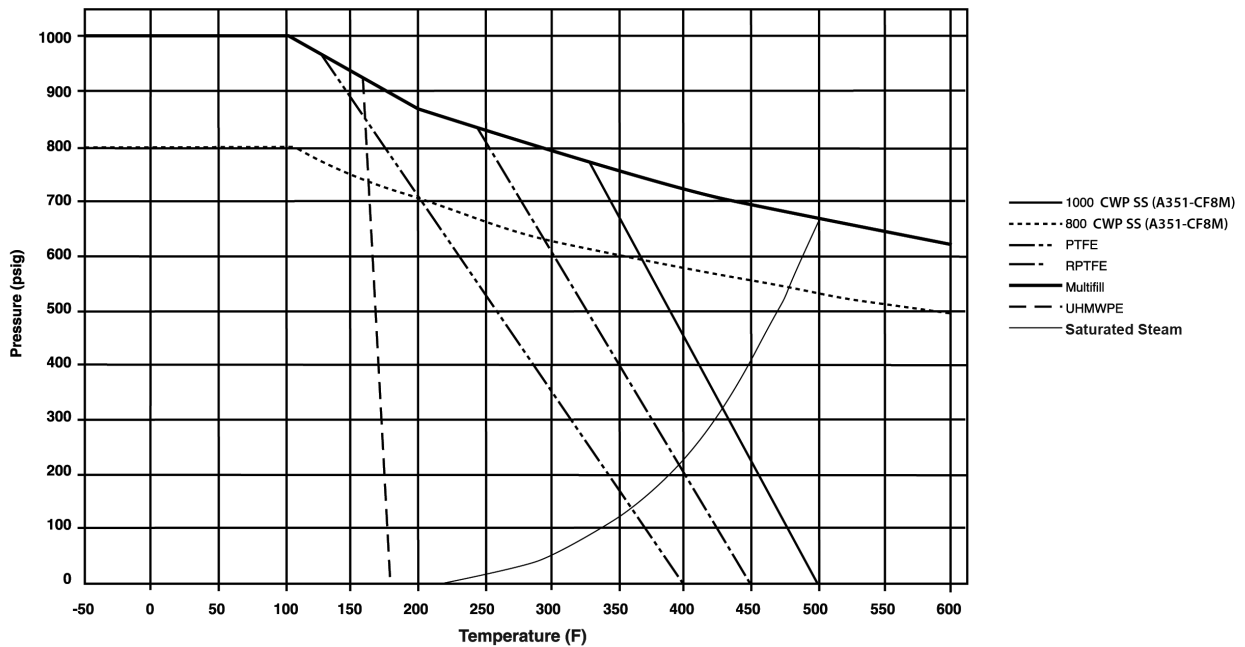
(GRAPH 7)



1000 CWP

(SS) ASTM A351-CF8M

(GRAPH 8)



Product Data Sheet
PDS-656
2021-01-09

TigermagEP Obstructionless Electromagnetic Flowmeter



Description

The TigermagEP is a microprocessor based electromagnetic flowmeter designed to measure the flow of conductive liquids in full pipes. The sensor and transmitter are integral and enclosed in a NEMA 7 explosion-proof housing. The sensor housing is made of steel.

A wide variety of liner and electrodes are available to tailor the meter to operate in many processes.

The Tigermag's nonvolatile EEPROM memory and circuitry eliminates the need for a microprocessor backup battery. It is not necessary to reprogram if the electronic module is replaced or exchanged with electronics from another size flowmeter.

Certified Accuracy

Each FM656 is 'wet-flow' calibrated in Sparling's Primary Flow Lab traceable to the National Institute of Standards and Technology (NIST).

Principle of Operation

Sparling magnetic flowmeters are based on Faraday's Law which states that the voltage induced in a conductor moving through a magnetic field is proportional to the velocity of that conductor. Accuracy is minimally affected by changes in temperature, pressure, viscosity, or conductivity.

Applications

The Model FM656's high signal frequency makes it ideally suited to applications with high levels of inherent noise including: Process Chemicals, Heavy Slurries, Polymers, Acids, Alkalies, Sewage, Cooling Water. Nearly any conductive liquid can be measured.

Features

- Sampling frequency up to 100Hz for accurate measurement of fluids with high levels of inherent noise.
- Forward, reverse and net totalization
- Programmable high and low flow alarms
- Nonvolatile EEPROM Memory
- Universal electronics module compatibility
- 2-Line, 16 character backlit display
- Programming made easy with Mag-Command™
- Low Flow Cutoff
- NEMA 4X/NEMA 7 explosion proof enclosure
- Accidental Submergence (NEMA 6/IP67), Permanent Submergence (NEMA 6P/IP68) and Direct Burial Sensors available
- Approvals Include: FM, CSA and NSF 61
- Rotatable Modular Display
- Empty pipe detection
- PZR - Positive Zero Return
- Standard 0.5% Accuracy
- Sizes available from 0.1" - 72"



Installation

The meter must be mounted at a point in the line which is always full of process liquid under flowing conditions.

A minimum of three diameters of straight pipe length are required from the center of the meter to normal obstructions to obtain specified accuracies.

The meter may be equipped with the following flanges: ANSI 150 or 300#, AWWA, DIN, PN 10 or 16, JIS or British Standard.

Easy To Read Backlit Rotatable Display



The 16 character, 2-line backlit Totalizer display is rotatable 360° in 90° increments ensuring easy reading in any orientation.

Nonvolatile EEPROM Memory

A backup battery is not required and there is no need to reprogram if the electronics module is replaced or exchanged. Meter identification (tube ID, serial number, K, offset, etc.) is stored on an EEPROM chip independent of transmitter electronics. The EEPROM chip has lifetime data retention.

Empty pipe detection

The Sparling TigerMagEP is designed to detect absence or inadequate volume of process fluid in the pipe and will hold the output signal to 4mA or zero. This feature does not require any hard wiring as it is a software selection. One of the most important values of this feature is that it prevents false totalization possible with other meters under partially filled pipe conditions.

Ease of Communications

The TigerMagEP is programmable with Mag-Command, Modbus or Hart Protocol. 4-20mA, RS-232 or RS-485 outputs give you flexibility when interfacing with your distributed control system.

Hi-Z Circuitry

The Sparling TigerMagEP provides superior performance in liquids which tend to deposit nonconductive coatings. Hi-Z circuitry produces a high input impedance to the transmitter's preamplifier (1×10^{12} Ohms). The impedance of the coating is negligible as compared to the impedance of the receiving instrument. The voltage drop across the electrode coating is also negligible eliminating the need for electrode cleaners.

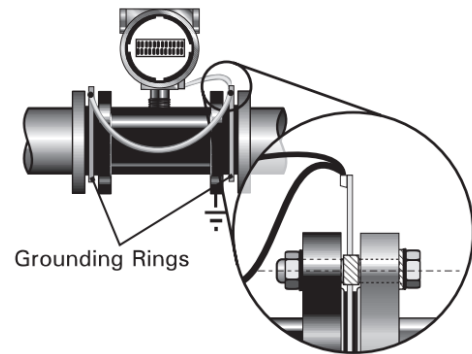
Remote Mounted Transmitter

Remote mounting of the transmitter is required when pipe vibration is excessive, when flooding is possible or where high temperature conditions exist (over 100°F).

The TigerMagEP remote transmitter is housed in a NEMA-4X enclosure and features a larger sized (8mm) 16 digit 2-line backlit display. All power, coil, and electrode connections are made within the transmitter enclosure and junction box. The meter is programmed using Mag-Command. Hall-effect switches which are energized from outside the enclosure. The enclosure can be wall mounted. An optional bracket for pipe mounting is available.

Grounding

The use of grounding rings is recommended to ensure accuracy. Grounding rings are required if adjacent piping is lined or nonconductive. Pump noise or excessive RF should be minimized to achieve highest accuracy.

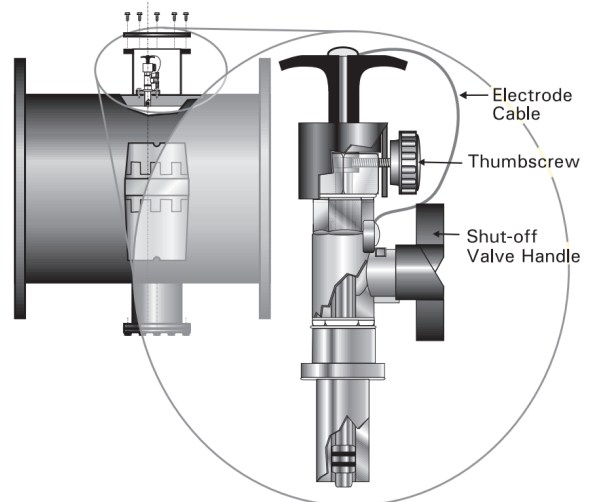


PZR - Positive Zero Return

An electronic circuit is activated by an external contact closure when lines go empty or when a pump or valve is shut down, indicating to the meter that it should drive the output signal to 4mA or 0.

Removable Electrodes

Two configurations of removable electrodes are available in sizes of 6" or greater for all FM656 meters. The first configuration allows removal of the electrode after the line has been depressurized and drained. Removal is performed with an 11/32" nut driver and a 3/4" socket wrench.



The second is the "hot-tap" electrode which allows electrode replacement while the system is still under pressure without disturbing the process flow. Removal can be easily performed with a phillips screwdriver and a crescent wrench. Special locking catches were designed to prevent high pressure accidents during electrode removal. The shut-off valve must be closed before the electrode may be removed.

Two flow alarms

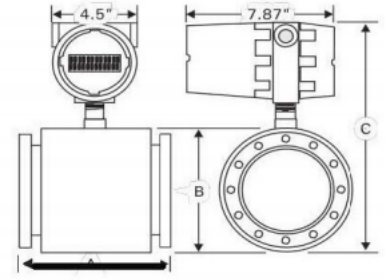
Fault alarms can be configured with alarm set points between 0-99% of flow for each alarm. Open collector output turns on above programmed set point.

Flow Rates & Dimensions

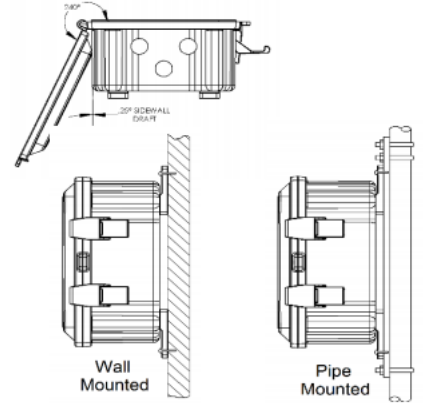
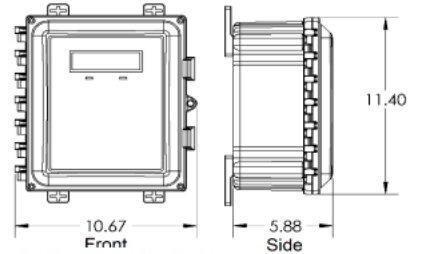
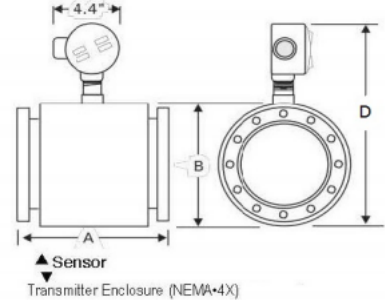
Meter Size (in)	Dimensions (in)								Flow Rates (GPM)		
	A		B		C		D		1 fps	3 fps	33 fps
	150#	300#	150#	300#	150#	300#	150#	300#			
0.100	4.00	4.00	3.50	3.75	9.50	9.62	9.25	9.30	*	*	*
0.250	4.00	4.00	3.50	3.75	9.50	9.62	9.25	9.30	0.153	0.459	5.05
0.375	4.00	4.00	3.50	3.75	9.50	9.62	9.25	9.30	0.342	1.03	11.3
0.500	4.00	4.00	3.50	3.75	9.50	9.62	9.25	9.30	0.568	1.71	18.8
1.00	4.00	4.00	4.25	4.88	10.2	10.5	9.94	10.3	2.02	6.07	66.7
1.50	4.00	4.00	5.00	5.12	10.9	11.4	10.6	11.2	5.29	15.9	174
2.00	4.00	4.00	6.00	6.50	11.7	11.9	11.4	11.6	9.18	27.5	303
2.50	6.00	6.00	7.00	7.50	12.6	12.9	11.6	11.9	13.1	39.2	431
3.00	6.00	6.00	7.50	8.25	13.0	13.4	12.8	13.2	20.1	60.4	664
4.00	6.00	6.00	9.00	10.0	14.4	14.9	14.1	14.6	35.8	107	1180
6.00	13.4	14.9	11.0	12.5	17.0	17.8	16.8	17.5	88.1	264	2910
8.00	13.4	15.4	13.5	14.3	19.4	19.8	19.1	19.5	157	470	5170
10.0	18.2	20.6	16.0	17.5	22.6	23.2	22.2	23.1	245	734	8070
12.0	19.4	21.8	19.0	20.5	25.0	25.8	24.8	25.5	352	1060	11600
14.0	21.4	23.8	21.0	23.0	26.7	27.7	26.4	27.4	430	1290	14200
16.0	23.4	25.9	23.5	25.5	29.0	30.0	28.7	29.7	569	1710	18800
18.0	27.3	29.9	25.0	28.0	31.1	32.6	34.9	32.4	728	2180	24000
20.0	27.6	30.4	27.5	30.5	33.4	34.9	33.1	34.6	907	2720	29900
24.0	32.8	35.8	32.0	36.0	37.4	39.4	37.2	39.2	1310	3920	43100
30.0	43.5	46.6	38.8	43.0	43.7	45.9	43.5	45.6	2070	6220	68400
36.0	47.8	50.9	46.0	50.0	50.2	52.2	50.0	52.0	3010	9040	99500
42.0	51.8	55.1	53.0	57.0	56.9	58.9	56.7	58.7	4110	12300	136000
48.0	51.8	55.4	59.5	65.0	63.1	65.8	62.8	65.6	5400	16200	178000
54.0	53.5	*	66.3	*	69.9	*	69.6	*	6810	20400	225000
60.0	65.5	*	73.0	*	76.8	*	76.5	*	8810	26400	291000
66.0	65.5	*	80.0	*	83.8	*	83.5	*	10700	32000	352000
72.0	72.8	*	86.5	*	90.0	*	89.8	*	12700	38100	419000

Dimensions for flanges. Allow 0.125" to 0.25" for lining thickness/Dimensions C & D ±0.125"
 Flow Rates: 0.25" - 4" flow rates are for FEP/PTFE, Poly, and HR liners. Ceramic sensor flow rates differ slightly.
 Please see PDS-626 for ceramic sensor flow rates for 0.25" - 4"

Integral Mount Transmitter



Remote Mount Transmitter



Note: Remote enclosure shown for meters shipped after July '16
 Please call factory for dimensions shipped July '16 and before

How to Order a TigermagEP

Model	Size	Liner	Electrode	Flange	Transmitter	Power
FM656	24	8	7	A	5	1

FM656 - Flanged Tigermag

AA - 0.1"	OA - 0.25"	OB - 0.375"	OD - 0.5"	OF - 1"	OG - 1.5"	OZ - 2"
OH - 2.5"	03 - 3"	04 - 4"	06 - 6"	08 - 8"	10 - 10"	12 - 12" etc.
14 - 14"	16 - 16"	18 - 18"	20 - 20"	24 - 24"	30 - 30"	

1 - Hard Rubber (1-72")	5 - Polyurethane (2-72")
6 - Ceramic ¹ (0.1-4")	8 - FEP (0.25-48")
A - Polyurethane for potable water (2-72")	

1 - 316 SS	2 - Hastelloy C	3 - 316 SS BN
4 - Titanium	5 - Tantalum	6 - Fused Pt: Ceramic Liners
7 - Platinum: Other Liners	8 - Zirconium	9 - Monel
0 - Tungsten Carbide	B - HastC BN	D - Titanium BN
E - Tantalum BN	G - Platinum BN	H - Zirconium BN
I - Monel BN		

1 - AWWA CI D (150#)	3 - AWWA CI F (300#)	A - ANSI B16.5 CI 150
B - ANSI B16.5 CI 300	C - ANSI B16.5 CI 400	D - ANSI B16.5 CI 500
S - Tri-Clamp (Sanitary)		

F - Integral NEMA 4X encl.
G - Integral NEMA 4X encl. Battery Operated
0 - Integral NEMA 7 encl.
1 - Remote NEMA 7 encl. encl., 15ft Cable
2 - Remote NEMA 7 encl. encl., 15ft Cable, Perm. Sub
3 - Remote NEMA 7 encl. encl., 15ft Cable, Acc. Sub
4 - Remote NEMA 7 encl. encl., 15ft Cable, Direct Burial
5 - Remote NEMA 4X encl. encl., 15ft Cable
6 - Remote NEMA 4X encl. encl., 15ft Cable, Acc. Sub
7 - Remote NEMA 4X encl. encl., 15ft Cable, Direct Burial
8 - Remote NEMA 4X encl. encl., 15ft Cable, Perm. Sub

0 - 77-265 VAC	1 - 12-60 VDC
----------------	---------------

HART, Modbus, RS485, RS232
High Temperature Coils (Req Over 266°F)
Hot Tap Removable Electrodes (4"+)
Removable Electrodes (4"+)
Add Cable (15ft - 300ft)
Relay for Fault and Flow Alarms

1. Ceramic Liner not available in the following sizes: 0.375" or 2.5"

3. FM approval is up to 120V

Standard Specifications

Accuracy:	0.1" - 0.25": $\pm 1\%$ of flow (1fps - 33fps) 0.5" - 8": $\pm 0.5\%$ of flow (1fps - 33fps)
Temp Effect	$\pm 0.025\%$ FS/ $^{\circ}$ C
Full Scale Ranges:	From 0fps - 3fps to 0fps - 33fps
Repeatability:	$\pm 0.1\%$ of full scale
Electrodes:	316 SS Standard (others available)
Liner:	Hard Rubber, Polyurethane, Ceramic, FEP/PTFE, Polyurethane- liner for potable water certified to NSF61
Outputs:	1) Isolated analog 4mA - 20mA DC into 800 Ohms 2) Scaled Pulse 24VDC with selectable 12.5/25/50/100 ms on time, max.freq. 60Hz 3) 0Hz - 1000Hz Freq., for 0%-100% of flow rate, 15VDC 4) Two flow alarms 5) Fault, with open collector 6) RS232 communication 7) Flow direction with open collector 8) Positive Zero Return (PZR) for external relay contacts. Outputs 2 and 3 can be open collector if required. 9) HART Protocol Available 10) Modbus Protocol Available
Mag-Command™:	Selection and change of meter parameters by magnetic probe without opening the enclosure.
Display:	2-Line, 16 Digit alphanumeric backlit display (rate and total). Modular, rotatable 360° in 90° increments
Min Velocity¹:	0.3fps
Power Requirements:	77-265VAC/12-60VDC
Power Consumption:	Less than 20 W
Enclosures:	Cast aluminium epoxy coated. Integral NEMA 7 encl. or Remote NEMA 4X encl.
Sensor Housing:	Fabricated steel, epoxy coated
Preamp Impedance:	1×10^{12} Ohms minimum
Amb. Temp:	-20°F - 140°F (-29°C - 60°C) Display darkens over 158°F (70°C)
End Connections:	150# or 300#
Sensor Tube:	304 Stainless Steel
Process Temp:	Integral Mount: <ul style="list-style-type: none">• Hard Rubber, Neoprene, Polyurethane, Food Grade Polyurethane: -40°F - 180°F• TEF, Ceramic: -40°F - 212°F Remote Mount (opt): <ul style="list-style-type: none">• TEF, Ceramic: -40°F - 266°F High Temperature Coils (opt): <ul style="list-style-type: none">• TEF: -40°F - 300°F• Ceramic: -40°F - 420°F
Selectable Damping:	0-99 seconds
Minimum Conductivity:	5 μ siemens
Low Flow Cutoff:	Selectable 0-9% of full scale

¹ Minimum Velocity is the lowest velocity the meter will show a reading. Accuracy, however, is subject to the limits above.

Model FM656 Specification available on request



11EER W18A-W60A Series WALL-MOUNT™
11EER W18L-W36L Series WALL-MOUNT™
10EER W72A Series WALL-MOUNT™

The Bard Wall-Mount Air Conditioner is an energy efficient self contained system, which is designed to offer maximum indoor comfort at a minimal cost without using valuable indoor floor space or outside ground space. This unit is the ideal product for versatile applications such as: new construction, modular offices, school modernization, telecommunication structures, portable structures, correctional facilities and many more. Factory or field installed accessories are available to meet specific job requirements for your unique application.

- Complies with efficiency requirements of ANSI/ASHRAE/IES 90.1-2019.
- Certified to AHRI Standard 390-2021 for SPVU (Single Package Vertical Units).
- Intertek ETL Listed to Standard for Safety Heating and Cooling Equipment ANSI/UL 1995/CSA 22.2 No. 236-05 Fourth Edition.
- Commercial Product - Not intended for residential applications.
- Bard is an ISO 9001:2015 Certified Manufacturer.
- The AHRI Certified® mark indicates Bard Manufacturing Company participation in the AHRI Certification program. For verification of individual certified products, go to www.ahridirectory.org.



BARDHVAC.COM

FORM NO. S3583-0922



Climate Control Solutions

Wall-Mount Nomenclature

Digit # 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
W 6 0 A C - A 0 Z X P X X X X

UNIT SERIES

Wall-Mount

NOMINAL CAPACITY

- 18 - 1.5 Ton
- 24 - 2.0 Ton
- 30 - 2.5 Ton
- 36 - 3.0 Ton
- 42 - 3.5 Ton
- 48 - 4.0 Ton
- 60 - 5.0 Ton
- 72 - 6.0 Ton

TYPE AND CONTROL LOCATION

- A - Air conditioner
- L - Air Conditioner with Left Side Control Panel (W18-W36 Only)

REVISION

- B - Revision W18-W36
- C - Revision W42-W72

PLACEHOLDER

- Standard Unit
- D - Hot Gas Reheat Dehumidification
- R - Motor Isolation (460V only for High Res. Ground)

VOLTAGE

- A - 230 Volt 1 Phase 60 Hz
- B - 230 Volt 3 Phase 60 Hz
- C - 460 Volt 3 Phase 60 Hz

ELECTRIC HEAT

- 00 - OKw with Lug Connection
 - 0Z - OKw with Circuit Breaker
 - 05 to 20 - Kw Heat with Circuit Breaker
- See Electrical Specs for further details

Nomenclature Notes:

- W18, W24, W30 and W36 models are available with the unit control panel located on the left or right unit side. W42, W48, W60, and W72 models have the unit control panel located in the front of the unit.
- Hot Gas Reheat Dehumidification is available with W30, W36, W42, W48, W60, and W72 models.
- Accessories and control options may not be available for all models. See factory installed controls options section for further details.
- All units have an external data tag with the model and serial number on the left or right side of the unit. A secondary data tag with the model and serial number is located inside the control panel area on or near the low voltage terminal box.

ACCESSORIES AND CONTROLS OPTIONS

- X - Standard controls (HPS,LPS,CCM)
- E - Low Ambient Control (LAC)
- F - LAC, Alarm Relay (ALR), Filter Press. Switch (FPS)
- J - LAC and Alarm Relay (ALR)
- K - LAC and PTCR Start Kit
- M - LAC, ALR, and PTCR Start Kit
- V - DDC Control Sensor kit with 10K Discharge air sensor, indoor blower airflow sensor, compressor current sensor, filter press. switch, LAC, ALR.

COIL & UNIT COATING OPTIONS

- X - Standard Copper/Aluminum coils.
- 1 - Coated Evaporator coil.
- 2 - Coated Condenser coil.
- 3 - Coated Evaporator and Condenser coils.
- 4 - Coated coils and unit condenser section coating.
- 5 - Coated coils and inside/outside of unit coating.

SUPPLY OUTLET

- X - Standard

COLOR AND CABINET FINISH

- X - Standard Beige baked enamel finish
- 1 - White baked enamel finish
- 4 - Buckeye Gray baked enamel finish
- 5 - Desert Brown baked enamel finish
- 8 - Dark Bronze baked enamel finish
- S - Stainless Steel
- A - Aluminum

FILTER

- X - Standard 1" MERV2 Disposable Filter
- W - 1" MERV2 Washable Filter
- P - 2" MERV8 Disposable Filter
- M - 2" MERV11 Disposable Filter
- N - 2" MERV13 Disposable Filter
- A - 2" MERV13 Filter with UVC-LED Light.

VENT PACKAGE

- X - Standard Fresh Air Damper (Intake only)
- A - Fresh Air Damper w/Exhaust
- B - Block Off Plate
- M - Commercial Room Ventilator, ON/OFF
- V - Comm. Room Ventilator, Modulating
- D - Economizer, 0-10V No Controls
- Y - Full Flow Economizer, Temperature
- Z - Full Flow Economizer, Enthalpy
- R - Energy Recovery Ventilator
- S - Partial Flow Economizer, Enthalpy no hood (W18-W36 only)



////// Engineered Features W18 Through W36 Unit Models

NEW! EXCLUSIVE *Non-Fiberglass Foil Faced Insulation: Environmentally friendly high “R” value non-fiberglass insulation that is made with recycled denim and cotton materials used with a FSK foil face that is both durable and cleanable.

Durable Cabinet Construction: Multiple cabinet construction options are available for different outdoor conditions. Optional cabinet coatings may be ordered for extreme outdoor environments. See cabinet finish and coatings section for further details.

Easy Filter Access: A separate filter door is provided for ease of filter access during routine unit maintenance. 1” and 2” filters are available with a rating of up to MERV13. See filter section for further details.

Field or Factory Installed Vents: Multiple ventilation options are available to provide outdoor air for ventilation and/or energy savings. Ventilation options may be factory or field installed. See vent section for further details.

Electric Strip Heat: Reliable, comfortable heater packages feature an automatic limit and thermal cut-off safety control. Heater packages may be factory or field installed. See optional electric heat section for further details.

Built-in Circuit Breakers: Standard on all electric heat versions of single (208/230 volt) and three phase (208/230 volt) equipment. Toggle disconnects are standard on all electric heat versions of three phase (460 volt) equipment.

Reliable, Easy-to-Use Controls: Easily accessible through left or right control panel locations. A lockable hinged access cover to circuit protection is provided. Phase rotation monitor is standard on all 3 phase models. Adjustable compressor on/off delay timer (CCM) with diagnostic lights is standard on all models. Both right and left control panel locations available. Electrical entrances provided through the back and side areas.

Green Fin Hydrophilic Evaporator Coil: Green fin stock enhances coil wettability to help prevent mold growth, aids with condensate drainage, and provides a limited amount of protection to corrosive particulates in the airstream.

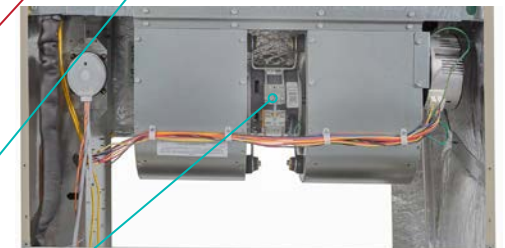
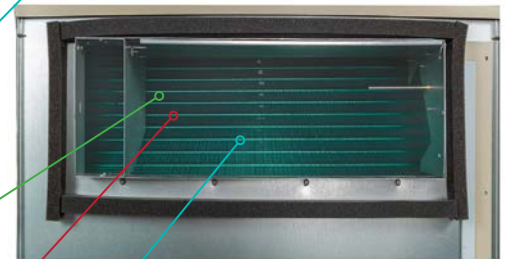
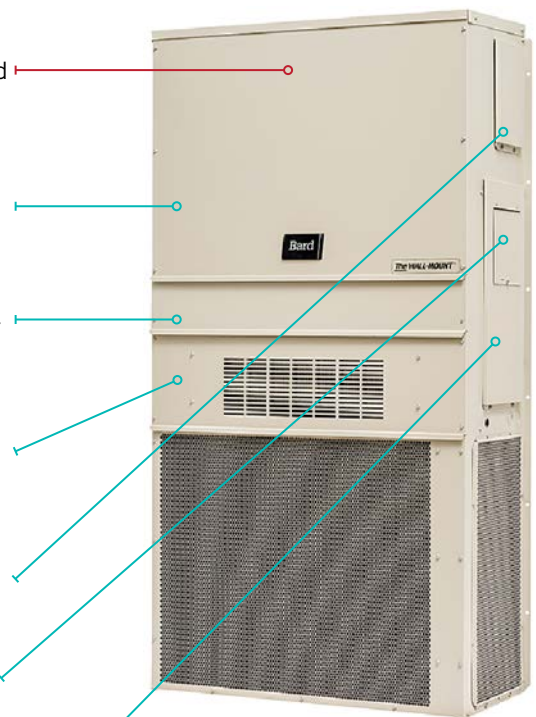
***Balanced Climate™ Technology (patent pending):** High latent capacity humidity & sound reduction removes up to 35% more humidity than any other on the market with the use of a 2 stage thermostat or controlling device. Bard Balanced Climate™ innovation comes standard on all models.

Optional Mechanical Dehumidification: Models are available with hot gas reheat dehumidification for energy efficient humidity removal. Electronic Expansion Valves are standard for all dehumidification models.

ECM Indoor Motor Technology: 5 speed dual shaft motor provides quiet airflow operation when used with a twin blower assembly. Motor overload protection standard on all models.

Enclosed Condenser Motor: An enclosed casing condenser motor with ball bearings is used for reliable operation and extended motor life. Enclosed condenser motors are standard on all units.

High Efficiency Cooling: Scroll compressors for quiet, efficient cooling. Designed with R-410A (HFC) non-ozone depleting refrigerant in compliance with the Montreal protocol and 2010 EPA requirements. A liquid line filter-drier is used to protect the system from moisture, and is standard on all units.



////// Engineered Features - W42 Through W72 Unit

NEW! EXCLUSIVE *Non-Fiberglass Foil Faced Insulation: Environmentally friendly high “R” value non-fiberglass insulation that is made with recycled denim and cotton materials used with a FSK foil face that is both durable and cleanable.

Durable Cabinet Construction: Multiple cabinet construction options are available for different outdoor conditions. Optional cabinet coatings may be ordered for extreme outdoor environments. See cabinet finish and coatings section for further details.

ECM Indoor Motor Technology: 5 speed dual shaft motor provides quiet airflow operation when used with a twin blower assembly. Motor overload protection standard on all models.

Electric Strip Heat: Reliable, comfortable heater packages feature an automatic limit and thermal cut-off safety control. Heater packages may be factory or field installed. See optional electric heat section for further details.

Field or Factory Installed Vents: Multiple ventilation options are available to provide outdoor air for ventilation and/or energy savings. Ventilation options may be factory or field installed. See vent section for further details.

Green Fin Hydrophilic Evaporator Coil: Green fin stock enhances coil wettability to help prevent mold growth, aids with condensate drainage, and provides a limited amount of protection to corrosive particulates in the airstream.

Built-in Circuit Breakers: Standard on all electric heat versions of single (208/230 volt) and three phase (208/230 volt) equipment. Toggle disconnects are standard on all electric heat versions of three phase (460 volt) equipment.

Easy Filter Access: A separate filter door is provided for ease of filter access during routine unit maintenance. 1” and 2” filters are available with a rating of up to MERV13. See filter section for further details.

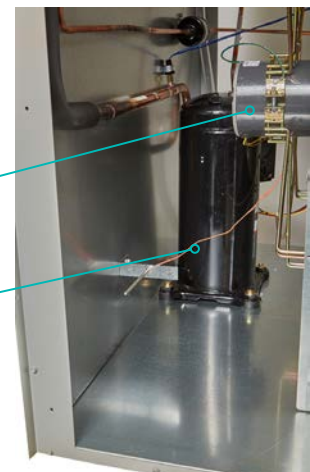
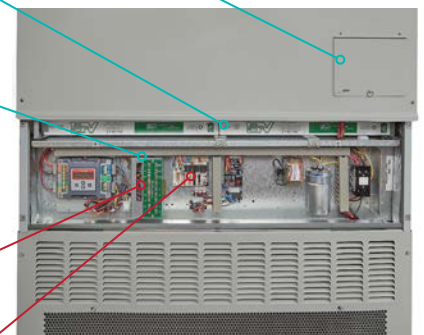
Reliable, Easy-to-Use Controls: Easily accessible through left or right control panel locations. A lockable hinged access cover to circuit protection is provided. Phase rotation monitor is standard on all 3 phase models. Adjustable compressor on/off delay timer (CCM) with diagnostic lights is standard on all models. Control panel is located in the front of the unit with electrical entrances on both sides and back.

***Balanced Climate™ Technology (patent pending):** High latent capacity humidity & sound reduction removes up to 35% more humidity than any other on the market with the use of a 2 stage thermostat or controlling device. Bard Balanced Climate™ innovation comes standard on all models.

Optional Mechanical Dehumidification: Models are available with hot gas reheat dehumidification for energy efficient humidity removal. Electronic Expansion Valves are standard for all dehumidification models.

Enclosed Condenser Motor: An enclosed casing condenser motor with ball bearings is used for reliable operation and extended motor life. Enclosed condenser motors are standard on all units.

High Efficiency Cooling: Scroll compressors for quiet, efficient cooling. Designed with R-410A (HFC) non-ozone depleting refrigerant in compliance with the Montreal protocol and 2010 EPA requirements. A liquid line filter-drier is used to protect the system from moisture, and is standard on all units.



////// Unit Modes of Operation

Cooling Operation:

The Bard WA Series products offer single stage compressor cooling operation using R410A refrigerant. Copper tube/Aluminum hydrophilic green fin coils are used to provide high efficiency and easy serviceability. Scroll compressor technology delivers years of quiet, reliable operation. Economizer vent options are available for increased energy efficiency during cooling operation when outdoor conditions are favorable.

Heating Operation:

The Bard WA Series products offer optional single or two stage heating operation using resistance heaters. Circuit breaker disconnect protection is standard in all units equipped with electric heat.

Mechanical Dehumidification (Hot Gas Reheat) Operation:

Mechanical Dehumidification provides an energy efficient way to remove humidity from the indoor air stream without over cooling or overheating the indoor space. The Bard W30 through W72 Series products offer optional dehumidification operation that removes moisture from air entering the unit. A three-way valve, reheat coil, and electronic expansion valve (EEV) are standard with all models. The dehumidification circuit incorporates an independent heat exchanger coil in the supply air stream. This coil reheats the supply air after it passes over the cooling coil without requiring the electric resistance heater to be used for reheat purposes. This results in very high mechanical dehumidification capability from the air conditioner on demand without using electric resistance reheat (electric heat is available for heating purposes). Airflow during dehumidification is reduced resulting in quiet and comfortable operation.

Ventilation:

The Wall-Mount product provides the perfect platform to not only cool and heat an indoor area, but also provide a means of bringing outdoor air into the building. By including ventilation in the Wall-Mount, expensive costs associated with additional outdoor air systems can be avoided. The Bard WA Series products offer optional ventilation operation that brings outdoor air into the structure, and vents can be factory or field installed. Ventilation can be used to bring in outdoor air for occupants, save energy by using outdoor air for free cooling, or positively pressurize a structure. Exhaust air options allow room air to be vented outdoors when fresh air is being brought into the structure. Energy recovery options are also available for occupied structures to save energy when ventilation is necessary regardless of outdoor temperature.

Filtration and Indoor Air Quality:

Providing the best air filtration solution is important to occupants and equipment inside a room or structure. Bard provides several filter options based on MERV filtration, and also other solutions to improve indoor air quality.

Balanced Climate™ Operation:

Balanced Climate™ is a great feature to remove additional room humidity during cooling operation. All units include this feature as an optional method of having a separate cooling stage that uses a lower indoor blower speed. Remove the Y1/Y2 jumper, and install a two stage cooling thermostat. Once enabled, a first stage of increased humidity removal and lowered cooling capacity will extend unit runtime and increase latent (humidity removal) capacity. Second stage operation will use the standard blower speed. This is a great option where additional humidity reduction is a benefit during normal cooling operation.

Note: Balanced Climate is not recommended for applications where room temperatures will typically be lower than 72°F or duct static will cause airflow to be below rated CFM amounts provided in the Airflow CFM chart in this document. Low Ambient Control use is required for Balanced Climate operation. Hot Gas Reheat is recommended for high humidity environments that require moisture removal without cooling or applications that require a large amount of ventilation air for occupied areas.

Low Outdoor Temperature Cooling Operation:

Equipment cooling often requires indoor areas to remain cool regardless of outdoor temperature. If your application requires operation of the compressor to provide cooling below 65° outdoor conditions, then just like any other HVAC system, a low ambient control (LAC) kit must be installed. The LAC will help maintain higher refrigerant pressure during compressor operation at lower outdoor temperatures. This is achieved by limiting outdoor fan operation based on low side system pressure. As temperatures decrease outdoors, outdoor fan use will continue to decrease. Applications that require cooling functionality from 0°F to -40°F outdoor temperatures must use economizer cooling operation.

Note: The LAC kit also includes a freeze stat installed on the unit indoor evaporator coil. The freeze stat helps monitor the indoor evaporator coil temperature and will cycle compressor operation when temperatures below freezing are indicated. Use of Balanced Climate or applications where indoor airflow will be reduced require the use of the LAC kit to help maintain adequate evaporator coil temperatures.

High Outdoor Temperature Cooling Operation:

The Bard WA Series products are designed and tested to function when used in higher outdoor temperature areas. Wall-Mount products utilize large, efficient condenser coils with high airflow condenser fan systems to save energy and lower high side refrigerant pressures. It is always important to follow all clearance guidelines supplied in the unit dimension section of this specification, and additional information provided in the user manual. Properly cleaning the condenser coil using a regular maintenance schedule along with filter changes will help maintain unit operation during high outdoor ambient temperature use. Always follow maintenance procedures provided in the user manual and installation instructions provided with your Bard product.



Capacity and Efficiency Ratings

MODELS	W18AB W18LB	W24AB W24LB	W30AB W30LB	W36AB W36LB	W42AC	W48AC	W60AC	W72AC
Cooling Capacity in BTUH [ⓐ]	18,000 BTUH	24,000 BTUH	29,200 BTUH	35,200 BTUH	42,000 BTUH	48,000 BTUH	57,000 BTUH	71,000 BTUH
Unit efficiency in EER	11.3 EER	11.2 EER	11.0 EER	11.0 EER	11.0 EER	11.0 EER	11.0 EER	10.0 EER

[ⓐ] Capacity is certified in accordance with ANSI/ARI Standard 390-2003.

[ⓑ] EER = Energy Efficiency Ratio and is certified in accordance with ANSI/ARI Standard 390-2003.
All ratings based on fresh air intake being 100% closed (no outside air introduction).

General Unit Specifications W18 (1-1/2 Ton) Through W48 (4 Ton)

MODELS	W18AB-A W18LB-A	W24AB-A W24LB-A	W24AB-B W24LB-B	W24AB-C	W30AB-A W30LB-A	W30AB-B W30LB-B	W30AB-C W30LB-C	W36AB-A W36LB-A	W36AB-B W36LB-B	W36AB-C W36LB-C
Unit Voltage Rating - Phase - 60Hz	230/208 - 1	230/208 - 1	230/208 - 3	460 - 3	230/208 - 1	230/208 - 3	460 - 3	230/208 - 1	230/208 - 3	460 - 3
Operating Voltage Range	197-253 V	197-253 V	197-253 V	414-506 V	197-253 V	197-253 V	414-506 V	197-253 V	197-253 V	414-506 V
Compressor Electrical Circuit										
Voltage	230/208 V	230/208 V	230/208 V	460 V	230/208 V	230/208 V	460 V	230/208 V	230/208 V	460 V
Rated Load Amps	5.7/6.6 A	8.3/9.3 A	5.0/5.6 A	2.7 A	9.6/10.9 A	6.1/6.9 A	3.3 A	11.4/13.2 A	7.1/8.3 A	4.6 A
Branch Circuit Selection Current	9.0 A	12.9 A	7.7 A	3.6 A	14.2 A	9.0 A	4.2 A	16.7 A	10.5 A	5.8 A
Lock Rotor Amps	56.3/56.3 A	58.3/58.3 A	55.4/55.4 A	28 A	73/73 A	58/58 A	28 A	79/79 A	73/73 A	38 A
Compressor Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Outdoor Fan Motor & Condenser Fan										
Outdoor Fan Motor Horsepower - RPM	1/5 - 1090	1/5 - 1090	1/5 - 1090	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075
Outdoor Fan Motor - Amps	1.1 A	1.1 A	1.1 A	0.6 A	1.2 A	1.2 A	0.6 A	1.2 A	1.2 A	0.6 A
Outdoor Fan--Diameter and CFM	18" - 1800	18" - 1800	18" - 1800	18" - 1800	20" - 2400	20" - 2400	20" - 2400	20" - 2200	20" - 2200	20" - 2200
Indoor Blower Motor & Indoor Airflow										
Indoor Blower Motor - HP - Speeds	1/3HP-5 sp	1/3HP-5 sp	1/3HP-5 sp	1/3HP-5 sp	1/2HP-5 sp	1/2HP-5 sp	1/2HP-5 sp	1/2HP-5 sp	1/2HP-5 sp	1/2HP-5 sp
Indoor Blower Motor - Amps	0.7 A	1.3 A	1.3 A	0.8 A	1.4 A	1.4 A	1.2 A	2.3 A	2.3 A	1.2 A
Indoor Motor Type	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM
Rated indoor CFM and static pressure (ESP) with wet coil and Standard filter	600 - .1	800 - .1	800 - .1	800 - .1	950 - .15	950 - .15	950 - .15	1150 - .15	1150 - .15	1150 - .15
Filter Size inches (cm) standard filter listed, 1 required	16x25x1 (41x64x3)	16x25x1 (41x64x3)	16x25x1 (41x64x3)	16x25x1 (41x64x3)	16x30x1 (41x77x3)	16x30x1 (41x77x3)	16x30x1 (41x77x3)	16x30x1 (41x77x3)	16x30x1 (41x77x3)	16x30x1 (41x77x3)
Basic Unit Weight without Vent lbs. (kg)	325 (148)	335 (152)	335 (152)	335 (152)	350 (159)	350 (159)	350 (159)	380 (173)	380 (173)	380 (173)
X - Barometric Fresh Air Damper	4.0 (1.8)	4.0 (1.8)	4.0 (1.8)	4.0 (1.8)	5.0 (2.3)	5.0 (2.3)	5.0 (2.3)	5.0 (2.3)	5.0 (2.3)	5.0 (2.3)
A - Barometric Damper w/ Exhaust	8.0 (3.6)	8.0 (3.6)	8.0 (3.6)	8.0 (3.6)	9.0 (4.0)	9.0 (4.0)	9.0 (4.0)	9.0 (4.0)	9.0 (4.0)	9.0 (4.0)
B - Blank-Off Plate	1.0 (.5)	1.0 (.5)	1.0 (.5)	1.0 (.5)	1.0 (.5)	1.0 (.5)	1.0 (.5)	1.0 (.5)	1.0 (.5)	1.0 (.5)
M, V - Commercial Room Ventilator	31.0 (14.0)	31.0 (14.0)	31.0 (14.0)	31.0 (14.0)	35.0 (15.9)	35.0 (15.9)	35.0 (15.9)	35.0 (15.9)	35.0 (15.9)	35.0 (15.9)
D, Y, Z - Economizer	37.0 (16.8)	37.0 (16.8)	37.0 (16.8)	37.0 (16.8)	37.0 (16.8)	37.0 (16.8)	37.0 (16.8)	37.0 (16.8)	37.0 (16.8)	37.0 (16.8)
R - Energy Recovery Ventilator	54.0 (24.4)	54.0 (24.4)	54.0 (24.4)	54.0 (24.4)	54.0 (24.4)	54.0 (24.4)	54.0 (24.4)	54.0 (24.4)	54.0 (24.4)	54.0 (24.4)

MODELS	W42AC-A	W42AC-B	W42AC-C	W48AC-A	W48AC-B	W48AC-C
Unit Voltage Rating - Phase - 60Hz	230/208 V - 1 PH	230/208 V - 3 PH	460 V - 3 PH	230/208 V - 1 PH	230/208 V - 3 PH	460 V - 3 PH
Operating Voltage Range	197-253 V	197-253 V	414-506 V	197-253 V	197-253 V	414-506 V
Compressor Electrical Circuit						
Voltage	230/208 V	230/208 V	460 V	230/208 V	230/208 V	460 V
Rated Load Amps	14.9/16.5 A	10.2/11.3 A	5.1 A	16.3/18.9 A	10.3/11.9 A	5.4 A
Branch Circuit Selection Current	19.9 A	13.6 A	6.1 A	21.8 A	13.8 A	6.3 A
Lock Rotor Amps	109/109 A	83.1/83.1 A	41 A	117/117 A	83.1/83.1 A	41 A
Compressor Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Outdoor Fan Motor & Condenser Fan						
Outdoor Fan Motor Horsepower - RPM	1/3 HP - 825RPM	1/3 HP - 825RPM	1/3 HP - 825RPM	1/3 HP - 825RPM	1/3 HP - 825RPM	1/3 HP - 825RPM
Outdoor Fan Motor - Amps	2.4 A	2.4 A	1.0 A	2.4 A	2.4 A	1.0 A
Outdoor Fan--Diameter and CFM	24" - 2900CFM	24" - 2900CFM	24" - 2900CFM	24" - 3000CFM	24" - 3000CFM	24" - 3000CFM
Indoor Blower Motor & Indoor Airflow						
Indoor Blower Motor - HP - Speeds	1/2 HP - 5 Spd	1/2 HP - 5 Spd	1/2 HP - 5 Spd	3/4 HP - 5 Spd	3/4 HP - 5 Spd	3/4 HP - 5 Spd
Indoor Blower Motor - Amps	1.7 A	1.7 A	1.2 A	3.2 A	3.2 A	1.7 A
Indoor Motor Type	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM
Rated indoor CFM and static pressure (ESP) with wet coil and Standard filter	1350CFM-.15ESP	1350CFM-.15ESP	1350CFM-.15ESP	1550CFM-.20ESP	1550CFM-.20ESP	1550CFM-.20ESP
Filter Size inches (cm) standard filter listed, 2 required	20" x 20" x 1" (51 x 51 x 3)	20" x 20" x 1" (51 x 51 x 3)	20" x 20" x 1" (51 x 51 x 3)	20" x 20" x 1" (51 x 51 x 3)	20" x 20" x 1" (51 x 51 x 3)	20" x 20" x 1" (51 x 51 x 3)
Basic Unit Weight without Vent lbs (kg)	490 (223)	490 (223)	490 (223)	495 (225)	495 (225)	495 (225)
X - Barometric Fresh Air Damper	13 (5.9)	13 (5.9)	13 (5.9)	13 (5.9)	13 (5.9)	13 (5.9)
A - Barometric Damper w/ Exhaust	16 (7.3)	16 (7.3)	16 (7.3)	16 (7.3)	16 (7.3)	16 (7.3)
B - Blank-Off Plate	14 (6.4)	14 (6.4)	14 (6.4)	14 (6.4)	14 (6.4)	14 (6.4)
M, V - Commercial Room Ventilator	42 (19.1)	42 (19.1)	42 (19.1)	42 (19.1)	42 (19.1)	42 (19.1)
D, Y, Z - Economizer	44 (20)	44 (20)	44 (20)	44 (20)	44 (20)	44 (20)
R - Energy Recovery Ventilator	87 (39.5)	87 (39.5)	87 (39.5)	87 (39.5)	87 (39.5)	87 (39.5)



General Unit Specifications W60 (5 Ton) Through W72 (6 Ton)

MODELS	W60AC-A	W60AC-B	W60AC-C	W72AC-A	W72AC-B	W72AC-C
Unit Voltage Rating - Phase - 60Hz	230/208 V - 1 PH	230/208 V - 3 PH	460 V - 3 PH	230/208 V - 1 PH	230/208 V - 3 PH	460 V - 3 PH
Operating Voltage Range	197-253 V	197-253 V	414-506 V	197-253 V	197-253 V	414-506 V
Compressor Electrical Circuit						
Voltage	230/208 V	230/208 V	460 V	230/208 V	230/208 V	460 V
Rated Load Amps	20.6/23.6 A	12.5/14.4 A	7.0 A	27.6/30.6 A	16.8/18.6 A	8.8 A
Branch Circuit Selection Current	26.5 A	16 A	7.8 A	37 A	22.5 A	10.6 A
Lock Rotor Amps	134/134 A	110/110 A	52 A	185/185 A	149/149 A	75 A
Compressor Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Outdoor Fan Motor & Condenser Fan						
Outdoor Fan Motor Horsepower - RPM	1/3 HP - 825RPM	1/3 HP - 825RPM	1/3 HP - 825RPM	1/2 HP - 1075RPM	1/2 HP - 1075RPM	1/2 HP - 1075RPM
Outdoor Fan Motor - Amps	2.4 A	2.4 A	1.0 A	4.3 A	4.3 A	1.6 A
Outdoor Fan--Diameter and CFM	24" - 3100CFM	24" - 3100CFM	24" - 3100CFM	24" - 4000CFM	24" - 4000CFM	24" - 4000CFM
Indoor Blower Motor & Indoor Airflow						
Indoor Blower Motor - HP - Speeds	3/4 HP - 5 Spds	3/4 HP - 5 Spds	3/4 HP - 5 Spds	3/4 HP - 5 Spds	3/4 HP - 5 Spds	3/4 HP - 5 Spds
Indoor Blower Motor - Amps	3.2 A	3.2 A	1.7 A	4.2 A	4.2 A	1.7 A
Indoor Motor Type	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM	Constant Torque ECM
Rated indoor CFM and static pressure (ESP) with wet coil and Standard filter	1750CFM -.20ESP	1750CFM -.20ESP	1750CFM -.20ESP	1900CFM -.25ESP	1900CFM -.25ESP	1900CFM -.25ESP
Filter Size inches (cm) standard filter listed, 2 required	20" x 20" x 1" (51 x 51 x 3)	20" x 20" x 1" (51 x 51 x 3)	20" x 20" x 1" (51 x 51 x 3)	20" x 20" x 1" (51 x 51 x 3)	20" x 20" x 1" (51 x 51 x 3)	20" x 20" x 1" (51 x 51 x 3)
Basic Unit Weight without Vent lbs. (kg)	505 (230)	505 (230)	505 (230)	555 (252)	555 (252)	555 (252)
X - Barometric Fresh Air Damper	13 (5.9)	13 (5.9)	13 (5.9)	13 (5.9)	13 (5.9)	13 (5.9)
A - Barometric Damper w/ Exhaust	16 (7.3)	16 (7.3)	16 (7.3)	16 (7.3)	16 (7.3)	16 (7.3)
B - Blank-Off Plate	14 (6.4)	14 (6.4)	14 (6.4)	14 (6.4)	14 (6.4)	14 (6.4)
M, V - Commercial Room Ventilator	42 (19.1)	42 (19.1)	42 (19.1)	42 (19.1)	42 (19.1)	42 (19.1)
D, Y, Z - Economizer	44 (20)	44 (20)	44 (20)	44 (20)	44 (20)	44 (20)
R - Energy Recovery Ventilator	87 (39.5)	87 (39.5)	87 (39.5)	87 (39.5)	87 (39.5)	87 (39.5)

Note: All units have a Short Circuit Current Protection Rating (SCCR) of 5kA RMS Symmetrical.

R410A Unit Charge Rates

WALL-MOUNT UNIT MODEL	STANDARD UNIT CHARGE RATE	DEHUMIDIFICATION UNIT CHARGE RATE
W18AB AND W18LB	3.50 lbs. (1.58 kg)	N/A
W24AB AND W24LB	4.25 lbs. (1.92 kg)	N/A
W30AB AND W30LB	4.125 lbs. (1.87 kg)	4.25 lbs. (1.92 kg)
W36AB AND W36LB	4.50 lbs. (2.04 kg)	4.50 lbs. (2.04 kg)
W42AC	7.25 lbs. (3.28 kg)	7.25 lbs. (3.28 kg)
W48AC	7.38 lbs. (3.34 kg)	7.38 lbs. (3.34 kg)
W60AC	9.25 lbs. (4.19 kg)	9.50 lbs. (4.30 kg)
W72AC	9.50 lbs. (4.30 kg)	9.75 lbs. (4.42 kg)

Note: Charge rates provided on unit serial plate. Unit hi/low pressure chart for unit charging provided in unit installation manual and on inner control panel door.



///// Indoor EC Motor Blower Speeds

Indoor airflow is measured in Cubic Feet per Minute (CFM) and will vary based on static pressure created by supply duct work, return duct work, unit filter type, deflection of the air by the supply grille, or any other restriction of air entering or leaving the unit. The indoor fan motor of the WA series product has the capability of running at multiple speeds. Indoor blower speed is selected inside the control panel area using the speed tap terminal block.

Blower and Vent Only Speed: The WA series uses this speed when **fan only (G) or ventilation operation (A)** is used. See airflow performance chart for CFM amount. If cooling and heating speed is adjusted from LO to MED or HI, the Blower and Vent Only speed will not change.

Balanced Climate Speed: The WA series uses this speed when the **Balanced Climate option (Y1) or mechanical dehumidification option (D)** is used. The Balanced Climate speed reduces unit airflow by approximately 30% which increases moisture removal (latent capacity) during cooling operation. Units with the hot gas reheat dehumidification option also use this speed to increase moisture removal when running in dehumidification mode. Unit capacity performance when using Balanced Climate can be calculated using the -30% capacity multiplier factor provided in the Cooling Application Data. Unit capacity performance for hot gas reheat dehumidification units can be found in the Dehumidification performance supplemental manual #7960-811. See airflow performance chart for CFM amount.

To use Balanced Climate, remove the jumper between Y1 and Y2 on the low voltage terminal strip. A 2 stage cooling thermostat is then used to control blower airflow stages. Be sure to follow all guidelines provided in the installation manual. A controls kit that includes a low ambient control (LAC) must be used for Balanced Climate Operation if ventilation options are to be used or cooling operation will occur below a 60° outdoor temperature. Balanced Climate can be used for duct free and ducted applications below ESP total static shown in indoor airflow performance charts. Balanced Climate provides increased moisture removal during the cooling cycle, but is not a replacement for optional mechanical dehumidification. Optional mechanical dehumidification provides moisture removal without significantly cooling the space being conditioned. Mechanical dehumidification is highly recommended for applications requiring indoor humidity control for schools, public areas, agricultural, pharmaceutical, and areas with high outdoor humidity and varying indoor heat load.

LO Speed (Default): The WA series uses this speed by default when using **standard cooling (Y2) or heating operation (W1/W2)**. This speed is labeled as LO on the speed selection terminal strip inside the unit control panel. All units ship with cooling and heating operation at LO cooling and heating speed, and provides the **optimal airflow amount for normal use**. See airflow performance chart for CFM amount.

MED Speed (User Selectable): This speed is user selectable when using **standard cooling (Y2) or heating operation (W1/W2)**. This speed is labeled as MED on the speed selection terminal strip inside the unit control panel. The MED speed tap provides an **increase in unit airflow** per the airflow performance chart.

HI Speed (User Selectable): This speed is user selectable when using **standard cooling (Y2) or heating operation (W1/W2)**. This speed is labeled as HI on the speed selection terminal strip inside the unit control panel. The HI speed tap provides **maximum unit airflow** per the airflow performance chart.

///// Indoor Airflow Static and Unit Performance

The airflow amount that passes through the unit is very important when considering cooling capacity and proper unit operation. Restriction of the amount of air passing through the unit is called external static pressure (ESP). As the amount of air passing through the unit is restricted, the ESP value increases. This will have a direct impact on how heating and cooling equipment performs when used in an application. It is important to have a professional HVAC contractor, distributor, or technician complete a duct static calculation if supply or return ducts are used with the WA series unit. Unit filter static must also be calculated into the total ESP value.

Supply Duct Static: Supply duct static will include duct work connected to the unit supply opening, supply registers, filtration installed in the supply duct, or any other device in the supply airstream that will restrict airflow. All ducts must be sealed to reduce duct air leakage, and flex duct work must not include restriction due to installation. Duct static must be calculated by a HVAC professional and include all factors of the duct design.

Return Duct Static: Return duct static will include duct work connected to the unit return opening, return registers, filtration installed in the return duct, or any other device in the return airstream that will restrict airflow. All ducts must be sealed to reduce duct air leakage, and flex duct work must not include restriction due to installation. Duct static must be calculated by a HVAC professional and include all factors of the duct design.

Unit Filter Static: The WA series uses a unit filter installed before the indoor blower assembly that filters both indoor air from the room and outdoor air entering through the ventilation device. When additional filtration is required (higher MERV rating), additional static will need to be added to the total external static pressure (ESP). The following chart is to be used to estimate additional static pressure for a installed clean filter.

FILTER CODE	FILTER MERV RATING	FILTER STATIC INCHES WC.	FILTRATION LEVEL
X	MERV 2	0" WC	Low Filtration, 1" Thickness Disposable Media.
W	MERV 2	-.02" WC	Low Filtration, 1" Thickness Permanent Media.
P	MERV 8	.03" WC	Average Filtration, 2" Thickness Pleated Disposable Media.
M	MERV 11	.05" WC	Above Average Filtration, 2" Thickness Pleated Disposable Media.
N	MERV 13	.08" WC	High Filtration, 2" Thickness Pleated Disposable Media.

Calculating Total External Static Pressure: Supply duct static, return duct static, unit filter static, and any other source of additional static pressure are added together. Once this is calculated, the actual unit airflow amount can be reviewed by using the Indoor Airflow CFM charts provided.

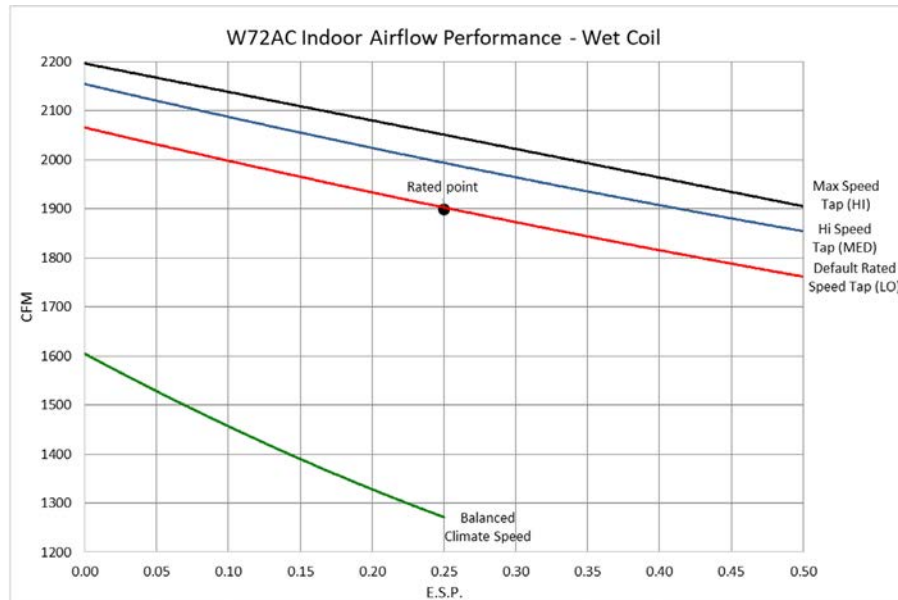
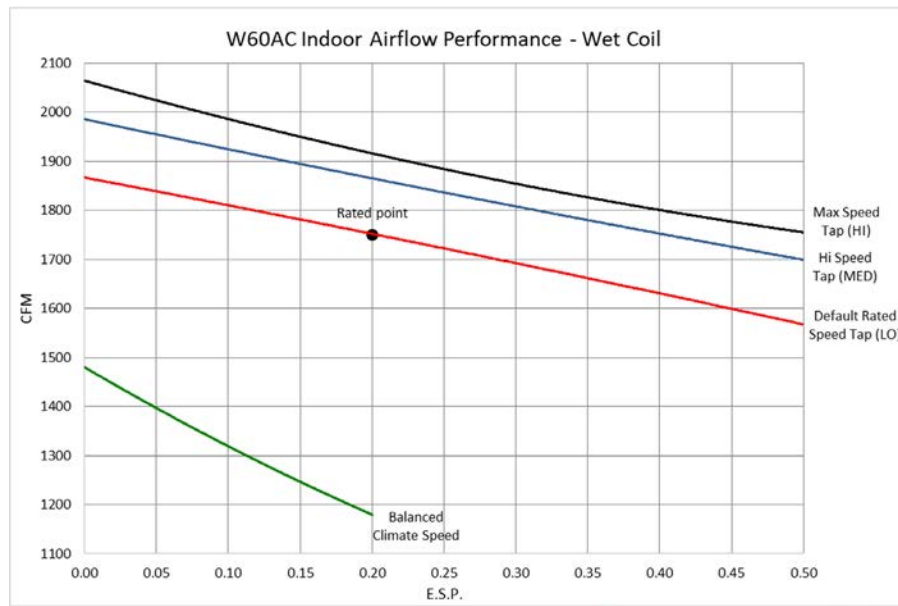
Total External Static Pressure Calculation:

Supply Duct Static + Return Duct Static + Filter Static + Additional External Static = Total External Static Pressure (ESP)

Non-Ducted Applications: Applications that do not include supply or return ducts inside the structure, use Bard supplied supply and return louvers, and do not have additional sources of external static will typically reflect rated airflow amounts shown in the Indoor Airflow CFM charts. Additional filter static must still be added as necessary to the rated airflow total external static pressure (ESP). Field supplied supply and return louvers must match Bard supplied supply and return louvers to achieve shown in the Indoor Airflow CFM charts. Adjustment of 4-way deflection supply louver may effect unit supply airflow. See louver deflection and throw characteristics provided in this document.



Indoor Airflow CFM @ Static Pressures and Adjustable Speeds - W60 and W72 Units



Total External Static Pressure Calculation:

$$\text{Supply Duct Static} + \text{Return Duct Static} + \text{Filter Static} + \text{Additional External Static} = \text{Total External Static Pressure (ESP)}$$

Total External Static Adjustment:

Indoor airflow data shown in the performance charts represent the unit running in cooling with a wet evaporator coil. A dry evaporator coil will provide less static. See adjustment factor in below table.

Indoor airflow data shown in the performance charts represent the unit with a 1" disposable MERV2 filter. For other filter options, external static pressure needs to be adjusted. See adjustment factor in below table.

FILTER CODE	FILTER MERV RATING	ADJUST STATIC
	DRY COIL AIRFLOW	-.04" WC
W	MERV 2 (Washable)	-.02" WC
X	MERV 2 (Disposable)	0" WC
P	MERV 8	+.03" WC
M	MERV 11	+.05" WC
N	MERV 13	+.08" WC

Indoor Airflow Speeds:

Balanced Climate Speed: The WA series uses this speed when the **Balanced Climate option (Y1)** or **mechanical dehumidification option (D)** is used. Not recommended for static levels higher than Balanced Climate airflow data provided.

LO Speed (Default): The WA series uses this speed by default when using **standard cooling (Y2)** or **heating operation (W1/W2)**. This speed is labeled as LO on the speed selection terminal strip inside the unit control panel. The WA series also uses this speed when **fan only (G)** or **ventilation operation (A)** is used. All units ship with cooling and heating operation at LO cooling and heating speed, and provides the **optimal airflow amount for normal use**.

MED Speed (User Selectable): This speed is user selectable when using **standard cooling (Y2)** or **heating operation (W1/W2)**. This speed is labeled as MED on the speed selection terminal strip inside the unit control panel. The MED speed tap provides an **increase in unit airflow** per the airflow performance chart. Fan only and dehumidification fan operation is not effected by using MED speed.

HI Speed (User Selectable): This speed is user selectable when using **standard cooling (Y2)** or **heating operation (W1/W2)**. This speed is labeled as HI on the speed selection terminal strip inside the unit control panel. The HI speed tap provides **maximum unit airflow** per the airflow performance chart. Fan only and dehumidification fan operation is not effected by using HI speed.

Indoor EC Motor Options for High Resistance Ground Applications

Today's ECM motor technology used in HVAC equipment provides a higher level of energy efficiency and more options for installers than older PSC motor designs. However, high resistance ground applications and locations where power supplied to the unit may not be clean (dirty power) require special consideration. Bard recommends ordering the motor isolation option "R" for new 460V products where high resistance grounding or dirty power may be present. A kit for 460V products can also be ordered Bard Part #8620-330 that can easily be installed to help avoid issues related to high resistance grounding or dirty power sources.



Cooling Application Data at Rated Airflow

MODEL	INDOOR RETURN AIR (DB/WB)	COOLING CAPACITY (BTUH)	DRY BULB OUTDOOR AIR TEMPERATURE ENTERING UNIT CONDENSER AREA											
			75°F 23.9°C	80°F 26.6°C	85°F 29.4°C	90°F 32.2°C	95°F 35°C	100°F 37.8°C	105°F 40.5°C	110°F 43.3°C	115°F 46.1°C	120°F 48.8°C	125°F 51.6°C	131°F 55°C
W18	75/62°F 23.8/16.6°C	Total Cooling	19800	18700	17600	16700	15700	15000	14200	13600	13000	12500	12000	11500
		Sensible Cooling	15000	14600	14200	13800	13400	13100	12800	12500	12200	12000	11700	11500
	80/67°F 26.6/19.4°C	Total Cooling	21100	20300	19500	18800	18000	17400	16700	16200	15600	15100	14600	14000
		Sensible Cooling	14500	14300	14000	13800	13500	13300	13100	12900	12700	12500	12300	12100
W24	75/62°F 23.8/16.6°C	Total Cooling	25200	23800	22400	21300	20000	19100	18000	17300	16400	15700	15100	14300
		Sensible Cooling	14900	14600	14100	13700	13300	12900	12500	12100	11700	11300	10900	10500
	85/72°F 29.4/22.2°C	Total Cooling	25000	24000	23000	22000	20900	20000	19000	18100	17100	16200	15200	14000
		Sensible Cooling	18400	18300	18200	18000	17800	17400	17100	16800	16300	15800	15200	14000
W30	75/62°F 23.8/16.6°C	Total Cooling	26600	26100	25500	24800	24000	23300	22400	21500	20600	19600	18500	17100
		Sensible Cooling	17800	17900	18000	18000	17900	17700	17500	17300	16900	16500	16000	15400
	80/67°F 26.6/19.4°C	Total Cooling	31700	30500	29300	28000	26700	25500	24200	22900	21700	20400	19100	17400
		Sensible Cooling	18300	18200	18100	17900	17600	17200	16700	16300	15600	14900	14200	13300
W36	75/62°F 23.8/16.6°C	Total Cooling	30800	29300	28000	26700	25500	24300	23200	22100	21000	19900	18900	17700
		Sensible Cooling	23500	23000	22400	21900	21400	20900	20400	20000	19400	19000	18600	17700
	80/67°F 26.6/19.4°C	Total Cooling	32800	31900	31100	30200	29200	28300	27300	26300	25200	24100	23000	N/A
		Sensible Cooling	22800	22500	22200	21900	21600	21200	20900	20600	20200	19900	19500	N/A
W42	75/62°F 23.8/16.6°C	Total Cooling	39100	37300	35700	34100	32500	31000	29500	28000	26500	25100	23700	N/A
		Sensible Cooling	23400	22900	22300	21800	21200	20500	19900	19300	18600	18000	17300	N/A
	85/72°F 29.4/22.2°C	Total Cooling	44400	42400	40500	38500	36600	34800	33100	31300	29600	27900	26200	24100
		Sensible Cooling	33900	33200	32300	31600	30800	30100	29300	28500	27700	27000	26100	24100
W48	75/62°F 23.8/16.6°C	Total Cooling	56500	54000	51600	49100	46700	44300	42100	39700	37400	35100	32800	N/A
		Sensible Cooling	33700	33000	32200	31400	30500	29600	28600	27600	26500	25500	24400	N/A
	80/67°F 26.6/19.4°C	Total Cooling	61600	58500	55600	52700	50100	47600	45300	43000	40900	38900	36900	35000
		Sensible Cooling	47200	45800	44400	43100	41900	40900	39800	38900	38000	37200	36500	35000
W60	75/62°F 23.8/16.6°C	Total Cooling	81300	78600	76100	73500	71000	68600	66200	63900	61700	59400	57300	54700
		Sensible Cooling	54100	53000	51900	50900	49900	48900	48000	47200	46400	45600	44900	44100
	85/72°F 29.4/22.2°C	Total Cooling	76200	72100	68500	65000	61800	58900	56100	53600	51300	49000	47000	44700
		Sensible Cooling	55800	54100	52400	50900	49500	48000	46800	45700	44600	43600	42700	41700
W72	75/62°F 23.8/16.6°C	Total Cooling	96800	91900	87400	83000	78600	75000	71400	68000	64800	61700	58900	N/A
		Sensible Cooling	55400	53800	52100	50600	49000	47300	45800	44300	42700	41200	39700	N/A
	80/67°F 26.6/19.4°C	Total Cooling	76200	72100	68500	65000	61800	58900	56100	53600	51300	49000	47000	44700
		Sensible Cooling	55800	54100	52400	50900	49500	48000	46800	45700	44600	43600	42700	41700

- Notes:
- Unit compressor cooling operation below 60°F requires a Low Ambient Control (LAC).
 - 1000 BTUH = .29307 kW
 - Outdoor air temperatures provided are an average of the condenser inlet air temperature.

Capacity Multiplier Factors							
% of Rated Airflow	-30%	-20%	-10%	Rated	+10%	+20%	+30%
Total BTUH	0.93	0.95	0.97	1	1.01	1.02	1.04
Sensible BTUH	0.90	0.93	0.95	1	1.02	1.05	1.09

Capacity Multiplier Calculation: Capacity multipliers are used to estimate unit capacity performance when airflow rates are decreased or increased compared to rated airflow. Rated airflow is the standard CFM amount used for capacity and efficiency calculations. Airflow rates may be effected by external static pressure (ESP) from supply ducts, return ducts, advanced filter options, or use of additional blower speeds. See unit airflow charts for additional information on unit airflow at different indoor blower speeds, filter static levels, and indoor airflow using Balanced Climate operation.

Example: Due to additional supply duct static, the actual supply airflow CFM for a installed W72 unit is 10% lower than the rated airflow shown in the blower performance chart. We want to know the actual BTUH amount of the unit at 85/72°F indoor and 100°F outdoor temperature for this application. The following formula will be used to calculate actual unit BTUH at the new supply airflow CFM amount:

Rated unit BTUH capacity x capacity multiplier factor = actual unit BTUH capacity.

Example: 75,000 rated Total BTUH x .97 capacity multiplier = 72,750 actual Total BTUH.

Example: 47,300 rated Sensible BTUH x .95 capacity multiplier = 44,935 actual Sensible BTUH.



////// **Electrical Specifications: W42 to W72 Units Without Dehumidification**

MODEL	Rated Volts & Phase	No. Field Power Circuits	Single Circuit				Multiple Circuits								
			③ Minimum Circuit Ampacity	① Maximum External Fuse or	② Field Power Wire Size	② Ground Wire Size	③ Minimum Circuit Ampacity		① Maximum External Fuse or Ckt. Breaker		② Field Power Wire Size		② Ground Wire Size		
							Ckt. A	Ckt. B	Ckt. A	Ckt. B	Ckt. A	Ckt. B	Ckt. A	Ckt. B	
W42AC-A00, A0Z A05 A10 A15 A20	230/208-1	1	31	50	8	10									
		1	31	50	8	10									
		1	57	60	6	10									
		1 or 2	83	90	4	8	57	26	60	30	6	10	10	10	
		1 or 2	109	125	2	6	57	52	60	60	6	6	10	10	
W42AC-B00, B0Z B06 B09 B15 B18	230/208-3	1	23	35	8	10									
		1	23	35	8	10									
		1	32	35	8	10									
		1	51	60	6	10									
		1	60	60	6	10									
W42AC-C00, C0Z C09 C15	460-3	1	12	15	14	14									
		1	17	20	12	12									
		1	26	30	10	10									
W48AC-A00, A0Z A05 A10 A15 A20	230/208-1	1	35	50	8	10									
		1	35	50	8	10									
		1	59	60	6	10									
		1 or 2	85	90	4	8	59	26	60	30	6	10	10	10	
		1 or 2	111	125	2	6	59	52	60	60	6	6	10	10	
W48AC-B00, B0Z B06 B09 B15 B18	230/208-3	1	26	35	8	10									
		1	26	35	8	10									
		1	33	35	8	10									
		1	51	60	6	10									
		2	N/A	N/A	N/A	N/A	34	28	40	30	8	10	10	10	
W48AC-C00, C0Z C09 C15	460-3	1	12	15	14	14									
		1	17	20	12	12									
		1	26	30	10	10									
W60AC-A00, A0Z A05 A10 A15 A20	230/208-1	1	38	50	8	10									
		1	38	50	8	10									
		1	59	60	6	10									
		1 or 2	85	90	4	8	59	26	60	30	6	10	10	10	
		1 or 2	111	125	2	6	59	52	60	60	6	6	10	10	
W60AC-B00, B0Z B06 B09 B15 B18	230/208-3	1	28	40	8	10									
		1	28	40	8	10									
		1	34	40	8	10									
		1	52	60	6	10									
		2	N/A	N/A	N/A	N/A	34	28	40	30	8	10	10	10	
W60AC-C00, C0Z C09 C15	460-3	1	14	20	12	12									
		1	18	20	12	12									
		1	26	30	10	10									
W72AC-A00, A0Z A05 A10 A15 A20	230/208-1	1	56	60	6	10									
		1	56	60	6	10									
		1 or 2	60	70	6	8	56	26	60	30	6	10	10	10	
		1 or 2	86	90	3	8	56	52	60	60	6	6	10	10	
		1 or 2	112	125	2	6	56	52	60	60	6	6	10	10	
W72AC -B00, B0Z B06 B09 B15 B18	230/208-3	1	38	50	8	10									
		1	38	50	8	10									
		1	38	50	8	10									
		1	54	60	6	10									
		2	N/A	N/A	N/A	N/A	38	28	40	30	8	10	10	10	
W72AC-C00, C0Z C09 C15	460-3	1	18	25	10	10									
		1	18	25	10	10									
		1	27	30	10	10									

- ① Maximum size of the time delay fuse or circuit breaker for protection of field wiring conductors.
- ② Based on 75°C copper wire. All wiring must conform to the National Electrical Code and all local codes.
- ③ These "Minimum Circuit Ampacity" values are to be used for sizing the field power conductors. Refer to the National Electrical code (latest version), Article 310 for power conductor sizing.

CAUTION: When more than one field power circuit is run through one conduit, the conductors must be derated. Pay special attention to Note 8 of Table 310 regarding Ampacity Adjustment Factors when more than three current carrying conductors are in a raceway.

Note: MOCP (Maximum Overcurrent Protection) value listed is the maximum value as per UL 1995 calculations for MOCP (branch-circuit conductor sizes in this chart are based on this MOCP). The actual factory installed Overcurrent Protective Device (Circuit Breaker) in this model may be lower than the maximum UL 1995 allowable MOCP value, but still above the UL 1995 minimum calculated value or Minimum Circuit Ampacity (MCA) listed.



///// **Electrical Specifications: W36 to W72 Units With "R" Isolation Option**

MODEL	Rated Volts & Phase	No. Field Power Circuits	Single Circuit				Multiple Circuits									
			③ Minimum Circuit Ampacity	① Maximum External Fuse or Ckt. Brkr.	② Field Power Wire Size	② Ground Wire Size	③ Minimum Circuit Ampacity		① Maximum External Fuse or Ckt. Breaker		② Field Power Wire Size		② Ground Wire Size			
							Ckt. A	Ckt. B	Ckt. A	Ckt. B	Ckt. A	Ckt. B	Ckt. A	Ckt. B		
W36ABRC00,CO2 C06 C09 C15	460-3	1	12	15	14	14										
W36LBRC02 C09 C15	460-3	1	12	15	14	14										
W42ACRC00,CO2 C09 C15	460-3	1	13	15	14	14										
W48ACRC00,CO2 C09 C15	460-3	1	14	15	14	14										
W60ACRC00,CO2 C09 C15	460-3	1	16	20	12	12										
W72ACRC00,CO2 C09 C15	460-3	1	20	25	10	10										

- ① Maximum size of the time delay fuse or circuit breaker for protection of field wiring conductors.
- ② Based on 75°C copper wire. All wiring must conform to the National Electrical Code and all local codes.
- ③ These "Minimum Circuit Ampacity" values are to be used for sizing the field power conductors. Refer to the National Electrical code (latest version), Article 310 for power conductor sizing.

CAUTION: When more than one field power circuit is run through one conduit, the conductors must be derated. Pay special attention to Note 8 of Table 310 regarding Ampacity Adjustment Factors when more than three current carrying conductors are in a raceway.

IMPORTANT: While this electrical data is presented as a guide, it is important to electrically connect properly sized fuses and conductor wires in accordance with the National Electrical Code and all local codes.

Note: MOCP (Maximum Overcurrent Protection) value listed is the maximum value as per UL 1995 calculations for MOCP (branch-circuit conductor sizes in this chart are based on this MOCP). The actual factory installed Overcurrent Protective Device (Circuit Breaker) in this model may be lower than the maximum UL 1995 allowable MOCP value, but still above the UL 1995 minimum calculated value or Minimum Circuit Ampacity (MCA) listed.

///// **Electric Heat Table - Refer to Electrical Specifications for Availability by Unit Model**

NOMINAL KW	AT 240V (1)				AT 208V (1)				AT 480V (2)			AT 460V (2)		
	KW	1-PH AMPS	3-PH AMPS	BTUH	KW	1-PH AMPS	3-PH AMPS	BTUH	KW	3-PH AMPS	BTUH	KW	3-PH AMPS	BTUH
4.0	4.0	16.7		13,652	3.00	14.4		10,239						
5.0	5.0	20.8	12.5	17,065	3.75	18.0	10.4	12,799						
6.0	6.0		14.4	20,478	4.50		12.5	15,359	6.0	7.2	20,478	5.52	6.9	18,840
8.0	8.0	33.3		27,304	6.00	28.8		20,478						
9.0	9.0		21.7	30,717	6.75		18.7	23,038	9.0	10.8	30,717	8.28	10.4	28,260
10.0	10.0	41.7		34,130	7.50	36.1		25,598						
15.0	15.0	62.5	36.1	51,195	11.25	54.1	31.2	38,396	15.0	18.0	51,195	13.80	17.3	47,099
18.0	18.0		43.3	61,434	13.50		37.5	46,076	18.0	21.7	61,434	16.56	20.8	56,519
20.0	20.0	83.3		68,260	15.00	72.1		51,195						

- (1) Listed electric heaters are available for 230/208V units only.
- (2) Listed electric heaters are available for 480V units only.



////// Ventilation Option Selection Chart

VENT CODE	FIELD INSTALLED KIT PART NUMBER	UNIT MODEL NUMBER	VENT OPERATION	VENT USE
X	FAD-NE2	W18AB/LB, W24AB/LB	Barometric Intake Damper, No Room Exhaust	Outdoor air intake damper that may be used to provide slight building positive pressurization or bring an adjustable amount of outdoor air into a structure. The damper opens during indoor blower operation and provides intake air only.
	FAD-NE3	W30AB/LB, W36AB/LB		
	FAD-NE5	W42AC, W48AC, W60AC, W72AC		
A	FAD-BE2	W18AB/LB, W24AB/LB	Barometric Intake Damper with Room Exhaust	Outdoor air intake damper that may be used to bring an adjustable amount of outdoor air into a structure. The damper opens during indoor blower operation and an exhaust damper provides barometric room pressure relief.
	FAD-BE3	W30AB/LB, W36AB/LB		
	FAD-BE5	W42AC, W48AC, W60AC, W72AC		
B	BOP-2	W18AB/LB, W24AB/LB	No ventilation, provides best protection against water, dirt, and debris infiltration.	Insulated plates are installed over the vent intake and exhaust openings. When used, the plates provide a degree of protection from splashing water and dirt/debris entry into the unit.
	BOP-3	W30AB/LB, W36AB/LB		
	BOPLATE-5	W42AC, W48AC, W60AC, W72AC		
M	CRV-F2-*	W18AB/LB, W24AB/LB	Motorized Intake Damper with Room Exhaust. Vent opens to user adjustable open position when energized. Vent is energized when 24VAC is applied to the "A" terminal located on the unit low voltage terminal strip.	The CRV-F provides a simple means of bringing in outdoor air when a motorized spring closed damper is required. Vent option provides up to 50% outdoor air intake. It also provides room pressure relief. Motor uses linkage to operate damper blades and springs closed when power to the damper motor is removed. No intake hood is required for all models.
	CRV-F3-*	W30AB/LB, W36AB/LB		
	CRV-F5	W42AC, W48AC, W60AC, W72AC		
V	CRV-V2-*	W18AB/LB, W24AB/LB	Motorized Intake Damper with Room Exhaust. Vent opens to user adjustable minimum position when "A" terminal located on the unit low voltage terminal strip is energized with 24VAC. 0-10VDC modulating operation option. Room pre-purge option.	The CRV-V provides a control board with advanced options for bringing in outdoor air when a motorized spring closed damper is required. Vent option provides up to 50% outdoor air intake. It also provides room pressure relief. Motor uses linkage to operate damper blades and springs closed when power to the damper motor is removed. Includes solid state control board for multiple ventilation settings. No intake hood is required for all models.
	CRV-V3-*	W30AB/LB, W36AB/LB		
	CRV-V5	W42AC, W48AC, W60AC, W72AC		
D	ECON-NC2-*	W18AB/LB, W24AB/LB	Motorized Intake Damper with Room Exhaust. Vent opens to user setting based on 0-10VDC input. 10k outdoor sensor is included with vent option. This vent does not include solid state board or JADE controller to operate economizer functionality.	The no controls economizer option is used where the controls contractor will provide a field installed logic board and indoor/outdoor sensors or other means to decide when conditions are favorable for free cooling. Vent option provides up to 100% outdoor air intake. It also provides room pressure relief. Motor uses linkage to operate damper blades and springs closed when power to the damper motor is removed. 7" intake hood (included) required for ECON-NC2 and ECON-NC3 options. No intake hood is required for ECON-NC5 option.
	ECON-NC3-*	W30AB/LB, W36AB/LB		
	ECON-NC5	W42AC, W48AC, W60AC, W72AC		
S	ECON-S2-*	W18AB/LB, W24AB/LB	Motorized Intake Damper with Room Exhaust. JADE economizer control uses outdoor temperature and humidity to provide free cooling operation based on enthalpy curve setting. Optional 0-10VDC input for modulating ventilation control. Optional user selected minimum position when "A" terminal located on the unit low voltage terminal strip is energized with 24VAC.	The economizer with enthalpy control is often used to provide free cooling for applications where humidity levels outdoors are relatively high, or indoor humidity levels need to be kept at a low amount. Vent option provides partial outdoor air intake based on outdoor temperature and humidity. It also provides room pressure relief. Motor uses linkage to operate damper blades and springs closed when power to the damper motor is removed. No intake hood is required.
	ECON-S3-*	W30AB/LB, W36AB/LB		
Y	ECON-DB2-*	W18AB/LB, W24AB/LB	Motorized Intake Damper with Room Exhaust. JADE economizer control uses outdoor temperature to provide free cooling operation based on user settings. Optional 0-10VDC input for modulating ventilation control. Optional user selected minimum position when "A" terminal located on the unit low voltage terminal strip is energized with 24VAC.	The dry bulb economizer option is often used in areas with low outdoor humidity levels or applications where indoor humidity levels can be relatively high. Vent option provides up to 100% outdoor air intake based on outdoor temperature. It also provides room pressure relief. Motor uses linkage to operate damper blades and springs closed when power to the damper motor is removed. 7" intake hood (included) required for ECON-DB2 and ECON-DB3 options. No intake hood is required for ECON-DB5 option.
	ECON-DB3-*	W30AB/LB, W36AB/LB		
	ECON-DB5	W42AC, W48AC, W60AC, W72AC		
Z	ECON-WD2-*	W18AB/LB, W24AB/LB	Motorized Intake Damper with Room Exhaust. JADE economizer control uses outdoor temperature and humidity to provide free cooling operation based on enthalpy curve setting. Optional 0-10VDC input for modulating ventilation control. Optional user selected minimum position when "A" terminal located on the unit low voltage terminal strip is energized with 24VAC.	The economizer with enthalpy control is often used to provide free cooling for applications where humidity levels outdoors are relatively high, or indoor humidity levels need to be kept at a low amount. Vent option provides up to 100% outdoor air intake based on outdoor temperature and humidity. It also provides room pressure relief. Motor uses linkage to operate damper blades and springs closed when power to the damper motor is removed. 7" intake hood (included) required for ECON-DB2 and ECON-DB3 options. No intake hood is required for ECON-DB5 option.
	ECON-WD3-*	W30AB/LB, W36AB/LB		
	ECON-WD5	W42AC, W48AC, W60AC, W72AC		
R	ERV-FA2-*	W18AB/LB, W24AB/LB - 208/230VAC voltage units	The Energy Recovery Ventilator Provides a solution to condition intake air entering the room while exhausting room air to minimize room pressurization. Heat is transferred from the entering air into the exhaust air during cooling seasons. Heat is transferred from the air being exhausted from the room into the air intake are during heating seasons. This is accomplished using energy recovery wheels, an intake blower assembly, and an exhaust blower assembly. Operation is controlled when the "A" terminal located on the unit low voltage terminal strip is energized with 24VAC.	The Energy Recovery Ventilator is often used to provide ventilation for an occupied area that requires outdoor air intake regardless of outdoor conditions. Vent option provides outdoor air intake and room pressure relief with optimal energy efficiency during warm or cool outdoor conditions. Intake and exhaust blower assemblies have 3 independent adjustable speed selections. 3" intake hood (included) required for ERV-F2 and ERV-F3 options. No intake hood is required for ERV-F5 option.
	ERV-FA3-*	W30AB/LB, W36AB/LB - 208/230VAC voltage units		
	ERV-FA5	W42AC, W48AC, W60AC, W72AC - 208/230VAC voltage units		
	ERV-FC2-*	W18AB/LB, W24AB/LB - 460VAC voltage units		
	ERV-FC3-*	W30AB/LB, W36AB/LB - 460VAC voltage units		
	ERV-FC5	W42AC, W48AC, W60AC, W72AC - 460VAC voltage units		



///// Economizer Specifications, ECON-DB, ECON-S, and ECON-WD

“Y” Vent Code Option – Economizer with JADE Controls and Dry Bulb Outdoor Sensor (ECON-DB)

The Economizer with JADE controls and dry bulb outdoor sensor is an optional feature on all models, and can be ordered pre-installed from Bard or may be field installed with the ECON-DB vent kit. Economizers are designed to provide free cooling when outdoor conditions are acceptable, and provide a small amount of outdoor air intake if required during non-economizer use. This saves energy and reduces compressor run time extending the life of the cooling equipment components. The ECON-DB ventilation option uses the JADE economizer controller and a 10k outdoor temperature sensor to decide when outdoor temperature is acceptable for free cooling operation. During free cooling economizer operation, the indoor blower will draw air through the economizer assembly mixing room air and outdoor air to provide a standard supply temperature. The damper blade is operated by a 24VAC actuator motor and blade linkage. See ECON-DB airflow charts provided in this specification for airflow amounts. Air exhaust is provided that allows room air to pass through the vent area and out of the unit. Room pressure forces air through the exhaust opening. Exhaust damper linkage controls the exhaust air amount and air intake amount simultaneously. Minimum vent position feature allows ventilation air to be brought into a room or structure when the unit ventilation terminal (A) is energized with 24VAC.

The economizer with JADE and dry bulb outdoor sensor includes the following options:

- Saves energy and reduces compressor-cooling runtime.
- The intake and exhaust damper opens to provide free cooling based on outdoor temperature. Outdoor temperature for economizer operation is user adjustable between 48°F and 80°F (8.8°C to 26.6°C). Default is 60°F (15.5°C).
- An economizer supply mixed air sensor provides a mixed air temperature of 53°F (11.6°C) by default.
- A 10k outdoor sensor is supplied with the vent option assembly to measure outdoor temperature.
- Spring closed motorized damper closes within 30 seconds when unit power is removed.
- When completely open, the vent provides outdoor air intake of the full airflow rating of the unit.
- Room exhaust is provided through the ventilation assembly reducing room pressure.
- Minimum vent position feature for outdoor air intake during non-economizer operation. Minimum position is used for meeting ANSI/ASHRAE Standard 62.1 air quality requirements or slight positive room pressurization for light industrial applications.
- 2-10VDC input for modulating ventilation when used with a CO2 sensor or other control device.
- Economizer may be used to provide cooling down to -40°F (-40°C) outdoor temperatures without compressor use.
- The JADE controller provides an easy to use LCD interface with user settings and diagnostics.
- Economizer assembly including damper seals and linkage meets 4cfm per ft2 leakage requirements.



Economizer Assembly

“S” and “Z” Vent Code Option – Economizer with JADE Controls and Enthalpy Outdoor Sensor (ECON-S and ECON-WD)

The Economizer with JADE controls and enthalpy outdoor sensor is an optional feature on all models, and can be ordered pre-installed from Bard or may be field installed with a vent kit. The “S” economizer option (ECON-S) is available for the W18 thru W36 models and provides up to 75% outdoor air intake without the need for an intake hood. The “Z” economizer option (ECON-WD) is available for all unit models and provides 100% outdoor air intake. W18 thru W36 models include 7” intake hood. Economizers are designed to provide free cooling when outdoor conditions are acceptable, and provide a small amount of ventilation air if needed during non-economizer operation. This saves energy and reduces compressor run time extending the life of the cooling equipment components. The ventilation options use the JADE economizer controller and an outdoor enthalpy (temperature and humidity) sensor to decide when outdoor conditions are acceptable for free cooling operation. During free cooling economizer operation, the indoor blower will draw air through the economizer assembly mixing room air and outdoor air to provide a standard leaving supply temperature. The damper blade is operated by a 24VAC actuator motor and blade linkage. See ECON-WD airflow charts provided in this specification for airflow amounts. Air exhaust is provided that allows room air to pass through the vent area and out of the unit. Room air pressure forces air through the exhaust opening. Exhaust damper linkage controls the exhaust air amount and air intake amount simultaneously. Minimum vent position feature allows ventilation air to be brought into a room or structure if required during non-economizer use when the unit ventilation terminal (A) is energized with 24VAC.

The economizer with JADE and enthalpy outdoor sensor includes the following options:

- Saves energy and reduces compressor-cooling runtime.
- The intake and exhaust damper opens to provide free cooling based on outdoor temperature and humidity. Enthalpy curves are pre-set and user selectable to maximize free cooling runtime or minimize indoor humidity levels during free cooling.
- An economizer supply mixed air sensor provides a mixed air temperature of 53°F (11.6°C) by default.
- An enthalpy sensor is supplied with the vent option assembly to measure outdoor temperature.
- Spring closed motorized damper closes within 30 seconds when unit power is removed.
- When completely open, the vent provides outdoor air intake of the full airflow rating of the unit.
- Room exhaust is provided through the ventilation assembly reducing room pressure.
- Minimum vent position feature for outdoor air intake during non-economizer operation. Minimum position is used for meeting ANSI/ASHRAE Standard 62.1 air quality requirements or slight positive room pressurization for light industrial applications.
- 2-10VDC input for modulating ventilation when used with a CO2 sensor or other control device.
- Economizer may be used to provide cooling down to -40°F (-40°C) outdoor temperatures without compressor use.
- The JADE controller provides an easy to use LCD interface with user settings and diagnostics.
- Economizer assembly including damper seals and linkage meets 4cfm per ft2 leakage requirements.



//////// Economizer Control Specifications, JADE Controller

JADE Economizer Control Features and Benefits

The JADE control is an important component of the ECON-DB and ECON-WD economizer ventilation options. It provides the logic to control the economizer operation based on outdoor conditions and includes an easy to use interface with an LCD display screen. Bard has pre-programmed the JADE from the factory to provide standard settings that apply for common installations.

The following basic setup menu items are available through the JADE menu settings:

- **Mixed Air Temperature:** This set point is used to control the air temperature that is provided by the economizer assembly. The mixed air temperature is set from the factory to provide optimal cooling performance during economizer use. Default setting is 53°F and can be adjusted between 38°F and 65°F.
- **Low T Lock:** This set point is used to lock out compressor operation when outdoor temperature is extremely low. Default setting is 0°F and can be adjusted between -45°F and 80°F.
- **Dry bulb Set point (ECON-DB only):** Provides the maximum outdoor temperature for economizer use. Default setting is 60°F and can be adjusted between 48°F and 80°F.
- **Enthalpy Curve Set point (ECON-WD only):** Provides the enthalpy (temperature and humidity) boundary curves for economizer use. Default setting is ES3 and can be set between ES1 and ES5.
- **Minimum Position:** Used to set the outdoor ventilation amount to be brought into the room or structure when the unit (A) terminal is energized. Default setting is 2VDC and can be set between 2VDC and 10VDC.
- **Demand Control Vent set point (DCV):** DCV is available when 2-10VDC signal is received from a CO2 sensor or other device. This is set to the maximum allowable CO2 level for the space when used with a CO2 sensor. Default setting is 1100ppm and can be adjusted between 500 to 2000ppm. Default setting is recommended, and CO2 level is normally adjustable at the CO2 sensor.
- **Auxiliary output:** An auxiliary output is available that will send 24VAC to terminal 6 on the unit control panel low voltage terminal strip. This feature can be easily set using the JADE interface to function as needed for certain applications. When set to EXH2, the auxiliary output can be used to control a secondary exhaust fan system during economizer operation. When set to SYS, the auxiliary output can be used to signal an issue with the economizer when the JADE has an active alarm. The alarm signal can be connected to a thermostat or controls system with the ability to signal a service alarm.

JADE Technical Specifications

- Voltage 20 to 30 VAC RMS
- Operating Temperature Range (F) -40 F to +150 F
- Operating Temperature Range (C) -40 C to +65 C
- Approvals, Federal Communications Commission Compliant
- Approvals, CE Compliant
- Complies with California Title 24
- Mixed air and Outdoor Enthalpy Sensor using Sylk Bus.
- Output 2-10 VDC to actuator, Sylk Bus.



Jade Control Module

Optional Return Air Sensor Kit Bard Part #8620-340 and #8620-334

The optional return air sensor kit provides a optional sensor that is field installed in the return airstream. When installed, the JADE economizer will monitor and adjust outdoor air intake based on comparing room temperature and outdoor temperature. This kit is optional, but may be required to meet state and local building codes in certain installation areas.

General Ventilation Option Guidelines

Applying heating and cooling equipment for various applications in the field requires careful planning to ensure the results provide are acceptable for occupants and heat generating equipment inside a room or structure. Products must be reviewed to meet all national, state, and local codes. When providing ventilation air to an indoor area, it is important that the equipment heating and cooling capacity be sized properly for the amount outdoor air being brought into the room or structure. Building pressurization requirements for specified pressurization amounts may require additional exhaust dampers, intake dampers, or fan pressurization systems. Avoid bringing in excessive ventilation amounts when it is not required per the application. Building codes may require special consideration regarding fire suppression systems, building pressurization, and other ventilation needs. Thermostats, CO2 sensors, and multiple unit lead/lag controllers that are used to control the equipment including ventilation must be reviewed per the application requirements. Follow all codes and standards that apply to the location where the equipment will be used, and review ASHRAE recommendations and guidelines for the application.

////// Unit Filter Options

Unit filter options for the Bard Wall-Mount provide multiple solutions for air filtration and indoor air quality improvement. Filter options allow for both room air passing through the unit and outdoor air provided by ventilation options to be cleaned before entering the indoor environment. Various filter types are available between MERV2 and MERV13 ratings. It is important to review application requirements, state and local codes, and ASHRAE recommendations to provide a clean, safe indoor area for occupants or heat generating equipment. Filter cleaning or replacement is an important part of ensuring that your Bard equipment is operating at optimal performance and indoor sound levels. A routine filter maintenance program based on room conditions is important, and higher MERV rated filters will normally require frequent filter changes. Filter trays are built into the unit with low filter bypass. Filter switch options are available that will help indicate when filter replacement or cleaning is necessary when used with a thermostat option to indicate filter change maintenance is needed.

“X” Filter Code Option – 1” Disposable MERV2 Filter

The 1” disposable non-pleated MERV2 filter is a standard feature on all models, and is normally used for low dust level areas where minimal filtration is required. Media material is typically polyester/fiberglass with a chipboard or cardboard frame. When maintenance is required, the filter is replaced. This option offers minimal filtration, low air resistance, and low maintenance costs.

“W” Filter Code Option – 1” Permanent MERV2 Filter

The 1” permanent non-pleated MERV2 filter is an optional feature on all models, and is normally used for low dust level areas where minimal filtration is required. Media material is typically foam with a plastic frame. When maintenance is required, the filter is cleaned and reused. If the filter media becomes damaged, the filter needs to be replaced. This option offers minimal filtration, low air resistance, and low maintenance costs.

“P” Filter Code Option – 2” Disposable MERV8 Filter

The 2” disposable pleated MERV8 filter is an optional feature on all models, and is normally used for moderate dust level areas where standard filtration is required. Media material is fiber based, provides high performance with an extended surface area that offers low-pressure drop. When maintenance is required, the filter is replaced. This option offers standard filtration, minimal air resistance, and average maintenance costs.

“M” Filter Code Option – 2” Disposable MERV11 Filter

The 2” disposable pleated MERV11 filter is an optional feature on all models, and is normally used for moderate to high filtration requirements. Media material is fiber based, provides high performance with an extended surface area that offers low-pressure drop. When maintenance is required, the filter is replaced. This option offers higher filtration, minimal air resistance, and average maintenance costs.

“N” Filter Code Option – 2” Disposable MERV13 Filter

The 2” disposable pleated MERV13 filter is an optional feature on all models, and is normally used for high filtration requirements. MERV13 filters are typically used where filtration of small particulates is required to offer a high level of indoor air quality. Often these filters are used in occupied areas including classrooms, gymnasiums, cafeterias, and other areas where filtration is at a high importance level. Media material is fiber based, provides high performance with an extended surface area that offers low-pressure drop. Filter replacement in 3-month or less intervals is recommended for the best filter and unit performance.

“A” Filter Code Option – 2” Disposable MERV13 Filter with UVC-LED Light

The 2” disposable pleated MERV13 filter is included with this option, and also a UVC-LED light used for disinfection. UVC-LED Light is a type of ultraviolet germicidal irradiation (UVGI) that disinfects the air through shortwavelength ultraviolet light. See UVC-LED Light specifications for further details.

////// Filter Replacement Part Number Chart

UNIT MODEL	FILTER CODE	FILTER MERV RATING	NUMBER OF FILTERS USED	BARD PART NUMBER	FILTER SIZE	FILTRATION LEVEL
W18, W24	X	MERV 2	1	7004-011	16 x 25 x 1	Low Filtration, 1” Thickness Disposable Media.
	W	MERV 2	1	7003-032	16 x 25 x 1	Low Filtration, 1” Thickness Permanent Media.
	P	MERV 8	1	7004-025	16 x 25 x 2	Average Filtration, 2” Thickness Pleated Disposable Media.
	M	MERV 11	1	7004-059	16 x 25 x 2	Above Average Filtration, 2” Thickness Pleated Disposable Media.
	N	MERV 13	1	7004-061	16 x 25 x 2	High Filtration, 2” Thickness Pleated Disposable Media.
W30, W36	X	MERV 2	1	7004-019	16 x 30 x 1	Low Filtration, 1” Thickness Disposable Media.
	W	MERV 2	1	7003-031	16 x 30 x 1	Low Filtration, 1” Thickness Permanent Media.
	P	MERV 8	1	7004-026	16 x 30 x 2	Average Filtration, 2” Thickness Pleated Disposable Media.
	M	MERV 11	1	7004-048	16 x 30 x 2	Above Average Filtration, 2” Thickness Pleated Disposable Media.
	N	MERV 13	1	7004-062	16 x 30 x 2	High Filtration, 2” Thickness Pleated Disposable Media.
W42, W48, W60, W72	X	MERV 2	2	7004-012	20 x 20 x 1	Low Filtration, 1” Thickness Disposable Media.
	W	MERV 2	2	7003-085	20 x 20 x 1	Low Filtration, 1” Thickness Permanent Media.
	P	MERV 8	2	7004-052	20 x 20 x 2	Average Filtration, 2” Thickness Pleated Disposable Media.
	M	MERV 11	2	7004-060	20 x 20 x 2	Above Average Filtration, 2” Thickness Pleated Disposable Media.
	N	MERV 13	2	7004-063	20 x 20 x 2	High Filtration, 2” Thickness Pleated Disposable Media.



/////// Cabinet Finishes and Construction

Unit cabinet finish options provide a way to have the Bard Wall-Mount blend in with existing building colors, provide additional corrosion protection, or reduce unit product weight. Unit top, structural sides, and front service panels are constructed using 20 guage materials. Base is constructed using 16 guage galvanized steel. Cabinet components are insulated with a non-fiberglass formaldehyde free insulation that has a high “R” value, is easy to clean with a FSK foil backing, and resists delamination.

Painted Steel Finish

This cabinet option uses zinc coated steel panels that are cleaned, rinsed, sealed and dried before a polyurethane primer is applied. The cabinet paint coating is comprised of a baked on textured enamel. The resulting finish is designed to withstand over 1000 hours of salt spray tests per ASTM B117-03.

The following painted steel colors are available:

- “X” Cabinet Finish Option – Beige
- “1” Cabinet Finish Option – White
- “4” Cabinet Finish Option – Gray
- “5” Cabinet Finish Option – Desert Brown
- “8” Cabinet Finish Option – Dark Bronze

Stainless Steel Finish

Exterior Stainless Steel finish cabinets are often selected for corrosion and chemical resistance. Higher grades of stainless steel are often specified to meet the requirements of harsh or corrosive environments. The Bard stainless steel unit offers a high quality stainless steel grade enclosure and fasteners for years of operation in these conditions.

Features of stainless steel “S” cabinet finish option:

- Sides, doors, grilles, back panels, and top are 316 grade stainless steel.
- Base, condenser partition, and fan shroud are 304 grade stainless steel.
- Stainless steel exterior cabinet screws, washers, nuts, and bolts, are used.
- Stainless steel outdoor motor mount and motor mount hardware.
- Compressor mounting hardware is stainless steel and hex no-spin rivet nuts are used in the unit base.
- Corrosion resistant coating is applied to fan blade.

Aluminum Finish

Aluminum external cabinet finish option “A” units are constructed of ASTM B 209 grade .06” thickness panels with a stucco appearance.



/////// Evaporator Coil, Condenser Coil, and Cabinet Coatings

Unit condenser and evaporator coils are designed, manufactured, and tested by Bard. A rifled copper hairpin design provides enhanced unit performance when used with a stamped aluminum fin for excellent heat transfer. End plate design includes extruded collars for hairpin tube protection. All coils are pressure tested before use and leak tested after unit construction. A copper tube and aluminum fin design coil is easy to clean and maintain through the life of the unit.

“X” Code Option – Standard Evaporator and Condenser Coils

Standard products include a green protective coating applied to the aluminum fin stock used for the evaporator coil. The evaporator coil coating is hydrophilic (attracts water) and allows for proper condensate drainage along with mild corrosion protection. Resistance to corrosive agents include ammonia, sodium hydroxide, sodium chloride, acidic solutions and solvents. Condenser coil construction is a copper hairpin with aluminum fin design that is easy to clean and maintain. Unit coating options are also available that offer additional corrosion protection to the unit cabinet. Applications where external or internal cabinet components will be exposed to extremely harsh environments require additional protection to copper, steel, and other materials.

“1” Code Option – Corrosion Resistance Coated Evaporator and Standard Condenser Coil

Option includes a Technicoat AA protective coating applied to the entire evaporator coil. After the evaporator coil is assembled, the entire coil is dipped in the coating process. This provides the best resistance to corrosive agents, and the coating process ensures the core of the aluminum fin pack is covered. Dehumidification units also include a dipped hot gas reheat coil. Standard condenser coil construction is a copper hairpin with aluminum fin design that is easy to clean and maintain. This option provides the best indoor coil protection when harmful chemicals or agents may be present in the indoor airstream. The exterior and interior unit cabinet is not coated with this option.



///// Evaporator Coil, Condenser Coil, and Cabinet Coatings (Continued)

"2" Code Option – Standard Evaporator and Corrosion Resistance Coated Condenser Coil

Option includes a green protective coating applied to the aluminum fin stock used for the evaporator coil. The evaporator coil coating is hydrophilic (attracts water) and allows for proper condensate drainage along with mild corrosion protection. Resistance to corrosive agents include ammonia, sodium hydroxide, sodium chloride, acidic solutions and solvents. A Technicoat AA protective coating is applied to the entire condenser coil. After the condenser coil is assembled, the entire coil is dipped in the coating process. This provides the best resistance to corrosive agents, and the coating process ensures the core of the aluminum fin pack is covered. This option provides the best outdoor coil protection when harmful chemicals or agents may be present in the outdoor airstream. Also provides a level of protection when units are installed in applications near salt water. The exterior and interior unit cabinet is not coated with this option.

"3" Code Option – Corrosion Resistance Coated Evaporator and Corrosion Resistance Coated Condenser Coil

Option includes a Technicoat AA protective coating applied to the entire evaporator coil. After the evaporator coil is assembled, the entire coil is dipped in the coating process. This provides the best resistance to corrosive agents, and the coating process ensures the core of the aluminum fin pack is covered. Dehumidification units also include a dipped hot gas reheat coil. A Technicoat AA protective coating is applied to the entire condenser coil. After the condenser coil is assembled, the entire coil is dipped in the coating process. This provides the best coil resistance to corrosive agents, and the coating process ensures the core of the aluminum fin pack is covered. The exterior and interior unit cabinet is not coated with this option.

"4" Code Option – Corrosion Resistance Coated Evaporator and Condenser Coil, Condenser Section Only Coating

Option includes a Technicoat AA protective coating applied to the entire evaporator coil. After the evaporator coil is assembled, the entire coil is dipped in the coating process. This provides the best resistance to corrosive agents, and the coating process ensures the core of the aluminum fin pack is covered. Dehumidification units also include a dipped hot gas reheat coil. A Technicoat AA protective coating is applied to the entire condenser coil. After the condenser coil is assembled, the entire coil is dipped in the coating process. This provides the best coil resistance to corrosive agents, and the coating process ensures the core of the aluminum fin pack is covered. The interior of the lower unit condenser section is corrosion coated for additional protection including the unit base, compressor, and condenser area copper tubing, filter/drier, and condenser fan.

"5" Code Option – Corrosion Resistance Coated Evaporator and Condenser Coil, Interior/Exterior Unit Coating

Option includes a Technicoat AA protective coating applied to the entire evaporator coil. After the evaporator coil is assembled, the entire coil is dipped in the coating process. This provides the best resistance to corrosive agents, and the coating process ensures the core of the aluminum fin pack is covered. Dehumidification units also include a dipped hot gas reheat coil. A Technicoat AA protective coating is applied to the entire condenser coil. After the condenser coil is assembled, the entire coil is dipped in the coating process. This provides the best coil resistance to corrosive agents, and the coating process ensures the core of the aluminum fin pack is covered. The entire exterior of the unit including the lower condenser section is coated along with all copper tubing, refrigeration, and air moving components. The interior components of the unit are also coated for the best cabinet component corrosion protection available.

///// Evaporator Coil and Condenser Coil Coatings Resistance List

The Technicoat AA coil coating provides a robust, dipped corrosion protection solution designed for indoor evaporator and outdoor condenser coils. Both field and lab testing results show no deterioration in harsh environments including refineries, mining operations, paper/pulp processing plants, and wastewater treatment facilities. ASTM B-117 testing includes over 10,000 hours with over 3,000 hours of SWAAT test time.

Chemical resistance includes the following:

- Alkalines including Ammoniac solution, Potassium Hydroxide, Calcium Hydroxide, and Magnesium Hydroxide.
- Alcohols including Isopropanol, Butanol, Amyl Alcohol, Benzyl Alcohol, Diacetone Alcohol, Glycerine, Propanol, and Pentanol
- Aliphatic Hydrocarbons including White Spirit, Shellsol, Bitumen, Isopar G, and Paraffin.
- Amines including Triethanolamine, Aniline Sulphate, Hexamethylenetetraamine, Phenylamine, Triethylamine, and Methylamine.
- Inorganic Compounds including Hydrogen Carbonate, Hydrogen Sulfide, Nitrous Acid, Sulphuric Acid, and Selenic Acid.
- Aromatic Hydrocarbons including Xylene, Toluene, Asphalt, Anthracene, Benzapherene, Gumlac, Benzene, and Naphtha.
- Fuels and Oils including Diesel, Fuel Oil, Petrol, Super Petrol, Lubricating Oils, Kerosene, Spheric Oils, LPG, and Mineral Oil.
- Ethers including Ethric Oils, Vegetable Oils, Butane, Acetylene, and Methane.
- Halogenated Hydrocarbons including Amyl Acetate, Propyl Acetate, Ethyl Oxalate, Butyl Acetate, and Butyl Propionate.
- Softeners including Palatinol C, Chloroparaffine 5XX, Dioctylphosphate, Desavin, Mesamol, and Dibutylphosphate.
- Organic Compounds including Benzoic Acid, Lactic Acid, Phenols, Fatty Acids, Malic Acid, and Picric Acid.
- Salts and water solutions including Sodium, Potassium, Calcium, Aluminum, Ammonium, Barium, Copper, Lead, and Lithium.
- Many other agents including Phosphor, Zinc, Glucose Syrup, Sulfur, Urea, Menthol, Antimony, Hydrogen, Rubber, and Shellac.

Special Properties:

- Anti-Odor
- Hydrophilic / Hydrophobic
- Anti-Corrosive

EXPOSURE CONDITIONS INCLUDE: Food Processing & Storage, Airports, Office Buildings, Hotels, Schools, Warehouses, Water Treatment, Breweries, Paper Mills, Refineries, Power Plants, Meat Processing Industries, Automotive Industries and other locations near shorelines and salt water.

Contact your local Bard distributor or representative for a list of all chemicals and additional chemical resistance information.



///// Cabinet Coatings Process and Resistance

Unit cabinet coatings involve a multi-step process that provides superior protection for conditions seen in harsh environments. Two different coating components are used to produce a chemically cured urethane based epoxy semi-gloss coating for industrial or architectural applications. Corrosion coating is also available for stainless steel construction units. Stainless steel components are scuffed and then coated with a gray tinted corrosion resistance coating.

Advantages include the following:

- Excellent corrosion protection.
- Suitable for salt and fresh water immersion.
- Excellent chemical and solvent resistance. Resists both splash and spillage of solvents, alkalis, salts, moisture, oils, greases, foodstuffs, and detergents.
- Low VOC, Self-priming and abrasion resistant.
- Excellent resistance to graffiti materials such as spray paint, magic markers, and lipstick.

Contact your local Bard distributor or representative for a list of all chemicals and additional chemical resistance information.

///// Controls Options Definitions

Unit controls include safety devices and accessories that can be used to customize the Bard Wall-Mount for uses in multiple applications. Controls can be supplied from the factory or field installed. The below listing provides a description of the controls options available for the Bard WA Series unit.

Hi Pressure Control (HPC) - The high-pressure control is standard in all units, and interrupts compressor operation if high side refrigerant pressures exceed switch settings. The switch is normally closed (NC) and opens during a high-pressure event. Events that can cause the switch to open include poor condenser coil cleaning maintenance, poor filter maintenance, condenser fan failure, or a leak/restriction in the refrigeration system.

Low Pressure Control (LPC) - The low-pressure control is standard in all units, and interrupts compressor operation if low side refrigerant pressures reach an extremely low level. The switch is normally closed (NC) and opens during a low-pressure event. Events that can cause switch use include poor filter maintenance, reduced or restricted airflow, evaporator fan failure, or a restriction in the refrigeration system.

Compressor Control Module (CCM) - The compressor control module is standard in all air conditioner units, and interrupts compressor operation if the high- or low-pressure switch circuits are opened or a low incoming voltage event (brownout) occurs. See unit manual for further details regarding the operation of the high and low-pressure control and how it interacts with the CCM to help protect the system from unit damage during a low-pressure event. The CCM includes a diagnostic light, brownout protection, and a make-on-break and delay on make timer.

Alarm Relay (ALR) - The alarm relay is an optional accessory that can be factory or field installed in the unit control panel. It consists of a relay that is energized based on a signal from the compressor control module. Once energized, the alarm relay will provide both normally open (NO) and normally closed (NC) contacts on the low voltage terminal strip to indicate an event has locked out compressor operation.

Low Ambient Control (LAC) - The low ambient control is an optional accessory that can be factory or field installed in the unit condenser section. When installed, the LAC monitors high side system pressures and helps maintain a specific pressure range during compressor operation. To maintain high side system pressures, condenser fan operation is either turned on and off in cycles, or the speed of the condenser fan modulates. Low ambient controls are recommended for applications where compressor cooling is required at lower outdoor temperatures below 60°F (15.5°C). Models with the low ambient control option also include a freeze stat attached to the coldest refrigerant circuit of the indoor evaporator coil. If freezing temperatures are sensed by the freeze stat, compressor operation is disabled momentarily to help prevent ice buildup on the indoor evaporator coil.

Crankcase Heater (CCH) - The crankcase heater is an optional accessory that can be field installed around the base of the compressor. When installed, the CCH provides heat to the compressor base when the compressor is not operational. Heating the compressor helps prevent oil migration when the unit is not running. Standard compressor functionality does not require the crankcase heater, but it is recommended for compressor operation in extremely cold environments including northern Canada.

Outdoor Thermostat (ODT) - The outdoor thermostat is an optional accessory that can be field installed in the unit control panel and condenser section. The outdoor thermostat measures outdoor temperatures and includes relay contacts (NC) breaking the compressor signal during cold outdoor conditions. The thermostat is in the control panel area and the sensor bulb is mounted to the fan shroud in the outdoor condenser section. Adjustment range is 0°F to 50°F. Default setting is 10°F.

PTCR Start Kit - Field installed option only. PTCR (Precision Temperature Coefficient Resistor) start kit includes the start device and wires needed for installation. The device is located inside the unit control panel near the compressor capacitor and provides an increase in starting torque. The PTCR Start Kit is not normally required when a clean, stable power source is available for the unit. The kit can only be used in 230 Volt single phase units.

Start Capacitor and Potential Relay Start Kit - Field installed option only. The kit includes a start capacitor and relay that is energized during startup of the compressor. The capacitor, relay, and needed wires are provided in a metal enclosure that is field installed in the outdoor section attached to the back. The Start Capacitor Kit is not normally required when a clean, stable power source is available for the unit. The kit can only be used in 230 Volt single phase units. Start capacitor kit cannot be used with the PTCR start kit installed.



DDC Controls Kit - The DDC controls kit is an optional accessory that can be factory or field installed. It consists of multiple sensors and switches that provide feedback to a field supplied DDC control (not included) or advanced thermostat (not included). The DDC controls kit consists of the following:

- Dirty Filter Indicator Switch. See below description.
- Discharge Air sensor. This is a temperature probe installed in the supply airstream of the product. It measures the air temperature leaving the unit and provides a 10k @ 77°F (Type 2) signal to a field supplied controller.
- Indoor Airflow Switch. This is a pressure differential device located in the entering and leaving airstream of the indoor blower. Normally open (NO) relay contacts are provided that indicate when the indoor blower is operating, and supply air is leaving the unit.
- Compressor Current Indicator Switch. This is amp sensing device located on one of the power lines leading to the compressor. Normally open (NO) relay contacts are provided that indicate when the compressor is operating during cooling mode. Amp load required to close the contacts is user adjustable.

Refer to user manual 7960-849 (W18 thru W36) and 7960-855 (W42 thru W72) for further information on components, wiring, and location of all devices in the unit.

Dirty Filter Switch Indicator (DFS) - The dirty filter indicator switch is an optional accessory that can be factory or field installed in the unit filter area. The switch measures pressure before and after the filter. During a restricted filter event, normally closed (NC) contacts will open indicating the filter requires maintenance. Once maintenance is complete, the switch is manually reset to indicate maintenance is complete. Pressure differential is adjustable to match user preference for filter replacement.



////// Factory Controls Options Chart Including Switches, Sensors, Relays, and Start Kits

Factory installed controls are provided by Bard to enhance a Wall-Mount product before it is shipped. All Wall-Mount products are shipped with a auto-reset high pressure switch and an auto-reset low pressure switch to help protect refrigeration components. A compressor control module with adjustable voltage protection, delay on make and break, and high/low pressure diagnostics is also standard

CONTROL CODE STANDARD MODELS	CONTROL CODE DEHUMIDIFICATION MODELS	DESCRIPTION OF FACTORY INSTALLED COMPONENTS
X	X	Hi Pressure Switch, Low Pressure Switch, Compressor Control Module.
E	E	Hi Pressure Switch, Low Pressure Switch, Compressor Control Module, Low Ambient Control
F	NA	Hi Pressure Switch, Low Pressure Switch, Compressor Control Module, Low Ambient Control, Dirty Filter Press. Switch
J	NA	Hi Pressure Switch, Low Pressure Switch, Compressor Control Module, Low Ambient Control, Alarm Relay
K	NA	Hi Pressure Switch, Low Pressure Switch, Compressor Control Module, Low Ambient Control, PTCR Start Kit
M	NA	Hi Pressure Switch, Low Pressure Switch, Compressor Control Module, Low Ambient Control, Alarm Relay, PTCR Start Kit
V	NA	Hi Pressure Switch, Low Pressure Switch, Compressor Control Module, Low Ambient Control, Alarm Relay, Discharge temperature sensor, Indoor Blower Airflow Press. Switch, Compressor Current Sensor, Dirty Filter Pressure Switch

////// Field Kit Controls Options Chart Including Switches, Sensors, Relays, and Start Kits

Field installed kits provide accessories that can be installed in the field. Required components, wires, enclosures, screws, and instructions that are needed are provided within the kit.

KIT PART NO.	UNITS USING KIT	DESCRIPTION OF FIELD INSTALLED KIT
CMA-37 = 230V	W18A, W18L, W24A, W24L	Low Ambient Control allows compressor cooling between 0°F and 50°F outdoor temp. - modulating
CMA-38 = 460V	W18A, W18L, W24A, W24L	Low Ambient Control allows compressor cooling between 0°F and 50°F outdoor temp. - modulating
CMA-39	W30A, W30L, W36A, W36L, W42A, W48A, W60A, W72A	Low Ambient Control allows compressor cooling between 0°F and 50°F outdoor temp. - fan cycling
CMC-15	W18A, W18L, W24A, W24L, W30A, W30L, W36A, W36L	PTCR Start Kit. Increases starting torque by 2 to 3x. 230V-60hz-1 phase (A voltage) only. Cannot be used in combination with SK start kit
CMC-32	W42A, W48A, W60A, W72A	PTCR Start Kit. Increases starting torque by 2 to 3x. 230V-60hz-1 phase (A voltage) only. Cannot be used in combination with SK start kit
SK-111	W18A, W18L, W24A, W24L, W30A, W30L, W36A, W36L	Start Capacitor and Potential Relay Start Kit. Increases starting torque by 9x. 230V-60hz-1 phase (A voltage) only. Cannot be used in combination with CMC start kit
CMA-14	W18A, W18L, W24A, W24L, W30A, W30L, W36A, W36L	Outdoor Thermostat Kit used to disable compressor cooling below 50°F outdoor temp. Adjustable between 50° and 0°F
CMA-43	W42A, W48A, W60A, W72A	Outdoor Thermostat Kit used to disable compressor cooling below 50°F outdoor temp. Adjustable between 50° and 0°F
CMC-34	W18A, W18L, W24A, W24L, W30A, W30L, W36A, W36L	Compressor Control Module Lockout Alarm Relay Kit.
CMC-35	W42A, W48A, W60A, W72A	Compressor Control Module Lockout Alarm Relay Kit.
CMC-36	W18A, W18L, W24A, W24L, W30A, W30L, W36A, W36L	Crank case heater kit. 230V units only.
CMC-37	W18A, W18L, W24A, W24L, W30A, W30L, W36A, W36L	Crank case heater kit. 460V units only.
CMC-38	W42A, W48A, W60A, W72A	Crank case heater kit. 230V units only.
CMC-39	W42A, W48A, W60A, W72A	Crank case heater kit. 460V units only.
CMC-29	W18A, W18L, W24A, W24L, W30A, W30L, W36A, W36L, W42A, W48A, W60A, W72A	Evaporator coil freezestat kit - Freezestat is a standard option on all units with a Low Ambient Control (LAC) or hot gas reheat dehumidification.
8620-330	W24A, W30A, W36A, W36L, W42A, W48A, W60A, W72A	Power isolation kit for ECM indoor fan motor. 460V units only.



Cabinet and Clearance Dimensions - W48A to W72A Series Units

CLEARANCES REQUIRED FOR SERVICE ACCESS AND ADEQUATE CONDENSER INLET AIRFLOW

MODELS	LEFT SIDE	RIGHT SIDE
W42AC, W48AC, W60AC, W72AC	20"	20"

- 1.) Follow all national, state, and local codes and regulations regarding the installation of heating and cooling equipment regarding Single Packaged Vertical Units (SPVU) including electrical access clearances.
- 2.) Field ventilation installation with the unit installed requires 40" on the left or right side of the unit.
- 3.) Bard recommends a minimum of 10 ft. between the unit front condenser air outlet and solid objects including fences, walls, bushes, and other airflow obstructions.
- 4.) Bard recommends a minimum of 15 ft. between the condenser air outlets of 2 units that are facing each other.
- 5.) Bard recommends a minimum clearance of 4" under the unit cabinet for condenser defrost drainage during heat pump operation.

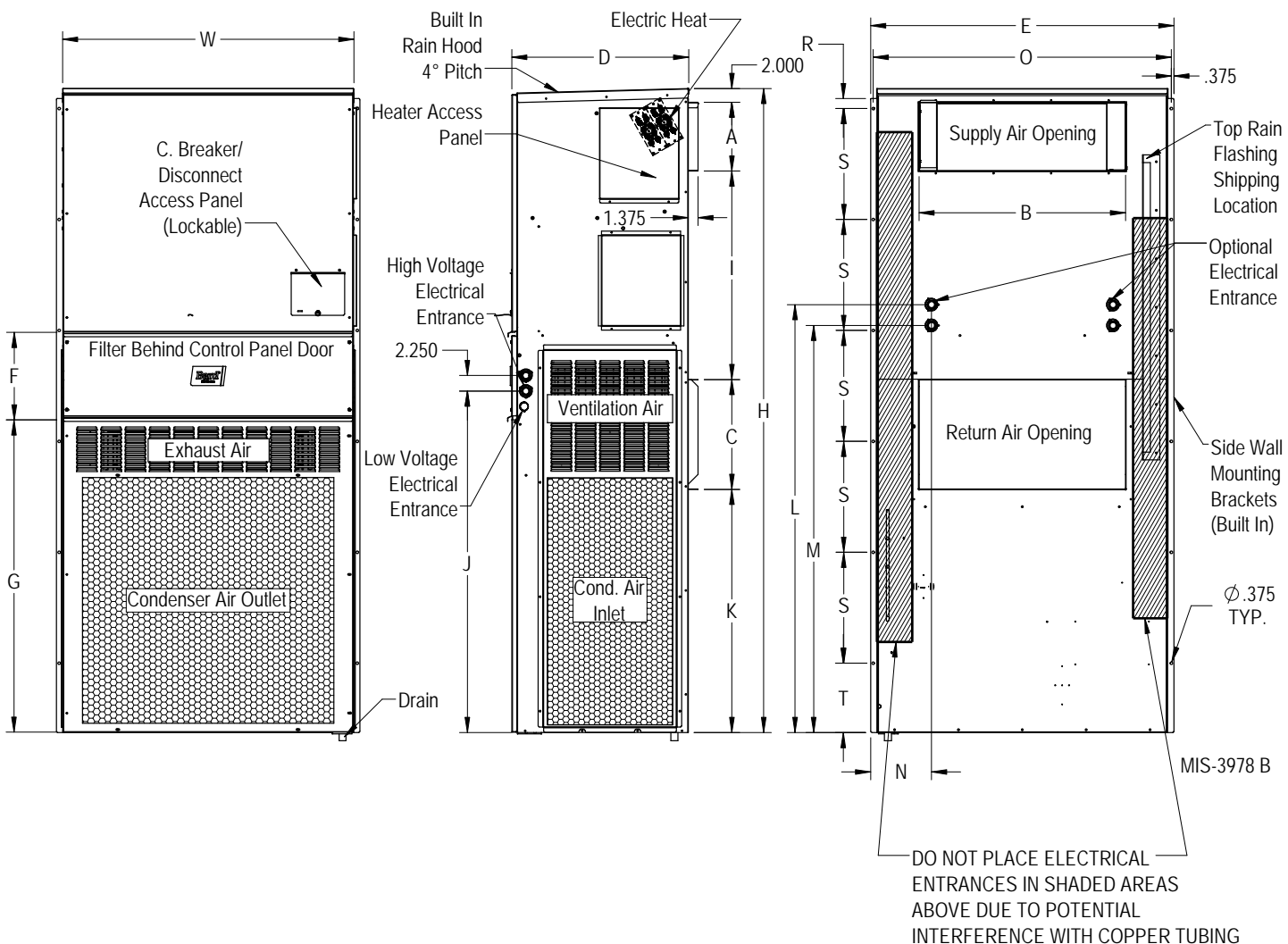
MINIMUM CLEARANCES REQUIRED TO COMBUSTIBLE MATERIALS

MODELS ①	SUPPLY AIR DUCT FIRST THREE FEET	CABINET
W42AC, W48AC, W60AC, W72AC	1/4"	0"

DIMENSIONS OF W42AC-72AC BASIC UNIT FOR ARCHITECTURAL & INSTALLATION REQUIREMENTS (NOMINAL)

MODEL	WIDTH (W)	DEPTH (D)	HEIGHT (H)	SUPPLY		RETURN																																
				A	B	C	B	E	F	G	I	J	K	L	M	N	O	R	S	T																		
W42AC W48AC	42	25.52	84.88	9.88	29.88	15.88	29.88	43.88	12.63	39.06	30	53.75	26.94	55.59	52.59	8.82	43	1.438	16	1.88																		
W60AC W72AC	42	25.52	93.00	9.88	29.88	15.88	29.88	43.88	12.63	45	30	59.75	35.06	61.72	58.72	8.82	43	1.438	16	10.00																		

① Wall mounting holes in side flanges are 0.375.



////// Wall Curb Accessories

Optional wall curb accessories are available to help reduce vibration through the outer wall surface or to use existing wall openings when replacing equipment. Follow all static pressure airflow requirements, safety and installation guidelines in the instructions provided with the curb and Wall-Mount products.

CURB	UNITS USING CURB	DESCRIPTION
WMICF2 -*	W18A, W18L, W24A, W24L	Provides vibration isolation for reduced sound transmission through wall
WMICF3 -*	W30A, W30L, W36A, W36L	Provides vibration isolation for reduced sound transmission through wall
WMICF5 -*	W42A, W48A, W60A, W72A	Provides vibration isolation for reduced sound transmission through wall
WWC3 -*	W30A, W30L, W36A, W36L	Install to use with existing 2, 3, or 5 ton wall openings. Wall openings must provide sufficient airflow. Follow all instructions in curb and unit manual including clearances to combustibles and maximum duct static pressure.
WWC5 -*	W42A, W48A, W60A, W72A	Install to use with existing 3 and 5 ton wall openings. Wall openings must provide sufficient airflow. Follow all instructions in curb and unit manual including clearances to combustibles and maximum duct static pressure.

* Color Option

////// Indoor Sound Reduction Accessories

Optional sound accessories are available to help reduce sound transmission from the supply and return openings inside the indoor area. Follow all static pressure airflow requirements, safety and installation guidelines in the instructions provided with the accessories and Wall-Mount products.

ACCESSORY	UNITS USING ACCESSORY	DESCRIPTION
WAPR11 -*	W18, W24, W30, W36, W42, W48, W60, W72	Indoor acoustical return air plenum that offsets the return air path. Air intake near floor level

* Color Option

////// Non-Ducted Supply and Return Grilles

Supply and return louver grilles are of a brushed aluminum finish. 2" flange versions are recommended for standard installations to allow grille attachment when large wall openings are present. Return filter grilles are available for filter access from an indoor area. Filter grilles do not include a filter, and are not recommended for unit with ventilation due to filter location. A manual damper return grille is available for W42 and W72 models. The manual damper is adjustable, and is only recommended for installations where increased return duct static pressure is required.

GRILLE NO.	UNITS USING GRILLE	DESCRIPTION OF LOUVER GRILLE
SG-2	W18A, W18L, W24A, W24L	8" x 20" with 1" Flange 4 way deflection supply grille.
SG-3	W30A, W30L, W36A, W36L	8" x 28" with 1" Flange 4 way deflection supply grille.
SG-5	W42A, W48A, W60A, W72A	10" x 30" with 1" Flange 4 way deflection supply grille.
RG-2	W18A, W18L, W24A, W24L	12" x 20" with 1" Flange return grille.
RG-3	W30A, W30L, W36A, W36L	12" x 28" with 1" Flange return grille.
RG-5	W42A, W48A, W60A, W72A	16" x 30" with 1" Flange return grille.
SG-2W	W18A, W18L, W24A, W24L	8" x 20" with 2" Flange 4 way deflection supply grille.
SG-3W	W30A, W30L, W36A, W36L	8" x 28" with 2" Flange 4 way deflection supply grille.
SG-5W	W42A, W48A, W60A, W72A	10" x 30" with 2" Flange 4 way deflection supply grille.
RG-2W	W18A, W18L, W24A, W24L	12" x 20" with 2" Flange return grille.
RG-3W	W30A, W30L, W36A, W36L	12" x 28" with 2" Flange return grille.
RG-5W	W42A, W48A, W60A, W72A	16" x 30" with 2" Flange return grille.
RFG-2W	W18A, W18L, W24A, W24L	12" x 20" with 2" Flange return grille with filter bracket.*
RFG-3W	W30A, W30L, W36A, W36L	12" x 28" with 2" Flange return grille with filter bracket.*
RFG-5W	W42A, W48A, W60A, W72A	16" x 30" with 2" Flange return grille with filter bracket.*
RGDK-2W	W18A, W24A, W24L	12" x 20" with 2" manual shutter style damper that is mounted in the return duct behind the return grille (sold separately). Adjustable to restrict return air from room.
RGDK-3W	W30A, W30L, W36A, W36L	12" x 28" with 2" manual shutter style damper that is mounted in the return duct behind the return grille (sold separately). Adjustable to restrict return air from room.
RGDK-5W	W42A, W48A, W60A, W72A	16" x 30" manual shutter style damper that is mounted in the return duct behind the return grille (sold separately). Adjustable to restrict return air from room.

* Not recommended to provide primary filtration with units that will bring in outdoor air.



////// Non-Ducted Supply Grilles - Spread and Throw Characteristics

One of the most important setup procedures for non-ducted supply applications is to adjust the 4 way supply grille blade positions. Placement of equipment, occupants, the thermostat, and room size can all play an important role in deciding how the conditioned supply air must be directed in an indoor area. The chart below may be used as a reference tool to help with this process.

SUPPLY GRILLE	AIRFLOW CFM	DEFLECTION	VELOCITY	TOTAL PRESSURE	THROW
SG-2 SG-2W	800 CFM	0°	1053	.076" WC	37-52 ft.
		22.5°	1143	.1" WC	28-40 ft.
		45°	1428	.162" WC	20-29 ft.
	865 CFM	0°	1138	.054" WC	40-55 ft.
		22.5°	1236	.075" WC	31-42 ft.
		45°	1544	.113" WC	21-30 ft.
SG-3 SG-3W	885 CFM	0°	852	.054" WC	37-54 ft.
		22.5°	1075	.075" WC	35-49 ft.
		45°	1162	.113" WC	21-30 ft.
	1285 CFM	0°	1237	.108" WC	42-66 ft.
		22.5°	1359	.147" WC	35-50 ft.
		45°	1687	.249" WC	25-37 ft.
SG-5 SG-5W	1450 CFM	0°	968	.073" WC	51-73 ft.
		22.5°	1071	.103" WC	39-56 ft.
		45°	1331	.169" WC	28-40 ft.
	2000 CFM	0°	1336	.130" WC	61-86 ft.
		22.5°	1477	.188" WC	54-65 ft.
		45°	1835	.335" WC	33-46 ft.

////// Sound Data - dBA @ 5 ft. and 10 ft.*

UNIT	DUCT FREE IN-DOOR COOLING OPERATION @ 5 FT.	DUCT FREE INDOOR COOLING OPERATION @ 10 FT.	DUCTED INDOOR COOLING OPERATION @ 5 FT.	DUCTED INDOOR COOLING OPERATION @ 10 FT.	OUTDOOR @ 10 FT.
W18AB/W18LB	49.6	47.3	48.6	46.2	62.8
W24AB/W24LB	52.4	50.4	51.9	48.9	62.3
W30AB/W30LB	53.9	52.9	54.5	47.3	67.1
W36AB/W36LB	53.9	52.9	54.5	47.3	67.1
W42AC	56.1	51.7	56.3	51.1	68.6
W48AC	57	52.7	57.8	52.8	69
W60AC	56.5	53.3	56	52.7	66.8
W72AC	61.2	56.6	60.8	57.1	77.1

Integrated values calculated per ANSI/ASA S12.60-2009/Part 2, Section 5.2.2.1.



Controller, Thermostat, Humidistat and CO2 Ventilation Control Options

Bard provides a wide variety of controllers for equipment cooling, thermostats, for equipment and comfort cooling, humidistats for dehumidification units, and CO2 sensors for ventilation control. Lockable thermostat covers are available for applications where security or supervisory control is desired.

CONTROLLER	OPERATION	DESCRIPTION
MC4002	1 to 2 Unit Lead/Lag Controller	Standard unit Lead/Lag Controller with remote alarming capability. Optional alarm board and SNMP or web page communication board. On board temperature sensor that can be remote mounted. Can use up to (2) remote temperature sensors.
MC5300	1 to 3 Unit Lead/Lag Controller	Advanced multi-unit Lead/Lag Controller with remote alarming capability. All models have Modbus communication and web pages. Optional alarm board with NO/NC contacts. On board temperature and humidity sensor that can be remote mounted. Can use up to (2) remote temperature sensors.
MC5600	1 to 6 Unit Lead Lag Controller	Advanced multi-unit Lead/Lag Controller with remote alarming capability. All models have Modbus communication and web pages. Optional alarm board with NO/NC contacts. On board temperature and humidity sensor that can be remote mounted. Can use up to (2) remote temperature sensors.

THERMOSTAT	OPERATION	DESCRIPTION
8403-060	3 Heat/3 Cool	Programmable or Nonprogrammable, ventilation output, dehumidification operation
8403-089	1 Heat/1 Cool	Temp. Settings per Day 4, 2, 1, 0 Programs per Week 7, 5-2, 5-1-1 or Nonprogrammable
8403-090	2 Heat/2 Cool	Temp. Settings per Day 4, 2, 1, 0 Programs per Week 7, 5-2, 5-1-1 or Nonprogrammable
8403-091	1 Heat/1 Cool	Easy to use, Nonprogrammable. FEMA use
8403-092	2 Heat/2 Cool	Programmable or Nonprogrammable, ventilation output, Wi-Fi
8403-095	2 Heat/1 Cool	Temp. Settings per Day 4, 2, 1, 0 Programs per Week 7, 5-2, 5-1-1 or Nonprogrammable

HUMIDISTAT	OPERATION	DESCRIPTION
8403-038	Humidity %RH	Easy to use w/SPDT switching. Ratings: Pilot duty 50VA @24V, 120VA @ 120/240V
8403-047	Humidity %RH	Electronic with display, EEPROM memory, lockable keypad, humidity sensor calibration

CO2 CONTROL	OPERATION	DESCRIPTION
S8403-096	CO2 PPM	CO2 ventilation control with digital display. On/Off or modulating ventilation operation

THERMOSTAT COVER*	SIZE	DESCRIPTION
8405-003	(Inside) 5-1/16" H x 6-1/16" W (Outside) 6-1/2" H x 7-1/2" W x 2-15/16" D	Clear acrylic with ventilation. Fits all thermostats except 8403-060
8405-005	(Inside) 5-7/8" H x 8-3/8" W (Outside) 7-1/4" H x 9-3/4" W x 3-3/8" D	Clear acrylic with ventilation. Fits all thermostats.
8405-006	(Inside) 5-1/16" H x 6-1/16" W (Outside) 6-3/8" H x 7-3/8" W x 2-7/8" D	Clear acrylic with ventilation. Fits all thermostats except 8403-060
8405-007	(Inside) 5-7/8" H x 8-3/8" W (Outside) 7-1/8" H x 9-5/8" W x 3-1/4" D	Beige painted steel cover with ventilation. Fits all thermostats.

* Thermostat covers include ventilation, but may effect temperature control reaction time. If security control lockout is needed, the 8403-060 thermostat provides input control lockout features.



Bard Manufacturing Company, Inc.
1914 Randolph Dr., Bryan, OH 43506
419-636-1194

www.bardhvac.com

Due to our continuous product improvement policy,
all specifications subject to change without notice.



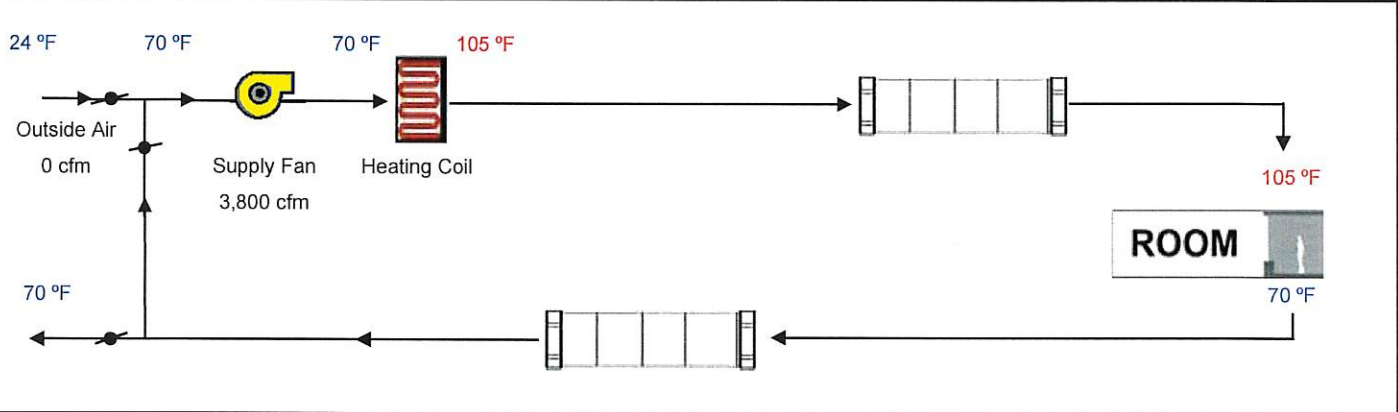
HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name West Lilac Road, APN 127-191-2200	Date 8/10/2023
System Name Pump Room W72A	Floor Area 550

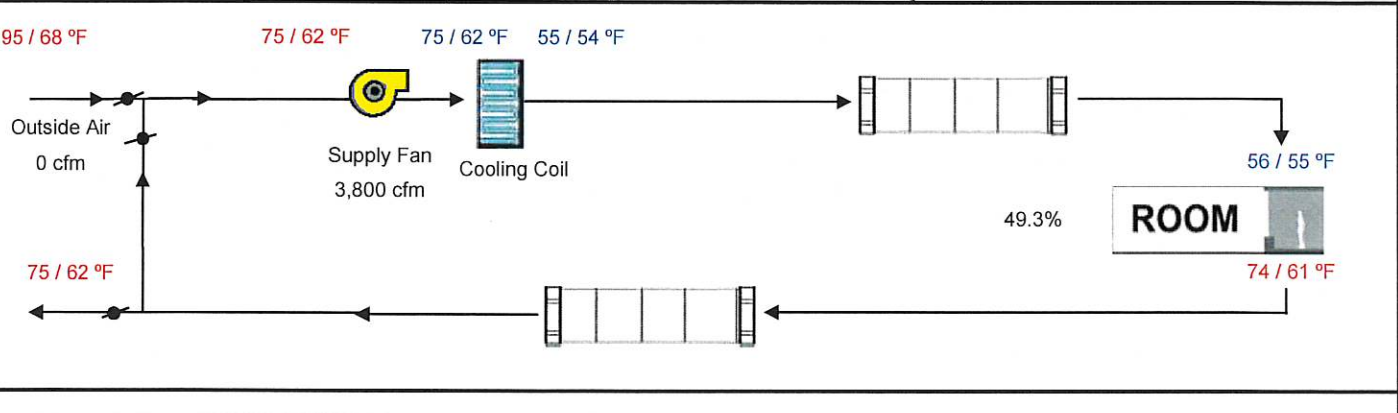
ENGINEERING CHECKS		SYSTEM LOAD					
Number of Systems	2	COIL COOLING PEAK			COIL HTG. PEAK		
Heating System		CFM	Sensible	Latent	CFM	Sensible	
Output per System	30,709	Total Room Loads	4,974	92,319	413	191	6,930
Total Output (Btuh)	61,418		Return Vented Lighting	0			
Output (Btuh/sqft)	111.7		Return Air Ducts	4,616			346
Cooling System			Return Fan	0			0
Output per System	71,000		Ventilation	0	0	0	0
Total Output (Btuh)	142,000	Supply Fan	0			0	
Total Output (Tons)	11.8	Supply Air Ducts	4,616			346	
Total Output (Btuh/sqft)	258.2	TOTAL SYSTEM LOAD		101,551	413		7,623
Total Output (sqft/Ton)	46.5						

Air System		HVAC EQUIPMENT SELECTION				
CFM per System	1,900	Bard Wall-Mount AC W72A		131,639	0	61,418
Airflow (cfm)	3,800					
Airflow (cfm/sqft)	6.91					
Airflow (cfm/Ton)	321.1					
Outside Air (%)	0.0%	Total Adjusted System Output (Adjusted for Peak Design conditions)		131,639	0	61,418
Outside Air (cfm/sqft)	0.00					
Note: values above given at ARI conditions		TIME OF SYSTEM PEAK		Jul 2 PM		Jan 1 AM

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Cooling Peak)



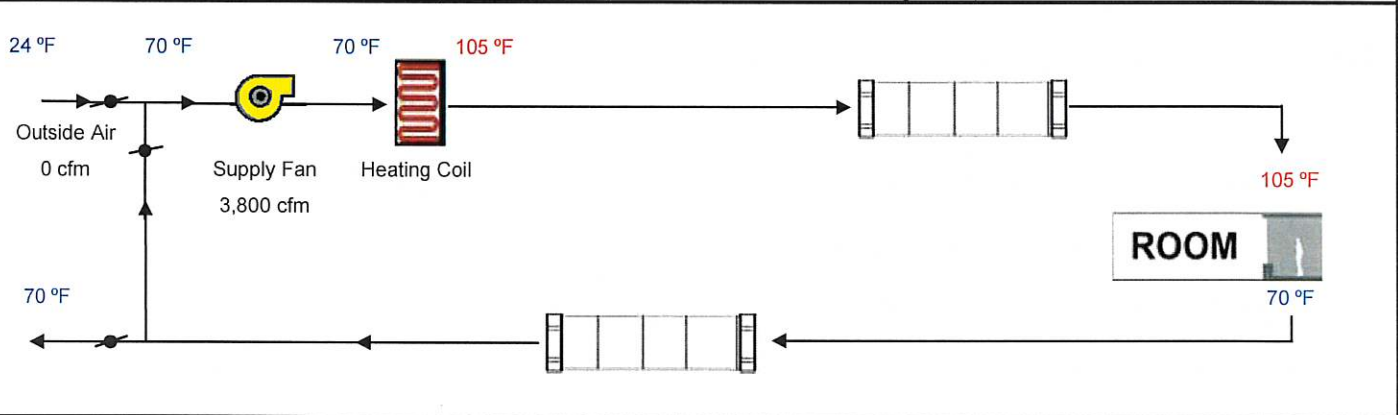
HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name West Lilac Road, APN 127-191-2200	Date 8/10/2023
System Name Control Room W72A	Floor Area 348

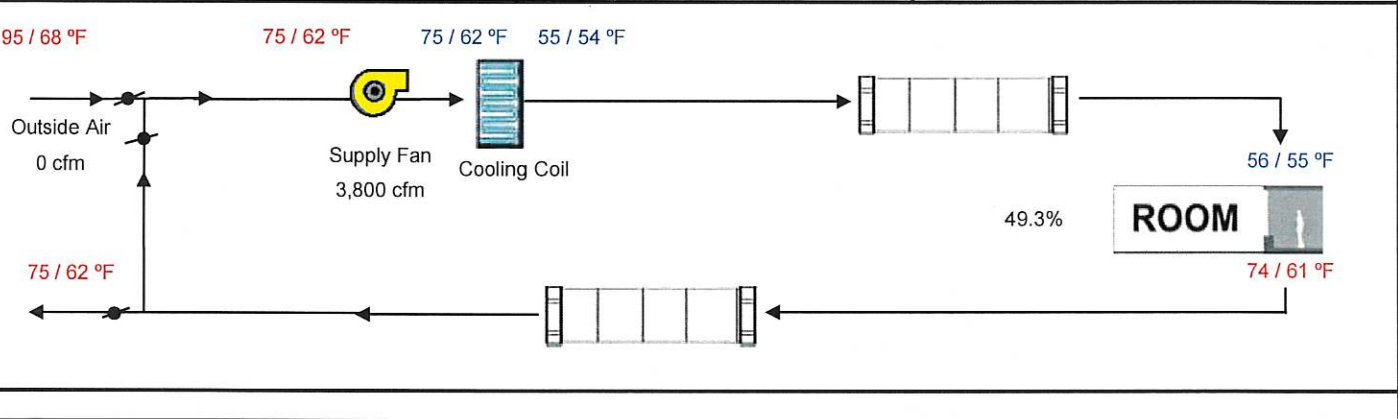
ENGINEERING CHECKS		SYSTEM LOAD					
Number of Systems	2	COIL COOLING PEAK			COIL HTG. PEAK		
Heating System		CFM	Sensible	Latent	CFM	Sensible	
Output per System	30,709	Total Room Loads	3,358	63,592	261	137	4,970
Total Output (Btuh)	61,418		Return Vented Lighting				
Output (Btuh/sqft)	176.5		Return Air Ducts				249
Cooling System			Return Fan				0
Output per System	71,000		Ventilation	0	0	0	0
Total Output (Btuh)	142,000	Supply Fan				0	
Total Output (Tons)	11.8	Supply Air Ducts				249	
Total Output (Btuh/sqft)	408.0	TOTAL SYSTEM LOAD				5,467	
Total Output (sqft/Ton)	29.4			69,951	261		

Air System		HVAC EQUIPMENT SELECTION				
CFM per System	1,900	Bard Wall-Mount AC W72A		131,398	0	61,418
Airflow (cfm)	3,800	Total Adjusted System Output (Adjusted for Peak Design conditions)		131,398	0	61,418
Airflow (cfm/sqft)	10.92	TIME OF SYSTEM PEAK		Jul 2 PM	Jan 1 AM	
Airflow (cfm/Ton)	321.1	Note: values above given at ARI conditions				
Outside Air (%)	0.0%					
Outside Air (cfm/sqft)	0.00					

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Cooling Peak)



ROOM COOLING PEAK LOADS

Project Name
West Lilac Road, APN 127-191-2200

Date
8/10/2023

ROOM INFORMATION

Room Name *Pump Room*
Floor Area 550.00 ft²
Indoor Dry Bulb Temperature 74 °F

DESIGN CONDITIONS

Time of Peak *Jul 2 PM*
Outdoor Dry Bulb Temperature 95 °F
Outdoor Wet Bulb Temperature 68 °F

Conduction	Area		U-Value		DETD ¹	=	Btu/hr
R-24 Wall	384.0	X	0.0359	X	20.9	=	288
Metal Door	42.0	X	0.7000	X	21.5	=	631
R-24 Wall	186.0	X	0.0359	X	23.6	=	157
R-24 Wall	426.0	X	0.0359	X	26.8	=	410
R-29 Roof	550.0	X	0.0641	X	65.7	=	2,315
R-21 Floor	550.0	X	0.0914	X	22.7	=	1,142
		X		X		=	
		X		X		=	
		X		X		=	
		X		X		=	
Page Total							4,943

1. Design Equivalent Temperature Difference (DETD)
Items shown with an asterisk (*) denote conduction through an interior surface to another room.

Solar Gain	Orientation	Area		SGF		SC		Weighting Factor	=	Btu/hr
			X		X		X		=	
			X		X		X		=	
			X		X		X		=	
			X		X		X		=	
			X		X		X		=	
			X		X		X		=	
			X		X		X		=	
			X		X		X		=	
			X		X		X		=	
			X		X		X		=	
Page Total										0

Internal Gain	Sched. Frac.	Area	Heat Gain	Watts/Sqft		Btu/Watt		Weighting Factor	=	Btu/hr	
Lights	1.00	550	0.327	X	3.413	X	1.000	=	614		
Occupants	1.00	550	250	Btu/occ.	/	333.000	Sqft/occ.	X	1.000	=	413
Receptacle	1.00	550	3.000	Watts/Sqft	X	3.413	Btu/Watt	X	1.000	=	5,631
Process	1.00	550	43.000	Watts/Sqft	X	3.413	Btu/Watt	X	1.000	=	80,717
Process Lighting	1.00	550	0.000	Watts/Sqft	X	3.413	Btu/Watt	X	0.000	=	0

Infiltration: [Schedule Fraction X Air Sensible X Area X Ceiling Height X ACH / 60] X ΔT =

TOTAL HOURLY SENSIBLE HEAT GAIN FOR ROOM **92,319**

Latent Gain	Sched. Frac.	Area	Heat Gain	Btu/occ.		Sqft/occ.		Btu/Watt	=	Btu/hr
Occupants	1.00	550	250	/	333.000	=	413			
Receptacle	1.00	550	0.000	Watts/Sqft	X	3.413	Btu/Watt	=	0	
Process	1.00	550	0.000	Watts/Sqft	X	3.413	Btu/Watt	=	0	

Infiltration: [Schedule Fraction X Air Latent X Area X Ceiling Height X ACH / 60] X ΔW =

TOTAL HOURLY LATENT HEAT GAIN FOR ROOM **413**

ROOM COOLING PEAK LOADS

Project Name <i>West Lilac Road, APN 127-191-2200</i>	Date <i>8/10/2023</i>
--	--------------------------

ROOM INFORMATION	DESIGN CONDITIONS
Room Name <i>Control Room</i>	Time of Peak <i>Jul 2 PM</i>
Floor Area <i>348.00 ft²</i>	Outdoor Dry Bulb Temperature <i>95 °F</i>
Indoor Dry Bulb Temperature <i>74 °F</i>	Outdoor Wet Bulb Temperature <i>68 °F</i>

Conduction	Area		U-Value		DETD ¹	=	Btu/hr
<i>R-24 Wall</i>	<i>228.0</i>	<i>X</i>	<i>0.0359</i>	<i>X</i>	<i>20.9</i>	<i>=</i>	<i>171</i>
<i>Metal Door</i>	<i>42.0</i>	<i>X</i>	<i>0.7000</i>	<i>X</i>	<i>21.5</i>	<i>=</i>	<i>631</i>
<i>R-24 Wall</i>	<i>270.0</i>	<i>X</i>	<i>0.0359</i>	<i>X</i>	<i>26.8</i>	<i>=</i>	<i>260</i>
<i>R-24 Wall</i>	<i>186.0</i>	<i>X</i>	<i>0.0359</i>	<i>X</i>	<i>35.2</i>	<i>=</i>	<i>235</i>
<i>R-29 Roof</i>	<i>348.0</i>	<i>X</i>	<i>0.0641</i>	<i>X</i>	<i>65.7</i>	<i>=</i>	<i>1,465</i>
<i>R-21 Floor</i>	<i>348.0</i>	<i>X</i>	<i>0.0914</i>	<i>X</i>	<i>22.7</i>	<i>=</i>	<i>723</i>
		<i>X</i>		<i>X</i>		<i>=</i>	
		<i>X</i>		<i>X</i>		<i>=</i>	
		<i>X</i>		<i>X</i>		<i>=</i>	
		<i>X</i>		<i>X</i>		<i>=</i>	
Page Total							3,484

1. Design Equivalent Temperature Difference (DETD)
 Items shown with an asterisk (*) denote conduction through an interior surface to another room.

Solar Gain	Orientation	Area		SGF		SC		Weighting Factor	=	Btu/hr
			<i>X</i>		<i>X</i>		<i>X</i>		<i>=</i>	
			<i>X</i>		<i>X</i>		<i>X</i>		<i>=</i>	
			<i>X</i>		<i>X</i>		<i>X</i>		<i>=</i>	
			<i>X</i>		<i>X</i>		<i>X</i>		<i>=</i>	
			<i>X</i>		<i>X</i>		<i>X</i>		<i>=</i>	
			<i>X</i>		<i>X</i>		<i>X</i>		<i>=</i>	
			<i>X</i>		<i>X</i>		<i>X</i>		<i>=</i>	
			<i>X</i>		<i>X</i>		<i>X</i>		<i>=</i>	
			<i>X</i>		<i>X</i>		<i>X</i>		<i>=</i>	
			<i>X</i>		<i>X</i>		<i>X</i>		<i>=</i>	
Page Total										0

Internal Gain	Sched. Frac.		Area		Heat Gain		Weighting Factor	=	Btu/hr			
Lights	<i>1.00</i>	<i>X</i>	<i>348</i>	<i>X</i>	<i>0.388</i>	<i>Watts/Sqft</i>	<i>3.413</i>	<i>Btu/Watt</i>	<i>X</i>	<i>1.000</i>	<i>=</i>	<i>461</i>
Occupants	<i>1.00</i>	<i>X</i>	<i>348</i>	<i>X</i>	<i>250</i>	<i>Btu/occ.</i>	<i>333.000</i>	<i>Sqft/occ.</i>	<i>X</i>	<i>1.000</i>	<i>=</i>	<i>261</i>
Receptacle	<i>1.00</i>	<i>X</i>	<i>348</i>	<i>X</i>	<i>3.000</i>	<i>Watts/Sqft</i>	<i>3.413</i>	<i>Btu/Watt</i>	<i>X</i>	<i>1.000</i>	<i>=</i>	<i>3,563</i>
Process	<i>1.00</i>	<i>X</i>	<i>348</i>	<i>X</i>	<i>47.000</i>	<i>Watts/Sqft</i>	<i>3.413</i>	<i>Btu/Watt</i>	<i>X</i>	<i>1.000</i>	<i>=</i>	<i>55,823</i>
Process Lighting	<i>1.00</i>	<i>X</i>	<i>348</i>	<i>X</i>	<i>0.000</i>	<i>Watts/Sqft</i>	<i>3.413</i>	<i>Btu/Watt</i>	<i>X</i>	<i>0.000</i>	<i>=</i>	<i>0</i>

Infiltration: [Schedule Fraction X Air Sensible X Area X Ceiling Height X ACH / 60] X ΔT =

TOTAL HOURLY SENSIBLE HEAT GAIN FOR ROOM **63,592**

Latent Gain	Sched. Frac.		Area		Heat Gain		Weighting Factor	=	Btu/hr	
Occupants	<i>1.00</i>	<i>X</i>	<i>348</i>	<i>X</i>	<i>250</i>	<i>Btu/occ.</i>	<i>333.000</i>	<i>Sqft/occ.</i>	<i>=</i>	<i>261</i>
Receptacle	<i>1.00</i>	<i>X</i>	<i>348</i>	<i>X</i>	<i>0.000</i>	<i>Watts/Sqft</i>	<i>3.413</i>	<i>Btu/Watt</i>	<i>=</i>	<i>0</i>
Process	<i>1.00</i>	<i>X</i>	<i>348</i>	<i>X</i>	<i>0.000</i>	<i>Watts/Sqft</i>	<i>3.413</i>	<i>Btu/Watt</i>	<i>=</i>	<i>0</i>

Infiltration: [Schedule Fraction X Air Latent X Area X Ceiling Height X ACH / 60] X ΔW =

TOTAL HOURLY LATENT HEAT GAIN FOR ROOM **261**

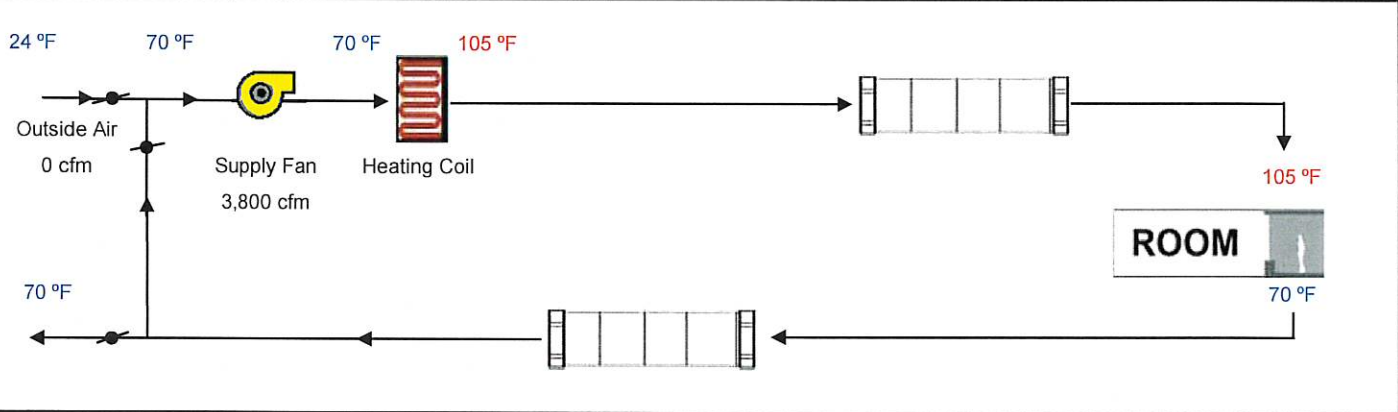
HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name 93136-01 RAINBOW	Date 8/10/2023
System Name Pump Room W72A	Floor Area 457

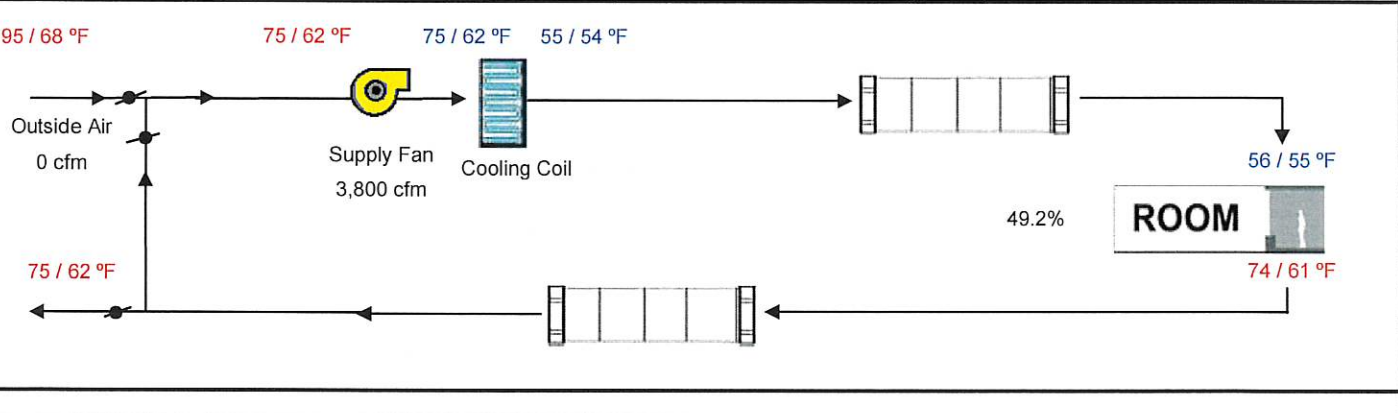
ENGINEERING CHECKS		SYSTEM LOAD				
Number of Systems	2	COIL COOLING PEAK			COIL HTG. PEAK	
Heating System		CFM	Sensible	Latent	CFM	Sensible
Output per System	30,709	Total Room Loads				
Total Output (Btuh)	61,418	4,826	89,726	343	166	6,027
Output (Btuh/sqft)	134.4	Return Vented Lighting				
Cooling System		Return Air Ducts				
Output per System	71,000	Return Fan				
Total Output (Btuh)	142,000	Ventilation				
Total Output (Tons)	11.8	Supply Fan				
Total Output (Btuh/sqft)	310.7	Supply Air Ducts				
Total Output (sqft/Ton)	38.6	TOTAL SYSTEM LOAD				
Air System		98,698			343	
CFM per System	1,900					
Airflow (cfm)	3,800					
Airflow (cfm/sqft)	8.32					
Airflow (cfm/Ton)	321.1					
Outside Air (%)	0.0%					
Outside Air (cfm/sqft)	0.00					

ENGINEERING CHECKS		HVAC EQUIPMENT SELECTION				
Bard Wall-Mount AC W72A		131,606	0			
Total Adjusted System Output (Adjusted for Peak Design conditions)		131,606	0	61,418		
Note: values above given at ARI conditions		TIME OF SYSTEM PEAK		Jul 2 PM	Jan 1 AM	

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Cooling Peak)



Dehumidifiers / PAD40C1AWT



PAD40C1AWT 40-pint Dehumidifier

The PELONIS dehumidifier can effectively prevent moisture damage and provide great comfort in any space.

Timer: 24-Hour On/Off Timer

Auto Shut-off: Energy saving

Comfort Mode: Superior climate control

Product Information: PAD40C1AWT 40-pint Dehumidifier

Warranty 1 Year Limited

Features

Capacity by DOE Rating: 40Pints Per Day

Energy Star Rated: Yes

Adjustable Humidistat: 35%-85%

Bucket Capacity: 12.66 pints

Min. Operating Temperature: 41°F

Indoor Noise Level: (Hi/L)53/49 dBA

IEF(L/kwh): 1.8

Refrigerant: R410a

Adjustable Humidistat: Yes
Control Type: Electronic Control
Auto Shutoff: Yes
Full Bucket Indicator: Yes
Comfort Mode: Yes
Turbo Fan: Yes
Auto Restart: Yes
Easy Move: Yes
Continuous Run: Yes
Automatic Defrost Control: Yes
Washable Filter: Yes
Built-in Pump: No
Power Supply: 1Ph, 115V-, 60Hz
Plug Type: 5-15P
Rated Input: 430 W
Current: 5.7 Amps
Color: White and Black
Product (W*D*H) 15.43 in x 11.10 in x 24.25 in
Product (W*D*H) 392 mm x 282 mm x 616 mm
Net/Gross Weight 39.46/42.33 lbs
Net/Gross Weight 17.9/19.2 kg

The Pelonis Promise

Safety is and has been our number 1 priority, for over 25 years.
Our products come with a 1 year worry-free warranty.



Protective & Marine Coatings

MACROPOXY® 646 FAST CURE EPOXY

PART A B58-600 SERIES
PART B B58V600 HARDENER

Revised: August 23, 2017

PRODUCT INFORMATION

4.53

PRODUCT DESCRIPTION

MACROPOXY 646 FAST CURE EPOXY is a high solids, high build, fast drying, polyamide epoxy designed to protect steel and concrete in industrial exposures. Ideal for maintenance painting and fabrication shop applications. The high solids content ensures adequate protection of sharp edges, corners, and welds. This product can be applied directly to marginally prepared steel surfaces and hot substrates up to 250°F/120°C

- Low VOC
- Low odor
- Outstanding application properties
- Meets Class A requirements for Slip Coefficient, 0.36 @ 6 mils / 150 microns dft (Mill White only)
- Chemical resistant
- Abrasion resistant

PRODUCT CHARACTERISTICS

Finish:	Semi-Gloss
Color:	Mill White, Black and a wide range of colors available through tinting
Volume Solids:	72% ± 2%, mixed, Mill White
Weight Solids:	85% ± 2%, mixed, Mill White
VOC (EPA Method 24):	Unreduced: <250 g/L; 2.08 lb/gal mixed Reduced 10%: <300 g/L; 2.50 lb/gal
Mix Ratio:	1:1 by volume

Recommended Spreading Rate per coat:

	Minimum	Maximum
Wet mils (microns)	7.0 (175)	13.5 (338)
Dry mils (microns)	5.0* (125)	10.0* (250)
~Coverage sq ft/gal (m²/L)	116 (2.8)	232 (5.7)
Theoretical coverage sq ft/gal (m²/L) @ 1 mil / 25 microns dft	1152 (28.2)	

*May be applied at 3.0-10.0 mils (75-250 microns) dft in a multi-coat system. Refer to Recommended Systems and Performance Tips Sections.

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 7.0 mils wet (175 microns):

	@ 35°F/1.7°C	@ 77°F/25°C 50% RH	@ 100°F/38°C
To touch:	4-5 hours	2 hours	1.5 hours
To handle:	48 hours	8 hours	4.5 hours
To recoat:			
minimum:	48 hours	8 hours	4.5 hours
maximum:	1 year	1 year	1 year
To cure:			
Service:	10 days	7 days	4 days
Immersion:	14 days	7 days	4 days
Pot Life:	10 hours	4 hours	2 hours
Sweat-in-time:	30 minutes	30 minutes	15 minutes

If maximum recoat time is exceeded, abrade surface before recoating. Drying time is temperature, humidity, and film thickness dependent. Paint temperature must be at least 40°F (4.5°C) minimum.

When used as an intermediate coat as part of a multi-coat system:

Drying Schedule @ 5.0 mils wet (125 microns):

	@ 35°F/1.7°C	@ 77°F/25°C 50% RH	@ 100°F/38°C
To touch:	3 hours	1 hour	1 hour
To handle:	48 hours	4 hours	2 hours
To recoat:			
minimum:	16 hours	4 hours	2 hours
maximum:	1 year	1 year	1 year

PRODUCT CHARACTERISTICS (CONT'D)

Shelf Life:	36 months, unopened Store indoors at 40°F (4.5°C) to 110°F (43°C).
Flash Point:	91°F (33°C), TCC, mixed
Reducer/Clean Up:	Reducer, R7K15
In California:	Reducer R7K111 or Oxsol 100

PERFORMANCE CHARACTERISTICS

Substrate*: Steel
Surface Preparation*: SSPC-SP10/NACE 2
System Tested*:
1 ct. Macropoxy 646 Fast Cure @ 6.0 mils (150 microns) dft
*unless otherwise noted below

Test Name	Test Method	Results
Abrasion Resistance	ASTM D4060, CS17 wheel, 1000 cycles, 1 kg load	84 mg loss
Accelerated Weathering-QUV¹	ASTM D4587, QUV-A, 12,000 hours	Passes
Adhesion	ASTM D4541	1,037 psi
Corrosion Weathering¹	ASTM D5894, 36 cycles, 12,000 hours	Rating 10 per ASTM D714 for blistering; Rating 9 per ASTM D610 per rusting
Nuclear Decontamination	ASTM D4256/ANSI N 5.12	99% Water Wash; 95% Overall
Direct Impact Resistance²	ASTM D2794 Modified	**120 in. lb.
Dry Heat Resistance	ASTM D2485	250°F (121°C)
Exterior Durability	1 year at 45° South	Excellent, chalks
Flexibility	ASTM D522, 180° bend, 3/4" mandrel	Passes
Fuel Contribution	NFPA 259	5764 btu/lb
Humidity Resistance	ASTM D4585, 6000 hours	No blistering, cracking, or rusting
Immersion	1 year fresh and salt water	Passes, no rusting, blistering, or loss of adhesion
Radiation Tolerance	ASTM D4082 / ANSI 5.12	Pass at 21 mils (525 microns)
Pencil Hardness	ASTM D3363	3H
Salt Fog Resistance¹	ASTM B117, 6,500 hours	Rating 10 per ASTM D610 for rusting; Rating 9 per ASTM D1654 for corrosion
Slip Coefficient, Mill White*	AISC Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts	Class A, 0.36
Surface Burning	ASTM E84/NFPA 255	Flame Spread Index 20; Smoke Development Index 35 (at 18 mils or 450 microns)
Water Vapor Permeance	ASTM D1653, Method B	1.16 US perms

Epoxy coatings may darken or discolor following application and curing.

*Refer to Slip Certification document

** Performed on 1/16 inch blasted steel

Footnotes:

¹ Zinc Clad II Plus Primer

² Two coats of Macropoxy 646 Fast Cure Epoxy

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Protective & Marine Coatings

MACROPOXY® 646 FAST CURE EPOXY

PART A **B58-600**
PART B **B58V600**

SERIES
HARDENER

Revised: August 23, 2017

PRODUCT INFORMATION

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RECOMMENDED USES

- Marine applications
- Fabrication shops
- Pulp and paper mills
- Power plants
- Offshore platforms
- Nuclear Power Plants
- Nuclear fabrication shops
- Mill White and Black are acceptable for immersion use for salt water and fresh water, not acceptable for potable water
- Suitable for use in USDA inspected facilities
- Acceptable for use in Canadian Food Processing facilities, categories: D1, D2, D3 (Confirm acceptance of specific part numbers/boxes with your VV Sales Representative)
- Conforms to AWWA D102 OCS #5
- Conforms to MPI # 108
- This product meets specific design requirements for non-safety related nuclear plant applications in Level II, III and Balance of Plant, and DOE nuclear facilities*.
- * Nuclear qualifications are NRC license specific to the facility.
- Suitable for use in the Mining & Minerals Industry
- Acceptable for use over and/or under Loxon S1 and Loxon H1 Caulking

RECOMMENDED SYSTEMS

		Dry Film Thickness / ct.	
		Mils	(Microns)
Immersion and atmospheric:			
Steel:			
2 cts.	Macropoxy 646 Fast Cure Epoxy	5.0-10.0	(125-250)
Concrete/Masonry, smooth:			
2 cts.	Macropoxy 646 Fast Cure Epoxy	5.0-10.0	(125-250)
Concrete Block:			
1 ct.	Kem Cati-Coat HS Epoxy Filler/Sealer	10.0-20.0	(250-500)
<i>as needed to fill voids and provide a continuous substrate.</i>			
2 cts.	Macropoxy 646 Fast Cure Epoxy	5.0-10.0	(125-250)
Atmospheric:			
Steel:			
(Shop applied system, new construction, AWWA D102, can also be used at 3 mils / 75 microns minimum dft when used as an intermediate coat as part of a multi-coat system)			
1 ct.	Macropoxy 646 Fast Cure Epoxy	3.0-6.0	(75-150)
1-2 cts.	of recommended topcoat		
Steel:			
1 ct.	Recoat Epoxy Primer	4.0-6.0	(100-150)
2 cts.	Macropoxy 646 Fast Cure Epoxy	5.0-10.0	(125-250)
Steel:			
1 ct.	Macropoxy 646 Fast Cure Epoxy	5.0-10.0	(125-250)
1-2 cts.	Acrolon 218 Polyurethane	3.0-6.0	(75-150)
	or Hi-Solids Polyurethane	3.0-5.0	(75-125)
	or SherThane 2K Urethane	2.0-4.0	(50-100)
	or Hydrogloss	2.0-4.0	(50-100)
Steel:			
2 cts.	Macropoxy 646 Fast Cure Epoxy	5.0-10.0	(125-250)
1-2 cts.	Tile-Clad HS Epoxy	2.5-4.0	(63-100)
Steel:			
1 ct.	Zinc Clad II Plus	2.0-4.0	(50-100)
1 ct.	Macropoxy 646 Fast Cure Epoxy	3.0-10.0	(75-250)
1-2 cts.	Acrolon 218 Polyurethane	3.0-6.0	(75-150)
Steel:			
1 ct.	Zinc Clad III HS	3.0-5.0	(75-125)
	or Zinc Clad IV	3.0-5.0	(75-125)
1 ct.	Macropoxy 646 Fast Cure Epoxy	3.0-10.0	(75-250)
1-2 cts.	Acrolon 218 Polyurethane	3.0-6.0	(75-150)
Aluminum:			
2 cts.	Macropoxy 646 Fast Cure Epoxy	2.0-4.0	(50-100)
Galvanizing:			
2 cts.	Macropoxy 646 Fast Cure Epoxy	2.0-4.0	(50-100)
FIRETEX M89/02, M90, M90/02, and M93/02:			
Steel & Galvanized Substrates being primed for FIRETEX only:			
1 ct.	Macropoxy 646 Fast Cure Epoxy	2.0-5.0	(50-125)

The systems listed above are representative of the product's use, other systems may be appropriate.

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Refer to product Application Bulletin for detailed surface preparation information.

Minimum recommended surface preparation:

Iron & Steel			
Atmospheric:		SSPC-SP2/3 or SSPC-SP WJ-3/NACE WJ-3L	
Immersion:		SSPC-SP10/NACE 2, 2-3 mil (50-75 micron) profile or SSPC-SP WJ-2/NACE WJ-2L	
Aluminum:			
		SSPC-SP1	
Galvanizing:		SSPC-SP1; See Surface Preparations section on page 3 for application of FIRETEX intumescent coating systems	
Concrete & Masonry			
Atmospheric:		SSPC-SP13/NACE 6, or ICRI No. 310.2R, CSP 1-3	
Immersion:		SSPC-SP13/NACE 6-4.3.1 or 4.3.2, or ICRI No. 310.2R, CSP 2-4	

Surface Preparation Standards

Condition of Surface	ISO 8501-1 BS7079:A1	SSPC	NACE
White Metal	Sa 3	SP 5	1
Near White Metal	Sa 2.5	SP 10	2
Commercial Blast	Sa 2	SP 6	3
Brush-Off Blast	Sa 1	SP 7	4
Hand Tool Cleaning	C St 2	SP 2	-
Pitted & Rusted	D St 2	SP 2	-
Rusted	C St 3	SP 3	-
Pitted & Rusted	D St 3	SP 3	-

TINTING

Tint Part A with Maxitones at 150% strength. Five minutes minimum mixing on a mechanical shaker is required for complete mixing of color.

Tinting is not recommended for immersion service.

APPLICATION CONDITIONS

Temperature:	
Air:	35°F (1.7°C) minimum, 120°F (49°C) maximum
Surface:	35°F (1.7°C) minimum, 250°F/120°C maximum
Material:	40°F (4.5°C) minimum, 120°F (49°C) maximum
Relative humidity:	Min 5°F (2.8°C) above dew point 85% maximum

Refer to product Application Bulletin for detailed application information.

ORDERING INFORMATION

Packaging:	
Part A:	1 gallon (3.78L) and 5 gallon (18.9L) containers
Part B:	1 gallon (3.78L) and 5 gallon (18.9L) containers
Weight:	
	12.9 ± 0.2 lb/gal ; 1.55 Kg/L mixed, may vary by color

SAFETY PRECAUTIONS

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WARRANTY

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Protective & Marine Coatings

MACROPOXY® 646 FAST CURE EPOXY

PART A B58-600 SERIES
PART B B58V600 HARDENER

Revised: August 23, 2017

APPLICATION BULLETIN

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SURFACE PREPARATIONS

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Iron & Steel, Atmospheric Service:

Minimum surface preparation is Hand Tool Clean per SSPC-SP2. Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. For better performance, use Commercial Blast Cleaning per SSPC-SP6/NACE 3, blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils / 50 microns). Prime any bare steel within 8 hours or before flash rusting occurs.

Iron & Steel, Immersion Service:

Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Near White Metal Blast Cleaning per SSPC-SP10/NACE 2. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2-3 mils / 50-75 microns). Remove all weld spatter and round all sharp edges by grinding. Prime any bare steel the same day as it is cleaned.

Aluminum

Remove all oil, grease, dirt, oxide and other foreign material by Solvent Cleaning per SSPC-SP1.

Galvanized Steel

Allow to weather a minimum of six months prior to coating. Solvent Clean per SSPC-SP1 (recommended solvent is VM&P Naphtha). When weathering is not possible, or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test patch. Allow paint to dry at least one week before testing adhesion. If adhesion is poor, brush blasting per SSPC-SP7 is necessary to remove these treatments. Rusty galvanizing requires a minimum of Hand Tool Cleaning per SSPC-SP2, prime the area the same day as cleaned.

In preparing galvanized steel substrates for the application of FIRE-TEX intumescent coating systems, Surface Preparation Specification SSPC-SP 16 must be followed obtaining a surface profile of minimum 1.5 mils (38 microns). Optimum surface profile will not exceed 2.0 mils (50 microns).

Concrete and Masonry

For surface preparation, refer to SSPC-SP13/NACE 6, or ICRI No. 310.2R, CSP 1-3. Surfaces should be thoroughly clean and dry. Concrete and mortar must be cured at least 28 days @ 75°F (24°C). Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement and hardeners. Fill bug holes, air pockets and other voids with Steel-Seam FT910.

Concrete, Immersion Service:

For surface preparation, refer to SSPC-SP13/NACE 6, Section 4.3.1 or 1.3.2 or ICRI No. 310.2R, CSP 2-4.

Follow the standard methods listed below when applicable:

ASTM D4258 Standard Practice for Cleaning Concrete.
ASTM D4259 Standard Practice for Abrading Concrete.
ASTM D4260 Standard Practice for Etching Concrete.
ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete.

SSPC-SP 13/Nace 6 Surface Preparation of Concrete.

ICRI No. 310.2R Concrete Surface Preparation.

Previously Painted Surfaces

If in sound condition, clean the surface of all foreign material. Smooth, hard or glossy coatings and surfaces should be dulled by abrading the surface. Apply a test area, allowing paint to dry one week before testing adhesion. If adhesion is poor, or if this product attacks the previous finish, removal of the previous coating may be necessary. If paint is peeling or badly weathered, clean surface to sound substrate and treat as a new surface as above.

Surface Preparation Standards

Condition of Surface	ISO 8501-1 BS7079:A1	SSPC	NACE
White Metal	Sa 3	SP 5	1
Near White Metal	Sa 2.5	SP 10	2
Commercial Blast	Sa 2	SP 6	3
Brush-Off Blast	Sa 1	SP 7	4
Hand Tool Cleaning	Rusted	C St 2	SP 2
	Pitted & Rusted	D St 2	SP 2
Power Tool Cleaning	Rusted	C St 3	SP 3
	Pitted & Rusted	D St 3	SP 3

APPLICATION CONDITIONS

Temperature:

Air: 35°F (1.7°C) minimum, 120°F (49°C) maximum

Surface: 35°F (1.7°C) minimum, 250°F/(120°C) maximum

Material: 40°F (4.5°C) minimum, 120°F (49°C) maximum

Relative humidity: At least 5°F (2.8°C) above dew point
85% maximum

APPLICATION EQUIPMENT

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compliant with existing VOC regulations and compatible with the existing environmental and application conditions.

Reducer/Clean Up Reducer R7K15

In California..... Reducer R7K111

Airless Spray

Pump..... 30:1

Pressure..... 2800 - 3000 psi

Hose..... 1/4" ID

Tip017" - .023"

Filter 60 mesh

Reduction..... As needed up to 10% by volume

Conventional Spray

Gun DeVilbiss MBC-510

Fluid Tip E

Air Nozzle..... 704

Atomization Pressure..... 60-65 psi

Fluid Pressure..... 10-20 psi

Reduction..... As needed up to 10% by volume

Requires oil and moisture separators

Brush

Brush..... Nylon/Polyester or Natural Bristle

Reduction..... As needed up to 10% by volume

Roller

Cover 3/8" woven with solvent resistant core

Reduction..... As needed up to 10% by volume

Plural Component Spray ...Acceptable

Refer to April 2010 Technical Bulletin - "Application Guidelines for Macroxy 646 Fast Cure Epoxy & Recoatable Epoxy

Primer Utilizing Plural

Component Equipment"

If specific application equipment is not listed above, equivalent equipment may be substituted.



Protective & Marine Coatings

MACROPOXY® 646 FAST CURE EPOXY

PART A
PART B

B58-600
B58V600

SERIES
HARDENER

Revised: August 23, 2017

APPLICATION BULLETIN

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APPLICATION PROCEDURES

Surface preparation must be completed as indicated.

Mix contents of each component thoroughly with low speed power agitation. Make certain no pigment remains on the bottom of the can. Then combine one part by volume of Part A with one part by volume of Part B. Thoroughly agitate the mixture with power agitation. Allow the material to sweat-in as indicated prior to application. Re-stir before using.

When spraying above 120°F, reduce material 10% with R7K100. Spray apply only. Product will produce an orange peel appearance when applied at elevated temperatures.

If reducer solvent is used, add only after both components have been thoroughly mixed, after sweat-in.

Apply paint at the recommended film thickness and spreading rate as indicated below:

Recommended Spreading Rate per coat:

	Minimum	Maximum
Wet mils (microns)	7.0 (175)	13.5 (338)
Dry mils (microns)	5.0* (125)	10.0* (250)
~Coverage sq ft/gal (m ² /L)	116 (2.8)	232 (5.7)
Theoretical coverage sq ft/gal (m ² /L) @ 1 mil / 25 microns dft	1152 (28.2)	

*May be applied at 3.0-10.0 mils (75-250 microns) dft in a multi-coat system. Refer to Recommended Systems and Performance Tips Sections.

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 7.0 mils wet (175 microns):

	@ 35°F/1.7°C	@ 77°F/25°C 50% RH	@ 100°F/38°C
To touch:	4-5 hours	2 hours	1.5 hours
To handle:	48 hours	8 hours	4.5 hours
To recoat:			
minimum:	48 hours	8 hours	4.5 hours
maximum:	1 year	1 year	1 year
To cure:			
Service:	10 days	7 days	4 days
Immersion:	14 days	7 days	4 days
<i>If maximum recoat time is exceeded, abrade surface before recoating.</i>			
<i>Drying time is temperature, humidity, and film thickness dependent.</i>			
Paint temperature must be at least 40°F (4.5°C) minimum.			
Pot Life:	10 hours	4 hours	2 hours
Sweat-in-time:	30 minutes	30 minutes	15 minutes

When used as an intermediate coat as part of a multi-coat system:

Drying Schedule @ 5.0 mils wet (125 microns):

	@ 35°F/1.7°C	@ 77°F/25°C 50% RH	@ 100°F/38°C
To touch:	3 hours	1 hour	1 hour
To handle:	48 hours	4 hours	2 hours
To recoat:			
minimum:	16 hours	4 hours	2 hours
maximum:	1 year	1 year	1 year

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

CLEAN UP INSTRUCTIONS

Clean spills and spatters immediately with Reducer R7K15. Clean tools immediately after use with Reducer R7K15. In California use Reducer R7K111. Follow manufacturer's safety recommendations when using any solvent.

PERFORMANCE TIPS

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle.

Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.

Excessive reduction of material can affect film build, appearance, and adhesion.

Do not mix previously catalyzed material with new.

Do not apply the material beyond recommended pot life.

In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with Reducer R7K15. In California use Reducer R7K111.

Tinting is not recommended for immersion service.

Use only Mill White and Black for immersion service.

Insufficient ventilation, incomplete mixing, miscatalyzed, and external heaters may cause premature yellowing.

Excessive film build, poor ventilation, and cool temperatures may cause solvent entrapment and premature coating failure.

Quik-Kick Epoxy Accelerator is acceptable for use. See data page 4.99 for details.

When coating over aluminum and galvanizing, recommended dft is 2-4 mils (50-100 microns).

Acceptable for Concrete Floors.

Can be used as a metalizing sealer. Consult Technical Bulletin - Sealers for Thermal Spray Metalizing, or your local Sherwin-Williams representative.

Refer to Product Information sheet for additional performance characteristics and properties.

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

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WARRANTY

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**Protective
&
Marine
Coatings**

**ACROLON ULTRA
HIGH PERFORMANCE POLYURETHANE**

PART A B65W821	EXTRA WHITE TINT BASE	PART A B65B820	BLACK
PART A B65T824	ULTRADEEP TINT BASE	PART A B65R820	SAFETY RED
PART A B65Y820	SAFETY YELLOW	PART B B65V820	HARDENER

PRODUCT INFORMATION

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RECOMMENDED SYSTEMS

	Dry Film Thickness / ct.	
	Mils	(Microns)
Steel, Epoxy Primer:		
1 ct. Macropoxy 646	5.0-10.0	(125-250)
1-2 cts. Acrolon Ultra	2.0-3.0	(50-75)
Steel, Epoxy Primer:		
1 ct. Recoatable Epoxy Primer	4.0-6.0	(100-150)
1-2 cts. Acrolon Ultra	2.0-3.0	(50-75)
Steel, Epoxy Mastic Primer:		
1 ct. Epoxy Mastic Aluminum II	6.0	(150)
1-2 cts. Acrolon Ultra	2.0-3.0	(50-75)
Steel, Inorganic Zinc Rich Primer:		
1 ct. Zinc Clad II Plus	3.0-5.0	(75-125)
1 ct. Macropoxy 646	5.0-10.0	(125-250)
1 ct. Acrolon Ultra	2.0-3.0	(50-75)
Steel, Organic Zinc Rich Primer:		
1 ct. Corothane I GalvaPac Zinc Primer	3.0-4.0	(75-100)
1 ct. Macropoxy 646	5.0-10.0	(125-250)
1-2 cts. Acrolon Ultra	2.0-3.0	(50-75)
Aluminum/Galvanizing:		
1 ct. DTM Wash Primer	0.7-1.3	(17.5-32.5)
1-2 cts. Acrolon Ultra	2.0-3.0	(50-75)
Concrete/Masonry:		
1 ct. Kem Cati-Coat HS Epoxy	10.0-20.0	(250-500)
1-2 cts. Acrolon Ultra	2.0-3.0	(50-75)

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Refer to product Application Bulletin for detailed surface preparation information.

Minimum recommended surface preparation:
 * Iron & Steel: SSPC-SP6/NACE 3, 2 mil (50 micron) profile
 * Primer Required

Surface Preparation Standards					
Condition of Surface	ISO 8501-1 BS7079:A1	Swedish Std. SIS055900	SSPC	NACE	
White Metal	Sa 3	Sa 3	SP 5	1	
Near White Metal	Sa 2.5	Sa 2.5	SP 10	2	
Commercial Blast	Sa 2	Sa 2	SP 6	3	
Brush-Off Blast	Sa 1	Sa 1	SP 7	4	
Hand Tool Cleaning	C St 2	C St 2	SP 2	-	
Pitted & Rusty	D St 2	D St 2	SP 2	-	
Power Tool Cleaning	C St 3	C St 3	SP 3	-	
Pitted & Rusty	D St 3	D St 3	SP 3	-	

TINTING

Tint with Maxitoner Colorants only into Part A. Extra White tints at 100% tint strength. Ultradeep tints at 100% tint strength. Five minutes minimum mixing on a mechanical shaker is required for complete mixing of color.

APPLICATION CONDITIONS

Temperature: 40°F (4.5°C) minimum, 120°F (49°C) maximum (air, surface, and material)
 At least 5°F (2.8°C) above dew point
 Relative humidity: 85% maximum

Refer to product Application Bulletin for detailed application information.

ORDERING INFORMATION

Packaging:
 Part A: 4 gallon (15.2L) kits
 Part B: 1 gallon (3.78L) units

Weight:
 White: 10.11 ± 0.2 lb/gal ; 1.21 Kg/L
 Ultradeep Tint Base: 9.62 ± 0.2 lb/gal ; 1.15 Kg/L mixed, may vary with color

SAFETY PRECAUTIONS

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Protective & Marine Coatings

ACROLON ULTRA HIGH PERFORMANCE POLYURETHANE

PART A B65W821	EXTRA WHITE TINT BASE	PART A B65B820	BLACK
PART A B65T824	ULTRADEEP TINT BASE	PART A B65R820	SAFETY RED
PART A B65Y820	SAFETY YELLOW	PART B B65V820	HARDENER

Revised 9/12

APPLICATION BULLETIN

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SURFACE PREPARATIONS

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Iron & Steel

Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Commercial Blast Cleaning per SSPC-SP6/NACE 3. For better performance, use Near White Metal Blast Cleaning per SSPC-SP10/NACE 2. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils / 50 microns). Prime any bare steel the same day as it is cleaned or before flash rusting occurs.

Aluminum

Remove all oil, grease, dirt, oxide and other foreign material by Solvent Cleaning per SSPC-SP1. Primer required.

Galvanized Steel

Allow to weather a minimum of six months prior to coating. Solvent Clean per SSPC-SP1. When weathering is not possible, or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test patch. Allow paint to dry at least one week before testing adhesion. If adhesion is poor, brush blasting per SSPC-SP7 is necessary to remove these treatments. Rusty galvanizing requires a minimum of Hand Tool Cleaning per SSPC-SP2, prime the area the same day as cleaned or before flash rusting occurs. Primer required.

Concrete and Masonry

For surface preparation, refer to SSPC-SP13/NACE 6, or ICRI No. 310.2, CSP 1-3. Surfaces should be thoroughly clean and dry. Concrete and mortar must be cured at least 28 days @ 75°F (24°C). Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement and hardeners. Fill bug holes, air pockets and other voids with Steel-Seam FT910. Primer required.

Follow the standard methods listed below when applicable:

ASTM D4258 Standard Practice for Cleaning Concrete.
 ASTM D4259 Standard Practice for Abrading Concrete.
 ASTM D4260 Standard Practice for Etching Concrete.
 ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete.
 SSPC-SP 13/Nace 6 Surface Preparation of Concrete.
 ICRI No. 310.2 Concrete Surface Preparation.

Surface Preparation Standards

Condition of Surface	ISO 8501-1 BS7079:A1	Swedish Std. SIS055900	SSPC	NACE
White Metal	Sa 3	Sa 3	SP 5	1
Near White Metal	Sa 2.5	Sa 2.5	SP 10	2
Commercial Blast	Sa 2	Sa 2	SP 6	3
Brush-Off Blast	Sa 1	Sa 1	SP 7	4
Hand Tool Cleaning	OC St 2	OC St 2	SP 2	-
Rusted	OC St 2	OC St 2	SP 2	-
Pitted & Rusted	OC St 2	OC St 2	SP 2	-
Rusted	OC St 3	OC St 3	SP 3	-
Power Tool Cleaning	D St 3	D St 3	SP 3	-
Pitted & Rusted	D St 3	D St 3	SP 3	-

APPLICATION CONDITIONS

Temperature:	40°F (4.5°C) minimum, 120°F (49°C) maximum (air, surface, and material) At least 5°F (2.8°C) above dew point
Relative humidity:	85% maximum

APPLICATION EQUIPMENT

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compliant with existing VOC regulations and compatible with the existing environmental and application conditions.

Reducer:	R7K225 or R7K111
Clean Up:	R7K58

Airless Spray

Pressure.....	2500 - 2800 psi
Hose.....	3/8" ID
Tip.....	.013" - .017"
Filter.....	none
Reduction.....	As needed up to 10% by volume

Conventional Spray

Gun.....	Binks 95
Fluid Nozzle.....	63 B
Atomization Pressure.....	50 - 70 psi
Fluid Pressure.....	20 - 25 psi
Reduction.....	As needed up to 5% by volume

Brush

Brush.....	Natural bristle
Reduction.....	As needed up to 5% by volume

Roller

Cover.....	3/8" woven with solvent resistant core
Reduction.....	as needed up to 5% by volume

If specific application equipment is not listed above, equivalent equipment may be substituted.



Protective & Marine Coatings

ACROLON ULTRA HIGH PERFORMANCE POLYURETHANE

PART A B65W821	EXTRA WHITE TINT BASE	PART A B65B820	BLACK
PART A B65T824	ULTRADEEP TINT BASE	PART A B65R820	SAFETY RED
PART A B65Y820	SAFETY YELLOW	PART B B65V820	HARDENER

APPLICATION BULLETIN

5.36

APPLICATION PROCEDURES

Surface preparation must be completed as indicated.

Mix contents of each component thoroughly with power agitation. Make certain no pigment remains on the bottom of the can. Then combine 4 parts by volume of Part A with 1 part by volume of Part B. Thoroughly agitate the mixture with power agitation.

If reducer solvent is used, add only after both components have been thoroughly mixed.

Apply paint at the recommended film thickness and spreading rate as indicated below:

Recommended Spreading Rate per coat:

	Minimum	Maximum
Wet mils (microns)	3.5 (87.5)	5.5 (137.5)
Dry mils (microns)	2.0 (50)	3.0 (75)
~Coverage sq ft/gal (m ² /L)	305 (7.5)	460 (11.3)

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 4.5 mils wet (112.5 microns):

	@ 40°F/4.5°C	@ 77°F/25°C	@ 120°F/49°C
		50% RH	
To touch:	4 hours	2 hours	1 hour
To handle:	12 hours	6 hours	4 hours
To recoat:			
minimum:	12 hours	6 hours	4 hours
maximum:	120 days	120 days	120 days
To cure:	14 days	10 days	7 days
<i>If maximum recoat time is exceeded, abrade surface before recoating.</i>			
<i>Drying time is temperature, humidity, and film thickness dependent.</i>			
Pot Life:	8 hours	4 hours	2 hours
Sweat-in-Time:	None required		

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

CLEAN UP INSTRUCTIONS

Clean spills and spatters immediately with R7K58. Clean tools immediately after use with R7K58. Follow manufacturer's safety recommendations when using any solvent.

DISCLAIMER

The information and recommendations set forth in this Product Data Sheet are based upon tests conducted by or on behalf of The Sherwin-Williams Company. Such information and recommendations set forth herein are subject to change and pertain to the product offered at the time of publication. Consult your Sherwin-Williams representative to obtain the most recent Product Data Information and Application Bulletin.

PERFORMANCE TIPS

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle.

Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.

Excessive reduction of material can affect film build, appearance, and adhesion.

Do not apply the material beyond recommended pot life.

Do not mix previously catalyzed material with new.

In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with MEK R6K10.

Mixed coating is sensitive to water. Use water traps in all air lines. Moisture contact can reduce pot life and affect gloss and color.

Acceptable application maximum DFT 4.0 mils / 100 microns (7.0 mils / 175 microns WFT).

Quick-Thane Urethane Accelerator is acceptable for use. See data page 5.97 for details.

E-Z Roll Urethane Defoamer is acceptable for use. See data page 5.99 for details.

Refer to Product Information sheet for additional performance characteristics and properties.

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

WARRANTY

The Sherwin-Williams Company warrants our products to be free of manufacturing defects in accord with applicable Sherwin-Williams quality control procedures. Liability for products proven defective, if any, is limited to replacement of the defective product or the refund of the purchase price paid for the defective product as determined by Sherwin-Williams. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY SHERWIN-WILLIAMS, EXPRESSED OR IMPLIED, STATUTORY, BY OPERATION OF LAW OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

3M™ Scotchkote™ Fusion-Bonded Epoxy Coating 134

INTERIOR PIPE COATING

Data Sheet and Application Guide

February 2016

Handling and Safety Precautions: Read all Health Hazard, Precautionary and First Aid, Material Safety Data Sheet, and product label prior to handling or use.

Product Description 3M Scotchkote Fusion-Bonded Epoxy Coating 134 is a one-part, heat curable, thermosetting epoxy coating designed for corrosion protection of metal. The epoxy is applied to preheated steel as a dry powder which melts and cures to a uniform coating thickness when properly applied. This bonding process provides excellent adhesion and coverage on applications such as valves, pumps, pipe drains, hydrants, pipes, tanks and porous castings. Scotchkote coating 134 is NSF/ANSI 61 certified for potable water applications and is also resistant to wastewater, corrosive soils, hydrocarbons, harsh chemicals, and sea water. Powder properties allow easy manual or automatic application by electrostatic or air-spray equipment.

Product Features

- No primer required for most applications.
- For electrostatic or air-spray application on preheated metal articles.
- Can be electrostatically applied to unheated metal parts and subsequently cured by baking.
- Long gel time allows application on large or complex articles, minimizing fear of runs, sags, laminations, or unsightly overspray.
- Especially useful for coating the inside of pipe or other fabrications where a smooth, corrosion resistant coating is required.
- Can be machined by grinding or cutting to meet close tolerance requirements.
- Allows easy visual inspection of coated articles.
- Can be painted with alkyd paint, acrylic lacquer, polyurethane, or acrylic enamel for color coding.
- Applied coating will not sag cold flow.
- Lightweight for lower shipping costs.
- Protects over wide temperature range.
- Resists direct burial soil stress.
- Resists cavitation and cathodic disbondment.
- Can be used for elevated temperature service in presence of H₂S, CO₂, CH₄, crude oil and brine when applied over phenolic primer such as 3M Scotchkote Liquid Phenolic Primer 345.
- Long-term performance history in water, sewage, and other service environments.
- Scotchkote coating 134 has been tested and certified to NSF /ANSI Standard 61, Drinking Water System Components. For NSF certified applications, the max approved thickness is 60 mil (1.5 mm) and the maximum approved operating temperature is 140°F/60°C. Primers may not be used for potable water applications.
- Scotchkote coating 134 meets the requirements of AWWA Standard C213 and C550.



3M™ Scotchkote™ Fusion-Bonded Epoxy Coating 134

Temperature Operating Range For non-potable water applications Scotchkote coating 134, when properly applied to a nominal thickness of 15 mils, should perform on pipelines operating between -100°F/-73°C to 203°F/95°C. For temperatures reaching 230°F/110°C thicker coatings, greater than 30 mils, may improve the service capability. However, it is difficult to accurately predict field performance from the laboratory data due to the wide variations in actual field conditions. Soil types, moisture content, temperatures, coating thickness, and other factors specific to the area all influence the coating performance and upper temperature operating limits.

General Application Information

1. Remove oil, grease and loosely adhering deposits.
2. Abrasive blast clean the surface to NACE No. 2/SSPC-SP10 ISO 8501:1, Grade SA 2 ½ near-white metal.
3. Apply mechanical masks or mask with materials such as 3M Scotch® Glass Cloth Tape 361 or 3M Aluminum Foil Tape 425 as required.
4. Preheat article to the desired application temperature per cure specifications.
5. Deposit Scotchkote coating 134 by powder spray to the specified thickness.
6. Cure according to cure specifications.
7. Visually and electrically inspect for coating flaws after the coating has cooled.
8. Repair all defects.

Cure Specifications Scotchkote coating 134 may be applied to metal articles which have been preheated to a temperature of 300°F/149°C to 475°F/246°C. After application, Scotchkote coating 134 must be cured according to the cure guide to achieve maximum performance properties.

If Scotchkote coating 134 is electrostatically applied to unheated parts, the cure time should be measured from the time the coated part reaches the cure temperature. After cure, the coating may be force cooled using air or water to facilitate inspection and handling.

3M™ Scotchkote™ Fusion-Bonded Epoxy Coating 134

Product - Physical and Chemical Properties

3M™ Scotchkote™ Fusion-Bonded Epoxy Coating 134 Cure Guide

Temperature of Article at Time of Powder Application	Typical Gel Time	Cure Time
475°F/246°C	40 seconds	7 minutes
450°F/232°C	60 seconds	10 minutes
400°F/204°C	120 seconds	15 minutes
350°F/177°C	330 seconds	25 minutes
425°F/218°C	90 seconds	25 minutes for NSF/ANSI 61 approved applications

Typical Properties

Property	Value
Color Forest Green	Color Forest Green
Specific Gravity – Powder (Air Pycnometer)	1.51
Coverage	127 ft ² /lb/mil (066 m ² /kg/mm)
Fluid Bed Density 33 lbs/ft ³ (530 kg/m ³)	33 lbs/ft ³ (530 kg/m ³)
Shelf Life at 80°F/27°C 18 months	Shelf Life at 80°F/27°C 18 months
Average Gel Time (400°F/204°C)	120 seconds
Edge Coverage	12% to 18%
Minimum Explosive Concentration	0.03 oz/ft ³ (30,6 g/m ³)
Ignition Temperature	986°F/530°C
V.O.C. (As Supplied)	0 g/L, as calculated

Chemical/Pressure/Temperature Resistance

Test Conditions	Gas Phase	Results
Autoclave, 120°F/49°C 48 hours, 1500 psi/10.3 MPa	99.5% CO ₂ 0.5% H ₂ S	Excellent adhesion, no coating loss or blisters in aqueous, hydrocarbon, or gas phase
Autoclave, 150°F/66°C 48 hours, 2200 psi/15.2 MPa	80% CH ₄ 12% CO ₂ 8% H ₂ S	Excellent adhesion, no coating loss or blisters in aqueous, hydrocarbon, or gas phase
Autoclave, 200°F/93°C 24 hours, 3300 psi/22.8 MPa	86% CH ₄ 8% CO ₂ 6% H ₂ S	Excellent adhesion, no coating loss or blisters in aqueous, hydrocarbon, or gas phase
Autoclave, 300°F/149°C 24 hours, 3000 psi/20.7 MPa	90% CH ₄ 10% CO ₂ Trace H ₂ S	Excellent adhesion, no coating loss or blisters in aqueous, hydrocarbon, or gas phase

All tests performed on 3M™ Scotchkote™ Fusion Bonded Epoxy Coating 134 applied over a 1 mil/25,4 µm phenolic primer. Liquid phase for all test conditions: 33% kerosene, 33% toluene, 34% brine solution of 5% NaCl.

3M™ Scotchkote™ Fusion-Bonded Epoxy Coating 134

Continued Product - Physical and Chemical Properties

Chemical Resistance Testing

ASTM G20-10 Immersion Testing at 20°C

Solution	30 days	60 days	90 days
Acetic Acid (5%)	No blistering or disbondment	No blistering or disbondment	No blistering or disbondment
Acetone	No blistering or disbondment, coating is slightly rubbery	No blistering or disbondment, coating is slightly rubbery	No blistering or disbondment, coating is slightly rubbery
Carbon Disulfide	No blistering or disbondment	No blistering or disbondment	No blistering or disbondment
Gasoline	No blistering or disbondment	No blistering or disbondment	No blistering or disbondment
Hydrochloric Acid (10%)	No blistering or disbondment	No blistering or disbondment	No blistering or disbondment
Kerosene	No blistering or disbondment	No blistering or disbondment	No blistering or disbondment
Lime Water, Saturated	No blistering or disbondment	No blistering or disbondment	No blistering or disbondment
Methyl Alcohol	No blistering or disbondment	No blistering or disbondment	No blistering or disbondment
Methyl Ethyl Ketone	No blistering or disbondment, coating is slightly rubbery	No blistering or disbondment, coating is slightly rubbery	No blistering or disbondment, coating is slightly rubbery
Nitric Acid (10%)	Discoloration; No blistering or disbondment	Discoloration; No blistering or disbondment	Discoloration; No blistering or disbondment
Sodium Carbonate Solution (20%)	No blistering or disbondment	No blistering or disbondment	No blistering or disbondment
Sodium Chloride Solution (10%)	No blistering or disbondment	No blistering or disbondment	No blistering or disbondment
Sodium Hydroxide Solution (10%)	No blistering or disbondment	No blistering or disbondment	No blistering or disbondment
Sulfuric Acid (30%)	No blistering or disbondment	No blistering or disbondment	Slight discoloration; No blistering or disbondment
Toluene	No blistering or disbondment	No blistering or disbondment	No blistering or disbondment
Trichloroethylene	No blistering or disbondment, coating is slightly rubbery	No blistering or disbondment, coating is slightly rubbery	No blistering or disbondment, coating is slightly rubbery

3M™ Scotchkote™ Fusion-Bonded Epoxy Coating 134

Continued Product - Physical and Chemical Properties

3M internal – Historical Chemical Resistance testing based on similar, but not identical products.**

Testing Temperature 73°F (23°C*)

Acetic Acid up to 25%	Ferric Nitrate	Potassium Borate
	Ferric Sulfate	Potassium Carbonate
Aluminum Chloride	Ferrous Nitrate	Potassium Chloride
Aluminum Hydroxide	Ferrous Sulfate	Potassium Dichromate up to 10%
Aluminum Nitrate	Formaldehyde up to 100%	Potassium Hydroxide
Aluminum Sulfate	Formic Acid up to 10%	Potassium Nitrate
Ammonium Carbonate	Freon; gas and liquid	Potassium Sulfate
Ammonium Chloride	Gas (Mfg)	Propylene Glycol
Ammonium Hydroxide up to 100%	Gas (Natural)	Sewage
Ammonium Nitrate	Gasoline Leaded	Silver Nitrate
Ammonium Phosphate	Gasoline Unleaded	Soap Solution
Ammonium Sulfate	Glycerine	Soaps
Amyl Alcohol	Heptane	Sodium Bicarbonate
Barium Carbonate	Hexane	Sodium Bisulfate
Barium Chloride	Hexylene Glycol	Sodium Carbonate
Barium Hydroxide	Hydrochloric Acid up to 25%	Sodium Chlorate
Barium Nitrate	Hydrofluoric Acid up to 40%	Sodium Chloride
Barium Sulfate	Hydrogen Sulfide	Sodium Hydroxide
Benzene	Isopropyl Alcohol	Sodium Meta Silicate up to 5%
Boric Acid	Jet Fuel	Sodium Nitrate
Borax		Sodium Sulfate
Butyl Alcohol	Linseed Oil	Sodium Thiosulfate up to 5%
Cadmium Chloride	Lubricating Oil	Stannic Chloride
Cadmium Nitrate	Magnesium Carbonate	Sulfur
Cadmium Sulfate	Magnesium Chloride	Sulfuric Acid up to 60%
Calcium Carbonate	Magnesium Hydroxide	Synthetic Sea Fuel (60% Naphtha,
Calcium Chloride	Magnesium Nitrate	20% Toluene, 15% Xylene,
Calcium Hydroxide	Magnesium Sulfate	5% Benzene)
Calcium Nitrate		Synthetic Silage
Calcium Sulfate	Mercuric Chloride	Tetrapropylene
Calcium Disulfide	Methanol (softened)	Toluene
Carbon Tetrachloride	MIBK (Methyl Isobutyl Ketone)	
Caustic Potash	Mineral Oil	Triethylene Glycol
Caustic Soda	Mineral Spirits	Trisodium Phosphate
Chlorine 2%	Molasses	Turpentine
Citric Acid up to 25%	Motor Oil	Undecanol
Copper Chloride	Muriatic Acid	Urea
Copper Nitrate	Naphtha	Urine
Copper Sulfate	Nickel Chloride	Vinegar
Crude Oil	Nickel Nitrate	Water
Cyclohexane	Nickel Sulfate	Chlorinated
Cyclohexene	Nitric Acid up to 30%	Demineralized
Cyclopentane	Nonane	Distilled
Detergent	Octane	Salt
Diesel Fuel	Oxalic Acid	Sea
Diethylene Glycol	Pentane	Xylo
Dipropylene Glycol	Perchloroethylene	Zinc Chloride
Ethanol (softened)	Phosphoric Acid up to 50%	Zinc Nitrate
Ethylbenzene	Phosphorous Trichloride	Zinc Sulfate
Ethylene Glycol	Potassium Aluminum Sulfate	10-10-10 Fertilizer, Saturated
Ferric Chloride up to 50%	Potassium Bicarbonate	

**Tests conducted for two years. No effect unless otherwise stated.

3M™ Scotchkote™ Fusion-Bonded Epoxy Coating 134

Storage In a cool dry location less than 80°F (27°C)

Shelf-Life 18 months from date of manufacture

Availability For ordering, technical, product information, or the Safety Data Sheet, call:
Phone: 800-722-6721
Fax: 877-601-1305

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www.3M.com/corrosion

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78-8141-8528-2 Rev A

EFI's APS FLOOR COATING!



EFI has begun offering its new APS Floor Coating on all of its Water-Shed® stations in *dark gray*.

Our APS floor coating system is a Polyurea Spray Elastomer offering superior **ABRASION RESISTANCE, CHEMICAL and CORROSION PROTECTION** while providing a **SAFER WORK ENVIRONMENT**.

It can withstand the harshest elements encountered in any municipal or industrial water application.

Our APS Floor Coating offers durable protection that permanently bonds to steel surfaces and provides complete chemical and corrosion protection for all flooring substrate surfaces. It provides an impenetrable barrier to protect station flooring in all environments typically found in the water pumping, treatment or distribution market.

In addition, the APS Floor Coating helps to enhance safety by providing a non-skid surface when wet conditions may create a slip hazard.

The coating is applied to 100-125 mils, making it 3 1/2 times stronger than coatings usually found in pick-up truck beds.

Basic Physical Properties:

All tests are performed by OCM Test Laboratories.

- ISO 17025 Certified
- American Association for Laboratory Accreditation (A2LA)

Test Name	Test Methods	Value
Water Vapor Trans.	ASTM E96	0.499 Grains/Hr Sq.Ft.
Dielectric Const.	ASTM D150	3.6
Flexural Strength	ASTM D790	2,630 PSI
Volume Resistance	ASTM D257	2.3x10 ¹⁴ ohm cm
Elongation	ASTM D412	162%
Tensile Strength	ASTM D412	3,432 PSI
Flexural Modulus	ASTM D790	0.056 MSI
Fungus Test	MIL-STD 810F	Pass
Coefficient of Friction	ASTM D1894	
Static		0.305
Kinetic		0.127
Taber Abrasion (gm Loss/1000 cycles)	ASTM D4060	0.0698
Tear Strength	ASTM D624	783 PSI
Hardness Shore D	ASTM D2240	60 ±1
Pull-off Test-Adhesion	ASTM C297	
To-Metal - No Primer		1,800 PSI
To-Metal - XPM Primer		1,910 PSI
To-Metal - LXS F515 Primer		1,870 PSI
Dissipation Factor	ASTM D150	0.031

The strength and durability of **EFI APS** Floor coating is clear! Imagine what it can do on your next **EFI** station!



"EFI-Solutions; first in Quality, Cost, Delivery and Customer Service!"

To learn more, contact your local **EFI** Representative for more information.



Chemical Resistances per ASTM D543

Chemical Names	Volume Change (%)	Elongation ASTM D412 Change (%)	Hardness Change (%)	Tensile Strength ASTM D412 Change
Sodium Carbonate 10%	4%	57%	-8%	23%
Potassium Hydroxide 50%	2%	65%	-3%	47%
Water (H2O)	2%	77%	-9%	29%
Saline Solution 30%	3%	NA	-8%	NA
Sodium Chloride 30%	2%	63%	-4%	31%
Tannic Acid 40%	4%	47%	-7%	30%
Phosphoric Acid 50%	4%	46%	-5%	27%
Sodium Sulfate 20%	2%	74%	-1%	30%
Sulfuric Acid 10%	2%	54%	-8%	28%
Toluene	17%	-29%	-18%	-63%
Sulfuric Acid 25%	2%	67%	-2%	39%
Sodium Sulfate 30%	5%	54%	-7%	6%
Xylene	17%	-3%	-24%	-59%
1,1,1 - Trichloroethylene	8%	-53%	-13%	-79%
Sodium Hydroxide 50%	0%	-9%	4%	49%
Sea Water	3%	79%	-7%	24%
Sugar Solution 30%	2%	62%	-6%	23%
Sodium Hydroxide 10%	2%	74%	-8%	26%



UL XP-461

April 2022

TECHNICAL DATA SHEET

PRODUCT MANUFACTURER

ULTIMATE LININGS
10301 Round Up Lane
Houston TX, 77064
800-989-9869

GENERAL PRODUCT DESCRIPTION

UL XP-461 is a 100% solids, two-component, high performance aromatic pure polyurea spray elastomer system. UL XP-461 is designed as a user-friendly product for moisture insensitive applications because of its pure polyurea chemistry and offers exceptional adhesion properties for properly prepared substrates. UL XP-461 produces an excellent skin formation for chemical resistance and moisture protection.

APPLICATION GUIDELINES

Both the Iso "A" Side and Resin "B" Side should be preconditioned between 70°F to 90°F (21°C to 32°C) before application. UL XP-461 must be applied using high-pressure, plural component, heated, 1:1 by volume, spray equipment with a minimum of 2,000 psi fluid pressure capability. UL XP-461 material (both Iso "A" Side and Resin "B" Side) should be heated between 140°F to 160°F (60°C to 71°C). Spray equipment must generate adequate fluid pressure for proper mixing and best polymerization results.

APPLICATION EQUIPMENT

UL XP-461 is designed to be sprayed through high-pressure impingement mixing equipment. Plural component spray equipment must have material heat-control capability, 1:1 by volume, and sprayable with round or flat tip. Refer to equipment manufacturer for equipment specifics and accessories.

EQUIPMENT SETTING PARAMETERS

Iso "A" and Polyol "B" components must be pumped by low-pressure transfer pumps to a suitable high-pressure proportional pumping system.

Temperature Settings

Iso "A" Block Heater:	140°F - 160°F
Resin "B" Block Heater:	140°F - 160°F
Hoses (Iso and Polyol):	140°F - 160°F

Hydraulic Pressure Setting

Equipment Hydraulic Pressure: 2,000 - 2,500 psi

EQUIPMENT CLEAN UP

Spray equipment should be cleaned immediately after use following equipment manufacturer's recommended procedures. Please refer to spray equipment operating and maintenance procedures for further details. UL XP-461 should be cleaned with environmentally safe urethane-grade cleaners. Cleaning materials must be free of reactive contaminants such as water and alcohol. All gun cleaners and spray equipment cleaning materials must be used and disposed of as permitted under local rules and regulations.

MATERIAL STORAGE

UL XP-461 has a shelf life of twelve (12) months from manufacture date in factory sealed containers. UL XP-461 should be stored between 60°F to 100 °F (16°C to 38°C). Do not expose unused materials to high humidity conditions. Always provide airtight reseal conditions to unused materials. For materials that are currently connecting to the pumps, always provide as much airtight and moisture free conditions to unused materials as possible to ensure proper chemical performance. Drums should be stored on pallets to avoid direct contact with the warehouse floor/ground.

SAFETY AND HANDLING

Please refer to Safety Data Sheets (SDS) for safety and handling of this material. All personnel working with this material are expected to read and understand all safety recommendations per SDS. All Personal Protection Equipment must be properly worn to comply with worker health and safety requirements.



UL XP-461

April 2022

TECHNICAL DATA SHEET

CHEMICAL TECHNICAL DATA

Conditions: 77°F and 50% Rel. Humidity	
Mix Ratio by Volume	1A:1B
Gel Time	2 to 5 sec.
Tack Free Time	5 to 10 sec.
Density "A" Side (lbs/gal)	9.50
Density "B" Side (lbs/gal)	8.40
Viscosity "A" Side	1000 ± 150 cP
Viscosity "B" Side	370 ± 150 cP

LIMITATIONS

The chemical resistance chart should be consulted prior to application; this is an exhaustive chemical compatibility list quantifying pre- and post-physical properties for chemicals exposure per ASTM D543. Application specific processing parameters such as temperature and operating pressure of coated objects must be considered before installing UL XP-461 coatings system.

BASIC PHYSICAL PROPERTIES

All tests are performed by independent third-party material test laboratories:

- OCM Test Laboratories
- ISO 17025 Certified
- American Association for Laboratory Accreditation (A2LA)
- Truesdail Laboratories, Inc.
- Pira International Material Test Lab
- Associated Polymer Labs, Inc.

PRODUCT USER RESPONSIBILITIES

Users of UL XP-461 product are responsible for reading the general guidelines, product data sheets, specifications and Safety Data Sheets (SDS) before using this material. Printed technical data and instructions are subject to change without notice. Contact your local ULTIMATE LININGS representative or visit our website www.ultimatelinings.com for current technical data instructions.

Test Name	Test Method	Value
Coefficient of Friction Static Kinetic	ASTM D1894	0.530 0.434
DMA Test (Loss Modulus, E" Tg)	ASTM D4065	-34°C
Elongation	ASTM D412	161%
Hardness Shore D	ASTM D2240	60 ± 1
Taber Abrasion (mg Loss/1000 cycles)	ASTM D4060	24.9 mg
Tear Strength	ASTM D624	658 pli
Tensile Strength	ASTM D412	2,958 psi
Flammability of Interior Materials	FMVSS 302	Pass
Impact	ASTM D2794	320 in. lbs. no failure

ADDITIONAL PRODUCT CERTIFICATIONS

- Complies with USFDA Coating Regulations for Incidental-Food-Contact Applications (Keller and Heckman LLP Letter of Opinion)



UL XP-461

April 2022

TECHNICAL DATA SHEET

CHEMICAL RESISTANCES PER ASTM D543 FOR IMMERSION IN FLUIDS METHODS

UL XP-461 materials are immersed in the chemicals below for a period of 7 days; physical properties of pre- and post-immersion were measured to quantify the changes in product physical properties.

Chemicals Name	Tensile Strength ASTM D412 Change (%)	Elongation ASTM D412 Change (%)	Hardness Change (%)	Mass Change (%)	Density Change (%)	Rating
Acetic Acid 10%	-32.62	21.62	-12.70	4.42	0.33	4
Ammonium Chloride 30%	-12.31	21.62	-3.17	1.13	0.19	2
Ammonium Hydroxide	-10.77	28.38	-1.59	2.33	0.59	2
Automotive Oil	-34.46	6.08	-7.94	0.61	0.26	3
Baking Soda 25%	-14.77	15.54	-9.52	1.51	0.25	2
Bleach (Chloride)	-20.31	19.59	-9.52	2.41	-0.12	2
Boric Acid 3%	-25.23	7.43	-4.76	1.78	-2.81	2
Calcium Chloride 50%	-8.62	12.84	-4.76	1.15	0.15	1
Calcium Hypochloride 5%	-16.92	10.14	-3.17	1.60	0.03	1
Citric Acid 10%	-15.08	18.92	-7.94	1.74	0.22	1
Club Soda	-17.85	18.24	-7.94	1.80	0.23	2
Cream Soda (POP)	-24.31	21.62	-6.35	1.82	0.19	2
Crude Oil (Heating)	2.46	5.41	-3.17	0.46	0.11	1
DEF	1.54	26.81	0.77	1.25	2.18	2
Diesel Fuel	-3.38	4.73	-12.70	1.58	-0.38	3
Ethylene Glycol	-2.77	18.24	-4.76	0.76	-0.45	1
Hydrochloric acid 5%	-27.69	-9.46	-6.35	0.35	0.17	2
Kerosene	-11.38	4.05	1.59	3.32	-10.28	2
Lactic Acid 20%	-12.31	24.32	0.00	2.65	0.37	2
Mineral Spirits	-39.69	-10.14	-6.35	0.57	0.05	4
Nitric Acid 10%	-42.46	25.68	-7.94	3.44	0.75	4
Phosphoric Acid 50%	-24.31	-5.41	-3.17	6.83	1.89	2
Potassium Hydroxide 50%	-14.15	-4.73	0.00	0.57	-0.23	1
Saline Solution 30%	-13.85	-0.68	-6.35	1.00	0.02	1
Sea Water	-25.85	-1.35	-1.59	1.72	-0.09	2
Sodium Carbonate 10%	-19.38	18.24	3.17	1.70	-0.01	2
Sodium Chloride 30%	-32.62	-8.78	-6.35	1.79	-1.54	3
Sodium Hydroxide 50%	-4.62	-8.78	3.17	-0.32	-0.12	1
Sodium Hydroxide 10%	-16.00	-2.03	-4.76	0.50	0.23	1
Sodium Sulfate 30%	-26.77	-0.68	-7.94	1.67	10.40	2
Sodium Sulfate 20%	-29.54	-1.35	-6.35	1.73	0.38	3
Sugar Solution 30%	-36.00	-14.19	-6.35	1.82	0.17	3
Sulfuric Acid 25%	-23.08	11.49	-3.17	1.38	0.26	2
Sulfuric Acid 10%	-18.15	18.92	-9.52	1.70	0.05	2
Tannic Acid 40%	-23.69	24.32	-9.52	2.91	0.24	2
Water (DI)	-20.71	-3.92	-1.79	1.78	1.03	1

1 – Excellent

2 – Good

3 – Fair

4 – Moderate

5 – Not Recommended



UL XP-461

April 2022

TECHNICAL DATA SHEET

PRODUCT DISCLAIMER

All guidelines, recommendations, statements, and technical data contained herein are based on information and tests we believe to be reliable and correct, but accuracy and completeness of said tests are not guaranteed and are not to be construed as a warranty, either expressed or implied. It is the user's responsibility to satisfy himself, by his own information and test, to determine suitability of the product for his own intended use, application and job situation and user assumes all risk and liability resulting from his use of the product. We do not suggest or guarantee that any hazards listed herein are the only ones that may exist. Neither seller nor manufacturer shall be liable to the buyer or any third person for any injury, loss or damage directly or indirectly resulting from use of, or inability to use, the product. Recommendations or statements, whether in writing or oral, other than those contained herein shall not be binding upon the manufacturer, unless in writing and signed by a corporate officer of the manufacturer. Technical and application information is provided for the purpose of establishing a general profile of the material and proper application procedures. Test performance results were obtained in a controlled environment and ULTIMATE LININGS makes no claim that these tests or any other tests accurately represent all environments.



UL KG 9000 FS

DOOR AND DOOR FRAME

July 2020
Version: 2.0

TECHNICAL DATA SHEET

PRODUCT MANUFACTURER

ULTIMATE LININGS
10301 Round Up Lane
Houston, TX 77064
800-989-9869

GENERAL PRODUCT DESCRIPTION

UL KG 9000 FS is a two-component aliphatic polyurea spray coating that is UV stable. This product can be used as a topcoat for polyurea and polyurethane systems on properly prepared substrates or as a stand-alone coating. UL KG 9000 FS is 100% solids with zero VOCs (Volatile Organic Compounds) and superior physical properties. UL KG 9000 FS is an environmentally friendly product with excellent color, gloss retention and UV stability.

Suitable applications include:

- Topcoat for polyurea and polyurethane
- Stand-alone coating

UL KG 9000 FS is sold in clear and black. Applicators may purchase pigments in standard colors. Custom colors can be formulated upon request.

UL KG 9000 FS is packaged in a 10-gallon set. A set is comprised of one (5) gallon of Isocyanate "A" component and one (5) gallon of Resin "B" component.

APPLICATION PROCESSING DATA

As a topcoat, UL KG 9000 FS should be applied as soon as possible over hot or warm base coat but no longer than one hour after base coat application. Tack free time and full cure time is temperature, humidity and film thickness dependent. Thicker films will take longer to through-cure. High humidity will shorten cure time. In cold, dry conditions, the cure time will be prolonged.

Approximate values only. This data should not be considered a specification and is intended for general information for planning the application process.

APPLICATION GUIDELINES

UL KG 9000 FS is optimally applied at four (4) mils of thickness for topcoat applications. Maximum thickness for stand-alone is 20 mils and minimum 10 mils.

PIGMENT MIXING INSTRUCTIONS

UL KG 9000 FS is sold as clear and can be pigmented. For custom color blends for UL KG 9000 FS, please contact your customer order representative.

APPLICATION EQUIPMENT

PIGMENT LOAD FOR ALL PIGMENTS

"B" SIDE RESIN VOLUME	PIGMENT LOAD
1.00 gallon (128 oz.)	2.95 lbs.
2.00 gallons (256 oz.)	5.90 lbs.
3.00 gallons (384 oz.)	8.85 lbs.
4.00 gallons (512 oz.)	11.80 lbs.
5.00 gallons (640 oz.)	14.75 lbs.

UL KG 9000 FS is designed to be sprayed through plural component equipment. Equipment must have material heat control capabilities, 1:1 by volume and sprayable with flat tips. Refer to equipment manufacturer for equipment specifics and accessories.

UL KG 9000 FS is tack free in one and half (1.5) to two (2) minutes. Prior to application, proper surface preparation is required. Surfaces must be clean, dry and in sound condition. Remove all oil, dust, grease, loose particles and rust.



UL KG 9000 FS

July 2020
Version: 2.0

TECHNICAL DATA SHEET

EQUIPMENT CLEAN UP

Xylene, Methyl Ethyl Ketone (MEK), Acetone, or Brake Clean are acceptable for cleanup of spray equipment, application tools, and for excess product removal.

MATERIAL STORAGE

UL KG 9000 FS has a shelf life of twelve (12) months from manufacture date in factory-sealed containers. UL KG 9000 FS should be stored between 65°F to 80°F (18°C to 27°C) and out of direct sunlight. Do not expose unused materials to high humidity conditions.

Always provide an airtight reseal for unused materials and store away from fire hazards.

SAFETY AND HANDLING

Please refer to safety data sheets (SDS) for safety and handling of this material. All personnel working with this material are expected to read and understand all safety recommendations per SDS. All Personal Protection Equipment must be properly worn to comply with worker health and safety requirements.

CHEMICAL TECHNICAL DATA

Conditions: 77°F and 50% Rel. Humidity	
Mix Ratio by Volume	1A:1B
Gel Time	20-30 seconds
Tack Free Time	1.5-2 minutes
Recoat Window	1 hour
Return to Service	24 hours
Density "A" Side (lbs/gal)	9.35 ± 0.5
Density "B" Side (lbs/gal)	8.80 ± 0.5
Viscosity "A" Side (cP)	350 ± 70
Viscosity "B" Side (cP)	90 ± 30

PHYSICAL PROPERTIES

TEST NAME	TEST METHOD	VALUE
Tensile Strength	ASTM D412	2700 psi
Elongation	ASTM D412	90%
Hardness	ASTM D2240	58 Shore D
Tear	ASTM D624	500 pli
Chip Resistance	ASTM D3170	Rated 10 No Failures
Taber Abrasion (mg loss/1000 cycles)	ASTM D4060	13 mg loss
Flammability of Interior Materials	FMVSS 302	Pass
UV Weathering Test	ASTM G154	Delta E 0.12 @ 1038 hrs.

CHEMICAL RESISTANCE

ASTM D1308 – 24 Hours Spot Test Under Watch-Glass at 77°F.

Chemical	Rating
Acetic Acid 10%	2
Ammonium Hydroxide 28-30%	1
Bleach	1
Brake Fluid, DOT 3	NR
Citric Acid 10%	1
Diesel	1
Distilled Water	1
Gasoline	1
Hydrochloric Acid 36-38%	3
Isopropyl Alcohol	1
Lactic Acid 45%	4
Phosphoric Acid 50%	2
Dawn Pot & Pan Detergent	1
Potassium Hydroxide 50%	1
Sodium Chloride 30%	1
Sodium Hydroxide 10%	2
Sodium Hydroxide 50%	3
Sulfuric Acid 10%	1
Sulfuric Acid 25%	4
Sulfuric Acid 95-98%	NR



UL KG 9000 FS

July 2020
Version: 2.0

TECHNICAL DATA SHEET

Toluene	NR
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Please contact your Ultimate Linings Technical Team for any questions regarding UL KG 9000 FS applications not referenced here.

RATING SYSTEM	
1	No Visible Damage
2	Little Visible Damage
3	Softening
4	Swelling and Softening
5	Discoloration
NR	Not Recommended

PRODUCT USER

Users of UL KG 9000 FS product are responsible for reading the general guidelines, training materials, product data sheets, specifications and safety data sheets (SDS) before using this material. Printed technical data and instructions are subject to change without notice. Contact your local Ultimate Linings representative for current technical data instructions.

PROJECT SPECIFIC

The following application details provide general guidelines for UL KG 9000 FS applications. All applications require proper surface preparation including the removal of all oil, dust, grease, loose particles and rust. Apply at 2-4 mils wet film thickness per coat for topcoat. Maximum thickness for stand-alone is 20 mils. Both the Isocyanate "A" Side and Resin "B" Side

PRODUCT DISCLAIMER

All guidelines, recommendations, statements, and technical data contained herein are based on information and tests we believe to be reliable and correct, but accuracy and completeness of said tests are not guaranteed and are not to be construed as a warranty, either expressed or implied. It is the user's responsibility to satisfy himself, by his own information and test, to determine suitability of the product for his own intended use, application and job situation and user assumes all risk and liability resulting from his use of the product. We do not suggest or guarantee that any hazards listed herein are the only ones that may exist. Neither seller nor manufacturer shall be liable to the buyer or any third person for any injury, loss or damage directly or indirectly resulting from use of, or inability to use, the product. Recommendations or statements, whether in writing or oral, other than those contained herein shall not be binding upon the manufacturer, unless in writing and signed by a corporate officer of the manufacturer. Technical and application information is provided for the purpose of establishing a general profile of the material and proper application procedures. Test performance results were obtained in a controlled environment and Ultimate Linings makes no claim that these tests or any other tests accurately represent all environments.

SPRAY APPLICATIONS

need to be heated to 160°F (71°C). UL KG 9000 FS should be sprayed with Plural Component Equipment. Please consult with your Technical Representative for further details. UL KG 9000 FS as topcoat should be applied to the base coat as soon as possible while the coating is warm, no later than 1 hour after base application.

SPRAY OVER ALUMINUM OR GALVANIZED STEEL
<ul style="list-style-type: none"> SSPC 10: 2 to 3 Mil Surface Profile Depth Prime with FCP or XPM

SPRAY OVER FIBERGLASS
<ul style="list-style-type: none"> Sand using a 40 to 80 Grit Sandpaper Prime with FCP or XPM

XSEL® Process Gauge - Stainless Steel

Type 232.34 - Dry Case

WIKA Datasheet 23X.34

Applications

- For applications with high dynamic pressure pulsations or vibration a liquid filled case and socket restrictor are available
- Suitable for corrosive environments and gaseous or liquid media that will not obstruct the pressure system
- Process industry: chemical/petrochemical, power stations, mining, on and offshore, environmental technology, mechanical engineering and plant construction

Product features

- Excellent load-cycle stability and shock resistance
- Solid front thermoplastic case
- Positive pressure ranges to 30,000 psi (2,000 bar)
- XSEL® Process Gauge with 5 year warranty on gauge and 10 year warranty on pressure system (see terms and condition)
- All lower mount connection gauges are factory prepared for liquid filling

(LBM: must install membrane prior to field filling)

Specifications

Design

ASME B40.100

Sizes

4½" & 6" (115 & 160 mm) dial size

Accuracy class

± 0.5% of span (ASME B40.100 Grade 2A)
± 1.0% of span (ASME B40.100 Grade 1A)
for ≥ 20,000 psi (1,600 bar) range and above

Ranges

Vacuum / Compound to 400 psi (25 bar)
Pressure from 15 psi (1 bar) to 30,000 psi (2,000 bar)
or other equivalent units of pressure or vacuum

Working pressure

Steady: full scale value
Fluctuating: 0.9 x full scale value
Short time: 1.5 x full scale value

Operating temperature

Ambient: -40°F to +140°F (-40°C to +60°C) - dry
-4°F to +140°F (-20°C to +60°C) - glycerine filled
-40°F to +140°F (-40°C to +60°C) - silicone filled
Medium: max. +212°F (+100°C)



Bourdon Tube Pressure Gauge Model 232.34

Temperature error

Additional error when temperature changes from reference temperature of 68°F (20°C) ±0.4% of span for every 18°F (10°K) rising or falling.

Weather protection

Weather resistant (IP54) - without membrane
Weather tight (IP65) - dry case or filled case with membrane installed (standard for low mount versions)

Pressure connection

Material: 316L stainless steel
Lower mount (LM) or lower back mount (LBM)
1/4" or 1/2" NPT with M4 internal tap

Restrictor

Material: Stainless steel (0.6 mm), standard

Bourdon tube

Material: 316L stainless steel
≤ 1,000 psi (69 bar): C-shape
≥ 1,500 psi (100 bar): Helical

Movement

Stainless steel
Internal overload stop set at 1.1x full scale
Underload stop-standard
Dampened movement-optional

Dial

White aluminum with black lettering, stop pin at 6 o'clock
Standard WIKA psi single scales (4½" only) with large figures at beginning and end for quick and easy identification.

Pointer

Black aluminum, adjustable

Case

Black fiberglass-reinforced thermoplastic (POCAN)
Solid front, blowout back
Turret-style case with built in rear flange lugs

Window

Clear acrylic with Buna-N gasket

Case filling Type 233.34

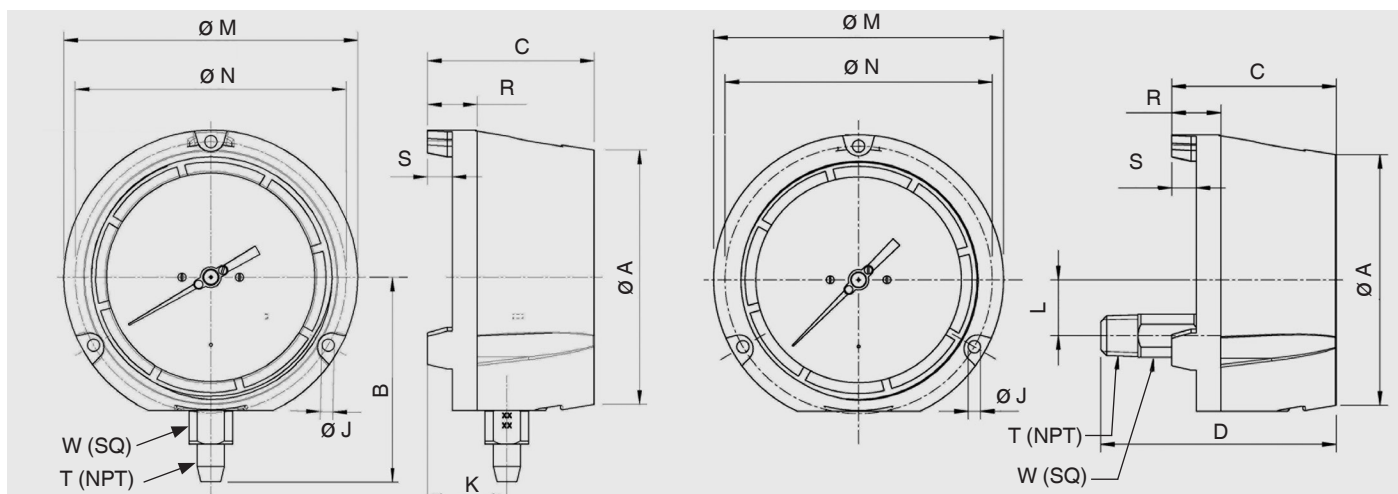
Glycerine 99.7% and > 40 psi (2.5 bar)

Glycerine/Water - <= 40 psi (2.5 bar)

Optional extras

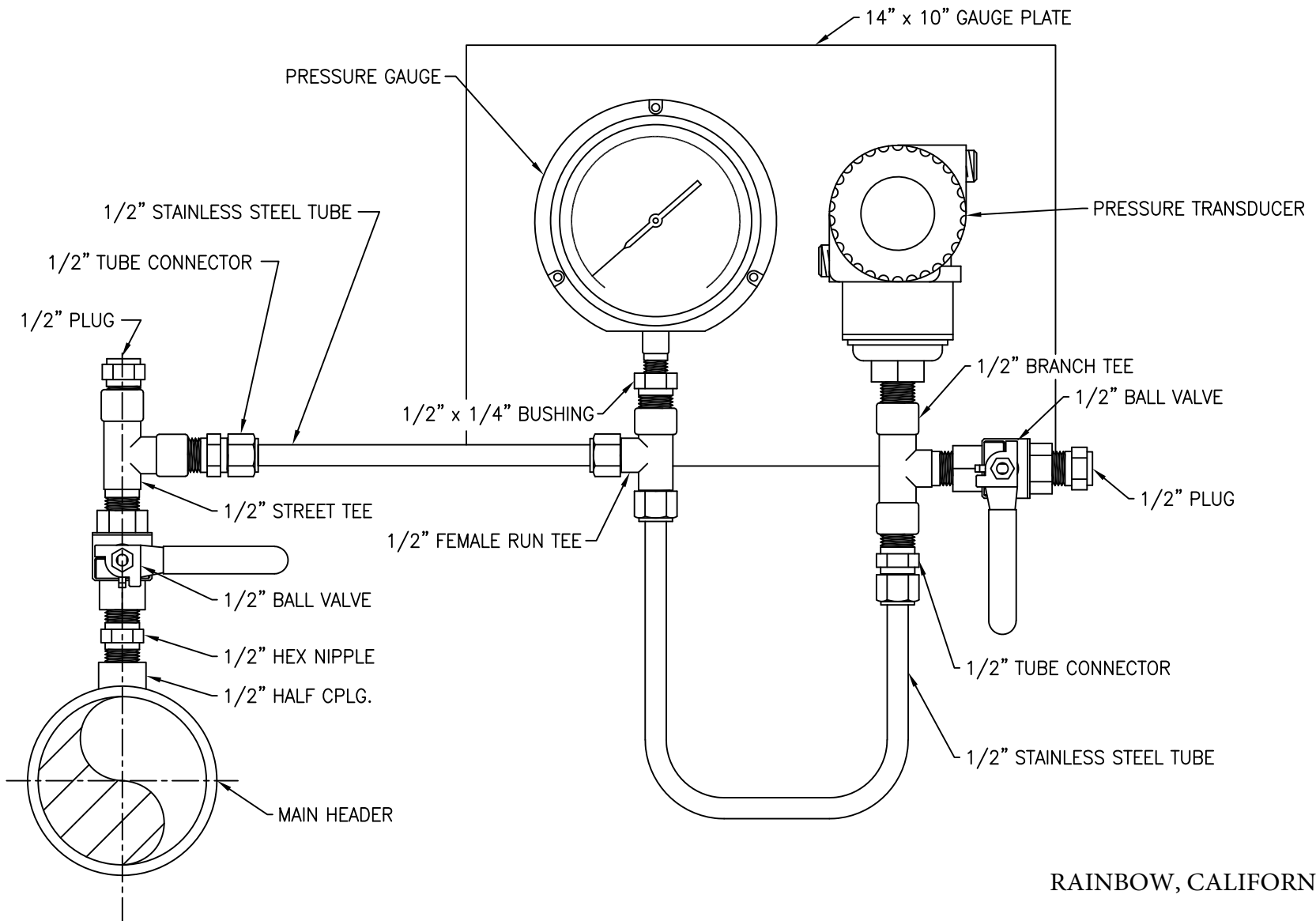
- Silicone dampened movement
- Panel mounting adaptor kit (field assembled)
- Silicone case filling
- Halocarbon case filling
- Cleaned for oxygen service
- Instrument glass or safety glass window
- Drag pointer (maximum reading indicator)
- Alarm contacts switches (magnetic or inductive)
- Special process connections
- Custom dial layout
- External zero adjustment (4.5" size only)
- Case and ring in red or yellow thermoplastic (4½" LM only)
- Insight® reflective dial options available in white, fluorescent yellow, fluorescent orange or glow-in-the-dark

Dimensions



Size		A	B	C	D	J	K	L	M	N	R	S	T	W	Weight ¹
4.5"	mm	128	103	84	120.3	6.3	40	28.5	148	136.5	25	12.5		22	2 lb. dry
	in	5	4.06	3.31	4.74	0.248	1.57	1.12	5.83	5.37	0.99	0.49	1/2"	0.87	3 lb. filled
6"	mm	164	122.5	88	123.4	7.1	40.2	28.5	190	177.8	25.4	12.7		22	3 lb. dry
	in	6.46	4.82	3.46	4.86	0.28	1.58	1.12	7.5	7	1	0.5	1/2"	0.87	4 lb. filled

¹ Weight without optional accessories



RAINBOW, CALIFORNIA

1/2" STAINLESS STEEL FITTINGS & TUBING
GAUGE PLATE - SUCTION



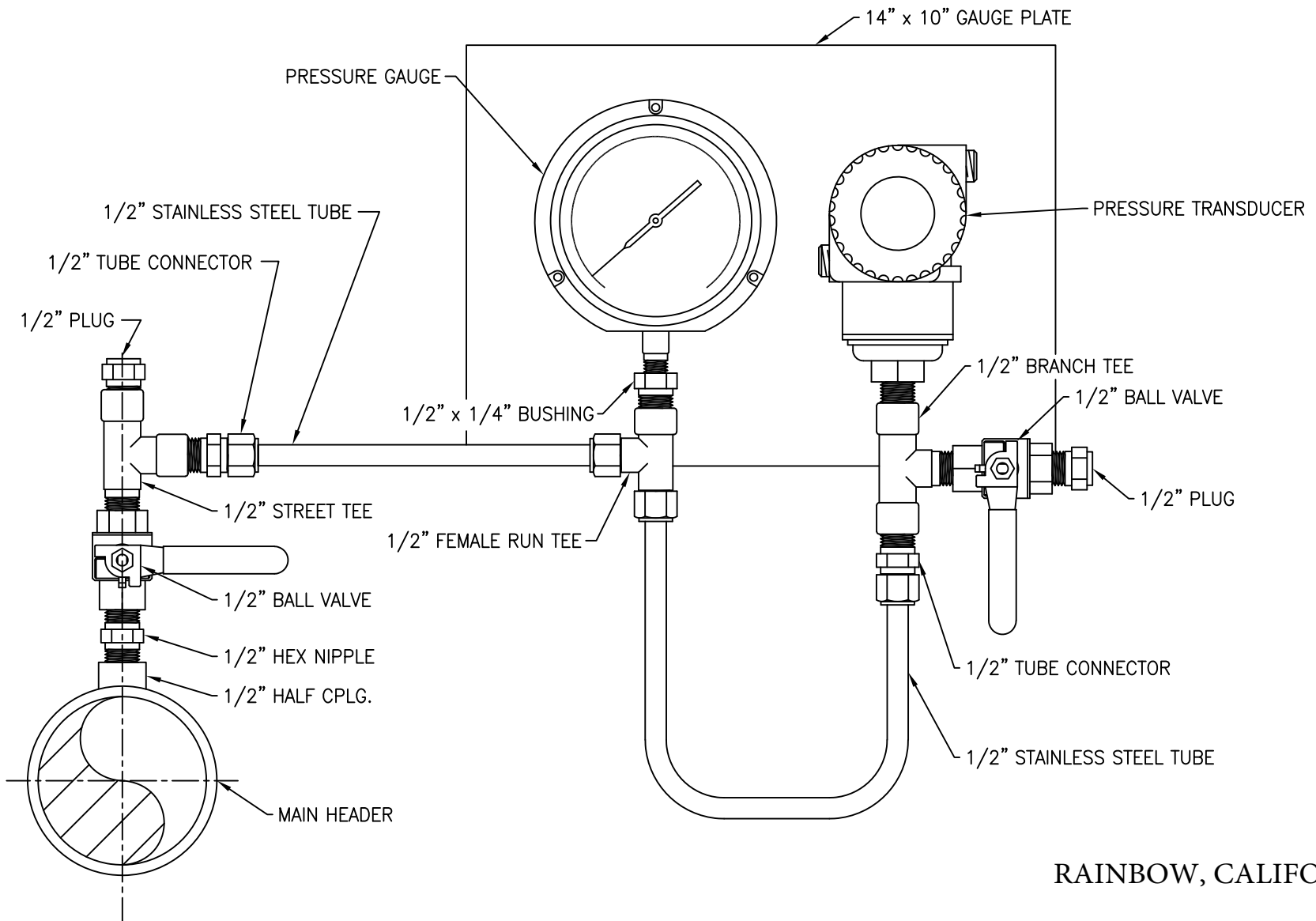
ENGINEERED FLUID, INC.

P.O. DRAWER 723 * CENTRALIA, ILLINOIS 62801

93134

JOB REF. NO. _____

DRAWING NO. H-3



RAINBOW, CALIFORNIA

1/2" STAINLESS STEEL FITTINGS & TUBING
GAUGE PLATE - DISCHARGE



ENGINEERED FLUID, INC.

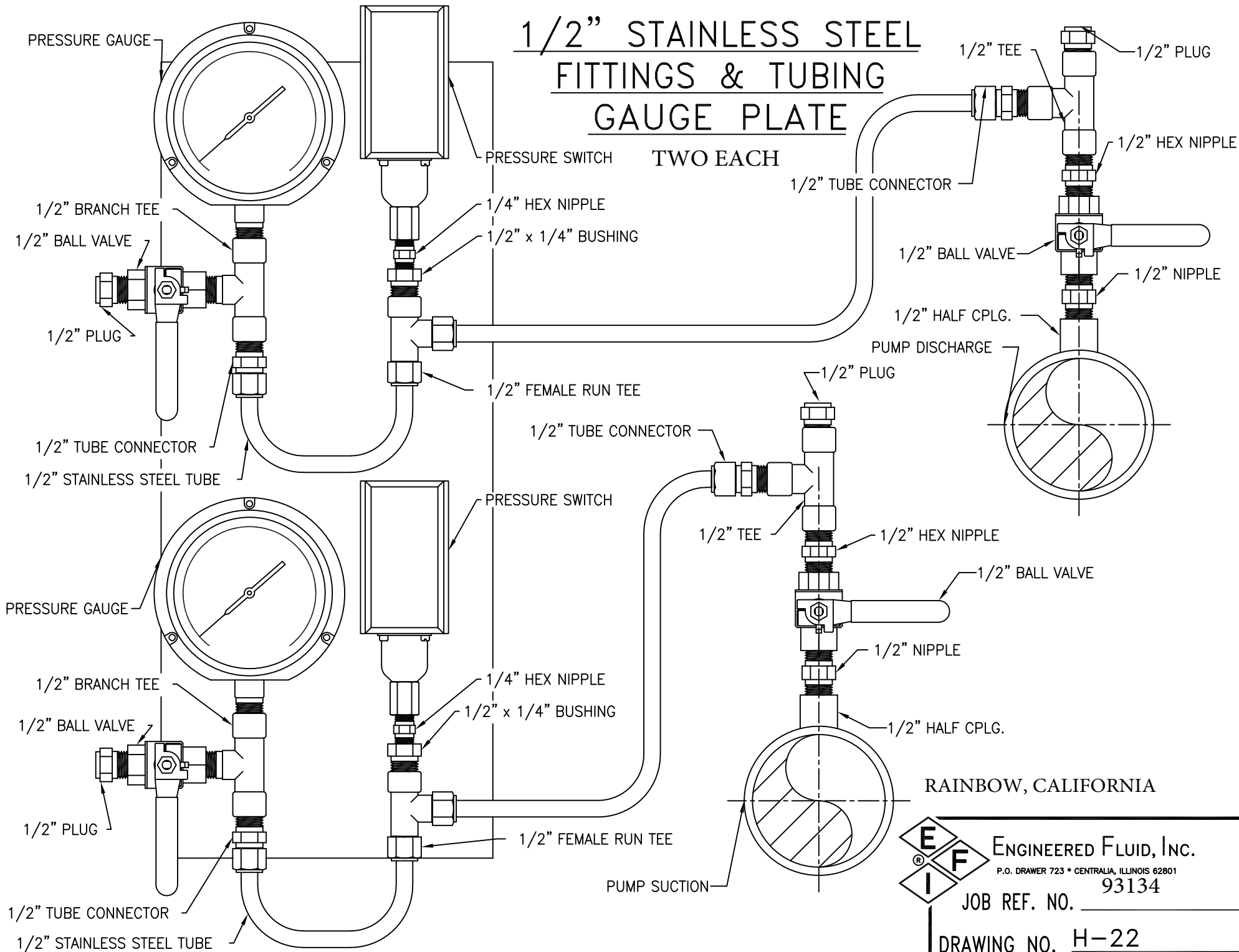
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JOB REF. NO. _____

DRAWING NO. H-3

1/2" STAINLESS STEEL FITTINGS & TUBING GAUGE PLATE



RAINBOW, CALIFORNIA



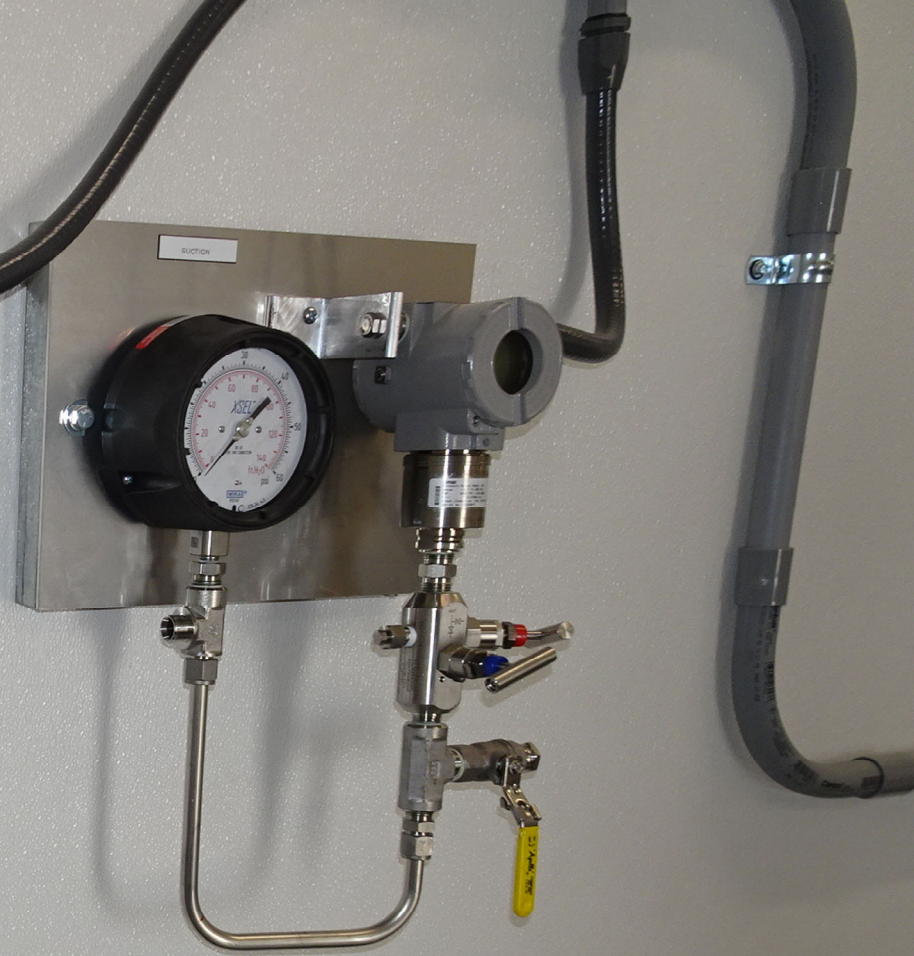
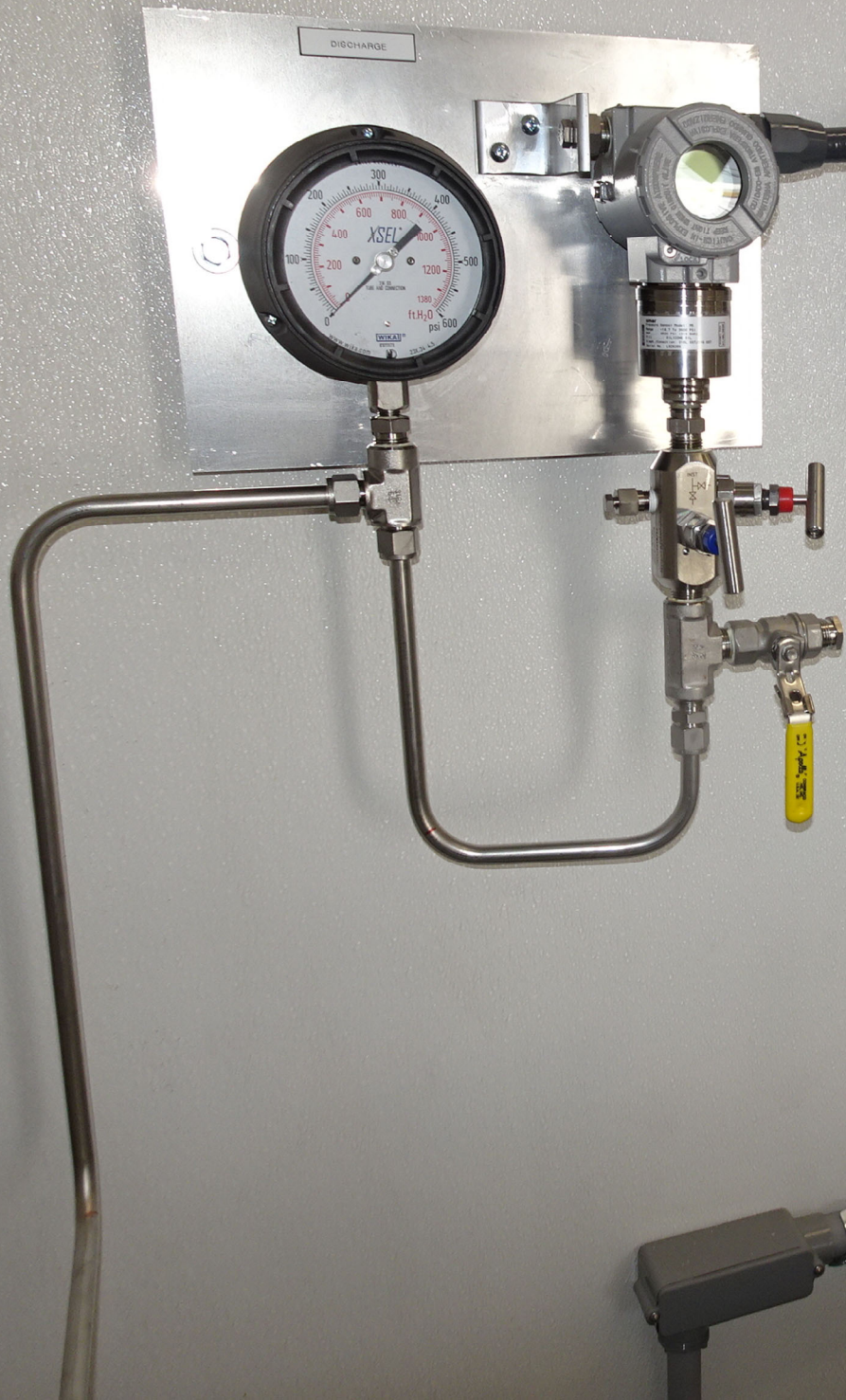
ENGINEERED FLUID, INC.

P.O. DRAWER 723 * CENTRALIA, ILLINOIS 62801

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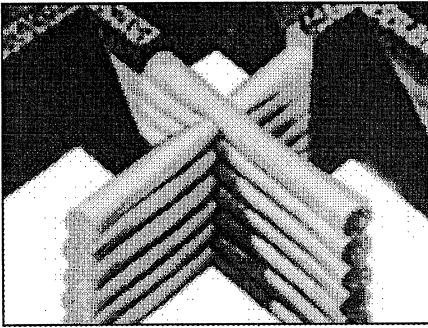
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DRAWING NO. H-22





DESCRIPTION



GatorGrate molded fiberglass grating is a one-piece, reinforced polyester or vinylester (FRP) grating, available in standard panels and sizes. It is manufactured by interweaving continuous, thoroughly wetted, fiberglass strand with thermosetting resin systems. Standard panels are available in four resin systems, two top surface configurations, four panel sizes and five standard grid patterns. Typical applications include floor systems, walkways, work platforms, stairs, ramps, trench covers & catwalks. GatorGrate has been successfully used in many industries – including food processing, beverage, chemical processing, water & wastewater treatment, metal finishing, pulp/paper, transportation, pharmaceutical, textile, oil/gas & mining/smelting/refining.

“How To Write An Outstanding Grating Specification” is available. Just ask for it.

STANDARD RESIN SYSTEMS

Standard GatorGrate resin systems are made from premium grade polyester resins. The four standard resin systems are:

IFR – Premium grade polyester resin system with Class 1 fire retardance per ASTM E-84. Standard color is green. Excellent corrosion resistance.

VFR – Vinylester resin system with Class 1 fire retardancy, per ASTM E-84. Standard color is orange. For maximum corrosion resistance in Seasafe’s standard resin systems, specify VFR.

ICG – Premium grade polyester resin with no additives. Standard color is translucent green. Superior corrosion resistance.

IUS – Premium grade polyester resin system that is acceptable for incidental food contact, per USDA standards. Standard color is gray. Excellent corrosion resistance.

Other resin systems and colors are available on special order. All GatorGrate resin systems incorporate an ultraviolet (UV) inhibitor.

STANDARD GRID PATTERNS

GatorGrate molded grating is available in five standard grid patterns. Grid dimensions are center line to center line. See drawings on page 4.

1" thick, 1" x 4", rectangular grid, standard duty.

Bearing bars 0.250" thick

Cross bars 0.500" thick

Open area of 65%

Designation is GG-SD10

1" thick, 1" x 4", rectangular grid, heavy duty.

Bearing bars 0.3125" thick

Cross bars 0.5625" thick

Open area of 60%

Designation is GG-HD10

1" thick, 1½" x 1½", square grid.

Bearing bars 0.2350" thick

Cross bars 0.2350" thick

Open area of 70%

Designation is GG-1510

1½" thick, 1½" x 1½", square grid.

Bearing bars 0.250" thick

Cross bars 0.250" thick

Open area of 70%

Designation is GG-1515

2" thick, 2" x 2", square grid.

Bearing bars 0.3125" thick

Cross bars 0.3125" thick

Open area of 72%

Designation is GG-2020

STANDARD PANEL SIZES & WEIGHTS

GG-SD10	3' wide x 10' long	97 lbs
	4' wide x 12' long	143 lbs
GG-HD10	3' wide x 10' long	110 lbs
	4' wide x 12' long	170 lbs
GG-1510	3' wide x 10' long	91 lbs
	4' wide x 12' long	140 lbs
GG-1515	3' wide x 10' long	124 lbs
	4' wide x 8' long	131 lbs
	4' wide x 12' long	193 lbs
	5' wide x 10' long	203 lbs
GG-2020	4' wide x 12" long	205 lbs

STANDARD TOP SURFACES

Grit top – integral, embedded silica sand, to a nominal depth of 3/16"

Meniscus top – concave, half-moon cross section

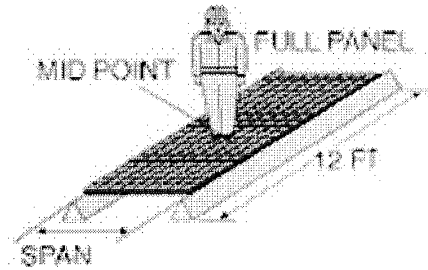
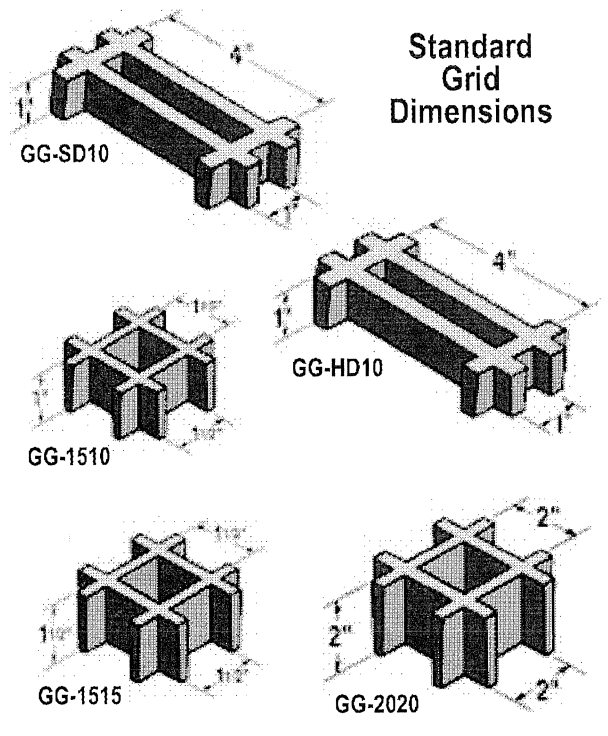
TYPICAL PHYSICAL PROPERTIES: See Tech Support Bulletin #4

Easy-To-Work-With GatorGrate

The Load and Deflection Data provided in these tables are intended for guidance only, to help you determine the proper grating size for your application. The use of different resin systems and top surface options can produce variations up to 15% in these values. Because the product will be used in environments and under operating conditions that are not within our control, we cannot guarantee the performance of the grating.

FRP products have low modulus of elasticity but high tensile strength, therefore loads are generally limited to the allowable deflection determined by the end user. The following data are based on tests utilizing panels supported on two sides only. Additional stiffness can be achieved by using cross supports (see Seasafe's Tech Support Bulletin #1).

Load & Deflection Application Data	Concentrated Load Full Panel
Occasional Foot Traffic (Inspections, etc.)	250 lbs.
Workman with Tools (Maintenance)	300 lbs.
Heavy Foot Traffic	400 lbs.



CONCENTRATED LOAD, FULL PANEL

GG-SD10 Standard Duty, Rectangular, 1" Thick (1" x 4")

Clear Span	Load, in Lbs., Deflection in Inches							.250"	.375"
	100	250	500	750	1000	1500	2000	Def	Def
18"	.015	.038	.076	.114	.152	.228	.303	1665	2490
24"	.030	.075	.150	.225	.300	.450	**	830	1250
36"	.121	.303	**	**	**	**	**	210	315
48"*	.140	.350	**	**	**	**	**	180	270

GG-HD10 Heavy Duty, Rectangular, 1" Thick (1" x 4")

Clear Span	Load, in Lbs., Deflection in Inches							.250"	.375"
	100	250	500	750	1000	1500	2000	Def	Def
18"	.014	.035	.071	.106	.142	.213	.284	1780	2680
24"	.027	.068	.135	.203	.270	.405	**	920	1380
36"	.071	.178	.355	**	**	**	**	350	520
48"*	.119	.298	**	**	**	**	**	210	310

GG-1510 Square, 1" Thick (1 1/2" x 1 1/2")

Clear Span	Load, in Lbs., Deflection in Inches							.250"	.375"
	100	250	500	750	1000	1500	2000	Def	Def
18"	.013	.032	.064	.097	.129	.193	.258	1940	2910
24"	.027	.068	.135	.203	.271	.406	**	925	1385
36"	.068	.170	.340	**	**	**	**	370	555
48"*	.140	.350	**	**	**	**	**	180	270

GG-1515 Square, 1 1/2" Thick (1 1/2" x 1 1/2")

Clear Span	Load, in Lbs., Deflection in Inches							.250"	.375"
	100	250	500	750	1000	1500	2000	Def	Def
18"	.006	.016	.032	.049	.065	.097	.129	3870	5805
24"	.011	.027	.053	.080	.107	.160	.214	2340	3510
36"	.030	.074	.149	.223	.298	.447	**	840	1260
48"*	.059	.147	.295	.442	**	**	**	425	635
60"*	.107	.268	**	**	**	**	**	235	350

GG-2020 Square, 2" Thick (2" x 2")

Clear Span	Load, in Lbs., Deflection in Inches							.250"	.375"
	100	250	500	750	1000	1500	2000	Def	Def
18"	.005	.012	.025	.037	.049	.074	.098	5100	7650
24"	.008	.019	.038	.057	.076	.114	.152	3295	4940
36"	.014	.035	.069	.104	.138	.208	.277	1810	2710
48"*	.029	.074	.147	.221	.294	.442	**	850	1275
60"*	.056	.141	.281	.422	**	**	**	445	665

* Clear span is 2" less than width of grating.

** Deflections greater than 0.500" have been omitted.

PRODUCT DATA SHEET

SAFETY MATTING

MANUFACTURED FOR E.F.I. BY: Koneta/LRV
1400 Lunar Drive
Wapakoneta, Ohio 45895



Rubber Drainage Runner

Specifications

Medium duty 1/2" Thickness
Unique tread design for sure footing
Promotes safety in wet or oily areas
Open slot design
Open slot underside permits aeration
and drainage
Raised knob underside reduces fatigue
Color: Charcoal



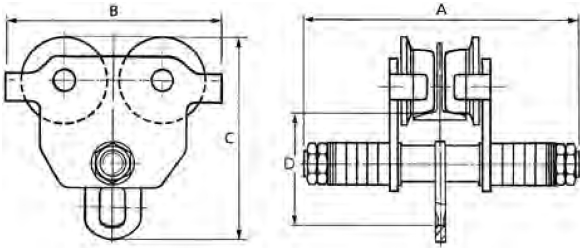
ENGINEERED FLUID, INC.

P.O. DRAWER 723 • CENTRALIA, ILLINOIS 62801

JOB REF. NO. Standard

DRAWING NO. 1720-011305-01

PUSH BEAM TROLLEY



*Wheel and Bail dimensions available on our website www.ozliftingproducts.com

FEATURES

- Lightweight, robust construction
- Super-quick adjustment to most I, S, and W-Beams (see measurements below)
- Durable baked-enamel paint protection
- Precision ball bearing trolley wheels
- Anti-drop plate
- Stainless steel ID tag
- Individual test certificate and serial number

SPECIFICATIONS (0.5, 1, 2, 3, 5 and 10 tons)

Product Code	OZ05PBT	OZ1PBT	OZ2PBT	OZ3PBT	OZ5PBT	OZ10PBT
Safe Working Load (lbs)	1,000 (lbs)	2,000 (lbs)	4,000 (lbs)	6,000 (lbs)	10,000 (lbs)	20,000 (lbs)
Adjustable Flange Width (in)	2.52-5.90 (in)	2.52-8.00 (in)	3.46-8.00 (in)	4.00-8.00 (in)	4.49-8.00 (in)	4.92-8.00 (in)
Dimensional Information (in)	A	9.75 (in)	12.69 (in)	13.19 (in)	14.31 (in)	15.07 (in)
	B	8.50 (in)	10.24 (in)	11.81 (in)	13.58 (in)	15.55 (in)
	C	7.67 (in)	9.41 (in)	11.26 (in)	13.23 (in)	15.47 (in)
	D	4.33 (in)	5.31 (in)	6.34 (in)	7.28 (in)	8.66 (in)
Minimum Radius Curve (ft)	2.95 (ft)	3.28 (ft)	3.60 (ft)	4.26 (ft)	4.59 (ft)	5.57 (ft)
Net Weight (lbs)	20 (lbs)	32 (lbs)	50 (lbs)	82 (lbs)	123 (lbs)	215 (lbs)

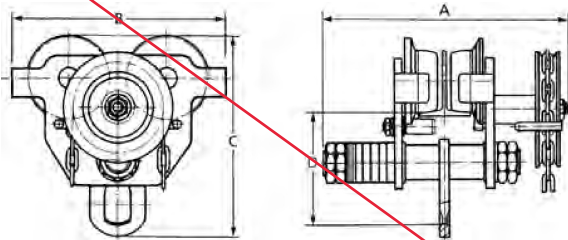
Dimensions are for reference only and subject to change without notice.

**Individually Tested
Test Certificate
- Included -**



**Standards:
CE
Complies with portions
of ASME 30.16**

GEARED BEAM TROLLEY



*Wheel and Bail dimensions available on our website www.ozliftingproducts.com

FEATURES

- Lightweight robust construction.
- Super-quick adjustment to most I, S, and W-Beams (see measurements below)
- Durable baked-enamel paint protection
- Precision ball bearing trolley wheels
- Gearing provides positive load positioning along the beam
- Individual test certificate and serial number
- Anti-drop plate
- Stainless steel ID tag

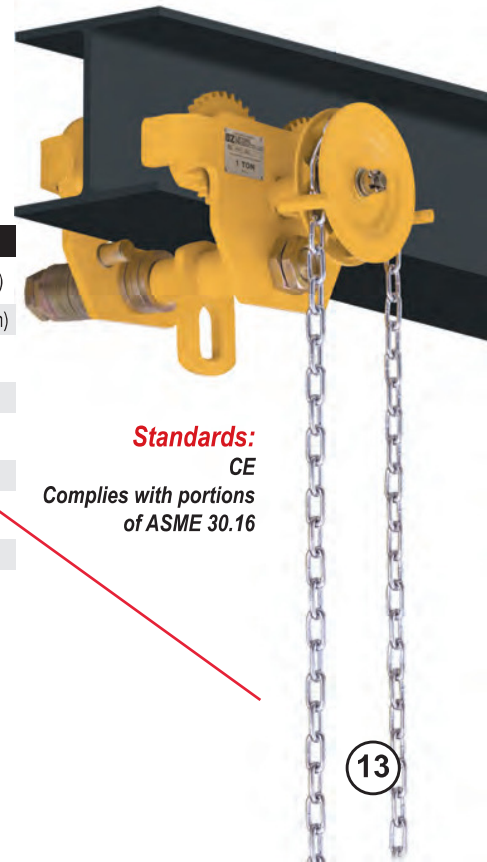
SPECIFICATIONS (1, 2, 3, 5, 10, 20, and 30 Ton)

Product Code	OZ1GBT	OZ2GBT	OZ3GBT	OZ5GBT	OZ10GBT	OZ20GBT	OZ30GBT
Safe Working Load (lbs)	2,000 (lbs)	4,000 (lbs)	6,000 (lbs)	10,000 (lbs)	20,000 (lbs)	40,000 (lbs)	60,000 (lbs)
Adjustable Flange Width (in)	2.57-8.00 (in)	3.46-8.00 (in)	4.01-8.00 (in)	4.49-8.00 (in)	4.92-8.00 (in)	8.27-13.00 (in)	6.00-12.5 (in)
Dimensional Information (in)	A	15.56 (in)	15.63 (in)	17.69 (in)	18.25 (in)	18.75 (in)	25.48 (in)
	B	10.24 (in)	11.81 (in)	13.58 (in)	15.55 (in)	17.91 (in)	25.28 (in)
	C	9.41 (in)	11.26 (in)	13.23 (in)	15.47 (in)	19.68 (in)	24.49 (in)
	D	5.31 (in)	6.34 (in)	7.28 (in)	8.66 (in)	11.02 (in)	12.40 (in)
Minimum Radius Curve (ft)	3.28 (ft)	3.60 (ft)	4.26 (ft)	4.59 (ft)	5.57 (ft)	14.76 (ft)	14.76 (ft)
Net Weight (lbs)	44 (lbs)	62 (lbs)	95 (lbs)	136 (lbs)	234.00 (lbs)	565 (lbs)	573 (lbs)
* Std. length of hand chain	9 (ft)	9 (ft)	9 (ft)	9 (ft)	9 (ft)	9 (ft)	9 (ft)

Dimensions are for reference only and subject to change without notice.

* Longer hand chain lengths available. Please contact the factory. ** Available in 50 Tons. Please contact factory for specifications.

**Individually Tested
Test Certificate
- Included -**



**Standards:
CE
Complies with portions
of ASME 30.16**



P.O. Box 845 Winona, MN 55987 • Tf: (800) 749-1064
Ph: (507) 474-6250 | Fx: (507) 452-5217 | Tech Support: (507) 457-3346
sales@ozliftingproducts.com | www.ozliftingproducts.com



DAYTON

Manual Chain Hoist: 2,000 lb Load Capacity, 67 lb Pull to Lift Rated Load

- Item # 38EV05
- Mfr. Model # 38EV05

Featuring a compact design, this low headroom chain hoist has a self-adjusting brake. Smooth operation is provided by friction-reducing roller and ball bearings, along with a jamproof chain guide. The hand chain hangs 1.64 ft. shorter than the lift.

Technical Specs

Load Capacity: 2,000 lb

Hoist Lift: 10 ft

Min. Between Hooks: 13 1/2 in

Pull to Lift Rated Load: 67 lb

Hook Opening: 1 in

Housing Length: 5 3/4 in x Housing Width: 5 3/4 in x Housing Depth: 5 in

Brake Weston Style, Double Disc Brake

Standards: ANSI/ASME B30.16, EN13157

Includes Safety Latch Hooks

Hoist Overload Protection: No

Manufacturers Warranty Length: 1 yr

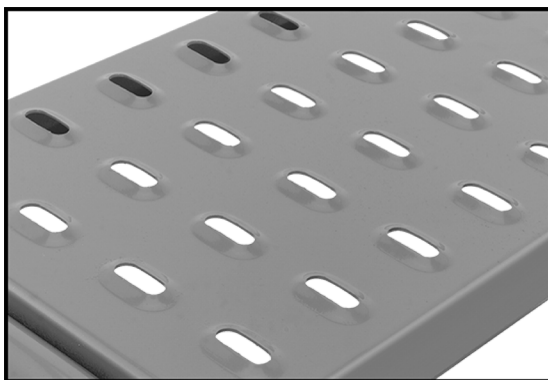
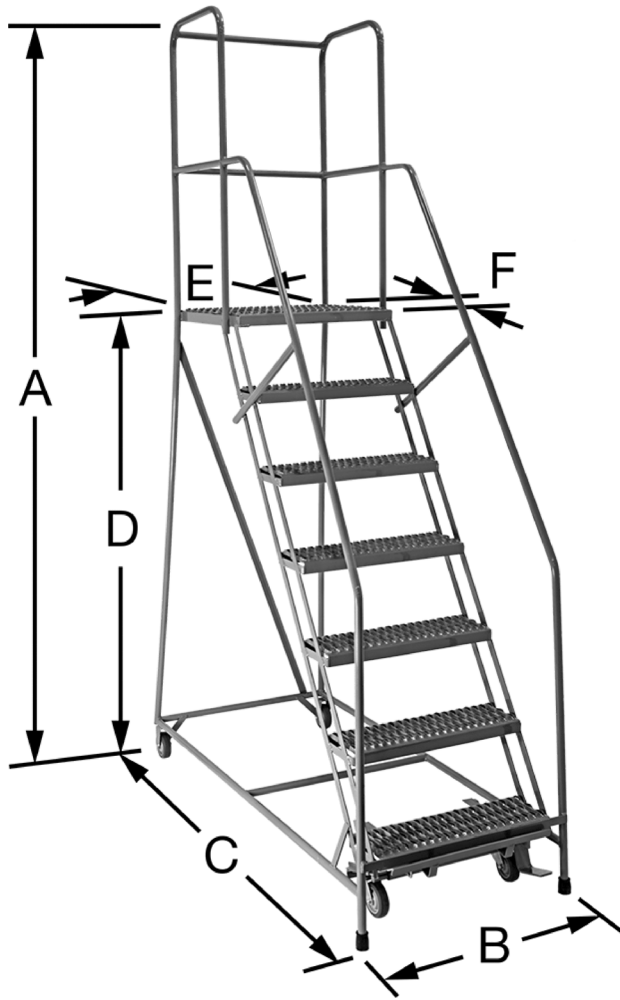
Hoist Mount Hook Mounted - No Trolley



Rolling Platform Ladder

7'10" High x 29" Wide x 40" Deep Overall

8039T41



Perforated

Ladder Type	Rolling Platform
Step	
Tread	Perforated
Shape	Flat
Overall	
Height (A)	7'10"
Width (B)	29"
Depth (C)	40"
Platform	
Height (D)	4'2"
Width (E)	24"
Depth (F)	9 1/2"
Tread	Perforated
Maximum Climbing	
Height	4'2"
Number of Steps	5
Capacity	450 lbs.
Ground Clearance	
Height	4"
Material	Powder-Coated Steel
Color	Gray
Wheel	
Configuration	Four Swivel Casters
Brake Type	Weight Actuated
Weight Actuation	
Type	Spring-Loaded Casters
With Handrail	Yes
Foldable	No
Assembled or	
Unassembled	Assembled
Features	Nonskid Feet
Specifications Met	OSHA Compliant 29 CFR 1910.23, Cal/OSHA Compliant Title 8 Section 3627, ANSI A14.7
RoHS	RoHS 3 (2015/863/EU) Compliant
REACH	REACH (EC 1907/2006) (01/17/2022, 223 SVHC) Compliant

DFARS	Specialty Metals COTS-Exempt
Country of Origin	United States
USMCA Qualifying	Yes
Schedule B	732690.8660
ECCN	EAR99
Related Product	Replacement Casters

Move these sturdy ladders easily between your work areas. You are responsible for adhering to local, state, and federal safety codes, including OSHA.

Note: The number of steps listed includes the platform.

Perforated and coated steps provide good slip resistance while being easy on your shoes. Perforated steps also allow liquids to drain and debris to fall through.

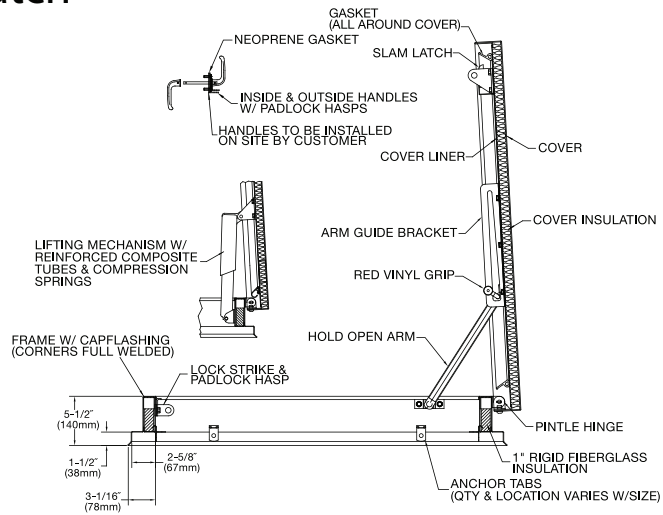
Spring-loaded casters stay stationary while in use—when you step on, the casters retract; when you step off, the casters roll again.



The VersaMount® Access Hatch



Optional anodized finish shown



Description:

The VersaMount® replacement hatch allows you to replace a damaged roof hatch without re-roofing. Simply remove the cover from the damaged hatch and place the VersaMount® hatch on top of the existing curb. The low-profile curb features a built-in flange and apron and innovative anchor clip system to ensure a fast, secure and weathertight installation. Available in a number of standard sizes.

Specifications:

Material (select one)

- Steel: Cover and frame are 14 gauge (1.9mm) G-90 paint bond galvanized steel
- Aluminum: Cover and frame are 11 gauge (2.3mm) aluminum
- Stainless Steel: Cover and frame are 14 gauge (1.9mm) Type 304 stainless steel

Cover

Brakeformed, hollow-metal design with 1" (25.4mm) concealed fiberglass insulation, 3" (76mm) beaded, overlapping flange, fully welded at corners, and internally reinforced for 40 psf (195 kg/m²) live load

Curb

4" (102mm) in height, brakeformed hollow-metal design with 1" (25.4mm) concealed fiberglass insulation, 2-5/8" (67mm) mounting flange and 1-1/2" (38mm) apron, fully welded at corners. Stainless steel anchor clips are included.

Gasket

Extruded EPDM rubber gasket permanently adhered to the cover

Hinges

Heavy-duty pintle hinges with 3/8" (9.5mm) Type 316 stainless steel hinge pins

Latch

Slam latch with interior and exterior turn handles and padlock hasps

Lift Assistance

Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.

Finish

- Steel: Alkyd base red oxide primer
- Aluminum: Mill finish
- Stainless Steel: Type 304 stainless steel with bead blast finish

Hardware

- Steel: Engineered composite compression spring tubes. Steel compression springs. All other hardware is zinc plated/chromate sealed.
- Aluminum: Engineered composite compression spring tubes. Steel compression springs. Type 316 stainless steel hinges. All other hardware is zinc plated/chromate sealed.
- Stainless Steel: Type 316 stainless steel



Job-Built Wood Curbs



Job-Built Concrete Curbs

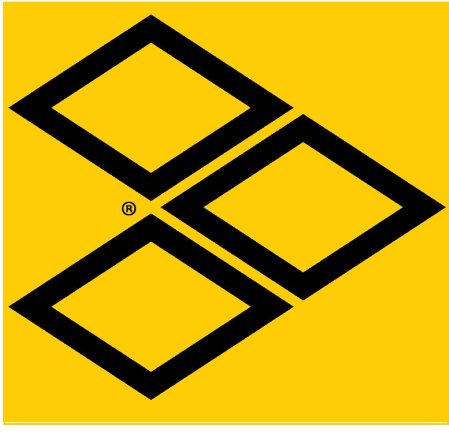


Existing Roof Hatch or Job-Built/Prefab Metal Curbs

Standard Sizes and Weights

SIZE		STEEL		ALUMINUM		STAINLESS STEEL				
(width x length)		Model #	Weight		Model #	Weight		Model #	Weight	
inches	mm		lbs.	kg.		lbs.	kg.		lbs.	kg.
36 x 30	914 x 762	S-20VM	152	70	S-50VM	86	39	S-90VM*	152	70
30 x 54	762 x 1372	NB-20VM	180	82	NB-50VM	100	46	NB-90VM*	180	82
30 x 96	762 x 2438	L-20VM	320	145	L-50VM	178	81	L-90VM*	320	145
1m x 1m		EW-20VM	170	77	EW-50VM	90	41	EW-90VM*	170	77

*These models are a special order.



EFI ENCLOSURES

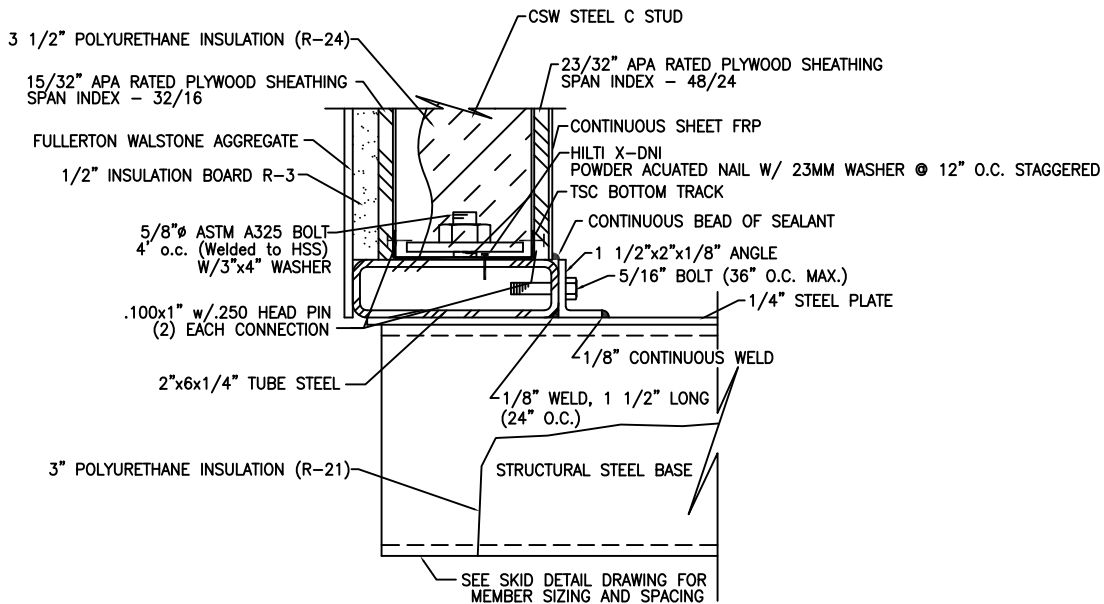
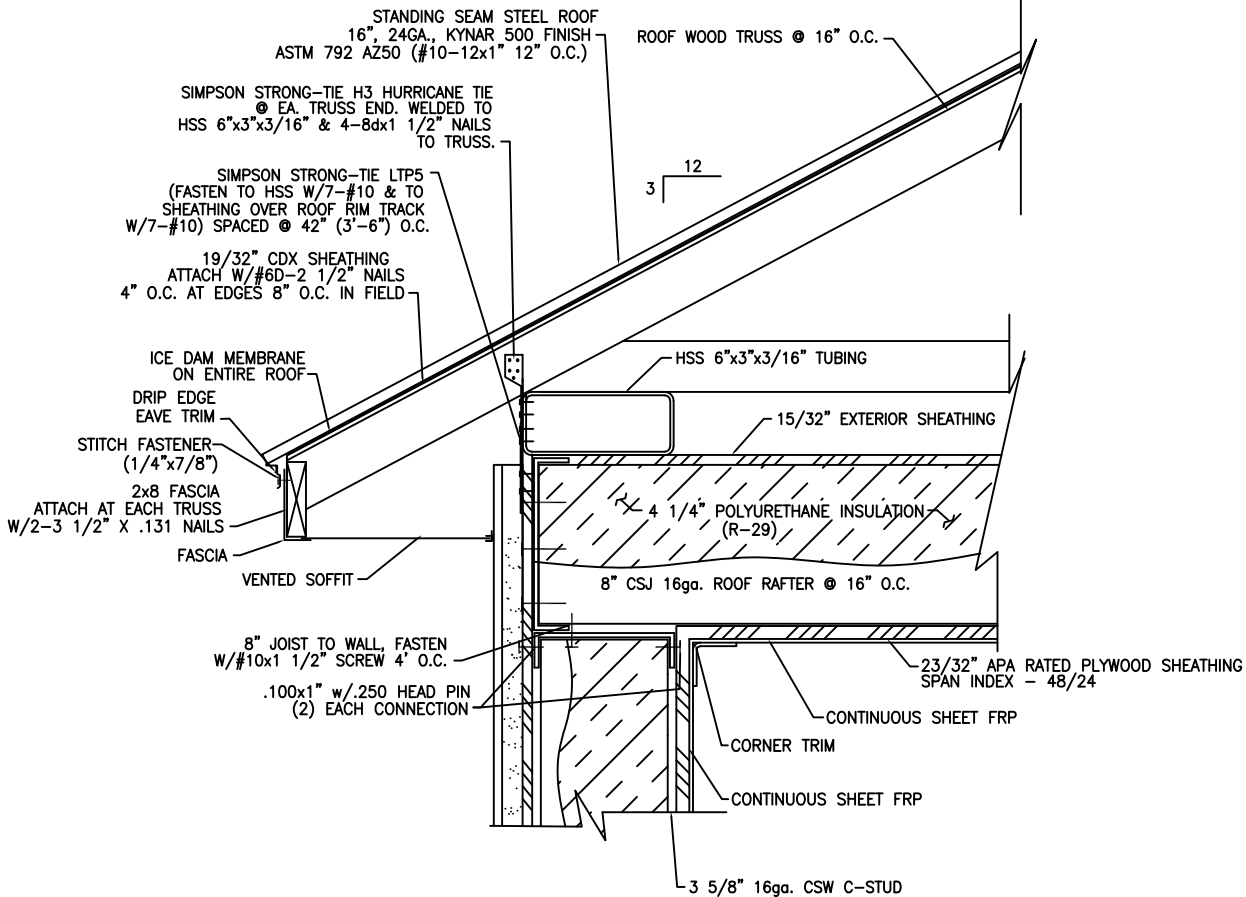


- Revolutionizing the Industry -

EFI's building will meet the following: 2022 California Building Code, Cal. Electric Code, Cal. Mechanical Code, Cal. Fire Code, Cal. Energy Code. This sheet should be removed from all of the submittals. EFI has a set of building design drawings that are reviewed by the State of California Business, Transportation and Housing Agency, Department of Housing and Community Development, Division of Codes and Standards.

CONSTRUCTED ROOF SHIPPED SEPARATE FROM BUILDING. ON SIGHT CRANE LIFT REQUIRED FOR INSTALLATION ON BUILDING

RIDGE VENT (NOT SHOWN FOR CLARITY)



WALL SECTION



ENGINEERED FLUID, Inc.

P.O. DRAWER 723 * CENTRALIA, ILLINOIS 62801, 618-533-1351

JOB REF. NO. _____

DRAWING NO. _____

EXTERIOR AND ROOFING FINISH

WalStone™

From Fullerton Finish Systems, Inc.



Natural Beauty & Permanence.

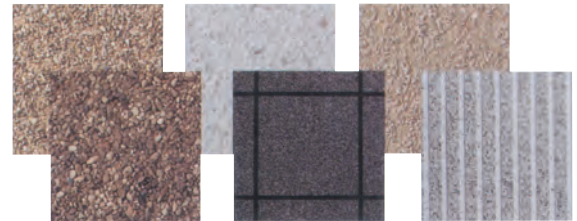
Factory-Finished Quality & Convenience.

WalStone™ panels give your building exteriors the distinctive flair of a natural stone finish, with consistency and fast, hassle-free installation.

The Fullerton Finish Systems Advantage...

- Low maintenance
- Design flexibility
- Consistent quality
- Lower structural cost
- Endless variety of custom looks

- Lightweight, durable, weather-resistant
- Easy and quick installation by your crew
- Quicker project completion
- No specialist subcontractors are required



Easy-Install Panels.

Choose from a wide range of stone types: crushed rock, granite, limestone, obsidian and more, with a variety of sizes, colors, textures and patterns. Each panel made to your specifications give you the perfect finish for any renovation or new construction.

The Fullerton Finish Systems Advantage... Design and Technical Support.

Mix and Match Fullerton Finish Systems products, colors and finishes to create an unlimited range of design effects. Our expert, experienced architectural and engineering staff can help you find the right product for your project, and provide creative ways to use them. Just give us a call.



The Quality Solution for New & Remodel Exterior Finishing

PO Box 609, Sand Springs, OK 74063 • Phone 918.246.9995 • Toll Free 866.915.9995 • Fax 918.246.9976

www.fullertonfinishsystems.com

WalStoneTM

From Fullerton Finish Systems, Inc.

Veneer Panel Specification

Part 1 - General

1.1 Description

A. Work described herein consists of furnishing factory fabricated panels with an exterior face of exposed aggregate finish applied with polymer epoxy resin on mineral fiber reinforced cement board as manufactured in Sand Springs, Oklahoma by Fullerton Finish Systems, Inc. - (918) 246-9995.

B. Manufacturer shall have been continuously engaged in the manufacture of exterior wall panels for 35 or more years.

1.2 Warranty

Manufacturer to warranty from date of purchase against defective materials or workmanship in fabrication for a period of five years.

Part 2 - Products

2.1 Description

A. Exposed aggregate finish shall be _____ (color) and _____ (size) per approved sample. All material shall be obtained from one source to match in color and size as nearly as possible.

B. Epoxy resin finish shall conform to requirements of MIL Spec. Mil-R-9300A and MIL-R-21931.

C. Mineral fiber reinforced cement board (M.F.B.) substrate shall meet the following minimum requirements:

Compressive Strength (lb/in²) **7000**

Flexural Strength (lb/in²) **2000**

Percent Moisture Movement

50% to 90% RH **0.06%**

Thermal "R" Value **0.15**

Burn Character

Flame/Smoke **0/5**

D. Product samples and shop drawings, if required, shall be submitted for approval before panel fabrication.

2.2 Performance

A. Panel substrate and aggregate finish shall withstand the following tests without noted change in appearance or material failure:

1,000 hours in Atlas Twinarc weatherometer.

14 cycles salt fog and thermal shock.

100 cycles -50 to +150 degrees F.

B. All testing shall have been performed by an independent testing facility.

Part 3 - Execution

3.1 Erection

A. Panels shall be erected plumb and true by qualified workman.

B. Panels shall be aligned and spaced as shown on manufacturer's shop drawings, if required.

C. Panels shall be handled and attached to building structure as per manufacturer's shop drawings, if required, installation procedure and/or architectural drawings.

D. All horizontal or vertical panel joints shall be filled with sealant over bond breaker tape.

E. Accessories

1. Sealant (Equal to Sashco Big Stretch or Dow Corning 790 or 795) shall be applied in accordance with sealant manufacturer's recommendations.

2. Bond breaker tape (slick faced polyvinyl chloride tape) minimum of 3/4" wide and equal to #50 by All Type. Tape shall be field applied to surface behind panel joint before panel erection.

3. Fasteners shall be low profile self-drilling stainless steel or zinc and clear chromate plated for rust resistance. Fasteners may be color coated to match exposed aggregate finish, if required.

4. All the accessories shall be of size, shape and spacing as shown on manufacturer's shop drawings, if required, and/or listed in manufacturer's Installation Guide.



The Quality Solution for New & Remodel Exterior Finishing

PO Box 609, Sand Springs, OK 74063 • Phone 918.246.9995 • Toll Free 866.915.9995 • Fax 918.246.9976
www.fullertonfinishsystems.com

WALSTONE STANDARD COLOR CHART



AMBER LITE



BLACK OBSIDIAN



CIBOLA GOLD



DARK BALDWIN



DESERT TAN



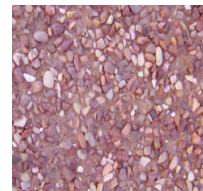
EAU CLAIRE



FLORENE GRAY



NUTMEG



SOONER AZTEC



TEXAS RAINBOW



TOWN MOUNTAIN



WYOMING WHITE



SILVERADO RIBWAL



TEXAS BLUE



IVORY BOTTACINO

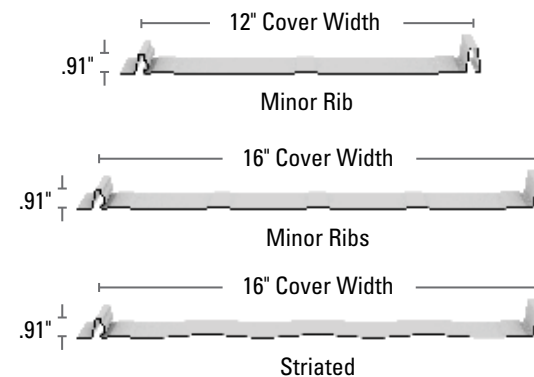


Standing Seam Systems



Meridian

Meridian is an economical, snap-together roofing system that is an excellent choice for commercial and residential applications. Panels are simply installed by placing pancake head fasteners in the panel's slotted flange. Meridian is installed over solid deck.



Details

- Factory formed eave notch upon request
- Minimum slope: 3:12
- Must be installed over solid deck

Panel Options

- Panel width: 12" and 16"
- Panel configurations: 16" minor ribs or striated, 12" minor ribs or striated
- Coating: Kynar 500® (PVDF)
- Substrate:
 - Standard 26 gauge Galvalume® for 16" panels only
 - Standard 24 gauge Galvalume for 12" and 16" panels

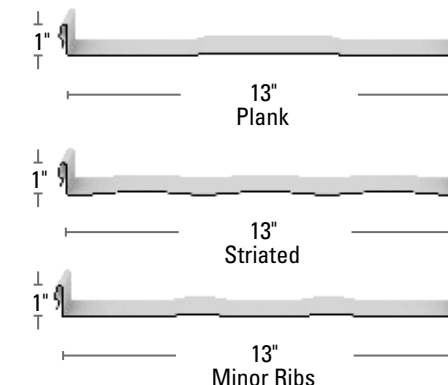
Testing Data

- Fire Rating: Class A
- Air Infiltration: ASTM E1680
- Water Infiltration: ASTM E1646
- Class 4 Impact Resistance: UL 2218
- Texas Department of Insurance Approval: Evaluation RC-34
- Florida State Approval: 2358.1
- For any available Test Data, Section Properties or Load Tables, please visit our download section at www.mcelroymetal.com.

Oil canning (pan wave) is a natural occurrence in metal panels and is not a cause for panel rejection.

Instaloc

Instaloc is a snap-together standing seam that features a 1" seam and is installed with concealed clips. Instaloc is an excellent selection for applications where greater uplift characteristics are required than achieved with Meridian.



Details

- Minimum Slope: 3:12
- Must be installed over solid deck
- Factory applied sealant

Panel Options

- Panel width: 13" standard. Other widths available upon request
- Panel configurations: striated pan, plank and minor rib
- Coating: Kynar 500® (PVDF)
- Substrate: Standard 24 gauge Galvalume

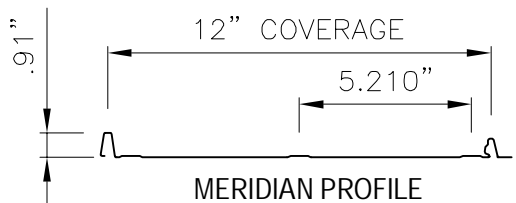
Testing Data

- Fire Rating: UL Class A
- Uplift Test: UL 580, UL 1897
- Class 4 Impact Resistance: UL 2218
- Texas Department of Insurance Approval: RC-86

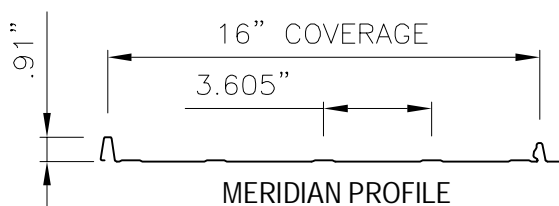
Instaloc is produced in Houston, TX

Meridian Panel

Product Data



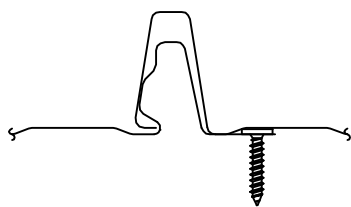
MERIDIAN PROFILE
(Striated or Minor Ribs)
(Minor Ribs Shown)



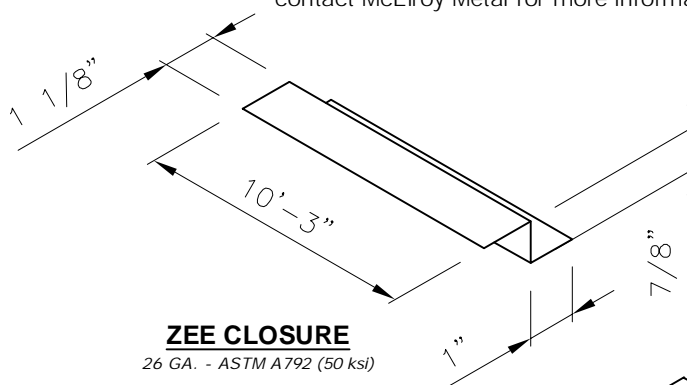
MERIDIAN PROFILE
(Striated or Minor Ribs)
(Minor Ribs Shown)



MERIDIAN PROFILE
(Striated or Minor Ribs)
(Striated Shown)



MERIDIAN SEAM



ZEE CLOSURE
26 GA. - ASTM A792 (50 ksi)



FOAM SEAM PLUG

Applications

Snap Seamed roof panel used on slopes down to 3:12. Standard panel lengths up to 45'. Please inquire for longer lengths.

Substrates

Plywood or ~~Rigid Insulation/Metal Deck.~~

Material

Standard ~~24 GA.~~ or 26 GA. ASTM A792 (50 ksi steel)
AZ55 - Bare, AZ50 - Painted

Manufacturing

Roll formed in factory.

Finishes

~~Acrylic Coated Galvalume®~~
Fluoropolymer (Kynar 500® PVDF resin-based)

Pan Conditions

16" ~~Minor Rib~~ or Striated - 24 or 26 ga.
12" ~~Minor Rib~~ or Striated - 24 ga. only
Oil canning is inherent in all metal panels and is not cause for panel rejection. A signed pan wave acknowledgement will be required for all orders prior to production.

Testing *

Uplift: UL 580 Class 90
Air & Water Infiltration: ASTM E1680, and ASTM E1646.
Fire Resistance: UL 790 Class A
Impact Testing: UL2218 Class 4
Florida Product Approval: FL 2358.1
Texas Windstorm: RC-34
Testing and Approvals are product specific. Please inquire for details.

NOTE:

All data represented on this sheet may not be applicable to all widths and gauges. Please contact McElroy Metal for more information.

ROOFING COLORS



Architectural Colors

per Chad Williams RMWD 6-8-23

STANDARD COLORS



REGAL WHITE



BONE WHITE



SURREY BEIGE



SANDSTONE



ALMOND



BUCKSKIN



ASH GRAY



SLATE GRAY



CHARCOAL



MATTE BLACK



MEDIUM BRONZE



DARK BRONZE



PATINA GREEN



EVERGREEN



MANSARD BROWN



COLONIAL RED



ROMAN BLUE



PATRICIAN BRONZE



TERRA COTTA

ALL COLORS ARE ENERGY STAR COMPLIANT



**BUILDING
FRAMING
MATERIAL**

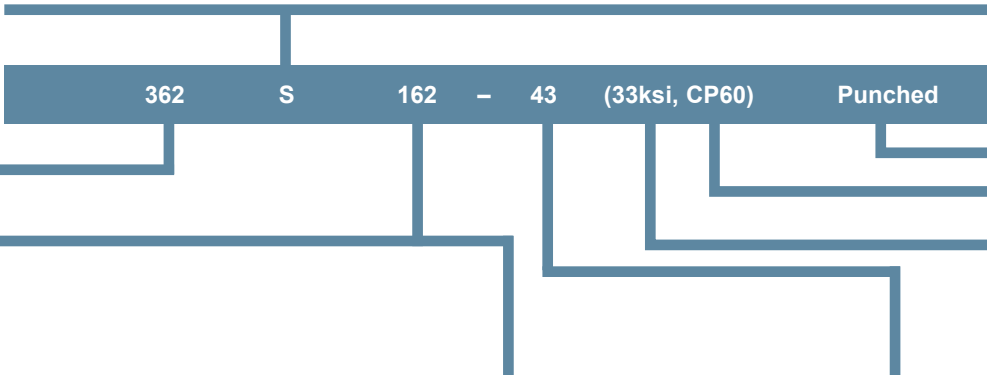
ClarkDietrich™ PRODUCT INFORMATION

Example: 362S162-43 (33ksi, CP60) punched



Punching

Punched studs or joists will be supplied unless the customer indicates unpunched material is required at time of order. All track and channels are unpunched.



Protective Coating
Structural framing CP60 (G90 available)
Drywall framing G40EQ (G40 or G60 available)

KSI -Yield Strength (Fy)
Structural: 33ksi or 50ksi steel
Drywall: See ProSTUD below.

ClarkDietrich structural member depths, flanges & available thickness				ClarkDietrich return lip dimensions			ClarkDietrich thickness identification and color coding					
Member depths	Flange widths range	Mils range	Gauge range	Flange width	Return lip	Member depths	Member mils	Thickness gauge	Design thickness	Min. thickness	Color code	
(250) 2-1/2"	1-3/8," 1-5/8," 2" & 2-1/2"	33-68	20-14 ga	137 (1-3/8")	3/8"	3-5/8"-8"	33	20	0.0346"	0.0329"	White	
(350) 3-1/2"	1-3/8," 1-5/8," 2" & 2-1/2"	33-68	20-14 ga	162 (1-5/8")	1/2"	2-1/2"-14"	43	18	0.0451"	0.0428"	Yellow	
(362) 3-5/8"	1-3/8," 1-5/8," 2" & 2-1/2"	33-97	20-12 ga	200 (2")	5/8"	3-5/8"-14"	54	16	0.0566"	0.0538"	Green	
(400) 4"	1-3/8," 1-5/8," 2" & 2-1/2"	33-97	20-12 ga	250 (2-1/2")	5/8"	3-5/8"-14"	68	14	0.0713"	0.0677"	Orange	
(550) 5-1/2"	1-5/8," 2" & 2-1/2"	33-97	20-12 ga	300 (3")	5/8"	6"-14"	97	12	0.1017"	0.0966"	Red	
(600) 6"	1-3/8," 1-5/8," 2," 2-1/2" & 3"	33-97	20-12 ga	Old stud/track designations			ClarkDietrich ProSTUD® Drywall framing system thickness					
(800) 8"	1-3/8," 1-5/8," 2," 2-1/2" & 3"	33-97	20-12 ga	Designation	Type	Flange/leg	Member gauge	Mils	KSI	Design thickness	Min. thickness	Color code
(925) 9-1/4"	1-5/8," 2" & 2-1/2"	43-97	18-12 ga	CWN	Stud	1-3/8"	ProSTUD 25	15	50	0.0158	0.0150	None
(1000) 10"	1-5/8," 2," 2-1/2" & 3"	43-97	18-12 ga	CSJ	Stud	1-5/8"	ProSTUD 20	19	65	0.0200	0.0190	Pink
(1200) 12"	1-5/8," 2," 2-1/2" & 3"	54-97	16-12 ga	CSW	Stud	2"	ProSTUD 20XD	22	57	0.0232	0.0220	Pink
(1400) 14"	1-5/8," 2," 2-1/2" & 3"	54-97	16-12 ga	CSE	Stud	2-1/2"	ProSTUD 30MIL	30	33	0.0312	0.0296	Pink
				CSS	Stud	3"	ProSTUD 33MIL	33	33	0.0346	0.0329	White
				TSC	Track	1-1/4"	ProTRAK (25, 20 & 20XD) = 50ksi ProTRAK 30 & 33mil = 33ksi					
				TSE	Track	3"						

HOW TO IDENTIFY OUR PRODUCTS

ClarkDietrich has adopted standard nomenclature established by the American Iron and Steel Institute (AISI) for identifying each of its products. Coding of each member consists of four parts, in this order:

- A number which identifies the web depth of the member to two decimal places. 600 = 6.00," 1000 = 10.00," 550 = 5.50," 362 = 3.625," etc.
- A letter that tells you the type of member, such as S = Stud/joist, T = Track, U = U-channel, and F = Furring channel.
- A number that defines the flange dimension in inches to two decimal places. 162 = 1.625," 200 = 2.00," 125 = 1.25," etc.
- A number following a hyphen that denotes the minimum delivered thickness in mils (33mils = 33/1000 inches which is approximately 0.0329"). Minimum delivered thickness is 95% of design thickness.

Product availability.

Most products manufactured by ClarkDietrich are readily available in all markets, but there can be exceptions. Please contact your ClarkDietrich Sales Representative to make sure the product you need is available in your market area.

Protective coatings.

Non-structural products are coated to meet the requirements of AISI S220 and ASTM C645, with a G40 or a protective coating with an equivalent corrosion resistance. ProSTUD® Drywall Framing System meets the Code Compliance Research Report ATI CRRR-0207. Non-structural products may also be ordered with enhanced coatings for special applications.

Structural framing products are available with a variety of protective coatings that meet the CP60 coating protection level requirements of AISI S200 and ASTM C955. These coatings may include G60, A60, AZ50 or GF30, all of which satisfy the above referenced standards. G90 coatings are an enhanced option that can be requested for highly corrosive environments. ClarkDietrich can supply a specific or enhanced coating to meet specific project requirements when requested.

ClarkDietrich is a proud member of the Steel Framing Industry Association (SFIA).

INTERIOR WALL FINISH

NUDO FiberLite® FRP Class C Embossed and Smooth Wall & Ceiling Panels

NUDO FiberLite FRP panels are solid sheets, composed of fiberglass and calcium carbonate-filled polyester resin and comply with the ASTM D5319 Standard for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels. This embossed or smooth panel is designed for interior wall finishes where, washable, durable panels are needed. NUDO FiberLite FRP is a durable, flexible building wall material that is resistant to mold, mildew and corrosion and meets the USDA guidelines. The panel has a Class C rating for flame spread and smoke development when tested per ASTM E-84.

Physical Properties: Table 1

Property	Typical Value		
	.09"	Measure	Test Method
Flexural Strength	17,000	psi	ASTM D790
Flexural Modulus	6.0 x 10 ⁵	psi	ASTM D790
Tensile Strength	8,000	psi	ASTM D638
Tensile Modulus	9.43 x 10 ⁵	psi	ASTM D638
Elongation	1.20	%	ASTM D638
Water Absorption	0.17	72 hrs @ 21°C	ASTM D570
Izod Impact	7.0	Ft-lbs/in	ASTM D256
Coefficient of Linear Thermal Expansion	2.22 x 10 ⁻⁵	50% Humidity Temp -23°C	ASTM D696
Barcol Hardness	30	Average	ASTM D2583
Specific Gravity	1.6138	N/A	ASTM D792
Abrasive Resistance	0.293	% weight loss	TABER
Flash Ignition Temperature	430°	Fahrenheit	ASTM D1929
Self Ignition Temperature	450°	Fahrenheit	ASTM D1929
Flame Spread Index	≤ 200	Unit N/A	ASTM E84
Smoke Generation	≤ 450	Unit N/A	ASTM E84
Surface Burn Test	Class C	Class C	ASTM E84

Physical Properties: Table 2

Part Number Identifier	Nominal Panel Thickness	Nominal Panel Weight	Color		Size
LP-F9 (Embossed)	.090	.65 psf	Almond Beige Black Blue Bordeaux Brown Ivory Silver	Khaki Pearl Red White Med Gray Dark Gray Pineapple	4' x 8', 10' Non-standard sizes available made-to-order.
LP-S9 (Smooth)	.090	.65 psf	Almond Pearl	White Black	4' x 8', 10'
LP-F9-CT (Embossed) LP-S9-CT (Smooth)	.090	.65 psf	Almond Ivory Pearl	Beige Silver White	2'x2'
LP-F10-CT (Embossed) LP-S10-CT (Smooth)	.10	.67 psf		White	2'x2', 4'

SPECIFICATIONS: The NUDO FiberLite FRP panels are manufactured with state-of-the-art laminating equipment and adhesives.

COMPOSITION:

1. Fiberglass and calcium carbonate-filled polyester resin.

FINISHED PANEL QUALITY:

1. The front side shall be embossed with a pebble type finish (embossed finished) or the panels shall have a wear side with a smooth finish (smooth). Colors shall be throughout the panel, and manufactured as specified.
2. The backside shall be smooth. Backside imperfections which do not affect functional properties are not cause for rejection.
3. Physical properties shall be set forth in Table 1.
4. Product quality standards and tolerance for panel weight and thickness shall be set for in Nudo Product, Inc. Quality Control Procedures/Standards which are available upon request.
5. Dimensions shall be specified on purchased order, subject to the following tolerances:
Width: $\pm 1/8"$ (3.2mm)
Length: $\pm 1/8"$ (3.2 mm)
Squareness: not more than $1/8"$ (3.2 mm) out of square.
5. Panels shall be installed in accordance with the manufacturer's guidelines as set forth in the installation guide.

CERTIFICATION:

1. Meets the minimum requirements of the major model building codes for Class C interior wall finishes. Flame spread of less than 200, smoke development less than 450 per ASTM E-84.

FABRICATING RECOMMENDATIONS:

Note: Protect your eyes with goggles; cover your nose and mouth with a filter mask when cutting FiberLite^{FRP} panels. When cutting FiberLite FRP, position the panel so that the saw blade enters the decorative side first, to avoid chipping and damage.

Hand Fabricating: Drilling – high speed drill bit (60° cutting angle, with 12° - 15° clearance) or hole saw.

Cutting: 72-tooth circular saw with reinforced carborundum or carbide-tipped blade.

STORAGE:

FiberLite FRP should be stored horizontally indoors on a contiguous flat surface. Protective film should remain on the panel until installation. Panels should never be stored on the floor or an outside wall. Optimum storage conditions are 60°F (16°C) to 75°F (24°C) and 35% to 55% relative humidity.

PRECONDITIONING:

Prior to installing FiberLite FRP, remove the packaging materials and allow the panels to acclimate to room temperature and humidity for at least 48 hours. Ideally, the room temperature and humidity during acclimation and installation should be the same as the final operation conditions.

PRODUCT LIMITATIONS:

FiberLite FRP is designed as an indoor decorative panel. It should never be exposed to extremely high or extremely low moisture conditions. FiberLite FRP is designed to be installed over a solid wall surface and should never be directly installed over studs, concrete, concrete block, or non insulated exterior walls. FiberLite FRP should be installed between 60°F (16°C) to 75°F (24°C) and 35% to 55% relative humidity. Non-compliance with product limitations may affect future performance and voids warranty.

We believe all information given is accurate. It is offered in good faith, but without guarantee. Since conditions of use are beyond our control, the user assumes all risks. Nothing herein shall be construed as a recommendation for use that infringes on valid patent or as extending a license under valid permit.

CLEANING INSTRUCTIONS:

FiberLite FRP is easy to clean. In most cases, use a clean, damp, non-abrasive cotton cloth and a mild liquid detergent or household cleaner. Always rinse with clean water and a clean, non-abrasive cotton cloth. Dry the panels with a soft, clean, non-abrasive cotton cloth.

DO NOT USE: Abrasive cleaners with bleach, cleaners with acid, alkali or sodium hypochlorite. They will damage and permanently discolor the surface. Be sure that bottles, rags or other materials with these cleaners never come in contact with the surface.

Examples of harsh cleaners to avoid, include but are not limited to:

Bleach
Drain Cleaners
Metal Cleaners
Over Cleaners
Rust Removers
Tub and Tile Cleaners
Lime Scale Remover

REMOVAL OF STAINS:

To remove stains, use full strength Fantastik, All Purpose Cleaner, Formula 409, Pine-Sol, or other mild household cleaners. Blot with clean, damp, non-abrasive cotton cloth, and rinse with cleaner water. When recommended cleaner changes its formulation, the change may be harmful to the surface. Nudo Products, Inc. cannot be held responsible for these changes. Follow all directions and warnings on the cleaner label because many are extremely flammable.

Dyes and pharmaceutical products will permanently stain the panels. These include hair dyes and rinses, silver nitrate, laundry bluing, tannic acid, povidone-iodine, dermatological tar compounds, and peroxide. To reduce these stains, apply a paste of baking soda and water on the area to pull out the stain. Do not rub, as the paste will be slightly abrasive. Wipe up the past with a clean, damp, non-abrasive cotton cloth, and rinse with clean water.

Stains that are stubborn or even permanent and may not disappear include: wood stains, cash register inks, newspaper, marking pen inks, indelible ink, food pricing ink, and label inks.

Stubborn stains that may disappear on their own after a short time or after repeated cleaning include food stains, glass rings, water marks, coffee and tea stains.

FLAME SPREAD AND SMOKE DEVELOPMENT RATINGS: The numerical flame spread and smoke development ratings are not intended to reflect hazards presented by Nudo Product, Inc. products or any other material under actual fire conditions. These rating are determined by small-scale tests conducted by Underwriters Laboratories and other independent testing facilities using the American Society for Testing and Materials E-84 test standards (commonly referred to as the "Tunnel-Test"). NUDO PRODUCTS, INC PROVIDES THESE RATING FOR MATERIAL COMPARISION PURPOSES ONLY. Like other organic building materials, (e.g. wood), panels made up of composite material will burn. When ignited, it may produce dense smoke very rapidly. All smoke is toxic. Fire safety requires proper design of facilities and fire suppression systems, as well as precautions during construction and occupancy. Local codes, insurance



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Form 3004N.C Rev. 13 6/19

Info@nudo.com
www.nudo.com

Marlite Adhesives Specifications

Marlite Brand Adhesives have been developed especially for use with Marlite Brand Products. When used in conjunction with a total Marlite Brand Product System, these adhesives assure the system's ease of installation, performance and long life.

~~C-375~~ ~~Construction Adhesive~~

C-375 is available in 3.5-gallon cans. A strong, flexible, water resistant adhesive formulated for fast, easy application, C-375 meets ASTM Specification C557. It is an excellent, multipurpose adhesive for use with wall panels, acoustic tile, and insulation (except polystyrene foam). It will bond surfaces together quickly or provide a long "open time" of up to 20 minutes, if required. Use to apply Plank or FRP panels over solid backing. This elastomeric polymer-base adhesive remains pliable to compensate for movement of up to 1/8". Application to both surfaces to be joined (cohesive method) produces a very strong immediate bond.

APPLICATION TEMPERATURE: >50°F
SHELF LIFE: 12 months in tightly closed cans
CONSISTENCY: ~~Y~~mastic, smooth paste
COVERAGE: 60 square feet per gallon
WEIGHT PER GALLON: 8.9 lbs.
BASE: elastomeric polymer
SOLVENT TYPE: naphtha
CLEAN-UP: naphtha or mineral spirits – exercise safe practice regarding flammability and toxicity when using mineral spirits
OPEN TIME: 20 minutes, depending on temperature and air movement
SERVICE TEMP. RANGE: -20°F to 140°F
MOISTURE RESISTANCE: excellent
FLAMMABILITY: flammable in wet state
FREEZE-THAW STABILITY: unaffected; will not freeze

C-551 FRP Adhesive

C-551 is available in 3.5-gallon cans. It is a highly water resistant, non-flammable adhesive designed for installing Marlite Brand FRP panels over existing porous-surfaced walls. Do not use on Marlite Plank or other wood-based products. Meets ASTM Specification C557. Also recommended for bonding polystyrene foamboard, polyurethane Foamboard, tileboard, and decorative strips to any structurally sound, porous interior surface, such as drywall or plywood.

APPLICATION TEMPERATURE: >50°F to 90°F
SHELF LIFE: 12 months in tightly closed cans
CONSISTENCY: medium viscosity, smooth smooth paste
COVERAGE: 60 square feet per gallon
WEIGHT PER GALLON: 10.6 lbs.
BASE: proprietary emulsion polymer
SOLVENT TYPE: naphtha
CLEAN-UP: use soapy water before adhesive sets. After adhesive sets, use mineral spirits - exercise safe practice regarding flammability and toxicity when using mineral spirits
OPEN TIME: 20 minutes, depending on temperature and humidity conditions
SERVICE TEMP. RANGE: 0°F to 140°F
MOISTURE RESISTANCE: excellent
FLAMMABILITY: nonflammable
FREEZE-THAW STABILITY: passes 5 cycles at 0°F
CAUTION: do not permit installation to go below freezing within the first 48 hours after application

BUILDING INSULATION

DESCRIPTION: ThermalGuard™ CC2 is a fast set, closed cell, 245fa blown spray polyurethane foam (SPF) insulation designed for use in residential and commercial structures, exterior foundation or perimeter insulation, below grade applications, exterior tank/pipe insulation, etc. ThermalGuard CC2 is applied as a liquid and expands 25x in seconds to fill and seal building cavities of any shape and size. It exhibits superior thermal insulation, air-barrier, and sound attenuation properties compared to conventional insulation materials. Once fully cured ThermalGuard CC2 remains rigid maintaining significant structural strength and thermal insulation properties in adverse conditions across a wide variety of applications. ThermalGuard CC2 achieves a Class I Fire retardance rating, is Appendix X compliant without any additional coatings and meets or exceeds minimum building code requirements for fire safety.

TYPICAL USES:

- Insulation foam for walls, ceilings, roof decks, crawlspaces
- Residential, commercial and industrial building insulation

FEATURES & BENEFITS:

- ICC-ES ESR-2100
- Passes NFPA 286 without a prescriptive thermal barrier when used in conjunction with Fireshell F10E fire-protective coating.
- Class I fire rated
- Appendix X compliant without any additional coatings
- Low odor during application and produces no toxic vapors after application
- Seals, insulates and minimizes uncontrolled air movement into a building envelope
- Reduces energy consumption from heating and cooling
- 245fa-blown, non-ozone depleting agent

CHEMICAL PROPERTIES:

		Isocyanate (A)	Resin (B)
Specific Gravity (grams/cc)	ASTM D-1475	1.23	1.13
Viscosity (cps)	ASTM D-2196	200 – 250	900 – 1200
Mix Ratio, Parts per Volume		1	1
Shelf Life - Unopened Containers		6 months	6 months

TYPICAL PHYSICAL PROPERTIES:

	Test	Result
Density (nominal):	ASTM D-1622	2.0 lb/ft3 (32 kg/m3)
Tensile Strength (psi)	ASTM D-1623	70
Compressive Strength (psi)	ASTM D-1621	40
Closed-Cell Content (%)	ASTM D-2856	96
Water Vapor Permeability (perm) @ 2" (51 mm)	ASTM E-96	.8
Air Leakage (L/s/m ² @ 75 Pa @ 1")	ASTM E-283	0.002
Fungus Growth	ASTM G-21	None
Dimensional Stability (%)	ASTM D-2126	<4Δ
Fire Rating:	ASTM E-84	Class I
Flame Spread Index	ASTM E-84	≤25
Smoke Development Index	ASTM E-84	≤450
R-Value:	ASTM C-518	6.85/inch
Service Temperature:		250° F (120° C)

PROCESS TEMPERATURE AND ENVIRONMENT CONDITIONS: ThermalGuard CC2 must be spray-applied using approved equipment. The system settings required to achieve quality spray foam application will vary depending on environmental and substrate conditions. The following recommended parameters will help ensure optimum foam quality.

Iso (A) & Resin (B) Components	Processing Pressure	Ambient Temperature
115 – 145° F (46 – 63° C)	900 – 1400 psi	20 – 105° F (-6.7 – 40.6° C)
Substrate Temperature	Substrate Moisture Content	Maximum Lift Thickness
20 – 105° F (-6.7 – 40.6° C)	<19%	4"

(continued)

THERMALGUARD™ CC2 (continued):

PREPARATION: ThermalGuard CC2 resin (B) does not require agitation. Do not pre-heat or recirculate resin (B) as doing so will result in the “boiling off” of the 245fa blowing agent which will result in poor yield and poor foam performance.

APPLICATION INSTRUCTIONS: ThermalGuard CC2 is installed by independent SPF contractors. It is recommended that building owners verify that the SPF insulation contractor maintains proper credentials, insurance, and licenses and is properly trained to safely install SPF insulation products.

ThermalGuard CC2 demonstrates excellent adhesion to various substrates when installed according to manufacturer specifications. Allow a minimum of 2 hours for full off-gas and cure before application of a primer, topcoat, or intumescent paint. For best results apply primer, topcoat, or intumescent coating within 72 hours of installation of foam. ThermalGuard CC2 should be installed at a maximum thickness of 4 inches per pass with a minimum of 30 minutes between passes. IT IS THE APPLICATOR'S RESPONSIBILITY TO TEST LIFT THICKNESS FOR A PARTICULAR APPLICATION PRIOR TO COMMENCING INSTALLATION TO ENSURE THAT THE PRODUCT CAN BE INSTALLED SAFELY AT THE DESIRED THICKNESS WITHOUT RISK OF CHARRING OR FIRE.

ThermalGuard CC2 should not be left exposed to sunlight, as UV light will rapidly degrade foam. Do not use near high heat or open flame.

ThermalGuard CC2 must be covered with an approved 15-minute thermal barrier when used as insulation for residential or commercial buildings. Installation must comply with all applicable building codes. Do not install ThermalGuard CC2 at a thickness exceeding 4 inches per pass and do not apply subsequent passes within 30 minutes of the previous pass.

SUBSTRATES: ThermalGuard CC2 is chemically & physically compatible with most common building materials including electrical wiring, wood, metal, concrete, plastic (PVC), copper, vinyl, and glass. It is the responsibility of the contractor to check substrate compatibility prior to starting of the job.

HOW SUPPLIED: Net weight per set is 965 pounds (437.7 kg). A set of ThermalGuard CC2 consists of one (1) 55 gallon (208 L) drum of 'A' component and one (1) 55 gallon (208 L) drum of 'B' component.

Part numbers - Set: TGCC2, Side A: FFPF-ISO A, Side B: FFPF-PUCC1.9P LOW ODOR.

STORAGE: ThermalGuard CC2 should be stored between 60 – 80° F (16 – 26° C) out of direct sunlight. Do not allow material to freeze.

SAFETY PRECAUTIONS: Health Considerations - Consult the Rhino Linings® Safety Data Sheets (SDS)

This chemical system requires the use of proper safety equipment and procedures. Please follow the Rhino Linings® product SDS and Safety Manual for detailed information and handling guidelines.

For Your Protection: The information and recommendations in this publication are, to the best of our knowledge, reliable. Suggestions made concerning the products and their uses, applications, storage and handling are only the opinion of Rhino Linings Corporation. Users should conduct their own tests to determine the suitability of these products for their own particular purposes and of the storage and handling methods herein suggested. The toxicity and risk characteristics of products made by Rhino Linings Corporation will necessarily differ from the toxicity and risk characteristics developed when such products are used with other materials during a manufacturing process. The resulting risk characteristics should be determined and made known to ultimate end-users and processors.

Because of numerous factors affecting results, **Rhino Linings Corporation makes no warranty of any kind, express or implied**, other than that the material conforms to its applicable current Standard Specifications. Rhino Linings Corporation hereby disclaims any and all other warranties, including but not limited to those of merchantability or fitness for a particular purpose. No statements made herein may be construed as a representation or warranty. The liability of Rhino Linings Corporation for any claims arising from or sounding in breach of warranty, negligence, strict liability, or otherwise shall be limited to the purchase price of the material.

Read This Before You Buy

What You Should Know About R-values

The chart shows the R-value of this insulation. R means resistance to heat flow. The higher the R-value, the greater the insulating power. Compare insulation R-values before you buy.

There are other factors to consider. The amount of insulation you need depends mainly on the climate you live in. Also, your fuel savings from insulation will depend upon the climate, the type and size of your house, the amount of insulation already in your house, and your fuel use patterns and family size. If you buy too much insulation, it will cost you more than what you'll save on fuel.

To get the marked R-value, it is essential that this insulation be installed properly.

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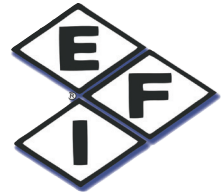


Rhino Linings Corporation

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ENTRY DOORS

ENGINEERED FLUID, INC



Line-X Ultra

EFI-Solutions is pleased to offer a product with more durability, *dfchVWjcbžfYgJ]YbW UbX'gfYb[h''@bY!L i 'hfU* is a two component *Dc`nUgdUfh]W5`d\Uh]WDC`ni fYU'gdfUm* coating that is UV stable. This *dfcXi VhWb'VY'i gYX'Ug'U'* topcoat or a stand alone coating.

Chemical Technical Data

Mix Ratio By Volume:	1A:1B
Gel Time:	45 Sec
Viscosity A Side:	200±100 CPS
Viscosity B Side:	200±100 CPS
Density A Side:	9.41
Density B Side:	8.85

EFI Door Coating

EFI Standard Steel Doors come in three Line-X Ultra colors. Ash Gray, Slurry Beige and White

Please Refer to component page Steel Entry Door System for more information.

Please Select Your Desired Color Below

per Chad Williams RMWD 6-8-23
Exterior Doors

Single Interior Door to be
WHITE with Window

Ash Gray



Surrey Beige

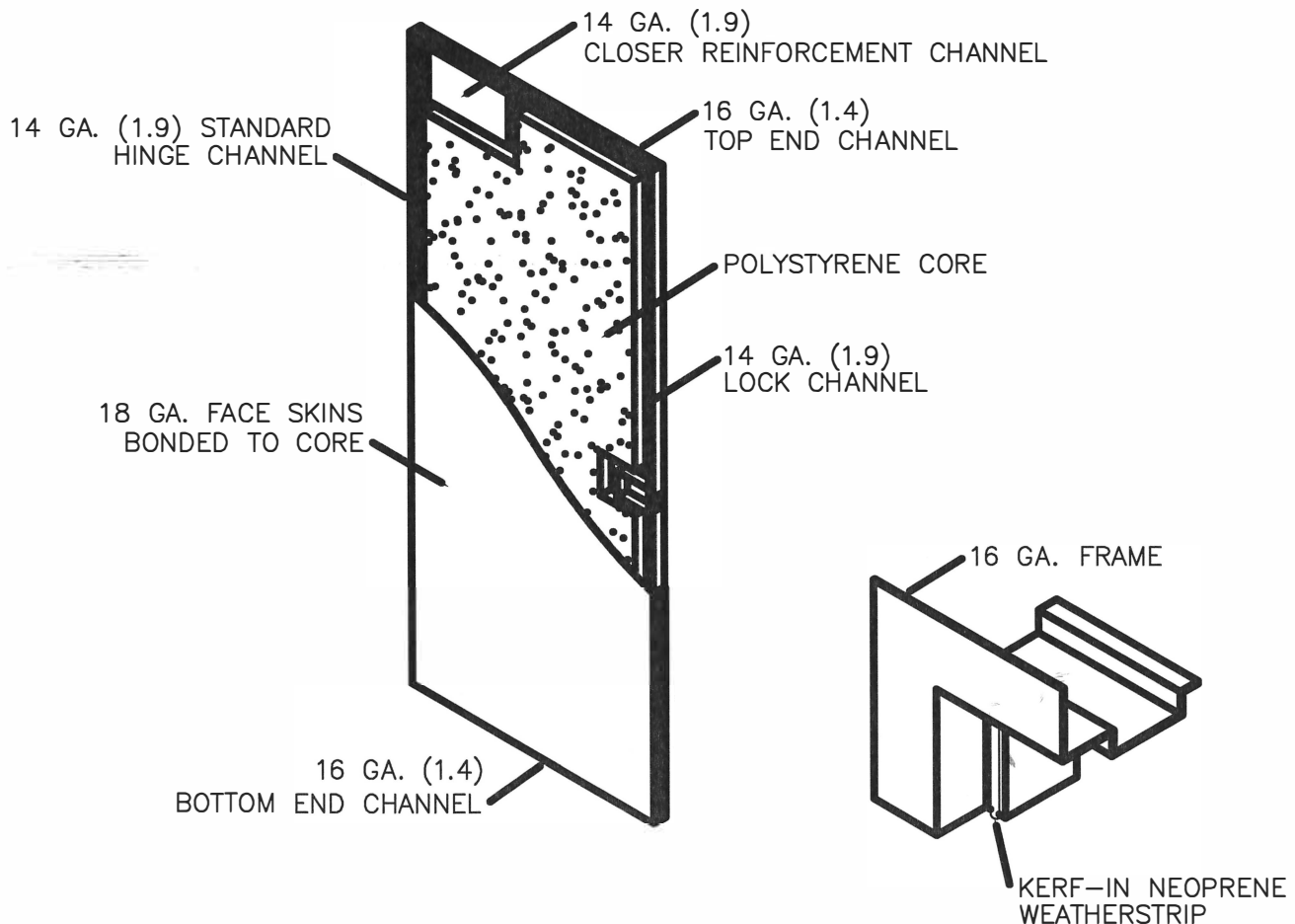


White



STEEL ENTRY DOOR SYSTEM – BILL OF MATERIALS

- 1) CUSTOM 16 GA. STEEL FRAME
- 2) 18 GA. POLYSTYRENE FOAM INSULATED DOOR
- 3) GRADE 2 CONCEALED GEARED HINGE
- 4) GRADE 2 LEVER LOCKSET (CLASSROOM FUNCTION)
WITH SIX PIN REMOVABLE CORE
- 5) COMMERCIAL DOOR CONTROL WITH HOLD OPEN FEATURE
(UL 10C – ANSI A156.4 GRADE 1)
- 6) 7/8" EXTRUDED ALUMINUM THRESHOLD WITH BUMPER SEAL
- 7) ALUMINUM DRIP SHIELD ABOVE DOOR
- 8) KERF-IN NEOPRENE WEATHERSTRIPPING

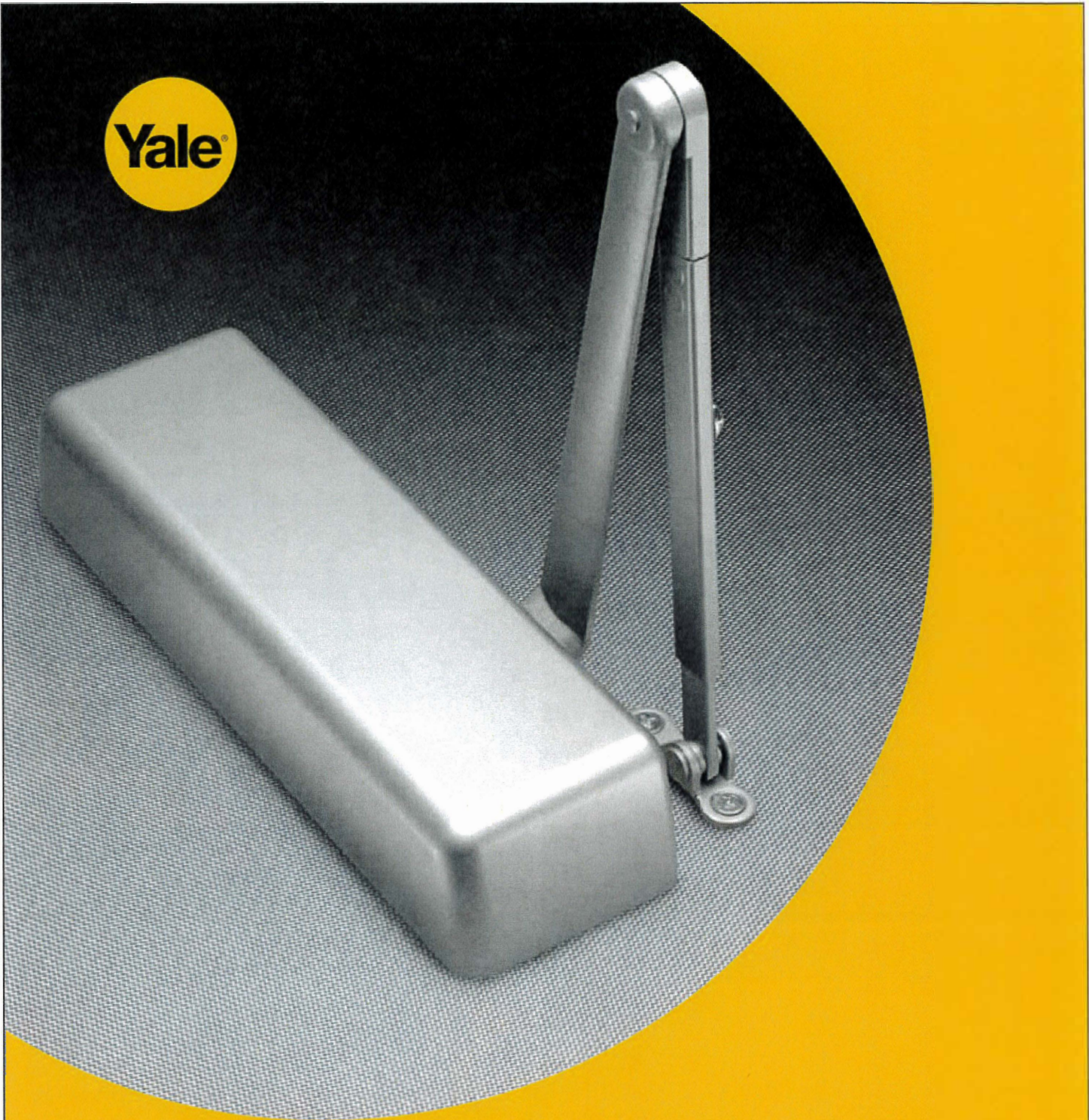


ENGINEERED FLUID, INC.

P.O. DRAWER 723 • CENTRALIA, ILLINOIS 62801, 618-533-1351

JOB REF. NO. _____

DRAWING NO. STEEL ENTRY DOOR



5800 Series

Cast Iron Door Closers

An ASSA ABLOY Group brand

ASSA ABLOY



introduction

Yale® 5800 series cast iron door closers are ideal for commercial applications where ease of use and installation are required at an economical price.

The 5800 series features rugged construction, adjustments for backcheck, closing and latch speed, rack and pinion operation and a variety of arm options.




features

- Adjustable spring sizes 1-6
- Non-handed
- Cast iron
- Tri-packed: regular, parallel or top jamb mounting
- Full plastic cover
- Spring power adjustment
- Hold open and heavy-duty arm configurations
- Sleeve nuts included with all models

functions

- Backcheck
- Closing speed
- Latching speed
- Delayed action; specify 5801DL

certifications

- Certified for ANSI/BHMA A156.4 Grade 1 
- UL and cUL listed. This includes compliance to UL10C. 
- Meets requirements for Americans with Disabilities Act (ADA)  and ANSI/BHMA A117.1
- 10-year limited warranty

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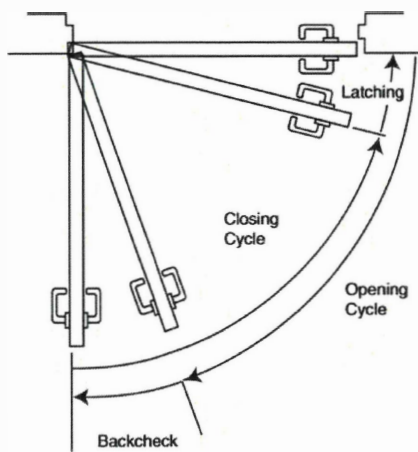
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finishes

ANSI/BHMA Code	Finish Description
689	Aluminum Painted
690	Dark Bronze Painted

door closing latching cycle



arms

Non-Hold Open

Self-closes door every time door is opened. Auxiliary stop (by others) required except when using the Holder/Stop arm.

Hold Open

Achieved by means of friction or ball and detent/roller. Friction hold open has a range of 90° to 180° using template location and mechanical adjustment. Ball and detent or roller hold open is effective in a range of 85° to 110°.

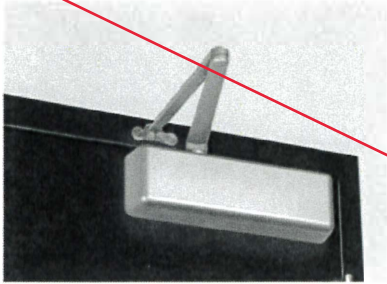
Hold open arm door closers are not permitted to be used on fire door assemblies.



5800 series | door closers

applications

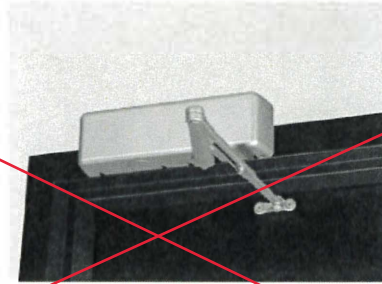
regular arm



Non-hold open arm shown, hold open application available.

- Pull side application, double lever arm
- Sufficient frame, door and/or ceiling clearance must be considered
- Due to arm projection, application may present an aesthetics issue or be prone to vandalism

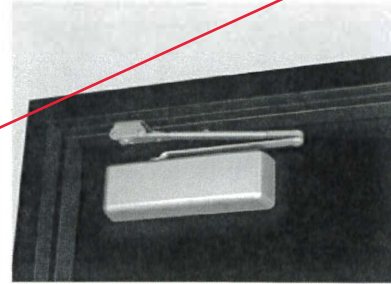
top jamb



Non-hold open arm shown, hold open application available.

- Push side application
- Sufficient frame face and/or ceiling clearance must be considered
- 2-1/4" (57mm) top rail on door is required
- Best door control for doors in exterior walls that swing out of building
- Consideration must be given to depth of reveal

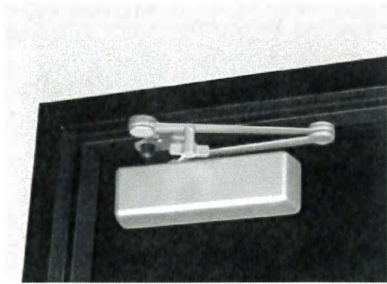
parallel arm



Non-hold open arm shown, hold open application available.

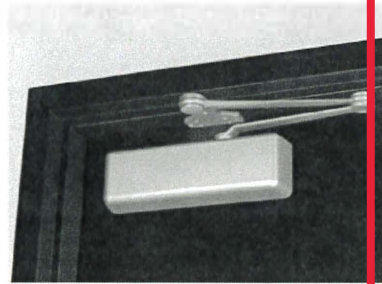
- Push side application
- In the closed position, there is little or no hardware projection beyond the frame face
- Due to arm geometry, approximately 25% less power-efficient than regular arm application
- Closer and arm mounted below the frame stop

holder/stop arm



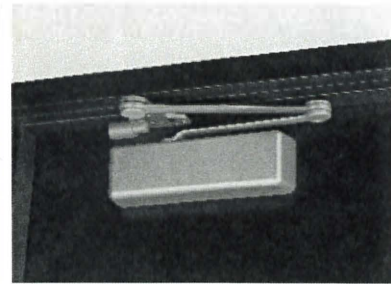
5821T Shown

- Holder/Stop arms incorporate a stop at the arm's soffit plate to dead stop the door at a predetermined degree of door swing between 85° and 110°, in 5° increments
- Prior to dead stop, backcheck slows the door speed to reduce the stop action



5821 Shown

- Holder/Stop arm is intended for use where an auxiliary door stop cannot be used and low to moderate abuse is anticipated
- Stop is removable to allow for additional applications where auxiliary door stops are installed



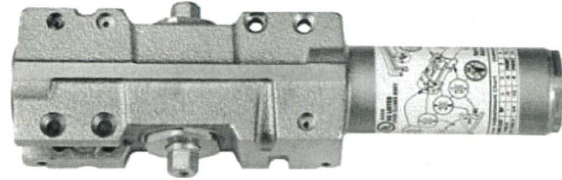
5831T Shown

- Holder/Stop Spring arms incorporate a buffer spring that provides greater protection at the end of the door opening cycle
- Spring is removable



model/part numbers

Model Number	Description
5801	Non-Hold Open Tri-Packed
5801DL	Non-Hold Open Tri-Packed, Delayed Action
5811	Hold Open Tri-Packed
5821	Heavy-Duty Non-Hold Open Parallel Arm with Removable Stop
5821T	Heavy-Duty Hold Open Parallel Arm with Thumbturn and Removable Stop
5831	Heavy-Duty Non-Hold Open Parallel Arm with Spring and Removable Stop
5831T	Heavy-Duty Hold Open Parallel Arm with Thumbturn, Spring and Removable Stop



Note: for heavy-duty parallel rigid arm applications, specify 5821 or 5821T, stop is removable.

See page 5 for more how to order info.

Miscellaneous Parts*	
Part Number	Description
5800COV	Full Plastic Cover
5800SP	Screw Pack
2730Kit	Door Saver Spring Stop

*Specify finish when ordering.

Optional Fasteners	
Part Number	Description
SN-134	Sleeve Nuts
TBGN134-47	Through-Bolts & Grommet Nuts

Note: Sleeve nuts furnished standard with all models.

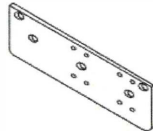
Cover Dimensions		
Width	Length	Projection
3-1/2" (89mm)	12-1/4" (311mm)	2-1/4" (57mm)



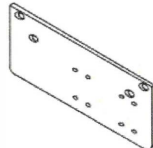
2730kit

accessories

closer mounting plates



5800RDP Narrow Frame Drop Plate (regular arm):
Required for hinge side mount where top rail is less than 3-3/4" (95mm). Plate requires 2" (51mm) minimum top rail.

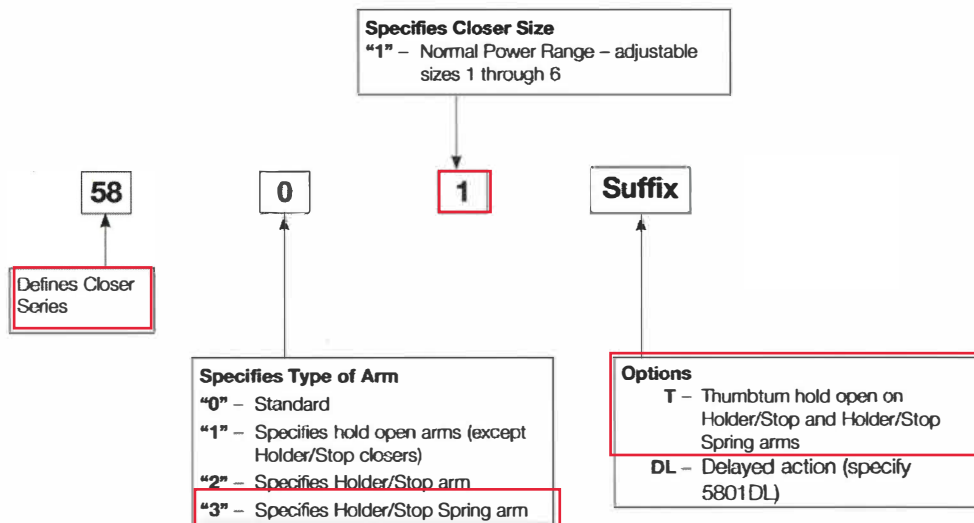


5800PDP Narrow Top Rail Drop Plate (parallel arm):
Required for parallel arm mounting where top rail is less than 5-1/2" (140mm), measured from the stop. Plate requires 2" (51mm) minimum top rail.

Note: All measurements are inches/mm.



how to order



Notes:

- For heavy-duty parallel rigid arm applications, specify 5821 or 5821T, stop is removable.
- Warranty becomes void if door closer is installed on the exterior side of a door in the exterior wall of a building.
- It is strongly recommended, and required on fire door assemblies, that doors having a door closer be hung on ball bearing or anti-friction hinges or pivots; unless an alternate method is identified in the door manufacturer's listing.
- Failure to use the correct type and size fasteners may void factory warranty.
- Fasteners for fire/smoke door assemblies must conform to NFPA 80. In some applications additional fasteners may be mandated by NFPA 80 that are not shipped with standard Yale® product, such as sleeve-nuts/sex-nuts or through-bolts and grommet nuts.
- Contact factory if door weight exceeds 250 lbs.



4700LN Series

ANSI/BHMA Grade 1 Certified
Cylindrical Lever Locks



An ASSA ABLOY Group brand

ASSA ABLOY



Features

FEATURES

- Available in 19 functions, 3 lever designs, and 9 finishes
- Knurled lever designs available
- Freewheeling trim
- Available with Microshield® antimicrobial coating



SPECIFICATIONS

Door Thickness: 1-3/4" (44mm) to 2" (51mm); 1-3/8" (35mm) or 2-1/4" (57mm), please specify on order

Strike: ANSI 4-7/8" x 1-1/4" x 1-1/4" (124mm x 32mm x 32mm) lip to center. See page 14 for optional strikes.

Backset: 2-3/4" (70mm)


Handing: Non-handed

Installation: ANSI/BHMA A156.115(-W)

ANSI/BHMA: Certified ANSI/BHMA A156.2, Series 4000 Grade 1

Warranty: 5 year

APPLICATIONS AND LISTINGS

- UL – cUL listed for use on fire doors having a rating up to and including 3 hours
- Windstorm certified refer to local codes 
- Meets accessibility guidelines for the Americans with Disabilities Act and the requirements of the Uniform Federal Accessibility Standards and ANSI 117.1

Note: Any retrofit or other field modification to a fire-rated opening can potentially impact the fire-rating of the opening, and Yale Locks & Hardware makes no representations or warranties concerning what such impact may be in any specific situation. When retrofitting any portion of an existing fire rated opening, or specifying and installing a new fire-rated opening, please consult with a code specialist or local code official (Authority Having Jurisdiction) to ensure compliance with all applicable codes and ratings.

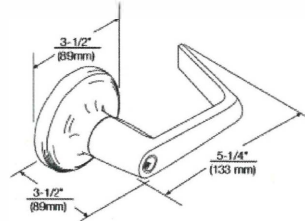
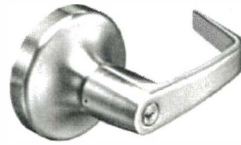




Lever Trim

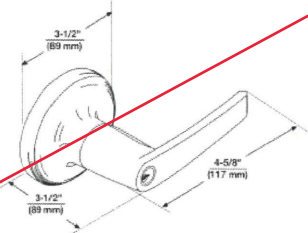
AUGUSTA AU

Lever: Cast Zinc
Rose: Wrought Brass



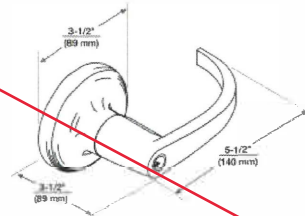
MONROE MO

Lever: Cast Zinc
Rose: Wrought Brass



PACIFIC BEACH PB

Lever: Cast Zinc
Rose: Wrought Brass


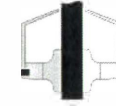

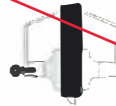
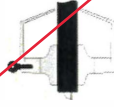


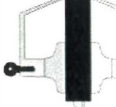


Available with large and small format interchangeable core. See page 11-12 for details.

Dimensions shown are in inches (mm).



Functions

<p>4701LN (F75)</p> <p>Passage or Closet Latch</p> <ul style="list-style-type: none"> • For doors that do not require locking. • Either lever operates latchbolt at all times.  <p>Outside Inside</p>	<p>4702LN (F76A)</p> <p>Privacy, Bedroom or Bath Lock</p> <ul style="list-style-type: none"> • For lavatory or other privacy doors. • Either lever operates latchbolt unless outside lever is locked by pushbutton inside.* • Button automatically releases when inside lever is turned or door is closed. • Emergency key inserted and turned in hole in outside lever will unlock door from outside. (Emergency key furnished with lockset. P/N 14-5302-1053-048) • Inside lever always active.  <p>Outside Inside</p>	<p>4703LN (F77A)</p> <p>Patio or Privacy Lock</p> <ul style="list-style-type: none"> • For exit doors with limited entry. • Deadlocking latchbolt. • Either lever operates latchbolt unless outside lever is locked by pushbutton inside.* • Button automatically releases when inside lever is turned or door is closed. • Inside lever always active.  <p>Outside Inside</p>	<p>4704LN (F82A)</p> <p>Entry Lock</p> <ul style="list-style-type: none"> • For entrance or office doors. • Deadlocking latchbolt. • Either lever operates latchbolt (except when outside lever is locked from inside).* • Pushing button in inside lever locks outside lever. (Automatically releases when inside lever is turned or key is rotated in locked outside lever.) • Latchbolt is operated by key in outside lever or by rotating inside lever. • Inside lever always active.  <p>Outside Inside</p>
<p>4705LN (F86)</p> <p>Storeroom or Closet Lock</p> <ul style="list-style-type: none"> • For use on storeroom, utility, exit doors. • Deadlocking latchbolt. • Latchbolt operated by lever inside, key in outside lever. • Outside lever always locked.* • Inside lever always active.  <p>Outside Inside</p>	<p>4706LN (F92)</p> <p>Service Station Lock</p> <ul style="list-style-type: none"> • Deadlocking latchbolt. • Either lever operates latchbolt. • Pushbutton in inside lever locks outside lever. (Automatically releases when inside lever is turned, door is closed or key is rotated in outside lever, except when slotted pushbutton is rotated 90° clockwise to retain outside lever in locked position.)* • Latchbolt operated by key in outside lever, inside lever always active.  <p>Outside Inside</p>	<p>4707LN (F109)</p> <p>Entry Lock</p> <ul style="list-style-type: none"> • For entrance, general home or office doors. • Deadlocking latchbolt. • Either lever operates latchbolt (except when outside lever is locked from inside).* • Pushing turn button in inside lever locks outside lever. (Automatically releases when inside lever is turned or key is rotated in locked outside lever.) • Outside lever may be retained in locked position by pushing and rotating turn button 90° clockwise to a horizontal position; not released until turn button is manually returned to the vertical position. • Latchbolt is operated by key in outside lever or by rotating inside lever. • Inside lever always active.  <p>Outside Inside</p>	<p>4708LN (F84)</p> <p>Classroom Lock</p> <ul style="list-style-type: none"> • For classroom or utility room doors. • Deadlocking latchbolt. • Either lever operates latchbolt (except when outside lever is locked by key).* • Inside lever always active. • Key releases outside lever.  <p>Outside Inside</p>

* Lever handles are Free-Wheeling in locked position. Shaded area denotes FreeWheeling lever.



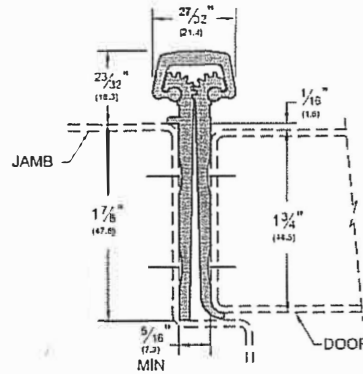
Full Mortise Hinges

- Full-Mortise units are designed mainly for new door applications and are applied to the frame rabbet and door edge to conceal both leaves

Full Mortise

_FM

AVAILABLE FINISHES: BL, C, D, G, PW, SN

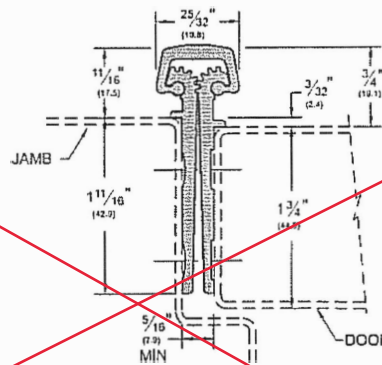


Full Mortise Short Leaf Inset

- Designed for use with doors which range between 1 3/4" to 2 1/4"
- Designed for use with hollow metal doors and frames where the inset conforms to S.D.I. specifications for aligning doors and frames

_FM_SLI

AVAILABLE FINISHES: BL, C, D, G, PW, SN

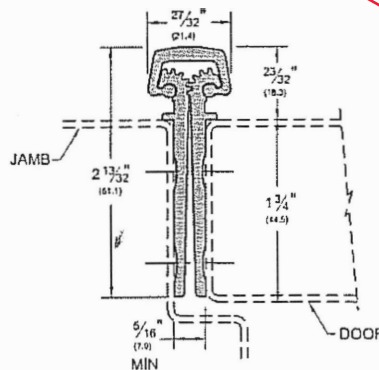


Full Mortise Short Leaf Flush

- Designed for use with doors which range between 1 3/4" to 2 1/4"
- Also used for bifold applications to keep the faces of the doors flush (not illustrated)

_FM_SLF

AVAILABLE FINISHES: BL, C, D, G, PW, SN



AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
 BL (Black Anodized) C (Clear Anodized) D (Dark Bronze Anodized) G (Gold Anodized)
 PW (Painted White) and SN (Satin Nickel) are special finishes available upon request.

800-346-7707 | www.pemko.com

Check the web site for the up-to-date catalog

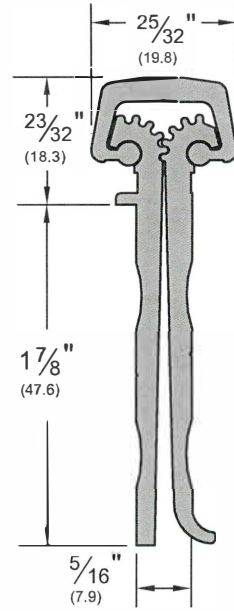
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ASSA ABLOY

The global leader in
 door opening solutions



ASSA ABLOY



_FM

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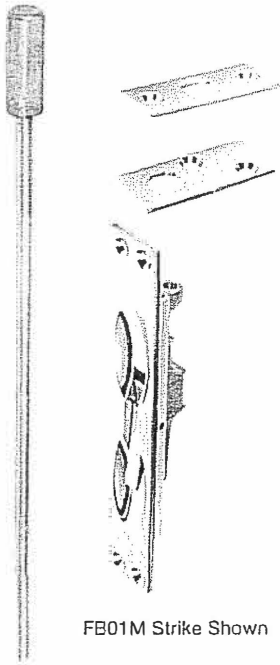
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Bolts & Coordinators Manual Flush Bolts

McKinney®

ASSA ABLOY

Manual Flush Bolt (Listed for Fire Rated Hollow Metal Doors) No. FB01M, FB01M-5



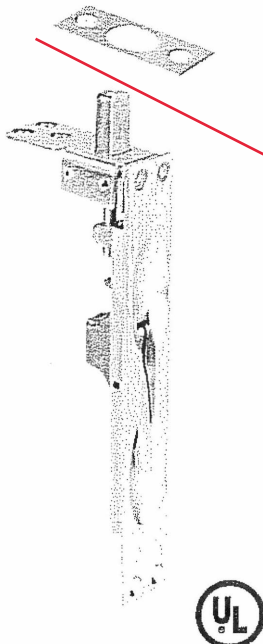
FB01M Strike Shown

- Material:** Brass
- Finishes:** 605, 606, 612, 613, 625, 626
- Fastener:** 8 ea. #8 x 3/4 FH Combo Screws
- Features:**
- Fits ANSI A115 door and frame preparation.
 - 3/4" bolt throw
 - 12" rod length
 - 1-1/2" adjustment for doors and strike clearances
 - Non-Handed
 - Conforms to Positive Pressure Standards UL 10C & UBC 7-2 (1997)
- Options:**
- Other size rods available are 18", 24", 36", 48".
 - Extra long bolt head - 2-1/2"
 - Use DPS1 Dust Proof Strike (shown on page 2) to to eliminate dust or debris in the bottom strike

No.	Size	Weight	ANSI A156.16
FB01M	Face Plate: 1" x 6-3/4" Strike: 15/16" x 2-1/4" Guide: 1" x 2"	1.5 lbs./2	L04251
FB01M-5	Face Plate: 1-1/4" x 6-3/4" Strike: 15/16" x 2-1/4" Guide: 1" x 2" (Note: Extra Long Head Bolt not available on FB01M-5)	1.7 lbs./2	L04251

USED ON DOUBLE DOORS ONLY

Manual Lever Extension Flush Bolt (Listed for Wood Composite Fire Rated Doors) No. FB02W



- Material:** Cast Brass
- Finishes:** 605, 606, 612, 613, 625, 626
- Fastener:** 2 ea. #8 x 1" FH Combo Screws
6 ea. 8-32 x 1/2 FH MS
4 ea. #8 Counter Sunk Washer
- Features:** 3/4" bolt throw, 3/4" backset; door strength maintained by corner reinforcing plate.
Non-Handed
Conforms to Positive Pressure Standards UL 10C & UBC 7-2 (1997)
- Options:** Use DPS1 Dust Proof Strike (shown on page 2) to eliminate dust or debris in the bottom strike

No.	Size	Weight	ANSI A156.16
FB02W	Face Plate: 1" x 6-3/4" Strike: 15/16" x 2-1/4"	1.7 lbs./2	L04261

Architectural Door Accessories

ASSA ABLOY

Pemko Commercial Thresholds: Latching Panic Exit Saddles

The global leader in
door opening solutions

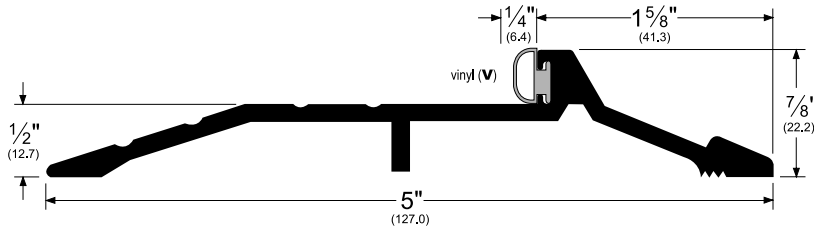
177_V



AVAILABLE FINISHES: A, B, D, G

WIDTH: 5" (127.0 mm)

HEIGHT: 7/8" (22.2 mm)



A (Mill Finish Aluminum)

B (Mill Finish Extruded Bronze [Brass])

D (Dark Bronze Anodized)

G (Gold Anodized)

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TITLE:

PREPARED FOR:

PREPARED BY:

DATE:

COMMENTS:

177_V_CUT Rev 1 - 02.10.17

Architectural Door Accessories

ASSA ABLOY

Pemko Product Reference Tech-Spec

The global leader in
door opening solutions

315_N_ Door Bottom

Example: 315 | C | N | 36

Profile# Finish Insert Length

TYPE: Door Bottom Sweep

MATERIAL: 6063-T6 Aluminum Alloy and Temper

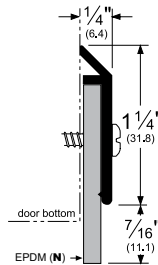
FINISHES: B (Brass), D (Dark Bronze Anodized), G (Gold Anodized)
PW (Painted White), SN (Satin Nickel Anodized)

LENGTHS: Up to 185"

WIDTH: 1/4" (6.4 mm)

HEIGHT: 1-11/16" (42.86 mm)

WEIGHT: Estimated per foot: 0.15 lbs



Product Test Ratings:



See Product Testing
section for more
information.

ANSI NUMBER: Aluminum: R3B434; Brass: R1B434

LEAD TIME: 4 working days (or less)

AVAILABLE: 315_N_ is shipped from Pemko's Memphis, Ventura, Vancouver and Toronto locations

WARRANTY: 5 Years from purchase date

CROSS REFERENCE: NGP: 200; Zero: 39

INSTRUCTIONS, CAD DRAWINGS, PROFILE DRAWINGS and CUT SHEET

Available upon request and on website

PRODUCT TESTING:

- **Air Infiltration Tested** – Tested to ASTM E-283-04 (2012) for low air leakage allowance; allows no more than 0.3 cfm per square foot at 1.57 psf.
- **Sound Tested** – Tested to ASTM E90 – 2009 in a single or in multiple sound seal configurations for sound attenuation in an opening
- **Smoke Tested** – Tested to UL 1784 and meets the requirements of NFPA 105-2013 for smoke leakage in an opening; allows no more than 3.0 cfm per square foot at 0.10" water column (about 75 Pa).
- **Fire Rated** – Tested to UL10B Standard Fire Tests and UL10C Positive Pressure Fire Tests of Door Assemblies
- **BHMA Certified** – Tested for performance with regards to the requirements in:
 - ANSI/BHMA A156.22 – Door Gasketing and Edge Seal Systems

MATERIAL SAFETY / FIRE HAZARDS

Per OSHA Regulations (Standards – 29 CFR) this Pemko item is considered an “article” as described in section 1910.1200 paragraph (c), meaning that it is a manufactured item other than a fluid and is not a hazard. To help our customers we are providing additional information in this section to cover relevant topics found on Safety Data Sheets (SDS) but not found elsewhere in this document.

FIRE HAZARD:

Aluminum alloy is a non-combustible material. Solid aluminum does not present a fire hazard.

FIRST AID MEASURES

Under normal conditions this item presents no small parts and so this item cannot be inhaled or swallowed and has no adverse reaction when coming in contact with skin. Observe good industrial hygiene after installation.

Note to physician: treat symptomatically and supportively

FIREFIGHTING MEASURES

As in any fire, prevent human exposure to fire, smoke, fumes, or products of combustion. Evacuate non-essential personnel from the fire area. Firefighters should wear face mask with self-contained breathing apparatus (SCBA) and impervious protective clothing. In case of aluminum fire, use class D dry powder to extinguish. DO NOT USE water or halogenated extinguishing media.

- Hazardous combustion products: none.

SPILL PROCEDURES

Sweep up any off-cuts from product and store in a suitable container for disposal

HANDLING, STORAGE, AND DISPOSAL

There are no specific handling instructions. Always store at room temperature and keep away from heat sources. When disposing, if possible, recycle the item and its packaging. Otherwise disposal should be in accordance with local, state, or federal legislation. Bury in an authorized landfill site or incinerate under approved controlled conditions.

EFFECTS OF EXPOSURE

There are no effects under normal conditions of use. Observe good industrial hygiene.

TOXICITY

There is no toxicity hazard under normal conditions of use

HEALTH HAZARD

This product may contain hazardous ingredients; harmful effects are unlikely under normal conditions.

CARE AND MAINTENANCE

CLEANING

Pemko's aluminum products and solid gasket products can be cleaned with a mild soap with warm water. A clean non-abrasive cloth should be used to clean the surface of these products. For removing grease, sealant, or other minimal adhesives a mild solvent such as mineral spirits may be used; then clean with mild soap mixed with warm water. To dry, either allow to air dry or wipe dry with a chamois, squeegee, or lint-free cloth.

For sponge gasket and weatherstrip products, wipe with a damp cloth. Do not use mineral spirits or other chemical as this may cause the plastic to "melt" or deteriorate. To dry, either allow to air dry or wipe dry with a chamois, squeegee, or lint-free cloth.

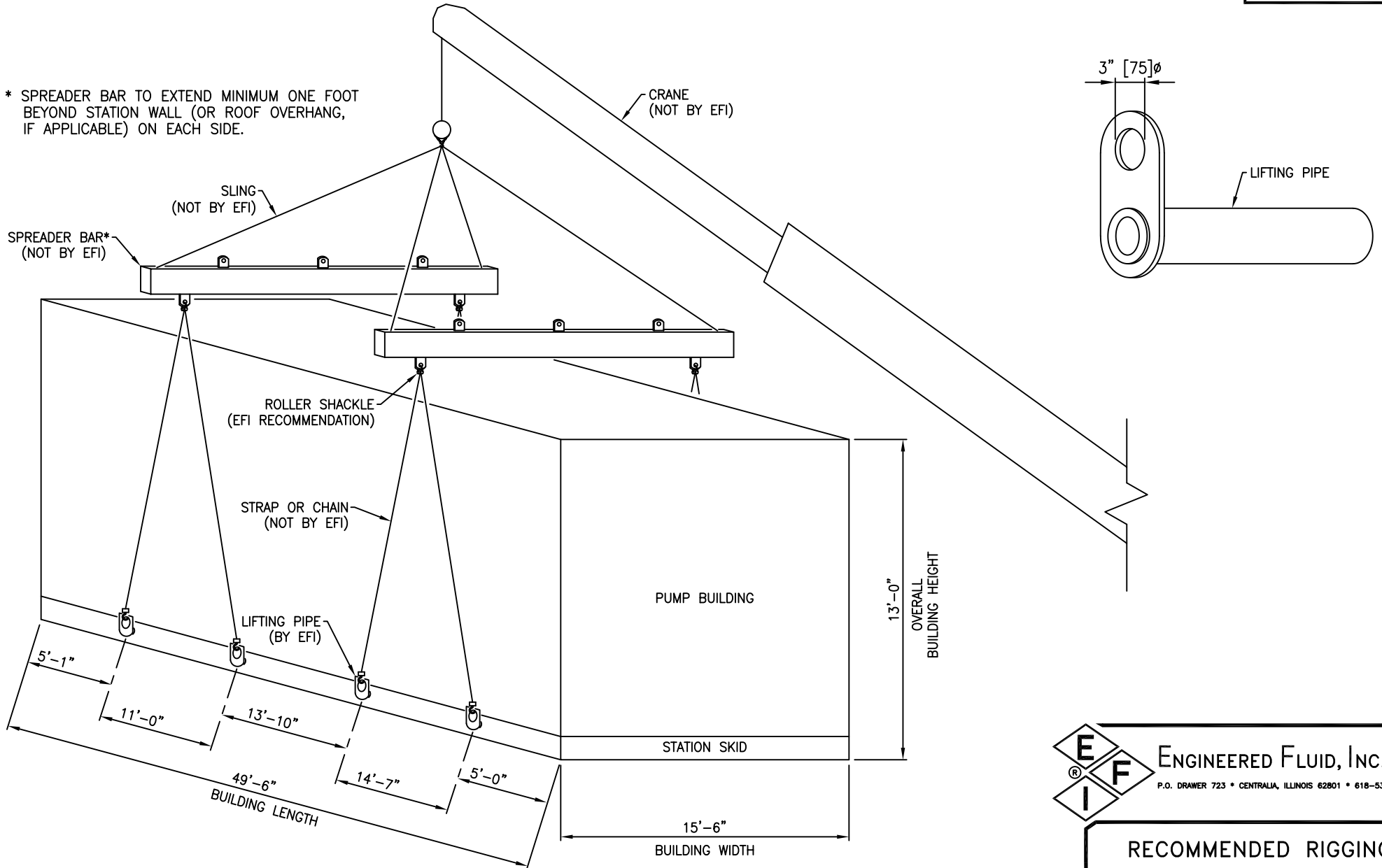
The use of strong solvents or cleaner concentrations may cause damage to the finish surface and isn't recommended.

MAINTENANCE

Pemko products are generally low-maintenance and require nothing more than general cleaning. Should anything outside of "general cleaning" arise, please consult Pemko Customer Service.

If you have any questions, or if you have a situation outside this scope, please contact Pemko Customer Service.

* SPREADER BAR TO EXTEND MINIMUM ONE FOOT BEYOND STATION WALL (OR ROOF OVERHANG, IF APPLICABLE) ON EACH SIDE.



**LIFTING PIPE SPACING TO BE DETERMINED AFTER DESIGN OF SKID STRUCTURE IS COMPLETED

COORDINATE STATION DELIVERY WITH EFI DELIVERY COORDINATOR:
Carin Jourdan / cjourdan@engineeredfluid.com / (618) 545-3633.



ENGINEERED FLUID, INC.

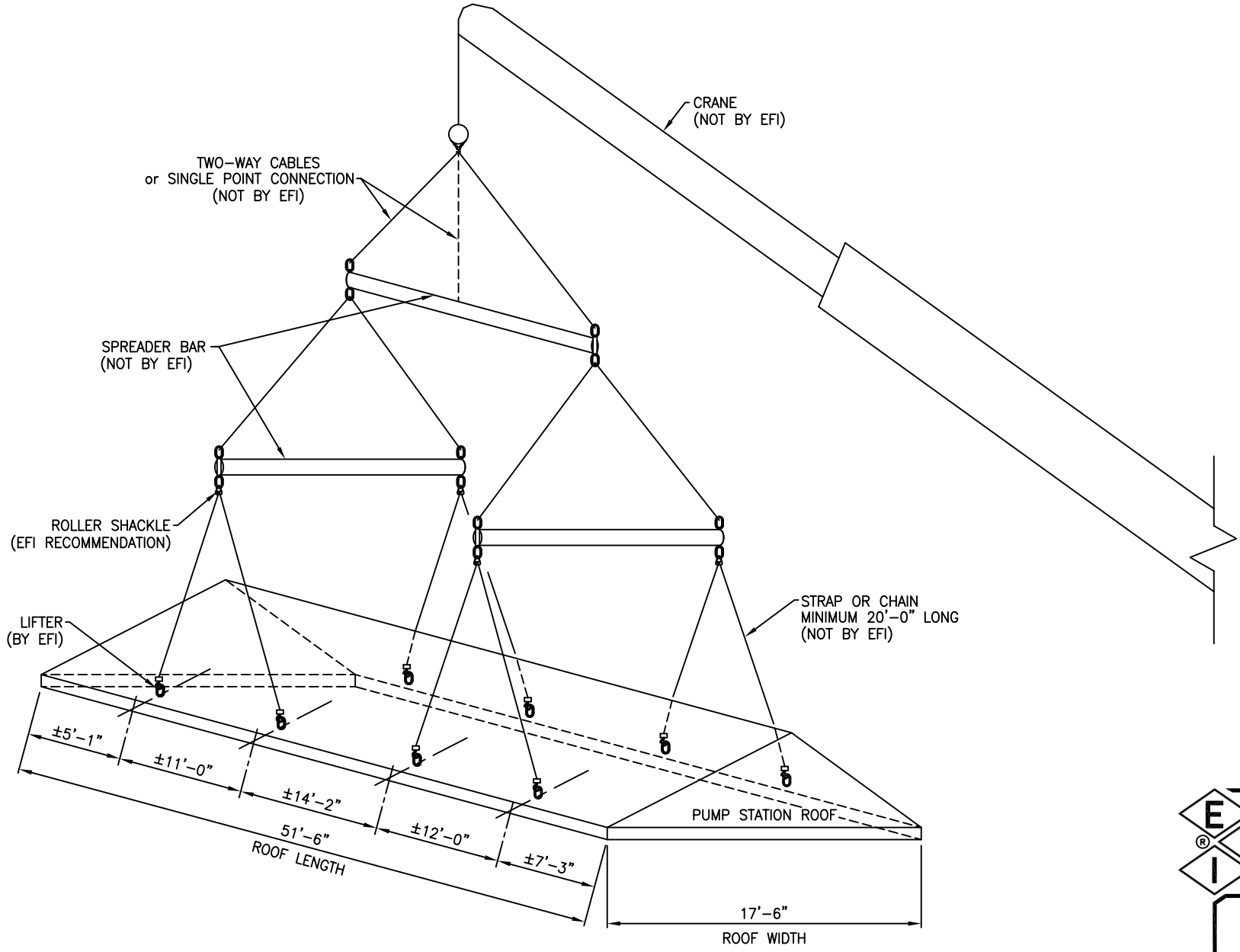
P.O. DRAWER 723 • CENTRALIA, ILLINOIS 62801 • 618-533-1351

RECOMMENDED RIGGING

RAINBOW MUNICIPAL WATER DISTRICT
WEST LILAC BPS
RAINBOW, CA

JOB REF NO. 93134

DRWG. NO. BUILDING LIFT PLAN



COORDINATE STATION DELIVERY WITH EFI DELIVERY COORDINATOR:
 Carin Jourdan / cjourdan@engineeredfluid.com / (618) 545-3633.



ENGINEERED FLUID, INC.

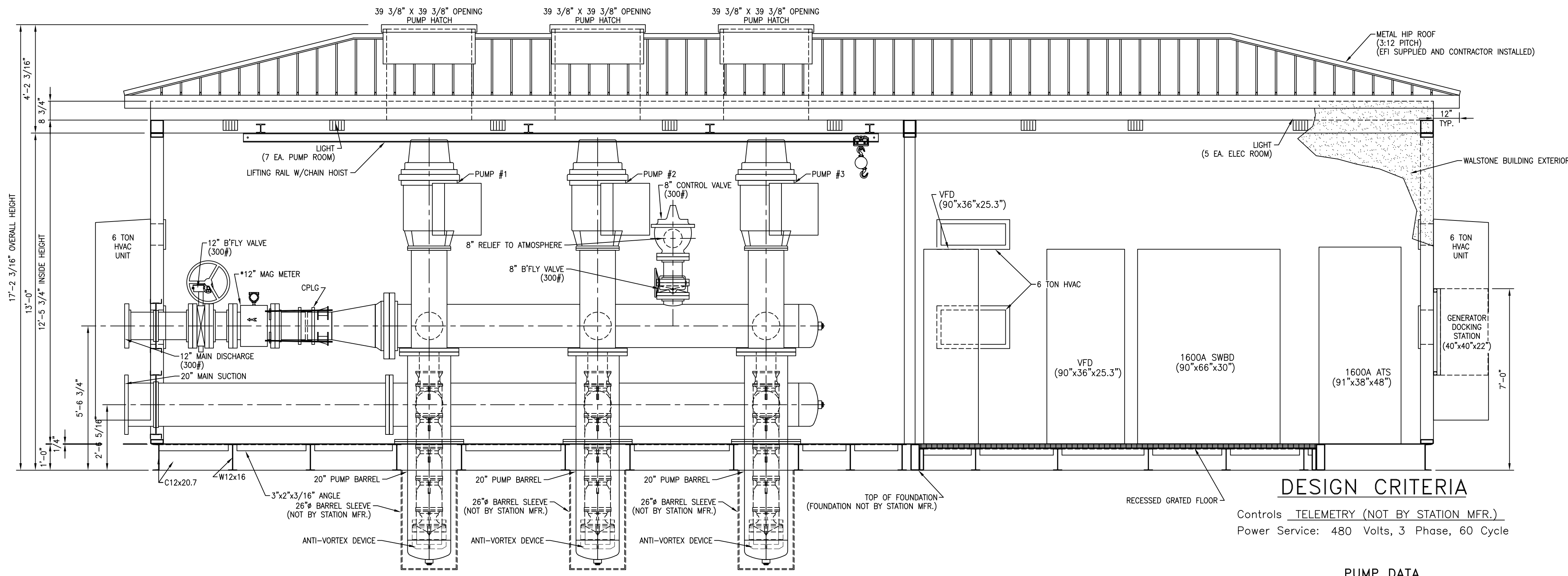
P.O. DRAWER 723 • CENTRALIA, ILLINOIS 62801 • 618-533-1351

RECOMMENDED RIGGING
 RAINBOW MUNICIPAL WATER DISTRICT
 WEST LILAC BPS
 RAINBOW, CA

JOB REF NO. 93134

DRWG. NO. ROOF LIFT PLAN

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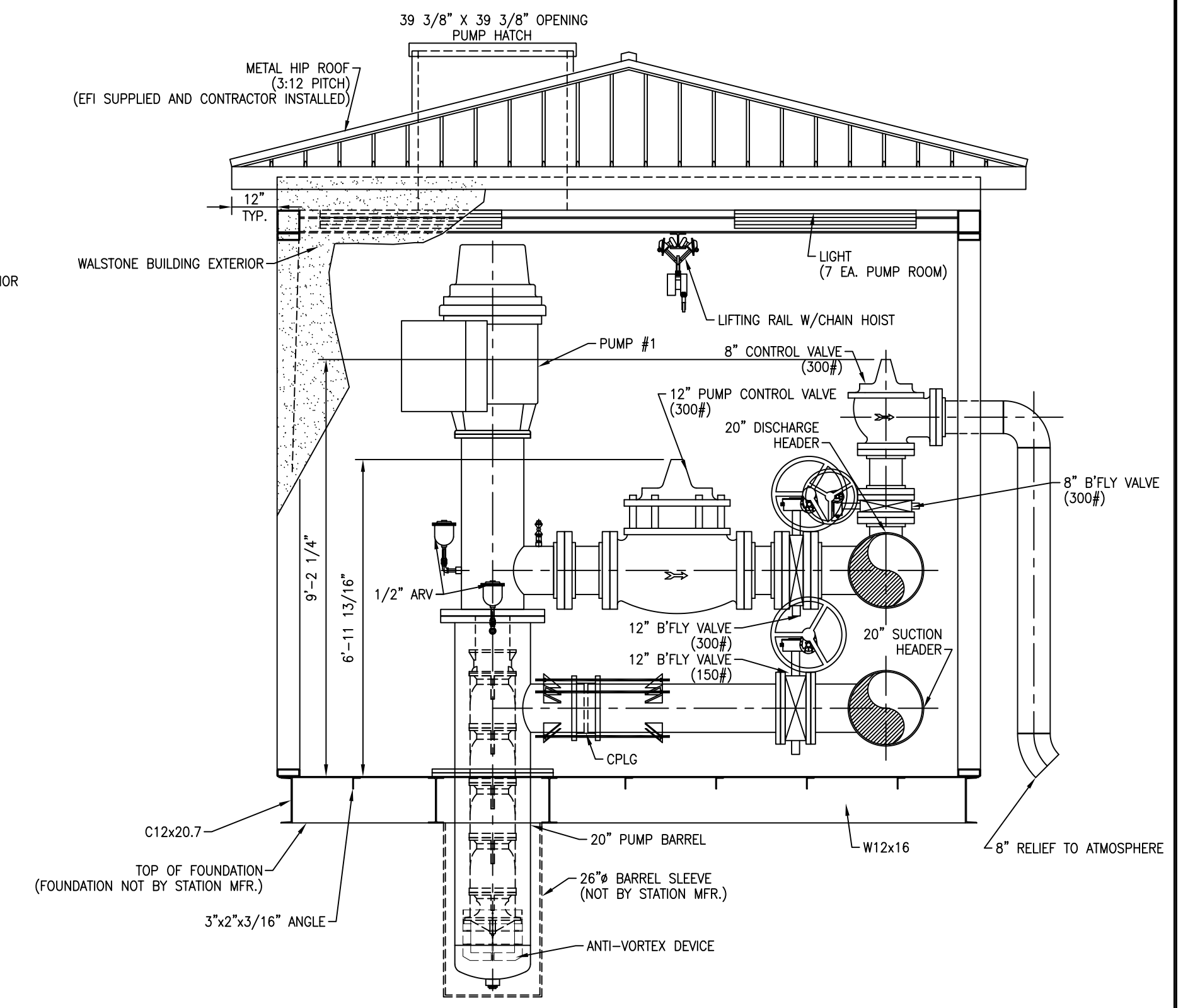
SECTION B-B

DESIGN CRITERIA

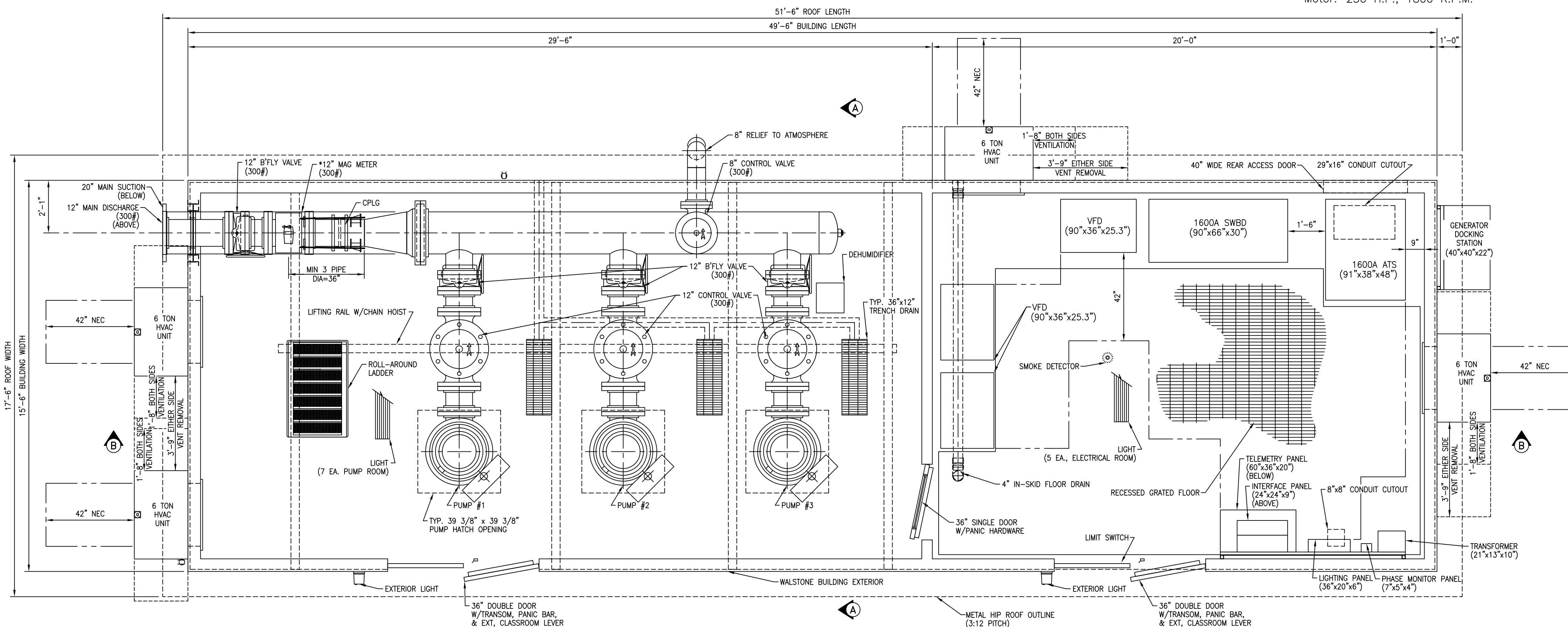
Controls TELEMETRY (NOT BY STATION MFR.)
 Power Service: 480 Volts, 3 Phase, 60 Cycle

PUMP DATA

Type: VERTICAL, MULTI-STAGE, TURBINE
 Pump 1, 2, & 3
 Capacity: 1800 G.P.M. AT 400 FEET T.D.H.
 Size: 12 1/4 STAGE, 12" DISCH., 20" Ø BARREL
 Motor: 250 H.P., 1800 R.P.M.



SECTION A-A



PLAN

GENERAL NOTES

CONTRACTOR'S NOTE:

SCHEDULE 40 STEEL PIPE
 MAIN SUCTION:
 20" ANSI STANDARD B16.5, CLASS 150 FLANGE
 MAIN DISCHARGE:
 12" ANSI STANDARD B16.5, CLASS 300 FLANGE

ALL PIPING AND EQUIPMENT
 WILL BE ADEQUATELY
 SUPPORTED AND BRACED

PLATE & STRUCTURAL
 STEEL: ASTM A-36

STRUCTURAL TUBING: A500, GRADE B

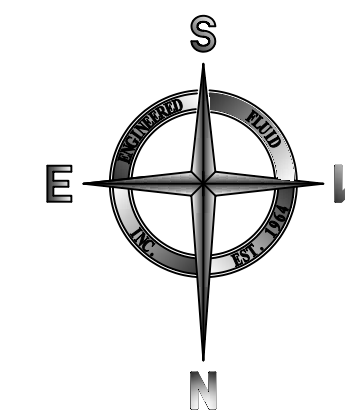
CONTRACTOR'S NOTES

DEHUMIDIFIER MUST
 BE POWERED UP AND TURNED ON
 IMMEDIATELY AFTER THIS STATION IS
 SET IN PLACE.

SHIMS MAY BE REQUIRED AROUND PERIMETER
 OF WATERSHED TO ENSURE PROPER LEVEL.
 WITHOUT PROPER LEVEL ENGINEERED FLUID
 CANNOT BE RESPONSIBLE FOR PROPER DOOR
 OPERATION.

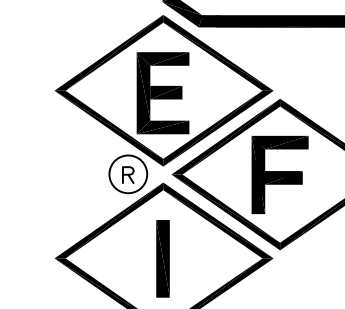
PLEASE NOTE ORIENTATION OF THE INLET
 AND OUTLET PIPE AND ELECTRICAL CONDUIT
 LOCATIONS IN REFERENCE TO THE JOBSITE LAYOUT.
 EFI CANNOT BE HELD RESPONSIBLE UNLESS
 CONFIRMATION OF THESE ORIENTATIONS IS RECEIVED
 THROUGH THE APPROVED SUBMITTALS.

THIS STATION IS NOT DESIGNED TO WITHSTAND
 PIPELINE THRUST OR EXTERNAL PIPE RESTRAINT
 FORCES. THRUST BLOCKING AND PIPE RESTRAINTS
 EXTERNAL TO THE STATION SHALL BE DESIGNED
 AND INSTALLED BY OTHERS.



REVISION #	DATE	REVISED BY	DESCRIPTION
1	6/8/23	CK	500HP TO 250HP REDESIGN
2	6/21/23	CK	MIRRORED STATION
3	7/25/23	CK	FINAL EDITS TO MEET CHANGE ORDER DESIGN

DESIGNED BY: RCB MECHANICAL CHECKED BY (C.E.)
 DRAWN BY: CK ELECTRICAL CHECKED BY: SCALE: 3/8" = 1'-0"



ENGINEERED FLUID, INC.
 P.O. DRAWER 723 • CENTRALIA, ILLINOIS 62801 • 618-533-1351

BOOSTER PUMP STATION
 RAINBOW MUNICIPAL WATER DISTRICT
 WEST LILAC BPS
 RAINBOW, CALIFORNIA

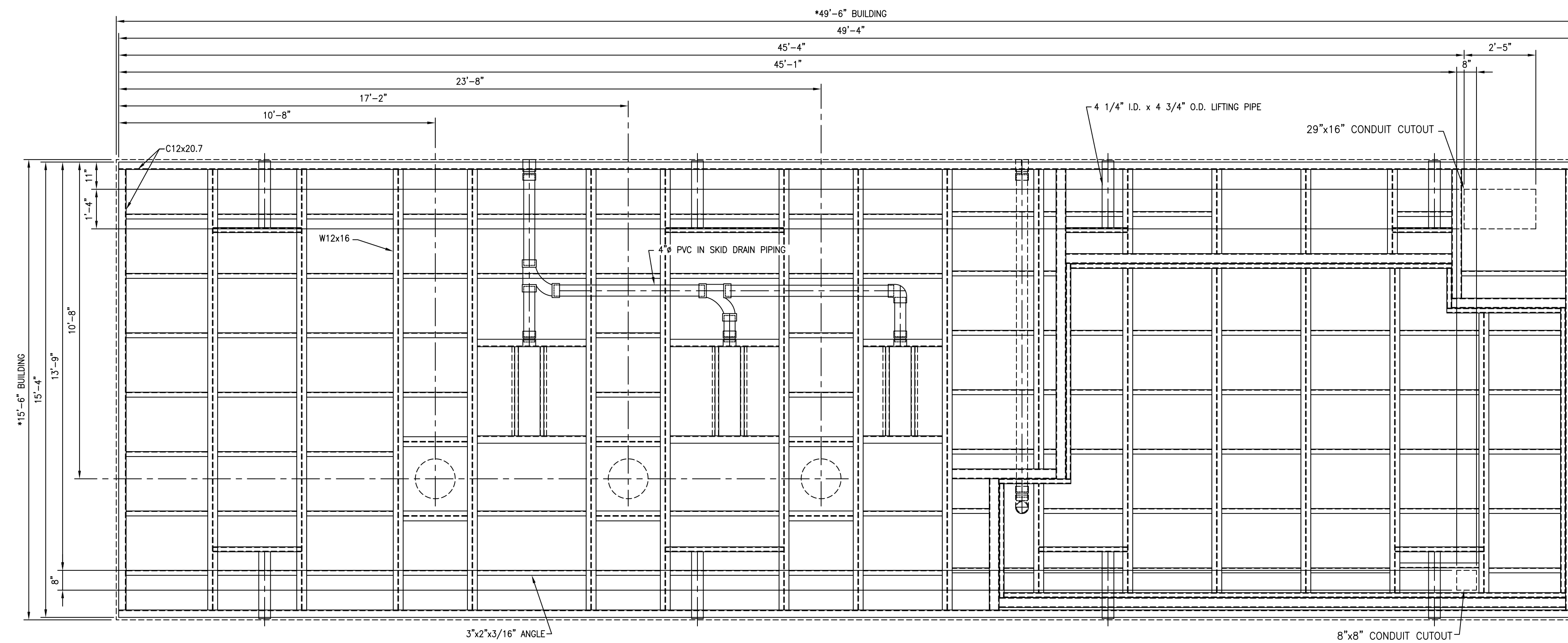
JOB REF NO. 93134

DRWG. NO. 93134-B-001.3

This drawing is conceptual and does not reveal certain details and manufacturing processes required to successfully build the equipment. As such, Engineered Fluid, Inc. is not responsible for injury or damages caused by any unauthorized fabrication or assembly using all or any part of this drawing.

* THIS DESIGN IS BASED ON THE SPARLING MODEL 656 MAGNETICFLOW METER, REQUIRING 3 UPSTREAM AND ZERO DOWNSTREAM STRAIGHT PIPE DIAMETER LENGTHS FOR MAINTAINING STATED ACCURACY LIMITS. SPECIFICATION OR USE OF ANY OTHER MANUFACTURERS FLOW METER MAY NOT KEEP THIS DESIGN WITHIN THE ACCURACY LIMITS OF THAT FLOW METER.

This drawing and all the information contained herein is the property of Engineered Fluid, Inc. and is to be retained in confidence, and, without the written permission of an officer of Engineered Fluid, Inc., is not to be duplicated, sent, shown or used for any other purpose than to disclose to the recipient a design concept, and this drawing is to be returned to Engineered Fluid, Inc., upon demand.

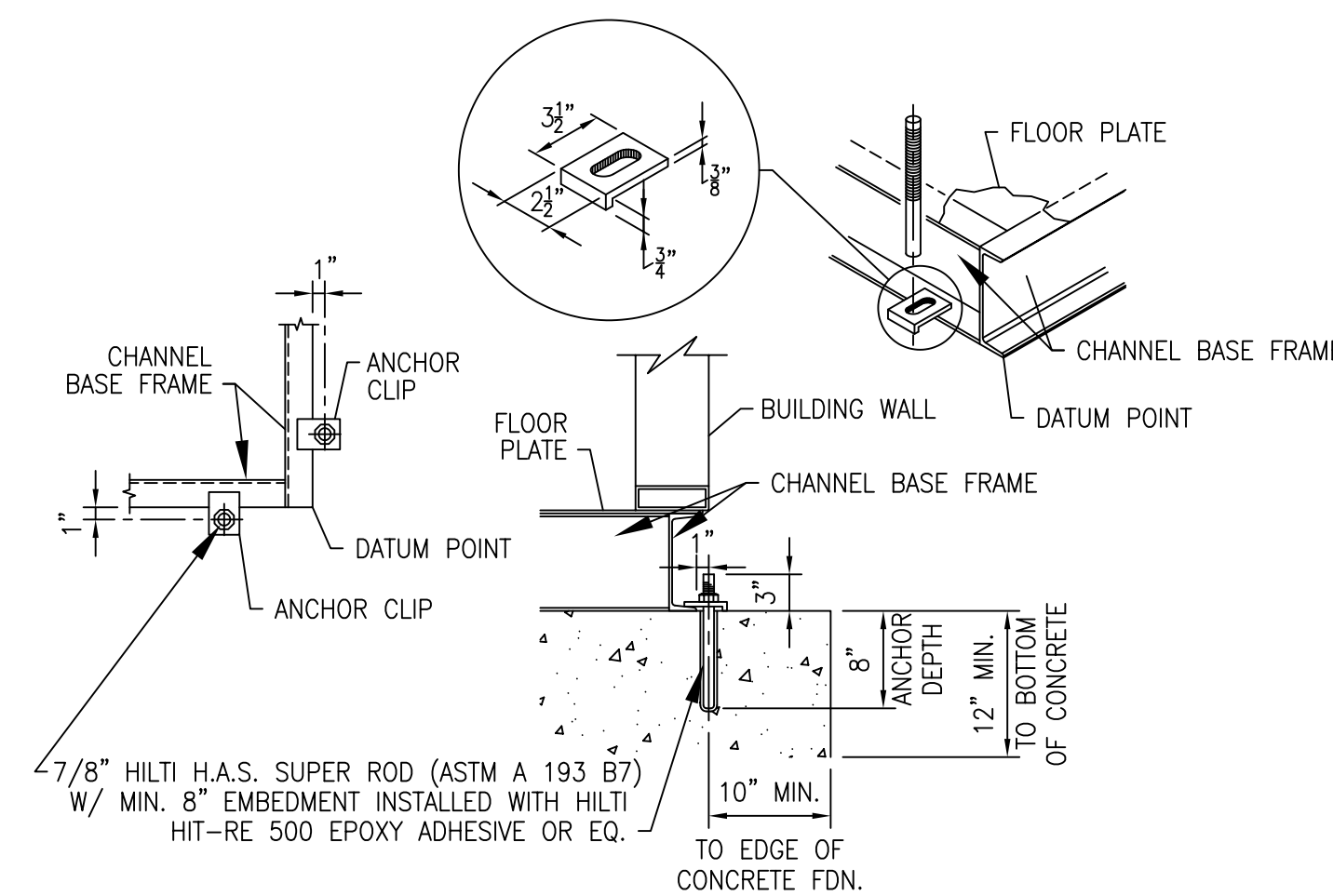


SKID PLAN

NOTE: FOUNDATION CUTOOUT MUST BE PROVIDED TO ACCOMMODATE ADEQUATE SPACE TO CONNECT ELECTRICAL/ TELEMETRY CONDUIT(S)

NOTE: FOUNDATION CUTOOUT MUST BE PROVIDED TO ACCOMMODATE ADEQUATE SPACE TO CONNECT MAIN PIPING

* BUILDING OVERHANGS SKID 1" AROUND ENTIRE PERIMETER



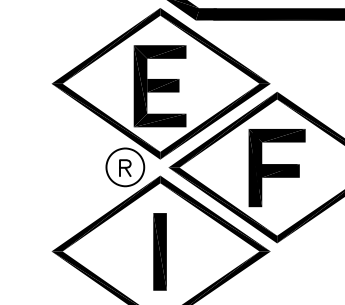
BASE FRAME ANCHOR DETAIL
CHANNEL FRAMING MEMBERS

- NOTE:
1. ANCHOR CLIPS FURNISHED BY E.F.I.
 2. ANCHOR BOLTS AND NUTS BY INSTALLER.
 3. FINAL FOUNDATION AND ANCHOR BOLT DESIGN AND DIMENSIONS AS DIRECTED BY ENGINEER (MINIMUMS ARE SHOWN).
 4. SHIMS MAY BE REQUIRED AROUND PERIMETER OF BASE FRAME FOR LEVELNESS AND PROPER DOOR ALIGNMENT IN FRAME.
 5. QUANTITY OF ANCHOR BOLTS SPECIFIED BY ENGINEER.
 6. ANCHOR BOLTS SHALL BE PLACED WITHIN 12" OF EACH CORNER WITH THE REMAINING ANCHORS BEING SPACED NO MORE THAN 6' APART ALONG ALL SIDES OF THE BUILDING PERIMETER WITH ANY WALL OF 7 FEET OR LESS HAVING TWO ANCHOR BOLTS, ALL ACCORDING TO IBC 2308.3.1, 2015 ED.

REVISION #	DATE	REVISED BY	DESCRIPTION
1	6/8/23	CK	500HP TO 250HP REDESIGN
2	6/21/23	CK	MIRRORED STATION
3	7/25/23	CK	FINAL EDITS TO MEET CHANGE ORDER DESIGN

DESIGNED BY: RCB MECHANICAL CHECKED BY (C.E.):
DRAWN BY: CK ELECTRICAL CHECKED BY:

SCALE: 3/8" = 1'-0"



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BOOSTER PUMP STATION
RAINBOW MUNICIPAL WATER DISTRICT
WEST LILAC BPS
RAINBOW, CALIFORNIA

This drawing is conceptual and does not reveal certain details and manufacturing processes required to successfully build the equipment. As such, Engineered Fluid, Inc. is not responsible for injury or damages caused by any unauthorized fabrication or assembly using all or any part of this drawing.

JOB REF NO. 93134

DRWG. NO. 93134-B-002.3

ELECTRICAL SECTION

IMPORTANT
PLEASE COMPLETE !

REQUIRED ELECTRICAL SERVICE

THIS STATION IS DESIGNED TO OPERATE WITH THE FOLLOWING ELECTRICAL SUPPLY:

3 PHASE _____
277/480 VOLTS _____
60 CYCLE _____
4 WIRE _____
1600 AMPS _____

ENGINEER OR CONTRACTOR TO VERIFY THIS IS THE
CORRECT ELECTRICAL SUPPLY AVAILABLE AT THE STATION
SITE. IF INCORRECT, PLEASE MARK CORRECT DATA ON
SPACES PROVIDED AT THE RIGHT.

VERIFIED BY _____ DATE _____

**ELECTRICAL PANEL WILL BE U.L.
LISTED AS REQUIRED BY THE
SPECIFICATION AND IN
CONFORMANCE WITH ENGINEERED
FLUID, INC. U.L. FILE # E85917 THIS
LABEL WILL BE AFFIXED TO THE
CONTROL PANEL**

EFI-SOLUTIONS

efi-solutions.com



FILE NO. E85917™



ENCLOSED INDUSTRIAL CONTROL PANEL

Project	West Lilac Pump Station			
	Rainbow Municipal Water District			
Location	Rainbow, California			
Engineer	Hoch Consulting			
Station Type	Water-Shed Booster Pump Station			
EFI JOB REFERENCE NO. 93134				
PLEASE REVIEW EACH COMPONENT & INITIAL IF ACCEPTABLE				
PLEASE REVIEW STATION ORIENTATION AND PIPE SIZES				
Part ID	Part Description	Long Description	Qty	INITIALS
	VARIABLE FREQUENCY DRIVES			
ACQ580-PFR-302A-4-EF11	ABB ENGINEERED VFD PACKAGE - 250HP	<p>ACQ580-PFR-302A-4+E211+G302+G328+G329+G403(EF11)</p> <p>250HP, 480V ENGINEERED VFD PACKAGE INCLUDES THE FOLLOWING:</p> <ul style="list-style-type: none"> -ACQ580-01 VFD MODULE -NEMA 1 ENCLOSURE W/FILTER FANS -INPUT FUSED DISCONNECT WITH ROTARY THROUGH THE DOOR HANDLE -TCI HGL PASSIVE HARMONIC FILTER W/CAPACITOR ISOLATING CONTACTOR -CONTROL TRANSFORMER -DOOR MOUNTED 30MM PILOT DEVICES: HOA, E-STOP, POWER ON LIGHT, RUN LIGHT, AND FAULT LIGHT -DOOR MOUNTED KEYPAD <p>INCLUDES CUSTOM CONTROL WIRING SCHEME, ADDITIONAL TIMERS AND CONTROL RELAYS, ADDITIONAL PILOT LIGHTS AND TERMINAL BLOCKS, AND CONTROL TRANSFORMER SIZED PER ADDITIONAL LOADING</p>	3	
	PHASE MONITOR PANEL			
460	LITTELFUSE PHASE MONITOR 190-480VOLT		1	
Q181310PCECC	HOFFMAN COMPOSITE ENCLOSURE		1	

<p>CUSTOM EATON SWITCHBOARD</p>	<p>EATON SWITCHBOARD (SEE DESCRIPTION)</p>	<p>POW-R-LINE C SWITCHBOARD, FRONT ACCESS/ FRONT AND REAR ALIGN, TYPE 1, 480V 3-PHASE 3- WIRE, 2500 COPPER, MINIMUM INTERRUPTING RATING: 65KA, BUS BRACING RATING: 65KA, DEPTH: 30 IN</p> <p>DESIGNATION 93134 SWBD</p> <p>STRUCTURE 1 2500 AMP CU MAIN STRUCTURE COMPARTMENT 1 - BREAKER 2500A 3P NRX-RF BRKR [FIXED-MANUAL], 65 KAIC PXR25 LSI W/ ARMS & MODBUS TRIP UNIT LOCAL USING BLUE LIGHT / SWITCH ON FACE OF SWITCHBOARD</p> <p>STRUCTURE 2 2500 AMP CU DISTRIBUTION STRUCTURE COMPARTMENT 1 - SURGE PROTECTIVE DEVICE (SPD) SPD SERIES 100KA SPD, STANDARD W/ FUSIBLE DISCONNECT COMPARTMENT 2 - BREAKER 15A 3P [HFD 225A FRAME] THERMAL MAG TRIP - STANDARD COMPARTMENT 3 - BREAKER 25A 3P [HFD 225A FRAME] THERMAL MAG TRIP - STANDARD COMPARTMENT 4 - BREAKER 25A 3P [HFD 225A FRAME] THERMAL MAG TRIP - STANDARD COMPARTMENT 5 - BREAKER 25A 3P [HFD 225A FRAME] THERMAL MAG TRIP - STANDARD COMPARTMENT 6 - BREAKER 30A 2P [HFD 225A FRAME] THERMAL MAG TRIP - STANDARD COMPARTMENT 7 - BREAKER 2P [HFD 225A FRAME] PROVISION COMPARTMENT 8 - BREAKER 25A 3P [HFD 225A FRAME] THERMAL MAG TRIP - STANDARD COMPARTMENT 9 - BREAKER 25A 3P [HFD 225A FRAME] THERMAL MAG TRIP - STANDARD COMPARTMENT 10 - BREAKER 25A 3P [HFD 225A FRAME] THERMAL MAG TRIP - STANDARD COMPARTMENT 11 - BREAKER 50A 3P [HFD 225A</p>	<p>1</p>	
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		<p>FRAME] THERMAL MAG TRIP - STANDARD COMPARTMENT 12 - BREAKER 1000A ADJ, 3P [NGH 1200A FRAME] DIGITRIP 310+ LSI COMPARTMENT 13 - BREAKER 1000A ADJ, 3P [NGH 1200A FRAME] DIGITRIP 310+ LSI COMPARTMENT 14 - BREAKER 1000A ADJ, 3P [NGH 1200A FRAME] DIGITRIP 310+ LSI</p> <p>QTY LIST OF MATERIALS 1 POW-R-LINE C 1 2500 AMP CU DISTRIBUTION STRUCTURE 12 PADLOCKABLE LOCKOFF DEVICE 1 SPD SERIES 100KA SPD, STANDARD W/ FUSIBLE DISCONNECT 1 2500 AMP CU MAIN STRUCTURE 2 COPPER GROUND BUS 3 1000A ADJ, 3P [NGH 1200A FRAME], TRIP 1000 A, 310+, (4) 4/0-500 KCMIL, MECHANICAL 6 25A 3P [HFD 225A FRAME], TRIP 25 A, THERMAL MAG, (1) #14-1/0, MECHANICAL 1 50A 3P [HFD 225A FRAME], TRIP 50 A, THERMAL MAG, (1) #14-1/0, MECHANICAL 1 30A 2P [HFD 225A FRAME], TRIP 30 A, THERMAL MAG, (1) #14-1/0, MECHANICAL 1 2P [HFD 225A FRAME] PROVISION 1 15A 3P [HFD 225A FRAME], TRIP 15 A, THERMAL MAG, (1) #14-1/0, MECHANICAL 1 2500A 3P NRX-RF BRKR [FIXED-MANUAL], 65 KAIC, TRIP 2500 A, PXR25 LSI W/ ARMS & MODBUS, (7) #4- 500 KCMIL, MECHANICAL, TOP</p> <p>90" X 66" X 30"</p>	

P1C100BT26CH01	EATON 100A PANELBOARD	<p>PANELBOARDS 30 CIRCUITS, 100A, FULLY RATED, 120/240V 1PH 3W, COPPER BUS, 10KAIC, 60A, 2P BAB MAIN BREAKER[TOP FED], SURFACE MOUNTED</p> <p>CATALOG NO P1C100BT26CH01 DESIGNATION LP-1</p> <p>QTY LIST OF MATERIALS 1 60A, 2P BAB MAIN BREAKER 21 PADLOCKABLE LOCKOFF DEVICE 4 20A, 1P BAB BRANCH BREAKER 16 15A, 1P BAB BRANCH BREAKER 1 30A, 2P BAB BRANCH BREAKER 8 1P BAB BRANCH PROVISION ONLY 1 COPPER MAIN BUS, 100 AMPS 1 STD. BOLTED CU GROUND BAR (CU CABLE ONLY) 1 PANEL NAMEPLATE - WHITE WITH BLACK LETTERS 1 TYPE 1 ENCLOSURE: EZB2036R 1 EZ TRIM, DOOR IN DOOR, CONCEALED HARDWARE: EZT2036S</p> <p>MAIN DEVICE TYPE: MAIN BREAKER - TOP CABLE ENTRY MAIN TERMINALS: MECHANICAL - (1) #8-1/0 (CU/AL) NEUTRAL TERMINALS: MECHANICAL - (1) #14-1/0 (CU/AL)</p> <p>36" X 20" X 6"</p>	1	

G03AUSA31600NGXC	ASCO 300SE ATS	<p>G03AUSA31600NGXC,11BE,119M</p> <p>Product : Series 300 Catalog Number : G03AUSA31600NGXC,11BE,119M Service Voltage / Hz : 480V/60Hz Optional Accessories : 11BE,119M Bypass Isolation : Not Applicable Product Description :300 Series, Automatic Service Entrance Transfer Switch No. of Switched Poles : 3 Neutral Configuration : Solid [A] Withstand Rating: : See WCR table below Frame = G, Switch Rating = 1600, Series = 300 Enclosure : 1(C)-UL Type 1 Enclosure Service : Three Phase, 4-wire Lug accommodations for 6/phase 1/0 to 600mcm</p> <p>11BE Adds the following features to the Group G controller: (1) Serial RS-485 Modbus Communications (2) Multi-Schedule Engine Exerciser (3) a 300 Entry Event Log and (4) a common alarm output function. When applied on 3-phase systems it also enables: (1) 3-Phase Emergency Source VLL sensing (2) Phase Rotation Monitoring (3) Emergency Source VLL Unbalance Monitoring.</p> <p>119M Energy Reducing Maintenance Switch (ERMS) ERMS lowers the instantaneous pickup setting, utilizes a faster acting instantaneous trip function, or activates an alternate set of trip settings on a breaker to provide reduced arc flash incident energy. To be used on service entrance rated switches containing Square D breakers with MicroLogic 5.0/6.0 P/H trip units Customer is responsible for all trip unit settings.</p>	1	
GTB-1600-B-3W-M-N3R	PSI CONTROLS 2000A GENERATOAR TAP BOX	<p>GENERATOR TAP BOX, WALL MOUNT 1600A, 480V, 3 WIRE MALE CAM-LOK RECEPTACLE NEMA 3R ENCLOSURE</p>	1	

Q010LEKF	HAMMOND 10KVA TRANSFORMER	HAMMOND 10KVA SINGLE PHASE DRY TYPE TRANSFORMER PRIMARY VOLTAGE: 240x480V PRIMARY TAPS: (2x) 2.5% ABOVE, (2x) 2.5% BELOW DESIGN: NEMA ST-20 SECONDARY VOLTAGE: 120/240V TYPE: HZQ, COOLING: ANC TEMP. RISE: 115C TEMP. CLASS: 180C FREQUENCY: 60HZ. IMPEDANCE (% @ 135C): 3.0 NEMA 3R ENCLOSURE, COPPER WINDING DIMENSIONS: 20.88"H x 12.25"W x 9.25"D	1	
LD291-M411-11-01/I1/P0	SMAR LD291-SERIES PRESSURE TRANSMITTER	SMAR (LD291-SERIES.) PRESSURE-XMTR. WITH (HART-PROTOCOL.) & (LCD-DISPLAY.) RANGE=(0-360 PSIG.) OUTPUT=(4-20 MA.) NOTE: COMPLETE WITH THE FOLLOWING ACCESSORY ITEM. 1.) (CARBON-STEEL.)/(MTG-BRACKET.) & FASTENERS. SMAR-MODEL # LD291-M411-11-01/I1/P0.	1	
LD291-M511-11-01/I1/P0	SMAR LD291-SERIES PRESSURE TRANSMITTER	SMAR (LD291-SERIES.) PRESSURE-XMTR. WITH (HART-PROTOCOL.) & (LCD-DISPLAY.) RANGE=(0-3600 PSIG.) OUTPUT=(4-20 MA.) NOTE: COMPLETE WITH THE FOLLOWING ACCESSORY ITEM. 1.) (CARBON-STEEL.)/(MTG-BRACKET.) & FASTENERS. SMAR-MODEL # LD291-M511-11-01/I1/P0.	1	
P2/M4W4TV2XH	SMAR 2-WAY VALVE-MANIFOLD	SMAR (316 ST.ST.)/(2-WAY.)/(VALVE-MANIFOLD.) SMAR MODEL # P2/M4W4TV2XH.	2	
836-C7A	AB PRESSURE SWITCH 4-150 PSI		3	
836-C10A	AB PRESSURE SWITCH 50-500 PSI	50-500 PSI 1300 PSI MAXIMUM PSI 12-115 PSI ADJUSTABLE DIFFERENTIAL	3	
LS35P51B02	ABB DPDT ROLLER LEVER LIMIT SWITCH 2NC		5	

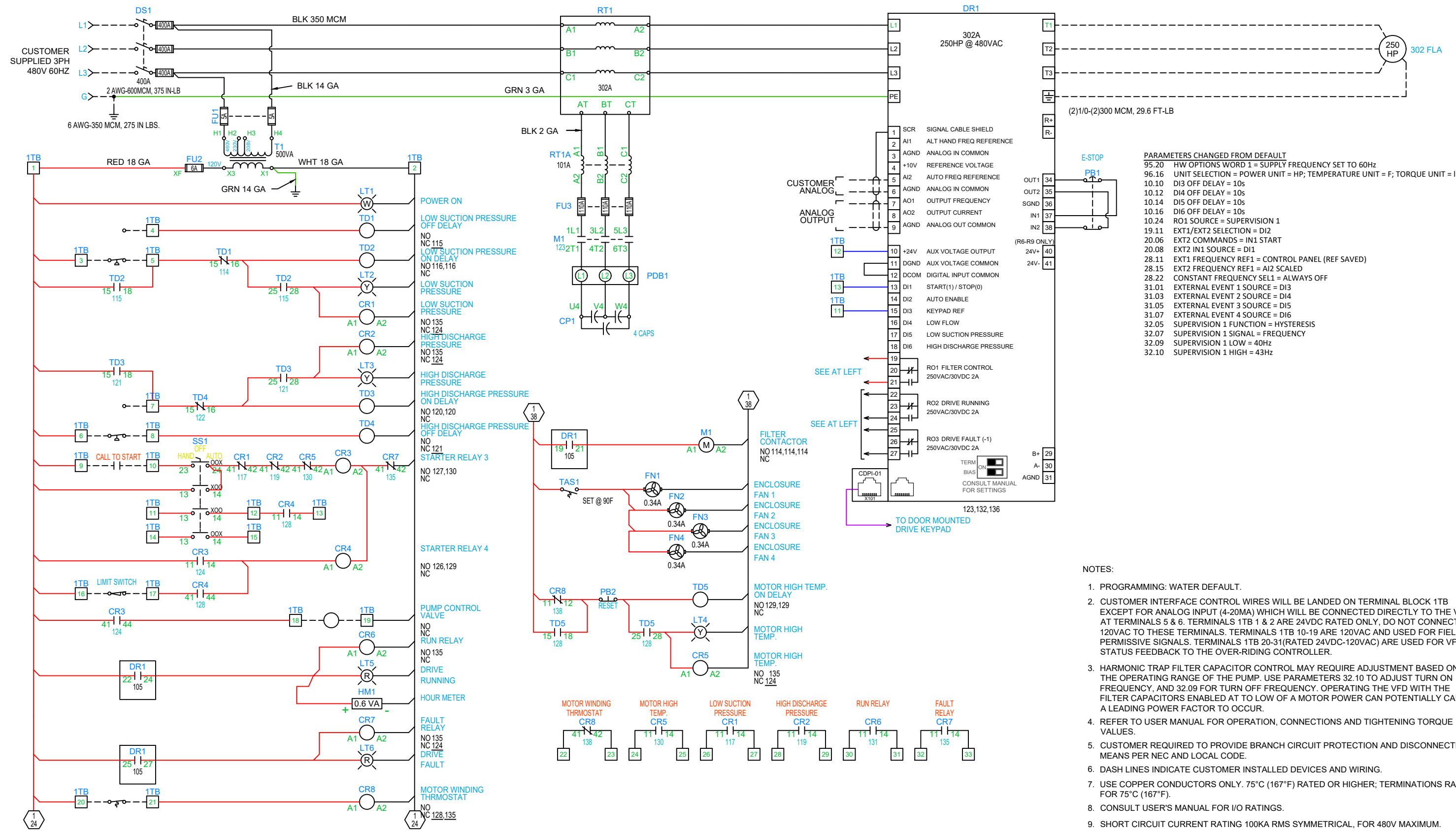
ETD9STS	COLUMBUS ELECTRIC SPDT HEAT OR COOL THERMOSTAT		4	
S1209F	GENTX SMOKE/CO ALARM		2	
FEM L48 6000LM IMAFL MD MVOLT GZ10 40K 80CRI DMVOLTGZ1040	LITHONIA FEM LED LIGHTING FIXTURE	FEM L48 6000LM IMAFL MD MVOLT GZ10 40K 80CRI ORDERING INFORMATION FEM = LITHONIA FEM SERIES. L48 = 48" LENGTH. 6000LM = 6,000 LUMENS. IMAFL = ACRYLIC, LINEAL RIBBED FROSTED LENS DIFFUSER. MD = MEDIUM DISTRIBUTION. MVOLT = MVOLT VOLTAGE. GZ10 = 0-10V DIMMING DRIVER. 40K = 4000K COLOR TEMPERATURE. 80CRI = 80CRI. WATTAGE = 45W @ 120V DIMENSIONS: 51.8"L x 6.8"W x 4.4"D 12lbs	12	
PRS-20-5K-PC	HUBBELL 20W LED EXTERIOR WALLPACK W/PHOTOCELL	VOLTAGE: 120-277V WATTAGE: 22.8 COLOR: 5K LUMENS: 2898	2	
2P12G1-ELF3-LD10-M	LIGHT ALARM EMERGENCY LIGHT 12VOLT 2LAMP	MR16 LED HEAD 6W MIST WHITE	2	
HBL1203IL	HUBBELL 3 WAY LIGHT SWITCH, 15A, 120/277VAC	EXTRA HEAVY DUTY INDUSTRIAL SERIES, BACK AND SIDE WIRED, ILLUMINATED IVORY TOGGLE	4	
BR15WR	HUBBELL 15A 125V BROWN DUPLEX RCPT	1-POLE 3-WIRE GROUNDING, 15A 125V, 5-15R, BACK AND SIDE WIRED, SMOOTH FACE, BROWN, SPECIFICATION GRADE, WEATHER RESISTANT	4	
GFRST15I	HUBBELL 15A COM SELF TEST GFCI IVORY		2	
HBL5261	HUBBELL SINGLE RECEPTACLE BROWN		1	
WP5000C	INTERMATIC EXTERIOR RECEPTACLE, EXTRA-DUTY, IN- USE		2	

SCH 40 CONDUIT	SCH 40 PVC CONDUIT		1	
STATION WIRE	STATION POWER WIRE - THHN/THWN		1	
	INTERFACE PANEL			
CSD24248	HOFFMAN NEMA 412 LP ENCLOSURE		1	
CP2424	HOFFMAN NEMA 412 MP PANEL		1	
SU201M-K6	ABB 6A 1 POLE CIRCUIT BREAKER		1	
1606-XLP30EQ	AB 24VDC POWER SUPPLY, 30W	INPUT: 100-240VAC OUTPUT: 24-28VDC / 1.3-1.1A / 30W SCREW TERMINALS 2.95 X 0.91 X 3.58	1	
PK9GTA	SQUARE D GROUNDING BAR KIT		4	
GGC1-1/2	FERRAZ SHAWMUT FUSE (5MIN)		5	
1492-J4	AB FEED THROUGH SCREW TERMINAL, GRAY, 4MM		100	
1492-EAJ35	AB SCREW END ANCHOR FOR 35MM DIN		10	
1492-EBJ3	AB 4MM TERMINAL BLOCK END BARRIER GRAY		6	
1492-JG4	AB FEED THROUGH SCREW GND TERMINAL ,4MM		9	
1492-H5	AB FINGER-SAFE SINGLE CIRCUIT FUSE BLOCK		1	
1492-N37	AB END BARRIER SGL CIRCUIT FUSE BLK		1	

ELECTRICAL DESIGN DRAWING ES-93134-B-101.1				
ELECTRICAL DESIGN DRAWING ES-93134-B-102.1				
ELECTRICAL DESIGN DRAWING ES-93134-B-103.1				
ELECTRICAL DESIGN DRAWING ES-93134-B-104.				
ELECTRICAL DESIGN DRAWING ES-93134-B-105.				
ELECTRICAL DESIGN DRAWING ES-93134-B-106.				
ELECTRICAL DESIGN DRAWING ES-93134-B-107.				

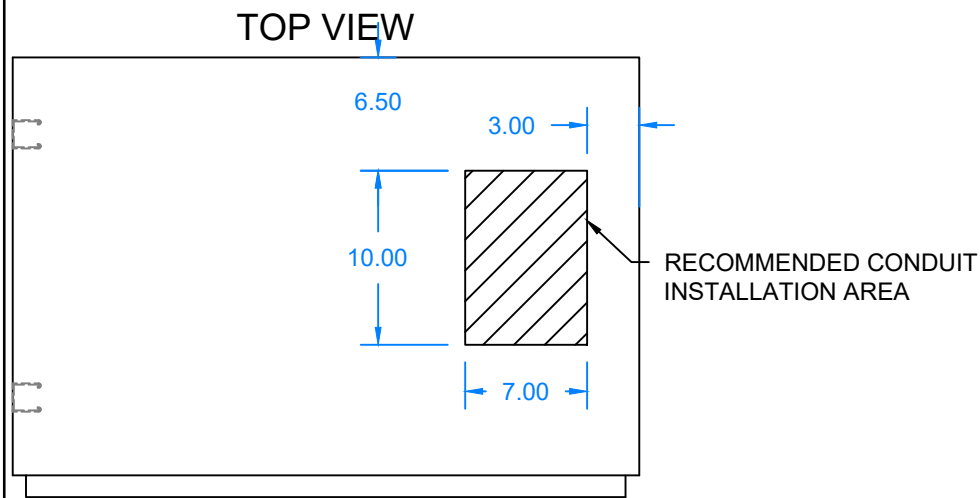
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FLA = 303 A



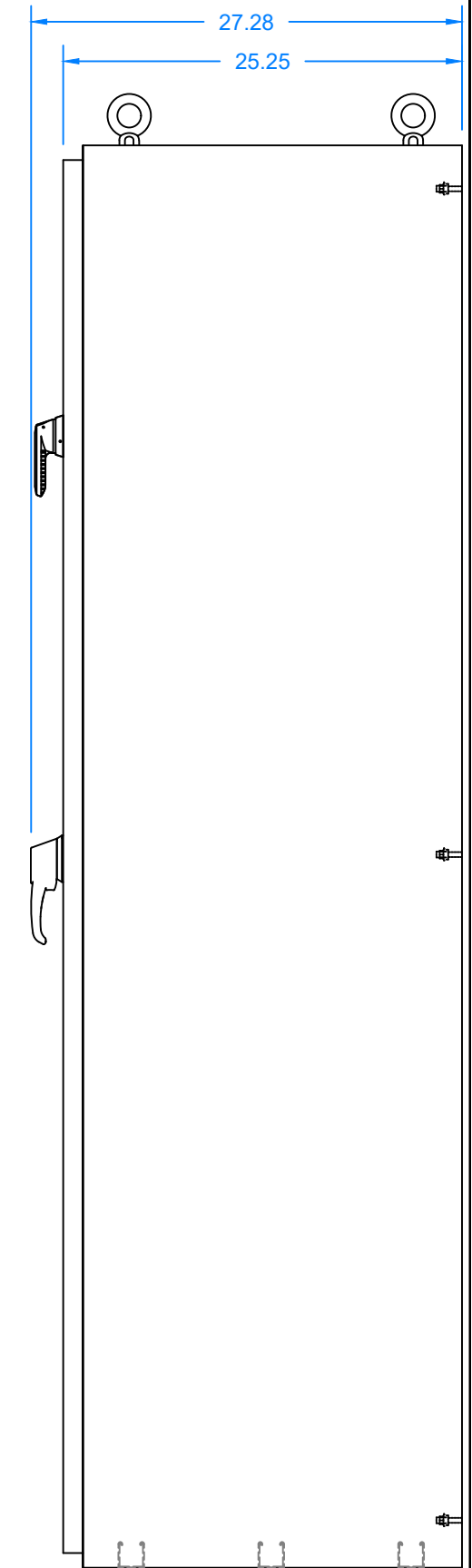
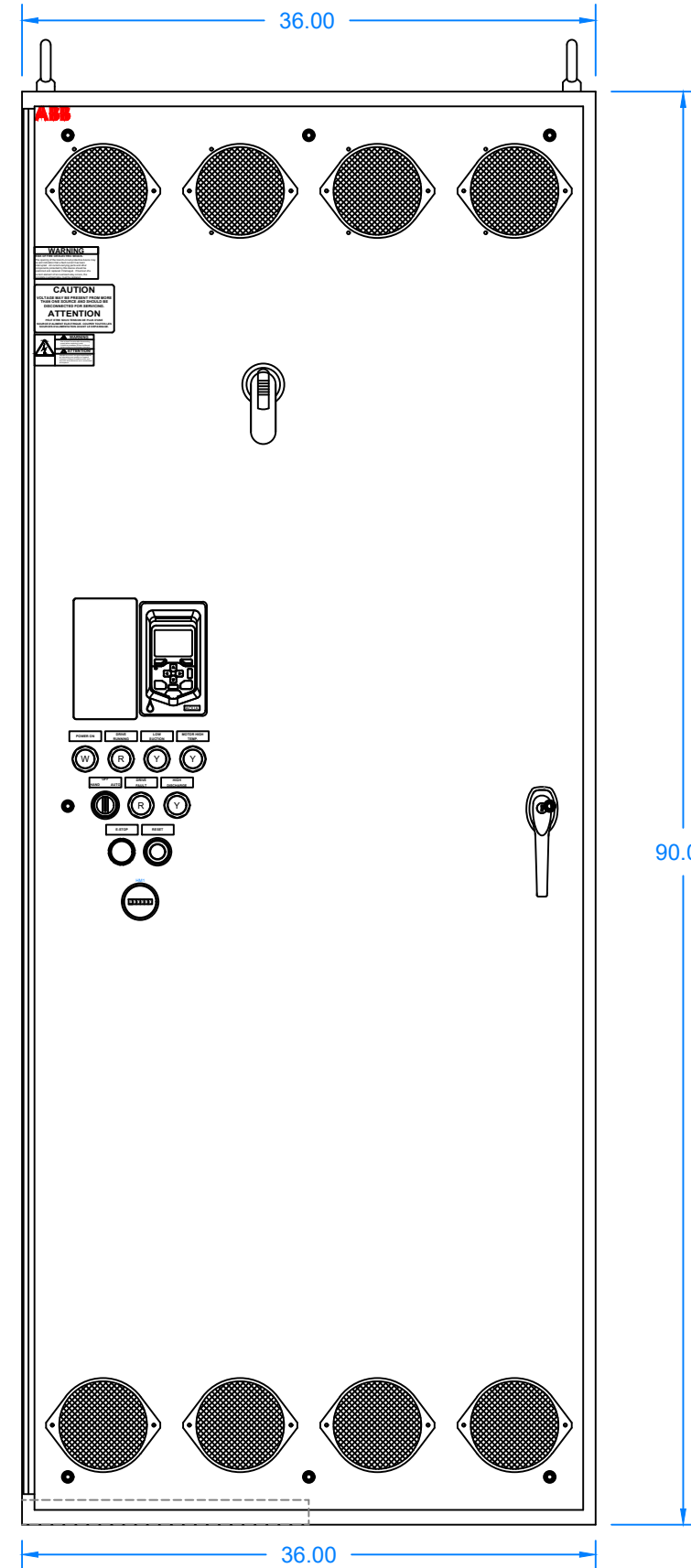
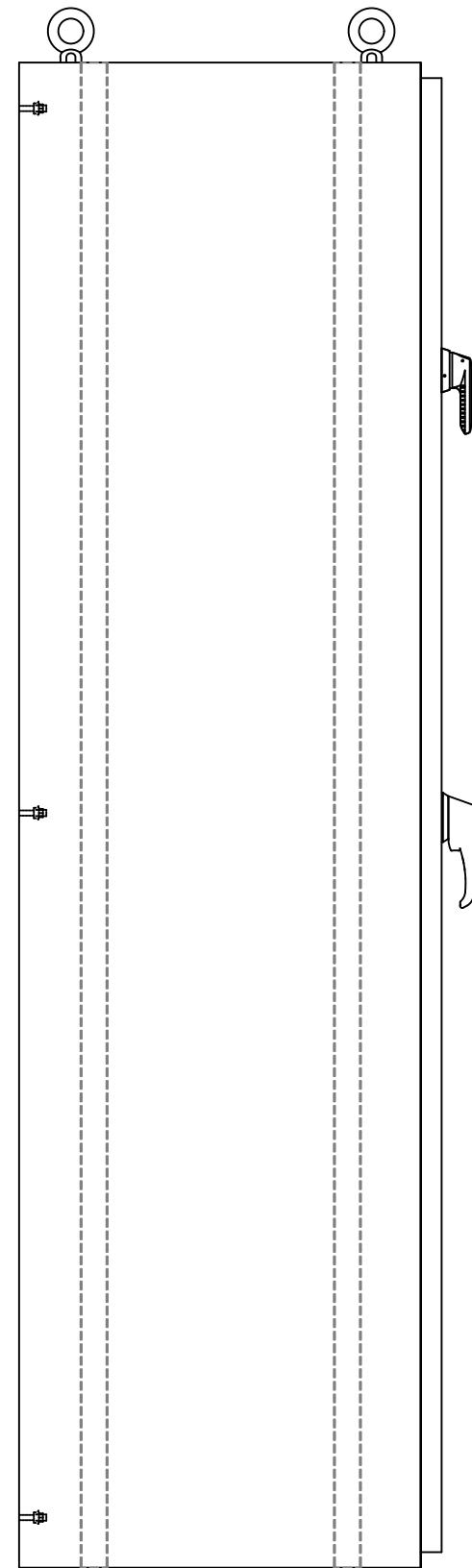
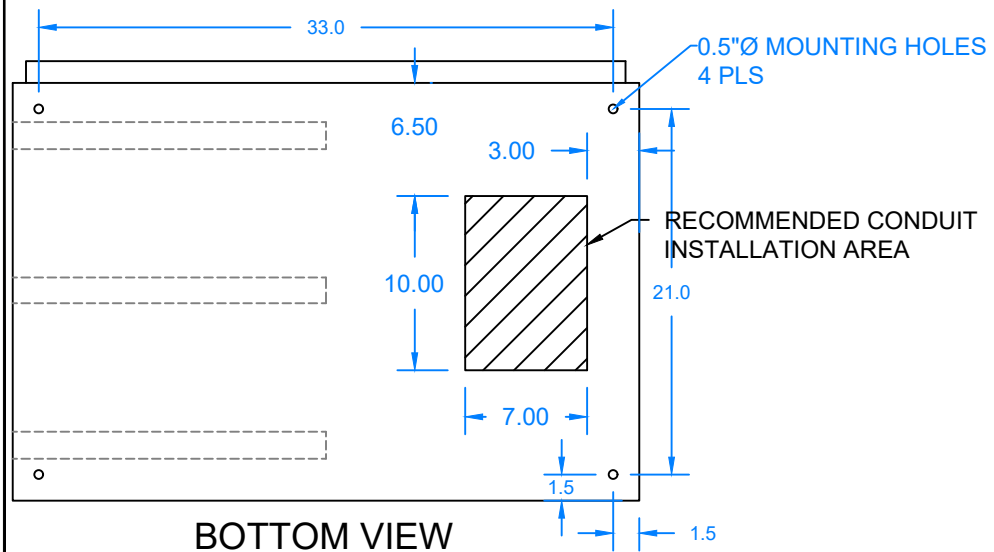
- NOTES:
1. PROGRAMMING: WATER DEFAULT.
 2. CUSTOMER INTERFACE CONTROL WIRES WILL BE LANDED ON TERMINAL BLOCK 1TB EXCEPT FOR ANALOG INPUT (4-20MA) WHICH WILL BE CONNECTED DIRECTLY TO THE VFD AT TERMINALS 5 & 6. TERMINALS 1TB 1 & 2 ARE 24VDC RATED ONLY. DO NOT CONNECT 120VAC TO THESE TERMINALS. TERMINALS 1TB 10-19 ARE 120VAC AND USED FOR FIELD PERMISSIVE SIGNALS. TERMINALS 1TB 20-31 (RATED 24VDC-120VAC) ARE USED FOR VFD STATUS FEEDBACK TO THE OVER-RIDING CONTROLLER.
 3. HARMONIC TRAP FILTER CAPACITOR CONTROL MAY REQUIRE ADJUSTMENT BASED ON THE OPERATING RANGE OF THE PUMP. USE PARAMETERS 32.10 TO ADJUST TURN ON FREQUENCY, AND 32.09 FOR TURN OFF FREQUENCY. OPERATING THE VFD WITH THE FILTER CAPACITORS ENABLED AT TO LOW OF A MOTOR POWER CAN POTENTIALLY CAUSE A LEADING POWER FACTOR TO OCCUR.
 4. REFER TO USER MANUAL FOR OPERATION, CONNECTIONS AND TIGHTENING TORQUE VALUES.
 5. CUSTOMER REQUIRED TO PROVIDE BRANCH CIRCUIT PROTECTION AND DISCONNECTING MEANS PER NEC AND LOCAL CODE.
 6. DASH LINES INDICATE CUSTOMER INSTALLED DEVICES AND WIRING.
 7. USE COPPER CONDUCTORS ONLY. 75°C (167°F) RATED OR HIGHER; TERMINATIONS RATED FOR 75°C (167°F).
 8. CONSULT USER'S MANUAL FOR I/O RATINGS.
 9. SHORT CIRCUIT CURRENT RATING 100KA RMS SYMMETRICAL, FOR 480V MAXIMUM.
 10. REFER TO RATING LABEL FOR REQUIRED BRANCH CIRCUIT FUSE SIZE AND TYPE.

0	INITIAL REVISION	03/03/23	BMJ		PROJECT NAME	DESCRIPTION	DRAWN BY	DRAWING NUMBER		
REV	DESCRIPTION	DATE	BY		ACQ580 DRIVE, NO BYPASS HGP 250HP 460VAC TYPE 1	WIRING DIAGRAM	BMJ CHECKED BY JDA APPROVED BY AKM	ACQ580-PFR-302A-4+E211+G302+G328+G329+G403(EF1,93136)		
								DATE PREPARED	REFERENCE NUMBER	SHEET
								03/03/23		1

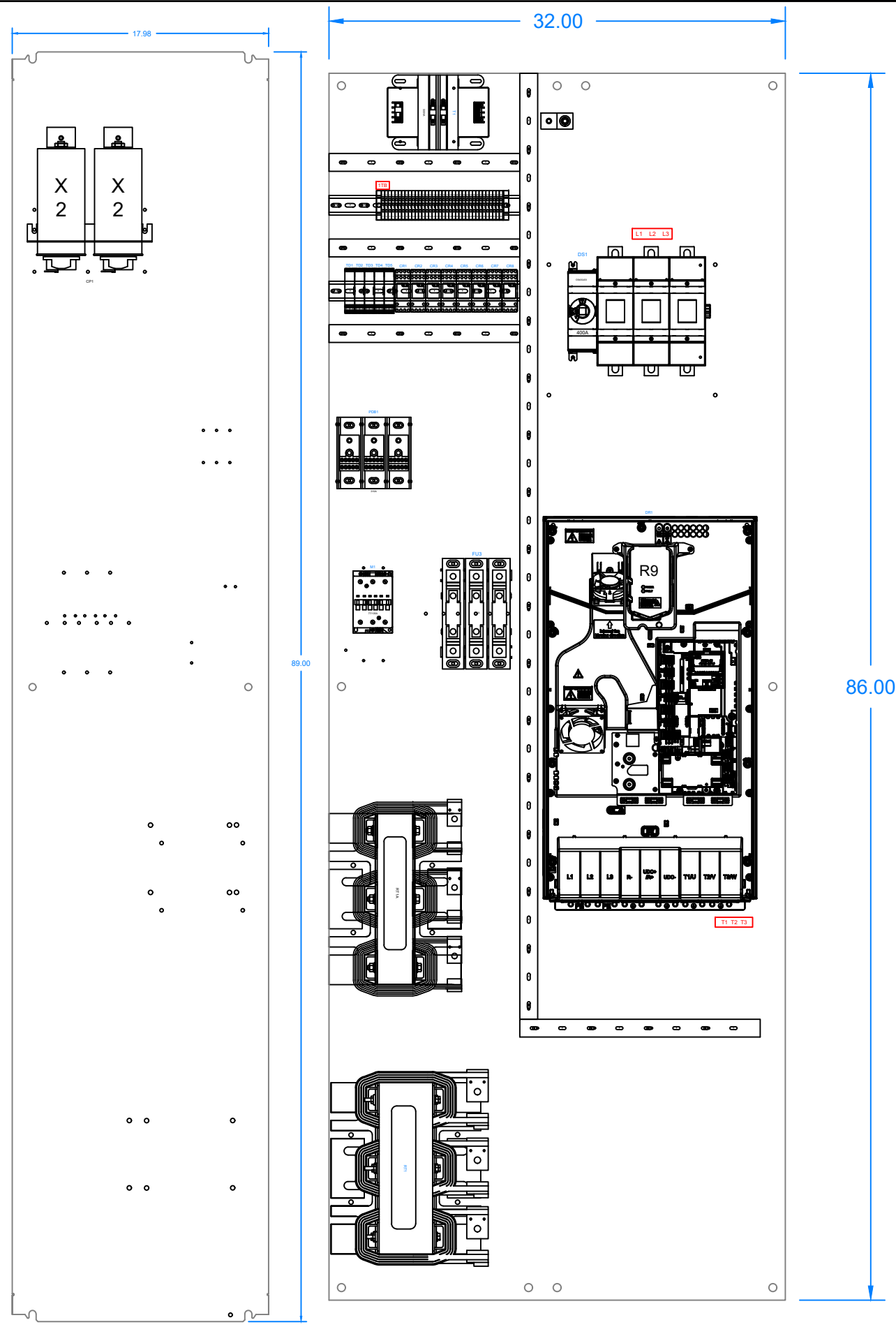


NOTES:

1. ALL DIMENSIONS SHOWN IN INCHES
2. UL TYPE 1
3. TOP ENTRY/TOP EXIT; BOTTOM ENTRY/BOTTOM EXIT
4. APPROX. WEIGHT = 1400LBS.



0	INITIAL REVISION	03/03/23	BMJ	ABB Inc.	PROJECT NAME ACQ580 DRIVE, NO BYPASS HGP 250HP 460VAC TYPE 1	DESCRIPTION ENCLOSURE LAYOUT CX1-30	DRAWN BY BMJ CHECKED BY JDA APPR'D BY AKM	DRAWING NUMBER ACQ580-PFR-302A-4+E211+G302+G328+G329+G403(EF1,93136) DATE PREPARED 03/03/23	REFERENCE NUMBER	SHEET 2
REV	DESCRIPTION	DATE	BY							



REV	DESCRIPTION	DATE	BY
0	INITIAL REVISION	03/03/23	BMJ



PROJECT NAME
ACQ580 DRIVE, NO BYPASS
 HGP
 250HP 460VAC TYPE 1

DESCRIPTION
PANEL LAYOUT


DRAWN BY
BMJ
 CHECKED BY
JDA
 APPR'D BY
AKM

DRAWING NUMBER
ACQ580-PFR-302A-4+E211+G302+G328+G329+G403(EF1,93136)
 DATE PREPARED
03/03/23

REFERENCE NUMBER
 SHEET
3

QTY	TAGS	PART NUMBER	MFG	DESCRIPTION
8	CR1 CR2 CR3 CR4 CR5 CR6 CR7 CR8	1SVR405611R7100	ABB	MINIATURE RELAY (w/LED), 250V, 12A, 2 FORM C, 110VAC COIL
8	CR1 CR2 CR3 CR4 CR5 CR6 CR7 CR8	1SVR405651R1000	ABB	STANDARD SOCKET FOR 2 c/o, CR-M
5	TD1 TD2 TD3 TD4 TD5	1SVR500020R1100	ABB	TIME DELAY RELAY, 7 SELECTABLE FUNCTIONS: 0.05 SEC - 100 HR IN 7 RANGES, 5AMPS, DIN-RAIL MOUNTED, CT-MFD.21 SERIES
1	DR1	3AUA0000118614	ABB	COMMUNICATION ADAPTER MODULE, ACX580, CDPI-01
1		3AUA294001B169	ABB	CAUTION LABEL DECAL, WAIT AFTER DISCONNECTING
1		3AUA294001B194	ABB	ABB LOGO DECAL
1		3AXD50000248568	ABB	ACQ580/880 KEYPAD HOLDER KIT
1		3AXD50000261413	ABB	ACX580/880 DAISY KEYPAD CABLE, 3M
1	DR1	ACQ580-01-302A-4	ABB	AC DRIVE - 3-PHASE 380/480V, 250HP, 302A, WALL MOUNTING
1	M1	AX80-30-00-84	ABB	CONTACTOR, 3 POLE, 77/105A, 600VAC, 120VAC COIL
2		C-106-2PM	ABB	ZINC/STEEL DIN RAIL EN 50022 (35mm x 7.5mm x 2m)
1	PB1	CE4T-10R-02	ABB	EMERGENCY STOP PUSH BUTTON, TWIST RELEASE, 40mm
1		LABEL-CAUTION	ABB	CAUTION LABEL DECAL
1		LABEL-WARNING	ABB	WARNING LABEL DECAL
1	DS1	OHB125J12	ABB	OPERATOR HANDLE, PISTOL, BLACK, PADLOCKABLE, TYPE 12 (IP65)
1	DS1	OS400J03	ABB	FUSIBLE DISCONNECT SWITCH, CLASS J, 400A, 3P, 600VAC, 250HP @ 480V
1	DS1	OXF12X535	ABB	SHAFT FOR PISTOL HANDLE, LENGTH: 535mm (21.1")
1	DS1	OZXA-400/3P	ABB	LUG KIT, 2 AWG-600 MCM (SET OF 3)
1	DS1	OZXA-406	ABB	LUG KIT, (6) 14-6 AWG (SET OF 3)
1	T1	X4500PSF1	ABB	CONTROL TRANSFORMER, 500VA, PRI: 460/230V, SEC: 115/24V
2	LT5 LT6	T10SB10-3EARM	BACO	PILOT LIGHT, RED, 130 VAC LED, 30mm
3	LT2 LT3 LT4	T10SB40-3EAYM	BACO	PILOT LIGHT, YELLOW, 130 VAC LED, 30mm
1	LT1	T10SB50-3EAWM	BACO	PILOT LIGHT, WHITE, 130 VAC LED, 30mm
1	PB2	T11DD01-3E01	BACO	PUSH BUTTON, FLUSH BUTTON, MOMENTARY, BLACK, 1 NC

QTY	TAGS	PART NUMBER	MFG	DESCRIPTION
1	SS1	T11MA03-3E40	BACO	SELECTOR SWITCH - 3-POS - MAINTAINED, 4NO
1	FU2	FNM-6	BUSSMANN	FUSE - CLASS CC, 250VAC, 6A
2	FU1	FNQ-R-5	BUSSMANN	FUSE - CLASS CC, 600VAC, 5A
3	FU3	JJS-110	BUSSMANN	FUSE - CLASS T, 600VAC, 110A
3	DS1	LPJ-400SP	BUSSMANN	FUSE, DUAL ELEMENT - CLASS J, 600VAC, 400A
1	FU3	TM60200-3CR	BUSSMANN	3 POLE FUSE BLOCK - CLASS T, 200A
1		1SNK 505 910 R0000	ENTRELEC	END SECTION - ES4
36	1TB	1SNK 506 010 R0000	ENTRELEC	TERMINAL BLOCK - ZS6, 6mm, GREY
2		1SNK 900 001 R0000	ENTRELEC	END STOP - BAM3
4	FN1 FN2 FN3 FN4	AFM-162B	GARDTEC	MESH FAN GRILL, 6" ROUND, BLACK
1		MCSSEN-903624N1-580B-8FF-C01	MCS	ENCLOSURE, 903624, N1, 8 EFI FAN HOLES
1		MCSPL-590	MCS	COVER PLATE, RBCU/KEYPAD, ACX580
1		MCSSP-9028-EFI	MCS	SUBPANEL, 90" X 28", EFI SIDE PANELS
1		MCSSP-9036-580EFI	MCS	SUBPANEL, 86" X 32", STANDARD EFI
4	FN1 FN2 FN3 FN4	UF15KC12-BTH	MECHATRONICS	ENCLOSURE FAN, 6", 293 CFM, 115 VAC
1	PDB1	MPDB67663	MERSEN	POWER DISTRIBUTION BLOCK, 3P, 1-IN,6-OUT, 310A
4	FN1 FN2 FN3 FN4	C90-72	ORION	FAN POWER CORD, 72"
4	FN1 FN2 FN3 FN4	G172-10HA	ORION	FAN GUARD, WIRE TYPE, 6" DIA.
5		F1X2WH6	PANDUIT	SLOTTED WIRING DUCT, 1" X 2", WHITE
1	TAS1	17121000010	PFANNENBERG	TEMPERATURE SWITCH, NO, FLZ 530
1	HM1	5003-008	REDDINGTON	GASKET FOR 722-0003 METER, 4X/12
1	HM1	722-0003	REDDINGTON	HOUR METER, 6-DIGIT, 90-240VAC, NEMA 4X/12
9	RT1	54153-TB	T & B	CRIMP LUG, STRAIGHT, 1/0 PINK, 5/16" BOLT HOLE
6	RT1	58174	T & B	CRIMP LUG, STRAIGHT, 350 MCM BLUE, 1/2" BOLT HOLE
1	GND1	ADR35	T & B	GROUND LUG, 6 AWG-350 MCM, 1/2" STUD
1	RT1	HGL0250AW800000	TCI	HGL HARMONIC FILTER KIT 5%, 250HP, 480VAC, 302A

0	INITIAL REVISION	03/03/23	BMJ		PROJECT NAME	DESCRIPTION	DRAWN BY	DRAWING NUMBER	
REV	DESCRIPTION	DATE	BY		ACQ580 DRIVE, NO BYPASS HGP 250HP 460VAC TYPE 1	BILL OF MATERIALS	BMJ CHECKED BY JDA APPROD BY AKM	ACQ580-PFR-302A-4+E211+G302+G328+G329+G403(EFI1,93136)	
							DATE PREPARED	REFERENCE NUMBER	SHEET
							03/03/23		4

LOW VOLTAGE AC DRIVES

ABB drives for water and wastewater

ACQ580, 1 to 700 HP



ACQ580 series

Always flowing. Never still.

Water utilities require reliable solutions securing the flow of water and wastewater.

The ACQ580 drive for water is part of ABB's all-compatible drives portfolio. This robust drive is designed to secure optimal operation of water and wastewater pumps, while ensuring low energy consumption.

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All-compatible solutions for water and wastewater applications

Environment all-compatible

Achieve your environmental goals with our energy-efficient drive for water and wastewater. The all-compatible drives offer built-in energy efficiency calculators. They help you to analyze and optimize your pump processes to reduce stress on the environment. Other environmentally friendly features include the built-in soft pipe fill function to ensure less water hammering on the water pipes, thus preventing the risk of unwanted leaks, unplanned outage and repair costs.

Process all-compatible

Water and wastewater processes consist of many phases which require optimal performance of your pump solution from start to finish. Our robust drives are available with enclosures up to UL (NEMA) Type 3R. The drive controls virtually any kind of motors from induction and permanent magnet motors to synchronous reluctance motors up to 700 HP. The drive is compatible with a wide range of fieldbus protocols, ensuring reliable communication between the drive and automation system in use.

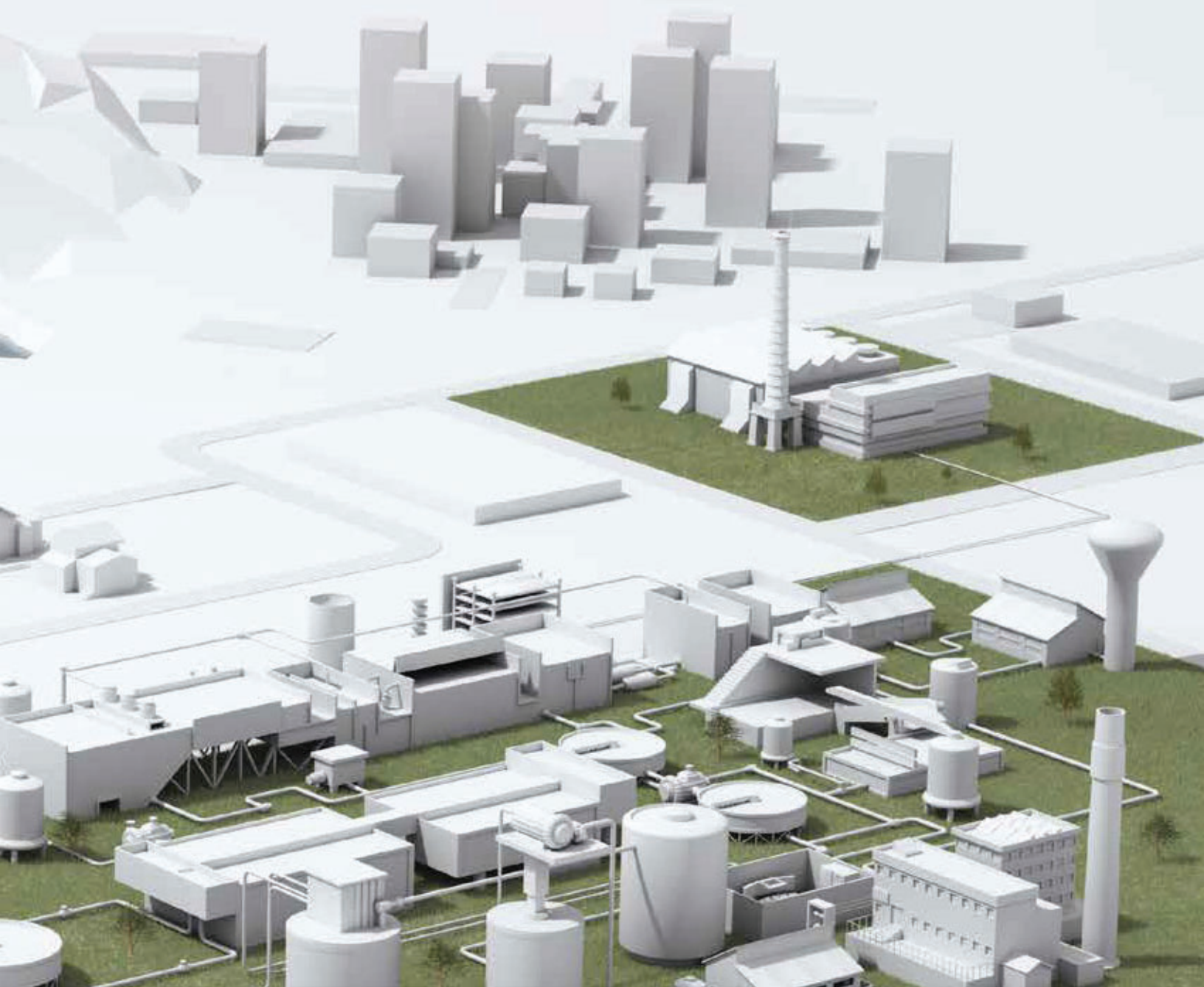


Business all-compatible

As a reliable global partner, we provide water process solutions that help to keep the life cycle costs of your pump solution stable. Additionally, we help keep your water process productive and consistent in an energy efficient way. Our wide range of water industry products and solutions offer optimal flow of water all hours of the day. This means lower energy consumption, improved productivity, flexibility and ease of use. With offices in over 90 countries and a global technical partner network, we offer technical advice and local support worldwide.

Human all-compatible

You can feel confident using our all-compatible drives for water and wastewater. The drive speaks the language of your pump application, making it easy to set up, configure and use. The intuitive Hand-Off-Auto control panel ensures that you have access to the essential information quickly. For accessing your drive from a distance and receiving valuable analytics, we offer remote monitoring solutions.



The energy efficient drive for water and wastewater pumping

Whether your pump system requires redundancy in multi-pump applications or built-in pump application functionalities designed for the water and wastewater industry, the ACQ580 is designed to meet your requirements, ensuring your overall water system is more resilient to downtime and malfunction.

Drive firmware features specific to water and wastewater applications

Pump control and protection features such as, cavitation detection and control, pump deragging, quick ramps for submersible float bearing cooling, etc..

See more on pages 8-10.



Simplicity at your fingertips

The control panel's straightforward primary settings menu with assistants helps you set up the drive quickly and effectively.

See more on pages 16-17.

Speaks water-specific terminology

The drive has built-in pump application control programs to secure optimal operation of the water and wastewater pumps.

See more on page 10.

Boosting energy efficiency

The energy optimizer helps you to save energy, and the energy efficiency information made available to you helps monitor and save the energy used in your processes. The drive meets IE2 energy efficiency requirements.

See more on page 11.



The ACQ580 water and wastewater drives are part of ABB's all-compatible drives portfolio. The drives secure the flow of water and wastewater in the pumping system throughout their whole life cycle. The ACQ580 drive is easy to commission and use. With built-in pump functionalities, the drive keeps the pumping system operating optimally, lowering the energy bill. The drive is used in water and wastewater treatment plants, pumping stations, desalination plants, industrial wastewater facilities and irrigation environments. Inflow pumps, transfer pumps, dosing pumps, sludge pumps, booster pumps, submersible pumps as well as compressors, blowers, decanter centrifuges, mixers and fans can be controlled by the drive.



Controls virtually any kind of motor

The drive has the ability to control almost any motors from induction and permanent magnet motors to synchronous reluctance motors. See more on page 69.



Startup and maintenance tool

Drive composer PC tool for startup, configuration, monitoring and process tuning. The PC tool is connected to the drive's control panel with a standard USB cable. See more on page 21.

Robust with built-in features

A robust performer with an enclosure class up to UL (NEMA) Type 3R, that is simple to select, and easy to install and use. Built-in features such as an EMC filter, choke, a Modbus RTU fieldbus interface and Safe Torque Off (STO) functionality simplify drive selection, installation and use. See more on page 24.



Reliable communication

With its wide range of optional fieldbus adapters and embedded RTU Modbus, the drive enables connectivity with all major automation networks and control systems. See more on page 19.



Input/output extensions

In addition to the standard interfaces, the drive has a built-in slot for additional input/output extension modules. See more on page 19.

Ultra-low harmonic (ULH) solution to meet IEEE519

The ACQ580 ultra-low harmonic drive is designed to minimize the effect of harmonics distortion on your electrical system. The drive keeps the network in the water utility clean and stable. As a result, electrical equipment in the plant wastes less energy as heat and fewer unwelcome disturbances occur. See more on pages 12-13.

Optimizing the flow of water and wastewater in your pumping solutions

The ACQ580 water and wastewater drive is built to help users, designers, OEMs, system integrators and engineering/consultant professionals secure pumping of water and wastewater in municipal utilities, pumping stations, industrial wastewater facilities, desalination plants and irrigation environments.

Soft pipe filling

Increase the lifetime of the piping and pump system by avoiding pressure peaks.

Quick ramps

Extend the lifecycle of submersible pumps by reducing wear of the mechanical parts using ramp sets to accelerate and decelerate the pumps.

Pump priority

Achieve energy savings with optimal pump alternation by running the higher capacity pumps when the consumption rate is higher.

Cavitation detection and control

Extend the pump lifetime and secure the process by detecting cavitation and ensuring optimal pump speed.

Multi-pump control

Ensure stable and uninterrupted production with multi-pump controls by optimizing the speed and number of running pumps.



Sleep boost

Save energy while extending the life time of the pumps and motors by decreasing start/stop cycles during all hours of the day.

Auto-change

Increase the mean time between repairs and save in service costs by balancing the long-term operation time of all pumps in a parallel pumping system.

Level control

Ensure optimal efficiency when filling or emptying a tank.

Sensorless flow calculation

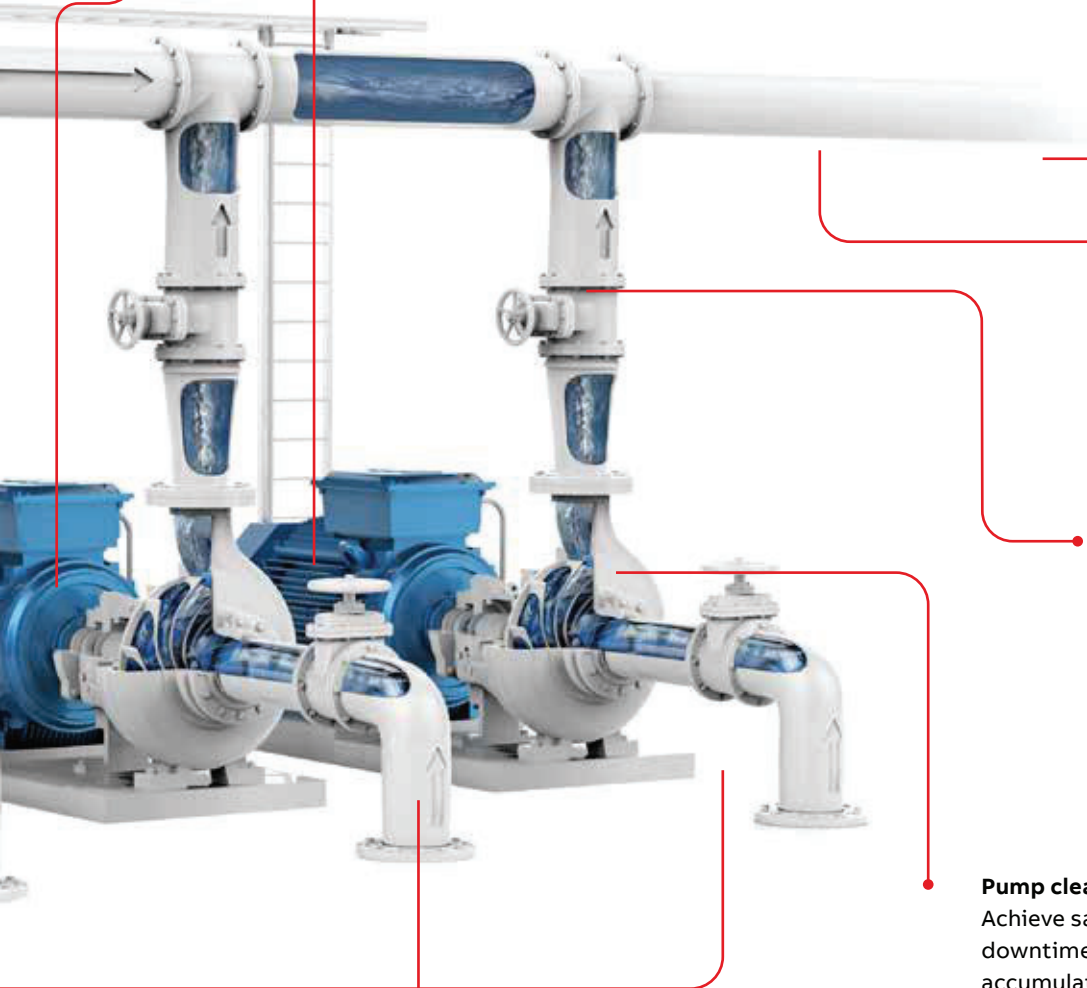
Reduce costs by eliminating the need for external components or backup the flow meters to avoid interruptions in the process.

Flow, pressure and dry pump protection

Protect the pumping system from a low and/or high pressure and flow, as well as prevent the pump from running dry.

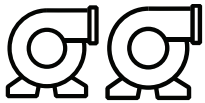
Pump cleaning and deragging

Achieve savings by preventing unplanned downtime. This is made possible as a result of accumulating obstructions being removed from the impeller of the pump.



Built-in pump application software

The built-in pump application software in the ACQ580 drives is designed to enhance the reliability and durability of the water and wastewater application in which it is used. The functions protect the pump and secure its optimal functionality, increasing cost efficiency. The built-in functionalities also support the user in securing the flow of the water and wastewater in the pump solution.



Multi-pump functionality Intelligent Pump Control (IPC)

The function maintains stable process conditions for several parallel pumps (up to 8 pumps at the same time) operating together. It is possible to optimize the speed and number of pumps needed when the required flow or pressure rate is variable. This built-in functionality ensures continuous operation for multi-pump systems even if one or more pumps fail or require maintenance.

Single Pump Control (PFC)

One drive connected to a pump with possibility to connect up to 6 DOL pumps to the system to meet the process requirements.

Soft Pump Control (SPFC)

Same as PFC, but the drive will be connected to a new pump upon startup, enabling smooth acceleration.



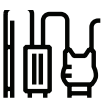
Sensorless flow calculation

Measures the amount of water flowing without the need for external sensors. This enables you to reduce costs as there is no need for setting up and using additional sensors or back up the flow meters to avoid interruptions in the process.



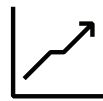
Level control

Control the filling or emptying of wastewater storage and water tower tanks. Level control can be used within a station controlling up to eight pumps. The level control function has varying pre-set water levels and the pumps will start and stop based on measured level. This method allows the pumps to run at an efficient speed and ensures the pump sump does not become over contaminated by sediment.



Soft pipe fill

The soft pipe fill function manages the pressure of water by filling the pipeline with a gentle approach. This helps to avoid sudden pressure peaks and reduces the risk of water hammer which can cause damage to the water pipes.



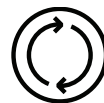
Quick-ramp

Protect bearings when a submersible pump is started without water. Quick ramp allows your pump to reach optimal speed to extend pump life, ensure operation and prevent unplanned outages.



Pump cleaning and deragging

Keeps the impeller of the pump clean by running a sequence of aggressive ramps between configurable pump speeds.



Turbidity reduction

When a pump starts as slow as possible, it creates the lowest turbidity values for the water being moved or extracted. When you combine quick ramps and long normal ramps, the drive will protect and run submersible pumps in the most optimal way.



Pump protection

The built-in protection functionalities ensure that pumps can operate at the best possible conditions. The maximum pressure protections help to protect the pump and the system in case of a blockage in the pipeline. In case of a pipe rupture, the minimum pressure protection can generate an alarm or fault and can be programmed to run at certain speed to avoid dirty water entering the pipeline. The inlet pressure protection can help to avoid cavitation.



Dry run protection

This function prevents the pump from running dry. The water pump shaft and impeller are rotating at fast rates. If there is no dry pump protection, the released heat can damage the pump over time, limiting its lifetime.



Cavitation detection and control

The cavitation detection function slows down the pump speed or stops the pump when cavitation occurs. Cavitation can happen in flow systems when the pressure in inlet side suddenly drops. It causes vapor bubbles and when the bubbles collapse, they can be destructive to a pump's internal components.

General software features of the drive

Startup assistant allows first-time users to quickly customize the drive, out of the box, according to their needs. This is complemented by a built-in help function to make parameter-by-parameter setting easy.

Motor control in scalar and vector control modes. They support a wide range of motors including induction, permanent magnet and synchronous reluctance motors.

The energy optimizer feature optimizes the motor flux so that total energy consumption is reduced when the drive operates below the nominal load. The total efficiency can be improved by 1...20% depending on load torque and speed.

Configurable motor features to monitor, protect and early warn against problems in the motor, the pump or the process.

The drive reduces motor noise by spreading the switching frequencies over a user-specified range.

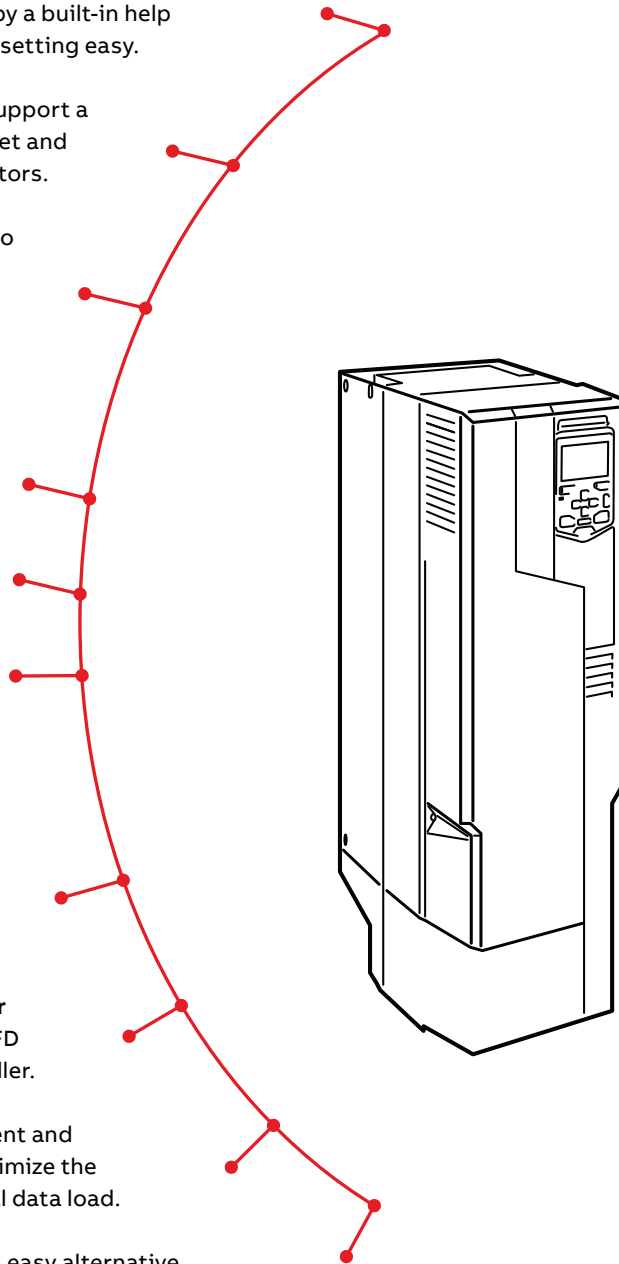
Drive safety and protection features include overcurrent, DC over- and undervoltage, drive overheating and short circuit protection, motor phase loss and supply phase loss detection, external communication loss management and many more.

Diagnostic assistant helps in locating the cause of any disturbance to the drive, and even suggests possible remedies. This reduces process downtime by making repairs or adjustments effortless.

A built-in and stand-alone process PID/loop controller allows you to control the process loop directly from the VFD without an external controller.

Load profile feature collects drive values, such as current and stores them in a log. This enables you to analyze and optimize the application with the help of historical data load.

Adaptive programming provides extra flexibility by offering easy alternative for simple programming needs. Download Drive Composer entry for free to start writing your application.

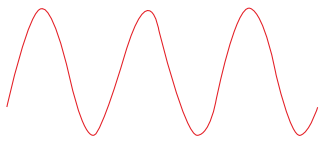


Overcome challenges of harmonics

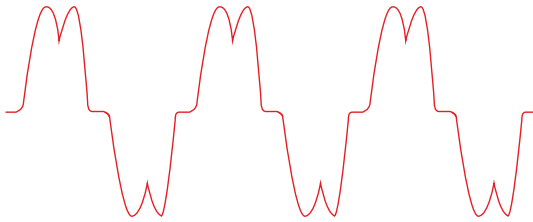
ACQ580 ultra-low harmonic drives have excellent harmonics performance and are perfectly suited for places that cannot handle high harmonic content in the network.

The problem with harmonics

Generators in power plants rotate at constant and regulated speed, resulting in a sine-wave shaped current in an AC grid in the ideal case.



However, in the modern world, the network is not pure sine wave. Electricity networks are affected by harmonics: higher-order oscillations introduced by various types of electrical equipment.



Problems caused by harmonic distortion

High levels of harmonic distortion in an utility can create a wide range of problems. Some of the problems that may be encountered are:

- Premature failure and reduced lifespan of devices often occurs when overheating is present, such as:
 - Overheating of transformers, cables, circuit breakers and fuses
 - Overheating of motors that are powered directly across the line
- Nuisance trips of breakers and fuses due to the added heat and harmonic loading
- Unstable operation of backup generators
- Unstable operation of sensitive electronics that require a pure sinusoidal AC waveform
- Flickering lights

All-in-one concept to meet IEEE519

ABB's ultra-low harmonic (ULH) drives for water are designed with built-in harmonic avoidance systems and complies with IEC61000-3-12. Also extremely low harmonic content helps your system meet IEEE519. Compared to other harmonic

There are many ways to mitigate harmonics and there is no "one size fits all" solution.

The table below compares the THD_i of various harmonic mitigation technologies, along with other comparisons.

	Six-pulse VFD no reactor/ choke	Six-pulse VFD Low DC bus capacitance	Six-pulse VFD + 5% reactor/choke	3-phase VFD Active front end drive ^{*)}
Typical THD _i	90-120%	35-40%	35-45 %	3-5 %
VFD system price ^{**)}	\$	\$	\$\$	\$\$\$
Footprint	◊	◊	◊◊	◊◊◊
Pros	Simple and low cost solution, acceptable for installations with low quantities of small drives.	Simple and low cost solution that results in some mitigation of current harmonics (THD _i).	Standard solution in water and wastewater applications.	Best harmonic performance of any of the solutions. Easy installation, only 3 wires in and 3 wires out. Ability to boost output voltage during low-line conditions. Unity true power factor.
Cons	High harmonic content, not recommended for installations with higher quantities of drives. Susceptible to poor power quality.	Higher voltage distortion (THD _v), more than the six-pulse VFD with 5% reactor/choke. More susceptible to problems caused by poor power quality. Almost no under voltage ride-through ability.	Systems with a large quantity or large sizes of drives, may require additional harmonic mitigation.	The drive itself generates slightly more heat than a standard six-pulse drive with reactor.

^{*)} Valuations are based on ABB low harmonic drives

^{**)} System price considers VFD & installation costs

mitigation solutions, the problems caused by harmonics are avoided in the first place. ULH drives have excellent harmonic performance technology built-in, including active supply unit and integrated low harmonic line filter. There is no need for external harmonic filters or multi-pulse transformers, leading to significant savings in the footprint.

Reliable operation under special conditions

ULH drives ensure that the motor receives the full voltage, even in low-voltage utility conditions or in a fluctuating network. Thanks to the drives’ capability to provide an output voltage up to 15 percent greater than the supply voltage, applications can overcome voltage drops caused by long supply or motor cables. All this is done without costly additional equipment or over sizing of drive system components.

Savings in total cost of ownership

Electrical utilities may charge additional penalties for consuming reactive power. The ULH drive has unity true power factor as a result of its low harmonics and no consumption of reactive power. Additionally, the drive is able to compensate the displacement power factor of the network to which it is connected. This reduces the risk of having additional running

costs or buying additional capacitor banks to correct the power factor.

With an integrated design that leverages drive technology as part of the harmonic solution, there is no risk of nuisance trips due to incompatible components, no need for additional hardware and no additional cooling requirements compared to other harmonic mitigation solutions, like passive and active filters. System level efficiency is better when there are less components in the network. Also, there is savings in the installation and maintenance costs.

In retrofit projects, the transformer might not be sized to meet the harmonic levels caused by non-linear loads such as standard 6-pulse drives, so there is a risk of overloading the transformer. Thanks to the extremely low harmonic content of ULH drives there is no need to oversize the transformer, switchgear, or cables.

When using backup generator power, the ULH drive does not create harmonic content that would require an oversized alternator. It also prevents unstable operation because the ULH never regenerates power back to the source.

	Six-pulse VFD + passive filter	Matrix technology drives	Multi-pulse VFD	Six-pulse VFD + active filter
Typical THD₁	5-10%	5-13 %	12 pulse 10-15% 18 Pulse 5-8% due to actual system dynamics, phase unbalance and background distortion.	4-7%
VFD system price **)	\$\$\$	\$\$\$\$	\$\$\$\$	\$\$\$\$
Footprint	□□□□	□□□	□□□□□	□□□□
Pros	Assuming physical space is available, a passive harmonic filter can be added after the drive is installed, if harmonics are determined to be a problem.	Includes regenerative braking.	Traditional harmonic mitigation method.	One active filter can clean up the harmonics from multiple drives/loads.
Cons	Leading power factor at light loads unless the filter’s capacitors are switched out of the circuit. Risk of resonances between the filter capacitors and other capacitors in the system. Complex wiring.	Low harmonic mode (5% THD ₁) does not allow full speed control throughout the entire frequency range, as it can only modulate up to 93% voltage. No under voltage ride-through of power circuitry due to the lack of DC bus.	Very large footprint. Significant number of points of failure. Optimal harmonic performance requires perfectly balanced AC power feed with little background distortion. Complex wiring and special transformer required. Very difficult to retrofit in the field.	Typically the most expensive solution. The filter becomes a single point of failure for harmonic mitigation. A filter failure could result in significant/immediate harmonic related issues within the system. Complex wiring.

Common features throughout the whole ACQ580 product family

ACQ580 drives have the operation logic, standard features and common options throughout the whole portfolio. Learn it once - use it everywhere.



Standard ACQ580 features

Choke and EMC

- Integrated harmonic mitigation
 - ACQ580-01/-Px; 5% equivalent impedance DC choke
 - ACQ580-04; 3% nominal impedance AC choke
 - ACQ580-31/-34; THDi of less than 3% at the drive terminal
- Fulfills the EN61000-3-12 standard
- EMC C2 filter for -01 and -31 allows safe installation in first environment
- EMC C3 and common mode filter for -04 and -34 allow safe installation in second environment

Scalar and vector control for process control

- Scalar control for effortless process control
- Vector control for accurate speed and torque control in demanding applications
- Support for induction, permanent magnet and synchronous reluctance motors (SynRM)

Extensive I/O connections

- The ACQ580 features extensive I/O connections for flexible configuration in various applications
- Colored and bigger terminals for easy commissioning and diagnostics

Assistant control panel and primary settings

- The assistant control panel speaks your language
- USB interface for PC and tool connection

Integrated safe torque off (STO)

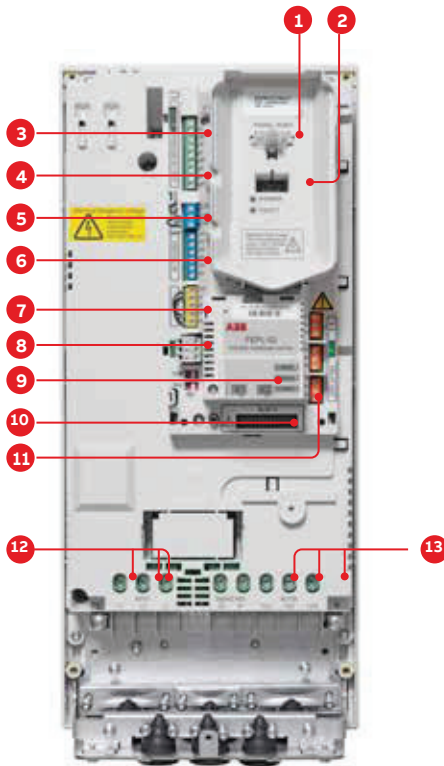
- Safe torque off for implementing safe machinery
- SIL 3, PL e

Comprehensive connectivity

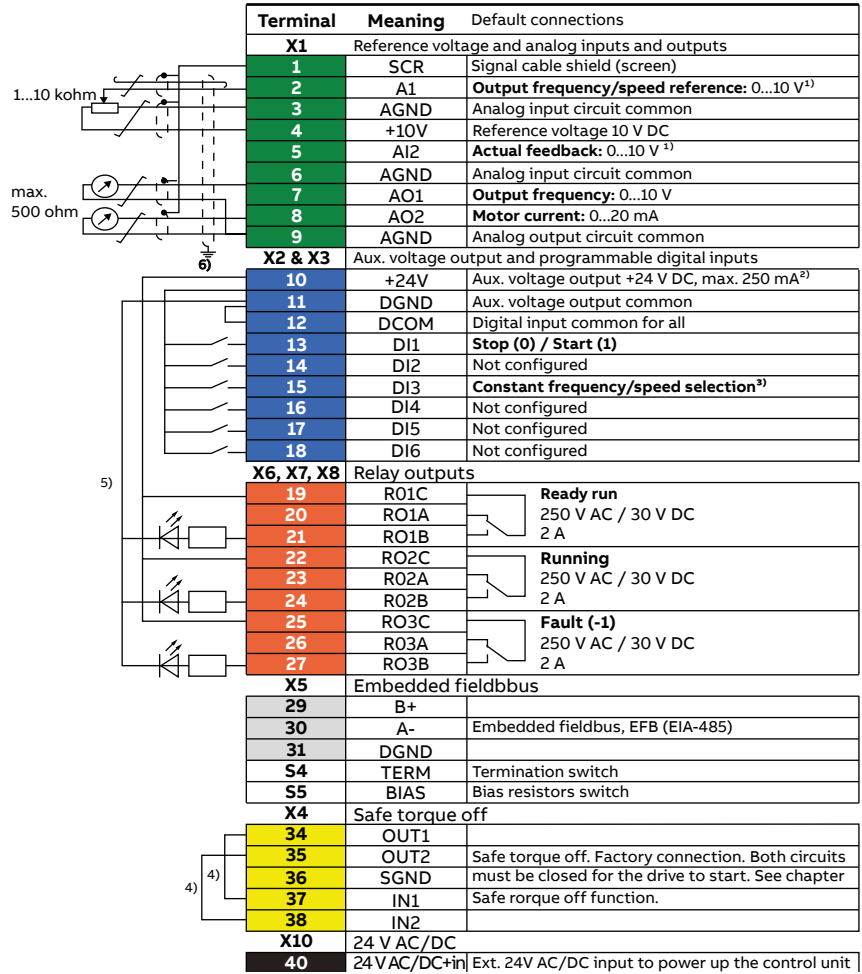
The ACQ580 drives offer a wide range of standard interfaces. In addition, the drive has two option slots that can be used for extensions including fieldbus adapter modules and input/output extension modules.

All signals and functions for each I/O point can be freely configured via drive settings. AI1, AI2 and AO1 can be set individually for either mA or V signals.

Default control connection diagram below:



1. Panel port (PC tools, control panel)
2. ABB drive customizer port for programming the drive without mains with CCA-01 tool
3. Analog inputs (2 × AI)
4. Analog outputs (2 × AO)
5. 24 V AC/DC output
6. Digital inputs (6 × DI)
7. Safe torque off (STO)
8. Embedded fieldbus
9. Communication options (fieldbuses)
10. I/O extensions
11. Relay outputs (3 × RO)
12. Mains connection
13. Motor connection



1) Current [0(4)...20 mA, Rin = 100 ohm] or voltage [0(2)...10 V, Rin > 200 kohm]. Change of setting requires changing the corresponding parameter.
 2) Total load capacity of the Auxiliary voltage output +24V (X2:10) is 6.0 W (250 mA / 24 V) minus the power taken by the option modules installed on the board.
 3) In scalar control (default): See Menu - Primary settings - Drive - Constant frequencies or parameter group 28 Frequency reference chain. In vector control: See Menu - Primary setting - Drive - Constant speeds or parameter group 22 Speed reference selection.
 4) Connected with jumpers at the factory.
 5) Use shielded twisted-pair cables for digital signals.
 6) Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.

Hand-Off-Auto control panel

The control panel features intuitive use and easy navigation. High resolution display enables visual guidance.

Almost anyone can set up and commission the ACQ580 drive using available control panels. You do not need to know any drive parameters, as the control panel helps you to set up the essential settings quickly and get the drive into action.

Control of multiple drives

One control panel can be connected to several drives simultaneously using the panel network feature. The user can also select the drive to operate in the panel network.



1. With the customizable **Home views**, you can monitor the values that matter most, e.g. speed, torque or motor temperature. Select the signals from a ready-made list or choose user-defined parameters.

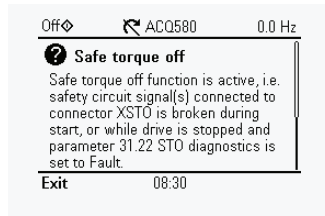
2. **Options** are used to set a reference, change the motor direction, select the drive, edit Home view pages, and see the fault and warning status.

3. All functions of the control panel are accessed through the **main menu**. It is possible to organize parameters in different ways and store essential parameters for different configurations for any specialized application needed.

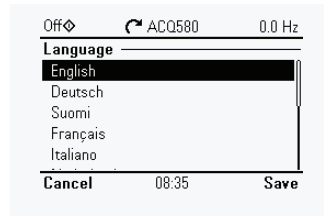
4. The help key provides context-sensitive guidance. Faults or warnings can be resolved quickly since the help key provides troubleshooting instructions.

5. The PC tool can be easily connected to the drive through the **USB connector** on the control panel.

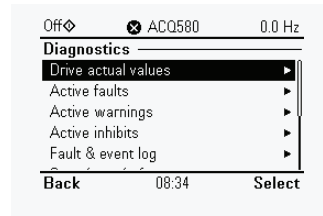
Assistant control panel display



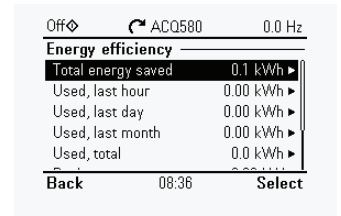
01



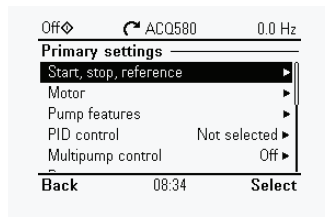
02



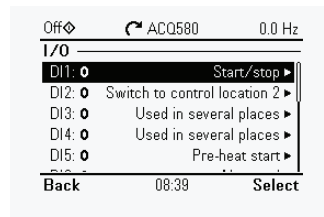
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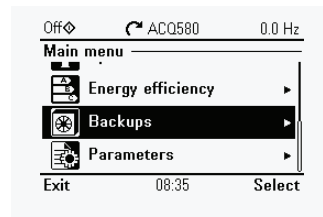
04



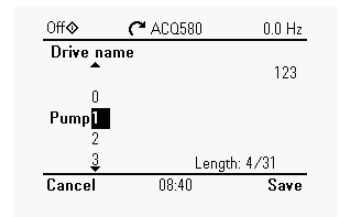
05



06



07



08

01 Help button

- Detailed descriptions related to faults and warnings
- More information about Primary settings options

02 Language options

Access to a selection list that consists of mutually exclusive options such as the language selection list (Access through the main menu).

03 Diagnostics

- Diagnostic information, such as faults and warnings
- Helps to resolve potential problems
- Helps to make sure that the drive setup is functioning correctly

04 Energy efficiency

View and configure parameters related to energy savings, such as kWh counters.

05 Primary settings for ACQ580

With the primary settings you can set motor values, commission multi-pump, set level control, set soft pipe filling etc. pumping features. When using Primary settings, there is no need to browse the parameters.

06 I/O Menu

- Access to each terminal name, number and electrical status
- Possibility to force inputs and outputs
- Access to sub-menus that provides further information on the menu item and allow to make changes to the I/O connections

07 Backups

Possibility to save parameter settings in the control panel memory and restore parameter settings from a backup to the drive.

08 Text editor

Add information, customize text and label the drive.

Control panel options and mounting kits

The standard delivery of the ACQ580 includes the assistant control panel, but it can be replaced by other control panels.



Hand-Off-Auto control panel, ACH-AP-H is included in the delivery. USB connection as standard.

Bluetooth control panel, ACH-AP-W
The optional Bluetooth panel enables connection with the Drivetune mobile app. The app is available for free from Google Play and the Apple App store. Together users can, for example, commission and monitor the drive remotely.



Industrial control panel, ACS-AP-I
The industrial control panel is compatible with all ABB drives, making it simple to use a single panel with different products.



Panel bus adapter, CDPI-01
The panel bus adapter is an ideal choice if there is a need to control multiple drives with a single control panel. The panel bus adapter also offers simplicity for cabinet installations because it can be used with a door mounted control panel to operate the drive easily and safely.



Blank control panel, CDUM-01
The blank control panel can be used for covering the control panel slot if no control panel or panel bus adapter is needed.



Control panel mounting platform, DPMP-01
This mounting platform is for surface mountings. This also requires CDPI-01 (panel bus adapter) and a control panel (assistant, basic, Bluetooth or industrial).



Door mounting kit, DPMP-EXT
The door mounting kit is ideal for cabinet installations. A kit for one drive includes one DPMP-02 (control panel mounting platform) and one CDPI-01 (blank control panel cover with RJ-45 connector).



Control panel door mounting kit for outdoor installation DPMP-04/05
Enables control panel outdoor mounting thanks to IP66 protection class, UV resistance and IK07 impact protection rating. It is suitable for mounting on UL (NEMA) Type 3R, 4 or 4X rated enclosures made with UV resistant materials.



Water control panel door mounting kit DPMP-06-EXT-Q
This kit allows remote mounting of the control panel on a larger enclosure or remotely. The kit contains one DPMP-06 (door mounting platform), one CDPI-01 (panel bus adapter) and a 3m connection cable. The platform is Water branded.



Water control panel door mounting kit DPMP-07-Q
This kit allows remote mounting of the control panel on a larger enclosure or remotely for ACQ580-04 modules. The kit contains one DPMP-07 and a 3m connection cable. The platform is Water branded.



Water control panel door mounting kit for indoor UL (NEMA) Type 4X installation DPMP-08-EXT-Q
This control panel holder kit is IP69k rated for use with UL (NEMA) type 4X rated enclosures. It is NSF169 rated for splash zones, washdown duty and chemical resistance. It is not UV resistant. The kit contains one DPMP-08 (door mounting platform), one ECPI-01 (panel bus adapter) and a 3m connection cable. The platform is Water branded.

Door mounting and daisy chaining

Improve safety and leverage the full potential of the ACQ580 control panel options with a door mounting kit and panel bus adapter.



Door mounting fosters easy operation and safety. It enables you to operate the drive without opening the cabinet door, saving time and keeping all the electronics behind the closed door. Up to 32 drives can be connected to one control panel for even

easier and quicker operation. When daisy chaining the drives, you need only one assistant control panel.

The rest of the drives can be equipped with panel bus adapters.

Cabinet door

Water cabinet mounting panel kit, DPMP-06-EXT-Q

The kit contains one DPMP-06 (door mounting platform), one CDPI-01 (panel bus adapter) and a 3m connection cable.

Assistant control panel

The assistant control panel is delivered as standard with the ACQ580 drives. Also a Bluetooth or industrial control panel can be used.

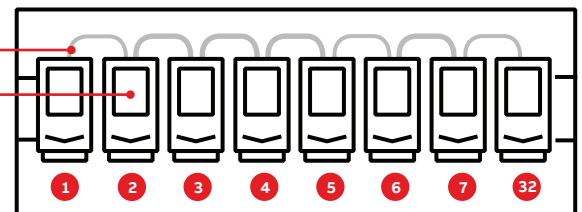
RJ-45 cable for daisy chaining drives

Panel bus adapter, CDPI-01

The panel bus adapter can be ordered with a plus code +J424 or with an MRP code 3AXD5000009843 as a loose option.



Cabinet, outside



Cabinet, inside

Control panel options

The ACH-AP-H Hand-Off-Auto control panel is included as standard in the delivery.

If no code is mentioned in the ACQ580 order, the assistant control panel is automatically added to the delivery. It can be replaced by one of the other +Jxxx options listed below.

Option code	Description	Type designation
	The Hand-Off-Auto control panel as standard in the delivery	ACH-AP-H
+J429	Control panel with Bluetooth interface	ACH-AP-W
+J425	Assistant Control panel with local/remote -logic	ACS-AP-I
+J424	Blank control panel cover (no control panel delivered)	CDUM-01
3AXD5000004419	Panel bus adapter	CDPI-01
3AUA0000108878	Control panel mounting platform (flush mounted, requires panel bus adapter)	DPMP-01
3AXD50000217717	Control panel door mounting kit (Outdoor UL/NEMA 3R, 4 and 4X (IP66), requires panel bus adapter)	DPMP-04
3AXD50000240319	Control panel door mounting kit (Outdoor UL/NEMA 3R, 4 and 4X (IP66), requires panel bus adapter) For AQ580-04 only.	DPMP-05
3AXD50000010763	Control Panel door mounting kit (Contains DPMP-02 &CDPI-01)	DPMP-EXT
3AXD50000361649	Water control panel door mounting kit (Contains DPMP-06 and CDPI-01)	DPMP-06-EXT-Q
3AXD50000371051	Water control panel door mounting kit (Contains DPMP-06 and CDPI-01) For ACQ580-04 only.	DPMP-07-Q
3AXD50000854912	Water control panel door mounting kit (Indoor UL/NEMA 4X/NSF169 washdown (IP69k), contains DPMP-08 and CDPI-01)	DPMP-08-EXT-Q

Communication and connectivity

Options

Fieldbus adapter modules

The ACQ580 comes with Modbus RTU fieldbus interface as standard, and it is also compatible with a wide range of additional fieldbus protocols. Fieldbus communication reduces wiring costs compared to traditional hardwired input/output connections. The fieldbus options can be installed into slot one (1).



Input/output extension modules

Standard input and output can be extended by using optional analog and digital input/output extension modules. The modules are easily installed in the extension slot two (2) located on the drive.

Fieldbus options

	Plus code	Fieldbus protocol	Adapter
	+K451	DeviceNet™	FDNA-01
	+K454	PROFIBUS DP, DPV0/DPV1	FPBA-01
	+K458	Modbus RTU	FSCA-01
	+K475	Two port Ethernet (Ethernet/IP, Modbus/TCP, PROFINET)	FENA-21
	+K490	Two port Ethernet/IP	FEIP-21
	+K491	Two port Modbus/TCP	FMBT-21
	+K492	Two port PROFINET IO	FPNO-21



Options

Plus code	Description	Type designation
+L501	External 24 V AC and DC 2 x RO and 1 x DO	CMOD-01
+L523	External 24 V and isolated PTC interface	CMOD-02
+L512	115/230 V digital input 6 x DI and 2 x RO	CHDI-01
+L525	Analog signal extension 3 x AI and 2 x AO	CAIO-01

Confident performance in challenging environmental conditions

Option code	Description
+C218	Conformally coated printed circuit boards to comply with class C4 (IEC60721-3-3:2019/ISO9223) / class 3C3 (IEC60721-3-3:2002)

ACQ580 drives are available with conformally coated printed circuit boards to provide protection against corrosive chemical gases that can be present in water and wastewater applications. ABB has completed testing on powered drives in controlled environmental chambers using real world concentrations and mixtures to ensure confidence that our products will perform. The boards comply with contamination class C4 according to IEC 60721-3-3:2019 and ISO 9223 and contamination class 3C3 according to IEC 60721-3-3:2002 for H₂S (Hydrogen Sulfide), NH₃ (Ammonia), NO₂ (Nitrogen Dioxide), SO₂ (Sulfur Dioxide) and Cl₂ (Chlorine).

Tools for configuration, monitoring and process tuning

ACQ580 has various tools to simplify the commissioning, operation and monitoring of the drive.



Easy configuration for unpowered drives

With the CCA-01 tool, it is possible to configure drive parameters and even download new software from PC to the unpowered ACQ580. The power is supplied by a PC USB port.



Drive Composer

The Drive Composer PC tool offers fast and harmonized setup, commissioning and monitoring. Drive Composer entry (a free version of the tool) provides startup and maintenance capabilities and gathers all drive information, such as parameter loggers, faults, and backups into a support diagnostics file.

Drive Composer pro provides additional features such as custom parameter windows, graphical control diagrams of the drive's configuration, and improved monitoring and diagnostics.



Connection with cable

Using the BCBL-01 cable, the PC can be connected directly to the RJ-45 panel port on the ACQ580 drive.



Connection to assistant panel

When using the Assistant control panel, the Drive composer tool is connected to the drive using the mini USB connection on the panel.

Description	Type designation
PC cable, USB to RJ45	BCBL-01
Cold configurator adapter, packed kit	CCA-01
Drive Composer pro PC tool (single user license)	DCPT-01

Free Drive Composer entry available at
<https://new.abb.com/drives/software-tools/drive-composer>

Drivetune mobile application for wireless access

User-friendly experience with Bluetooth connectivity.

Drivetune mobile app is a powerful tool for performing basic drive startup and troubleshooting tasks. It is possible to connect with drives and access data available in the Internet at the same time. The wireless Bluetooth connectivity means

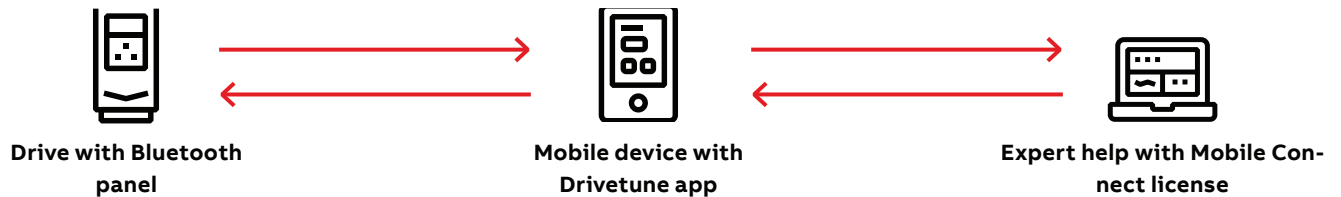
that users won't need to enter hazardous or difficult-to-reach work areas to access information necessary to help them commission and tune the drive.



- Startup, commission and tune your drive and application with full parameter access
- Optimize performance via drive troubleshooting features
- Create and share backups and support packages
- Keep track of drives installed base

ABB Ability™ Mobile Connect for drives is a module in the Drivetune app. It gives you the access to the technical support for fast problem solving. Mobile Connect makes all the necessary data instantly available to the expert, providing support.

Remote and rapid access to ABB's drive experts can save you and your team considerable time, money and headaches. Check Mobile Connect availability in your country.



Download Drivetune



Drivetune for commissioning and managing drives



Complete offering from wall-mounted drives to cabinet installations

No matter the frame size or power range, all ACQ580 drives bring you ease of use, scalability and quality.

—
01 Wall-mounted drives
(ACQ580-01 and
ACQ580-31)

—
02 Drive modules
(ACQ580-04 and
ACQ580-34)

—
03 Packaged drive with
disconnect means
(ACQ580-PC/PD)

ACQ580-01 The wall-mounted drive

The wall-mounted drives are available with the power and voltage range from 1 to 150 Hp at 208/230V, 1 to 350 Hp at 480V, and 2 to 250 Hp at 575V. Drives are available as standard with protection class UL (NEMA) Type 1 & 12 / IP21 & IP55 with pluscode +B056. Side-by-side mounting, flange mounting and horizontal mounting are all available for the wall-mounted ACQ580 drives.



ACQ580-04 Drive modules for cabinet installations

The ACQ580 drive modules are optimal for system integrators, cabinet builders or OEMs who want to optimize the cabinet design in the 400 to 700 hp range at 480V, but do not want to compromise the easy installation, commissioning and maintenance. Available UL (NEMA) Type Open / IP00.



ACQ580-31 Ultra-low harmonic drives for wall-mounting

The ULH variant drives produces even below 3% THDi, helping to keep network clean, stable and IEEE519 compliant while eliminating the need for installing external filters or multi-pulse transformers. The ULH drives for wall-mounting are available from 5 to 150 Hp at 480V and protection classes UL (NEMA) Type 1 & 12 / IP21 & IP55.

ACQ580-34 Ultra-low harmonic drives for cabinet installation

The ULH module is optimal for tailored cabinet design and is available from 200 to 400 hp at 480V and protection classes UL (NEMA) Type Open / IP00.

—
03



ACQ580-PC/PD packaged drives with disconnect means

The ACQ580 drive with integrated disconnect is a robust, rugged and compact package that enables mounting within line of site of equipment as well as an additional means for lockout tagout. It is available with either a disconnect switch (-PD) or circuit breaker (-PC) as the input disconnect means. Both include fuses and are available in power ranges from 1 to 100 Hp at 208/230V, 1 to 200 Hp at 480V and 2 to 150 Hp at 575V. They are available in UL (NEMA) Type 1 / IP21, UL (NEMA) Type 12 / IP55 (with +B056 pluscode) and UL (NEMA) Type 3R (with +B058 pluscode).

ACQ580-04

Drive modules for cabinet installations



- Compact drive module for cabinet mounting
- Save floor space and easy to maintain and service
- High power in compact size
- Easy installation and commissioning with pedestal on wheels and ramp

ACQ580 drive modules have been optimized for assembly into cabinets to ensure high quality and compact installation at minimal cost.

The module variant is UL (NEMA) Type Open / IP00 as standard, but has optional finger shrouds available. For optimized cabinet usage, features include power input connections on the top of the module and power output on the bottom.

Option code	Description
+B051	IP20 Finger shrouds for modules
+H370	Full-size cable connection terminals for input power cables
+0H371	Drive module without full-size output cable connection terminals
+0H354	No pedestal
+OP919	No cabinet installation ramp



ACQ580 custom packaged drives

Designed to meet your requirements



Choose the enclosure type and style that is needed for the project

Built to UL508A

Fans and filters are standard

Wide selection of optional features designed specifically for water and wastewater applications

Due to the project and specified nature of the water and wastewater industry, ABB frequently provides custom drive packages built around any wall-mounted drive or drive module in the ACQ580 lineup. We have a dedicated custom quotations and project team that will assist in preparing bids and following a project through to completion. Speak with your local sales contact for more information.

With custom packaged drives, the feature possibility is near endless. Some popular options include:

- Output line reactors or dV/dt filters
- Pilot lights and push buttons (available in 22mm and 30mm push-to-test designs)
- Speed potentiometers and hand-off-auto selector switches
- Metering options
- Surge suppressors
- Control transformers
- Cabinet lighting
- Thermostats and temperature function devices
- Softstart and traditional bypass configurations

Technical specifications

ACQ580-01/04

Supply connection	
Voltage and power range	
Input voltage (U1)	
ACQ580-01-xxxA-2	240 V 1-phase input, 3-phase output
ACQ580-01-xxxA-2	208-240 V 3-phase input, 3-phase output
ACQ580-01-xxxA-4	440-480 V 3-phase input, 3-phase output
ACQ580-01-xxxA-6	525-600 V 3-phase input, 3-phase output
ACQ580-04-xxxA-4	440-480 V 3-phase input, 3-phase output
Input voltage tolerance	10% / -15%
Line Limitations	Max ±3% of nominal phase to phase input voltage
Power Factor (cos Φ) at nominal load	0.98
Efficiency at rated power	98%
Power Loss	Approximately 2-3% of rated power
Motor connection	
Supported motor control	Scalar and vector
Supported motor types	Asynchronous motor, permanent magnet motor (vector), SynRM (vector)
Voltage	3-phase, from 0 to supply voltage
Frequency	0 to 500 Hz
Short Term Overload Capacity Variable Torque	110% for 1 min/10min
Peak Overload Capacity Variable Torque	1.35 for 2 second (2 sec / 1 minute)
Switching Frequency	2, 4, 8 or 12 kHz (Up to 150 Hp); 1 or 4 kHz (Over 150 Hp), Automatic fold back in case of overload
Acceleration/Deceleration Time	0 to 1800 s
Short Circuit Current Rating	100 kA (UL) with fusing
External power supply	
R6-R11: Standard	1.50 A at 24 V AC/DC ±10% / 36W
R1-R5: Optional card	1.04 A at 24 V AC/DC ±10% / 25W
Safety	
Safe Torque Off (STO)	
STO Standard Input	17...30 VDC, 55mA
Degree of Protection	
Degree of protection (IEC/EN 60529)	
ACQ580-01	IP21, IP55
ACQ580-04	IP00
Enclosure types (UL 508C/61800-5-1)	
ACQ580-01	UL (NEMA) Type 1 & 12
ACQ580-04	UL Type Open

Inputs and outputs	
2 analog inputs	Selection of Current/Voltage input mode is user programmable.
Voltage reference	0 (2) to 10 V, Rin > 200 kΩ
Current reference	0 (4) to 20 mA, Rin = 100 Ω
Potentiometer reference value	10 V ±1% max. 20 mA
2 analog outputs	AO1 is user programmable, for current or voltage. AO2 current
Voltage reference	0 to 10 V, Rload: > 100 kΩ
Current reference	0 to 20 mA, Rload: < 500 Ω
Applicable potentiometer	1 kΩ to 10 kΩ
Internal auxiliary voltage	24 V DC ±10%, max. 250 mA
Accuracy	+/- 1% full scale range at 25°C (77°F)
Output updating time	2 ms
6 digital inputs	12 to 24 V DC, 10 to 24 V AC, Connectivity of PTC sensors supported by a single digital input. PNP or NPN connection (5 DIs with NPN connection). Programmable
Input Updating Time	2 ms
3 relay outputs	Maximum switching voltage 250 V AC/30 V DC. Maximum continuous current 2 A rms. Programmable, Form C
Contact material	Silver Tin Oxide (AgSnO ₂)
PTC, PT100 and PT1000	Any of the analog inputs, or digital input 6, are configurable for PTC with up to 6 sensors.
Adjustable filters on analog inputs and outputs All control inputs isolated from ground and power	
Operation	
Air Temperature	-15 to +40°C (5 to 104°F) 50°C (122°F) available with derate 0 to -15 °C (32 to 5°F) No Frost Allowed Output derated above +40°C (104°F)
Installation site Altitude	0 to 1000 m (3281 ft) above sea level Output derated above 1000m (3281 ft) up to 4000m (13123ft)
Relative Humidity	5 to 95% No condensation allowed Maximum relative humidity is 60% in the presence of corrosive gasses
Atmospheric pressure	70 to 106 kPa (10.2 to 15.4 PSI) 0.7 to 1.05 atmospheres
Vibration	Risk category IV Certified (IBC 2018)

Technical specifications

ACQ580-01/04

Environmental protections	
Chemical Gasses	IEC 60721-3-3. Class 3C2 as standard and 3C3/C4 as option
Note: Conformal coated PCBs	
Solid Particles	IEC 60721-3-3. Class 3S2 No conductive dust allowed
Pollution degree (IEC/EN 61800-5-1)	Pollution degree 2
Product Compliance	
Standards and directives	
Low Voltage Directive 2006/95/EC	
EMC Directive 2004/108/EC	
60721-3-3: 2002	
60721-3-1:1997	
Quality assurance system ISO 9001 and	
Environmental system ISO 14001	
UL, cUL, CSA and EAC approvals	
Galvanic isolation according to PELV	
RoHS2 (Restriction of Hazardous Substances)	
EN 61800-5-1: 2007; IEC/EN 61000-3-12;	
EN 61800-3: 2017 + A1: 2012 Category C2	
(1st environment restricted distribution);	
Safe torque off (EN 61800-5-2)	
Seismic (IBC, OSHPD)	
Eco-design regulations EU 2019/1781	
EMC (According to EN61800-3)	C2 (1st environment, restricted distribution)
Available Options	
External 24V AC/DC and digital I/O extension (2xRO and 1xDO) (CMOD-01)	
Additional 115/230 V Digital input (6xDI and 2xRO) (CHDI-01)	
Additional analog I/O extension (3xAI bipolar and 2xAO unipolar) (CAIO-01)	
Fieldbus Adapter Modules	EtherNet/IP, Modbus TCP, PROFIBUS-DP, PROFINET, DeviceNet
Operation, Programming and Diagnostic Tool	Drive Composer Pro / Entry
Cold configuration tool (CCA-01)	
Keypad	
Standard	Hand/Off/Auto
Optional	Bluetooth

Storage (in Protective Shipping Package)	
Air Temperature	-40 to +70°C (-40 to +158°F)
Relative Humidity	Less than 95% No condensation allowed Maximum relative humidity is 60% in the presence of corrosive gasses
Chemical Gasses	IEC 60721-3-1. Class 1C2
Solid Particles	IEC 60721-3-1. Class 1S2
Atmospheric pressure	70 to 106 kPa 0.7 to 1.05 atmospheres
Vibration (ISTA)	
R1....R4	In accordance with ISTA 1A
R5....R9	In accordance with ISTA 3E
R10...R11	Max. 1 mm (0.04 in) (5...13.2 Hz), max. 7 m/s ² (23 fts/s ²)(13.2...100 Hz) sinusoidal
Transportation (in Protective Shipping Package)	
Air Temperature	-40° to 70°C (-40° to 158°F)
Relative Humidity	Less than 95% No condensation allowed Maximum relative humidity is 60% in the presence of corrosive gasses
Atmospheric Pressure	60 to 106 kPa (8.7 to 15.4 PSI) 0.6 to 1.05 atmospheres
Chemical Gasses	IEC 60721-3-2. Class 2C2
Solid Particles	IEC 60721-3-2. Class 2S2
Shock/ Drop (ISTA)	
R1....R4	In accordance with ISTA 1A
R5....R9	In accordance with ISTA 3E
R10...R11	With packing max. 100 m/s ² (330 ft/s ²), 11 ms
Vibration (ISTA)	
R1....R4	In accordance with ISTA 1A
R5....R9	In accordance with ISTA 3E
R10...R11	Max. 3.5 mm (0.14 in) (2...9 Hz), max. 15 m/s ² (49 ft/s ²) (9...200 Hz) sinusoidal

How to select a drive?

It is very easy to select the right drive. This is how you build up your own ordering code using the type designation key.

1 Start with identifying your supply voltage.

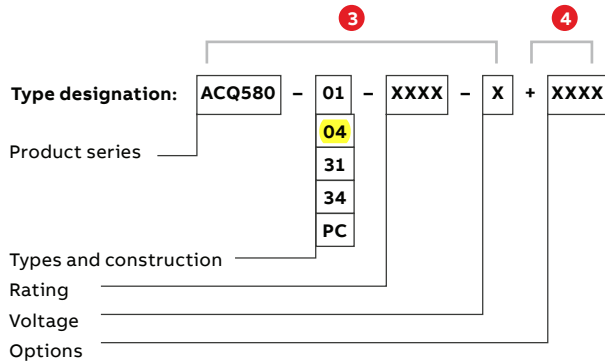
This tells you what rating table to use. The ACQ580 supports 208 to 600 V.

2 Choose your motor's nominal current rating from the ratings table on pages 37 - 41.

3 Select your drive's type code from the rating table based on your motor's nominal current rating.

4 Choose your options.

Details about each option begin on page 18. Add the option codes to the end of the drive's ordering code. Remember to use a "+" before each option code.



Example configuration:

ACQ580-01-124A-4+B056+J429

Wall-mounted 124A, 100 Hp, 480V drive in UL (NEMA) Type 12 / IP55 enclosure and Bluetooth control panel.

Ratings, types and voltages
ACQ580-01, wall-mounted drives

Motor power	208-240V	277V	347V	480V	575V	600V	690V
ACQ580-01-001	0.25	0.25	0.25	0.25	0.25	0.25	0.25
ACQ580-01-002	0.5	0.5	0.5	0.5	0.5	0.5	0.5
ACQ580-01-003	1	1	1	1	1	1	1
ACQ580-01-004	2	2	2	2	2	2	2
ACQ580-01-005	3	3	3	3	3	3	3
ACQ580-01-006	4	4	4	4	4	4	4
ACQ580-01-007	5	5	5	5	5	5	5
ACQ580-01-008	7.5	7.5	7.5	7.5	7.5	7.5	7.5
ACQ580-01-009	10	10	10	10	10	10	10
ACQ580-01-010	15	15	15	15	15	15	15
ACQ580-01-011	20	20	20	20	20	20	20
ACQ580-01-012	25	25	25	25	25	25	25
ACQ580-01-013	30	30	30	30	30	30	30
ACQ580-01-014	40	40	40	40	40	40	40
ACQ580-01-015	50	50	50	50	50	50	50
ACQ580-01-016	75	75	75	75	75	75	75
ACQ580-01-017	100	100	100	100	100	100	100
ACQ580-01-018	150	150	150	150	150	150	150
ACQ580-01-019	200	200	200	200	200	200	200
ACQ580-01-020	300	300	300	300	300	300	300
ACQ580-01-021	400	400	400	400	400	400	400
ACQ580-01-022	500	500	500	500	500	500	500
ACQ580-01-023	600	600	600	600	600	600	600

Pages 38-43

Ratings, types and voltages
ACQ580-01, wall-mounted drives

Motor power	208-240V	277V	347V	480V	575V	600V	690V
ACQ580-01-024	750	750	750	750	750	750	750
ACQ580-01-025	1000	1000	1000	1000	1000	1000	1000
ACQ580-01-026	1500	1500	1500	1500	1500	1500	1500
ACQ580-01-027	2000	2000	2000	2000	2000	2000	2000
ACQ580-01-028	3000	3000	3000	3000	3000	3000	3000
ACQ580-01-029	4000	4000	4000	4000	4000	4000	4000
ACQ580-01-030	5000	5000	5000	5000	5000	5000	5000
ACQ580-01-031	7500	7500	7500	7500	7500	7500	7500
ACQ580-01-032	10000	10000	10000	10000	10000	10000	10000
ACQ580-01-033	15000	15000	15000	15000	15000	15000	15000
ACQ580-01-034	20000	20000	20000	20000	20000	20000	20000
ACQ580-01-035	30000	30000	30000	30000	30000	30000	30000
ACQ580-01-036	40000	40000	40000	40000	40000	40000	40000
ACQ580-01-037	50000	50000	50000	50000	50000	50000	50000
ACQ580-01-038	75000	75000	75000	75000	75000	75000	75000
ACQ580-01-039	100000	100000	100000	100000	100000	100000	100000
ACQ580-01-040	150000	150000	150000	150000	150000	150000	150000
ACQ580-01-041	200000	200000	200000	200000	200000	200000	200000
ACQ580-01-042	300000	300000	300000	300000	300000	300000	300000
ACQ580-01-043	400000	400000	400000	400000	400000	400000	400000
ACQ580-01-044	500000	500000	500000	500000	500000	500000	500000

Pages 38-43

Door mounting and daisy chaining

Improve safety and leverage the full potential of the ACQ580 control panel options with a door mounting kit and panel bus adapter.

Door mounting kit, SMP-401
SMP-401 is a mounting kit for panel bus adapters. It is used to mount the panel bus adapter on the door of the drive. The SMP-401 is used to connect the panel bus adapter to the door of the drive.

Panel bus adapter, SMP-401
The panel bus adapter is used to connect the panel bus adapter to the door of the drive. It is used to connect the panel bus adapter to the door of the drive.

ACQ580-01-045

Option	Description	Part number
04	UL (NEMA) Type 12 enclosure	ACQ580-01-045
31	UL (NEMA) Type 12 enclosure	ACQ580-01-045
34	UL (NEMA) Type 12 enclosure	ACQ580-01-045
PC	UL (NEMA) Type 12 enclosure	ACQ580-01-045

Pages 20-33

Ratings, types and voltages

ACQ580-04, drive modules



Type Code	Output Ratings				Frame Size
	HP	Nominal	Light Duty	Heavy Duty	
		I_N	I_{LD}	I_{HD}	
3-phase $U_i = 380$ to 480V. Power ratings are valid at nominal output voltage $U_N = 460$ V 50/60 Hz					
ACQ580-04-505A-4	400	505	483	361	R10
ACQ580-04-585A-4	450	585	573	414	R10
ACQ580-04-650A-4	500	650	623	477	R10
ACQ580-04-725A-4	600	725	705	566	R11
ACQ580-04-820A-4	700	820	807	625	R11
ACQ580-04-880A-4	700	880	807	625	R11

Notes:

ACQ580-04 comes standard with common mode filter, DC connection bus bars, full size output terminals, DP-MP-07-Q control panel holder, standard ACH-AP-H control panel and EMC filter for grounded systems. Control section is loose for remote mounting.

I_N Rated current available continuously without overloadability.

I_{LD} Maximum current with 10% overload, allowed for one minute every 10 minutes when parameter 97.02 minimum switching frequency is set to 2kHz or less.

I_{HD} Maximum current with 50% overload, allowed for one minute every 10 minutes.

The ratings apply for frames R10 to R11 up to +40 °C in UL Type Open (IP 00/20).

For derating at high altitudes, temperatures or switching frequencies, see the user's HW manual, document code: 3AXD50000048677.

Dimensions

ACQ580-01, UL Type 1 and UL Type 12

Frame	Height (H)	Height (H)	Width (W)	Width (W)	Depth (D)	Depth (D)	Weight	Weight
	Type 1	Type 12	Type 1	Type 12	Type 1	Type 12	Type 1	Type 12
	in	in	in	in	in	in	lb	lb
R1	14.69	17.78	4.82	5.09	8.78	9.17	11	11
R2	18.62	21.49	4.86	5.10	9.00	9.40	15	15
R3	19.29	20.93	7.99	8.16	9.01	9.32	26	29
R4	25.04	27.03	7.99	8.59	10.13	10.44	42	45
R5	28.83	32.01	7.99	8.59	11.60	12.59	63	64
R6	28.60	34.81	9.92	11.46	14.53	16.40	94	95
R7	34.67	40.86	11.18	12.76	14.58	16.30	120	124
R8	38.01	44.23	11.81	13.80	15.47	17.80	153	170
R9	37.60	46.75	14.96	16.95	16.46	18.78	214	228

Type 12 dimensions include hood dimensions



ACQ580-04, UL Type Open

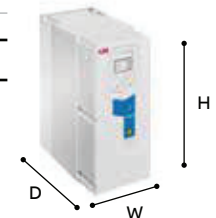
Frame	Height (H)	Width (W)	Depth (D)	Weight
	in	in	in	lb
R10	57.55	13.78	20.81	357
R11	65.43	13.78	20.81	441



ACQ580-31, UL Type 1 and UL Type 12

Frame	Height (H)	Height (H)	Width (W)	Width (W)	Depth (D)	Depth (D)	Weight	Weight
	Type 1	Type 12	Type 1	Type 12	Type 1	Type 12	Type 1	Type 12
	in	in	in	in	in	in	lb	lb
R3	19.49	19.49	8.07	8.07	13.74	14.17	47	52
R6	30.35	36.56	9.92	11.46	15.44	17.65	135	129
R9	38.01	44.22	11.81	13.00	17.23	19.53	247	260

Type 12 dimensions include hood dimensions



ACQ580-34, UL Type Open

Frame	Height (H)	Width (W)	Depth (D)	Weight
	in	in	in	lb
R11	67.80	25.06	19.86	805



Hardware options may affect the dimensions. Please see the corresponding hardware manuals.

Cooling and fuses

Cooling

ACQ580 drives are fitted with variable-speed cooling fans. The speed-controlled fans cool the drive only when needed, reducing overall noise level and energy consumption.

Fuse connection

Fuses for branch circuit protection per NEC are listed below. ABB recommends fast acting class T or faster fuses in the USA. Obey local regulations.

Cooling and fuses

ACQ580-01, wall-mounted drives, 208 to 240 V

Type designation	Frame size	Cooling air flow				Noise dB(A)	Recommended input protection fuses				
		Typical heat dissipation ¹⁾		Air flow			Input Current A	Max current A	Voltage rating V	Bussmann type	UL class ²⁾
		W	BTU/h	m3/h	CFM						
ACQ580-01-04A6-2	R1	50	171	43	25	59	4.6	15	600	JJS-15	T
ACQ580-01-06A6-2	R1	69	235	43	25	59	6.6	15	600	JJS-15	T
ACQ580-01-07A5-2	R1	79	270	43	25	59	7.5	15	600	JJS-15	T
ACQ580-01-10A6-2	R1	120	409	43	25	59	10.6	15	600	JJS-15	T
ACQ580-01-017A-2	R1	203	693	43	25	59	16.7	30	600	JJS-30	T
ACQ580-01-024A-2	R2	247	843	101	59	64	24.2	40	600	JJS-40	T
ACQ580-01-031A-2	R2	348	1187	101	59	64	30.8	40	600	JJS-40	T
ACQ580-01-046A-2	R3	518	1767	179	105	76	46.2	80	600	JJS-80	T
ACQ580-01-059A-2	R3	762	2600	179	105	76	59.4	80	600	JJS-80	T
ACQ580-01-075A-2	R4	809	2760	288	170	69	74.8	100	600	JJS-100	T
ACQ580-01-088A-2	R5	861	2938	139	82	63	88	150	600	JJS-150	T
ACQ580-01-114A-2	R5	1268	4327	139	82	63	114	150	600	JJS-150	T
ACQ580-01-143A-2	R6	1916	6538	435	256	67	143	200	600	JJS-200	T
ACQ580-01-169A-2	R7	1965	6705	450	265	67	169	250	600	JJS-250	T
ACQ580-01-211A-2	R7	2809	9585	450	265	67	211	300	600	JJS-300	T
ACQ580-01-273A-2	R8	3518	12004	550	324	65	273	400	600	JJS-400	T
ACQ580-01-343A-2	R9	2547	8691	1150	677	68	343	500	600	JJS-500	T
ACQ580-01-396A-2	R9	3060	10441	1150	677	68	396	600	600	JJS-600	T

1) Typical drive losses when it operates at 90% of the motor nominal frequency and 100% of the drive nominal output current

2) Class J, CC and CF fuses are also allowed at the same nominal current and voltage ratings

Notes:

1. Fuses are required as part of the installation, are not included in the base drive configuration and must be provided by others.

2. Fuses with a higher current rating than specified must not be used.

3. The UL listed fuses recommended by ABB are the required branch circuit protection per NEC. Circuit breakers are also acceptable as branch circuit protection, see the Hardware Manual or manual supplement Branch Circuit Protection for ABB Drives (3AXD50000645015).

4. The recommended size or smaller UL listed 248 fast acting, time delay, or high speed fuses must be used to maintain the UL listing of the drive. Additional protection can be used. Refer to local codes and regulations.

5. A fuse of a different class can be used at the high fault rating where the Ipeak and I2t of the new fuse is not greater than that of the specified fuse.

6. UL listed 248 fast acting, time delay, or high speed fuses from other manufacturers can be used if they meet the same class and rating requirements specified in the rules above.

7. When installing a drive, always follow ABB installation instructions, NEC requirements and local codes.

8. Alternative fuses can be used if they meet certain characteristics. For acceptable substitutions, see the Hardware Manual or manual supplement Branch Circuit Protection for ABB Drives (3AXD50000645015).

Cooling and fuses

ACQ580-04, drive modules, 380 to 480 V

Type designation	Frame size	Cooling air flow				Noise	Recommended input protection fuses					
		Typical heat dissipation ¹⁾		Air flow			Input Current	Max current	Voltage rating	Manufacturer	Fuse Type	UL class
		W	BTU/h	m ³ /h	CFM							
ACQ580-04-505A-4	R10	6492	22152	1200	707	72	483	600	600	Bussmann	JJS-600	T
ACQ580-04-585A-4	R10	6840	23339	1200	707	72	573	800	600	Ferraz	A4BY800	L
ACQ580-04-650A-4	R10	8046	27454	1200	707	72	623	800	600	Ferraz	A4BY800	L
ACQ580-04-725A-4	R11	8108	27666	1200	707	72	705	1000	600	Ferraz	A4BY1000	L
ACQ580-04-820A-4	R11	9652	32934	1200	707	72	807	1000	600	Ferraz	A4BY1000	L
ACQ580-04-880A-4	R11	10887	37148	1420	848	71	807	1000	600	Ferraz	A4BY1000	L

1) Typical drive losses when it operates at 90% of the motor nominal frequency and 100% of the drive nominal output current

Notes:

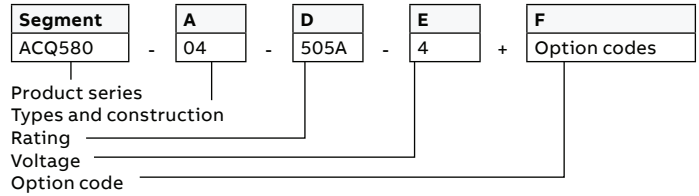
- Fuses are required as part of the installation, are not included in the base drive configuration and must be provided by others.
- Fuses with a higher current rating than specified must not be used.
- The UL listed fuses recommended by ABB are the required branch circuit protection per NEC. Circuit breakers are also acceptable as branch circuit protection, see the Hardware Manual or manual supplement Branch Circuit Protection for ABB Drives (3AXD50000645015).
- The recommended size or smaller UL listed 248 fast acting, time delay, or high speed fuses must be used to maintain the UL listing of the drive. Additional protection can be used. Refer to local codes and regulations.
- A fuse of a different class can be used at the high fault rating where the I_{peak} and I_{2t} of the new fuse is not greater than that of the specified fuse.
- UL listed 248 fast acting, time delay, or high speed fuses from other manufacturers can be used if they meet the same class and rating requirements specified in the rules above.
- When installing a drive, always follow ABB installation instructions, NEC requirements and local codes.
- Alternative fuses can be used if they meet certain characteristics. For acceptable substitutions, see the Hardware Manual or manual supplement Branch Circuit Protection for ABB Drives (3AXD50000645015).
- In multicable installations, install only one fuse per phase (not one fuse per conductor).

ACQ580-04

The type designation tells you the specifications and configuration of the drive.

The table shows the primary drive variants.

Sample type code: ACQ580-04-505A-4+XXXX



Basic codes

Segment	Option	Description
A	Construction 04 =	When no additional options are selected: Drive module with ramp, coated circuit boards, loose control unit, assistant control panel with USB port, control panel door mounting kit, embedded Modbus RTU, AC choke, common mode filter, EMC filter, safe torque off, DC connection busbars, full size output cable connection, quick installation and startup guide
D	Current rating	Refer to the rating table
E	Voltage rating	4 = 460 V

Option codes

Segment	Option	Code	Description
F	Control panel and panel options	STD	ACH-AP-H Hand-Off-Auto control panel (as standard)
		+0J400	No control panel
		+J425	ACS-AP-I Assistant control panel
		+J429	ACH-AP-W Hand-Off-Auto control panel with a Bluetooth interface
	I/O (one slot available for I/O options) (L501, L523 and L512 available as retrofit options)	+L501	External 24 V DC/AC and Digital I/O extension (2xRO and 1xDO) / CMOD-01
		+L512	115/230V Digital input (6xDI and 2xRO) / CHDI-01
		+L523	External 24 V and isolated PTC interface / CMOD-02
		+L525	CAIO-01 Analog signal extension (3 x AI and 2 x AO)
		Fieldbus (One fieldbus adapter supported. Fieldbus adapters available as loose options for retrofit.)	+K451
	+K454		PROFIBUS® DP (FPBA-01)
	+K458		Modbus/RTU adapter (FSCA-01)
	+K475		2-port Ethernet (EtherNet/IP™, Modbus®/TCP, PROFINET®)
	+K490		EtherNet/IP™ (FEIP-21)
	+K491		Modbus®/TCP (FMBT-21)
Enclosure ratings	+B051	UL (NEMA) Type Open (IP20 finger safe)	
	Construction	+H370	Full-size input terminals
+0H371		No full size output terminals	
+0H534		No pedestal	
+0P919		No cabinet installation ramp	
Additional options	+C218	Conformally coated printed circuit boards to comply with class C4 (IEC60721-3-3:2019/ISO9223)/class 3C3 (IEC60721-3-3:2002)	

ABB automation products



VFD-Gateway: Ethernet/IP Gateway module

The VFD-Gateway supports the Ethernet/IP protocol to allow drive data access to and from up to five (5) ABB drives. It uses a standard Ethernet cable on the gateway Ethernet port and serial communications via RS485 using the Modbus RTU protocol to the integral serial port on select ABB drives. The VFD-Gateway is customer DIN rail mountable separate from the drive. The Gateway provides software-free setup via a web browser interface. (Cables not included.)

AC500

ABB's powerful flagship PLC offering provides wide range of performance levels and scalability within a single simple concept where most competitors require multiple product ranges to deliver similar functionality.

AC500-S

A PLC based modular automation solution that makes it easier than before to mix and match standard and safety I/O modules to expertly meet your safety requirements in all functional safety applications. "Extreme conditions" version is also offered.

AC500-eCo

Meets the cost-effective demands of the small PLC market while offering total inter-operability with the core AC500 range. Web server, FTP server and Modbus-TCP for all Ethernet versions. A Pulse Train Out-put module is available for multi-axis positioning.

AC500-XC

"Extreme conditions" modules with extended operating temperature, immunity to vibration and hazardous gases, for use at high altitudes, in humid conditions, etc. It replaces expensive cabinets with its built-in protection against dirt, water, gases and dust.

Water library package

ABB's water library is compatible with the AC500 series PLC's. They provide advanced pumping functions, data logging, remote access and reliable data communication. The libraries ensure saved engineering time and costs as well as ease of use with fast programming possibilities.

Programmability

Automation Builder integrates the engineering and maintenance for PLC, drives, motion, HMI and robotics. It complies with the IEC 61131-3 standard offering all five IEC programming languages for PLC and drive configuration. Automation Builder supports a number of languages and comes with new libraries. FTP functions, SMTP, SNMP, smart diagnostics and debugging capabilities.

Control panels

Our control panels offer a wide range of touchscreen graphical displays from 3.5" up to 15". They are provided with user-friendly configuration software that enables tailor made customized HMI solutions. Rich sets of graphical symbols and the relevant drivers for ABB automation products are provided. Control panels for visualization of AC500 web server applications are available.

Softstarters

ABB's softstarters increase a motor's lifetime by protecting it from electrical stresses. With everything that you need in one unit, from bypass contactor to overload protection, a single Softstarter makes for a compact and complete starting solution.



Our service expertise, your advantage

ABB Motion Services helps customers around the globe by maximizing uptime, extending product life cycle, and enhancing the performance and energy efficiency of electrical motion solutions. We enable innovation and success through digitalization by securely connecting and monitoring our customers' motors and drives, increasing operational uptime, and improving efficiency. We make the difference for our customers and partners every day by keeping their operations running profitably, safely and reliably.

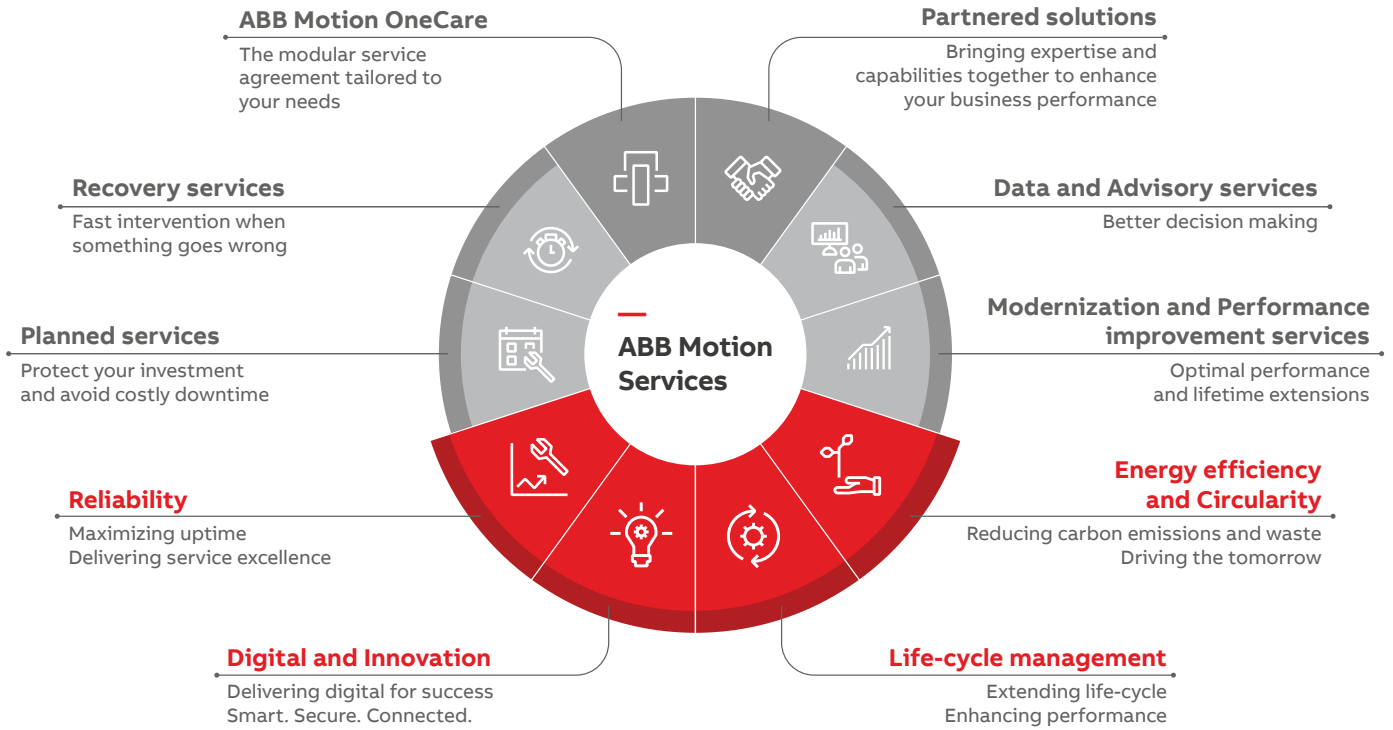
With a service offering tailored to your needs, ABB Motion Services maximizes the uptime and extends the life cycle of your electrical motion solutions, while optimizing their performance and maximizing your energy efficiency gains throughout the entire lifetime of your applications. We help to keep your applications turning profitably, safely, and reliably.

Digitalization enables new smart and secured ways to prevent unexpected downtime while optimizing the operation and maintenance of your assets. We securely connect and monitor your motors, drives or your entire powertrain to our easy to use cloud service solutions. Connecting your applications also gives you access to our in-depth service domain expertise.

We quickly respond to your service needs. Together with our partners, local field service experts, and service workshop networks, we provide and install original spare parts to help resolve any issues and minimize the impact of unexpected disruptions.

Our tailored to your needs service offerings and digital solutions will enable you to unlock new possibilities. Not only are we your premier supplier of motion equipment, we are your trusted partner and advisor offering support throughout the entire life cycle of your assets. We ensure your operations run profitably, safely and reliably and continue to drive real world results, now and in the future. Our service teams work with you, delivering the expertise needed to keep your world turning while saving energy every day.





OUR EXPERTISE
YOUR ADVANTAGE

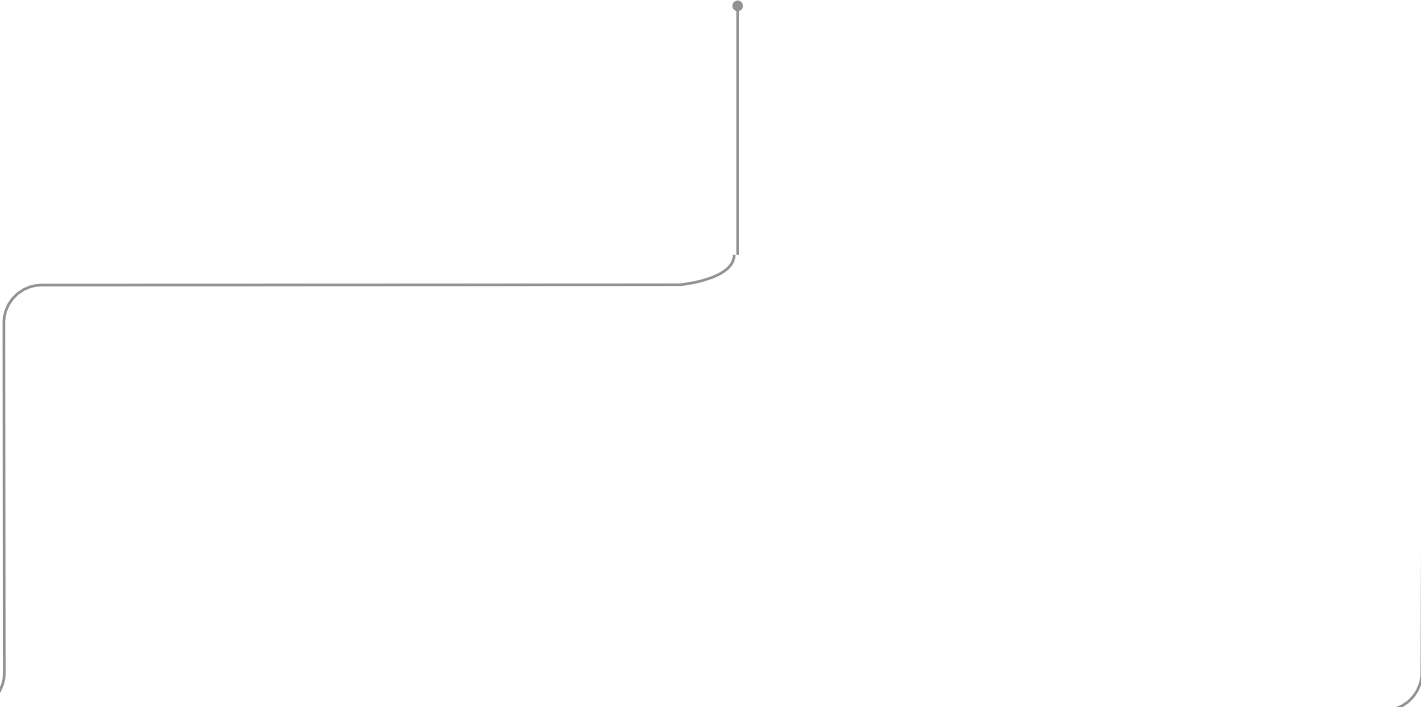


ABB Motion OneCare

The modular service agreement tailored to your needs



ABB Motion OneCare is a customized service agreement that is tailored to suit your service needs. Throughout the lifecycle of your critical drive and motor equipment, ABB will be with you providing digital monitoring, preventive maintenance, spares, and site support when the need arises. ABB Motion OneCare partners with you to make your equipment run reliably on budget, and on time.

ABB Motion OneCare

An ABB Motion OneCare service agreement is tailored specifically to your business needs and budget.

ABB partners with you to help you plan, coordinate and execute your equipment maintenance according to its criticality in your facility. We analyze your equipment's condition and recommend services that optimize your application's uptime, all bundled into a single agreement for easy management.

An ABB Motion OneCare agreement can cover a single service, life-cycle support of a motor, generator, drive or digital services. Alternatively, the entire maintenance can be handled by ABB's experts.

Overview of available services

ABB provides a comprehensive portfolio of conventional and data-driven services to ensure maximum performance of your installed motors, generators and drives. The following is a sample of services that can be combined within an ABB Motion OneCare agreement:

- ABB Ability™ digital services
- Technical support and remote assistance
- Preventive Maintenance (PM) & Failure Coverage
- Availability spares
- On-site maintenance
- Repairs, upgrades and retrofits
- Life-cycle assessments
- Service coordination and training

Key Benefits:

Tailored to your needs – Any of ABB's offerings can be customized to support your goals

Life cycle planning – Ensures predictable and emergency response support throughout the lifetime of your equipment

Ease of response when you need it – Our response time and focused support for your equipment is our top priority

24/7 Technical Support – ABB experts are available 24/7/365 for questions or when issues arise

Factory-trained field technicians – Maintenance and breakdown services are performed by those who know your equipment

ABB Motion OneCare agreement process



We meet with you to understand your needs

Each customer has different maintenance requirements. Do you need rapid site response and troubleshooting to maximize equipment uptime, on-site maintenance services optimized to site conditions or cloud-connected condition monitoring? We provide personnel training and support throughout the life cycle of your motors, generators and drives to keep them running at peak performance.



We assess the condition of your equipment

An on-site assessment identifies the condition and criticality of the motors, generators and drives in your facility. The assessment provides a benchmark for the provision of services.



Together, we determine the service agreement that best fits your needs

Based on your service requirements and the condition of your motors, generators and drives we will tailor a service agreement that fits your needs and budget.



Fulfillment of agreement

Together we coordinate the planned maintenance interventions. We give feedback of all activities carried out and provide an outlook for the delivery of short and mid-term services.



Follow-up and feedback

We keep a watchful eye on the performance of your equipment and offer a regular review to ensure your maintenance requirements are aligned with your production demands.

ABB Ability™ Digital Powertrain

Condition monitoring for drives



Accurate, real-time information about powertrain events. When you have the facts, you can make the right decisions.

Condition Monitoring gives you fact-based insight into your powertrain assets, such as drives and motors, via KPIs and signal data, to identify irregularities before they become problems. This helps you make proactive decisions, built on real-time information – and saves you money!

The service can be tailored to fit your needs

Our standard package gives you industry leading monitoring capabilities – whether you want to view the drive status through ABB's Internet portal or integrate this data with your existing monitoring systems.

The standard package includes the following services:

- Condition Monitoring
- Alarm Management
- Asset Health
- Team Support
- Backup Management

The standard package can be supplemented with optional services:

- Offline Data Collection
- Expert Reports
- Remote Assistance
- Condition monitoring of your entire powertrain



Solid fact-based decision making

Get the facts, and the history, to help run your operations better and more safely.



Always stay one step ahead of problems

Recognize early signs of possible failures and assess the risks, before they turn into serious operational issues.



Find the root cause of process issues

Remotely access data from ABB drives built-in sensors to track the cause of problems. Get back to smooth operation quickly with data back-ups.



Remotely analyze and optimize drives

Get critical drive information anywhere anytime – even in difficult to access sites, or when a site visit is impossible.

Choose the right motor for your application

ABB's line of Baldor-Reliance pump motors serve customer needs from commercial swimming pools to very demanding water / wastewater and petrochemical applications. The motors are available locally in a variety of enclosures and ratings. These motors are designed to the same reliable industrial standards that ABB customers have come to expect.



Jet pump

1/3 - 3Hp (.25-2.2kW) Used for commercial and industrial pumping applications. All come with corrosion resistant stainless shaft.



EC Titanium™

1-20Hp (.75-15kW)
Highly efficient variable speed AC motor available in the market today. Available as integrated motor-drive package or stand-alone design. (IP54)



Closed-coupled motors

1-75Hp (.75-56kW) For commercial and industrial pump applications requiring JM, JP and West Coast Fit.



General purpose

1/12-250Hp (.06-186kW)
Designed for use in a wide variety of industrial applications, these motors are durable and reliable. (IP44)



Inverter-Duty close coupled pump

1-50Hp (.75-37kW) Internal AEGIS bearing protection ring used for bearing current mitigation ideal for variable speed pumping applications.



Severe Duty XT

1-300Hp (.75-22kW)
Versatile motor with severe duty features - this motor is ideal for wastewater applications. (IP54)



P-based vertical solid shaft pump

3-75Hp (2.2-56kW)
Severe duty construction for harsh environment. Normal, medium and high thrust applications. (IP55)



Close coupled pump washdown

25-75Hp (19-56kW)
IP55 totally enclosed pump ideal for wet and corrosive environments. (IP55)



Submersible motors

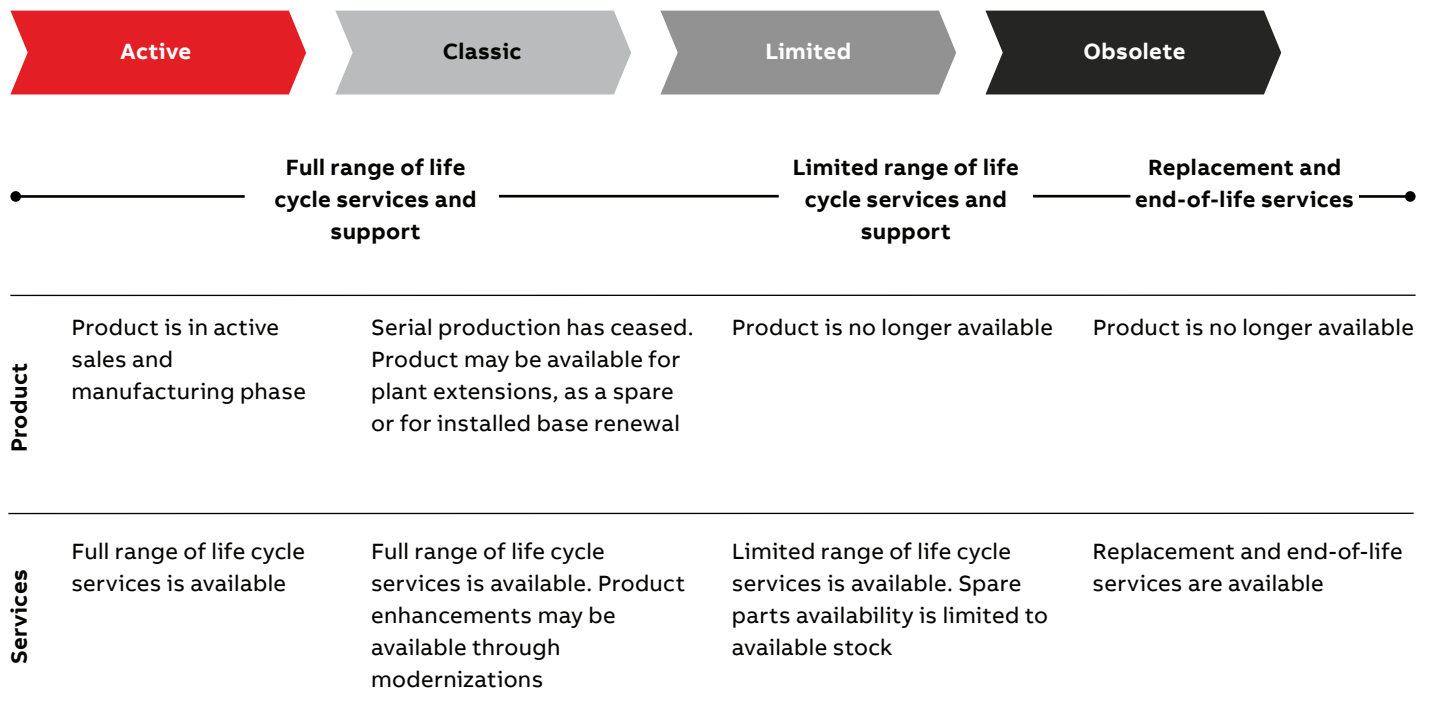
1-100Hp (.75-75kW)
Ideal for slurry pumps and wet pit applications, this motor can be submerged for continuous duty in water or sewage. (IP68)

ABB Drives Life Cycle Management

A life time of peak performance

You're in control of every life cycle phase of your drives. At the heart of drive services is a four-phase product life cycle management model. This model defines the services recommended and available throughout drives lifespan.

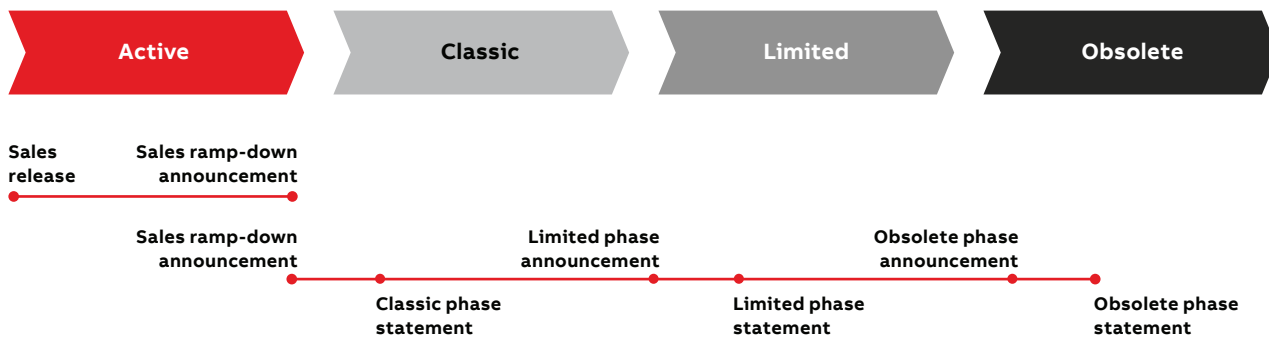
Now it's easy for you to see the exact service and maintenance available for your drives.



Keeping you informed throughout the life cycle

We notify you every step of the way using life cycle status statements and announcements.

Your benefit is clear information about your drives' status and precise services available. It helps you plan the preferred service actions ahead of time and make sure that continuous support is always available.



Sales release

Details about product portfolio and release schedule.

Sales ramp down announcement

Last time buy and last deliveries dates, informed well in advance.

Life cycle phase change announcement

Early information about the upcoming life cycle phase change and affects on the service availability. Informed well in advance, minimum six months prior to the change.

Life cycle phase statement

Information about the current life cycle status, product and services availability and recommended actions. Plan for the next life cycle phase transition.

Securing the flow of water and wastewater in the pump system

We want to be part of securing the operation of your water and wastewater utilities and distribution system. We want to help prevent any interruptions in your pump operation. We also want to ensure that the water is flowing in an effortless and energy efficient manner in accordance with required standards and regulations.



Complete offering of devices and services for the water industry

As a global partner, we can manage your water assets and bring you clear benefits from a total cost of ownership perspective. We do this by reducing costs throughout the whole life cycle of your pumping solution. Our portfolio includes drives, motors, PLCs and sensors. We also offer remote monitoring solutions to access information from a pump operating at a distance, saving time and reducing costs. Our devices have been designed to be compatible with each other, which ensures reliable communication and functionality.

Proactive maintenance for minimizing disruption to your pump and water distribution system

Motor-driven applications can be found throughout the water and wastewater industry. They have a high degree of reliance placed upon them and often perform critical duties and have a high in-service value. A possible failure of a device in the water and wastewater distribution system can result in loss of production, and introduce safety and environmental consequences. To reduce the risk of failure, each element of the pump solution – whether a drive, motor, bearing, coupling or gearing – must be properly maintained at the right times in their life cycle. From the moment you make the first inquiry to the disposal and recycling of each component, the services offered by ABB span the entire life cycle of your pump. Throughout the value chain, training, technical support and customized contracts are also available.



Additional information

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

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For more information, please contact
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Online manuals for wall-mounted ACQ580-01 drives



Online manuals for ACQ580-04 drive modules



Online manuals for wall-mounted ACQ580-31 ultra-low harmonic drives



Online manuals for ACQ580-34 ultra-low harmonic drive modules



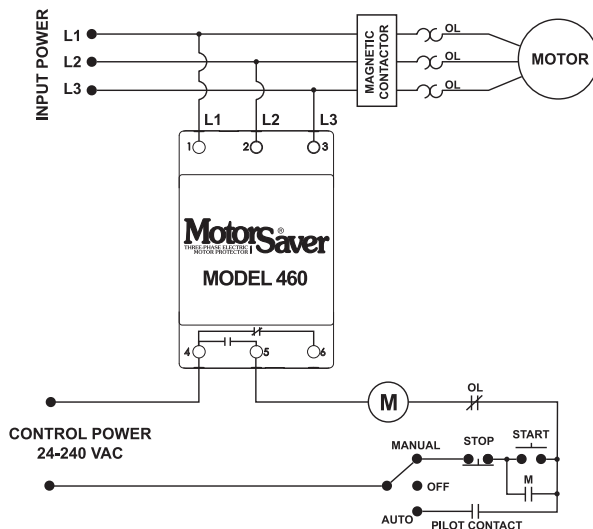
460 SERIES

3-Phase Voltage Monitor



Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 460 WITH MOTOR CONTROL



Description

The 460 is a 3-phase voltage monitor that protects 190-480VAC or 475-600V, 50/60Hz motors regardless of size. The product provides a user selectable nominal voltage setpoint and the voltage monitor automatically senses line voltage.

This unique microcontroller-based voltage and phase-sensing device constantly monitors the 3-phase voltages to detect harmful power line conditions such as low, high, and unbalanced voltage, loss of any phase, and phase reversal. When a harmful condition is detected, the MotorSaver® output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to an acceptable level for a specified amount of time (restart delay). The trip and restart delays prevent nuisance tripping due to rapidly fluctuating power line conditions.

All 460 models feature adjustable 1-30 second trip delay, 1-500 second restart delay, 2-8% voltage unbalance trip point, and one form C contact except where noted below.

Features & Benefits

FEATURES	BENEFITS
Auto-sensing wide voltage range	Automatically senses system voltage between 190 - 480VAC or 475-600VAC. Saves set-up time
Adjustable trip & restart delay settings	Prevent nuisance tripping due to rapidly fluctuating power line conditions
Microcontroller based circuitry	Improved accuracy and higher reliability
Advanced LED diagnostics	Quick visual indicator for cause of trip and relay status
Adjustable voltage unbalance trip setting	Provides reliable protection when regenerative voltage is present

Ordering Information

MODEL	VOLTAGE	DESCRIPTION
460	190-480VAC	Automatically senses line voltage, adjustable 1-30 second trip delay, 1-500 second restart delay, and 2-8% voltage unbalance trip point
460-L	190-480VAC	Fixed 4 second trip delay and 1 second for single-phase faults, and fixed 6% voltage unbalance trip point
460-14	190-480VAC	Equipped with 2 sets of contacts: Form A (NO) and Form B (NC). Used for applications requiring 2 different voltages such as 5VDC for a PLC input and 115VAC for an alarm
460-575	475-600VAC	Commonly used in Eastern Canada and on generator units that generate 600 VAC power
460-575-14	475-600VAC	Commonly used in Eastern Canada and on generator units that generate 600 VAC power. Equipped with 2 sets of contacts: Form A and Form B
460-15	190-480VAC	Equipped with 2 sets of Form A (NO) contacts. Used on applications where two different units are to be controlled at once such as a unit that has separate contacts for a compressor and a fan
460-MR	190-480VAC	Equipped with a 2-prong connection for a normally open push button mounted outside the panel. Used in applications requiring an external manual reset button
460-VBM	190-480VAC	Fixed 6% voltage unbalance trip point. User adjustable low and high voltage trip points
460-400HZ	190-480VAC	For use with 400Hz power supply
460-OEM	190-480VAC	Bulk package of 460, 20 units
460L-OEM	190-480VAC	Bulk package of 460-L, 20 units

460 SERIES

Specifications

Frequency	50/60Hz
Low Voltage (% of setpoint)	
Trip	90% ±1%
Reset	93% ±1%
High Voltage (% of setpoint)	
Trip	110% ±1%
Reset	107% ±1%
Voltage Unbalance (NEMA)	
Trip	2-8% adjustable
Reset	Trip setting minus 1% (5-8%) Trip setting minus 0.5% (2-4%)
460L	6% UB fixed (4.5% reset)
Trip Delay Time	
Low, High and Unbalanced Voltage	1-30 seconds adjustable
460L	4 seconds fixed
Single-Phase Faults (>15% UB)	1 second fixed
Restart Delay Time	
After a Fault	1-500 seconds adjustable
After a Complete Power Loss	1-500 seconds adjustable
Output Contact Rating	
Form C	
Pilot Duty	480VA @ 240VAC, B300
General Purpose	10A @ 240VAC
Form A & Form B	
Pilot Duty	360VA @ 240VAC, B300
General Purpose	8A @ 240VAC

Ambient Temperature Range

Operating	-20° to 70°C (-4° to 158°F)
Storage	-40° to 80°C (-40° to 176°F)
Maximum Input Power	6 W
Class of Protection	IP20, NEMA 1 (finger safe)
Relative Humidity	10-95%, non-condensing per IEC 68-2-3
Terminal Torque	4.5 in.-lbs.
Wire Type	Stranded or solid 12-20 AWG, one per terminal
Standards Passed	
Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 3, 6kV contact, 8kV air
RFI, Radiated	150 MHz, 10V/m
Fast Transient Burst	IEC 61000-4-4, Level 3, 3.5kV input power and controls

Surge

IEC	IEC 61000-4-5, Level 3, 4kV line-to-line; Level 4, 4kV line-to-ground
ANSI/IEEE	C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line
Hi-potential Test	Meets UL508 (2 x rated V +1000V for 1 minute)

Safety Marks

UL	UL508 (File #E68520)
CE	IEC 60947-6-2
Enclosure	Polycarbonate
Dimensions	H 88.9 mm (3.5"); W 52.9 mm (2.08"); D 59.69 mm (2.35")
Weight	0.7 lb. (11.2 oz., 317.51 g)
Mounting Method	35 mm DIN rail or Surface Mount (#6 or #8 screws)
460-MR (manual reset)	External NO pushbutton required.

QLINE E, TYPE 4X



INDUSTRY STANDARDS

Polycarbonate Enclosure

UL 508A Listed; Type 4, 4X, 6, 12, 13; File No. E61997
 cUL Listed per CSA C22.2 No 94; Type 4, 4X, 6, 12, 13; File No. E61997
 Enclosure flammability evaluated per UL 508A

NEMA/EEMAC Type 4, 4X, 6, 12, 13
 CSA File No. 42186: Type 4, 4X, 12, 13
 IEC 60529, IP67

ABS Enclosure

NEMA/EEMAC Type 4, 4X, 6, 12, 13
 IEC 60529, IP67

APPLICATION

QLINE E Enclosures house larger controls, provide additional size-range options and offer greater internal mounting flexibility than smaller QLINE products. Featuring contoured bodies with flush cover screws, they are functional in corrosive environments and can withstand occasional submersion.

The ABS series shares the same features and similar physical properties as the polycarbonate but is a more economical, non-UL rated alternative.

SPECIFICATIONS

- Body is impact-resistant polycarbonate for PCE series and ABS for ABE series
- Opaque and clear covers are impact-resistant polycarbonate for PCE, opaque covers are ABS for ABE series
- Polycarbonate and ABS material is easily punched, drilled, filed or sawed
- Cross-point flush cover screws are strong, durable polyamide
- Cover includes a molded-in wire lead hole
- Mounting tracks along body side walls for PC card installation
- Molded internal pads for mounting optional panels, rails and other components
- Seamless foam-in-place gasket assures watertight and dust-tight seal
- Material is halogen free

FINISH

Polycarbonate and ABS enclosure material is RAL 7035 light-gray inside and out. Optional panels are plated steel.

ACCESSORIES

See also Accessories.

- Brass Inserts
- Hardware Kit
- Hinge Kit
- HOL-SEALERS Non-Metallic Hole Seals
- Mounting Bracket Kit

MODIFICATION AND CUSTOMIZATION

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

BULLETIN: Q41

Standard Product **Polycarbonate**

Catalog Number	AxBxC mm/in.	Cover Style	External Dimensions L x W mm/in.	Panel	Panel Size D x E mm/in.	Mounting G x H mm/in.	F mm/in.	K mm/in.	P mm/in.	Q mm/in.	S mm/in.
Q1388PCE	119 x 69 x 67	Opaque	125 x 75	Q138PE	98 x 48	110 x 60	61	25	40	75	90
	4.69 x 2.72 x 2.64		4.92 x 2.95		3.86 x 1.89	4.33 x 2.36	2.40	0.98	1.57	2.95	3.54
Q1388PCECC	119 x 69 x 67	Clear	125 x 75	Q138PE	98 x 48	110 x 60	61	25	40	75	90
	4.67 x 2.70 x 2.65		4.92 x 2.95		3.86 x 1.89	4.33 x 2.36	2.40	0.98	1.57	2.95	3.54
Q13138PCE	119 x 119 x 67	Opaque	125 x 125	Q1313PE	98 x 98	110 x 110	61	25	90	75	90
	4.67 x 4.67 x 2.65		4.92 x 4.92		3.86 x 3.86	4.33 x 4.33	2.40	0.98	3.54	2.95	3.54
Q13138PCECC	119 x 119 x 67	Clear	125 x 125	Q1313PE	98 x 98	110 x 110	61	25	90	75	90
	4.67 x 4.67 x 2.65		4.92 x 4.92		3.86 x 3.86	4.33 x 4.33	2.40	0.98	3.54	2.95	3.54
Q18138PCE	169 x 119 x 67	Opaque	175 x 125	Q1813PE	148 x 98	160 x 110	61	25	90	100	140
	6.63 x 4.67 x 2.65		6.89 x 4.92		5.83 x 3.86	6.30 x 4.33	2.40	0.98	3.54	3.94	5.51
Q18138PCECC	169 x 119 x 67	Clear	175 x 125	Q1813PE	148 x 98	160 x 110	61	25	90	100	140
	6.63 x 4.67 x 2.65		6.89 x 4.92		5.83 x 3.86	6.30 x 4.33	2.40	0.98	3.54	3.94	5.51
Q18188PCE	169 x 169 x 67	Opaque	175 x 175	Q1818PE	148 x 148	160 x 160	61	25	140	125	140
	6.63 x 6.63 x 2.65		6.89 x 6.89		5.83 x 5.83	6.30 x 6.30	2.40	0.98	5.51	4.92	5.51
Q18188PCECC	169 x 169 x 67	Clear	175 x 175	Q1818PE	148 x 148	160 x 160	61	25	140	125	140
	6.63 x 6.63 x 2.65		6.89 x 6.89		5.83 x 5.83	6.30 x 6.30	2.40	0.98	5.51	4.92	5.51
Q25188PCE	244 x 169 x 67	Opaque	250 x 175	Q2518PE	223 x 148	235 x 160	61	25	139	202	215
	9.59 x 6.63 x 2.65		9.84 x 6.89		8.78 x 5.83	9.25 x 6.30	2.40	0.98	5.47	7.95	8.46
Q25188PCECC	244 x 169 x 67	Clear	250 x 175	Q2518PE	223 x 148	235 x 160	61	25	139	202	215
	9.59 x 6.63 x 2.65		9.84 x 6.89		8.78 x 5.83	9.25 x 6.30	2.40	0.98	5.47	7.95	8.46
Q13810PCE	119 x 69 x 92	Opaque	125 x 75	Q138PE	98 x 48	110 x 60	86	50	40	75	90
	4.67 x 2.70 x 3.64		4.92 x 2.95		3.86 x 1.89	4.33 x 2.36	3.39	1.97	1.57	2.95	3.54
Q13810PCECC	119 x 69 x 92	Clear	125 x 75	Q138PE	98 x 48	110 x 60	86	50	40	75	90
	4.67 x 2.70 x 3.64		4.92 x 2.95		3.86 x 1.89	4.33 x 2.36	3.39	1.97	1.57	2.95	3.54
Q131310PCE	119 x 119 x 92	Opaque	125 x 125	Q1313PE	98 x 98	110 x 110	86	50	90	75	90
	4.67 x 4.67 x 3.64		4.92 x 4.92		3.86 x 3.86	4.33 x 4.33	3.39	1.97	3.54	2.95	3.54
Q131310PCECC	119 x 119 x 92	Clear	125 x 125	Q1313PE	98 x 98	110 x 110	86	50	90	75	90
	4.67 x 4.67 x 3.64		4.92 x 4.92		3.86 x 3.86	4.33 x 4.33	3.39	1.97	3.54	2.95	3.54
Q181310PCE	169 x 119 x 92	Opaque	175 x 125	Q1813PE	148 x 98	160 x 110	86	50	90	100	140
	6.63 x 4.67 x 3.64		6.89 x 4.92		5.83 x 3.86	6.30 x 4.33	3.39	1.97	3.54	3.94	5.51
Q181310PCECC	169 x 119 x 92 6.63 x 4.67 x 3.64	Clear	175 x 125	Q1813PE	148 x 98	160 x 110	86	50	90	100	140
Q181810PCE	169 x 169 x 92	Opaque	175 x 175	Q1818PE	148 x 148	160 x 160	86	50	140	125	140
	6.63 x 6.63 x 3.64		6.89 x 6.89		5.83 x 5.83	6.30 x 6.30	3.39	1.97	5.51	4.92	5.51
Q181810PCECC	169 x 169 x 92	Clear	175 x 175	Q1818PE	148 x 148	160 x 160	86	50	140	125	140
	6.63 x 6.63 x 3.64		6.89 x 6.89		5.83 x 5.83	6.30 x 6.30	3.39	1.97	5.51	4.92	5.51
Q251810PCE	244 x 169 x 92	Opaque	250 x 175	Q2518PE	223 x 148	235 x 160	86	50	139	202	215
	9.59 x 6.63 x 3.64		9.84 x 6.89		8.78 x 5.83	9.25 x 6.30	3.39	1.97	5.47	7.95	8.46
Q251810PCECC	244 x 169 x 92	Clear	250 x 175	Q2518PE	223 x 148	235 x 160	86	50	139	202	215
	9.59 x 6.63 x 3.64		9.84 x 6.89		8.78 x 5.83	9.25 x 6.30	3.39	1.97	5.47	7.95	8.46
Q13813PCE	119 x 69 x 117	Opaque	125 x 75	Q138PE	98 x 48	110 x 60	111	75	40	75	90
	4.67 x 2.70 x 4.62		4.92 x 2.95		3.86 x 1.89	4.33 x 2.36	4.37	2.95	1.57	2.95	3.54
Q13813PCECC	119 x 69 x 117	Clear	125 x 75	Q138PE	98 x 48	110 x 60	111	75	40	75	90
	4.67 x 2.70 x 4.62		4.92 x 2.95		3.86 x 1.89	4.33 x 2.36	4.37	2.95	1.57	2.95	3.54
Q131313PCE	119 x 119 x 117	Opaque	125 x 125	Q1313PE	98 x 98	110 x 110	111	75	90	75	90
	4.67 x 4.67 x 4.62		4.92 x 4.92		3.86 x 3.86	4.33 x 4.33	4.37	2.95	3.54	2.95	3.54
Q131313PCECC	119 x 119 x 117	Clear	125 x 125	Q1313PE	98 x 98	110 x 110	111	75	90	75	90
	4.67 x 4.67 x 4.62		4.92 x 4.92		3.86 x 3.86	4.33 x 4.33	4.37	2.95	3.54	2.95	3.54
Q181313PCE	169 x 119 x 117	Opaque	175 x 125	Q1813PE	148 x 98	160 x 110	111	75	90	100	140
	6.63 x 4.67 x 4.62		6.89 x 4.92		5.83 x 3.86	6.30 x 4.33	4.37	2.95	3.54	3.94	5.51
Q181313PCECC	169 x 119 x 117	Clear	175 x 125	Q1813PE	148 x 98	160 x 110	111	75	90	100	140
	6.63 x 4.67 x 4.62		6.89 x 4.92		5.83 x 3.86	6.30 x 4.33	4.37	2.95	3.54	3.94	5.51
Q181813PCE	169 x 169 x 117	Opaque	175 x 175	Q1818PE	148 x 148	160 x 160	111	75	140	125	140
	6.63 x 6.63 x 4.62		6.89 x 6.89		5.83 x 5.83	6.30 x 6.30	4.37	2.95	5.51	4.92	5.51
Q181813PCECC	169 x 169 x 117	Clear	175 x 175	Q1818PE	148 x 148	160 x 160	111	75	140	125	140
	6.63 x 6.63 x 4.62		6.89 x 6.89		5.83 x 5.83	6.30 x 6.30	4.37	2.95	5.51	4.92	5.51
Q181315PCE	169 x 119 x 142	Opaque	175 x 125	Q1813PE	148 x 98	160 x 110	136	100	90	100	140
	6.63 x 4.67 x 5.61		6.89 x 4.92		5.83 x 3.86	6.30 x 4.33	5.35	3.94	3.54	3.94	5.51
Q181315PCECC	169 x 119 x 142	Clear	175 x 125	Q1813PE	148 x 98	160 x 110	136	100	90	100	140
	6.63 x 4.67 x 5.61		6.89 x 4.92		5.83 x 3.86	6.30 x 4.33	5.35	3.94	3.54	3.94	5.51
Q181815PCE	169 x 169 x 142	Opaque	175 x 175	Q1818PE	148 x 148	160 x 160	136	100	140	125	140
	6.63 x 6.63 x 5.61		6.89 x 6.89		5.83 x 5.83	6.30 x 6.30	5.35	3.94	5.51	4.92	5.51
Q181815PCECC	169 x 169 x 142	Clear	175 x 175	Q1818PE	148 x 148	160 x 160	136	100	140	125	140
	6.63 x 6.63 x 5.61		6.89 x 6.89		5.83 x 5.83	6.30 x 6.30	5.35	3.94	5.51	4.92	5.51
Q251815PCE	244 x 169 x 142	Opaque	250 x 175	Q2518PE	223 x 148	235 x 160	136	100	139	202	215
	9.59 x 6.63 x 5.61		9.84 x 6.89		8.78 x 5.83	9.25 x 6.30	5.35	3.94	5.47	7.95	8.46
Q251815PCECC	244 x 169 x 142	Clear	250 x 175	Q2518PE	223 x 148	235 x 160	136	100	139	202	215
	9.59 x 6.63 x 5.61		9.84 x 6.89		8.78 x 5.83	9.25 x 6.30	5.35	3.94	5.47	7.95	8.46

A x B x C are internal dimensions.

Purchase panels separately.

Detail Bill of Material

Project Name: EFI# 93134
General Order No:

Item No.	Qty	Product	Description
	1	Switchboards	Pow-R-Line C Switchboard, Front Access/ Front and Rear Align, Type 1, 480V 3-Phase 3-Wire, 2500 Copper, Minimum Interrupting Rating: 65kA, Bus Bracing Rating: 65kA, Depth: 30 In
		Designation	93134 SWBD
Structure	1	2500 Amp CU Main Structure	<p>Compartment 1 - Breaker 2500A 3P NRX-RF Brkr [Fixed-Manual], 65 kAIC</p> <p>PXR25 LSI w/ ARMS & Modbus Trip Unit</p> <p>Local using blue light / switch on face of Switchboard</p>
Structure	2	2500 Amp CU Distribution Structure	<p>Compartment 1 - Surge Protective Device (SPD) SPD Series 100kA SPD, Standard w/ Fusible Disconnect</p> <p>Compartment 2 - Breaker 15A 3P [HFD 225A Frame]</p> <p>Thermal Mag Trip - Standard</p> <p>Compartment 3 - Breaker 25A 3P [HFD 225A Frame]</p> <p>Thermal Mag Trip - Standard</p> <p>Compartment 4 - Breaker 25A 3P [HFD 225A Frame]</p> <p>Thermal Mag Trip - Standard</p> <p>Compartment 5 - Breaker 25A 3P [HFD 225A Frame]</p> <p>Thermal Mag Trip - Standard</p> <p>Compartment 6 - Breaker 30A 2P [HFD 225A Frame]</p> <p>Thermal Mag Trip - Standard</p> <p>Compartment 7 - Breaker 2P [HFD 225A Frame] Provision</p> <p>Compartment 8 - Breaker 25A 3P [HFD 225A Frame]</p> <p>Thermal Mag Trip - Standard</p> <p>Compartment 9 - Breaker 25A 3P [HFD 225A Frame]</p> <p>Thermal Mag Trip - Standard</p> <p>Compartment 10 - Breaker 25A 3P [HFD 225A Frame]</p> <p>Thermal Mag Trip - Standard</p> <p>Compartment 11 - Breaker 50A 3P [HFD 225A Frame]</p> <p>Thermal Mag Trip - Standard</p> <p>Compartment 12 - Breaker 1000A Adj, 3P [NGH 1200A Frame]</p> <p>Digitrip 310+ LSI</p> <p>Compartment 13 - Breaker 1000A Adj, 3P [NGH 1200A Frame]</p> <p>Digitrip 310+ LSI</p> <p>Compartment 14 - Breaker 1000A Adj, 3P [NGH 1200A Frame]</p> <p>Digitrip 310+ LSI</p>

Detail Bill of Material

Project Name: EFI# 93134
General Order No:

Negotiation No: D4TD0228X3K1
Alternate No: 0000

Qty	List of Materials
1	Pow-R-Line C
1	2500 Amp CU Distribution Structure
12	Padlockable lockoff device
1	SPD Series 100kA SPD, Standard w/ Fusible Disconnect
1	2500 Amp CU Main Structure
2	Copper Ground Bus
3	1000A Adj, 3P [NGH 1200A Frame], Trip 1000 A, 310+, (4) 4/0-500 kcmil, Mechanical
6	25A 3P [HFD 225A Frame], Trip 25 A, Thermal Mag, (1) #14-1/0, Mechanical
1	50A 3P [HFD 225A Frame], Trip 50 A, Thermal Mag, (1) #14-1/0, Mechanical
1	30A 2P [HFD 225A Frame], Trip 30 A, Thermal Mag, (1) #14-1/0, Mechanical
1	2P [HFD 225A Frame] Provision
1	15A 3P [HFD 225A Frame], Trip 15 A, Thermal Mag, (1) #14-1/0, Mechanical
1	2500A 3P NRX-RF Brkr [Fixed-Manual], 65 kAIC, Trip 2500 A, PXR25 LSI w/ ARMS & Modbus, (7) #4-500 kcmil, Mechanical, Top

Switchboard General Information

Pow-R-Line C - Specifications

Quantity: 1

Alignment: Front Access/ Front and Rear Align

Service: 480V 3-Phase 3-Wire

Minimum Interrupt Rating: 65 kA

Bus Specifications

Bus Amps: 2500

Bus Bracing Rating: 65kA

Neutral Amps: None

Bus Material: Copper

Heat Test

Ground Bus Material: Copper Ground Bus Bolted To Frame, (1)
#6-350 kcmil Ground Lug

Incoming Information

Incoming Entry: Top

Incoming Location: Left

Incoming Qty & Size: Terminals, Mechanical, (7) #4-500 kcmil, Top

Structure Specifications

Non Service Entrance

Enclosure Type: Type 1

Special Notes

Qty Description

Catalog Number

Enclosure properties

Struct #

Description/Modifications

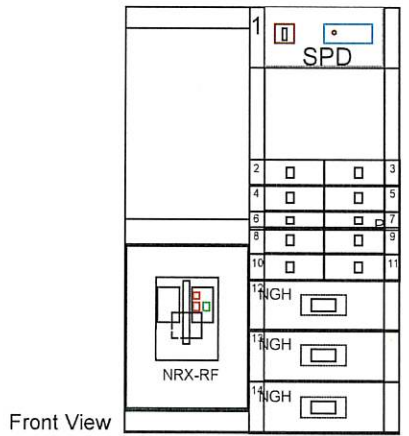
1

Top incoming main device (Incoming Main Device/MLO Section)

2

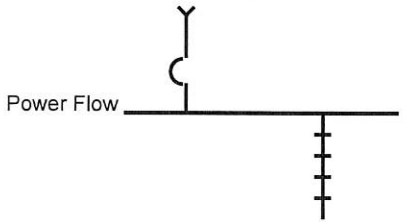
50x chassis mounted feeders (Feeder Structure)

The information on this document is created by Eaton Corporation. It is disclosed in confidence and it is only to be used for the purpose in which it is supplied.	PREPARED BY SHAUN HOPPE	DATE 3/1/2023	Eaton			SumterSC
	APPROVED BY	DATE	JOB NAME EFI# 93134	DESIGNATION 93134 SWBD		
	VERSION 9.0.31.3	TYPE Switchboards	DRAWING TYPE CustAppr			
NEG-ALT Number D4TD0228X3K1-0000	REVISION 0	DWG SIZE DwgA	G.O.	ITEM	SHEET 1 of 4	

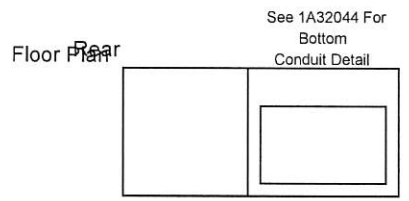


Front View

Struct	1 *	2 *
Depth	30	30
Width	30	36



Power Flow



Floor Plan

See 1A32044 For
Bottom
Conduit Detail

Total of 2 Structures, Total Weight of 1668 Weight-Lbs.

Total of 2 Structures, Total Width of 66 Inches

Structure	1	2			
Ship-Inches	30.00	36.00			
Ship-MM	762	914			
Wdth-Inches	30.00	36.00			
Wdth-MM	762	914			
Depth(Inner)-In.	30.00	30.00			
Depth(Inner)-MM	762	762			
Depth(Outer)-In.	30.00	30.00			
Depth(Outer)-MM	762	762			
Height-Inches	90.00	90.00			
Height-MM	2286	2286			
Weight-Lbs.(Est.)	600	1068			
Weight-Kg.(Est.)	272	484			

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PREPARED BY SHAUN HOPPE	DATE 3/1/2023	Eaton		SumterSC	
APPROVED BY	DATE	JOB NAME EFI# 93134	DESIGNATION 93134 SWBD		
VERSION 9.0.31.3		TYPE Switchboards	DRAWING TYPE CustAppr		
REVISION 0	DWG SIZE DwgA	G.O.	ITEM	SHEET 2 of 4	

NEG-ALT Number
D4TD0228X3K1-0000

Switchboard Units Information

Str#	Unit	Description/Modifications	Nameplate
------	------	---------------------------	-----------

1		Main Breaker - Ind Mtd-2500A 3P NRX-RF Brkr [Fixed-Manual], 65 kAIC, Trip 2500A., PXR25 LSI w/ ARMS & Modbus, 100 % rated ARMS Operation - Local using blue light / switch on face of Switchboard Terminals, Mechanical, (7) #4-500 kcmil, Top Neutral Terminal, None	
---	--	---	--

2			
	1	Surge Protective Device -SPD Series 100kA SPD, Standard w/ Fusible Disconnect	
	2	Feeder Breaker - Chassis Mtd-15A 3P [HFD 225A Frame], Trip 15A., Thermal Mag Terminals, Mechanical, (1) #14-1/0 Lockoff devices: Padlockable Hasp Neutral Terminal, None	
	3	Feeder Breaker - Chassis Mtd-25A 3P [HFD 225A Frame], Trip 25A., Thermal Mag Terminals, Mechanical, (1) #14-1/0 Lockoff devices: Padlockable Hasp Neutral Terminal, None	
	4	Feeder Breaker - Chassis Mtd-25A 3P [HFD 225A Frame], Trip 25A., Thermal Mag Terminals, Mechanical, (1) #14-1/0 Lockoff devices: Padlockable Hasp Neutral Terminal, None	
	5	Feeder Breaker - Chassis Mtd-25A 3P [HFD 225A Frame], Trip 25A., Thermal Mag Terminals, Mechanical, (1) #14-1/0 Lockoff devices: Padlockable Hasp Neutral Terminal, None	
	6	Feeder Breaker - Chassis Mtd-30A 2P [HFD 225A Frame], Trip 30A., Thermal Mag Terminals, Mechanical, (1) #14-1/0 Lockoff devices: Padlockable Hasp Neutral Terminal, None	
	7	Feeder Breaker - Chassis Mtd-2P [HFD 225A Frame] Provision, PROVISIONS FOR BREAKER ONLY Neutral Terminal, None	
	8	Feeder Breaker - Chassis Mtd-25A 3P [HFD 225A Frame], Trip 25A., Thermal Mag Terminals, Mechanical, (1) #14-1/0 Lockoff devices: Padlockable Hasp Neutral Terminal, None	
	9	Feeder Breaker - Chassis Mtd-25A 3P [HFD 225A Frame], Trip 25A., Thermal Mag Terminals, Mechanical, (1) #14-1/0 Lockoff devices: Padlockable Hasp Neutral Terminal, None	
	10	Feeder Breaker - Chassis Mtd-25A 3P [HFD 225A Frame], Trip 25A., Thermal Mag Terminals, Mechanical, (1) #14-1/0 Lockoff devices: Padlockable Hasp Neutral Terminal, None	

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	APPROVED BY	DATE	JOB NAME EFI# 93134	DESIGNATION 93134 SWBD
	VERSION 9.0.31.3	TYPE Switchboards	DRAWING TYPE CustAppr	
NEG-ALT Number D4TD0228X3K1-0000	REVISION 0	DWG SIZE DwgA	G.O.	ITEM SHEET 3 of 4

- 11 Feeder Breaker - Chassis Mtd-50A 3P [HFD 225A Frame], Trip 50A., Thermal Mag
Terminals, Mechanical, (1) #14-1/0
Lockoff devices: Padlockable Hasp
Neutral Terminal, None

 - 12 Feeder Breaker - Chassis Mtd-1000A Adj, 3P [NGH 1200A Frame], Trip 1000A., 310+, LSI
Terminals, Mechanical, (4) 4/0-500 kcmil
Lockoff devices: Padlockable Hasp
Neutral Terminal, None

 - 13 Feeder Breaker - Chassis Mtd-1000A Adj, 3P [NGH 1200A Frame], Trip 1000A., 310+, LSI
Terminals, Mechanical, (4) 4/0-500 kcmil
Lockoff devices: Padlockable Hasp
Neutral Terminal, None

 - 14 Feeder Breaker - Chassis Mtd-1000A Adj, 3P [NGH 1200A Frame], Trip 1000A., 310+, LSI
Terminals, Mechanical, (4) 4/0-500 kcmil
Lockoff devices: Padlockable Hasp
Neutral Terminal, None
-

The information on this document is created by Eaton Corporation. It is disclosed in confidence and it is only to be used for the purpose in which it is supplied.

PREPARED BY	DATE	Eaton		SumterSC	
SHAUN HOPPE	3/1/2023	JOB NAME	EFI# 93134		
APPROVED BY	DATE	DESIGNATION	93134 SWBD		
VERSION	TYPE	DRAWING TYPE			
9.0.31.3	Switchboards	CustAppr			
NEG-ALT Number	REVISION	DWG SIZE	G.O.	ITEM	SHEET
D4TD0228X3K1-0000	0	DwgA			4 of 4

General Description—Pow-R-Line C, Front- or Rear-Access, Group-Mounted Feeders

Pow-R-Line C Switchboards

Meets NEMA Standard PB-2 and UL 891.

Construction Details

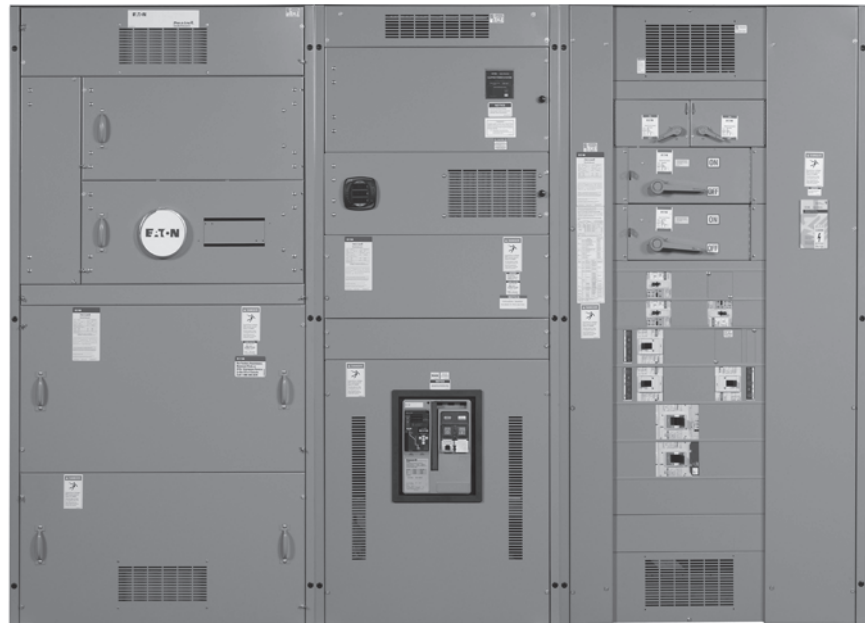
- 6000 A main bus maximum
- Front accessible—main sections front- and/or side-access
- Front- and rear-access; main sections front- and/or side-access
- Feeder devices group-mounted
- Sections rear-aligned or front- and rear-aligned

Main Devices, Individually Mounted

- Molded case circuit breakers, 400–2500 A, fixed-mounted
- Insulated case circuit breakers, Magnum SB, 800–5000 A, fixed and drawout
- Air power circuit breakers, Magnum™ DS, 800–5000 A, fixed or drawout
- Air power circuit breakers with current limiting fuses, Magnum DSL, 800–5000 A
- Bolted pressure switches, 800–5000 A, fixed
- Insulated case circuit breakers, Series NRX NF, 800–1200 A, fixed and drawout
- Insulated case circuit breakers, Series NRX RF, 800–3000 A, fixed and drawout
- Fusible switches, 400–1200 A, fixed

Feeder Devices, Group-Mounted

- Bolt-on molded case circuit breakers, 15–1200 A
- Drawout molded case circuit breakers, 70–1200 A
- Fusible switches, 30–1200 A



Pow-R-Line C Switchboard

Feeder Devices, Individually Mounted

- Molded case circuit breakers, 800–2500 A, fixed
- Insulated case circuit breakers, Magnum SB, 800–5000 A, fixed and drawout
- Air power circuit breakers, DS and Magnum DS, 800–4000 A, fixed and drawout
- Insulated case circuit breakers, Series NRX NF, 800–1200 A, fixed and drawout
- Insulated case circuit breakers, Series NRX RF, 800–3000 A, fixed and drawout
- Bolted pressure switches, 800–1600 A, fixed

Selective Coordination

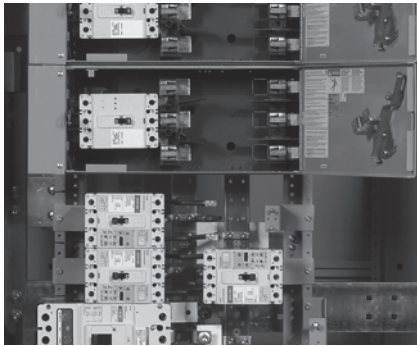
Selectively coordinated systems dictated by code and customer mandates may be achieved with Eaton switchboards to either 0.1 or 0.01 seconds as mandated by codes and/or customers. Refer to **Tab 1, Section 1.4** for additional details.

Note: For selection and layout guidelines, please reference **Page 21.1-1**.

For a complete product specification in CSI format, see Eaton's Product Specification Guide..... **Section 16429**

Features

- Eaton’s circuit breaker ratings up to 200 kAIC
- Trip units that integrate Eaton’s Arcflash Reduction Maintenance System™ reduces potential arc flash available
- Integral ground fault protection available in electronic trip units from 15–5000 A
- Electronic trip units that integrate zone selective interlocking capabilities available in molded case, insulated case and air power circuit breaker
- Available with circuit breakers and fusible switches on the same chassis

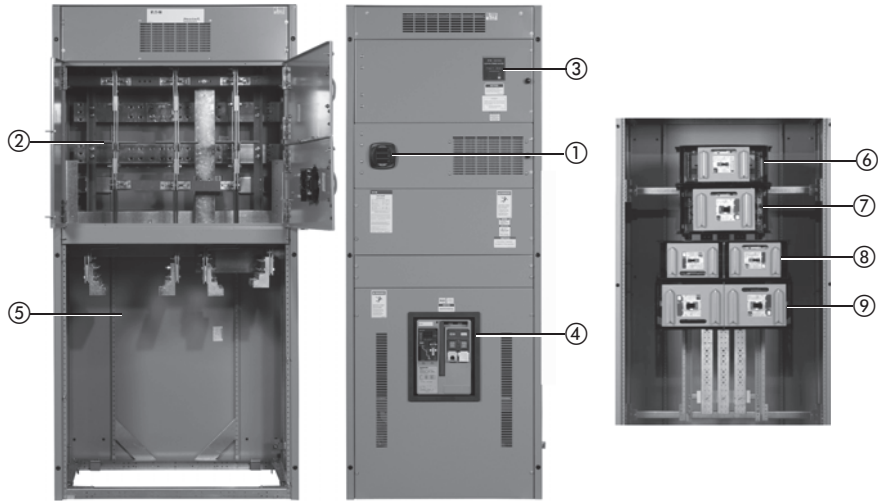


The Single Chassis Design Provides Device Flexibility

- UL listed and labeled. Meets NEC and NEMA standards
- Eaton microprocessor-based metering devices are standard when metering is specified. Conventional metering is available. IQ and Power Xpert devices can provide a communications capability. See **Tab 3**
- Optional integral surge protective device (SPD) is available in Pow-R-Line C switchboards, when specified. See **Tab 34**
- Aluminum, copper or silver-plated copper bus
- A full range of device modifications is available
- Available in NEMA Type 1 and 3R enclosures, UL listed

Modifications

- Ground fault protection on mains and distribution devices
- Coordination with other Eaton divisions for busway and transformer connections



Type 1 Pow-R-Line C Features

- ① Customer metering.
- ② Utility metering compartment.
- ③ Surge protective device.
- ④ Main breaker (Magnum SB).
- ⑤ Cable pull and termination space.
- ⑥ 250 A frame single mount.
- ⑦ 600 A frame single mount.
- ⑧ 250 A frame dual mount.
- ⑨ 600 A frame dual mount.

Table 21.0-2. Pow-R-Line C Group-Mounted Switchboards
Voltage: 240–480–600 Vac, 250 Vdc
Mains: 400–6000 A

Main Device Type	Amperes	Short-Circuit Symmetrical Rating (kA)
Molded case circuit breakers	400–2500	14–200
Insulated case circuit breakers, Magnum SB	800–5000	30–100
Insulated case circuit breakers, Series NRX NF	800–1200	65–85
Insulated case circuit breakers, Series NRX RF	800–3000	65–100
Air power circuit breakers, Magnum DS	800–5000	200
Air power circuit breakers with CL fuses, DSL	800–5000	200
Bolted pressure switches	800–5000 ①	200
Fusible switches	400–1200	200
Main lugs only	400–6000	Rating determined by overcurrent protective device

Feeder Device Type	Amperes	Short-Circuit Rating (kA)
Bolt-on, fixed-mounted molded case circuit breakers	15–2500	10–200
Drawout, molded case circuit breakers	70–600	10–200
Fusible switches	30–1200	200
Stacked—main with branch devices	400–2500	18–200
Magnum SB up to two high	800–2000	30–100
Magnum DS up to two high ②	800–2000	30–100
Series NRX NF up to two high and quad stack	800–1200	65–85
Series NRX RF up to two high	800–3000	65–100

① 5000 A bolted pressure switches are not UL listed.
② Third-party witness tested at 30 cycles.

General Description

Application Considerations and Definitions

Eaton's Pow-R-Line® family of distribution switchboards incorporates new design concepts that fit the ever-increasing need for applications on high short circuit systems, while retaining maximum flexibility, safety and convenience throughout the line.

Front Access

Front-access switchboards align at the rear, enabling them to be placed against a wall (Type Pow-R-Line C™ front accessible). If the main section is deeper than others, due to physical size of the main device, the necessary offset in lineup will occur in front, and the main section will be accessible from the side as well as from the front. Eaton also offers front accessible switchboards that align at the front and rear.

Rear Access

Rear-access switchboards align at the front and the rear. Bus maintenance and cable entry and exit require rear access. There are two types of rear accessible switchboards. Both types use the same incoming utility and/or main structures. The first type uses group-mounted feeder devices with panel construction (Type Pow-R-Line C rear accessible). The second type uses individually compartmentalized feeder devices with load side insulated bus bar extensions (Type Pow-R-Line i).

Individually Mounted

Larger overcurrent protective devices (OCPD) may be individually mounted. In most cases, this means that the OCPD is mounted vertically in the switchboard and is connected via bus bar. All insulated case circuit breakers, power air circuit breakers and bolted pressure contact switches are individually mounted. Molded case circuit breakers 600 A and above may be individually mounted when used as a main or as a feeder device feeding other OCPD within a section or adjacent sections.

Compartmentalized Feeder and Branch Devices

Compartmentalized molded case circuit breakers and fusible switches provide additional isolation. Individually mounted molded case circuit breakers and fusible switches through 1200 A are available in a compartmentalized, rear-access,

rear-connected switchboard. See Pow-R-Line i switchboards in this section for details.

Standard Switchboard Height

Standard Pow-R-Line switchboard height is 90.00 inches (2286.0 mm). Contact Eaton for special heights.

Group Mounting

Group-mounted circuit protective devices are an assembly of units mounted on a panelboard type chassis. Units may be molded-case breakers, fusible switches, customer metering and surge protective devices.

A main molded case breaker or main fusible switch, within the sizes listed for panelboard design, can be included in the panel-mounted assembly in lieu of a separate, individually mounted unit.

Space Only for Future Devices Group-Mounted Construction

Where space only for future circuit protective devices is required, the proper space and a blank filler plate will be supplied. Connections and mounting hardware are not included.

Provision for Future Devices

Where provisions for future circuit protective devices are required, space for the device, corresponding vertical bus, device connectors and the necessary mounting hardware will be supplied.

Bus Bar System

Standard bus in the switchboards is tin-plated aluminum. Copper, silver-plated copper or tin-plated copper are also available.

Main bus and sub-main buses meet UL® and NEMA® standards for temperature rise on all Pow-R-Line switchboards. Special density rated bus is available.

Overcurrent Devices

To properly select and size overcurrent devices for use in a switchboard, the allowable temperature rise must be taken into account as to its effect on the tripping characteristics of the devices in question per UL 891.

Accordingly, the NEC® requires overcurrent devices to be rated not less than 125% of the continuous load they are protecting. To comply with this, an 80% derating factor must be used with all overcurrent devices such as molded case

breakers and FDPW fusible switches unless they are tested and listed for application at 100% of the rating. All Magnum type breakers and bolted pressure switches are 100% rated.

Short-Circuit Rating

Standard bus and connectors on all switchboards are rated for use on systems capable of producing up to 65,000 A rms symmetrical short-circuit current at the incoming terminals.

Increased bus short-circuit ratings equal to that of connected switchboard devices, up to 200,000 A rms symmetrical, are available in most Pow-R-Line C switchboards when approved main devices are installed. UL labeled switchboard sections are marked with their applicable short-circuit rating.

When air power circuit breakers are used as feeder devices in a switchboard, these devices may experience up to a 30-cycle (1/2 second) delay if the instantaneous setting is turned off. Eaton has qualified our low voltage switchboards when air power circuit breakers are used as feeders (and mains) to 30 cycles. This rating is not recognized under the UL 891 standard. However, Eaton has witness tested the structure bussing with a qualified National Recognized Testing Laboratory (NRTL) at 30 cycles (1/2 second) up to 100 kAIC symmetrical.

Provision for Busway Entrance and Exit

Busway connections to switchboard sections include cutout and drilling in the top of the switchboard with riser connections from the switchboard device or bus, up to the point where the bus duct enters the switchboard. No connections are furnished external to the switchboard.

In all transactions involving busway attached to switchboards, it is essential that information regarding orientation of the busway with respect to the front of the switchboard be supplied to the coordinating assembly plant.

On Pow-R-Line C switchboards, a solid bus bar is used to connect the bus duct to the individually mounted main device, main or sub-main switchboard bus, or vertical main bus of panel-mounted circuit protective device panels. **Busway fed by group-mounted branch devices are cable connected.**

Aluminum riser connections are standard. Copper- or silver-plated copper is available as an option.

General Description

Transitions

Transition structures are required for connecting switchboards to the secondary of power center transformer (fluid filled), motor control centers, and for other special switchboard configurations such as “L” or “U” shaped lineups. In some applications, an extra structure complete with connections is required; in others, where switchboard depth and space permit, only the connection conductors are required. Refer to Eaton for these applications.

Auxiliary Structures

These are normally mounted adjacent to service structures or distribution structures, and used where incoming service or feeder conductors require additional space or facilities not included in the standard switchboard, such as:

1. Mounted adjacent to a top connected service structure and used as a cable pull structure where service conductors are brought in underground. Auxiliary structures are the same depth and height as the service structure, and are wide enough to accommodate the incoming cables.
2. Mounted adjacent to a service structure and used as a bus transition compartment for running riser bus from the load-side of the service structure up to top outgoing bus duct connection when distribution structures are not required. Auxiliary structures are the same depth and height as service structures.

In addition to the above applications, auxiliary structures may be mounted adjacent to a distribution structure and used as a structure for lighting panel or other device that may be cable-connected to a branch circuit device in the distribution structure. Dimensions are compatible with the arrangements required.

Switchboards Used as Service Equipment

Service equipment is the electrical equipment that constitutes the main control and means of power cutoff the electric service (normally Power Company supply) brought into the building.

Where switchboards are to be used as service equipment, certain NEC and UL requirements apply that necessitate modifications not normally supplied in switchboards.

The following is a summary of the requirements that are pertinent to the application of a switchboard for service equipment:

- A. A switchboard with main lugs only (no main disconnect) must be designed so that all circuits in the switchboard can be disconnected from the supply source by the operation of no more than six operating handles (breaker or switch).

Switchboard equipped with main disconnect devices are not subject to the above six disconnect limitation, as the entire board can be de-energized with the main disconnect device.
- B. For testing purposes, means are also required to disconnect the switchboard neutral bus from the grounded service neutral conductor (single-phase, three-wire; and three-phase, four-wire systems). To comply with this requirement, a removable link (solid bar) is provided in the switchboard neutral bus. This link is generally located near the point where the main feeders enter the switchboard or in the area of the main disconnect device where one is provided.

To further comply with NEC and UL requirements, a separate bonding strap is connected from the neutral bus to the switchboard frame. This bonding connection is located on the line side of the removable neutral link, maintaining a service ground to the switchboard frame when the test link is removed. See **Figure 21.0-1**.

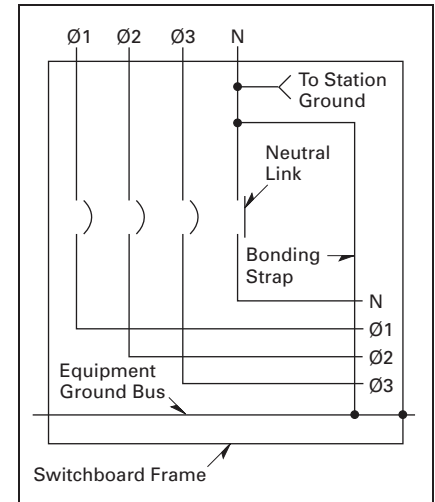


Figure 21.0-1. Neutral Link

UL labeling will clearly indicate service equipment listed switchboards.

General Description

Underwriters Laboratories Requirements and Labeling

The basic requirement for obtaining a UL label on a switchboard, is that all the component devices (breakers, switches, and so on) in the switchboard assembly are UL listed. In addition, the switchboard must comply with all applicable provisions of UL 891.

Today's modern electrical systems require that switchboards offer a wide selection of electrical devices, many of which do not fall within the scope of UL listed devices. Therefore, the conditions under which a switchboard may be labeled are limited.

Listed below are several important guidelines for consideration when a UL label is specified:

1. UL nameplates, where applicable, are supplied for each vertical structure rather than one common nameplate for the complete switchboard lineup. Where all of the component devices in the switchboard are UL listed and all applicable provisions of UL 891 are met, each of the switchboard sections may be labeled.
2. Individual vertical structures of a switchboard may be labeled where they comply with UL requirements, although other vertical structures in the same switchboard lineup may not meet the UL standards, and will not be labeled.
3. All Pow-R-Line C switchboards are UL labeled when all mounted devices are UL listed.

Alternate Power Source Capabilities

Multiple solutions are available to accommodate alternate power sources available. Due to the large number of customer and system requirements, details are not provided in this guide. Eaton offers solutions that include main-main configuration and main-tie-main configurations. Automatic transfer equipment, including UL 1008 listed transfer switches and other automatic transfer schemes, are available.

Automatic Transfer Equipment

For continuity of service, automatic transfer equipment between two incoming sources may be required. This equipment transfers the load upon failure of the normal (or preferred) source to the standby (or alternate) source. Upon restoration of the normal source, the load is automatically transferred back to it. To accomplish this, electrically operated main protective devices (and bus tie devices, if required) must be employed. Additional relays also are required to detect source voltage failure and to transfer control power, when required. A manual selector switch is usually provided to select the mode of operation—automatic or manual transfer.

Seismic Qualification

Refer to **Tab 1** for information on seismic qualification for this and other Eaton products.

The Eaton logo is rendered in a bold, blue, sans-serif font. The letters 'E', 'A', and 'N' are solid blue. The letter 'T' is white with a blue outline. The letter 'O' is white with a blue outline and a solid blue dot in the center. The entire logo is centered horizontally.

Powering Business Worldwide

Series G Selection Data—RG-Frame

Series G, R-Frame
Electronic RMS, 800–2500 A



R-Frame Breaker

Table 27.4-45. Dimensions in Inches (mm)

Number of Poles	Width	Height	Depth
3	15.50 (393.7)	16.00 (406.4)	9.75 (247.7)
4	20.00 (508.0)	16.00 (406.4)	9.75 (247.7)

Table 27.4-46. Digitrip 310 Electronic Trip Unit Rating Plugs

Frame	Rating Plugs
1600	800, 1000, 1200, 1250, 1400, 1500, 1600
2000	①
2500	1000, 1200, 1250, 1400, 1600, 2000 ① 1200, 1250, 1600, 2000, 2500 ①

① Adjustable rating plug available.

Table 27.4-47. Digitrip 510/610/810/910 and Digitrip OPTIM Electronic Trip Unit Rating Plugs

Frame	Rating Plugs
1600	800, 1000, 1200, 1600
2000	1000, 1200, 1600, 2000
2500	1600, 2000, 2500

Table 27.4-48. Series G Molded-Case Circuit Breaker Interrupting Capacity Ratings

Circuit Breaker Type	Number of Poles	Trip Type	Interrupting Capacity (kA Symmetrical Amperes)—Volts AC (50/60 Hz)								
			UL 489			IEC 60947-2					
			240	480	600	220–240		380–415		660–690	
			<i>I_{cu}</i>	<i>I_{cs}</i>	<i>I_{cu}</i>	<i>I_{cs}</i>	<i>I_{cu}</i>	<i>I_{cs}</i>	<i>I_{cu}</i>	<i>I_{cs}</i>	
RGH	3, 4	N.I.T.	125	65	50	135	100	70	50	25	13
RGC	3, 4	N.I.T.	200	100	65	200	100	100	50	35	18

Table 27.4-49. Line and Load Terminals

Maximum Breaker Amperes	Terminal Body Material ②	Wire Type	Hardware	AWG/kcmil Wire Range/Number of Conductors	Metric Wire Range (mm ²)	Catalog Number
-------------------------	--------------------------	-----------	----------	---	--------------------------------------	----------------

Wire Terminal

1600	Aluminum	Cu/Al	English	(4) 500–1000 kcmil	300–500	TA1600RD
1600	Copper	Cu	English	(4) 1–600 kcmil	50–300	T1600RD
2000	Aluminum	Cu/Al	English	(6) 2–600 kcmil	35–300	TA2000RD

② UL listed for use with copper or aluminum conductors as noted.

The Eaton logo is rendered in a bold, blue, sans-serif typeface. The letter 'E' is solid blue. The 'A' is white with a blue outline. The 'T' is solid blue. The 'O' is white with a blue outline and a solid blue dot in its center. The 'N' is solid blue. The letters are closely spaced and centered horizontally.

Powering Business Worldwide

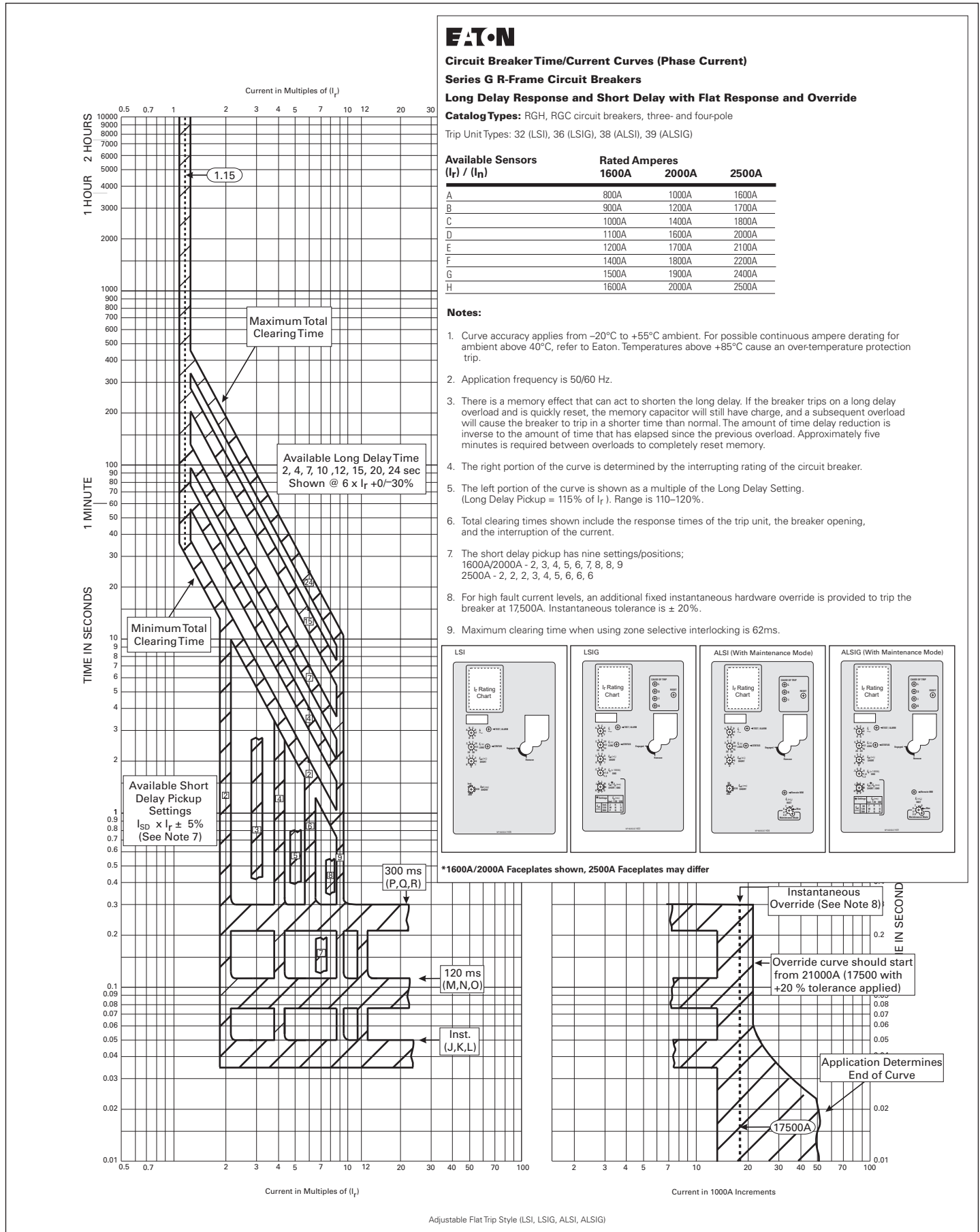


Figure 2. Digitrip 310+ Long Delay Response and Short Delay with Flat Response and Override Curve (LSI, LSIG, ALSI, ALSIG) - Curve Number TC01210020E, September 2017



Circuit Breaker Time/Current Curves (Phase Current)

Series G R-Frame Circuit Breakers

Long Delay Response and Short Delay with I²T Response Curve and Override

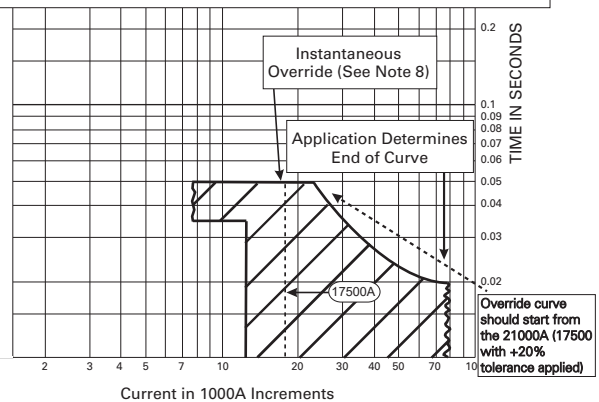
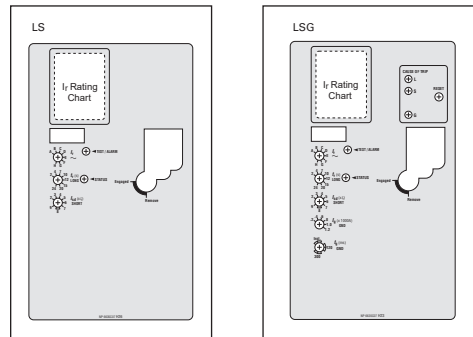
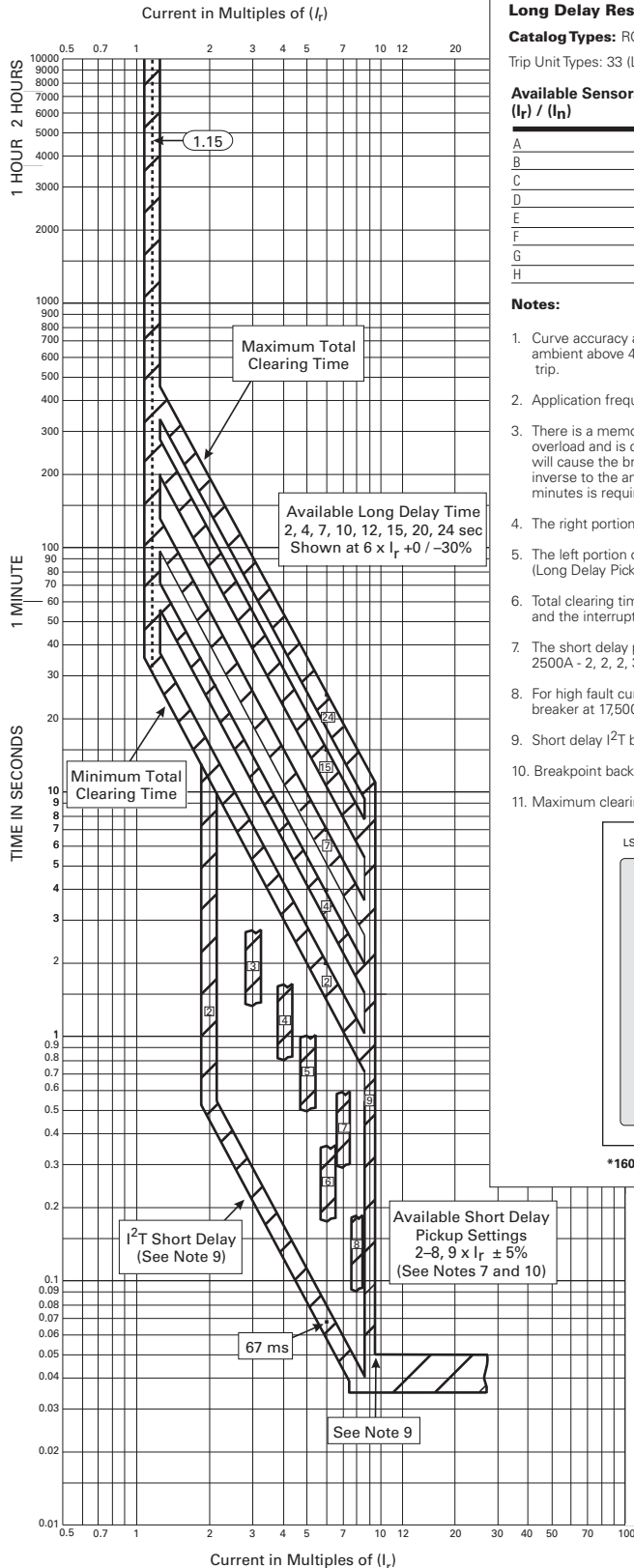
Catalog Types: RGH, RGC circuit breakers, three- and four-pole

Trip Unit Types: 33 (LS), 35 (LSG)

Available Sensors (I _r) / (I _n)	Rated Amperes		
	1600A	2000A	2500A
A	800A	1000A	1600A
B	900A	1200A	1700A
C	1000A	1400A	1800A
D	1100A	1600A	2000A
E	1200A	1700A	2100A
F	1400A	1800A	2200A
G	1500A	1900A	2400A
H	1600A	2000A	2500A

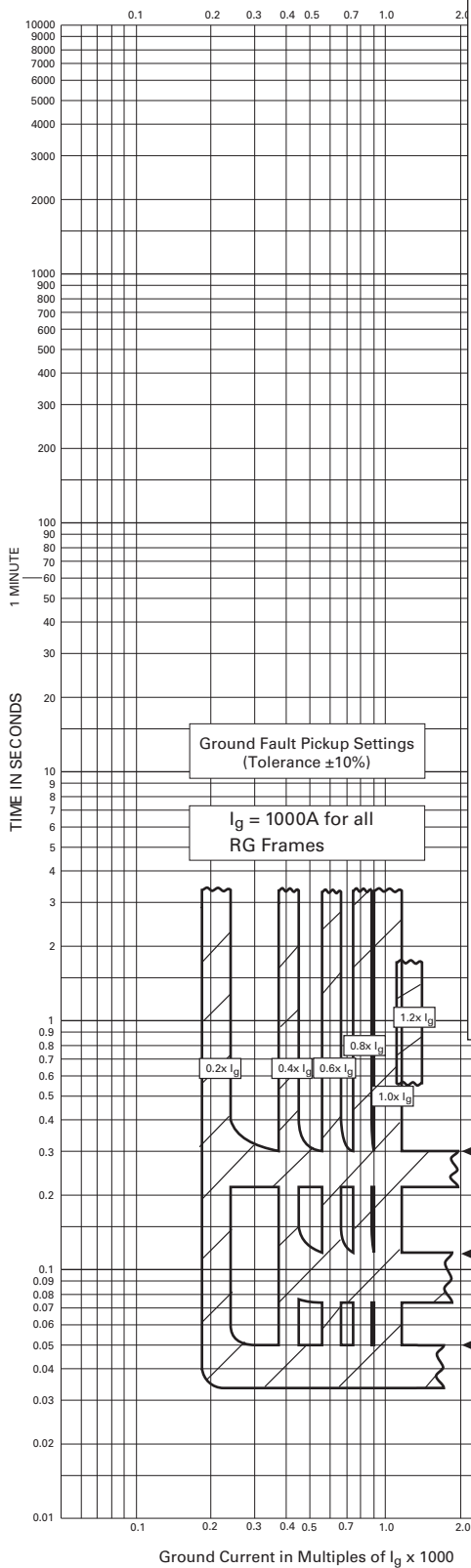
Notes:

- Curve accuracy applies from -20°C to +55°C ambient. For possible continuous ampere derating for ambient above 40°C, refer to Eaton. Temperatures above +85°C cause an over-temperature protection trip.
- Application frequency is 50/60 Hz.
- There is a memory effect that can act to shorten the long delay. If the breaker trips on a long delay overload and is quickly reset, the memory capacitor will still have charge, and a subsequent overload will cause the breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately five minutes is required between overloads to completely reset memory.
- The right portion of the curve is determined by the interrupting rating of the circuit breaker.
- The left portion of the curve is shown as a multiple of the Long Delay Setting. (Long Delay Pickup = 115% of I_r). Range is 110-120%.
- Total clearing times shown include the response times of the trip unit, the breaker opening, and the interruption of the current.
- The short delay pickup has nine settings/positions; 1600A/2000A - 2, 3, 4, 5, 6, 7, 8, 9
2500A - 2, 2, 2, 3, 4, 5, 6, 6, 6
- For high fault current levels, an additional fixed instantaneous hardware override is provided to trip the breaker at 17,500A. Instantaneous tolerance is ± 20%.
- Short delay I²T band has a tolerance of ±15%.
- Breakpoint back to FLAT response occurs at 8 x I_r for upper line of the I²T curve.
- Maximum clearing time when using zone selective interlocking is 62ms.



I²T Trip Style (LS, LSG)

Figure 3. Digitrip 310+ Long Delay Response and Short delay with I²T Response Curve (LS, LSG) - Curve Number TC01210021E, September 2017



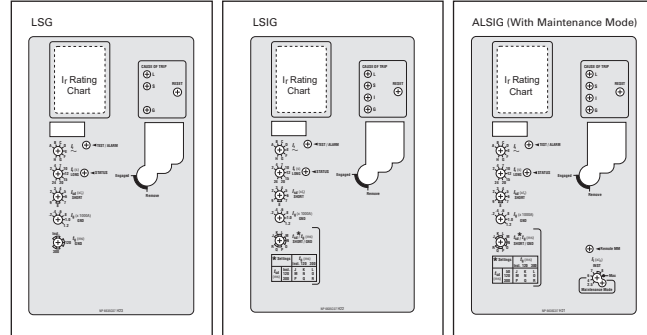
Circuit Breaker Time/Current Curves (Ground Current)

Series G R-Frame Circuit Breakers

Ground Fault Delay Response Curve

Catalog Types: RGH, RGC circuit breakers, three- and four-pole

Trip Unit Types: 35 (LSG), 36 (LSIG), 39 (ALSIG)



*1600A/2000A Faceplates shown, 2500A Faceplates may differ

SD / GF Delay Settings Table

* Settings		t_g (ms)		
		Inst. 120	300	
t_{sd} (ms)	Inst. 120	J	K	L
	300	M	N	O
		P	Q	R

Ground fault delay response notes:

1. Curve accuracy applies from $-20^{\circ}C$ to $+55^{\circ}C$ ambient. For possible continuous ampere derating for ambient above $40^{\circ}C$, refer to Eaton. Temperatures above $+85^{\circ}C$ cause an over-temperature protection trip.
2. Application frequency is 50/60 Hz.
3. Trip units are suitable for functional field testing with test kit cat no: MTST230V.
4. For LD Response and SD with Flat Responses curve, see TC01210020E.
5. For LD Responses and SD with I^2T Response curve, see TC01210021E.
6. For testing information, please contact Eaton.

Figure 4. Ground Fault Delay Response Curve (LSG, LSIG, ALSIG) Curve Number TC01210022E, June 2012

EATON
Digitrip 310+ Circuit Breaker Time/Current Curves
Maintenance Mode/Instantaneous
Setting (1600A/2000A)

Notes:

1. The Maintenance Mode feature must be ENABLED for these curves to apply. The LED indicator is blue when in Maintenance Mode.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. Total clearing times shown include the response times of the trip unit, the breaker opening, and the interruption of the current.
4. Available pickup settings ($\times I_n$) (tolerance is $\pm 15\%$)
1600A Frame: 2.5, 4, 6, 7, 8, 8, 11
2000A Frame: 2.5, 4, 6, 7, 8, 8, 9
5. These curves are comprehensive for the complete family of Series G R-Frame electronic breakers, including all frame sizes, ratings, and constructions. The total clearing times shown are conservative and consider the maximum response times of the trip unit, the circuit breaker opening, and the interruption of the current in worst case conditions such as: maximum rated voltages, single-phase interruption, and minimum power factor. Faster clearing times are possible depending on the specific system conditions.

Contact Eaton for additional information.

Series G R-Frame Trip Unit Nameplates

ALSI (With Maintenance Mode)

ALSIG (With Maintenance Mode)

***1600A/2000A Faceplates shown, 2500A Faceplates may differ**

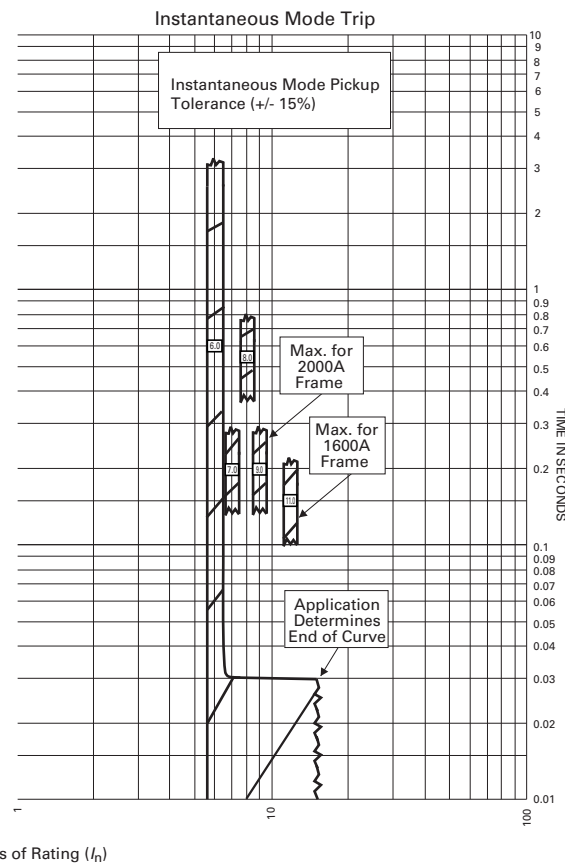
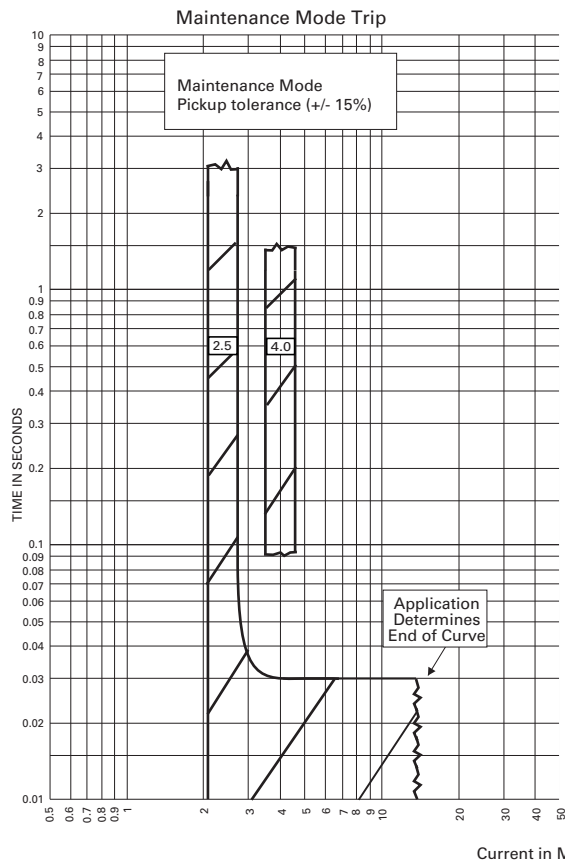


Figure 5. Maintenance Mode/Instantaneous Setting 1600A/2000A (ALSI, ALSIG) - Curve Number TC01210024E, September 2015

EATON
Digitrip 310+ Circuit Breaker Time/Current Curves
Maintenance Mode/Instantaneous Setting (2500A)

Notes:

1. The Maintenance Mode feature must be ENABLED for these curves to apply. The LED indicator is blue when in Maintenance Mode.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. Total clearing times shown include the response times of the trip unit, the breaker opening, and the interruption of the current.
4. Available pickup settings ($\times I_n$) (tolerance is $\pm 15\%$) 2.5, 4, 6, 6, 6, 7.
5. These curves are comprehensive for the complete family of Series G R-Frame electronic breakers, including all frame sizes, ratings, and constructions. The total clearing times shown are conservative and consider the maximum response times of the trip unit, the circuit breaker opening, and the interruption of the current in worst case conditions such as: maximum rated voltages, single-phase interruption, and minimum power factor. Faster clearing times are possible depending on the specic system conditions.

Contact Eaton for additional information.

Series G R-Frame Trip Unit Nameplates

ALSI (With Maintenance Mode)

ALSIG (With Maintenance Mode)

***1600A/2000A Faceplates shown, 2500A Faceplates may differ**

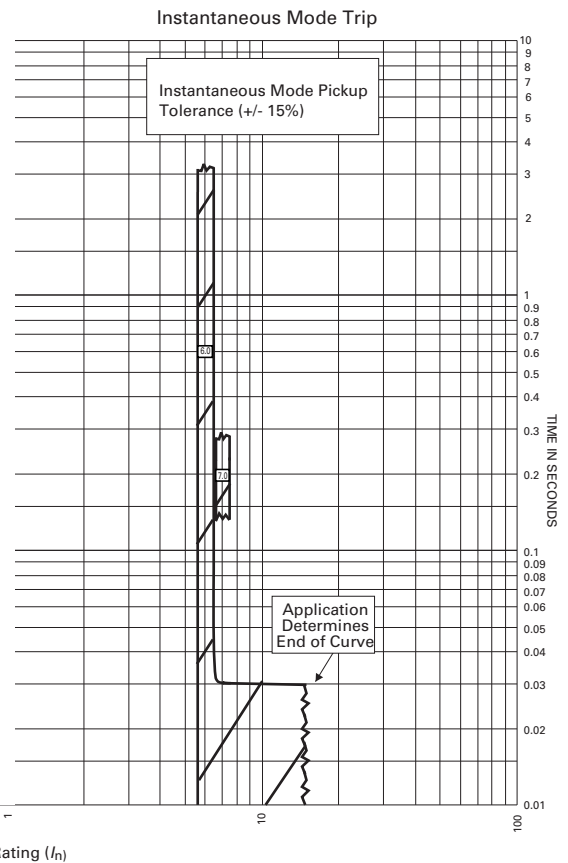
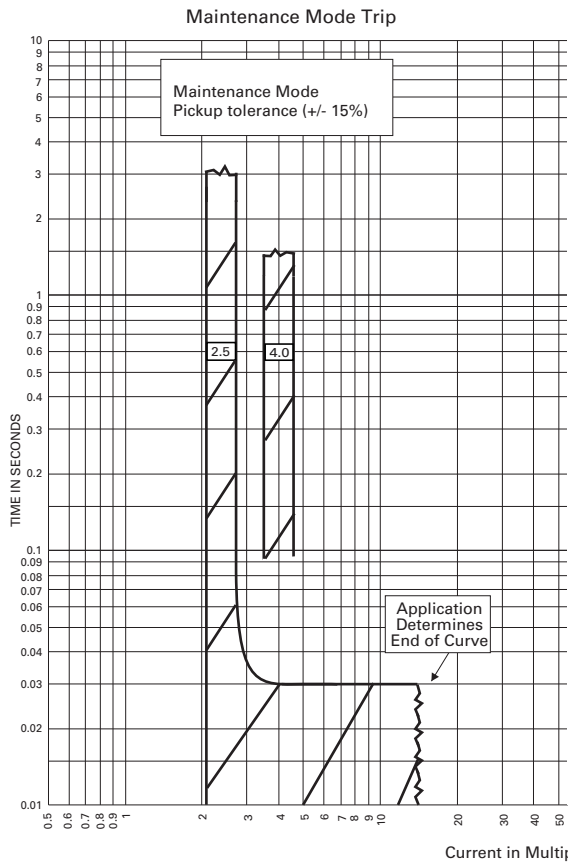


Figure 6. Maintenance Mode/Instantaneous Setting 2500A (ALSI, ALSIG) Curve Number TC01210023E, September 2015

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Powering Business Worldwide

Series G Selection Data—LG-Frame

Series G, L-Frame
Electronic RMS, 100–630 A*
Thermal-Magnetic, 250–630 A*
***UL Maximum is 600 A**



L-Frame Breaker

Table 27.4-36. Dimensions in Inches (mm),
Weight in Lbs (kg)

Number of Poles	Width	Height	Depth	Weight
3	5.48 (140)	10.13 (258)	4.09 (104)	16 (7.3)
4	7.22 (183)	10.13 (258)	4.09 (104)	20 (9.1)

Table 27.4-37. Thermal-Magnetic Trip Rating

Frame	Ratings
LG	250, 300, 350, 400, 500, 600
LG ①	320, 630

① Not UL listed.

Table 27.4-38. Digitrip 310+
Electronic Trip Units

Frame	Ratings
LG_630	250, 300, 315, 350, 400, 500, 600, 630
LG_600	250, 300, 315, 350, 400, 450, 500, 600
LG_400	160, 200, 225, 250, 300, 315, 350, 400
LG_250	100, 125, 150, 160, 175, 200, 225, 250

Note: 160, 315 and 630 are IEC ratings only.
LG breaker is HACR rated.

Table 27.4-39. UL 489/IEC 60947-2 Interrupting Capacity Ratings

Circuit Breaker Type	Number of Poles	Interrupting Capacity (kA rms Symmetrical Amperes) (kA)									
		Volts AC (50/60 Hz)								Volts DC ②	
		240–240		380–415		480	600	690	250 ③		
		I _{cu}	I _{cs}	I _{cu}	I _{cs}			I _{cu}	I _{cs}	I _{cu}	I _{cs}
LGE630	3, 4	65	65	35	35	35	18	12	6	22	22
LGS630	3, 4	85	85	50	50	50	25	20	10	22	22
LGH630	3, 4	100	100	70	70	65	35	25	13	42	42
LGC630	3, 4	200	200	100	100	100	50	30	15	42	42
LGU630	3, 4	200	200	150	150	150	65	35	18	50	50
LGX630	3, 4	200 ④	200	200	200	200	65	35	18	50	50

② DC rating applies to substantially non-inductive circuits.

③ Two-pole circuit breaker, or two poles of three-pole circuits.

④ IEC rating is 300 kA at 240 Vac.

Table 27.4-40. Line and Load Terminals

Maximum Breaker Amperes	Terminal Body Material	Wire Type	AWG Wire Range/Number of Conductors	Metric Wire Range mm ²	Number of Terminals Included	Catalog Number
400	Aluminum	Cu/Al	500–750 (1)	240–380 (1)	3	3TA631LK ⑤
400	Aluminum	Cu/Al	500–750 (1)	240–380 (1)	4	4TA631LK ⑤
400	Copper	Cu	500–750 (1)	240–380 (1)	3	3T631LK ⑤
400	Copper	Cu	500–750 (1)	240–380 (1)	4	4T631LK ⑤
630	Aluminum	Cu/Al	2–500 (2)	35–240 (2)	3	3TA632LK ⑤⑥
630	Aluminum	Cu/Al	2–500 (2)	35–240 (2)	4	4TA632LK ⑤⑥
630	Copper	Cu	2–500 (2)	35–240 (2)	3	3T632LK ⑤
630	Copper	Cu	2–500 (2)	35–240 (2)	4	4T632LK ⑤
400	Aluminum	Cu/Al	2–500 (1)	35–240 (1)	1	TA350LK ⑥
400	Copper	Cu	2–500 (1)	35–240 (1)	1	T350LK

⑤ Includes LTS3K (three-pole) or LTS4K (four-pole) terminal covers.

⑥ Standard terminal included with complete breaker.

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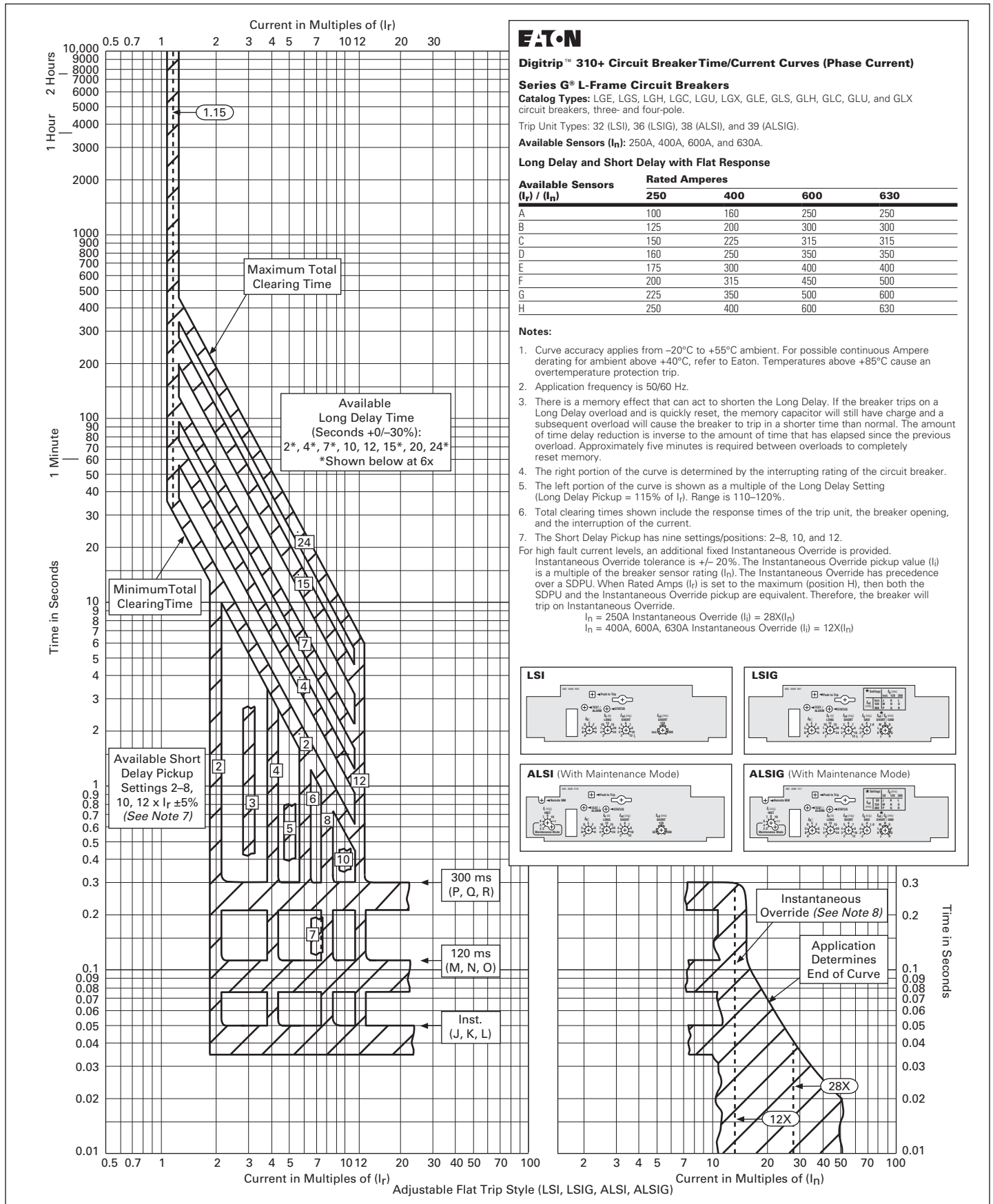
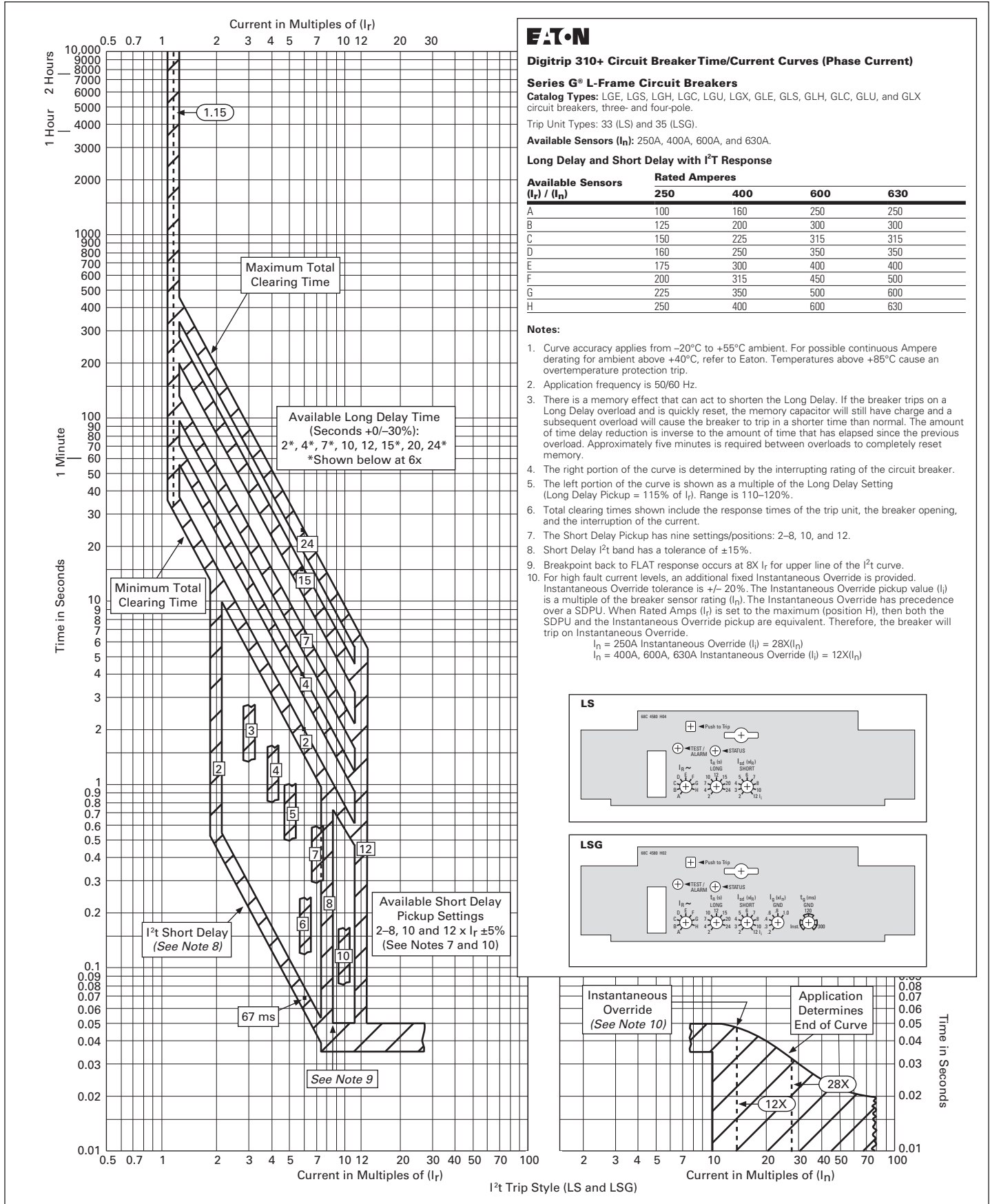
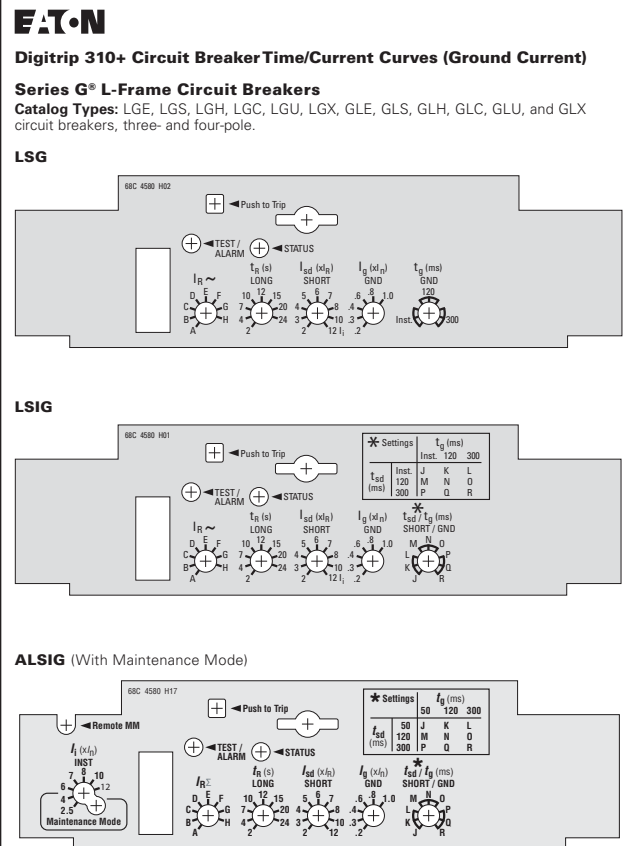
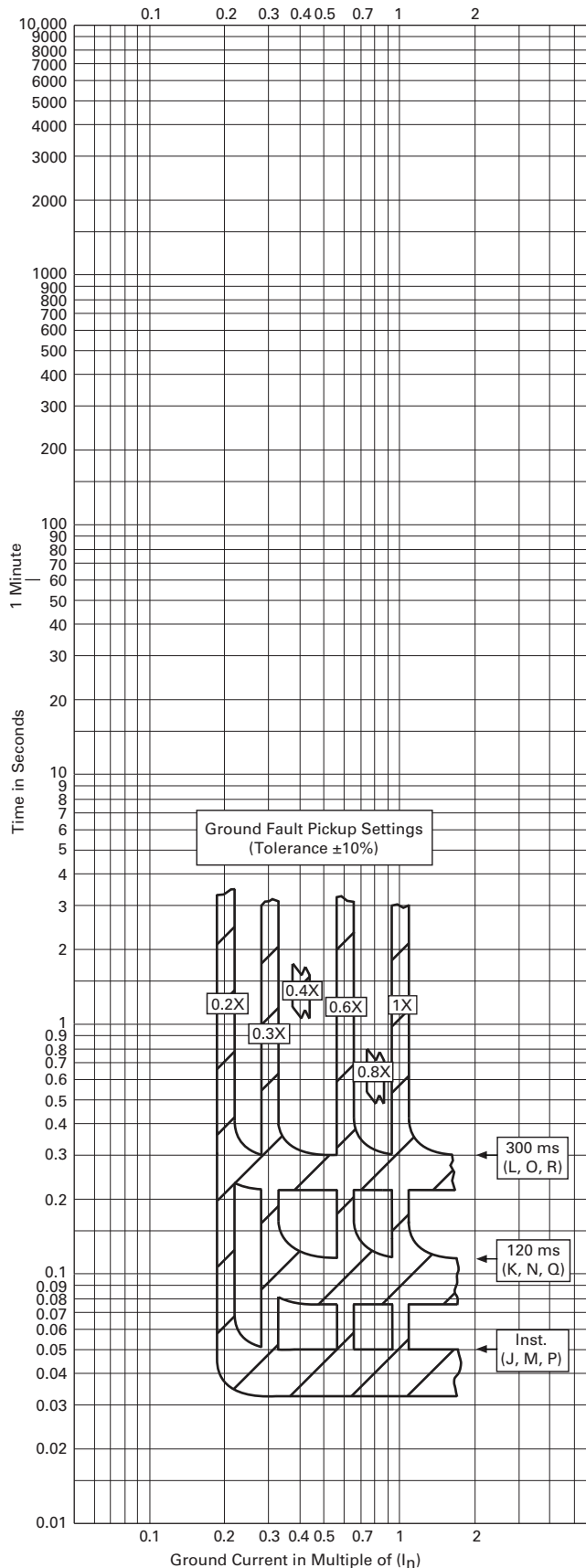


Figure 2. Digitrip 310+ Long Delay Response and Short Delay with Flat Response Curve (LSI, LSIG, ALSI, ALSIG) - Curve Number TC01207004E, May 2008

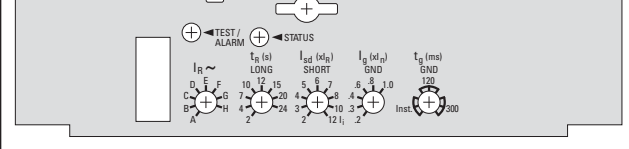




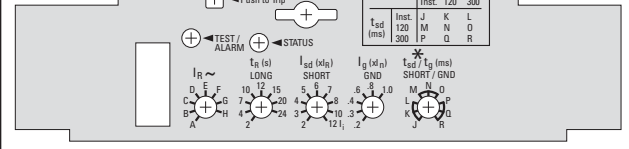
EATON
Digitrip 310+ Circuit Breaker Time/Current Curves (Ground Current)

Series G® L-Frame Circuit Breakers
Catalog Types: LGE, LGS, LGH, LGC, LGU, LGX, GLE, GLS, GLH, GLC, GLU, and GLX circuit breakers, three- and four-pole.

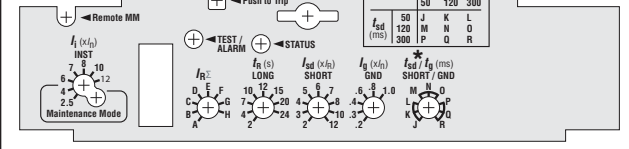
LSG



LSIG



ALSIG (With Maintenance Mode)



Note: Refer to table below for variations.
Available Sensors (I_n): 250A, 400A, 600A, and 630A.

SD/GF Delay Settings Table

* Settings	t_g (ms)			
	Inst.	120	300	
t_{sd} (ms)	120	J	K	L
	300	M	N	O
		P	Q	R

Ground Fault Delay Response Notes:

1. Curve accuracy applies from -20°C to $+55^{\circ}\text{C}$ ambient. For possible continuous Ampere derating for ambient above $+40^{\circ}\text{C}$, refer to Eaton. Temperatures above $+85^{\circ}\text{C}$ cause an overtemperature protection trip.
2. Application frequency is 50/60 Hz.
3. Trip units are suitable for functional field testing with test kit style #70C1056G52.
4. For LD Response and SD with Flat Response curve, see TC01207004E.
5. For LD Response and SD with I^2t Response curve, see TC01207005E.
6. For testing information, please contact Eaton.

Figure 4. Ground Fault Delay Response Curve (LSG, LSIG, ALSIG)—Curve Number TC01207006E, May 2008

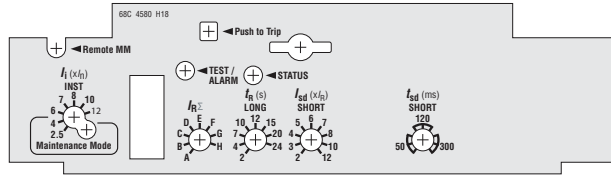


Digitrip 310+ Circuit Breaker Time/Current Curves

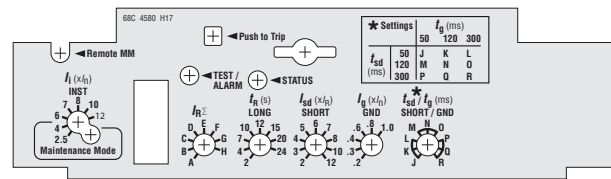
Maintenance Mode / Instantaneous Setting

Series G® L-Frame Trip Unit Nameplates

ALSI (With Maintenance Mode)

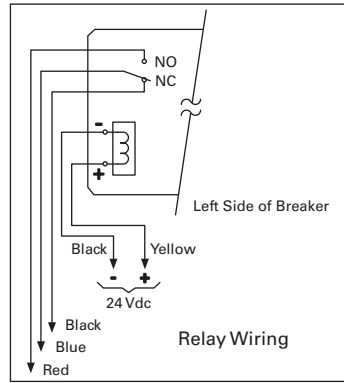


ALSIG (With Maintenance Mode)



Notes:

1. The Maintenance Mode feature must be ENABLED for these curves to apply, when in Maintenance Mode.
2. The Maintenance Mode is Enabled locally by turning the Maintenance Mode/INST dial to the 2.5X or 4X position, or via remote signal. Enabling the Maintenance Mode via remote signal sets the pickup to 2.5X regardless of Maintenance Mode/INST dial position.
3. The end of the curve is determined by the interrupting rating of the circuit breaker.
4. Total clearing times shown include the response times of the trip unit, the breaker opening, and the interruption of the current.
5. Nominal Values (Pickup) (Tolerance is $\pm 15\%$) 2.5X I_n , 4X I_n , 6X I_n , 7X I_n , 8X I_n , 10X I_n , 12X I_n .
6. These curves are comprehensive for the complete family of Series G L-Frame electronic breakers, including all frame sizes, ratings, and constructions. The total clearing times shown are conservative and consider the maximum response times of the trip unit, the circuit breaker opening, and the interruption of the current in worst case conditions, such as maximum rated voltages, single-phase interruption, and minimum power factor. Faster clearing times are possible depending on the specific system conditions.
7. For L-Frame breakers with 250A sensors ($I_n = 250A$), an INST setting of 12 is equal to 28X (7000A).
8. Contact Eaton for additional information.



This feature allows enabling of the maintenance mode remotely by applying 24 Vdc to the yellow (+) and black (-) wires that exit the left hand side of the breaker. The maintenance mode settings that is enabled is the 2.5X setting.

There are two indicators that can verify that the trip unit has been remotely activated/enabled into the maintenance mode feature:

- A. The blue LED (MM) located on the top left side of the trip unit will light.
- AND/OR
- B. The relay output is provided by three wires exiting the left hand side of the breaker: blue = C, red = NO, black = NC. The relay will change state when the maintenance mode is remotely enabled.

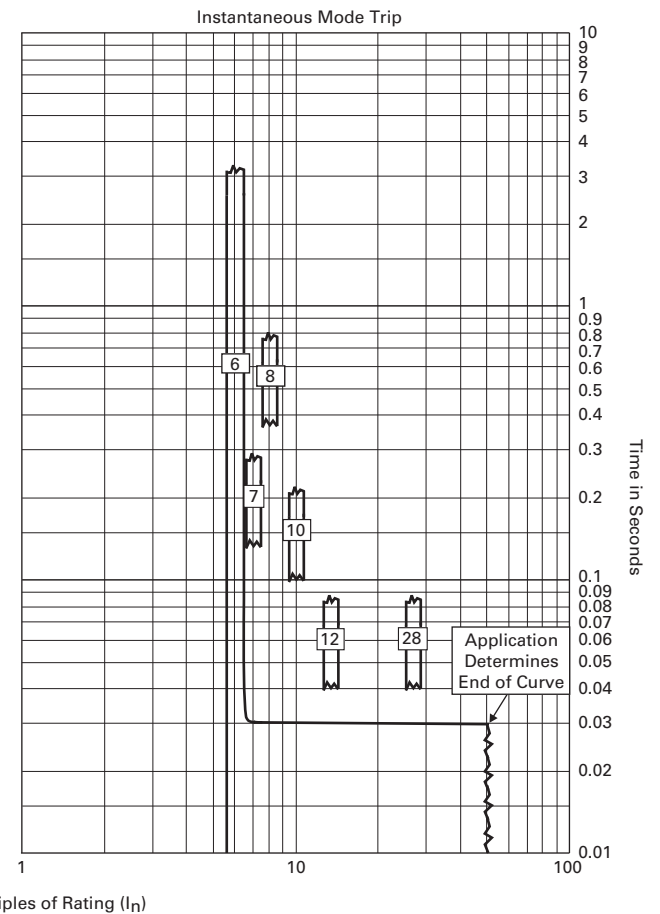
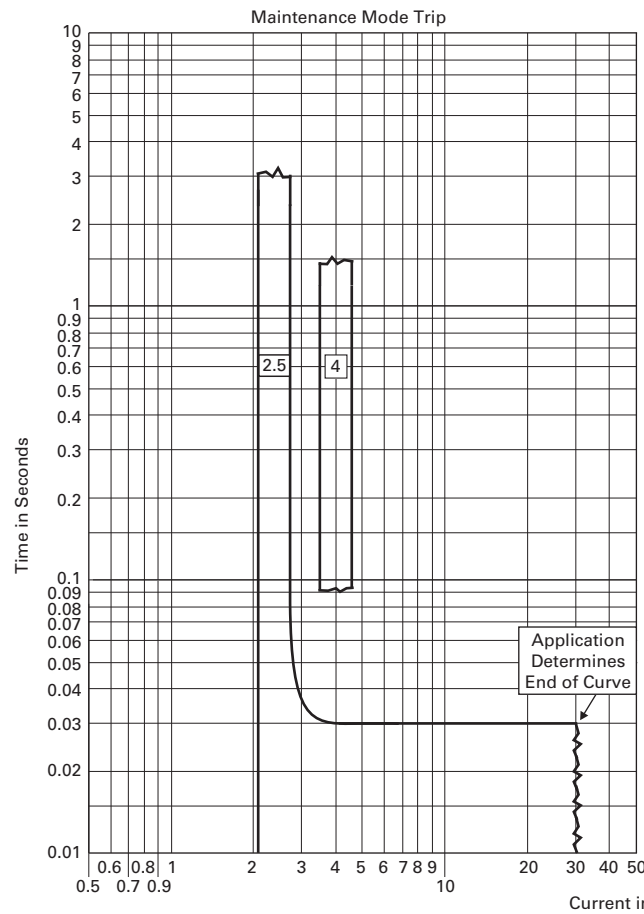


Figure 5. Maintenance Mode / Instantaneous Setting (ALSI, ALSIG)—Curve Number TC01207014E, May 2008

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Powering Business Worldwide

Series C Selection Data—F-Frame

Series C, F-Frame
Thermal-Magnetic 10–225 A
Electronic RMS 15–225 A



F-Frame Breaker

Table 27.4-55. Dimensions in Inches (mm)

Number of Poles	Width	Height	Depth
1	1.38 (34.8)	6.00 (152.4)	3.38 (85.7)
2	2.75 (69.9)	6.00 (152.4)	3.38 (85.7)
3	4.13 (104.8)	6.00 (152.4)	3.38 (85.7)
4	5.50 (139.7)	6.00 (152.4)	3.38 (85.7)

Table 27.4-56. Thermal-Magnetic Trip Ratings

Frame	Ratings
ED, EDH, EDC	100, 125, 150, 175, 200, 225
EHD, FDB, FD, HFD, FDC, HFDDC	10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150
FD, HFD, FDC	175, 200, 225

Table 27.4-57. Digitrip 310+ Electronic Trip Units

Types	Frame	Ratings
FDE, HFDE, FDCE	225	100, 110, 125, 150, 160, 175, 200, 225
	160	60, 70, 80, 90, 100, 125, 150, 160
	80	15, 20, 30, 40, 50, 60, 70, 80

Table 27.4-58. UL 489 Interrupting Capacity Ratings

Circuit Breaker Type	Number of Poles	Trip Type ①	Interrupting Capacity (Symmetrical Amperes)					
			Volts AC (50/60 Hz)				Volts DC	
			240	277	480	600	125	250 ②③
EDB	2, 3	N.I.T.	22,000	—	—	—	10,000	—
EDS	2, 3	N.I.T.	42,000	—	—	—	10,000	—
ED	2, 3	N.I.T.	65,000	—	—	—	10,000	—
EDH	2, 3	N.I.T.	100,000	—	—	—	10,000	—
EDC ④	2, 3	N.I.T.	200,000	—	—	—	10,000	—
EHD	1	N.I.T.	—	14,000	—	—	10,000	—
	2, 3	N.I.T.	18,000	—	14,000	—	—	10,000
FDB	2, 3, 4	N.I.T.	18,000	—	14,000	14,000	—	10,000
FD	1	N.I.T.	—	35,000	—	—	10,000	—
FD	2, 3, 4	N.I.T.	65,000	—	35,000	—	—	10,000
FDE ⑤	2, 3, 4	N.I.T.	65,000	—	35,000	18,000	—	—
HFD	1	N.I.T.	—	65,000	—	—	10,000	—
HFD	2, 3, 4	N.I.T.	100,000	—	65,000	—	—	22,000
HFDE ⑤	2, 3, 4	N.I.T.	100,000	—	65,000	25,000	—	—
FDC ④	2, 3, 4	N.I.T.	200,000	—	100,000	35,000	—	22,000
FDCE ⑤	2, 3, 4	N.I.T.	—	—	—	25,000	—	—
HFDDC ⑥	3	N.I.T.	—	—	—	—	—	42,000 ⑦

① N.I.T. is non-interchangeable trip unit.

② Two-pole circuit breaker, or two poles of three-pole circuit breaker.

③ Time constant is 3 milliseconds minimum at 10 kA and 8 milliseconds minimum at 22 kA.

④ Current limiting.

⑤ Electronics available on three-pole only.

⑥ HFDDC is UL only and is not tested to other standards.

⑦ Interrupting rating is 35,000 A at 600 Vdc with three poles in series, for ungrounded systems only.

Table 27.4-59. Line and Load Terminals

Maximum Breaker Amperes	Terminal Body Material ⑧	Wire Type	AWG Wire Range	Metric Wire Range (mm ²)	Catalog Number Package of 3 Terminals
-------------------------	--------------------------	-----------	----------------	--------------------------------------	--

Standard Pressure Type Terminals

20 (EHD)	Steel	Cu/Al	(1) #14–#10	2.5–4	3T20FB ⑨
100	Steel	Cu/Al	(1) #14–1/0	2.5–50	3T100FB
150	Aluminum	Cu/Al	(1) #4–4/0	25–95	3TA150FB
225	Aluminum	Cu/Al	(1) #4–4/0	25–95	3TA225FD

Optional Pressure Terminals

50	Aluminum	Cu/Al	(1) #14–#4	2.5–16	3TA50FB ⑨
100	Aluminum	Cu/Al	(1) #14–1/0	2.5–50	3TA100FD
150	Stainless Steel	Cu	(1) #4–4/0	25–95	3T150FB
225	Aluminum	Cu/Al	(1) #6–300 kcmil	16–150	3TA225FDK

⑧ UL listed for use with copper or aluminum conductors as noted.

⑨ Not for use with ED, EDH, EDC breakers.

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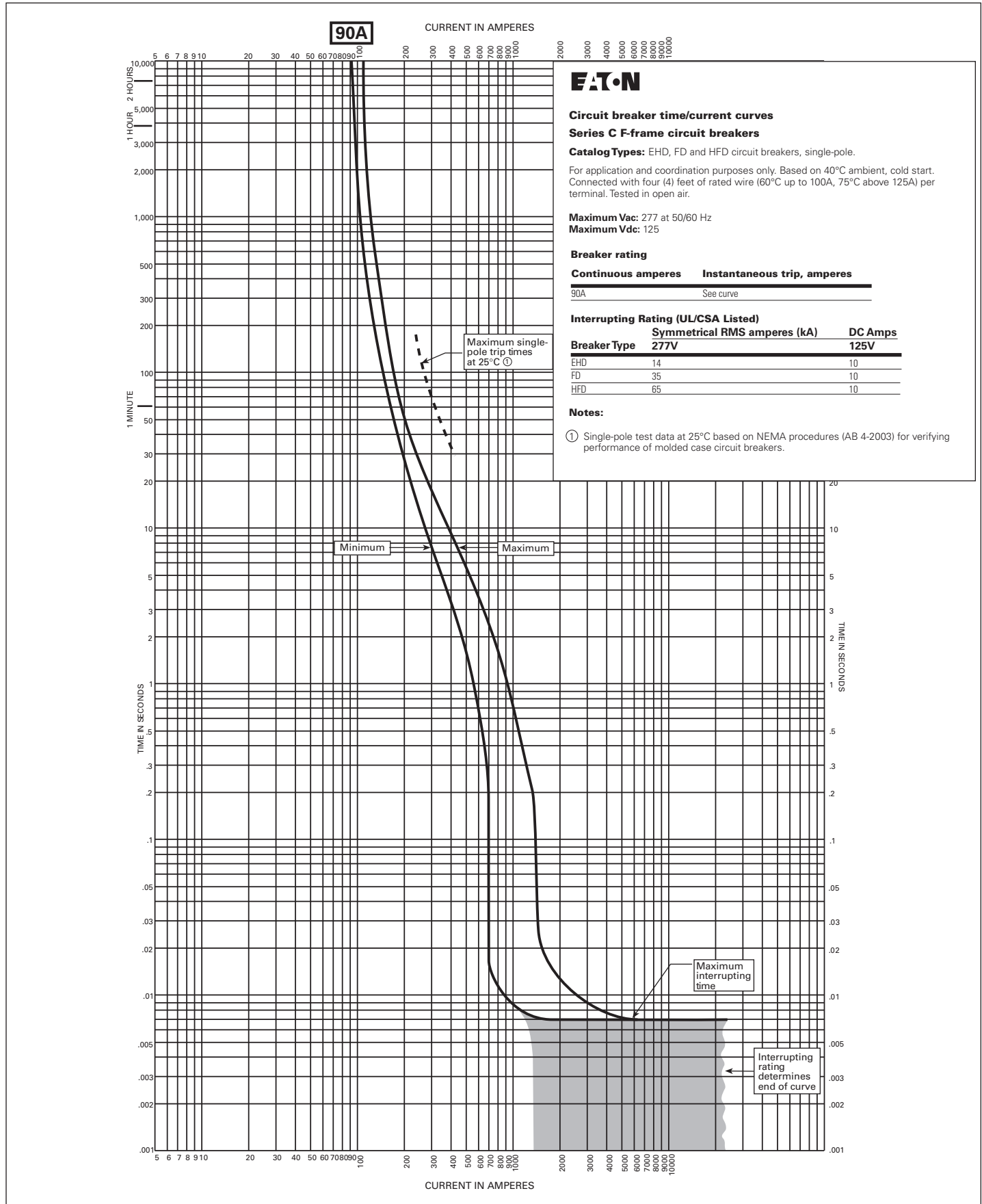


Figure 23. Single Pole, Series C, Types EHD, FD, and HFD 90A – Curve Number SC-4434-88A

The Eaton logo consists of the word "EATON" in a bold, blue, sans-serif font. The letter "O" is stylized as a white circle with a blue dot in the center, creating a circular graphic element.

Powering Business Worldwide

Electronic Trip Units

Electronic Trip Units



Circuit Breakers with Microprocessor Trip Units

Table 27.4-9. Digitrip RMS Circuit Breaker Trip Unit Selection (See Table 27.4-10 for details)

Description	Digitrip 310	Digitrip 310+	Digitrip 510	OPTIM 550	Digitrip 610	Digitrip 810	Digitrip 910	OPTIM 1050
Circuit Breaker Type								
Molded-case F-Frame 225 A		■						
Molded-case JG250-Frame 250 A		■						
Molded-case K-Frame 400 A		■		■				■
Molded-case L-Frame 600 A	LD	■		■				■
	LG		■					
Molded-case M-Frame 800 A	■							
Molded-case N-Frame 1200 A	ND	■		■				■
	NG		■					
Molded-case R-Frame 2500 A	RD	■		■	■	■	■	■
	RG		■					
Features								
Curve shaping functions	5	6	9	10	9	9	9	10
Front adjustable	■	■	■		■	■	■	
Programmable				■				■
Zone selective interlocking		■	■	■ ^①	■	■	■	■
Load monitoring		Option ^②		■	■	■	■	■
Diagnostics (cause-of-trip)		Option ^③	■	■	■	■	■	■
Power/energy monitoring		Option ^④				■	■	■
Harmonics							■	■
Waveform capture							■	■
Communications		Option ^④		■ ^①		■	■	■
Arcflash Reduction Maintenance System (local and remote)		■ ^⑤						
Ground fault alarm	■ ^⑥	Option		■ ^{①⑥}	■	■	■	■

① Optional feature.

② Requires ammeter/cause-of-trip display.

③ Requires cause-of-trip LED module or ammeter/cause-of-trip display.

④ Requires Power Metering and Monitoring Module (PM3). See Page 27.4-41 for product details.

⑤ Only available in LG, NG and RG breakers.

⑥ Requires auxiliary alarm module below R-Frames.

Note: For time current curves for the trip units, see www.eaton.com.

Electronic Trip Units

Table 27.4-10. Molded-Case Digitrip Selection Guide

Trip Unit Type	Digitrip RMS 310+	Digitrip RMS 310	Digitrip RMS 510	Digitrip RMS 610	Digitrip RMS 810	Digitrip RMS 910	Digitrip OPTIM 550	Digitrip OPTIM 1050	
rms sensing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Breaker Type									
Frame	FDE, JG, K, LG, NG, RG ①	L, M	R	R	R	R	K, L, N	K, L, N, R	
Ampere range	15–2500 A	300–800 A	800–5000 A	800–5000 A	800–5000 A	800–5000 A	70–1200 A	70–5000 A	
Interrupting rating at 48 V	35, 65, 100, 150 (kA)	35, 65, 100 (kA)	65, 100 (kA)	65, 100 (kA)	65, 100 (kA)	65, 100 (kA)	35, 65, 100 (kA)	35, 65, 100 (kA)	
Protection									
Ordering options	LS LSG	LSI LSIG	LS LSG	LSI LSIG	LI, LS, LSI, LIG, LSG, LSIG	LI, LS, LSI, LIG, LSG, LSIG	LI, LS, LSI, LIG, LSG, LSIG	LSI, LSI (A), LSIG	LSI (A), LSIG
Arcflash Reduction Maintenance System	No	ALSI ALSIG ②	No	No	No	No	No	No	
Fixed rated plug (I _n)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Overtemperature trip	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Long Delay Protection (L)									
Adjustable rating plug (I _n)	No	Yes	No	No	No	No	No	No	
Long delay pickup	40–100% frame	0.5–1.0 x (I _n) ③	0.5–1.0 x (I _n)	0.5–1.0 x (I _n)	0.5–1.0 x (I _n)	0.5–1.0 x (I _n)	0.4–1.0 x (I _n)	0.4–1.0 x (I _n)	
Long delay time I ² t	2–24 seconds	10 seconds	2–24 seconds	2–24 seconds	2–24 seconds	2–24 seconds	2–24 seconds	2–24 seconds	
Long delay time I ⁴ t	No	No	No	No	No	No	1–5 seconds	1–5 seconds	
Long delay thermal memory	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
High load alarm	Yes	No	No	0.85 x I _r	0.85 x I _r	0.85 x I _r	0.5–1.0 x I _r	0.5–1.0 x I _r	
Short Delay Protection (S)									
Short delay pickup	Varies by frame ④		200–800% x (I _n)	200–600% S1 and S2 x (I _r)	200–600% S1 and S2 x (I _r)	200–600% S1 and S2 x (I _r)	200–600% S1 and S2 x (I _r)	150–800% x (I _r)	150–800% x (I _r)
Short delay time I ² t	Yes	No	100 ms	100–500 ms	100–500 ms	100–500 ms	100–500 ms	100–500 ms	
Short delay time flat	No	Inst–300 ms	No	Inst–300 ms	100–500 ms	100–500 ms	100–500 ms	100–500 ms	
Short delay time Z.S.I.	Yes	No	No	Yes	Yes	Yes	Yes	Optional	
Instantaneous Protection (I)									
Instantaneous pickup	No	Varies by frame ④	No	200–800% x (I _n)	200–600% M1 and M2 x (I _n)	200–600% M1 and M2 x (I _n)	200–600% M1 and M2 x (I _n)	200–800% x (I _n)	200–800% x (I _n)
Discriminator	No	Yes	No	Yes ⑤	Yes ⑤	Yes ⑤	Yes ⑤	Yes	
Instantaneous override	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Ground Fault Protection (G)									
Ground fault alarm	Yes	Yes	Yes	No	No	No	No	No	
Ground fault pickup	20–100% frame ⑥	Var/frame ⑥	25–100% x I _n ⑥	25–100% x I _n ⑥	25–100% x I _n ⑥	25–100% x I _n ⑥	25–100% x I _n ⑥	20/25–100% ⑦	20/25–100% ⑦⑧
Ground fault delay I ² t	No	No	100–500 ms	100–500 ms	100–500 ms	100–500 ms	100–500 ms	100–500 ms	
Ground fault delay flat	Inst–300 ms	Inst–500 ms	100–500 ms	100–500 ms	100–500 ms	100–500 ms	100–500 ms	100–500 ms	
Ground fault Z.S.I.	Yes	Yes	Yes	Yes	Yes	Yes	Optional	Yes	
Ground fault thermal memory	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
System Diagnostics									
Cause of trip LEDs	No	No	Yes	Yes	Yes	Yes	Yes	Yes	
Magnitude of trip information	No	No	No	Yes	Yes	Yes	Yes	Yes	
Remote signal contacts	No	No	No	Yes	Yes	Yes	No	Yes	
System Monitoring									
Digital display	No	No	No	Yes	Yes	Yes	Yes ⑨	Yes ⑨	
Current	No	No	No	Yes	Yes	Yes	Yes	Yes	
Voltage	No	No	No	No	No	No	No	No	
Power and energy	No ⑩	No ⑩	No	No	Yes	Yes	No	Yes	
Power quality-harmonics	No	No	No	No	No	Yes	No	Yes	
Power factor	No	No	No	No	Yes (over PowerNet only)	Yes	No	Yes	
Communications									
PowerNet	No	No	No	No	Yes	Yes	Optional	Yes	
Testing									
Testing method	Test kit	Test set	Integral	Integral	Integral	Integral	OPTIMizer, BIM, PowerNet (optional)	OPTIMizer, BIM, PowerNet	

① No rating plugs necessary.

② Only available on LG, NG and RG breaker.

③ Adjust by rating plug.

④ FDE and JG 200–1200% x I_n
LG 200–1200% x I_n
NG 200–900% x I_n
RG 200–800% x I_n

⑤ LS/LSG only.

⑥ Not to exceed 1200 A.

⑦ L- and N-Frames *20–100% x I_S.
R-Frame *25–100% x I_n.

⑧ By OPTIMizer/BIM.

⑨ Yes, with addition of power monitoring/
metering module (PM3).

⑩ Yes, with addition of Energy Sentinel.

BIM = Breaker Interface Module

I_S = Sensor Rating

I_n = Rating Plug

I_r = LDPU Setting x I_n

General Description—Trip Units

Electronic RMS Trip Unit

General

Eaton offers the most comprehensive range of electronic trip units in the industry for molded-case circuit breakers. All electronic trip units are rms sensing and can be applied from 70 A up through 2500 A. Eaton offers electronic trip units as standard for circuit breakers rated above 800 A, and offers electronic trip units as optional for circuit breakers 70 A up through 800 A.

Digitrip electronic trip units are AC devices that employ microprocessor-based technology that provides a true rms current sensing means for proper correlation with thermal characteristics of conductors and equipment. The primary function of the Digitrip electronic trip unit is to provide circuit protection. This is achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker shunt trip when pre-set current levels and time delay settings are exceeded. All Eaton electronic trip units use a high effective sampling rate to maintain measurement accuracy, monitoring, and protection with nonlinear loads having harmonic content up to the 27th order.

Electronic trip units are applied to distribution systems when high standards of protection and coordination are called for. In addition, electronic trip units can provide further enhanced features such as alarming, diagnostics, system monitoring and communications.

Eaton RMS sensing trip units fall into two main categories:

- Front adjustable trip units (Digitrip™ RMS 310, 310+, 510, 610, 810 and 910)
- Programmable trip units (Digitrip OPTIM™ 550 and 1050)

Front-Adjustable Trip Units

Front-adjustable trip units are electronic trip units that have up to nine time-current setting options that are set by switches mounted on the front of the trip unit. The application for front adjustable trip units would be distribution systems that can be coordinated within the range of settings available and that do not require sophisticated coordination strategies to be applied down through the distribution system to small rated breakers.

Programmable Trip Units (OPTIM)

Programmable trip units are electronic trip units that have up to 10 time-current setting options that are programmed electronically by the use of a programming device. The application for programmable trip units would be high integrity distribution systems that require superior levels of system coordination coupled with system alarming, diagnostics and monitoring.

Rating Plugs

Rating plugs provide a means to establish the breaker's continuous current rating. Rating plugs are color-coded and interchangeable to make it easy to match the correct rating plug with the correct trip unit. The same rating plug can be applied to both 50 and 60 Hz distribution systems. Some rating plugs are fixed and some have an adjustable range of amperage values for greater flexibility. Digitrip 310, 510, 610, 810 and 910 trip units can be supplied with either a fixed or adjustable rating plug. Digitrip 310+ trip units are equipped with adjustable rating plugs. OPTIM style trip units are furnished with fixed rating plugs but have a programmable Long Time Pickup rating to allow application over a range of amperage values.

Cause of Trip Indication

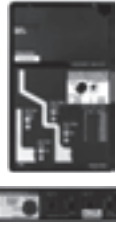







All OPTIM and Digitrip 510, 610, 810 and 910 trip units include Cause-of-Trip indication LEDs. Breakers using the RMS 310+ electronic trip unit have the ability to output cause-of-trip information through the test port. The Cause-of-Trip LED module provides trip information via LED indication. The Digiview and Panelmount Digiview can be installed in the RMS 310+ test port to provide both cause-of-trip information and phase current through an LCD display.



Cause-of-Trip LED Module

Digiview

Table 27.1-1. The Digitrip Family of Low Voltage Electronic Trip Units

RMS 310	RMS 310+	RMS 510	OPTIM 550	RMS 610	RMS 810	RMS 910	OPTIM 1050
							
rms sensing — 5 functions — Front adjustable	rms sensing — 6 functions — Front adjustable — Optional display for diagnostics and load monitoring — Zone selective interlocking — Optional Arcflash Reduction Maintenance System™	rms sensing — 9 functions — Front adjustable — Zone selective interlocking — Diagnostics	rms sensing — 10 functions — Programmable — Load monitoring — Diagnostics — Zone selective interlocking ① — Communications ①	rms sensing — 9 functions — Front adjustable — Zone selective interlocking — Load monitoring — Diagnostics	rms sensing — 9 functions — Front adjustable — Zone selective interlocking — Load monitoring — Diagnostics — Communications — Power and energy monitoring	rms sensing — 9 functions — Front adjustable — Zone selective interlocking — Load monitoring — Diagnostics — Communications — Power and energy monitoring — Harmonics	rms sensing — 10 functions — Programmable — Zone selective interlocking — Load monitoring — Diagnostics — Communications — Power and energy monitoring — Harmonics

① Optional features.

Additional Protection Features

Discriminator/Making Current Release

Eaton’s Digitrip RMS electronic trip units are designed and built with safety and reliability in mind, both to protect the user and the equipment, as well as to make sure the trip functions within its design parameters. By providing a discriminator circuit to Digitrip RMS 510, 610, 810 and 910 trip units, as well as to Digitrip OPTIM 550 and 1050 trip units that do not have an instantaneous setting, the user is protected should a faulted circuit exist. The discriminator (or making current releases as it is often called) is set at 11 times the rating plug ampere rating and is enabled for approximately the first 10 cycles of current flow. Should a fault condition exist, the breaker will trip with no intentional time delay on closing, protecting the user from a potentially unsafe condition.

Instantaneous Override

In addition to a discriminator, an instantaneous override is present in all molded-case and insulated-case circuit breakers to provide additional protection for the breaker. The instantaneous override is factory set nominally just below the breaker withstand rating.

Trip Unit Overtemperature

Digitrip electronic trip units can operate reliably in ambient temperatures that range from –20 °C to +85 °C. In the unlikely event that temperatures exceed this ambient, the trip unit has a built-in overtemperature trip to protect the trip unit should the temperature exceed these design parameters.

Thermal Memory

Digitrip RMS and Digitrip OPTIM electronic trip units incorporate powered thermal memory, i.e., the units remember recent overcurrent events that may have initiated the trip timing sequence, and then returned to nominal levels, halting the sequence prior to trip initiation. In the event that the current levels again exceed the pickup set point within a few cycles of the original pickup, the unit’s memory recalls the previous near trip and automatically imposes a shorter delay time. In effect, the unit treats multiple time-related events as a single continuous event thereby preventing system damage due to cumulative overheating.

As a further enhancement, the trip units incorporate an unpowered thermal memory feature. In the event that current levels cause the breaker to trip and the breaker is immediately reclosed, the trip unit remembers the previous overcurrent trip and again

imposes a shorter delay time should an additional overcurrent occur before a sufficient cooldown period has elapsed.

Thermal memory protects the distribution system from cumulative overheating caused by repeated overcurrent conditions. OPTIM trip units allow this to be turned ON or OFF.

System Alarms

Digitrip RMS 610, 810 and 910 electronic trip units incorporate a high load alarm capability. Set at 85% of I_p , the alarm will be initiated once the load current exceeds 85% for 40 seconds. Once this occurs, the HILD message will flash in the display window and the power/relay module will operate to send a remote signal.

Digitrip OPTIM electronic trip units also offer a high load alarm capability but with more flexibility. OPTIM trip units have a high load alarm that can be programmed to operate between 50% and 100% of I_p .

Digitrip OPTIM electronic trip units incorporate a ground fault alarm capability. Settings available for ground fault alarm are the same as for ground fault trip. Once a ground fault alarm occurs, both local and remote signal indication is available (OPTIM 550 is remote only).

General Description—Trip Units

System Diagnostics

Whenever a circuit breaker trips, it is normally imperative that the cause of trip be determined quickly, the faulty conditions rectified, and the breaker put back into service. Digitrip RMS 510, 610, 810 and 910, and Digitrip OPTIM electronic trip units incorporate a complete package of systems diagnostics to meet this challenge.

Four cause-of-trip LEDs are embedded in the front of the trip unit case, indicating that the cause-of-trip was either a long delay, short delay, instantaneous or ground fault. Remote signal indication for cause of trip as well as magnitude of trip information is also available.

Breakers using the RMS 310+ electronic trip unit have the ability to output cause-of-trip information through the test port. The Cause-of-Trip LED module provides trip information via LED indication. The Digiview and Panelmount Digiview can be installed to provide both cause-of-trip information and phase current through an LCD display.

Systems Monitoring

Digitrip RMS and Digitrip OPTIM electronic trip units offer a complete menu of monitoring capability to include current, power and energy, power factor, power quality harmonics, and other related parameters with a high level of accuracy.

Digital Display

Digitrip RMS 610, 810 and 910 have a large, easy-to-read four-digit alphanumeric display mounted on the trip unit. The display is supported by LEDs that indicate which parameter is being displayed along with the unit the value is displayed in, e.g., kA and so on.

Current Monitoring

Digitrip RMS 610, 810 and 910 trip units are capable of monitoring currents in individual phases (A, B, C) as well as ground currents. Digitrip OPTIM 550 and 1050 trip units are capable of monitoring currents in individual phases (A, B, C) as well as neutral and ground currents.

Values are displayed in the digital display window in kA. Accuracy of the current monitored values is $\pm 2\%$ of full scale sensor rating.

Breakers using the Digitrip 310+ electronic trip unit have the ability to output phase current monitoring information through the test port. The Digiview or Panelmount Digiview can be installed to provide phase current through an LCD display.

For current and voltage monitoring with 0.5% accuracy of reading that can be used with thermal-magnetic or electronic trip units, refer to the Power Monitoring/Metering Module (PM3) on **Page 274-41**.

Power and Energy Monitoring

For the trip unit to calculate true power and energy values, a Potential Transformer Module (PTM) is required. This PTM is mounted internally (R-Frame and larger) or externally (N-Frame or smaller) to the breaker, and provides voltage to the trip unit.

Digitrip RMS 810 and 910 trip units are capable of monitoring peak power demand, present power demand, and reverse power flow in MW. Additionally, both forward and reverse energy consumption in MWh can be monitored. Digitrip OPTIM 1050 trip units can also monitor the same power and energy parameters, but the units are displayed in kW and kWh.

The accuracy of power monitored values is $\pm 4\%$ of full scale sensor/frame rating.

The accuracy of energy monitored values is $\pm 5\%$ of full scale sensor/frame rating.

Both the RMS 910 and OPTIM 1050 report power factor. Digitrip RMS 910 trip units have the additional capability of monitoring line-to-line voltage.

For Real Power and Reactive Power monitoring with ANSI C12.1 revenue class accuracy that can be used with thermal-magnetic or electronic trip units, refer to the Power Monitoring/Metering Module (PM3) on **Page 274-41**.

Harmonics Monitoring

Digitrip RMS 910 and Digitrip OPTIM 1050 trip units are capable of monitoring values of current harmonics. Percentage of total harmonic content can be monitored for each level of harmonic content up to the 27th harmonic. Additionally, a total harmonic distortion (THD) value can be calculated and displayed providing the user with total system current harmonic monitoring capability.

Time-Current Curve Shaping

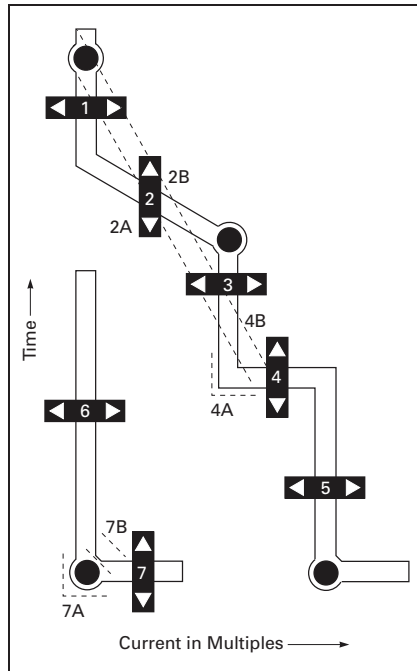


Figure 27.1-1. Time-Current Curve Shaping

Note: See selection guide charts for availability of adjustments.

Long Delay (L)

1. Long Delay Pickup
Determines the continuous ampere rating of the breaker.
2. Long Delay Time
Determines the amount of time the breaker will carry a low level overload before tripping.
 - a. I^2t Response
 I^2t in: For coordination with other circuit breakers with electronic trip devices and for coordination with thermal-magnetic circuit breakers.
 - b. I^4t Response
 I^4t in: For coordination with fuses and upstream transformer damage curves.

Short Delay (S)

3. Short Delay Pickup
Determines or sets the level of fault current at which the short-time trip delay countdown is actuated.
4. Short Delay
Sets the amount of time the breaker will carry both a low level and high fault currents before tripping.
 - a. Flat Response
 I^2t out: For coordination with other circuit breakers with electronic trip devices.
 - b. I^2t Response
 I^2t in: For coordination with fuses and thermal-magnetic breakers.

Instantaneous (I)

5. Instantaneous Pickup
Determines the level of fault current that will actuate a trip with no time delay.

Ground Fault (G)

6. Ground Fault Pickup
Determines the level of fault current at which the ground fault trip delay countdown is actuated.
7. Ground Fault Delay
Determines the amount of time the breaker will carry a ground fault before tripping.
 - a. Flat Response
 I^2t out: For coordination with other circuit breakers with electronic ground fault settings.
 - b. I^2t Response
 I^2t in: For coordination with zero sequence ground fault relays, fuses and thermal-magnetic breakers.

Curve Shaping

Eaton Digitrip RMS 310 trip units are available with up to five phase and ground adjustments on the front of the trip unit. Digitrip RMS 310+ trip units are available with up to six phase and ground adjustments on the front of the trip unit. Selective system coordination with both upstream and downstream devices can be achieved to provide an economic solution for less sophisticated distribution systems.

For more sophisticated selective coordination systems Digitrip RMS 510, 610, 810 and 910 trip units are available with up to nine curve shaping choices via switches on the front of the unit. Curve shaping flexibility is provided by dependent long and short delay adjustments that are based on continuous amperes (I_T) selection.

Digitrip OPTIM 550 and 1050 trip units offer programmable curve shaping via 10 curve shaping choices that are programmed electronically into the trip unit. OPTIM also offers virtual infinite settings to allow the user to optimize coordination for a selectively coordinated distribution system. In addition, time-current set points can be downloaded via a communication system from a central personal computer. Digitrip OPTIM is normally applied to systems where system integrity is very important.

General Description—Trip Units

Zone Selective Interlocking

Zone selective interlocking capabilities are available with Digitrip RMS 310+ 510, 610, 810 and 910 trip units as well as Digitrip OPTIM 550 and 1050 trip units.

Note: Optional accessory on the OPTIM 550.

Zone selective interlocking provides increased system protection and can reduce arc flash risk by allowing the breaker closest to the fault to trip without any preset time delays. This is achieved by setting up the distribution system as shown in **Figure 27.1-2**. The hardwired connection between the trip units sends a restraining signal upstream, allowing the breaker closest to the fault to act instantaneously. Zone selective interlocking reduces stress on the distribution system and can reduce arc flash risk by isolating faults without time delays.

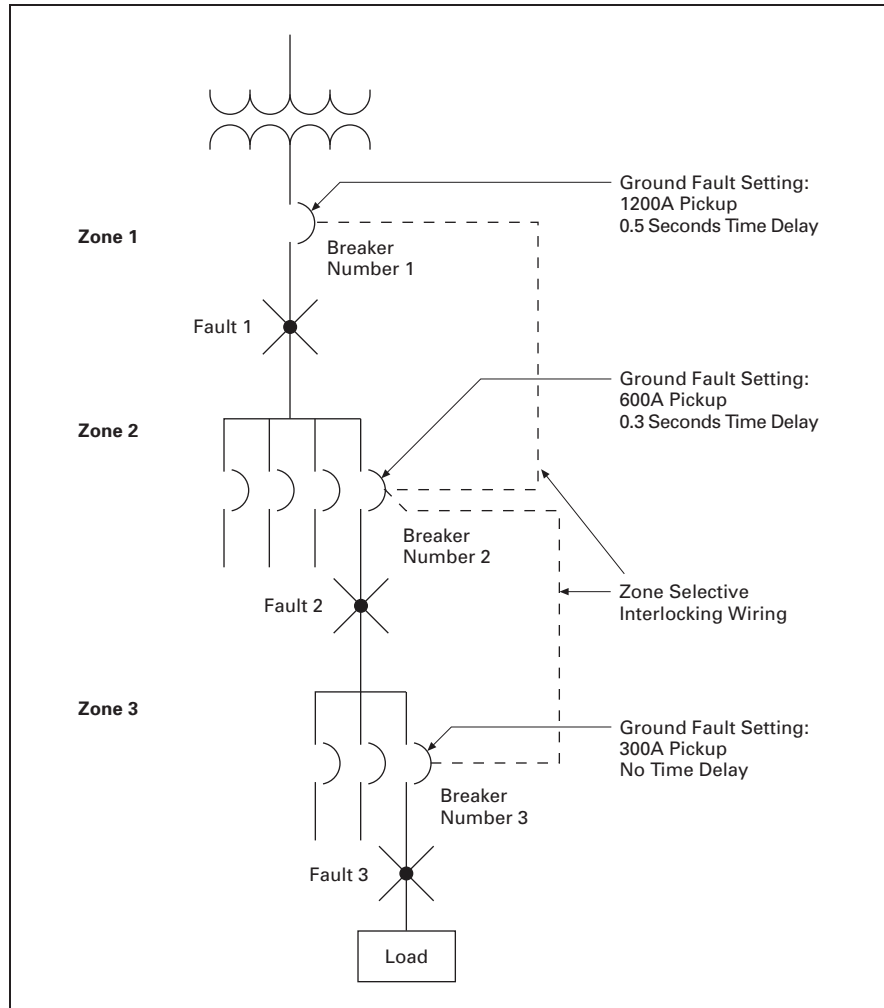


Figure 27.1-2. Zone Selective Interlocking

Fault 1

There are no interlocking signals. The main breaker trip unit will initiate the trip instantaneously.

Fault 2

The feeder breaker trip unit will initiate the trip instantaneously to clear the fault; and Zone 2 will send an interlocking signal to the Zone 1 trip unit. The Zone 1 trip unit will begin to time out, and in the event that the feeder breaker in Zone 2 would not clear the fault, the main breaker in Zone 1 will clear the fault in 0.5 seconds.

Fault 3

The branch breaker trip unit will initiate the trip instantaneously to clear the fault; and Zone 3 will send an interlocking signal to the Zone 2 trip unit; and Zone 2 will send an interlocking signal to Zone 1.

Zone 1 and Zone 2 trip units will begin to time out, and in the event that the branch breaker in Zone 3 would not clear the fault, the feeder breaker in Zone 2 will clear the fault in 0.3 seconds. Similarly, in the event that the feeder breaker in Zone 2 would not clear the fault, the main breaker in Zone 1 will clear the fault in 0.5 seconds.

The Eaton logo is rendered in a bold, blue, sans-serif typeface. The letters 'E', 'A', and 'N' are solid blue. The letter 'T' is white with a blue outline. The letter 'O' is white with a blue outline and contains a solid blue circle in its center. The entire logo is centered horizontally on the page.

EATON

Powering Business Worldwide

Eaton's SPD Series for integration into electrical distribution equipment



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Powering Business Worldwide

Introduction

Eaton's SPD Series surge protective devices

Eaton's SPD Series surge protective devices are the latest and most advanced UL® 1449 3rd Edition certified surge protectors. Units are available integrated within Eaton electrical assemblies, including panelboards, switchboards, motor control centers, switchgear, and bus plugs. Side-mount versions of the SPD Series are also available for installation external to an electrical assembly. Application of SPD Series units throughout a facility will ensure that equipment is protected with the safest and most reliable surge protective devices available.

SPD Series units are available in all common voltages and configurations and also in a variety of surge current capacity ratings from 50 through 400 kA. Three feature package options are also available to choose from. The breadth of the SPD Series' features, options, and configurations ensures that the correct unit is available for all electrical applications, including service entrances, distribution switchboards, panelboards, and point-of-use applications.

Applications

The SPD Series is available as an integrated device within the following Eaton electrical assemblies:

- Panelboards
- Switchboards
- Motor control centers
- Switchgear
- Automatic transfer switches
- Bus plugs

Features

- Uses thermally protected metal oxide varistor (MOV) technology
- 20 kA nominal discharge current (I_n) rating (maximum rating assigned by UL)
- 50 through 400 kA surge current capacity ratings
- Three feature package options
- 200 kA short circuit current rating (SCCR)
- 10-year warranty

Standards and certifications



- UL 1449 3rd Edition recognized component for the United States and Canada, covered by Underwriters Laboratories certification and follow-up service



SPD Series Unit Integrated Within an Eaton Panelboard

Feature package options

The SPD Series provides users with the option of selecting between three feature packages. These feature packages are the basic, standard, and standard with surge counter. The proper feature package can be selected based on the requirements of the application or specification.

Table 1. Feature Package Comparison

Feature	Basic	Standard	Standard with Surge Counter
Surge protection using thermally protected MOV technology	✓	✓	✓
Dual-colored protection status indicators for each phase	✓	✓	✓
Dual-colored protection status indicators for the neutral-ground protection mode	✓	✓	✓
Audible alarm with silence button		✓	✓
Form C relay contact		✓	✓
EMI/RFI filtering, providing up to 50 dB of noise attenuation from 10 kHz to 100 MHz		✓	✓
Surge counter with reset button			✓

Remote display mounting option

The SPD Series offers the option of mounting its display remotely from the device. This is useful for applications where OEMs or other integrators would like to embed the unit within a piece of equipment and still be able to view its display.

SPD Series unit catalog numbers ending with 'B' (refer to catalog number configuration on **Page 7**) should be ordered for applications where the display is to be mounted remotely. These units include the SPD Series unit and the remote display panel.

In addition to the unit itself, a remote display cable will have to be purchased. Remote display cables are available in 4, 8, and 12 foot lengths.

Table 2. Remote Display Cables

Description	Catalog Number
4 ft remote display cable	SPDRDCAB04
8 ft remote display cable	SPDRDCAB08
12 ft remote display cable	SPDRDCAB12

Note: Integrated units factory-installed with Eaton switchgear assemblies do not require the purchase of a remote display cable. The cable is provided and all required mounting is performed at the factory.

Existing SPD Series units previously installed without a remote display also have the capability of mounting their displays remotely from the device. Complete remote display kits are available that contain all items required to mount the display remotely, including the remote display cable. Remote display kits are available in 4, 8, and 12 foot cable length options.

Table 3. Remote Display Kits

Description	Catalog Number
Remote display kit with 4 ft remote display cable	SPDRDKIT04
Remote display kit with 8 ft remote display cable	SPDRDKIT08
Remote display kit with 12 ft remote display cable	SPDRDKIT12

For the dimensions of the cutout required to accommodate the remote display panel, see **Figure 1** below.

Dimensions

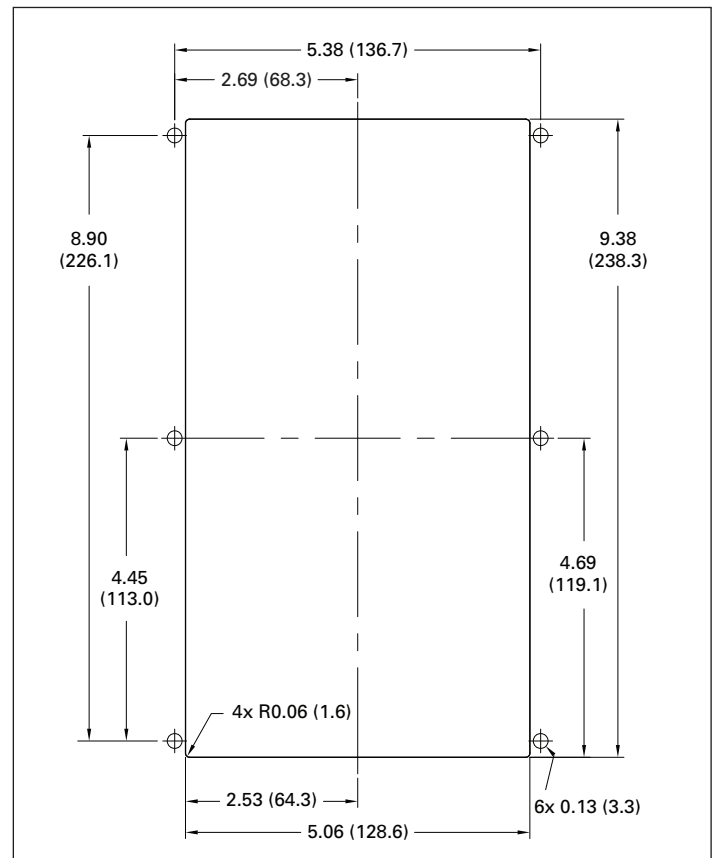


Figure 1. Dimensions of the Cutout Required to Accommodate the Optional Remote Display Panel

Dimensions (continued)

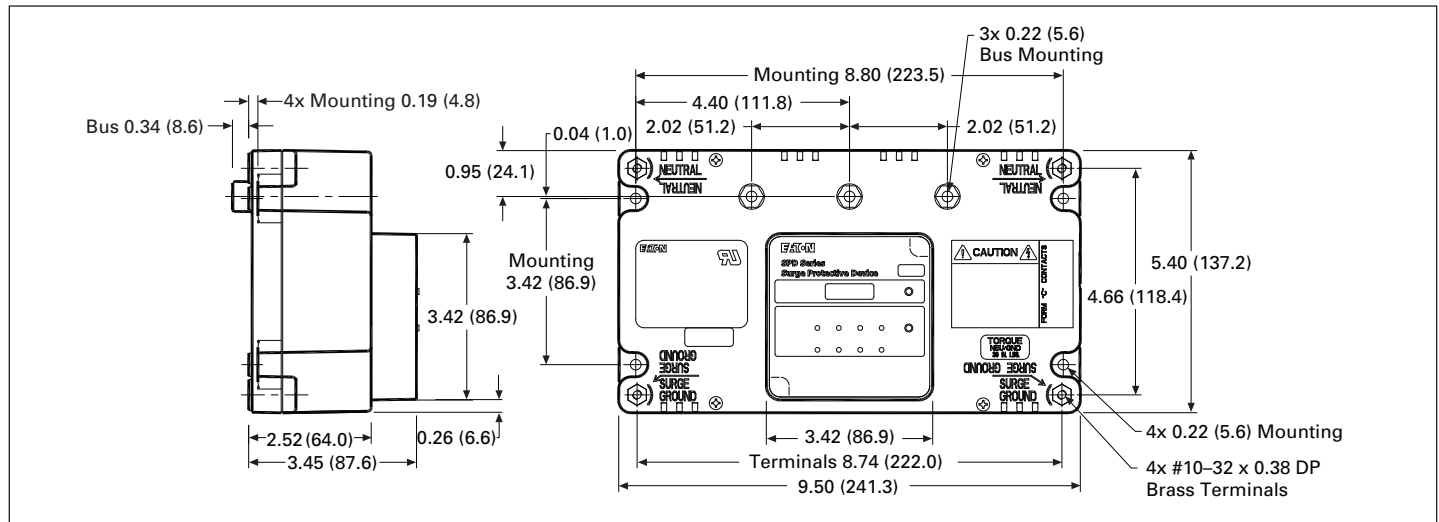


Figure 2. Dimensions of 50 through 200 kA Integrated Units

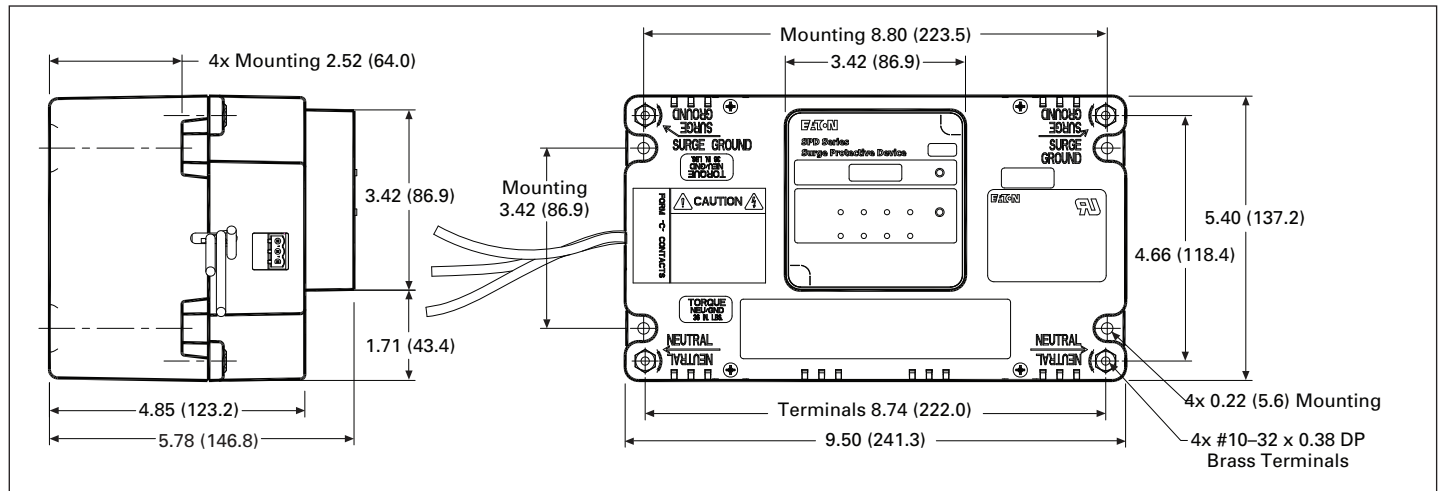


Figure 3. Dimensions of 250 through 400 kA Integrated Units

Performance data

ANSI/UL 1449 3rd Edition voltage protection ratings

Voltage protection rating (VPR) data is included for both direct bus mounted units (catalog number ending with 'A') and units interfaced to the electrical assembly via a circuit breaker (catalog number ending with 'B,' 'C,' or 'J'). Direct bus mounted units are available for installation within Eaton PRL1a, 2a, 3a, and 3E panelboards only.

Table 4. 50 kA Direct Bus Mounted Integrated Unit VPR

Voltage Code	Protection Mode			
	L-N	L-G	N-G	L-L
240S	500	1000	500	1000
208Y and 220Y 400Y and 480Y 600Y	500 1000 1200	1000 2000 2500	500 1000 1200	1000 2000 2500
240D 480D 600D	N/A N/A N/A	1000 2000 2500	N/A N/A N/A	900 2000 2500
240H	500	1000	500	1000

Table 5. 80–100 kA Direct Bus Mounted Integrated Unit VPR

Voltage Code	Protection Mode			
	L-N	L-G	N-G	L-L
240S	500	600	500	900
208Y and 220Y 400Y and 480Y 600Y	500 1000 1200	600 1200 1500	500 1000 1200	900 1800 2500
240D 480D 600D	N/A N/A N/A	1000 1800 2500	N/A N/A N/A	900 1800 2500
240H	500	600	500	900

Table 6. 120–200 kA Direct Bus Mounted Integrated Unit VPR

Voltage Code	Protection Mode			
	L-N	L-G	N-G	L-L
240S	500	600	500	800
208Y and 220Y 400Y and 480Y 600Y	500 900 1200	600 1000 1200	500 900 1200	800 1800 2500
240D 480D 600D	N/A N/A N/A	900 1800 2500	N/A N/A N/A	900 1800 2500
240H	500	600	500	800

Table 7. 250–300 kA Circuit Breaker Interfaced Integrated Unit VPR

Voltage Code	Protection Mode			
	L-N	L-G	N-G	L-L
240S	600 ^①	700	600	1000
208Y and 220Y 400Y and 480Y 600Y	600 ^① 1000 1500	700 1200 1500	600 900 1200	1000 1800 2500
240D 480D 600D	N/A N/A N/A	1000 1800 2500	N/A N/A N/A	1000 1800 2500
240H	600 ^①	700	600	1000

^① L-N VPR for 250–300 kA units containing the standard and standard with surge counter feature packages is 600V. L-N VPR for units containing the basic feature package is 700V. All other VPR numbers reported in all tables represent the VPR for all feature packages.

Table 8. 50 kA Circuit Breaker Interfaced Integrated Unit VPR

Voltage Code	Protection Mode			
	L-N	L-G	N-G	L-L
240S	700	1200	700	1200
208Y and 220Y 400Y and 480Y 600Y	700 1200 1500	1200 2000 2500	700 1200 1500	1200 2000 2500
240D 480D 600D	N/A N/A N/A	1200 2000 2500	N/A N/A N/A	1200 2000 2500
240H	700	1200	700	1200

Table 9. 80–100 kA Circuit Breaker Interfaced Integrated Unit VPR

Voltage Code	Protection Mode			
	L-N	L-G	N-G	L-L
240S	700	700	700	1000
208Y and 220Y 400Y and 480Y 600Y	700 1200 1500	700 1200 1500	700 1200 1500	1000 1800 2500
240D 480D 600D	N/A N/A N/A	1200 2000 2500	N/A N/A N/A	1200 2000 2500
240H	700	700	700	1000

Table 10. 120–200 kA Circuit Breaker Interfaced Integrated Unit VPR

Voltage Code	Protection Mode			
	L-N	L-G	N-G	L-L
240S	700	700	600	1000
208Y and 220Y 400Y and 480Y 600Y	700 1000 1500	700 1200 1500	600 1000 1200	1000 1800 2500
240D 480D 600D	N/A N/A N/A	1000 2000 2500	N/A N/A N/A	1000 1800 2500
240H	700	700	600	1000

Table 11. 400 kA Circuit Breaker Interfaced Integrated Unit VPR

Voltage Code	Protection Mode			
	L-N	L-G	N-G	L-L
240S	700	700	600	1000
208Y and 220Y 400Y and 480Y 600Y	700 1000 1500	700 1200 1500	600 900 1200	1000 1800 2500
240D 480D 600D	N/A N/A N/A	1000 1800 2500	N/A N/A N/A	1000 1800 2500
240H	700	700	600	1000

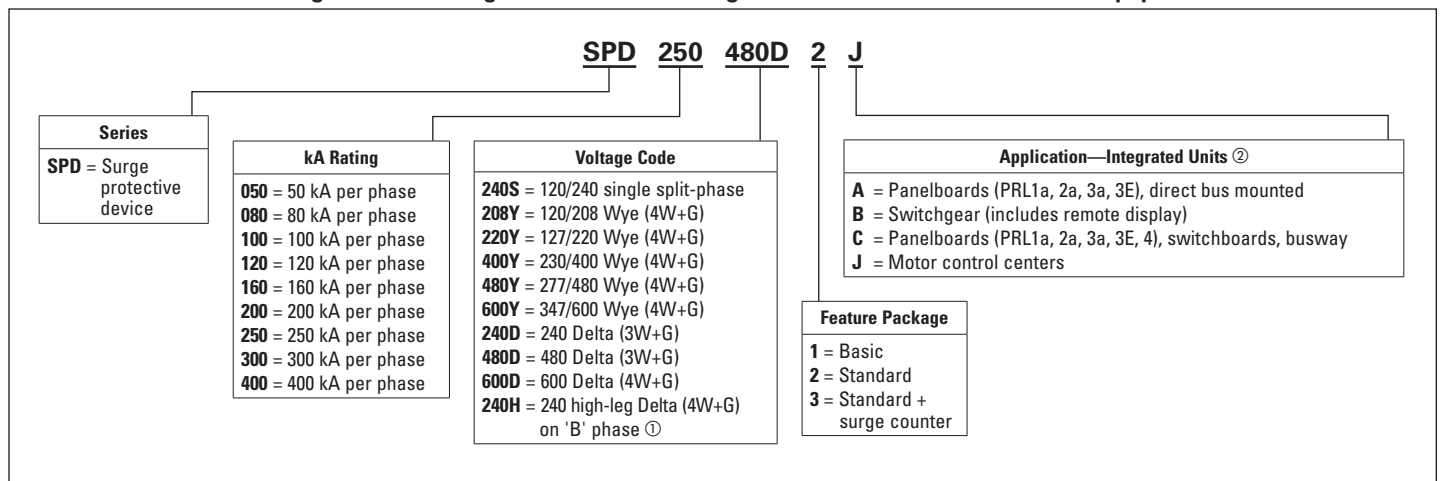
Specifications

Table 12. SPD Series Specifications

Description	Specification
Surge capacity ratings available	50, 80, 100, 120, 160, 200, 250, 300, 400 kA per phase
Nominal discharge current (I _n)	20 kA
Short circuit current rating (SCCR)	200 kA
SPD type	Basic feature package = Type 1 (can also be used in Type 2 applications) Standard and Standard with Surge Counter feature packages = Type 2
Single split phase voltages available	120/240
Three-phase Wye system voltages available	120/208, 127/220, 230/400, 277/480, 347/600
Three-phase Delta system voltages available	240, 480, 600
Input power frequency	50/60 Hz
Power consumption (basic units): 208Y, 220Y, 240S, 240D, and 240H voltage codes 400Y, 480Y, and 480D voltage codes 600Y and 600D voltage codes	0.5W 1.1W 1.3W
Power consumption (standard and standard with surge counter units): 208Y, 220Y, 240S, 240D, and 240H voltage codes 400Y, 480Y, and 480D basic voltage codes 600Y and 600D voltage codes	0.6W 1.7W 2.1W
Protection modes	Single split phase L-N, L-G, N-G, L-L Three-phase Wye L-N, L-G, N-G, L-L Three-phase Delta L-G, L-L Three-phase high-leg Delta . . . L-N, L-G, N-G, L-L
Maximum continuous operating voltage (MCOV): 240S, 208Y, 220Y, and 240H MCOV 400Y and 480Y MCOV 600Y MCOV 240D MCOV 480D MCOV 600D MCOV	150 L-N, 150 L-G, 150 N-G, 300 L-L 320 L-N, 320 L-G, 320 N-G, 640 L-L 420 L-N, 420 L-G, 420 N-G, 840 L-L 320 L-G, 320 L-L 640 L-G, 640 L-L 840 L-G, 840 L-L
Ports	1
Operating temperature	−4°F through 122°F (−20°C through 50°C)
Operating humidity	5% through 95%, noncondensing
Operating altitude	Up to 16,000 ft (5000m)
Seismic withstand capability	Meets or exceeds the requirements specified in IBC® 2006, CBC 2007, and UBC® Zone 4
Weight	50–200 kA units approximately 3.5 lbs (1.6 kg) 250–400 kA units approximately 7.0 lbs (3.2 kg)
Form C relay contact ratings	150 Vdc or 125 Vac, 1A maximum
Form C relay contact logic	Power ON, normal state—NO contact = open, NC contact = closed Power OFF or fault state—NO contact = closed, NC contact = open
EMI/RFI filtering attenuation	Up to 50 dB from 10 kHz to 100 MHz
Agency certifications and approvals	UL 1449 3rd Edition recognized component for the U.S. and Canada UL 1283 (Type 2 SPDs only)
Warranty	10 years

Catalog number selection

Table 13. SPD Series Catalog Number Configuration for Units Integrated into Electrical Distribution Equipment



Example: SPD250480D2J = SPD Series, 250 kA per phase, 480D voltage, standard feature package, motor control center application

① Please consult the factory for 240 high-leg Delta (4W+G) applications with high leg on 'C' phase.
 ② Units used in PRL1a, 2a, 3a, and 3E panelboard applications are available in 50–200 kA ratings only. Use the 'C' option for PRL1a, 2a, 3a, and 3E panelboard applications when unit is connected through a circuit breaker.

Technical support information

If you have any questions or need additional information, please contact the Eaton Technical Resource Center at 800-809-2772, option 4, option 2. You may also submit inquiries via e-mail: surgeprotection@eaton.com.

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Electrical Sector
1111 Superior Ave.
Cleveland, OH 44114
United States
877-ETN-CARE (877-386-2273)
Eaton.com

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August 2009



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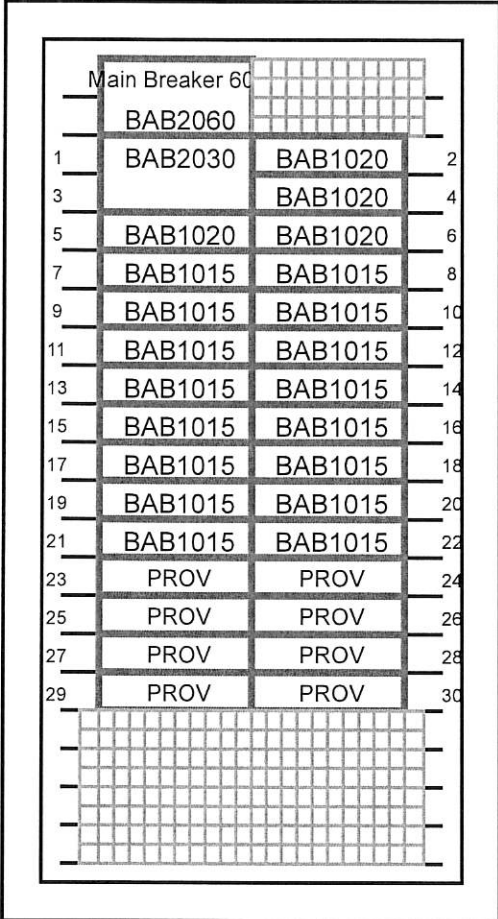
Detail Bill of Material

Project Name: EFI# 93134
General Order No:

Item No.	Qty	Product	Description
	1	Panelboards	30 Circuits, 100A, Fully Rated, 120/240V 1Ph 3W, Copper Bus, 10kAIC, 60A, 2P BAB Main Breaker[Top Fed], Surface Mounted

Catalog No P1C100BT26CH01
Designation LP-1

Qty	List of Materials
1	60A, 2P BAB Main Breaker
21	Padlockable Lockoff Device
4	20A, 1P BAB Branch Breaker
16	15A, 1P BAB Branch Breaker
1	30A, 2P BAB Branch Breaker
8	1P BAB Branch Provision Only
1	Copper Main Bus, 100 Amps
1	Std. Bolted Cu Ground Bar (Cu Cable Only)
1	Panel Nameplate - White with Black Letters
1	Type 1 Enclosure: EZB2036R
1	EZ Trim, Door in Door, Concealed Hardware: EZT2036S



General Information (Section 1 of 1)

Service Voltage: 120/240V 1Ph 3W **Enclosure:** Type 1
Bus Rating & Type: 100A Copper **Neutral Rating:** 100A
Ground Bar: Std. Bolted Copper, Cu cable only
S.C. Rating: 10k A.I.C. Fully Rated

Main Device Type: Main Breaker - Top Cable Entry
Main Terminals: Mechanical - (1) #8-1/0 (Cu/Al)
Neutral Terminals: Mechanical - (1) #14-1/0 (Cu/Al)
Box Catalog No.: EZB2036R
Trim: EZ Trim, Door in Door, Concealed Hardware (EZT2036S)

Surface Mounted

Box Dimensions: 36.00" [914.4mm]H x 20.00" [508.0mm]W x 5.75" [146.1mm]D
Min. Gutter Size: Top = 5.5" [139.7mm] Bottom = 5.5" [139.7mm]
 Left = 6.0" [152.4mm] Right = 6.0" [152.4mm]

Panel ID Nameplate: (1) LP-1
Type: Plastic, adhesive-backed (2) 120/240V 1Ph 3W
Color: White with Black Letters (3)

UL *****Non-Interchangeable Main Device*****

Trim Lock: Standard Lock & Key (Keyed WEM2)
 Circuit Directory: Plastic Sleeve with Card
 Main Circuit Breaker Trip Type: Thermal-Magnetic.
 Seismic Label (IBC/CBC Seismic Qualified).
 Heat Loss - Watts (Est.) = 50
 Weight - lbs (Est.) = 96
 Wire shall be based on the ampacity of 75°C rated conductors unless otherwise indicated.

Device Modifications:

Ref #	Description
1256C41G05	Padlockable Lockoff
Ckt #: 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22	

Branch Devices						
Qty	Poles	Trip	Frame	Amps	kAIC	
4	1	20	BAB	100	10	
16	1	15	BAB	100	10	
1	2	30	BAB	100	10	
8	1		PROV			
Main Devices						
Qty	Poles	Trip	Frame	Amps	kAIC	
1	2	60	BAB	100	10	

Notes:

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PREPARED BY SHAUN HOPPE	DATE 3/1/2023	Eaton			
APPROVED BY	DATE	JOB NAME EF1# 93134			
VERSION 1.0.0.57		DESIGNATION LP-1	DRAWING TYPE Customer Approval		
NEG-ALT Number D4TD0228X3K1-0000	REVISION 0	DWG SIZE A	G.O.	ITEM	SHEET 1 of 1




Detail Bill of Material

Project Name: EFI# 93134
 General Order No:

Item No.	Qty	Product	Description
1	1	Transfer Switch	<p>G03AUSA31600NGXC, 11BE, 40TB 119M, 134</p> <p>Product : Series 300 Catalog Number : G03AUSA31600NGXC, 11BE, 40TB, 119M, 134 Service Voltage / Hz : 480V/60Hz Optional Accessories : 134, 11BE, 40TB, 119M Bypass Isolation : Not Applicable Product Description : 300 Series, Automatic Service Entrance Transfer Switch No. of Switched Poles : 3 Neutral Configuration : Solid [A] Frame = G, Switch Rating = 1600 Series = 300 Enclosure : 1(C)-UL Type 1 Enclosure Service : Three Phase, 4-wire</p> <p>11BE Adds the following features to the Group G controller: (1) Serial RS-485 Modbus Communications (2) Multi-Schedule Engine Exerciser (3) a 300 Entry Event Log and (4) a common alarm output function. When applied on 3-phase systems it also enables: (1) 3-Phase Emergency Source VLL sensing (2) Phase Rotation Monitoring (3) Emergency Source VLL Unbalance Monitoring.</p> <p>40TB Normal and Emergency Reversed (Available on all frames and sizes)</p> <p>119M Energy Reducing Maintenance Switch (ERMS) ERMS lowers the instantaneous pickup setting, utilizes a faster acting instantaneous trip function, or activates an alternate set of trip settings on a breaker to provide reduced arcflash incident energy. To be used on service entrance rated switches containing Square D breakers with MicroLogic 5.0/6.0 P/H trip units Customer is responsible for all trip unit settings.</p> <p>134 100% Rated Breaker</p>

Comments & Clarifications

Product : Series 300
 Catalog Number : G03AUSA31600NGXC,11BE,40TB,119M,134
 Service Voltage / Hz : 480V/60Hz
 Optional Accessories : 134,11BE,40TB,119M
 Bypass Isolation : Not Applicable
 Product Description : 300 Series, Automatic Service Entrance Transfer Switch
 No. of Switched Poles : 3
 Neutral Configuration : Solid [A]
 Frame = G,
 Switch Rating = 1600
 Series = 300
 Enclosure : 1(C)-UL Type 1
 Enclosure Service : Three Phase, 4-wire
 11BE
 Adds the following features to the Group G controller: (1) Serial RS-485 Modbus Communications (2) Multi-Schedule Engine Exerciser (3) a 300 Entry Event Log and (4) a common alarm output function. When applied on 3-phase systems it also enables: (1) 3-Phase Emergency Source VLL sensing (2) Phase Rotation Monitoring (3) Emergency Source VLL Unbalance Monitoring.
 40TB Normal and Emergency Reversed (Available on all frames and sizes)
 119M
 Energy Reducing Maintenance Switch (ERMS) ERMS lowers the instantaneous pickup setting, utilizes a faster acting instantaneous trip function, or activates an alternate set of trip settings on a breaker to provide reduced arc flash incident energy. To be used on service entrance rated switches containing Square D breakers with MicroLogic 5.0/6.0 P/H trip units Customer is responsible for all trip unit settings.
 134 100% Rated Breake

The information on this document is created by Eaton Corporation. It is disclosed in confidence and it is only to be used for the purpose in which it is supplied.	PREPARED BY SHAUN HOPPE		DATE 3/1/2023		 <small>Powering Business Worldwide</small>	
	APPROVED BY		DATE		JOB NAME EFI# 93134	
	VERSION 1.0.0.0		TYPE NSP2		DRAWING TYPE Customer Appr.	
NEG-ALT Number D4TD0228X3K1-0000	REVISION 0	DWG SIZE A	G.O.	ITEM	SHEET 1 of 1	

The ASCO Service Entrance Power Transfer Switch combines automatic power switching with the disconnecting, grounding, and bonding required for use as service entrance equipment. It meets all National Electrical Code® requirements for service entrance use.



ASCO SERIES 300
SE Rated 800 amperes Type 1 enclosure



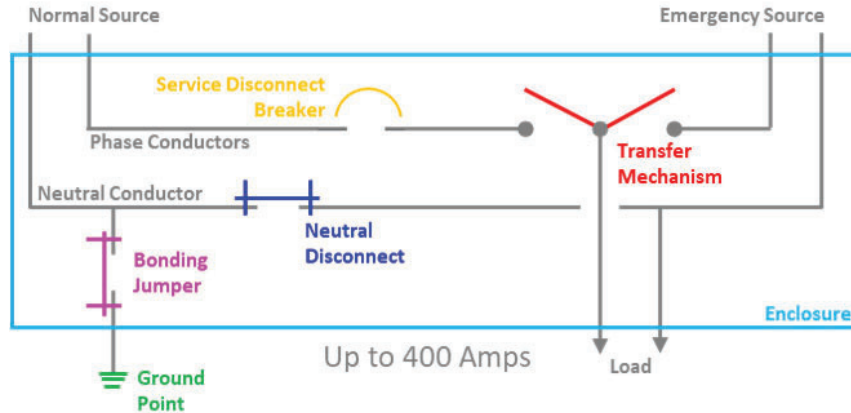
ASCO SERIES 300
SE Rated 200 amperes in Type 3R enclosure

Product Features:

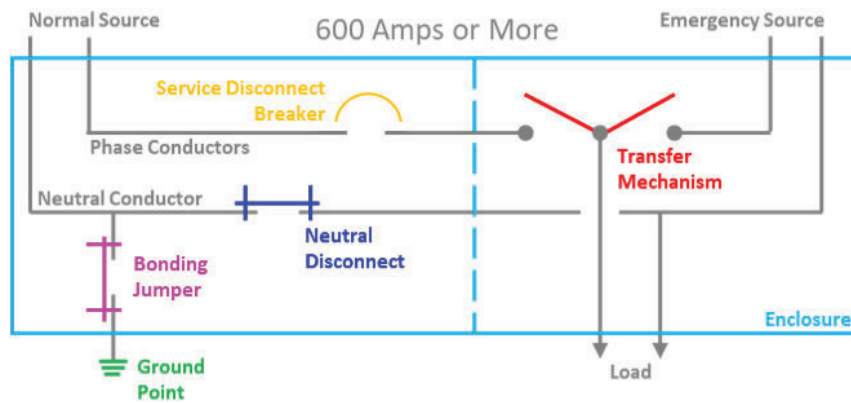
- Sizes available from 70 - 3000 amps, 600 VAC, 50 or 60 Hz, single or 3-phase
- 70 - 400 Ampere listed to UL 1008
- 600 - 3000 Ampere listed to UL 891
- Automatic Transfer Switch is listed to UL 1008 for total system loads
- Silver plated copper ground and neutral bus with solderless screw type terminals
- Ground fault trip protection provided on 1000 amps and above
- Available with solid or switched neutral

Construction

Products 400 amperes or less, utilize a single enclosure, including a service disconnect circuit breaker, as well as the transfer switch and grounding and bonding provisions.



Products 600 amperes and above provide a service equipment section containing the service disconnect circuit breaker as well as grounding and bonding provisions. A second section contains the power transfer switch.



For additional detail, see the [interactive 3-D view](#) in the [ASCO Digital Hub](#).

Order Information

To order an ASCO SERIES 300SE Power Transfer Switch, complete the following catalog number:

J	+	03AUS	+	B	+	3	+	0600	+	N	+	GX	+	C
Frame		Product Type		Neutral Code		Phase Poles		Amperes Continuous Rating		Voltage Code		Controller Code		Enclosure
D = 70 - 225 Amp		03AUS = Automatic		A = Solid Neutral		2		0070, 0100, 0150, 0200, 0225 ⁴ , 0250 ⁴ , 0400, 0600, 0800, 1000, 1200, 1600, 2000, 2500, 3000		A ¹ = 115 B ¹ = 120 C = 208 D = 220 E = 230 F = 240 H = 380 J = 400 K = 415 L = 440 M = 460 N = 480 P = 550 Q = 575 R = 600		G = No Optional Accessories GX = Optional Accessories		C = Type 1 (Standard) M = Type 3R Secure Double Door N = Type 4 ² Secure Double Door P = Type 4X ^{6,8} Secure Double Door 304 SS Q = Type 12 ² Secure Double Door R = Type 3RX ^{6,8} Secure Double Door 316 SS S = Type 3RX ^{6,8} Secure Double Door 304 SS V = Type 4X ^{6,8} Secure Double Door 316 SS
J = 150 - 600 ⁷ Amp		03NUS = Non-Automatic		B = Switched Neutral		3								
H = 800 - 1200 Amp		3ADUS = Automatic, Delayed Transition												
G = 1600 - 3000 Amp		3NDUS = Non-Automatic, Delayed Transition												

Notes:

- 115-120 volt available 150-400 amperes for 3AUS, 3NUS only.
- Available for 70-1600 amperes, use type 3R for 2000-3000 ampere applications.
- A solid neutral is provided as standard.
- 200, 225 ampere rated switches suitable for use with copper cable only. Refer to paragraph 310.15 of the NEC for additional information.

- Type 316 stainless steel is the standard. It provides an improved reduction in corrosion of salt and some chemicals. It is the preferred choice for marine environments.
- Available only on switches rated 1600, 2000, 2600 and 3000 amperes.
- J 150-225 ampere for SERIES 3ADUS/3NDUS only.
- Available only on switches rated 70 - 1600 amperes.

Specifications

ASCO SERIES 300SE Power Transfer Switch Dimensions and Shipping Weights

UL Type 1 Enclosure⁴

Switch Rating Amps	Phase Poles	Neutral Code	Dimensions, In. (mm)			Approx. Shipping Weight Lb. (kg)
			Width	Height	Depth	
70, 100, 150, 200, 225	2	A	36 (914)	48 (1219)	13 (330)	400 (185)
	2	B	36 (914)	48 (1219)	13 (330)	410 (189)
	3	A	36 (914)	48 (1219)	13 (330)	410 (189)
	3	B	36 (914)	48 (1219)	13 (330)	430 (198)
150, 200, 225, SERIES 3ADUS/3NDUS Only	2	A	36 (914)	48 (1219)	13 (330)	400 (185)
	2	B	36 (914)	48 (1219)	13 (330)	408 (188)
	3	A	36 (914)	48 (1219)	13 (330)	408 (188)
	3	B	36 (914)	48 (1219)	13 (330)	420 (193)
250 ¹ , 400 ¹	2	A	42 (1067)	48 (1219)	15.5 (394)	420 (193)
	2	B	42 (1067)	48 (1219)	15.5 (394)	430 (198)
	3	A	42 (1067)	48 (1219)	15.5 (394)	430 (198)
	3	B	42 (1067)	48 (1219)	15.5 (394)	450 (207)
600 ¹	2	A	38 (965)	91 (2311)	28 (711)	860 (396)
	2	B	38 (965)	91 (2311)	28 (711)	870 (401)
	3	A	38 (965)	91 (2311)	28 (711)	870 (401)
	3	B	38 (965)	91 (2311)	28 (711)	880 (405)
800 ¹	2	A	38 (965)	91 (2311)	28 (711)	1460 (673)
	2	B	38 (965)	91 (2311)	28 (711)	1470 (677)
	3	A	38 (965)	91 (2311)	28 (711)	1470 (677)
	3	B	38 (965)	91 (2311)	28 (711)	1480 (682)
1000 ¹ , 1200 ¹	2	A	38 (965)	91 (2311)	48 (1218)	1460 (673)
	2	B	38 (965)	91 (2311)	48 (1218)	1470 (677)
	3	A	38 (965)	91 (2311)	48 (1218)	1470 (677)
	3	B	38 (965)	91 (2311)	48 (1218)	1480 (682)
1600 ¹ , 2000 ¹	3	A	38 (965)	91 (2311)	48 (1218)	1580 (727)
	3	B	38 (965)	91 (2311)	48 (1218)	1680 (773)
2500 ¹ , 3000 ¹	3	A	38 (965)	91 (2311)	72 (1829)	4590 (2111)
	3	B	38 (965)	91 (2311)	72 (1829)	4690 (2157)

- Notes:**
- Unit is designed for top and bottom cable entry for all services and load.
 - Enclosures for 600 – 3000 amps are freestanding.
 - A space heater accessory 44G is required with all service entrance (Type 3R) switches to help reduce condensation and protect the circuit breaker. It is recommended when environmental enclosures (Type 4, 12) are ordered for installation outdoors. See Optional Accessories page for space heater options (acc. 44G).
 - Dimensional data is approximate and subject to change. Certified dimensions available upon request.

SERIES 300SE External Power Connections Sizes UL-Listed Solderless Screw-Type Terminals

Switch Rating	Ranges of AL-CU Wire Sizes
70, 100, 150, 200 ¹ , 225 ¹	One #14 to 4/0 AWG
150 ¹ , 200 ¹ , 225 ¹ , 250, 400	One #4 AWG to 600 MCM Two 1/0 to 250 MCM
600	Two 1/0 to 600 MCM
800, 1000, 1200	Four 1/0 to 600 MCM
1600, 2000	Six 1/0 to 600 MCM
2500	Twelve 3/0 to 750 MCM
3000	Twelve 3/0 to 750 MCM

- Notes:**
- All SERIES 300SE switches are furnished with a solid neutral plate (unless switched neutral configuration is specified) and terminal lugs.
 - 200 and 225 ampere rated switches for use with copper cable only. Refer to paragraph 310.15 of the NEC for all additional information.
 - J 150-225 ampere for SERIES 3ADUS/3NDUS only.
 - Use wire rated 75 degrees minimum for all power connections.
 - Refer to the outline drawing for maximum power cable connections for circuit breaker.

UL Type 3R Enclosure⁴

Switch Rating Amps	Phase Poles	Neutral Code	Dimensions, In. (mm)			Approx. Shipping Weight Lb. (kg)
			Width	Height	Depth	
70, 100, 150, 200, 225	2	A	36 (914)	48 (1219)	16 (406)	500 (232)
	2	B	36 (914)	48 (1219)	16 (406)	520 (241)
	3	A	36 (914)	48 (1219)	16 (406)	520 (241)
	3	B	36 (914)	48 (1219)	16 (406)	530 (246)
150, 200, 225, SERIES 3ADUS/3NDUS Only	2	A	41 (1041)	95.5 (2424)	33 (838)	500 (232)
	2	B	41 (1041)	95.5 (2424)	33 (838)	520 (241)
	3	A	41 (1041)	95.5 (2424)	33 (838)	520 (241)
	3	B	41 (1041)	95.5 (2424)	33 (838)	530 (246)
250 ¹ , 400 ¹	2	A	42 (1067)	48 (1219)	18 (487)	500 (232)
	2	B	42 (1067)	48 (1219)	18 (487)	520 (241)
	3	A	42 (1067)	48 (1219)	18 (487)	520 (241)
	3	B	42 (1067)	48 (1219)	18 (487)	530 (246)
600 ¹	2	A	41 (1041)	95.5 (2425)	33 (838)	1200 (555)
	2	B	41 (1041)	95.5 (2425)	33 (838)	1220 (564)
	3	A	41 (1041)	95.5 (2425)	33 (838)	1220 (564)
	3	B	41 (1041)	95.5 (2425)	33 (838)	1240 (574)
800 ¹	2	A	38 (965)	91 (2311)	28 (711)	1520 (703)
	2	B	38 (965)	91 (2311)	28 (711)	1540 (712)
	3	A	38 (965)	91 (2311)	28 (711)	1540 (712)
	3	B	38 (965)	91 (2311)	28 (711)	1580 (731)
1000 ¹ , 1200 ¹	2	A	38 (965)	91 (2311)	48 (1218)	1520 (703)
	2	B	38 (965)	91 (2311)	48 (1218)	1540 (712)
	3	A	38 (965)	91 (2311)	48 (1218)	1540 (712)
	3	B	38 (965)	91 (2311)	48 (1218)	1580 (731)
1600 ¹ , 2000 ¹	3	A	38 (965)	91 (2311)	48 (1218)	2200 (1018)
	3	B	38 (965)	91 (2311)	48 (1218)	2240 (1036)
2500 ¹ , 3000 ¹	3	A	38 (965)	91 (2311)	72 (1829)	5280 (2479)
	3	B	38 (965)	91 (2311)	72 (1829)	5380 (2475)

Extended Warranties for SERIES 300SE Transfer Switches (3AUS/3NUS/3ADUS/3NDUS)

Description
1 Year Extension (Total of 3 Years)
2 Year Extension (Total of 4 Years)
3 Year Extension (Total of 5 Years)

- Notes:**
- Standard warranty is (24) months, 2 years from date of shipment, extended warranty is in addition to the two years, for a total of 3, 4 or 5 years, except where the warranty period for the circuit breaker shall be limited to 24 months from date of shipment from ASCO.
 - Refer to Publication 3223 for warranty terms and conditions.

SERIES 300SE AIC Breaker Rating¹

Switch Rating	AIC Rating (KA)	Voltage
70, 100, 150, 200, 225	25,000	480
150, 200, 225, SERIES 3ADUS/3NDUS Only	35,000	480
250, 400, 600	35,000	480
800	65,000	480
1000, 1200	50,000	480
1600, 2000	65,000	480
2500, 3000	100,000	480

- Notes:**
- Refer to SERIES 300 Publication 1195 for switch ratings.



Standard designs for commercial and light industrial facilities that are simple to procure, install, and commission.

Value Prop:

ASCO Transfer Switches make backup power possible. They enhance power availability by transferring electrical loads to alternate sources of power. From simple backup solutions to mission-critical facilities, transfer switches connect backup power to enhance safety and sustain operations.

Questions to Ask:

- Do you have a Generator?
- If so, do you have an existing switch?
- How old it is?
- Can we look at it?
- If yes, and in need of a Transfer Switch, ask the following:
Service Entrance, Non-Service Entrance, amperage, voltage, enclosure type, number of switched poles, open, closed or delayed transition, start up required?

Typical Applications

- Reliably transfer loads between two or more power sources
- Service and maintain equipment without disrupting power to loads
- Reduce equipment space requirements
- Transfer loads without impacting downstream equipment
- Add capability for a “backup-to-the-backup”



- Outpatient Healthcare Facilities
- Small & Midsize Businesses
- Light Industrial Applications
- Integrated & Stand-Alone Quick Connects

[ASCO Transfer Switch Overview Download](#)

Transfer switch models differ by type of operation:



Automatic

Automatic models switch loads to emergency power and back again whenever outages occur, without human intervention.



Non-Automatic

Non-Automatic models use operator initiated, local or remote electrical controls to transfer loads on command.



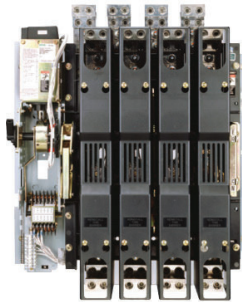
Manual

The simplest type, manual transfer switches require a person to operate a mechanical switching mechanism

Transfer Switch Components

1 Enclosure

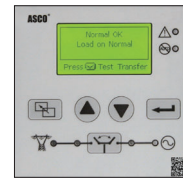
Available in a range of UL-rated types, rugged enclosures protect equipment and ensure promote reliability for a variety of indoor and outdoor environments.



2 Transfer Mechanism

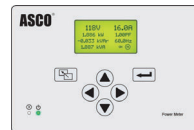
Electrically operated and mechanically held, solenoid-powered operating mechanisms reliably transfer load quickly for even the most demanding applications

[ASCO Digital Binder Download](#)



3 Controller

Electronic controller stores operating criteria, senses electrical conditions, executes transfer sequences, and tracks operational data.



4 Communications & Metering

From simple indicators to remote annunciators, from real-time monitoring and control to interfacing building automation systems, communication features increase usability and system reliability.

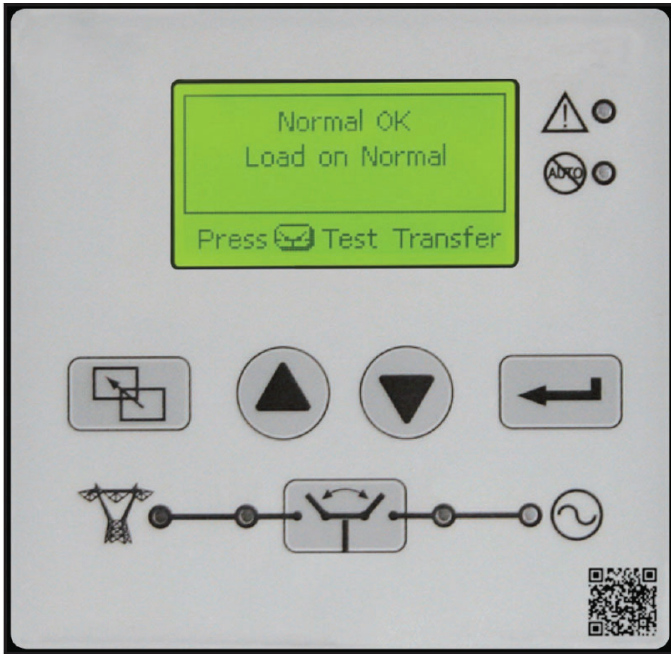
Accessories	Part No.	Description
1UP	935149	Provides internal ride-through power for the controller to ensure consistent communication while awaiting generator start up
18RX	935148	Provides dry contact outputs to signal the acceptability of each source
11BE	935147	Bundle provides RS-485 Serial Modbus Comms, Advanced Engineer Exerciser Scheduler, 300 Entry Historical Event Log, Alarm Output
72EE	948551	Provides Ethernet communication module that allows for remote monitoring via a built webpage, Modbus TCP, SNMP, or email alerts
44G	K613127-003	Provides internally powered strip heater to prevent condensation 208V - 399V
44G	K613127-002	Provides internally powered strip heater to prevent condensation 400V - 600V
125A	125A	Request at bid - Seismic Rating
135L	135L - Power Meter 5210	Request at bid - 5210 Power Meter added to load side of switch which displays current, power, energy, and THD

[MyASCOPower](#)

ASCO Power Technologies
160 Park Avenue, Florham Park, NJ 07932

www.ascopower.com
customer@ascopower.com • 1-800-800-ASCO (2726)
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The Group G Controller has enhanced capabilities for dependable operation in a wide range of applications.



Control and Display Panel

The Group G Controller's easy-to-navigate 128 x 64 graphical LCD display with keypad provides LED indicators for switch position, source availability, not-in-auto mode, and alert condition. It also provides test and time delay bypass soft keys.

Features

- Intuitive, easy-to-navigate 128 x 64 graphical LCD display with soft keypad and provides six LED indicators
- Switch Position (green for normal, red for emergency LED)
- Source Availability (green for normal, red for emergency LED)
- “Not In Auto” (amber LED)
- Common Alarm (amber LED)
- Integrated display is self-contained requires no other components for effective operation
- Allows for open or delayed transition for both automatic and non-automatic configurations
- An integrated, multilingual, user interface for configuration and monitoring for application flexibility
- Multiple source-sensing capabilities for voltage and under frequency
- Optional current card provides current sensing without an external metering device

ASCO Group G Controller

Standard Selectable Features

- Inphase monitor to transfer motor loads, without any intentional off time, to prevent inrush currents from exceeding normal starting levels
- Engine exerciser to automatically test backup generator each week, with or without load 20 minutes not adjustable, (advanced multi-schedule exerciser available as part of optional 11BE bundle)
- Commit to transfer
- Selective load disconnect circuit to provide a pre-transfer and/or post-transfer signal when transferring from emergency to normal and/or normal to emergency
- Re-transfer to normal through soft keys on user interface permits selection of “manual” or “automatic” operation
- 60Hz or 50Hz selectable switch. Three-/single- phase selectable switch

Voltage, Frequency, and Current Sensing Features

- 3 phase sensing on the Normal source and single phase sensing on the Emergency Source (3 phase Emergency sensing optional)
- Under and over voltage and frequency settings on normal and emergency
- True RMS voltage sensing with +/-1% accuracy
- Frequency sensing accuracy is +/- 0.1Hz
- Voltage and frequency parameters adjustable in 1% increments
- Selecting settings: single or three phase voltage sensing on normal, and single phase sensing on emergency; 50 or 60Hz. 3-phase voltage unbalance on normal (Emergency unbalance optional)
- Load current sensing card (optional)

Remote Control Features

- External inputs for connecting
- Remote test switch
- Remote contact for test or peak shaving applications - if emergency source fails, the switch will automatically transfer back to normal source if acceptable
- Inhibit transfer to emergency
- Remote time delay bypass switch emergency to normal

Time Delays

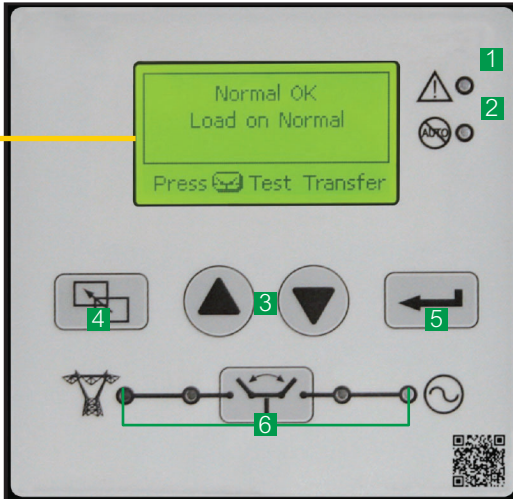
- Engine start time delay – delays engine starting signal to override momentary normal source outages, adjustable from 0 to 6 seconds, (Feature 1C)
- Emergency source stabilization time delay to ignore momentary transients during initial generator set loading, adjustable from 0 to 4 seconds (Feature 1F)
- Re-transfer to normal time delay with two settings (Feature 3A)
 - Power failure mode – 0 to 60 minutes
 - Test mode – 0 to 10 hours
- Unloaded running time delay for engine cooldown, adjustable from 0 to 60 minutes (Feature 2E)
- Pre- and post-signal time delay for selective load disconnect with a programmable bypass on source failures, adjustable from 0 to 5 minutes, (specify ASCO optional Accessory 31BG)
- Delayed transition load disconnect time delay, adjustable from 0 to 5 minutes (3ADTS/3NDTS configuration only)

Power Knowledge



Timing Delays
for ATS Transition
Modes

ASCO Group G Controller Power Control Center



Door-Mounted Control & Display Panel

- 1 Common Alarm
- 2 Not In Auto Indicator
- 3 Scroll, Up/Down Arrows
- 4 Escape Key
- 5 Enter Key
- 6 LED Source Availability and Switch Position Indicators Transfer / Time Delay Override control push-button

Status

Control Status

Source Status

Normal		Emergency	
V _a	207V	V _a	207V
V _b	206V		
V _c	207V		
	60.0Hz		60.0Hz

Normal	Load	Emerg.
V _a 207V %	I _a 200A	
V _b 204V %	I _b 198A	
V _c 205V %	I _c 200A	V _a 207V
	60.0Hz	60.0Hz

Alarm Status

Controller Information

Settings

Main Menu/ Settings

Settings/ Engine Exerciser

Settings/General/ Communications

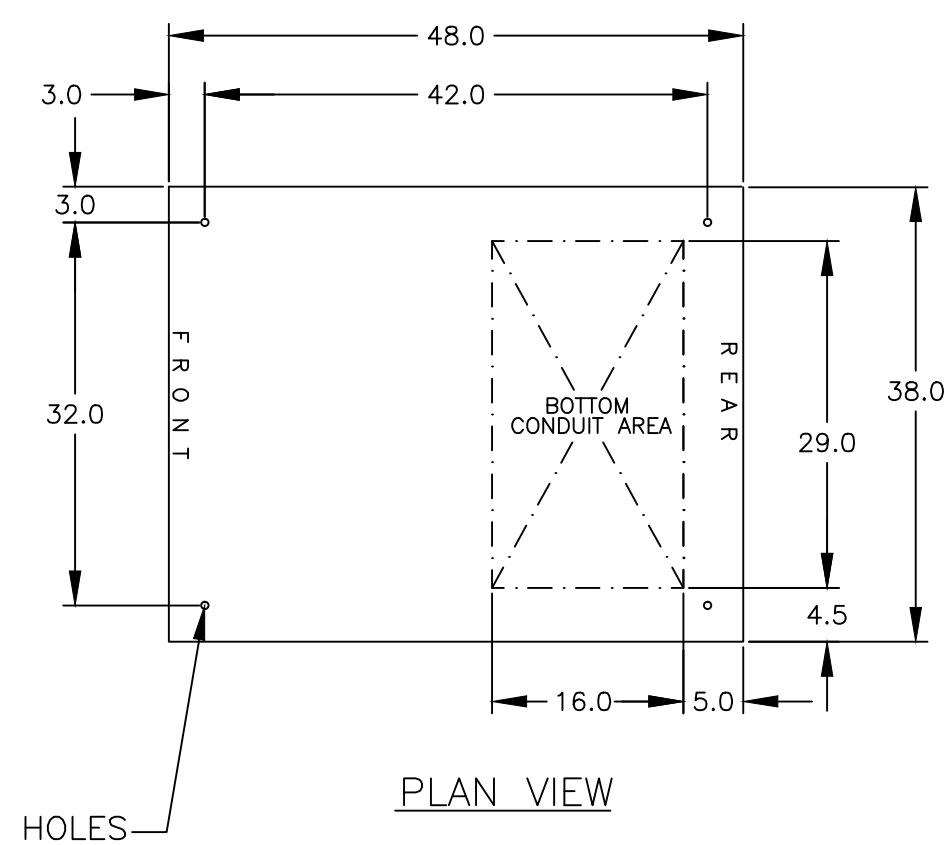
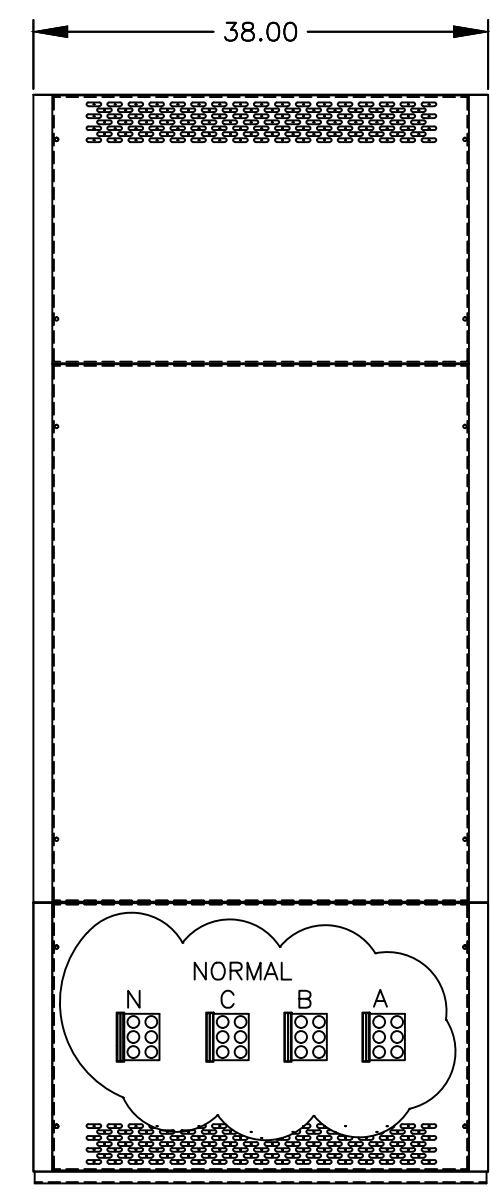
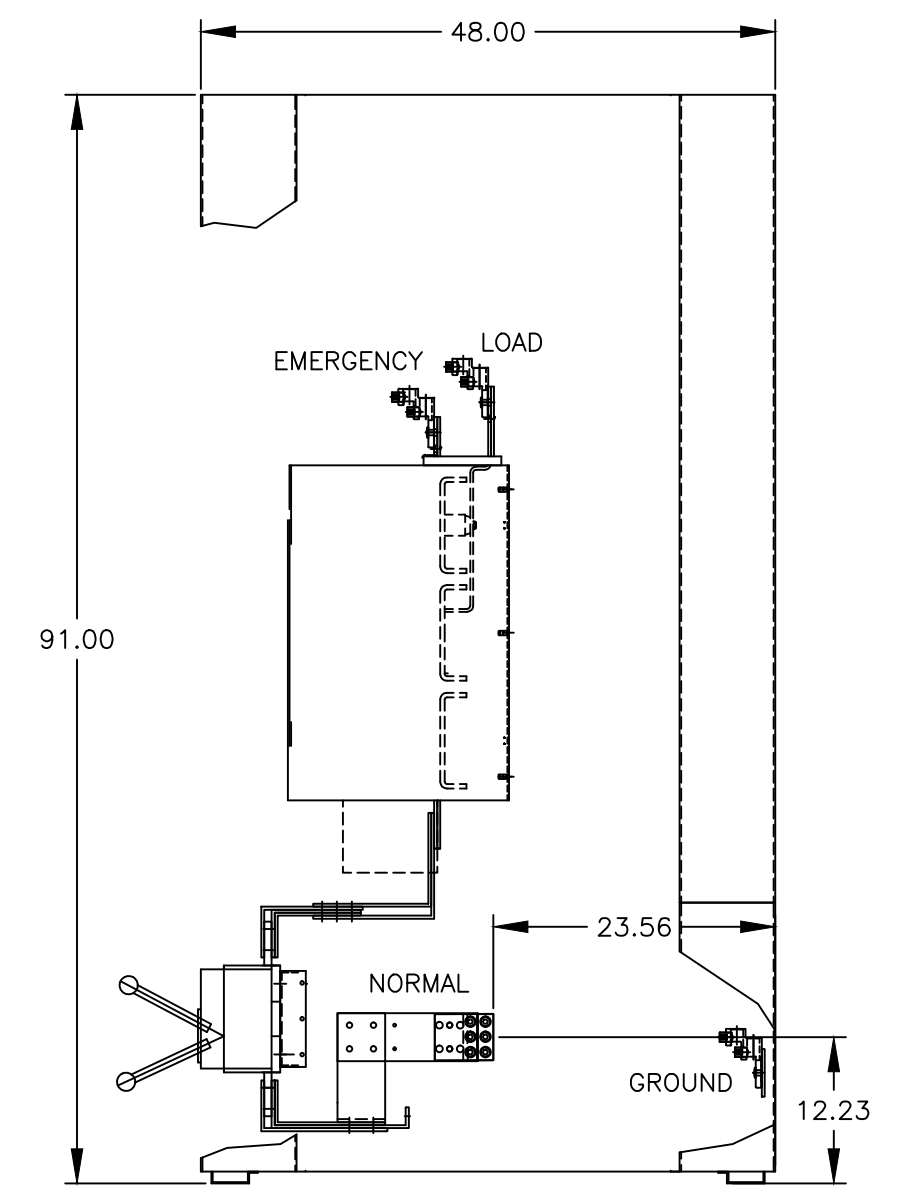
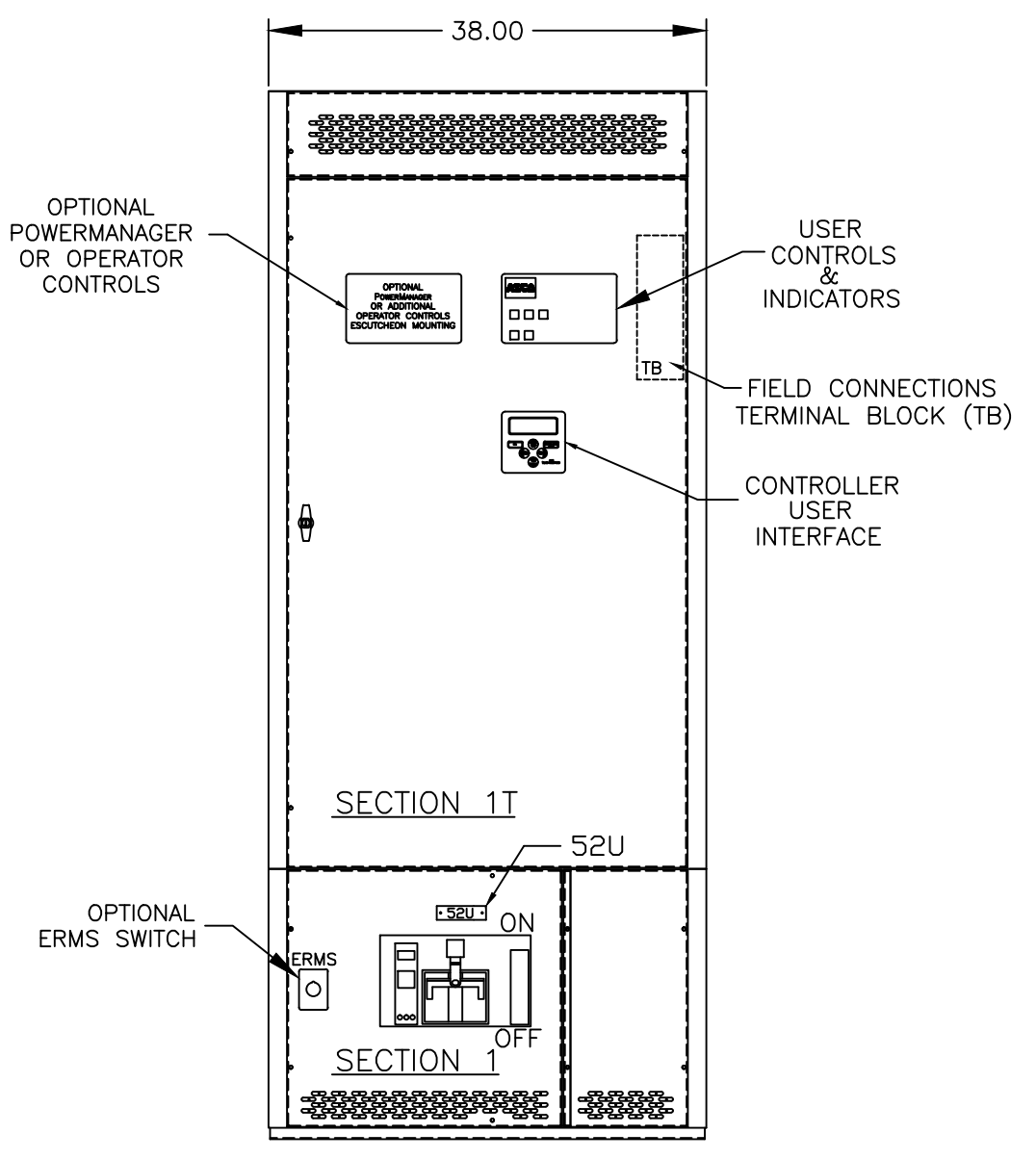
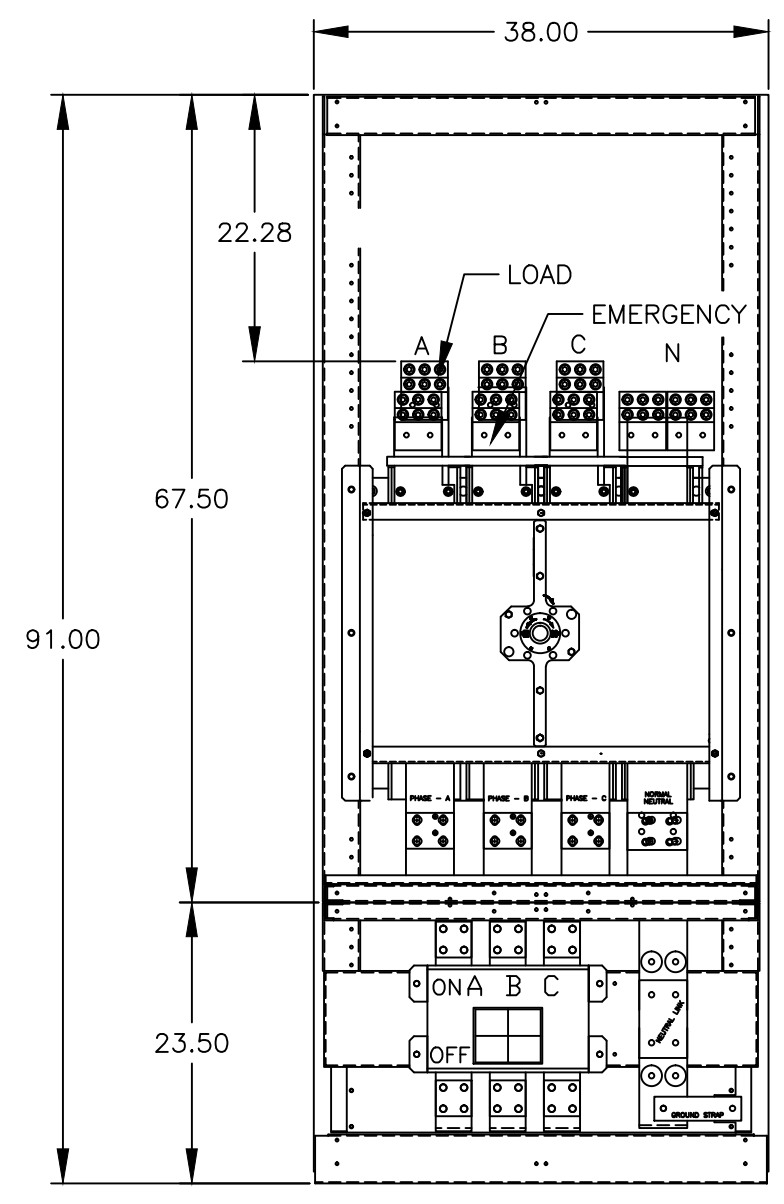
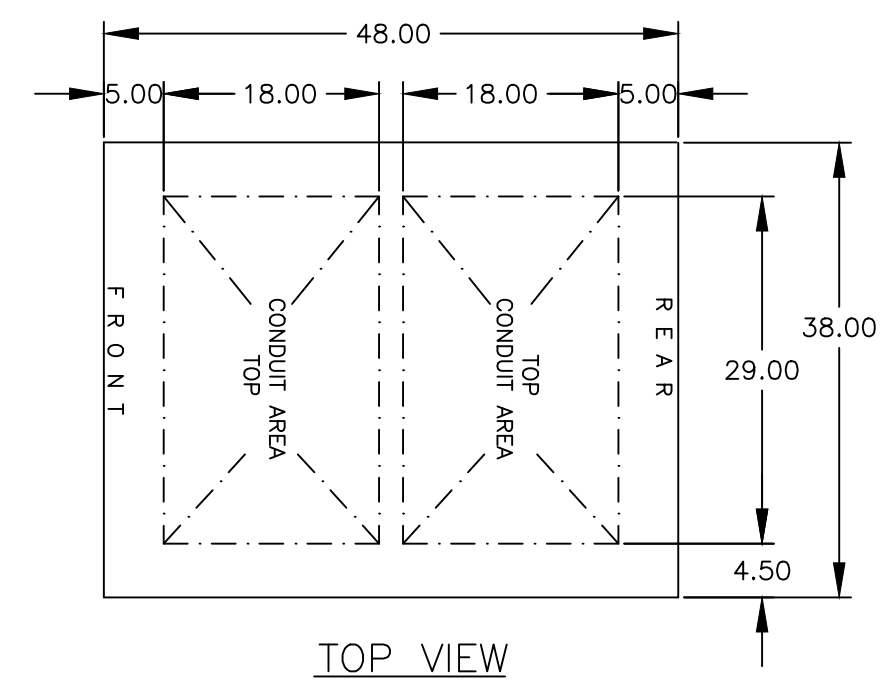
Settings/General/ Common Alarms

Main Menu/ Event Logging

Main Menu/ Statistics

Main Menu/ Factory/Diagnostics

Main Menu/ About



GENERAL NOTES

- FLOOR MOUNTED ENCLOSURE.
TYPE 1 CONSTRUCTED FROM CODE GAUGE STEEL.
FINISH: ANSI 61 GRAY POLYESTER SEMI GLOSS ELECTROSTATIC POWDER.
- DOORS EQUIPPED WITH KEY LOCKABLE HANDLE AND CAPTIVE SCREWS.
- DESIGNED FOR FRONT & REAR ACCESS.
- RECOMMENDED CLEARANCES: FRONT: 36" REAR: 36"
- SECTION 1 & SECTION 1T SHIP AS ONE UNIT. NO SHIPPING SPLIT.

SYSTEM NOTES

- SYSTEM RATING: 1000 AMPS, 1200 AMPS, 1600 AMPS, 2000 AMPS.
SHORT CIRCUIT RATING: 65,000 RMS SYM @ 480V.
THE EMERGENCY SOURCE MUST BE PROTECTED BY A REMOTE OVERCURRENT PROTECTION DEVICE AS LISTED ON THE MARKINGS ON THE TRANSFER SWITCH.
- ALL BUS IS SILVER-PLATED COPPER, BASED ON 1000A PER SQ. IN. DENSITY.
- GROUND: 20% RATED.
- NEUTRAL: 100% RATED.
- APPLICABLE LABEL(S): U.L. 891, SUITABLE ONLY FOR USE AS SERVICE EQUIPMENT.

TRANSFER SWITCH

- G FRAME AUTOMATIC TRANSFER SWITCH 1000A - 2000A.
- TRANSFER SWITCH RATING: 1000 AMPS, 1200 AMPS, 1600 AMPS AND 2000 AMPS.
SHORT CIRCUIT RATING WHEN PROTECTED BY A CIRCUIT BREAKER
TIME RESPONSE, MAXIMUM 0.05 SECONDS: 85,000 RMS SYM @ 480V.
- A FULL RATED NEUTRAL CONNECTION FOR EACH SOURCE AND THE LOAD IS OPTIONAL.
WHEN PROVIDED IT IS IN ONE OF THE FOLLOWING FORMATS.
A. SOLID NEUTRAL
B. SWITCHED NEUTRAL POLE
C. OVERLAPPING NEUTRAL POLE
- UL 1008

CIRCUIT BREAKER: ITEM 52U

- SQUARE "D" 80% RATED TYPE 'RJF', 3000AF/1000AT, 3000AF/1200AT, 3000AF/1600AT OR 3000AF/2000AT STATIONARY MOUNTED, MANUALLY OPERATED, WITH LONG DELAY, SHORT DELAY, INSTANTANEOUS AND GROUND FAULT TRIP SETTINGS.
SHORT CIRCUIT RATING: AIC 65,000 RMS SYM @ 480V.
- OPTIONAL ENERGY REDUCTION MAINTENANCE SETTING SYSTEM MAY BE SUPPLIED.
- OPTIONAL 100% RATED
- U.L. 489

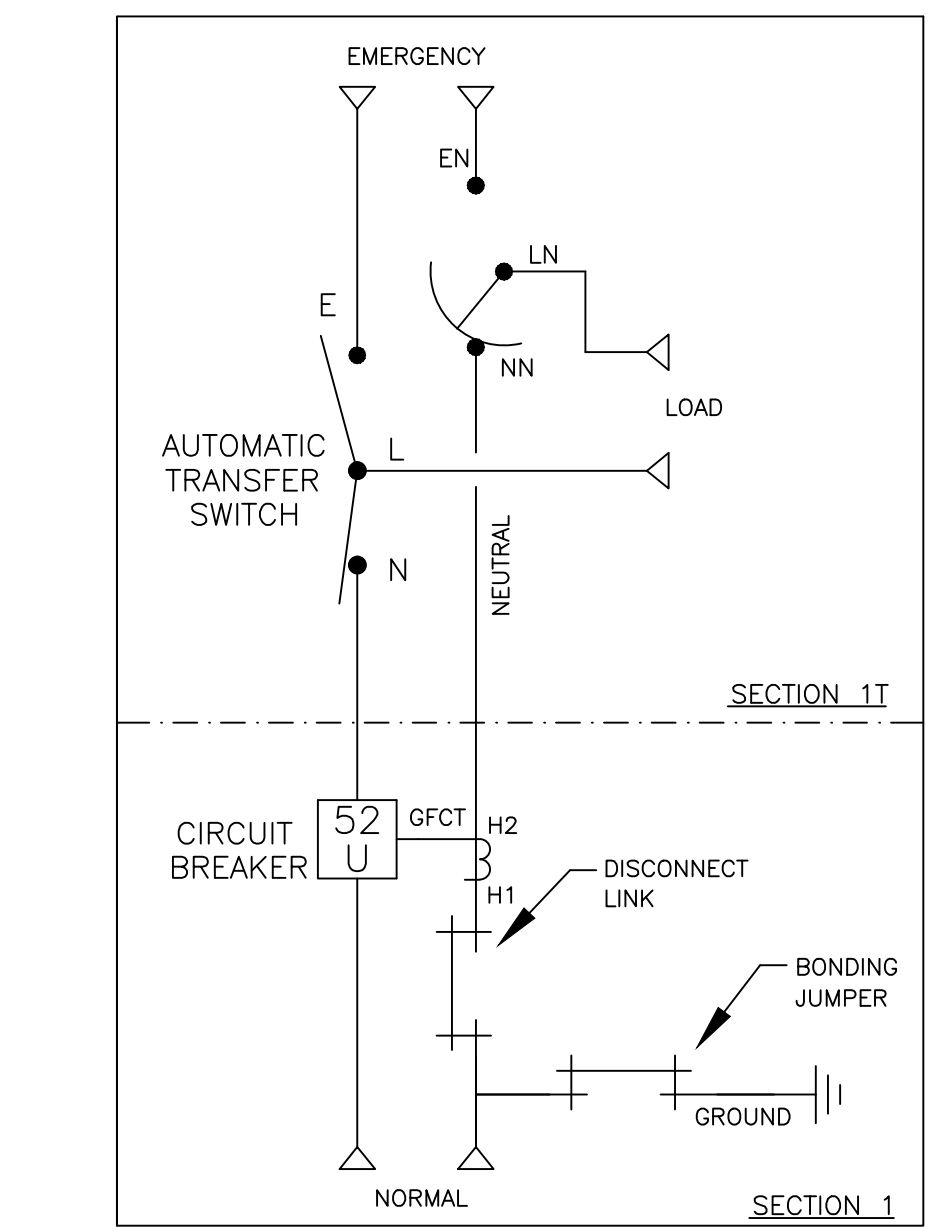
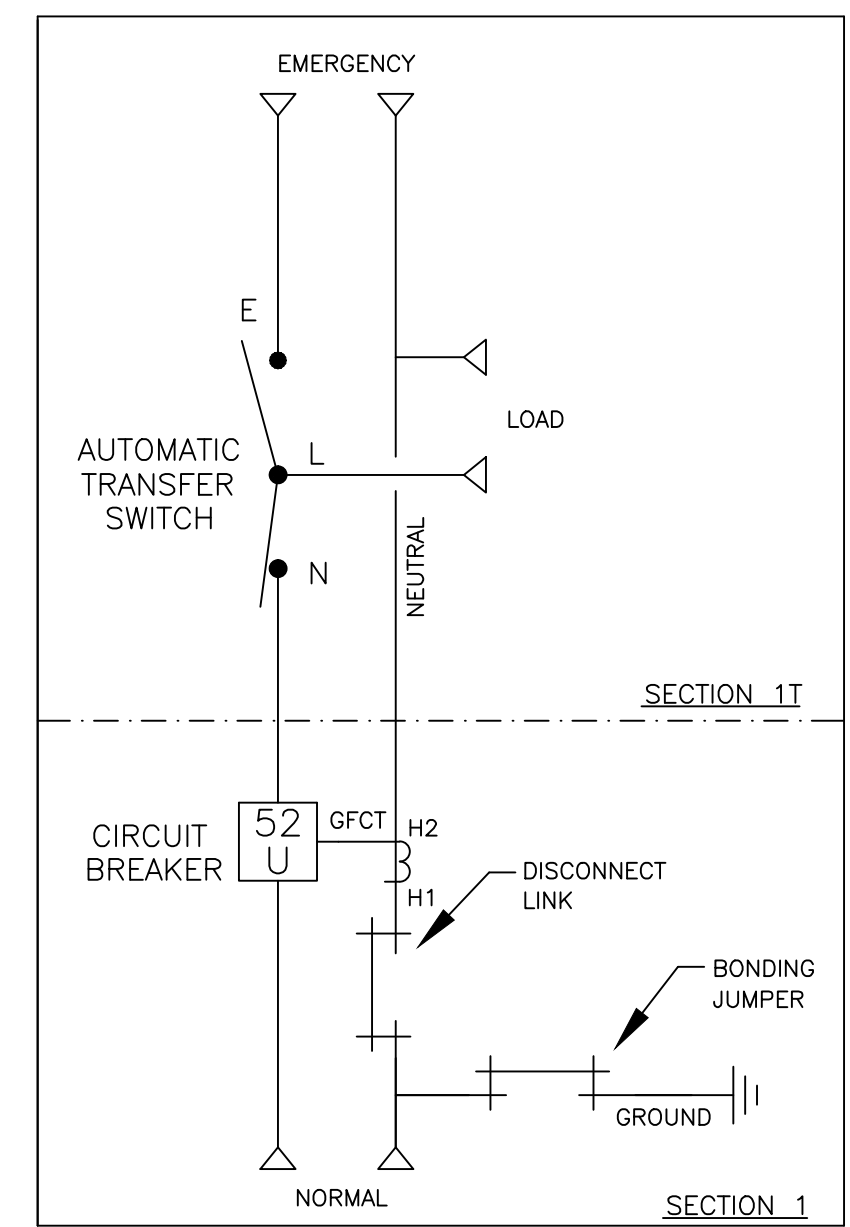
TERMINATIONS 1000A - 1200A

- SUPPLIED WITH MECHANICAL (SCREW TYPE) LUGS FOR CU/AL CABLE.
NORMAL: (4) 1/0 - 600MCM PER PHASE & NEUTRAL
LOAD: (4) 1/0 - 600MCM PER PHASE & NEUTRAL
EMERGENCY: (4) 1/0 - 600MCM PER PHASE & NEUTRAL
GROUND: (12) 1/0 - 600MCM
A. SUITABLE WIRE BENDING SPACE IS PROVIDED AS PER NEC.
- OPTIONAL LUGS MAY BE SUPPLIED.

TERMINATIONS 1600A - 2000A

- SUPPLIED WITH MECHANICAL (SCREW TYPE) LUGS FOR CU/AL CABLE.
NORMAL: (6) 1/0 - 600MCM PER PHASE & NEUTRAL
LOAD: (6) 1/0 - 600MCM PER PHASE & NEUTRAL
EMERGENCY: (6) 1/0 - 600MCM PER PHASE & NEUTRAL
GROUND: (18) 1/0 - 600MCM
A. SUITABLE WIRE BENDING SPACE IS PROVIDED AS PER NEC.
- OPTIONAL LUGS MAY BE SUPPLIED.

ONE LINE DIAGRAMS



E	261842	RG	RN	07/05/16
	SEE ECN			
D	254009	LY	RN	3/31/15
	SEE ECN			
J	275948	NC	RN	11/27/18
	SEE ECN			
H	273067	BCG	RN	6/19/18
	SEE ECN			
G	263909	BCG	RN	10/27/16
	SEE ECN			
F	263084	BCG	RN	9/9/16
	SEE ECN			

PROJECT NAME:		REV. TO SHEET	ECN NO.	BY	APP.	DATE
OUTLINE		MOUNTING				
GAUS 1000A - 2000A, RJF SE BREAKER						
TYPE 1 91 X 38 X 48						
BY	DATE	MANUFACTURING TOLERANCES TO BE IN ACCORDANCE WITH ASCO PROCEDURE MP-1-003. FOR PLASTIC PARTS SEE MP-1-005		ASSEM. REF. NO.	COMPUTER GENERATED DRAWING	
CHECKED	RN	4-30-07			SCALE 1/16" = 1" SIZE DS	
PROJECT APPROVAL			PROPERTY OF ASCO POWER TECHNOLOGIES. USE PERMITTED FOR OUR WORK ONLY. ALL RIGHTS OF DESIGN OR INVENTION ARE RESERVED.		DWG. NO.	
FINAL APPROVAL			ASCO® ASCO POWER TECHNOLOGIES, L.P. FLORHAM PARK, NEW JERSEY 07932 U.S.A.		754577-051	
			DRIVING J	ECN NO. 275948	SHEET	1 OF 1



Control Solutions
PSI

Emergency Power Products Powerful Results

Address: 9900 Twin Lakes Parkway
Charlotte,
NC 28269

Phone: 704-596-5617

Website: www.psicontrolsolutions.com

Email: sales@psicontrolsolutions.com

Generator Docking Station "GTBWM"

Generator Docking Station wall mount offer businesses a means of safely and effectively creating permanent connections to auxiliary and secondary power sources such as portable generator systems. This tap box product is wall-mounted and capable of weathering standard conditions both indoors and outdoors via protection offered by NEMA 3R and NEMA 3RSS 316 stainless steel rated enclosure options.



cETLus Listed to UL standard 1008
200-4000 Amps



PSI Control Solutions, Inc
9900 Twin Lakes Parkway Charlotte,
NC 28269

Phone: 704-596-5617

Website: www.psicontrolsolutions.com

Email: sales@psicontrolsolutions.com

Features

- NEMA 3R ENCLOSURE OR NEMA 3RSS 316 STAINLESS STEEL ENCLOSURE
- ANSI-61 GRAY FOR NEMA 3R
- NEUTRAL AND GROUND INCLUDED
- PILOT LIGHT INDICATION FOR VOLTAGE PRESENT
- RATED THROUGH 600VAC
- 3 OR 4 WIRE
- 3 POLE BREAKER 65KAIC @ 480 VOLTS
- BUS BAR SHALL BE SIZED 1000A/SQ INCH
- LUGS ARE SIZED AT 125% OF RATED AMPS
- 100% TESTED AT FULL VOLTAGE
- OPTIONAL PHASE REVERSAL PROTECTION RELAY
- BOTTOM CAM-LOCK CABLE DOOR CAN NOT BE OPENED UNTIL FRONT DOOR IS UNLOCKED AND OPENED
- CAM-LOCK RECEPTACLES ARE MOUNTED AT AN ANGLE TO HELP WITH CONNECTING THE CABLE TO THE RECEPTACLE

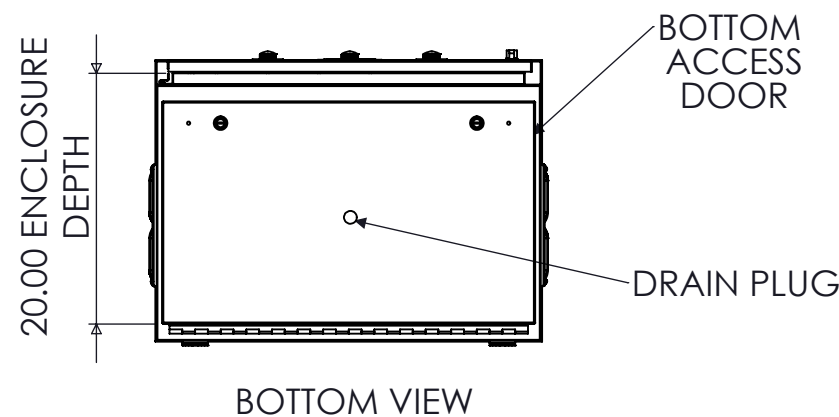
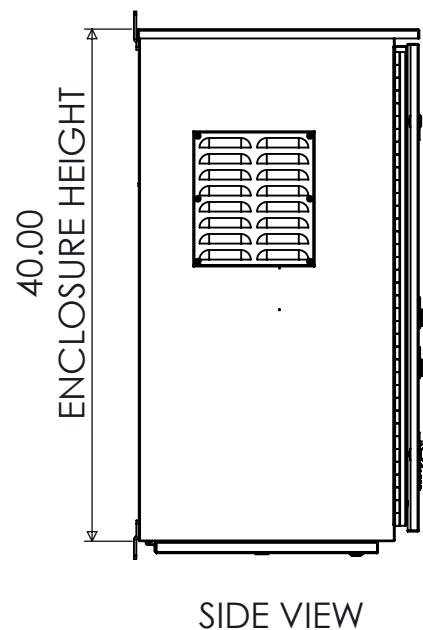
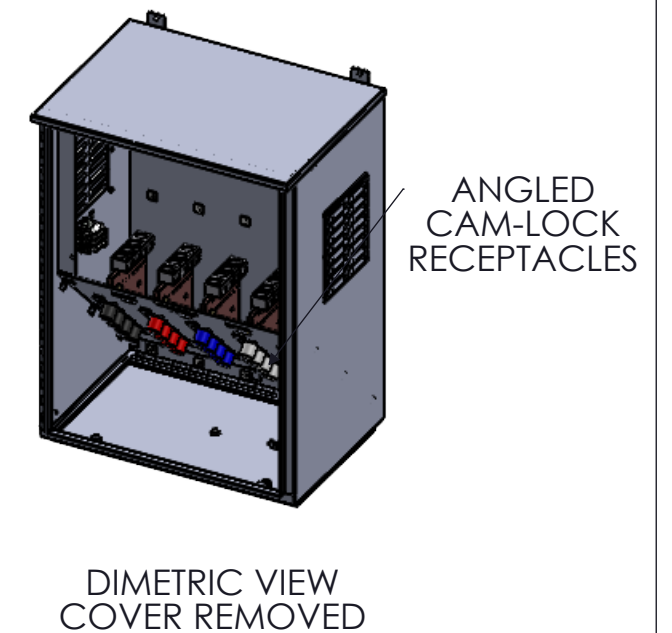
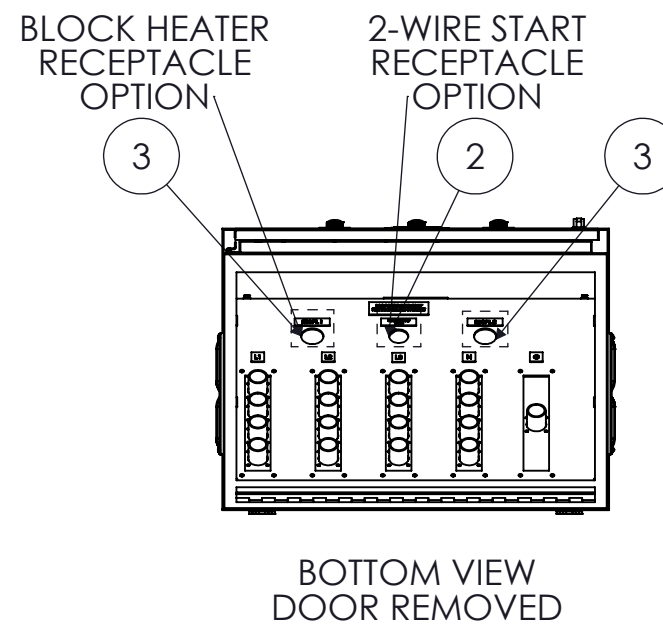
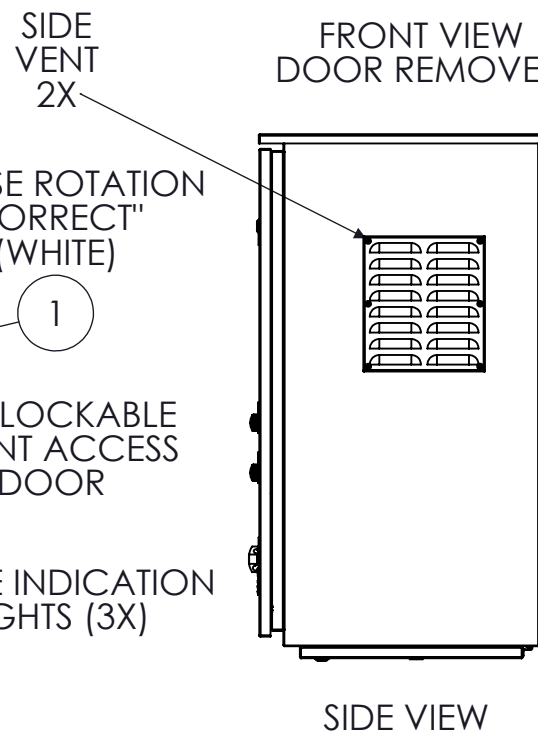
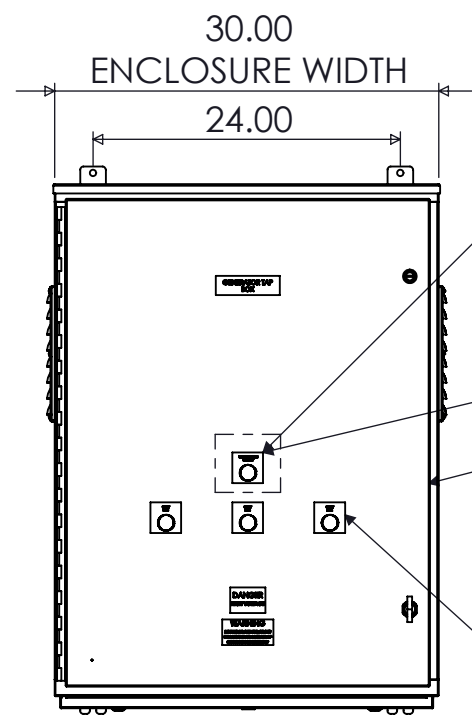
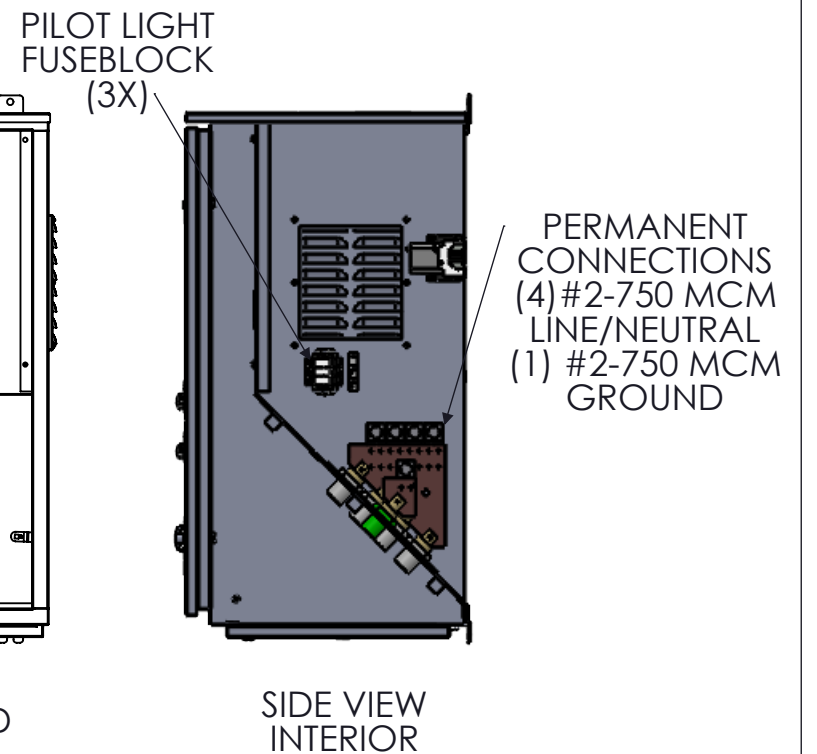
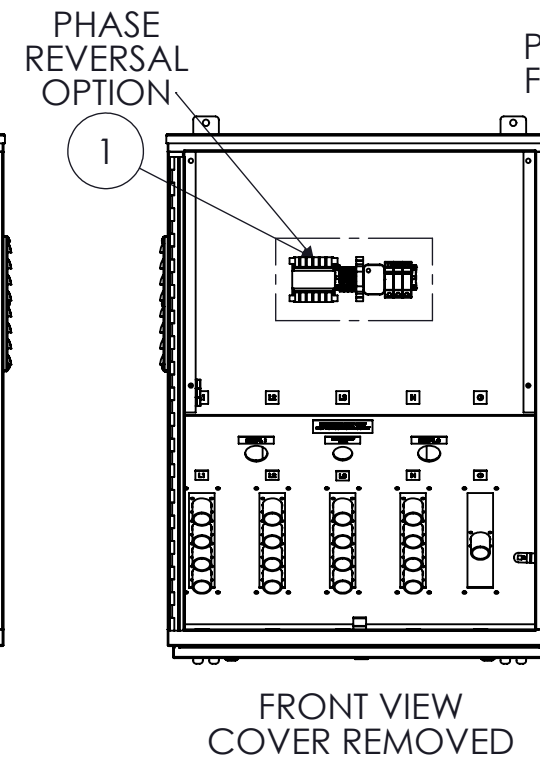
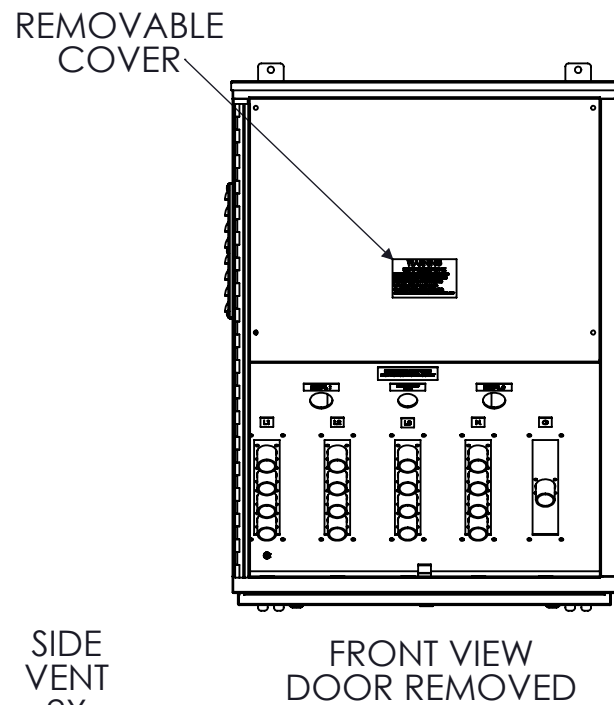
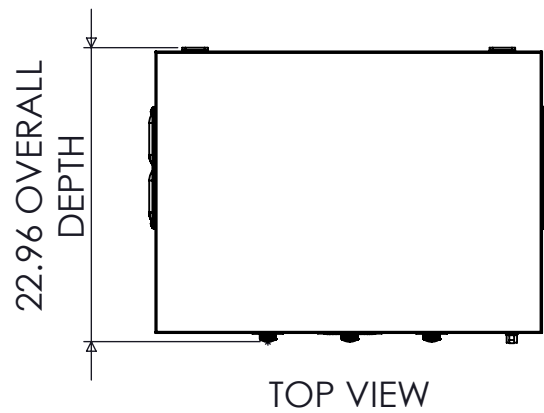


Part Number Structure Table

Product Type	Ampacity	Voltage	Wire	Cam-Locks	Enclosure	Option Phase Reversal, Loss, and Undervoltage Protection Relay
GTBWM	400	208-240	3	Female	3R	None A=400-800 B=1200-2000
	800	480	4	Male	3RSS	
	1200	480/277				
	1600	575-600				
	2000					

SPECIFICATIONS:

MAX VOLTAGE - 600 VAC , 3PH
 RATED CURRENT - 1600A
 STANDARDS - UL508A RATED
 ENCLOSURE RATING - NEMA 3R
 REF - ES11GTB5



OPTIONS NOTES:

- 1) PHASE REVERSAL OPTION
- 2) 2-WIRE START OPTION
- 3) BLOCK HEATER OPTION
- 4) TYPE 316 STAINLESS STEEL ENCLOSURE AVAILABLE

RECEPTACLE COLOR SCHEME

	L1	L2	L3	N	GND
240V	BLK	RED	BLU	WHT	GRN
480V	BRN	ORG	YEL	WHT	GRN
600V	BLK	BLK	BLK	WHT	GRN

PSI Power & Controls
 9900 TWIN LAKES PARKWAY
 CHARLOTTE, NC 28269
 704-596-5617
 PSICONTROLSOLUTIONS.COM

1600 NEMA 3R GENERATOR TAP BOX			
REV	DESCRIPTION	DATE	DRAWN C. JUNG
0	ORIGINAL RELEASE	1/9/15	CHECKED
1	LABELING ADDED	10/6/21	SUP. NO
			SUP. BY NO
			PANEL NO
			BUL. NO
			GROUP NO
			ORDER NO

DRAWING TYPE	DIMENSIONAL
DRAWING NUMBER	PL1600GTBMM



ENCAPSULATED TRANSFORMERS FOR HAZARDOUS LOCATIONS



HPS Titan® has been designed to operate in harsh environments/hazardous locations where dangerous gases, liquids, dust, etc., could lead to serious consequences. HPS Titan® encapsulated transformers are used in installations where safety is your priority, efficiency is a concern and the environment, location and application are key. Typical applications include institutional, commercial, industrial, petrochemical, marine, mining, etc.

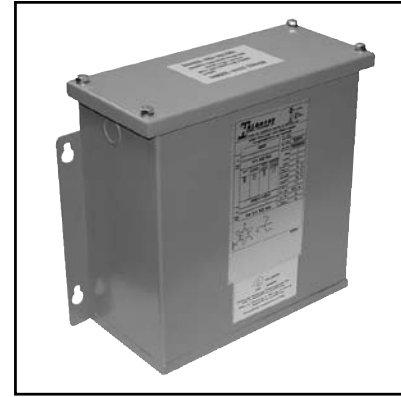
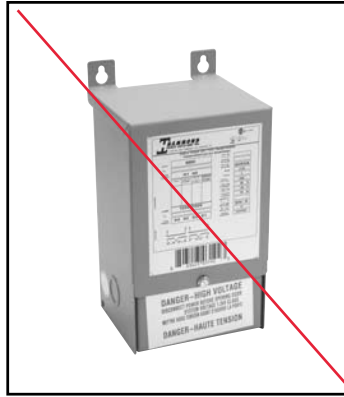
HPS Titan® series transformers are UL Listed for "Class 1, Division 2, Groups A, B, C and D Hazardous Locations" and are ABS Type Approved for "Marine Duty Service and Offshore Applications - Electrical Distribution and Propulsion". And with a North American Temperature Classification of T3C, the HPS Titan® series will remain cool under load.

Key features:

- Single phase ratings from .05 kVA to 37.5 kVA; three phase ratings from 2 kVA to 150 kVA
- 60 Hz frequency (50/60 Hz on units with 380V primary)
- Primary volts: 120, 208/240/277, 347/380, 240x480, 600, export model: 190/200/208/220x380/400/416/440
- UL 1604 approval, Class 1 Division 2
- ABS type approval
- Electrostatic shield standard on all three phase units and single phase units over 0.50 kVA
- 10 year warranty

HPS TITAN SERIES TRANSFORMERS FOR HARSH ENVIRONMENTS AND HAZARDOUS LOCATIONS

SINGLE PHASE STANDARD SPECIFICATIONS



	.05 kVA to 1 kVA	1.5 to 37.5 kVA
UL 1604, Class I, Division 2	File: E258346	File: E258346
ABS Type Approval (RQS)	Certificate No.: 04-MO523208-X	Certificate No.: 04-MO523208-X
Frequency	60 Hz (50/60 Hz on units with 380V primary)	60 Hz (50/60 Hz on units with 380V primary)
Insulation System	130°C (80°C rise) standard on all units	180°C (115°C rise) standard on all units. Optional 130°C (80°C rise) available.
Electrostatic Shield	Optional on units up to .500 kVA. Standard on .750 kVA and 1 kVA units.	Standard on all units.
Encapsulation	All units are encapsulated with electrical grade silica sand and resin compounds.	All units are encapsulated with electrical grade silica sand and resin compounds.
Enclosure Type	Heavy Duty Encapsulated NEMA Type 3R Optional NEMA 4, 4X (stainless steel) and 12	Heavy Duty Encapsulated NEMA Type 3R Optional NEMA 4, 4X (stainless steel) and 12
Enclosure Finish	ANSI 61 Grey, UL50	ANSI 61 Grey, UL50
Termination	Front accessible separate high and low voltage lead wires or copper tabs.	Front accessible separate high and low voltage lead wires or copper tabs.
Conduit Knock-Outs	Standard side and rear knock-outs on all units.	Standard side and rear knock-outs on all units.
Impedance	Typically 1 to 5%.	Typically 1 to 5%.
Mounting	Standard Wall Mounting.	Standard Wall Mounting. Lifting ears provided on all units 5 kVA and up.
Sound Level	Meets NEMA ST-20 standards. (optional low noise units available on request)	Meets NEMA ST-20 standards. (optional low noise units available on request)

Other voltages not listed in this section are available upon request. Please contact customer service for details, price and availability.

All HPS TITAN single phase transformers are UL Listed for "Class 1, Division 2, Groups A, B, C and D Hazardous Locations" and are ABS Type Approved for "Marine Duty Service and Offshore Applications - Electrical Distribution and Propulsion". And with a North American Temperature Classification of T3C, the HPS TITAN series will remain cool under load.



SECTION 9



SINGLE PHASE, NEMA 3R STYLE ENCLOSURE

240 X 480 Primary Volts

120/240 Secondary Volts

60 Hz

kVA	Catalog Number	Case Style (Page 249)	Approx. Dimensions (Inches)			Approx. Weight (Lbs.)	Mtg Type W - Wall	Wiring Diagram (Pages 258-268)
			Width	Depth	Height			
0.05	QC05LECB	NQ0	3.75	5.25	7.25	6	W	SCD 1
0.10	QC10LECB	NQ0	3.75	5.25	7.25	7	W	SCD 1
0.15	QC15LECB	NQ0	3.75	5.25	7.25	8	W	SCD 1
0.20	QC20LECB	NQ1	4.50	5.75	7.25	11	W	SCD 1
0.25	QC25LECB	NQ1	4.50	5.75	7.25	13	W	SCD 1
0.35	QC35LECB	NQ1	4.50	5.75	7.25	14	W	SCD 1
0.5	QC50LECB	NQ2	5.00	4.75	9.25	15	W	SCD 1
0.75	QC75LEKB	NQ2	5.00	4.75	9.25	18	W	SCD 1
1	Q1C0LEKB	NQ3	5.88	5.50	10.00	22	W	SCD 1
1.5	Q1C5LEKF	NQ3	5.88	5.50	10.00	25	W	SCD 1
2	Q002LEKF	NQ4	7.00	6.50	11.25	40	W	SCD 1
3	Q003LEKF	NQ4	7.00	6.50	11.25	55	W	SCD 1
5	Q005LEKF	NQ5	10.00	7.75	17.25	90	W	SCD 1
7.5	Q007LEKF	NQ5	10.00	7.75	17.25	115	W	SCD 2
10	Q010LEKF	NQ6	12.25	9.25	20.88	165	W	SCD 2
15	Q015LEKF	NQ6	12.25	9.25	20.88	225	W	SCD 2
25	Q025LEKF	NQ7	14.50	10.75	21.38	285	W	SCD 2
37.5	Q037LEKF	NQ8	14.50	10.75	27.38	410	W	SCD 2

For shielded units up to 0.50 kVA, replace the suffix "CB" with a "KB".

600 Primary Volts

120/240 Secondary Volts

60 Hz

kVA	Catalog Number	Case Style (Page 249)	Approx. Dimensions (Inches)			Approx. Weight (Lbs.)	Mtg Type W - Wall	Wiring Diagram (Pages 258-268)
			Width	Depth	Height			
0.05	QC05PECB	NQ0	3.75	5.25	7.25	6	W	SCD 4
0.10	QC10PECB	NQ0	3.75	5.25	7.25	7	W	SCD 4
0.15	QC15PECB	NQ0	3.75	5.25	7.25	8	W	SCD 4
0.20	QC20PECB	NQ1	4.50	5.75	7.25	11	W	SCD 4
0.25	QC25PECB	NQ1	4.50	5.75	7.25	13	W	SCD 4
0.35	QC35PECB	NQ1	4.50	5.75	7.25	14	W	SCD 4
0.50	QC50PECB	NQ2	5.00	4.75	9.25	15	W	SCD 4
0.75	QC75PEKB	NQ2	5.00	4.75	9.25	18	W	SCD 4
1	Q1C0PEKB	NQ3	5.88	5.50	10.00	22	W	SCD 4
1.5	Q1C5PEKF	NQ3	5.88	5.50	10.00	25	W	SCD 4
2	Q002PEKF	NQ4	7.00	6.50	11.25	40	W	SCD 4
3	Q003PEKF	NQ4	7.00	6.50	11.25	55	W	SCD 4
5	Q005PEKF	NQ5	10.00	7.75	17.25	90	W	SCD 4
7.5	Q007PEKF	NQ5	10.00	7.75	17.25	115	W	SCD 6
10	Q010PEKF	NQ6	12.25	9.25	20.88	165	W	SCD 6
15	Q015PEKF	NQ6	12.25	9.25	20.88	225	W	SCD 6
25	Q025PEKF	NQ7	14.50	10.75	21.38	285	W	SCD 6
37.5	Q037PEKF	NQ8	14.50	10.75	27.38	410	W	SCD 6

For shielded units up to 0.50 kVA, replace the suffix "CB" with a "KB".

SECTION 9





LD290 Series

LD290 - **LD291** - LD292 - LD293

PRESSURE TRANSMITTERS

- 0 ~ 125 Pa to 0 ~ 25 MPa
- 0 ~ 0.5 inH₂O to 0 ~ 3600 psi
- ± 0.075% Accuracy
- 40:1 Rangeability
- Wetted parts in 316 SS, Hastelloy
- Totally digital; including sensor, electronics and communication (Except LD290)
- Digital LCD display
- Weather proof, explosion proof and intrinsically safe
- Self diagnostics
- Three options of technology



smar

4-20 mA

- Updating time of output current in 100 ms;
- With high performance mathematical co-processor;
- Digital electronics and sensor;
- Weather proof, explosion proof and intrinsically safe;
- FMEDA (failure Modes, Effects and Diagnostic Analysis);
- MTBF (Mean Time Between Failures) of 239 years;
- MTTR (Mean Time to Repair) of 18 minutes;
- MTTF (Mean Time to Failure) of 239 years;
- Applicable in safety areas according to SIL (Safety Integrity Level) requirements;
- Write protection by hardware;
- Designed and manufactured according to ISO 9001 standards.

HART® 4-20 mA

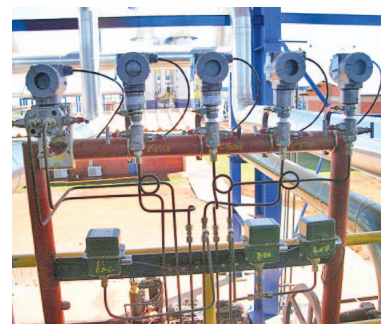
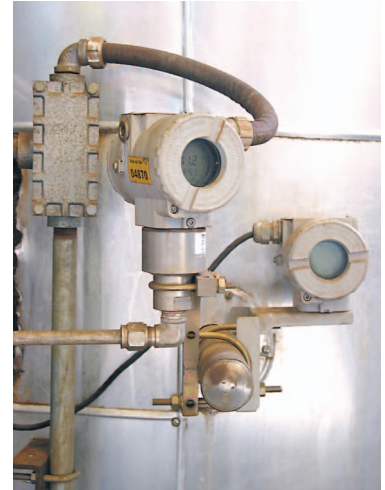
- Updating time of output current in 100ms;
- Improved performance due to dedicated math co-processor;
- FMEDA (Failure Modes, Effects and Diagnostic) Analysis;
- MTBF (Mean Time Between Failures) of 239 years;
- MTTR (Mean Time to Repair) of 18 minutes;
- MTTF (Mean Time to Failure) of 239 years;
- Applicable in safety areas according to SIL (Safety Integrity Level) requirements;
- Write protection by hardware;
- Designed and manufactured according to ISO 9001 standards;
- Zero, span and damping adjustment through HART® local switches (only if fitted with display);
- Easy update for FOUNDATION™ fieldbus and PROFIBUS PA technologies.

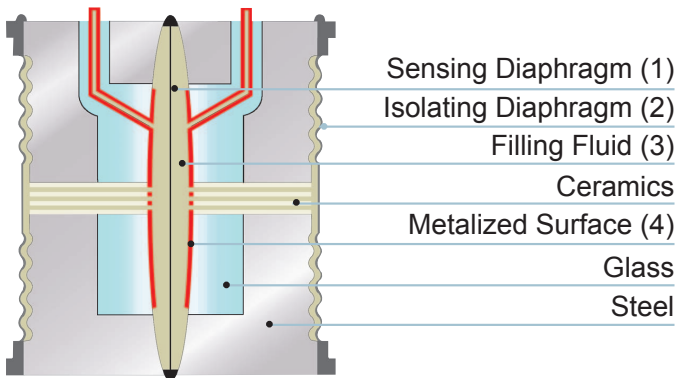
FOUNDATION™ fieldbus

- Instantiation and deletion of function blocks;
- Network master capability;
- Easy update for HART® and Profibus PA technologies.

PROFIBUS PA

- Use of the Analog Input function;
- Easy firmware upgrade (via Flash Memory Interface);
- Easy update to FOUNDATION™ fieldbus and HART® protocol.





The **LD290 Series** are an economical alternative gauge pressure transmitter. It is based on a field-proven capacitive sensor that provides reliable operation and high performance.

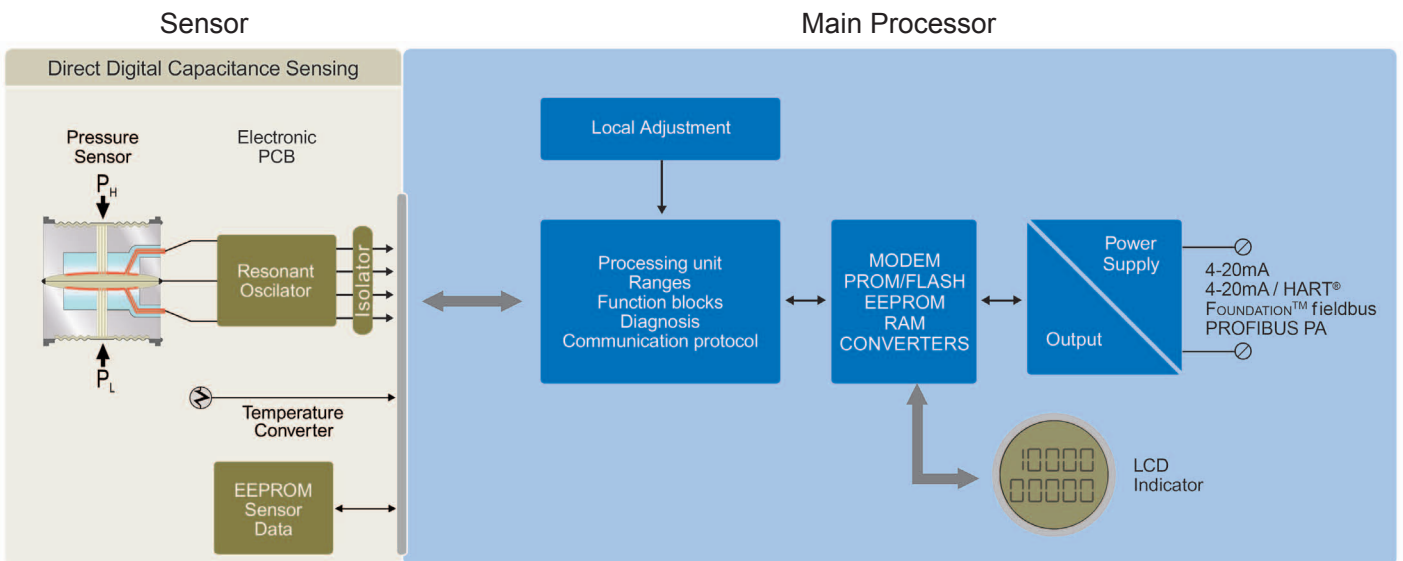
This lightweight design eliminates the need for mounting brackets and transmitter supports in many applications. Its microprocessor-based electronics allows total interchangeability with Smar capacitive sensors. It is automatically corrects sensors characteristics changes caused by temperature fluctuations.

The sensor is shown in the picture above. The sensing diaphragm (1) is at the cell center. The diaphragm deflects as a result of the difference between the pressures applied to the left and right sides of the sensor. Pressure is directly applied to the isolating diaphragms (2), which provide resistance against process fluid corrosion. The pressure is transmitted to the sensing diaphragm through the filling

fluid (3). The sensing diaphragm is a moving capacitor plate while the two metallized surfaces (4) are fixed plates. The sensing diaphragm deflection results in capacitance variations between the moving and fixed plates.

The electronic resonance circuit reads capacitance variation between the moving and fixed plates. The CPU conditions the measurement and communicates according to protocol. As there is no A/D conversion, errors and drifts during conversions are eliminated. A temperature sensor provides temperature compensations, which combined with the sensor precision, results in high accuracy and rangeability for the **LD290 Series**.

The process variable, as well as monitoring and diagnostics information, are provided by digital communication protocol. The available protocol options are: HART®, FOUNDATION™ fieldbus and PROFIBUS PA.



Gage Pressure - LD290M

The **LD290M** model is a pure 4-20 mA transmitter. Even though it has only analog input, its microprocessor-based electronics allow for total interchangeability with Smar capacitive sensors. ~~It automatically corrects sensor characteristics changes caused by temperature fluctuations.~~

Gage Pressure - LD291M, LD292M and LD293M

The **LD291M**, **LD292M** and **LD293M** models offer digital communication based in HART®, FOUNDATION™ fieldbus and PROFIBUS PA - protocols, simplifying calibration and providing remote diagnostics. Their microprocessor-based electronic circuit allows for total interchangeability with Smar capacitive sensors.

Sanitary Transmitter - LD290S, LD291S, LD292S and LD293S

The **LD290S**, **LD291S**, **LD292S** and **LD293S** models are specially designed for food and other applications where sanitary connections are required. With threaded or “tri-clamp” connections, it allows for easy and quick maintenance and cleaning. Tri-clamp and other connections are compliant to 3A-7403 standard for food grade applications. For further information, see the Smar SR301 Series Catalog.

Flanged Pressure Transmitter - LD290L, LD291L, LD292L and LD293L

The **LD290L**, **LD291L**, **LD292L** and **LD293L** models have a flange mounted unit for direct installation on vessels. Extended diaphragms are also available.

Pressure Transmitter with Extended Probe - LD290I, LD291I, LD292I and LD293I

The **LD290I**, **LD291I**, **LD292I** and **LD293I** models allow measurement of liquid level in open tanks, closed non-pressurized tanks, canals, wells etc. The measurement principle is based on measuring the column of fluid with the immersion of the hard probe into the liquid.



Manifold Valves

Smar manifold valves provide all of the necessary safety for field maintenance of **LD290 Series** transmitters. Working at pressures up to 6,000 psi, they are easy to handle and lighter than others in the market. Pressure and leakage tests carried out in 100% of the valves, also for models mounted on the transmitter. For further information, please see the Smar Manifold Valves Catalog.



Parameterization and Diagnostics

LD290 Series are available in four different technologies: 4-20 mA (**LD290**), HART® (**LD291**), FOUNDATION™ fieldbus (**LD292**) and PROFIBUS PA (**LD293**).

These instruments can be configured with Smar software and other manufacturers' configuration tools.

Local adjustment is available in all **LD290 Series**. It is possible to configure zero and span, and other functions

using the magnetic tool. Smar has developed AssetView, which is a user-friendly Web Tool that can be accessed anywhere and anytime using an Internet browser. It is designed for management and diagnostics of field devices to ensure reactive, preventive, predictive and proactive maintenance.

4-20 mA - LD290

Only configurable using magnetic tool if device is fitted with display.



HART® - LD291

LD291 (HART® protocol) can be configured by:

- Smar CONF401 for Windows;
- Smar DDCON100 for Windows;
- Smar HPC301 and HPC401 for several models of Palms*;
- Other manufacturers' configuration tools based on DD (Device Description) or DTM (Device Type Manager), such as AMS™, FieldCare™, PACTware™, HHT275 and HHT375, PRM Device Viewer. For LD291 management and diagnostics, AssetView ensures continuous information monitoring.



* Requires HPI311.

FOUNDATION™ fieldbus - LD292

LD292 utilizes the FOUNDATION™ fieldbus H1 protocol, an open technology that allows any H1 enabled configuration tool to configure this device.

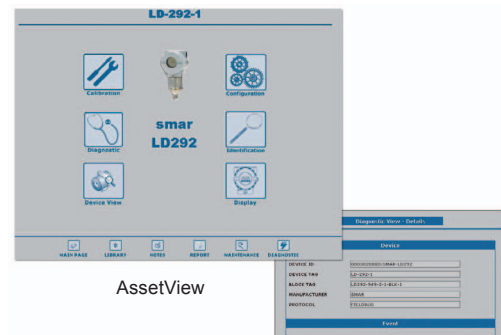
Syscon (System Configuration Tool) is a software tool used to configure, maintain and operate the field devices. Syscon offers efficient and friendly interaction with the user, using Windows NT version 4.0 or later, Windows 2000 and Windows XP.

Configuration tools such as AMS™, FieldCare™ and HHT375 can configure LD292 devices. DD (Device Description) and CF (Capability File) files can be downloaded at either the Smar or Fieldbus FOUNDATION™ website.

LD292 supports complex strategies configurations due to the high capacity and variety of dynamic instantiable function blocks. Seventeen different types of function

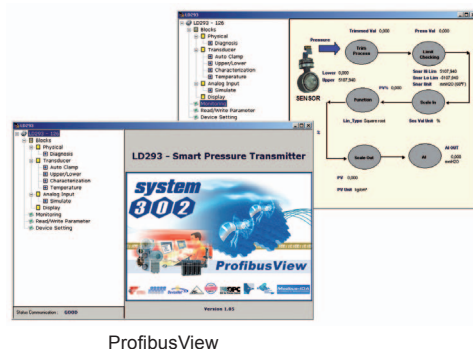
blocks are supported, and up to 20 function blocks can be running simultaneously.

Maintenance procedures with AssetView diagnostics and status information from FOUNDATION™ fieldbus result in a safe plant with higher availability.

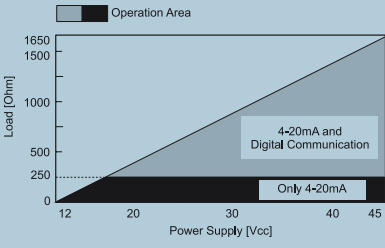


PROFIBUS PA - LD293

LD293 (PROFIBUS PA protocol) can be configured using Smar ProfibusView and Simatic PDM and by the FDT (Field Device Tool) and DTM (Device Type Manager) concept tools, such as FieldCare™ and PACTware™. It can also be integrated by any PROFIBUS System using the GSD file. PROFIBUS PA also has quality and diagnostic information, improving plant management and maintenance. The EDDL and DTM are available in Smar website. Conforms to profile 3.0.



Functional Specifications

Process Fluid	Liquid, gas or steam																																																		
Output and Communication Protocol	<p>4-20 mA Two-wire, 4-20 mA controlled according to NAMUR NE43 Specification.</p> <p>HART® Two-wire, 4-20 mA according to NAMUR NE43 specification, with superimposed digital communication (HART® Protocol).</p> <p>FOUNDATION™ fieldbus and PROFIBUS PA Digital only. Complies with IEC 61158-2:2000 (H1): 31.25 kbit/s voltage mode, bus powered.</p>																																																		
Power Supply / Quiescent Current	<p>4-20 mA and HART® 12 to 45 Vdc.</p> <p>FOUNDATION™ fieldbus and PROFIBUS PA Bus powered: 9 to 32 Vdc. Quiescent current consumption: 12 mA</p> <p>Output impedance: nonintrinsic safety from 7.8 kHz - 39 kHz should be greater or equal to 3 kOhm. Intrinsic safety output impedance (assuming an IS barrier in the power supply) from 7.8 kHz - 39 kHz should be greater or equal to 400 Ohm.</p> 																																																		
Indicator	4 1/2 - digit numerical and 5-character alphanumeric LCD indicator (optional).																																																		
Hazardous Area Certifications	Intrinsic Safe (FM, CSA, Nemko, Dekra/EXAM, Cepel and NEPSI), non-incendive (FM, CSA and Cepel), explosion proof (FM, Nemko and Cepel) and dust ignition proof (FM).																																																		
European Directive Information	<p>Authorized representative in European Community Smar GmbH-Rheingaustrasse 9-55545 Bad Kreuznach.</p> <p>PED Directive (97/23/EC) - Pressure Directive This product is in compliance with the directive and was designed and manufactured in accordance with sound engineering practice using several standards from ANSI, ASTM, DIN and JIS. Quality Management System certified by BVQI (Bureau Veritas Quality International).</p> <p>EMC Directive (2004/108/EC) - Eletromagnetic Compatibility The EMC test was performed according to IEC standard: IEC61326-1:2006, IEC61326-2-3:2006, IEC61000-6-4:2006, IEC61000-6-2:2005. For use in industrial environment only. Keep the shield insulated at the instrument side, connecting the other one to the ground if necessary to use shielded cable.</p> <p>ATEX Directive (94/9/EC) - Equipment and protective systems intended for use in potentially explosive atmospheres This product is certified according to the European Standards at NEMKO and EXAM European Standards.</p> <p>LVD Directive (2006/95/EC) - Electrical Equipment designed for use within certain voltage limits According the LVD directive Annex II the equipment under ATEX "Electrical equipment for use in an explosive atmosphere" directive are excluded from scope from this directive.</p>																																																		
Temperature Limits	<table border="0"> <tr> <td>Ambient:</td> <td>-40</td> <td>to</td> <td>85°C</td> <td>(-40 to 185 °F)</td> </tr> <tr> <td></td> <td>-15</td> <td>to</td> <td>85°C</td> <td>(-59 to 185 °F) (LD290I)</td> </tr> <tr> <td>Process:</td> <td>-40</td> <td>to</td> <td>100°C</td> <td>(-40 to 212 °F) (Silicone Oil)</td> </tr> <tr> <td></td> <td>0</td> <td>to</td> <td>85°C</td> <td>(32 to 185 °F) (Inert Fluorolube Oil)</td> </tr> <tr> <td></td> <td>-25</td> <td>to</td> <td>85°C</td> <td>(-13 to 185 °F) (Viton O'Ring)</td> </tr> <tr> <td></td> <td>-40</td> <td>to</td> <td>150°C</td> <td>(-40 to 302 °F) (LD290L)</td> </tr> <tr> <td></td> <td>-15</td> <td>to</td> <td>150°C</td> <td>(-59 to 302 °F) (LD290I)</td> </tr> <tr> <td>Storage:</td> <td>-40</td> <td>to</td> <td>100°C</td> <td>(-40 to 212 °F)</td> </tr> <tr> <td>Display:</td> <td>-20</td> <td>to</td> <td>80°C</td> <td>(-4 to 176 °F)</td> </tr> <tr> <td></td> <td>-40</td> <td>to</td> <td>85°C</td> <td>(-40 to 185 °F) (Without Damages)</td> </tr> </table>	Ambient:	-40	to	85°C	(-40 to 185 °F)		-15	to	85°C	(-59 to 185 °F) (LD290I)	Process:	-40	to	100°C	(-40 to 212 °F) (Silicone Oil)		0	to	85°C	(32 to 185 °F) (Inert Fluorolube Oil)		-25	to	85°C	(-13 to 185 °F) (Viton O'Ring)		-40	to	150°C	(-40 to 302 °F) (LD290L)		-15	to	150°C	(-59 to 302 °F) (LD290I)	Storage:	-40	to	100°C	(-40 to 212 °F)	Display:	-20	to	80°C	(-4 to 176 °F)		-40	to	85°C	(-40 to 185 °F) (Without Damages)
Ambient:	-40	to	85°C	(-40 to 185 °F)																																															
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	-40	to	85°C	(-40 to 185 °F) (Without Damages)																																															
Turn-on Time	<p>4-20 mA and HART® Performs within specifications in less than 5 seconds after power is applied to the transmitter.</p> <p>FOUNDATION™ fieldbus and PROFIBUS PA Performs within specifications of less than 10 seconds after power is applied to the transmitter.</p>																																																		
Overpressure and Static Pressure Limits (MWP – Maximum Working Pressure)	<p>14 MPa (138 bar) for ranges 2, 3, 4. 31 MPa (310 bar) for range 5.</p> <p>For Level Ranges ANSI/DIN (models LD290L): 150#: 6 psia to 235 psi (-0,6 to 16 bar) to 199,4 °F (93 °C) 300#: 6 psia to 620 psi (-0,6 to 43 bar) to 199,4 °F (93 °C) 600#: 6 psia to 1240 psi (-0,6 to 85 bar) to 199,4 °F (93 °C) PN10/16: -60 kPa to 1,02 MPa to 212 °F (100 °C) PN25/40: -60 kPa to 2,55 MPa to 212 °F (100 °C)</p> <p>Overpressures above will not damage the transmitter, but a new calibration may be necessary.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">WARNING</p> <p>It is described here only the maximum pressures of the materials referenced in each rule, it can not be manufactured on request.</p> <p>Temperatures above 150 °C are not available in standard models.</p> </div>																																																		

PRESSURES TABLE FOR SEAL AND LEVEL FLANGES DIN EN 1092-1 2008 STANDARD

Material Group	Pressure Class	Maximum Temperature Allowed						
		RT	100	150	200	250	300	350
		Maximum Pressure Allowed (bar)						
10E0 AISI 304/304L	PN 16	16	13.7	12.3	11.2	10.4	9,6	9.2
	PN 25	25	21.5	19.2	17.5	16.3	15.1	14.4
	PN 40	40	34.4	30.8	28	26	24.1	23
	PN 63	63	63	57.3	53.1	50.1	46.8	45
	PN 100	100	86.1	77.1	70	65.2	60.4	57.6
	PN 160	160	137.9	123.4	112	104.3	96.7	92.1
	PN 250	250	215.4	192.8	175	163	151.1	144

Material Group	Pressure Class	Maximum Temperature Allowed						
		RT	100	150	200	250	300	350
		Maximum Pressure Allowed (bar)						
14E0 AISI 316/316L	PN 16	16	16	14.5	13.4	12.7	11.8	11.4
	PN 25	25	25	22.7	21	19.8	18.5	17.8
	PN 40	40	40	36.3	33.7	31.8	29.7	28.5
	PN 63	63	63	57.3	53.1	50.1	46.8	45
	PN 100	100	100	90.9	84.2	79.5	74.2	71.4
	PN 160	160	160	145.5	134.8	127.2	118.8	114.2
	PN 250	250	250	227.3	210.7	198.8	185.7	178.5

Material Group	Pressure Class	Maximum Temperature Allowed						
		RT	100	150	200	250	300	350
		Maximum Pressure Allowed (bar)						
16E0 1.4410 Super Duplex 1.4462 Duplex	PN 16	16	16	16	16	16	-	-
	PN 25	25	25	25	25	25	-	-
	PN 40	40	40	40	40	40	-	-
	PN 63	63	63	63	63	63	-	-
	PN 100	100	100	100	100	100	-	-
	PN 160	160	160	160	160	160	-	-
	PN 250	250	250	250	250	250	-	-

PRESSURES TABLE FOR SEAL AND LEVEL FLANGES ASME B16.5 2009 STANDARD

Material Group	Pressure Class	Maximum Temperature Allowed								
		-29 to 38	50	100	150	200	250	300	325	350
		Maximum Pressure Allowed (bar)								
Hastelloy C276	150	20	19.5	17.7	15.8	13.8	12.1	10.2	9.3	8.4
	300	51.7	51.7	51.5	50.3	48.3	46.3	42.9	41.4	40.3
	400	68.9	68.9	68.7	66.8	64.5	61.7	57	55	53.6
	600	103.4	103.4	103	100.3	96.7	92.7	85.7	82.6	80.4
	900	155.1	155.1	154.6	150.6	145	139	128.6	124	120.7
	1500	258.6	258.6	257.6	250.8	241.7	231.8	214.4	206.6	201.1
	2500	430.9	430.9	429.4	418.2	402.8	386.2	357.1	344.3	335.3

Overpressure and Static Pressure Limits (MWP - Maximum Working Pressure) (continuation)

Overpressure and Static Pressure Limits (MWP - Maximum Working Pressure) (continuation)	Material Group	Pressure Class	Maximum Temperature Allowed									
			-29 to 38	50	100	150	200	250	300	325	350	
	Maximum Pressure Allowed (bar)											
	S31803 Duplex S32750 Super Duplex	150	20	19.5	17.7	15.8	13.8	12.1	10.2	9.3	8.4	
		300	51.7	51.7	50.7	45.9	42.7	40.5	38.9	38.2	37.6	
		400	68.9	68.9	67.5	61.2	56.9	53.9	51.8	50.9	50.2	
		600	103.4	103.4	101.3	91.9	85.3	80.9	77.7	76.3	75.3	
		900	155.1	155.1	152	137.8	128	121.4	116.6	114.5	112.9	
		1500	258.6	258.6	253.3	229.6	213.3	202.3	194.3	190.8	188.2	
	2500	430.9	430.9	422.2	382.7	355.4	337.2	323.8	318	313.7		
	Material Group	Pressure Class	Maximum Temperature Allowed									
			-29 to 38	50	100	150	200	250	300	325	350	
	Maximum Pressure Allowed (bar)											
	AISI316L	150	15.9	15.3	13.3	12	11.2	10.5	10	9.3	8.4	
		300	41.4	40	34.8	31.4	29.2	27.5	26.1	25.5	25.1	
		400	55.2	53.4	46.4	41.9	38.9	36.6	34.8	34	33.4	
		600	82.7	80	69.6	62.8	58.3	54.9	52.1	51	50.1	
		900	124.1	120.1	104.4	94.2	87.5	82.4	78.2	76.4	75.2	
		1500	206.8	200.1	173.9	157	145.8	137.3	130.3	127.4	125.4	
	2500	344.7	333.5	289.9	261.6	243	228.9	217.2	212.3	208.9		
	Material Group	Pressure Class	Maximum Temperature Allowed									
-29 to 38			50	100	150	200	250	300	325	350		
Maximum Pressure Allowed (bar)												
AISI316	150	19	18.4	16.2	14.8	13.7	12.1	10.2	9.3	8.4		
	300	49.6	48.1	42.2	38.5	35.7	33.4	31.6	30.9	30.3		
	400	66.2	64.2	56.3	51.3	47.6	44.5	42.2	41.2	40.4		
	600	99.3	96.2	84.4	77	71.3	66.8	63.2	61.8	60.7		
	900	148.9	144.3	126.6	115.5	107	100.1	94.9	92.7	91		
	1500	248.2	240.6	211	192.5	178.3	166.9	158.1	154.4	151.6		
2500	413.7	400.9	351.6	320.8	297.2	278.1	263.5	257.4	252.7			
Volumetric Displacement	Less than 0.15 cm ³ (0.01 in ³)											
Damping Adjustment	4-20 and HART® Through magnetic tool: adjustable for any value from 0 to 128 seconds, added to the sensor response time (0.2 s). FOUNDATION™ fieldbus and PROFIBUS PA From any value between 0 and 32 seconds plus intrinsic sensor response time (0.2 s).											
Configuration and Zero and Span Adjustments	4-20 mA Only zero and span via local adjustment if device is fitted with display. HART® By digital communication (HART® protocol) using the Configuration Interface CONF301 or the Hart Pocket Configurator HPC301. Basic configuration may be done using local adjustment magnetic tool if device is fitted with display. FOUNDATION™ fieldbus and PROFIBUS PA Basic configuration may be done using local adjustment magnetic tool if device is fitted with display. Complete configuration is possible using remote, SYSCON (LD292), Smar ProfibusView and Simatic PDM (LD293).											
Humidity Limits	0 to 100% RH (Relative Humid).											

Performance Specifications

Accuracy	<p>For ranges 2, 3, 4 or 5: $\pm 0.075\%$ of span (for span ≥ 0.1 URL) $\pm [0.0375 + 0.00375 \text{ URL/SPAN}] \%$ of span (for span < 0.1 URL)</p> <p>For Level Transmitter: $\pm 0.08 \%$ of span (for span ≥ 0.1 URL) $\pm [0.0504 + 0.0047 \text{ URL/span}] \%$ of span (for span < 0.1 URL)</p> <p>For Insertion Transmitter: $\pm 0.2\%$ of span</p> <p>Linearity effects, hysteresis and repeatability are included.</p>
Stability	$\pm 0.15\%$ of URL per 5 years
Temperature Effect	<p>$\pm [0.02\% \text{ URL} + 0.06\% \text{ of span}]$, per 20 °C (68 °F) for span ≥ 0.2 URL $\pm [0.023\% \text{ URL} + 0.045\% \text{ of span}]$, per 20 °C (68 °F) for span < 0.2 URL</p> <p>For LD290L: 6 mmH₂O per 20 °C for 4" and DN100 17 mmH₂O per 20 °C for 3" and DN80 Consult for other flange dimensions and fill fluid.</p>
Power Supply Effect	$\pm 0.005\%$ of calibrated span per volt
Mounting Position Effect	Zero shift of up to 250 Pa (1 inH ₂ O) which can be calibrated out. No span effect.
Electromagnetic Interference Effect	Approved according to IEC61326-1:2006, IEC61326-2-3:2006, IEC61000-6-4:2006, IEC61000-6-2:2005.

Physical Specifications

Electrical Connection	See options in Ordering Code.
Process Connection	See options in Ordering Code.
Wetted Parts	316L SST, Hastelloy C276 Diaphragm for sanitary models available in Monel 400 and Tantalum too.
Nonwetted Parts	<p>Electronic Housing Injected aluminum with polyester painting or 316 SST. According to NEMA Type 4X or Type 4, IP66, IP66W*. <small>*The IP66W sealing test (immersion) was performed at 1 bar for 24 hours. For any other situation, please consult Smar. IP66W tested for 200h to according NBR 8094 / ASTM B 117 standard.</small></p> <p>Level Flange (LD290L): 316 SST, 304 SST and Plated Carbon Steel.</p> <p>Fill Fluid Silicone Oil or Inert Fluorolube Oil.</p> <p>Cover O-Rings Buna-N</p> <p>Mounting Bracket Plated Carbon Steel or 316 SST. Accessories (bolts, nuts, washers and U-clamps) in Carbon Steel or 316 SST.</p> <p>Identification Plate 316 SST.</p>
Approximate Weights	< 2.0Kg (4lb): aluminum housing without mounting bracket.

MODEL GAGE PRESSURE TRANSMITTERS											
LD290M	4-20 mA										
LD291M	HART® & 4-20 mA										
LD292M	FOUNDATION™ fieldbus										
LD293M	PROFIBUS PA										
CODE	Type	Range Limits			Range Limits						
		Min	Max	Unit	Min	Max	Unit				
2	Gage	12.5	500	mbar	5.02	201.9	inH ₂ O				
3	Gage	62.5	2500	mbar	25.13	1005.45	inH ₂ O				
4	Gage	0.625	25	bar	157.1	10054.5	inH ₂ O				
5	Gage	6.25	250	bar	90.65	3625.94	psi				
CODE	Diaphragm Material		Fill Fluid								
1	316L SST		Silicone Oil								
2	316L SST		Inert Fluorolube Oil (2)								
3	Hastelloy C276		Silicone Oil (1)								
4	Hastelloy C276		Inert Fluorolube Oil (2)								
D	316L SST		Inert Krytox Oil (2)								
E	Hastelloy C276		Inert Krytox Oil (2)								
Q	316L SST		Inert Halocarbon 4.2 Oil (2)								
R	Hastelloy C276		Inert Halocarbon 4.2 Oil (2)								
CODE	Process Connections Material										
H	Hastelloy C276 (1)			I	316L SST			Z	User's specifications		
CODE	Local Indicator										
0	Without Indicator										
1	With Indicator										
CODE	Process Connections										
1	1/2 - 14 NPT - Female			M	1/2 - 14 NPT - Male			X	1" NPT Sealed (316L Diaphragm, DC200/20 Silicone Fill Fluid)		
A	M20 X 1,5 Male			R	Remote Seal			Z	User's specifications		
G	G 1/2 A DIN 16288 - Form B			U	1/2 BSP - Male						
H	G 1/2 DIN 16288 - Form D			V	Valve Manifold integrated to the transmitter						
CODE	Electrical Connection										
0	1/2 - 14 NPT (3)										
1	1/2 - 14 NPT X 3/4 NPT (316 SST) - with adapter (4)										
2	1/2 - 14 NPT X 3/4 BSP (316 SST) - with adapter (11)										
3	1/2 - 14 NPT X 1/2 BSP (316 SST) - with adapter (11)										
4	1/2 - 1/2 NPTF (316 SST) - with adapter										
5	1/2 - 3/4 NPTF (316 SST) - with adapter										
CODE	Mounting Bracket										
0	Without Mounting Bracket										
1	Carbon Steel Mounting Bracket with Carbon Steel accessories							7	Carbon Steel Mounting Bracket with 316 SST accessories		
2	316 SST Mounting Bracket with 316 SST accessories							A	304 SST Mounting Bracket with 316 SST accessories		
CODE	Optional Items										

LD290M - 2 | 1 | I | 1 | 1 | A | 0 | *

← Typical Model Number

LD291M - 2 | 1 | I | 1 | 1 | A | 0 | *

LD292M - 2 | 1 | I | 1 | 1 | A | 0 | *

LD293M - 2 | 1 | I | 1 | 1 | A | 0 | *

* Leave blank for no optional items.

MODEL		GAGE PRESSURE TRANSMITTER (CONTINUATION)					
CODE	Output Signal (10)						
G0	4-20 mA						
G4	4-20 mA + Output for Remote Indicator						
CODE	Housing Material (8) (9)						
H0	Aluminium (IP/TYPE)			H3	316 SST for saline atmosphere (IPW/TYPEX) (7)		
H1	316 SST (IP/TYPE)			H4	Copper Free Aluminium (IPW/TYPEX) (7)		
H2	Aluminium for saline atmosphere (IPW/TYPEX) (7)						
CODE	Identification Plate						
I1	FM: XP, IS, NI, DI		I4	EXAM (DMT): Ex-ia; NEMKO: Ex-d		I7	EXAM (DMT) Grupo I, M1 Ex-ia
I2	NEMKO: Ex-d, Ex-ia		I5	CEPEL: Ex-d, Ex-ia		ID	NEPSI: Ex-ia, Ex-d
I3	CSA: XP, IS, NI, DI		I6	Without Certification		IJ	NEMKO: Ex-d
CODE	Painting						
P0	Munsell N 6,5 Gray		P5	Polyester Yellow			
P3	Polyester Black		P8	Without Painting			
P4	Epoxy White		P9	Blue Safety Base Epoxy – Electrostatic Painting			
CODE	Display Unit 1 (10)						
Y0	Percentage			Y3	Temperature (Temperature)		
Y1	Current (mA)			YU	User's specification (6)		
Y2	Pressure (Eng. Unit)						
CODE	Display Unit 2 (10)						
Y0	Percentage			Y6	Temperature (Temperature)		
Y4	Current (mA)			YU	User's specification (6)		
Y5	Pressure (Eng. Unit)						
CODE	Tag Plate						
J0	With TAG			J2	User's specification		
J1	Without TAG						

LD290M	-	G0	H0	I1	P0	Y0	Y5	J0
LD291M	-	G0	H0	I1	P0	Y0	Y5	J0
LD292M			H0	I1	P0			J0
LD293M			H0	I1	P0			J0

← TYPICAL MODEL NUMBER

Optional Items

Special Procedures	C1 – Degrease Cleaning (Oxygen or Chlorine Service)
Burnout	BD – Down Scale BU – Up Scale
Optional Items	ZZ – User Specification

NOTE

- (1) Meets NACE material recommendation per MR-01-75.
- (2) Inert fluid: safe for oxygen service.
- (3) This adapter has certified for use in Explosion Proof (CEPEL, NEPSI, NEMKO, EXAM, FM, CSA).
- (4) This adapter has certified for use in Explosion Proof (CEPEL, CSA).
- (5) This adapter has certified for use in Explosion Proof (CEPEL, NEPSI, NEMKO, EXAM).
- (6) Limited values to 4 1/2 digits; limited unit to 5 characters.
- (7) IPW/TYPEX was tested for 200 hours according to NBR 8094 / ASTM B 117 standard.
- (8) IPX8 tested for 10 meters of water column for 24 hours.

(9) Ingress Protection:

Products	CEPEL	NEMKO / EXAM	FM	CSA	NEPSI
LD29X	IP66/W	IP66/68/W	Type 4X/6/6P	Type 4X	IP67

(10) Only available for LD290 and LD291.

(11) Not certified for use in hazardous locations.

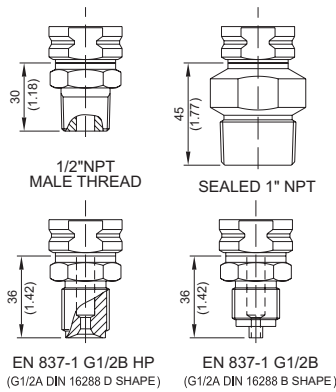
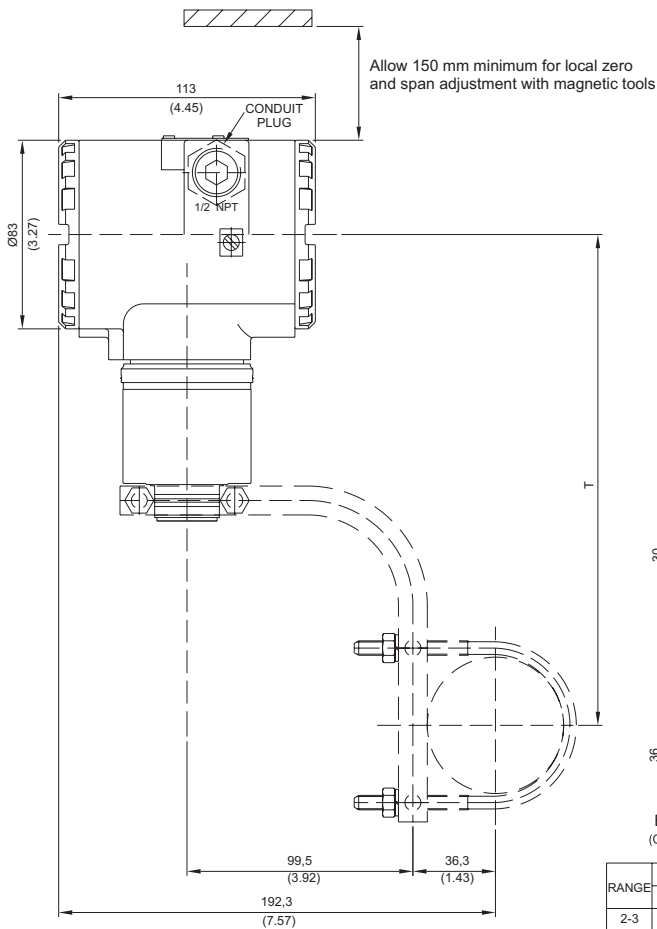
Note

Hastelloy is a trademark of the Cabot Corp.
Monel is a trademark of International Nickel Co.
Viton and Teflon are trademarks of E. I. DuPont de Nemours & Co.

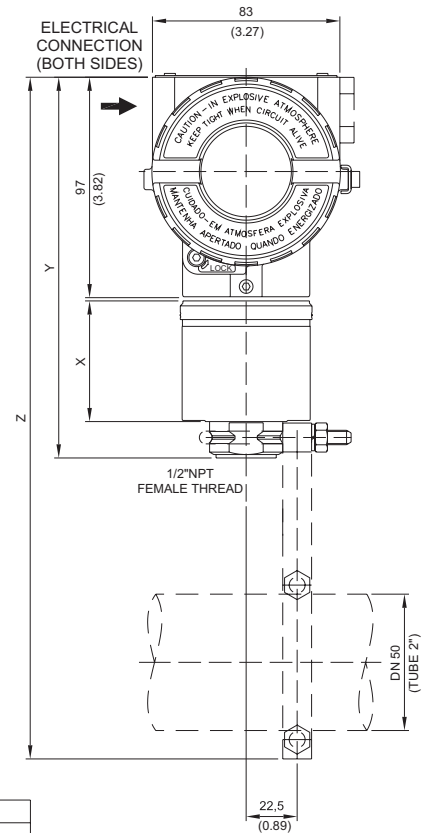
Fluorolube is a trademark of Hooker Chemical Corp.
HART® is a trademark of HART® Communication Foundation
Foundation is a trademark of Fieldbus Foundation.
Profibus is a trademark of Profibus International.

Smar Pressure Transmitters are protected by US patent number 6,433,791

LD290M - Gage Pressure Transmitters



RANGE	DIMENSIONS mm (*)			
	X	Y	T	Z
2-3	48,6 (1.91)	163,5 (6.44)	211,5 (8.33)	295,5 (11.63)
4	50,6 (1.99)	165,5 (6.52)	213,5 (8.41)	297,5 (11.71)
5	53,1 (2.09)	168 (6.61)	216 (8.50)	300 (11.81)



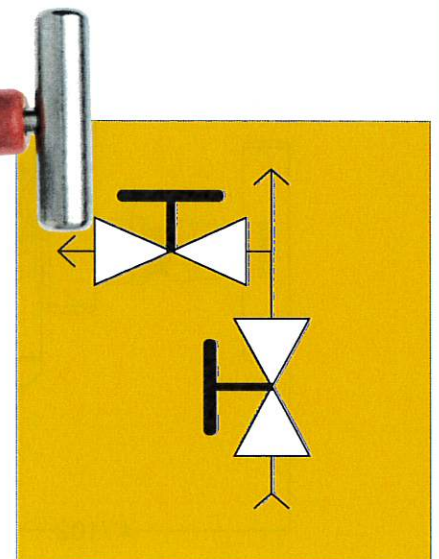
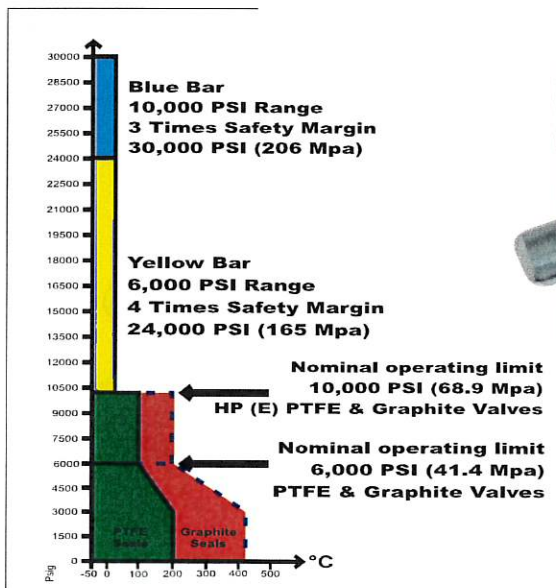
CONNECTION WITHOUT EXTENSION	Dimensions in mm (inche)				
	A1	ØC	ØD	E	ØF
Tri-Clamp - 1 1/12"	27 (1.06)	50 (1.96)	61 (2.40)	18 (0.71)	35 (1.38)
Tri-Clamp - 1 1/2" HP	27 (1.06)	50 (1.96)	66 (2.59)	25 (0.98)	35 (1.38)
Tri-Clamp - 2"	29 (1.14)	63.5 (2.50)	76.5 (3.81)	18 (0.71)	47.6 (1.87)
Tri-Clamp - 2" HP	29 (1.14)	63.5 (2.50)	81 (3.19)	25 (0.98)	47.6 (1.87)
Threaded DN40 - DIN 11851	37 (1.46)	56 (2.20)	78 (3.07)	21 (0.83)	38 (1.50)
Threaded DN50 - DIN 11851	38 (1.50)	68.5 (2.70)	92 (3.62)	22 (0.86)	50 (1.96)
Threaded SMS - 1 1/2"	31 (1.22)	55 (2.16)	74 (2.91)	25 (0.98)	35 (1.38)
Threaded SMS - 2"	32 (1.26)	65 (2.56)	84 (3.30)	26 (1.02)	48.6 (1.91)
Threaded RJT - 2"	35 (1.38)	66.7 (2.63)	86 (3.38)	22 (0.86)	47.6 (1.87)
Threaded IDF - 2"	34 (1.34)	60.5 (2.38)	76 (2.99)	30 (1.18)	47.6 (1.87)

Table 1 - LD290S - Table relative to dimension drawing from page 17

PRECISION Instrument Manifolds

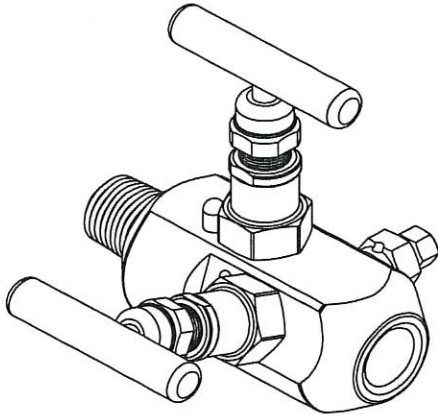
PRECISION Venting Gauge Valve (VGV) Series

- ◆ Two Valve design allows Isolation of instrument and venting in one manifold
- ◆ In-situ calibration capability
- ◆ Vent Valve downstream of isolation
- ◆ Vent outlet 1/4" FNPT can be tubed to recovery or flare
- ◆ Ideal for use with Pressure Transmitters that have NPT inlet
- ◆ Ideal for use with Pressure Gauges
- ◆ Threaded inlet and outlet ideal for 'remote' mount applications

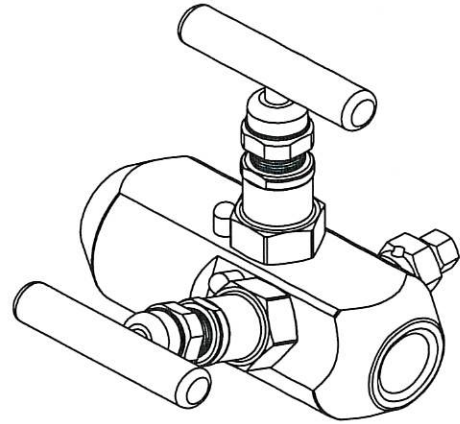


PRECISION Instrument Manifolds

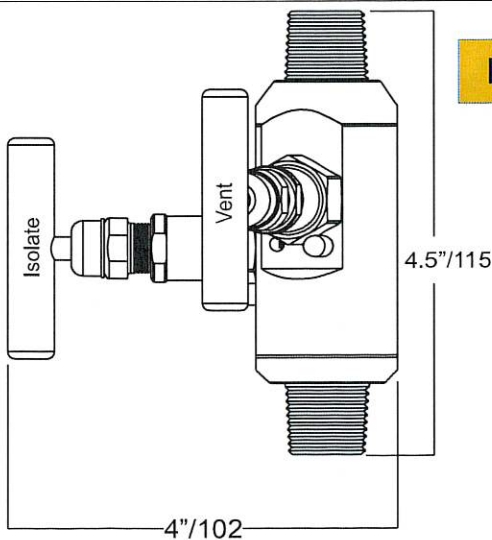
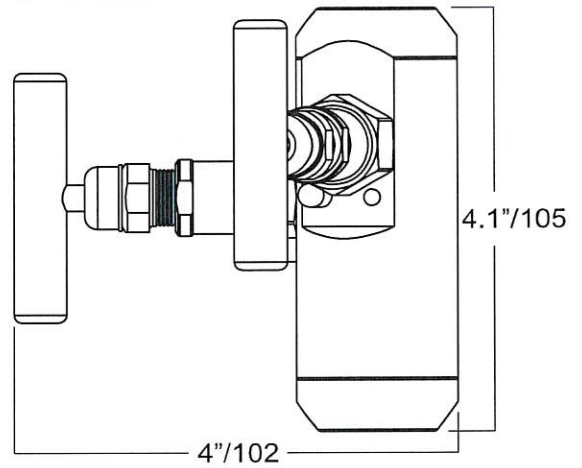
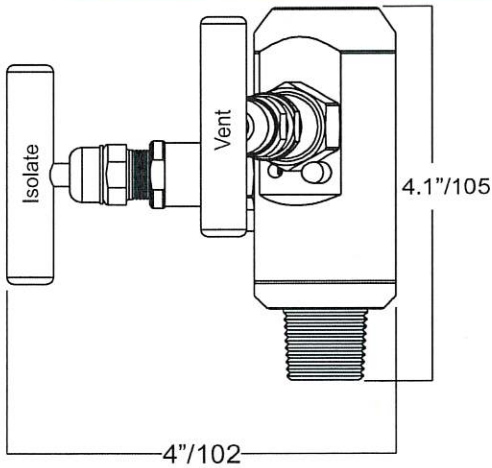
2 Valve Venting Gauge Valve Dimensions



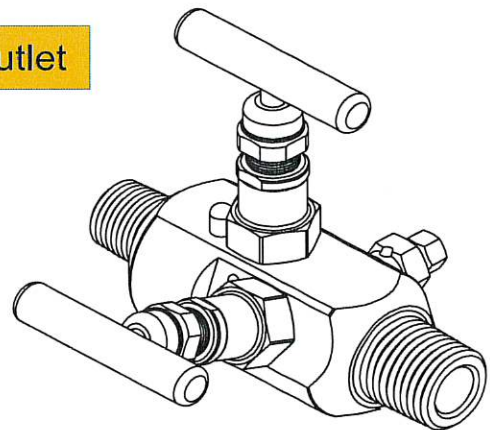
Male inlet/Female outlet



Female inlet/Female outlet



Male inlet/outlet



PRECISION Instrument Manifolds

2 Valve Venting Gauge Valve Selection Chart

P 2 / M 4 W 4 T V 2 X E H - Options

P for PRECISION or
S for Square stock body

Manifold Type
2 = Isolate & Vent
Code Break

Process / Inlet Connection type
M = Male
W = Female

Process Connection Size
4 = 1/2" NPT **S** = Socket Weld
6 = 3/4" NPT **B** = Butt Weld
(Weld end valves MUST have L Grade Material and Graphite seals, see table 2)

Instrument / Outlet Connection type
M = Male
W = Female

Instrument / Outlet Connection Size
4 = 1/2" NPT **S** = Socket Weld
B = Butt Weld
(Weld end valves MUST have L Grade Material and Graphite seals, see table 2)

Seals
T = TFE
G = Graphite

Bleed / Vent Requirements
V = Vent port controlled by Vent Valve head standard

Bleed Size
2 = 1/4" NPT

Handle Options
X = All T Bar Handles
A = Equalize Tamper Resistant
V = Vent Tamper Resistant
B = All Tamper Resistant

Pressure Rating
Blank = 6,000 Psig
E = 10,000 Psig

Materials of Construction
H = 316SS
L = 316L SS for NACE
J = Monel 400
Z = Inconel 718
K = Carbon Steel
C = H-C 276

Options

R = Bottom Mounting (M8 X 14)
O = Mounting to Order
OX = Oxygen Clean

Table 2

B - Butt Weld
S - Socket Weld
1 - Sched 5S
2 - Sched 10S
3 - Sched 40S
5 - Sched 80S
7 - Sched 160
9 - Sched XXS

VENTING GAUGE VALVES

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

Figure 11 - Style C External Bellows — Copper Alloy, Type 1 With Pilot Light Option



Figure 12 - Style C External Bellows — Copper Alloy, Type 4 & 13



Pressure Specifications				Enclosure Type				
Adjustable Operating Range [in. Hg Vacuum...psi]	Adjustable Differential [psi] (Approximate Mid-Range Values) ⁽²⁾	Maximum psi		Open Type (Without Enclosure)	Type 1	Type 4 & 13	Type 4X	Type 7 & 9 and 4 & 13 ⁽⁴⁾
		Line Pressure	Occasional Surge Pressure ⁽³⁾	Cat. No.	Cat. No.	Cat. No.	Cat. No.	Cat. No.
12 in. Vacuum...8 ⁽¹⁾	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	836-C2S	836-C2E
0.8...30	0.5...6	80	80	836-C3	836-C3A	836-C3J	836-C3S	836-C3E
30 in. Vacuum...45	1...12	175	190	836-C4	836-C4A	836-C4J	836-C4S	836-C4E
2...80	1...12	190	210	836-C5	836-C5A	836-C5J	836-C5S	836-C5E
30 in. Vacuum...100	2...25	300	375	836-C6	836-C6A	836-C6J	836-C6S	836-C6E
4...150	2.5...25	300	375	836-C7	836-C7A	836-C7J	836-C7S	836-C7E
6...250	4...45	500	650	836-C8	836-C8A	836-C8J	836-C8S	836-C8E
35...375	6...80	900	1200	836-C9	836-C9A	836-C9J	836-C9S	836-C9E
50...500	12...115	1300	1600	836-C10	836-C10A	836-C10J	836-C10S	836-C10E
50...650	16...115	1300	1600	836-C11	836-C11A	836-C11J	836-C11S	836-C11E
200...900	25...115	1300	1600	836-C12	836-C12A	836-C12J	836-C12S	836-C12E

- (1) For applications where settings approach 0 psi, select a control that has an adjustable range that goes into vacuum.
- (2) To determine differential in inches of mercury vacuum multiply value in table by 2.036 (or approximately 2).
- (3) Transients (pulses) can occur in a system prior to reaching a steady-state condition. Surge pressures within published values that are generated during startup or shutdown of a machine or system, not exceeding eight times in a 24-hour period, are negligible.
- (4) 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 and D, CLASS II: Groups E, F, and G, and CLASS III

LS35P51B02

General Information

Extended Product Type:	LS35P51B02
Product ID:	1SBV012151R1202
EAN:	3471522610980
Catalog Description:	LS35P51B02 Limit Switch
Long Description:	LS35P51B02 Limit Switch

Categories

Products » Low Voltage Products and Systems » Control Products » Sensors » Limit Switches

Ordering

EAN:	3471522610980
Minimum Order Quantity:	5 piece
Customs Tariff Number:	85364900

Dimensions

Product Net Width:	30 mm
Product Net Weight:	0.107 kg

Container Information

Package Level 1 Units:	1 piece
Package Level 1 Width:	118 mm
Package Level 1 Height:	54 mm
Package Level 1 Length:	32 mm
Package Level 1 Gross Weight:	0.105 kg
Package Level 1 EAN:	3471522610980

Environmental

Ambient Air Temperature:	Operation -25 ... +70 °C Storage -30 ... +80 °C
---------------------------------	--

Resistance to Shock acc. to IEC 60068-2-27: Half-sine Pulse for 11 ms, No Change in Contact Position 50 m/s²

Resistance to Vibrations acc. to IEC 60068-2-6: 25g (10 to 500 Hz) no change in position of contacts greater than 100 μs

Technical UL/CSA

Pilot Duty of Contact Elements acc. UL508:	A600 Q600
Flammability According to UL94:	V0

Additional Information

Action Type of the Contact Element (acc. to IEC 60947-5-1):	snap action contacts
Actuation Speed:	acc. to IEC 60947-5-1 Max. 1.50 m/s acc. to IEC 60947-5-1 Min. 0.00 m/s
Actuation Torque:	acc. to IEC 60947-5-1 Min. 0.10 N·m

Actuator Type:	adjustable Ø 18 mm polyamide roller lever
Angular Head Adjustment:	adjustable head every 90°
Angular Lever Adjustment:	10° in 10°
Climatic Withstand:	according to IEC 68-2-3 and salty mist according to IEC 68-2-11
Connecting Capacity:	AWG 20 ... AWG 14 0.5 ... 2.5 mm ²
Connecting terminals (delivered in open position):	M3.5 (+,-) pozidriv 2 screw with cable clamp
Consistency (Measured over 1 Million Operations):	0.1 mm
Contact Element Form (acc. to IEC 60947-5-1):	Zb
Conventional Free-air Thermal Current (I_{th}):	acc. to IEC 60947-5-1, q = 40 °C 10.0 A
Degree of Protection:	acc. to IEC 60529 IP65
Electrical Shock Protection acc. to IEC 536:	Double insulation - Class II
IIT Publishing Status:	Level 0 - Information enabled
Maximum Electrical Switching Frequency:	3600 cycles per hour
Mechanical Durability:	10 million
Mounting by Screws (not supplied):	2 x M4 screws
Mounting Position:	all positions are authorised
Movement to be Detected:	30° Cam Translation Movement
Number and Type of Bottom Cable Glands:	1/2 NPT plastic adaptor
Number of Auxiliary Contacts NC:	2
Order Multiple:	1 piece
Positive Opening Operation of NC Contact(s):	No
Product Main Type:	LS30
Product Name:	Limit Switch
Rated Frequency (f):	Supply Circuit 50 Hz Supply Circuit 60 Hz
Rated Impulse Withstand Voltage (U_{imp}):	6 kV
Rated Insulation Voltage (U_i):	acc. to IEC 60947-5-1 and VDE 0110 (Gr. C) 690 V acc. to UL/CSA 600 V
Rated Operational Current AC-15 (I_e):	(130 V) 5.5 A (230 V) 3.1 A (240 V) 3 A (24 V) 10 A (400 V) 1.8 A
Rated Operational Current DC-13 (I_e):	(110 V) 0.6 / 66 A (24 V) 2.8 / 67.2 A (250 V) 0.27 / 67.5 A

Resistance Between Contacts: 25 mΩ

Standards: IEC 60947-1, IEC 60947-5-1, EN 60947-1, EN 60947-5-1, UL 508 and CSA C22-2 N°14

Terminal Marking: according to EN 50013

Certificates and Declarations (Document Number)

Declaration of Conformity - CE: 1SBD250881C2000

Data Sheet, Technical Information: AC1300

Classifications

ETIM 4: EC001829 - Position switch modular

ETIM 5: EC001829 - Position switch modular

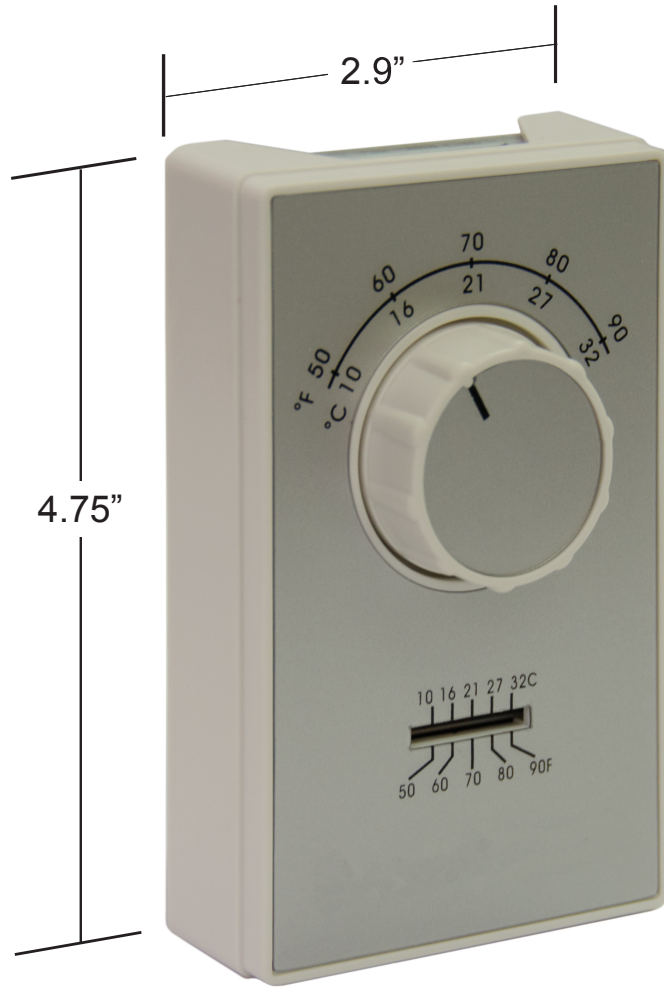
ETIM 6: EC001829 - Position switch modular



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ET9 Series

Line Voltage Thermostats



1.5"
Deep

Operational Specifications

Setpoint Temperature Range

50-90°F / 10-32°C

35-75°F / 2-24°C

Rated Differential

2-4°F

Voltage

120-277VAC

Amp Rating

Heating: 22 Amps, Resistive Max.

Cooling: 3/4 HP 125 VAC,

1-1/2 HP 250/277 VAC

Thermometer: Standard

Glass, Alcohol filled

Anticipation: Optional

Fixed Heat

Imported to TPI Specifications

Packaging Specifications

Product Size

4.75"H x 2.9"W x 1.5"D*

Depth is from wall to top of knob.

Individual Carton Size

4.75"L x 3W x 2.75"D

Individual Carton Weight

< 1lb (varies slightly by model)

Master Carton Qty

25 Pcs

Master Carton Size

16"L x 14.5"W x 6"H

Master Carton Weight

19 LBS (varies slightly by model)

Model	PCN #	DESCRIPTION	Range	Connections	Pos. Off	Anticipator	
AET9DWTS	05238302	DPST Heat Only	50-90°F	Wire Leads	Yes	Yes	
AET9SWTS	05238402	SPST Heat Only	50-90°F	Wire Leads	No	Yes	
ET9DTS	05238502	DPST Heat Only	50-90°F	Terminals	Yes	No	
ET9D4TS	05238602	DPST Heat Only	35-75°F	Terminals	Yes	No	
ET9DWTS	05238702	DPST Heat Only	50-90°F	Wire Leads	Yes	No	
ET9MTS	05238802	2 Stage Heat Only	50-90°F	Terminals	No	No	
ET9STS	05238902	SPST Heat Only	50-90°F	Terminals	No	No	
ET9S4TS	05239002	SPST Heat Only	35-75°F	Terminals	No	No	
ET9SRTS	05239102	SPST Cool Only	50-90°F	Terminals	No	No	
ET9SWTS	05239202	SPST Heat Only	50-90°F	Wire Leads	No	No	
ETD9MTS*	05239302	2 Stage Heat, 1 Stg Cool	50-90°F	Terminals	No	No	
ETD9STS	05239402	SPDT Heat or Cool	50-90°F	Terminals	No	No	

* The 2 stage heat / 1 stage cool models may also be used as a 1 stage heat / 1 stage cool deadband thermostat.

Columbus Electric/div. of TPI
Johnson City, Tennessee

T800-251-7828
F423-477-0545

Photoelectric Smoke Alarm

S 1 2 0 9

S E R I E S

Applications

The S1209 (120VAC/9VDC) Series photoelectric smoke alarms are for use as an evacuation device in all dwelling units, including but not limited to homes, apartments, hospitals, hotels and motels. The S1209 Series is listed in compliance with ANSI/UL 217 for installation per NFPA 72 and the International Codes (IBC/IFC/IRC).

Available in two models, the S1209 Series is engineered to virtually eliminate nuisance alarms and deliver outstanding performance wherever reliable smoke detection is required.

The S1209 Series is provided with a 9VDC alkaline battery for emergency power back-up in the event building power is lost. The battery impedance is verified and the alarm provides a low or missing battery warning. The battery drawer provides easy replacement without removing the unit from the wall or ceiling.

The Gentex S1209 Series is provided with a push button self test and functionality test feature. The push button self test verifies power operation and tests battery levels. The push and hold button functionality test analyzes the photoelectric sensing chamber for proper operation of smoke alarm. The self and functionality tests are in compliance with NFPA 72 and ANSI/UL Standards.

Features of the smoke alarm series include DUALINK® tandem capabilities with all Gentex tandem interconnect capable alarms products. Options include Form A/Form C dry contacts for remote annunciation and connection to a protected premises alarm system to provide a supervisory/trouble signal. The S1209 Series provides Temporal 3 evacuation tone for the smoke alarm units



Product Listings

SIGNALING



LISTED



- ANSI/UL 217 Listed
- CSFM # 7257-0569:0145

Product Compliance

- NFPA 72
- IBC/IFC/IRC
- Quality Management System is certified to: ISO 9001:2008



Standard Product Features

- 120VAC with 9VDC battery back-up
- Photoelectric smoke sensing technology
- Horn frequency 3100 Hz (nominal)
- Temporal 3 evacuation audible signal
- Optional Auxiliary Form A/Form C relay contacts (F model)
- Relay contacts operate when on battery back-up
- Nominal 2.5% sensitivity
- Push button self test feature, verifies power sources/operation
- Push and hold button functional test feature, analyzes sensing chamber
- Quick-disconnect wiring harness
- DUALINK® - tandem with all Gentex tandem capable alarms
- Red LED pulses every 30 seconds, green LED for AC power on
- Solid State Red LED to indicate smoke presence
- Mounting hardware adapts to standard junction boxes
- Dust cover to prevent particle contamination during installation
- Low or missing battery indicator
- 12 month warranty from date of manufacture or 18 months from date of purchase

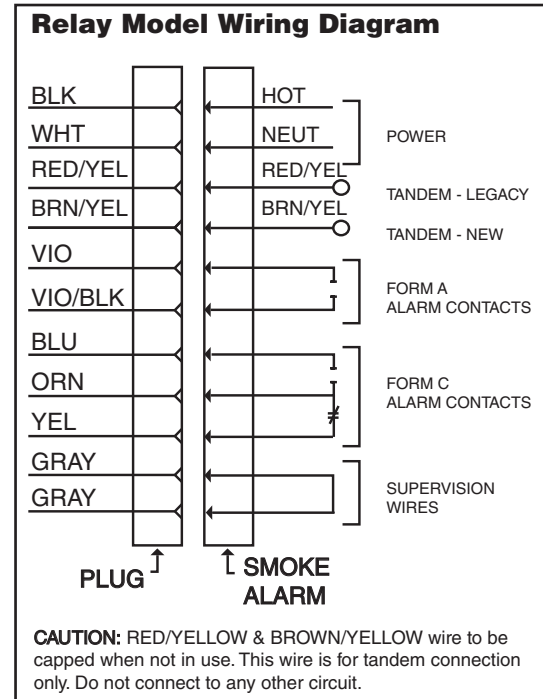
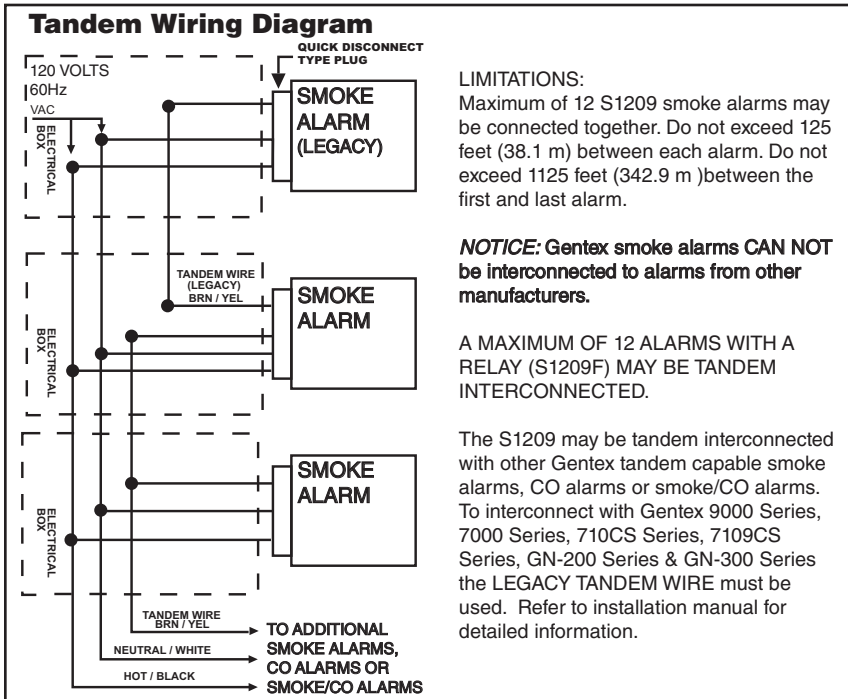
Model Number	Part Number	Form A/ Form C Relay
S1209	917-0059-002	
S1209F	917-0057-002	•

Electrical Specifications

Operating Voltage.....	120VAC, 60Hz
Operating Current	0.045 amps
Operating Current (Relay Options)	0.070 amps
Operating Ambient Temp Range	40°F-100°F (4.4°C-38°C)
Alarm Horn Rating	meets or exceeds 85dBA
.....	at 10ft (3.048 m)
Auxiliary Relay	1 Form A & 1 Form C (0.5 amp)
Size	Diameter at base: 5.75 in. (14.605 cm)
.....	Overall diameter: 6.25 in. (16.51 cm)
.....	Depth: 1.8 in (4.572 cm)
Secondary Power Source	Alkaline 9 VDC battery
.....	Duracell® MN 1604

S1209 SERIES

Wiring Diagrams



NOTES:

- Utilizing DUALINK®, if S1209 alarm annunciates, all smoke alarms, CO alarms or combination smoke/CO alarms tandem interconnected will sound smoke alarm warning.
- Utilizing DUALINK®, if S1209 is tandem interconnected with CO alarms or combination smoke/CO alarms and CO devices go into alarm, CO alarms and smoke alarm will sound CO warning.
- When both smoke and CO conditions are present, smoke condition will have priority and alarm will sound smoke annunciation.

Architect & Engineering Specifications

The photoelectric smoke alarm shall be a Gentex Model S1209/S1209F or approved equal which shall provide at least the following features and functions:

- Nominal smoke sensitivity shall be 2.5%.
- The smoke alarm portion of device shall utilize an infrared LED sensing circuit which pulses in 4 to 5 second intervals when subjected to smoke. After 2 consecutive pulses in smoke, the alarm will activate.
- The S1209 Series alarm shall have a Duracell® MN 1604 9VDC alkaline battery as a back-up in the event building power is lost.
- The 9VDC battery impedance shall be verified by the circuit of the smoke alarm.
- The alarm shall provide an indicator when the battery is low in power, high impedance or is missing.
- A solid state piezo alarm meets or exceeds the rating of 85dBA at 10ft.
- A visual LED monitor (condition indicator) will slow pulse in normal operation and rapid pulse in alarm (red color)
- An easily accessible test button shall be provided. Push down on button for 5 seconds causing smoke alarm to activate. If device does not go into alarm, the device is not working properly.
- The device shall have tandem interconnect capability of up to 12 smoke alarms.
- The alarm shall have the capability to tandem interconnect with all Gentex tandem capable smoke alarms, CO alarms or combination smoke/CO alarms, including 7000/7003 Series, 9000/9003 Series, 710CS/713CS Series, 7109CS/7139CS Series, GN-200/GN-300 Series, CO1209 Series and GN-503 Series
- The manufacturer shall provide models with the optional feature of auxiliary Form A/Form C relay contacts for initiating remote functions and annunciation
- Unit must be ANSI/UL 217 listed for both wall and ceiling mounting.
- Unit shall be listed by Underwriters Laboratories and California State Fire Marshal (CSFM).

All equipment shall be completely factory assembled, wired and tested, and the contractor shall be prepared to submit a certified letter testifying to this condition. Alarms which do not meet all of the requirements of this specification will not be considered.

For complete product specifications, refer to product installation manual.

24 units per carton
24 pounds per carton

GENTEX CORPORATION

Fire Protection Products Group • www.gentex.com
10985 Chicago Drive • Zeeland, Michigan 49464
616.392.7195 • 1.800.436.8391 • 616.392.4219 Fax

Gentex Corporation reserves the right to make changes to the product data sheet at their discretion.

Important Notice:

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551-0001-02

Catalog Number
Notes
Type

FEATURES & SPECIFICATIONS

INTENDED USE — A general purpose and energy-efficient surface-mounted or suspended LED fixture, suitable for wet, damp and/or cold locations. For vapor-tight demanding environments where moisture or dust is a concern and where relatively low fixture mounting heights and wide fixture spacing are common. Typical applications include industrial facilities, parking garages, retail malls, multi-purpose rooms, garden centers, and food processing **Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate.** [Click here for Acrylic-Polycarbonate Compatibility table for suitable use.](#)

CONSTRUCTION — One-piece 5VA fiberglass housing with integral perimeter channel utilizing continuous poured-in-place NEMA 4X gasket. Approved as a wireway and for through wiring. Captive polymeric latches are standard. Stainless steel latches (#316) available as an option for food processing or more demanding applications.

Power connection is easily accomplished through pre-drilled holes at each end populated with wet location fittings for maximum flexibility. Fixture easily mounts to ceilings and other solid structures, or can be suspended with chain, cable or rod using stainless steel mounting brackets (included).

OPTICS — Injection molded, acrylic lens (.080" thick) provides high impact-resistance comparable to 100% DR. For L48 Medium Distribution, a UV stabilized polycarbonate diffuser (.080" thick) in clear or frosted for additional impact strength where vandal protection is desired.

Expected service life of 60,000 hours at 80% lumen maintenance (L80); predicted life of more than 100,000 hours.

ELECTRICAL — Utilizes high-efficiency LEDs mounted to core circuit boards. High-efficiency drivers operate 120 thru 277V, 347V and 480V offered with 0-10 volt dimming, allowing granular control when coupled with wireless networking controls. Integral 6kV/3kA surge protection, tested in accordance to IEEE/ANSI standards.

INSTALLATION — Fixture can be ceiling or suspended mounted. Pre-punched stainless steel mounting brackets are included (two per luminaire) for easy field-attachment of bolts, screws and other mounting hardware. A covered ceiling is not required to maintain wet location listing or IP rating.

LISTINGS — CSA certified to UL and C-UL standards. Listed for wet locations in ambient temps ranging from -35°C (-31°F) to 25°C (77°F) when fixture is surface mounted or up to 45°C (113°F) when fixture is suspended at least 6" from ceiling. IP65, IP66 and IP67 rated. NSF splash-zone 2 certified and meets FDA/USDA guidelines. Nema 4X rated lens and housing. 1500 PSI hose-down. DesignLights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

WARRANTY — 5-year limited warranty. Complete warranty terms located at: www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

NOTE: Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

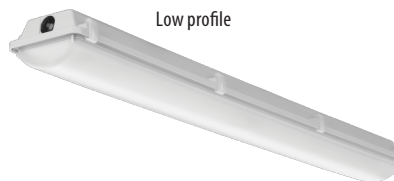
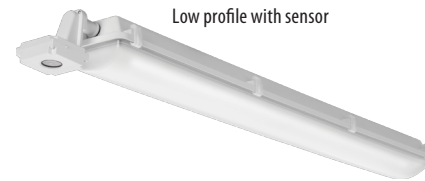
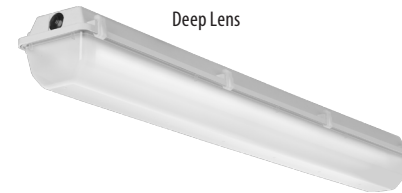
Stock configurations are offered for shorter lead times:

Standard Part Number	Stock Part Number
FEM L48 4000LM LPAFL MD MVOLT GZ10 40K 80CRI	FEM L48 4L MVOLT
FEM L48 4000LM LPAFL MD MVOLT GZ10 50K 80CRI	FEM L48 4L MVOLT 5K

Low-Profile Enclosed and Gasketed Industrial

FEM LED

CEILING/ SUSPENDED MOUNT



A+ Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® or XPoint™ Wireless control networks marked by a shaded background*

To learn more about A+, visit www.acuitybrands.com/aplus.

*See ordering tree for details

FEM LED Low-Profile Enclosed and Gasketed



A+ Capable options indicated by this color background.

ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: FEM L48 4000LM IMAFL WD MVOLT GZ10 40K 80CRI

Series	Length	Nominal Lumens	Diffuser	Distribution	Voltage	Driver	Color temperature	CRI
FEM	L48 48" ¹	3000LM 3,000 lumens	IMAFL Acrylic, lineal ribbed frosted lens	MD Medium	MVOLT MVOLT	GZ10 0-10V dimming	30K 3000K	80CRI 80 CRI
		4000LM 4,000 lumens	IMACD Acrylic, clear deep lens	WD Wide ⁴	120 120V		35K 3500K	90CRI 90 CRI
		6000LM 6,000 lumens	IMAFD Acrylic, deep frosted lens		277 277V		40K 4000K	
		8000LM 8,000 lumens	LPAFL Acrylic, low profile frosted lens ³		347 347V ⁵		50K 5000K	
		10000LM 10,000 lumens	LPACL Acrylic, low profile clear lens ³		480 480V ⁵			
	L96 96" ²	9000LM 9,000 lumens	LPPCL Polycarbonate, low profile clear lens ³					
		12000LM 12,000 lumens	LPPFL Polycarbonate, low profile frosted lens ³					
		15000LM 15,000 lumens						
		18000LM 18,000 lumens						
		20000LM 20,000 lumens						

Options

SF	Single fuse (available with 120, 277, 347) ⁶	CS88	6' Brad Harrison 16/3 cord and straight blade plug set ⁶	MSI10NWL	Low mount 360° integral motion sensor, wet location, On/Off operation ⁶
DF	Double Fusing (available with 347, 480V) ⁶	CS88L12	12' Brad Harrison 16/3 cord and straight blade plug set ⁶	MSI102L3VWL	Low mount 360° integral motion sensor, wet location, High/Low operation (bi-level) ⁶
BSL722	Bodine® emergency LED battery pack for 0°C and up ^{6,7}	CS88R	Brad Harrison receptacle	MSI10NWL DSCNWL	Low mount 360° integral motion sensor, wet location, On/Off operation for motion sensing, override Off due to daylight ⁶
BSL722C	Bodine® emergency LED battery pack for -20°C and up ^{6,7}	CS89	6' white cord, 16/3, no plug, wet location	MSI10XAWL DSCXAWL	Xpoint wireless integral motion sensor, On/Off operation for motion sensing, override Off due to daylight ⁶
BSL722C	Bodine® emergency LED battery pack for -20°C and up ^{6,7}	CS89L12	12' white cord, 16/3, no plug, wet location	XAD	XPoint™ wireless controller, 0-10V dimming ⁶
BGTD	Generator transfer device ^{6,8}	TRS	Tamper Resistant Torx® T10 screws		
SPD	Surge protection device, additional 10kV/5kA ⁶	DPMB	Dual pendant mounting bracket		
WLF	Wet location fitting (two outboard, top)	DL	Damp location		
WLFEND	Wet location fitting (one end)	STSL	Stainless steel latches		
WLFEND2	Wet location fitting (both ends)				

Accessories: Order as separate catalog number.

MHCH 36	Jack chain 36" (pair)
MHHK120	10' single leg air craft cable (ships as pair)
MHHK120SS	10' single leg air craft cable, stainless steel (ships as pair)
RK1 T10DRV	Torx® T10 screwdriver for TRS option
FEMDPMB	Dual pendant mounting bracket (ships as a pair)

Notes

- 1 Available with 3000LM, 4000LM, 6000LM, 8000LM, and 10000LM lumen packages. Not available with WD when using low profile diffuser.
- 2 Available with 9000LM, 12000LM, 15000LM, 18000LM, and 20000LM. Not available with low profile diffuser options.
- 3 Not available with L96. Not available with L48 when ordering WD option.
- 4 Not available with L48 when ordering low-profile lens options.
- 5 Utilizes step-down transformer. Not available with BGTD.
- 6 Must specify voltage.
- 7 Not available with 347 or 480V. For use in ambient temperature up to 30°C.
- 8 Available with 120V or 277V only. For use in ambient environments up to 25°C. Not available with L48 when ordering 10000LM lumen package. Not available with L96 when ordering 18000LM or 20000LM lumen packages.

FEM LED Low-Profile Enclosed and Gasketed

OPERATIONAL DATA

	Lumen packages	Wattage				Diffusers			
		120v	277v	347v	480v	Acrylic Linear Frosted (IMAFL)	Frosted (IMAFD, LPAFL, LPPFL)	Clear (IMACD, LPAFL, LPPFL)	
L48 Medium Distribution *test results reflect less than 1% difference between acrylic (clear/deep/low profile) and polycarbonate (low profile) lens	Delivered Lumens at 30K 80CRI	3000LM	23	23	24	25	2972	3032	3071
		4000LM	31	30	31	32	4019	4100	4153
		6000LM	45	44	46	47	5925	6044	6122
		8000LM	69	67	70	71	7593	7746	7845
		10000LM	80	78	81	82	9781	9979	10107
	Delivered Lumens at 35K 80CRI	3000LM	23	23	24	25	3039	3100	3140
		4000LM	31	30	31	32	4109	4192	4246
		6000LM	45	44	46	47	6057	6179	6258
		8000LM	69	67	70	71	7762	7918	8020
		10000LM	80	78	81	82	9999	10201	10332
	Delivered Lumens at 40K 80CRI	3000LM	23	23	24	25	3086	3148	3189
		4000LM	31	30	31	32	4173	4257	4312
		6000LM	45	44	46	47	6151	6275	6356
		8000LM	69	67	70	71	7883	8042	8145
		10000LM	80	78	81	82	10155	10360	10493
	Delivered Lumens at 50K 80CRI	3000LM	23	23	24	25	3200	3264	3306
		4000LM	31	30	31	32	4326	4414	4470
		6000LM	45	44	46	47	6378	6506	6590
		8000LM	69	67	70	71	8173	8338	8445
		10000LM	80	78	81	82	10529	10741	10879

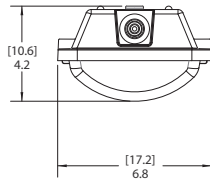
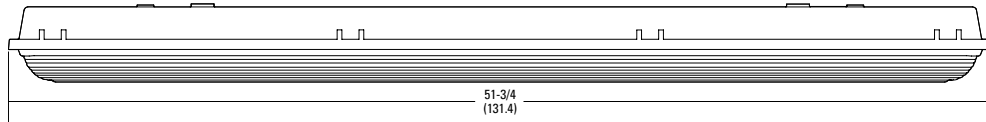
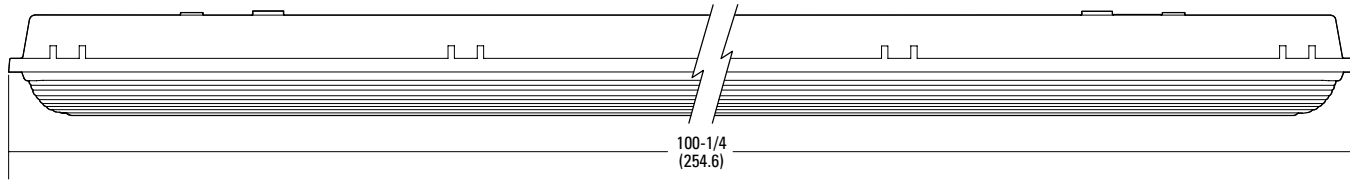
	Lumen packages	Wattage				Diffusers			
		120v	277v	347v	480v	Acrylic Linear Frosted (IMAFL)	Acrylic Frosted (IMAFD)	Acrylic Clear (IMACD)	
L96 Medium Distribution	Delivered Lumens at 30K 80CRI	9000LM	65	64	66	67	8718	8959	9072
		12000LM	88	86	89	90	11370	11685	11831
		15000LM	120	118	122	124	14263	14657	14841
		18000LM	145	141	146	148	16863	17330	17547
		20000LM	160	156	162	164	19313	19847	20096
	Delivered Lumens at 35K 80CRI	9000LM	65	64	66	67	8913	9159	9274
		12000LM	88	86	89	90	11624	11945	12095
		15000LM	120	118	122	124	14581	14984	15172
		18000LM	145	141	146	148	17239	17716	17938
		20000LM	160	156	162	164	19743	20289	20544
	Delivered Lumens at 40K 80CRI	9000LM	65	64	66	67	9051	9302	9419
		12000LM	88	86	89	90	11805	12131	12284
		15000LM	120	118	122	124	14808	15218	15409
		18000LM	145	141	146	148	17507	17992	18218
		20000LM	160	156	162	164	20051	20605	20864
	Delivered Lumens at 50K 80CRI	9000LM	65	64	66	67	9385	9644	9765
		12000LM	88	86	89	90	12239	12578	12736
		15000LM	120	118	122	124	15353	15778	15976
		18000LM	145	141	146	148	18152	18654	18888
		20000LM	160	156	162	164	20789	21364	21632

FEM LED Low-Profile Enclosed and Gasketed

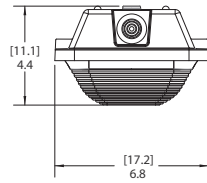
DIMENSIONS

Specifications subject to change without notice.
All dimensions are in inches (centimeters) unless otherwise indicated.

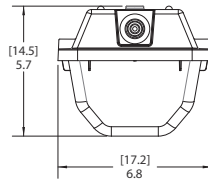
Weight (may vary with options or accessories)
FEM L48: 11.9 lbs (5.397kg)
FEM L96: 24.3 lbs (11.022kg)



Diffuser Type:
LPAFL
LPAFL
LPPFL
LPPCL



Diffuser Type:
IMAFL



Diffuser Type:
IMAFD
IMACD

PHOTOMETRICS

See www.lithonia.com for photometry reports.

DATE: _____ LOCATION: _____
 TYPE: _____ PROJECT: _____
 CATALOG #: _____

Perimashield PRS

WALLPACK

tradeSELECT®

FEATURES

- Non-cutoff refractor illuminates surrounding area to enhance safety and security
- Durable polycarbonate lens and die-cast housing are impact resistant
- Photocontrol for automatic off during daylight hours
- Easy to install by one person
- Environmentally friendly with minimal uplight



RELATED PRODUCTS

- ∅ [NRG®300L](#) ∅ [Sling Wall](#) ∅ [Sling Canopy](#)



SPECIFICATIONS

HOUSING

- Rugged die-cast aluminum housing
- Lens is made of UV stabilized Polycarbonate with self-retaining screws

OPTICS

- Prismatic frosted lens is field replaceable
- Type IV Distribution

INSTALLATION

- Capable of mounting on a minimum of 3-3.5" junction box
- Conduit entrances on bottom and sides

ELECTRICAL

- 0-10 Volt dimmable driver
- For use in 120-277V applications

OPTIONS/CONTROLS

- Photocell can be disconnected during installation if not needed

CERTIFICATIONS

- Fixture is IP65 rated
- Listed to UL1598 for use in wet locations

WARRANTY

- 5 year limited warranty
- See [HLI Standard Warranty](#) for additional information

KEY DATA	
Lumen Range	2841–2898
Wattage Range	22.8
Efficacy Range (LPW)	125–127
Fixture Projected Life (Hours)	>60K
Weights lbs. (kg)	2.75 (1.2)

ORDERING GUIDE

STOCK ORDERING INFORMATION

Catalog Number	Distribution	Wattage	Voltage	Delivered Lumens	LPW	CCT/CRI	Weight lbs. (kg)	Color
PRS-20-5K-PC	Wall	Type IV	22.8	120-277	2898	127	5000K/70	2.75 (1.2)
PRS-20-4K-PC	Wall	Type IV	22.8	120-277	2841	125	4000K/70	2.75 (1.2)

Perimashield PRS

WALLPACK

ELECTRICAL DATA

Nominal Wattage	Input Voltage	Oper. Current (Amps)	System Power (Watts)
20	120	0.19	22.8
	208	0.11	
	240	0.10	
	277	0.08	

PROJECTED LUMEN MAINTENANCE

Ambient Temperature	OPERATING HOURS					
	0	25,000	TM-21-11 36,000	50,000	100,000	L70 (Hours)
25°C / 77°F	1.00	0.95	0.93	0.90	0.81	170,000
40°C / 104°F	0.99	0.94	0.92	0.89	0.80	165,000

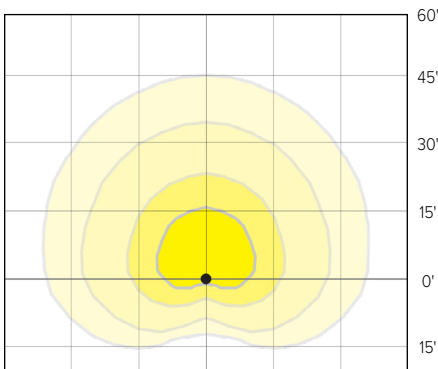
LUMINAIRE AMBIENT TEMPERATURE FACTOR (LATF)

Ambient Temperature		Lumen Multiplier
0°C	32°F	1.03
10°C	50°F	1.01
20°C	68°F	1.00
25°C	77°F	1.00
30°C	86°F	0.99
40°C	104°F	0.98
50°C	122°F	0.97

Use these factors to determine relative lumen output for average ambient temperatures from 0-40°C (32-104°F).

PHOTOMETRY

PRS-20

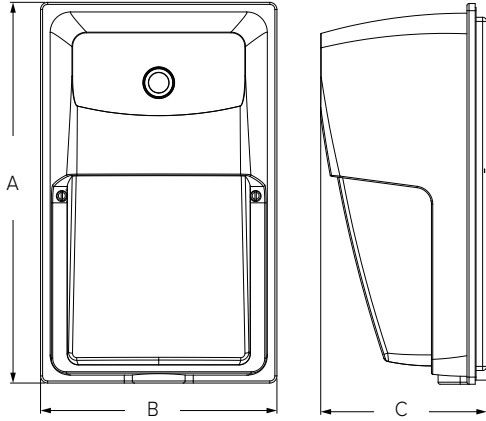


Mounting Height: 10'

Perimashield PRS

WALLPACK

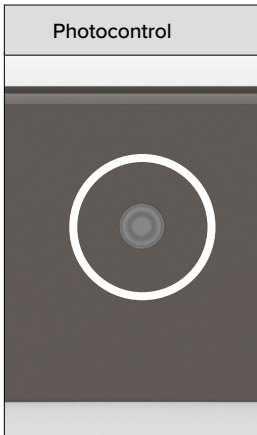
DIMENSIONS



A	B	C	Weight
10.9" (277mm)	6.8" (172mm)	4.8" (121mm)	2.75lbs (1.25kg)

ADDITIONAL INFORMATION

Accessories and Services



Photocontrol comes standard for energy-saving dusk-to-dawn operation

USE OF TRADEMARKS AND TRADE NAMES

All product and company names, logos and product identifies are trademarks™ or registered trademarks® of Hubbell Lighting, Inc. or their respective owners. Use of them does not necessarily imply any affiliation with or endorsement by such respective owners.

PG & P12G Series

Steel housing 6V up to 54W & 12V-54W capacities Lead-Calcium battery



BATTERY UNITS

Housing

- Steel housing
- Standard mist white finish, optional black finish
- Choice of MR16 LED lamp voltages and wattages
- Heads available in thermoplastic or decorative die-cast aluminum

Mounting

- Wall mount
- Universal J-box mounting

Electronics

- Pulse plus charger
- Low voltage disconnect
- Automatic brownout protection
- Battery lock-out
- Fused output circuit
- Optional: Improved Diagnostics
- Optional: Nexus® monitoring system
- 120/277 60Hz

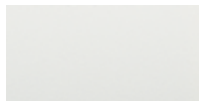
Photometric performance

Lamp	Spacing center-to-center (feet)	
	7 feet mounting height	15 feet mounting height
LD1	43'	36'
LD7	55'	43'
LD9	71'	56'
LD10	100'	85'

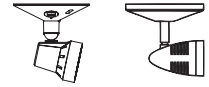
Housing color



Black



Mist White



Available Head Style Choices: ELF3 DR130
Head Style Suffix: /ELF3 /DR130

Choice of Battery

- 6V or 12V Lead-Calcium battery

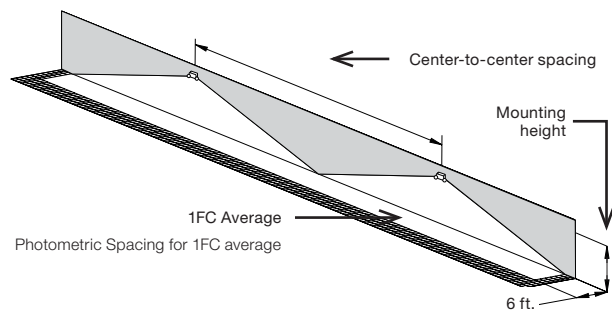
Approvals

- UL 924 Standard
- New York City Approved

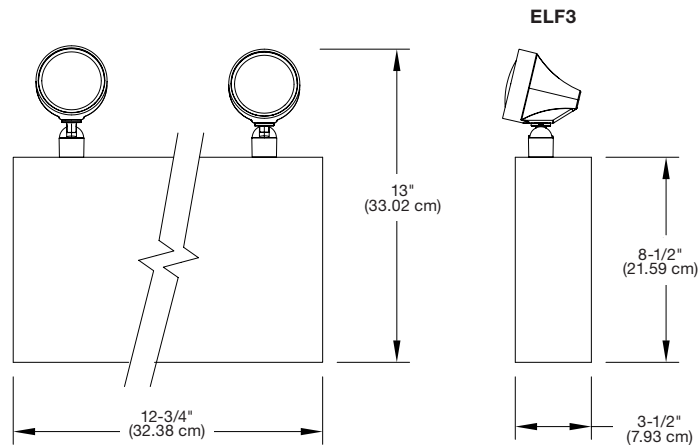
Warranty (subject to proper installation and maintenance)

Unit: three-year limited warranty

Detailed warranty terms located on **page 182** or online at: www.lightalarms.com



Dimensions (Dimensions are approximate and subject to change)



Power consumption chart

Series	Battery	Voltage	DC Specs				AC Specs	
			Battery capacity (in watts)				Units dual voltage ¹	Current Maximum
			90 Mins	2 Hrs	3 Hrs	4 Hrs		
PG1	Lead-Calcium	6V	18	15	0	0	120VAC 277VAC	0.25A 0.15A
PG2		6V	54	36	27	18		
P12G1		12V	54	36	27	18		

¹ All units 120/277 dual voltage, information based on wiring to specific voltage type

Accessories (Order as a separate item)

Description	Product code
Wire guard	WG2-L
Mounting platform	MP-PQA

Ordering format

Number of heads	Series/Capacity	Head style	Lamp type	Housing color	Options
0= No heads	PG1 = 6V-18W	/ELF3= ELF3	LD1 = 6V-4W MR16 LED	-M= Mist White	Blank = No Options
1= One head	PG2 = 6V-54W	(MR16, Plastic)	LD7 = 12V-4W MR16 LED	-B= Black	-ID = Improved Diagnostics (audible) ^{1,3}
2= Two heads	P12G1 = 12V-54W	/DR130 = DR130	LD9 = 12V-5W MR16 LED		-IDNA = Improved Diagnostics (non audible) ^{1,3}
3= Three heads		(MR16, Metal)	LD10 = 12V-6W MR16 LED		-NEX = Nexus® Wired (contact your sales representative) ³
					-NEXRF = Nexus® Wireless (contact your sales representative) ³
					-T3 = Time delay (15 minute)
					-DS = Lamp disconnect switch
					-VS = Vandal-Resistant Screws
					-3CP = 120V Cord & plug, 3 wire, 3ft long ²

Example: 2PG1/DR130LD1

¹ -ID & -IDNA include a time delay feature that can be enabled/disabled in the field or set by the factory by including -ID-TD* or -IDNA-TD*

² -3CP custom length available. Consult your sales representative

³ Minimum lamp load required: 20% of unit capacity

Switches, Three Way
 15A, 120-277V AC
 HBL® Extra Heavy Duty Industrial Switch

HUBBELL

Features

- Large brass binding head screws with deep slots
- Abuse resistant nylon toggle
- Strip gauge for accurate wiring

Ordering Information

Description	Toggle Color	UPC	Catalog Number
Nylon toggle, back and side wired, Illuminated Toggle	Ivory	783585430287	HBL1203IL

Listings

UL Listed
 CSA Certified
 Fed. Spec. W-S-896

Specifications

Top Material	Thermoset
Base Material	Thermoset, Blue
Toggle Material	Nylon
Contacts	Silver Alloy
Terminal Screws	Brass
Ground Screw	Brass (Green)

Performance

Electrical

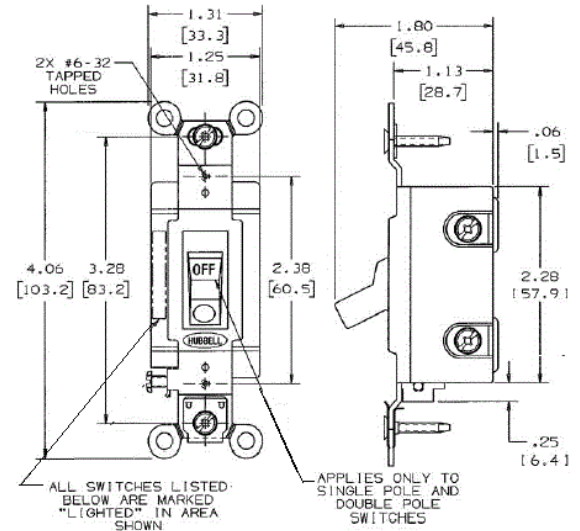
Dielectric Voltage	Withstands 1500V AC minimum for 1 minute
Max. Continuous Current	15A
Max. Working Voltage	277V AC
Overload	Minimum 4.8 times rated current for 100 cycles
Temperature Rise	30°C maximum at rated current

Mechanical

Terminal Accommodations #14 AWG min. - #10 AWG max. Solid and stranded copper wire only

Environmental

Flammability	UL 94V-2
Operating Temperature	Max. continuous: 75°C; Min. continuous: -40°C without impact



Complementary Products

Nylon Wall Plate NP11

Online Resources

Customer Use Drawing
 eCatalog
 Installation Instructions

Dimensions in Inches (mm)

Hubbell Wiring Device-Kellems • Hubbell Incorporated (Delaware) • 40 Waterview Drive • Shelton, CT 06484

Phone (800) 288-6000 • Fax (800) 255-1031 • Specifications subject to change without notice.



Straight Blade Devices 15A, 125V, 2 Pole, 3 Wire Grounding Commercial Specification Grade Duplex Receptacles

HUBBELL

Features

- Weather-resistance complies with national electrical code requirements
- Smooth face
- Wrap-around galvanized steel strap
- Triple wipe contacts

Ordering Information

Description	Device Color	UPC	Catalog Number
Weather Resistant, smooth face, back and side wired	Brown	783585144467	BR15WR

Listings

UL Listed to UL498 File No. E2186
Certified to CSA C22.2, No. 42
Fed. Spec. W-C-596
NEMA® WD-6 Compliant

Specifications

Face	Nylon
Base	Nylon
Power Contacts	.030 in. (.8) Brass
Ground Contacts	Brass
Wire Clamp	.062 in. (1.6) Nickel plated steel
Terminal Screws	Stainless steel
Mounting Screws	Stainless steel
Automatic Self-grounding Staple	Stainless steel
Mounting Screws	Stainless steel

Performance

Electrical

Current Interrupting	Certified for current interrupting at full rated current
Dielectric Voltage	Withstands 2,000V minimum

Mechanical

Product Identification	Ratings are a permanent part of the device
Terminal Accommodation	#14-#10 AWG copper stranded or solid conductor only
Terminal Identification	Terminals identified in accordance with UL 498 and CSA

Environmental

Flammability	UL 94 V-2
Operating Temperatures	Maximum continuous 75°C; minimum -40°C (w/o impact)



Accessories

Wallplate or Weatherproof Cover Duplex Opening

Resources

[eCatalog](#)

Dimensions in Inches (mm)

Hubbell Wiring Device-Kellems • Hubbell Incorporated (Delaware) • 40 Waterview Drive • Shelton, CT 06484

Phone (800) 288-6000 • Fax (800) 255-1031 • Specifications subject to change without notice.





Features

- Patented AUTOGUARD® self test technology
- Internal back wiring clamp and guide for quick and secure termination
- Triple wipe construction

Ordering Information

Description	Color	UPC	Catalog Number
15A, 125V, Style Line®, AUTOGUARD® self test GFCI receptacle, flush face, back and side wired, multiple drive screws	Ivory	883778122033	GFRST15I

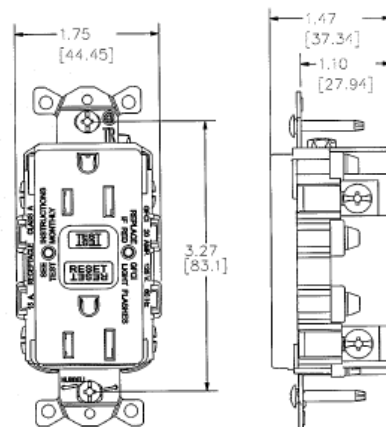


Listings

UL Listed - Canadian and U.S.
Meets ADA Standards
Meets all NEC® requirements
CSA Certified
NEMA® WD-6 Compliant

Specifications

Face	Nylon
Base	Nylon
Power Contacts	Brass
Ground Contacts	Brass
Mounting Strap	Zinc plated steel
Mounting Screws	Zinc plated steel



Online Resources

[Customer Use Drawing](#)
[eCatalog](#)
[Installation Instructions](#)

Straight Blade Devices

15A, 125V, 2 Pole, 3 Wire Grounding

HBL® Extra Heavy Duty Specification Grade Single Receptacle

HUBBELL

Features

- One-piece brass integral ground strap
- Unique bypass contact design

Ordering Information

Description	Device Color	UPC	Catalog Number
Back and side wired	Brown	783585013855	HBL5261

Listings

UL Listed to UL498 File No. E2186
Certified to CSA 22.2, No. 42 File 285
Fed. Spec. W-C-596
NEMA® WD-6 Compliant

Specifications

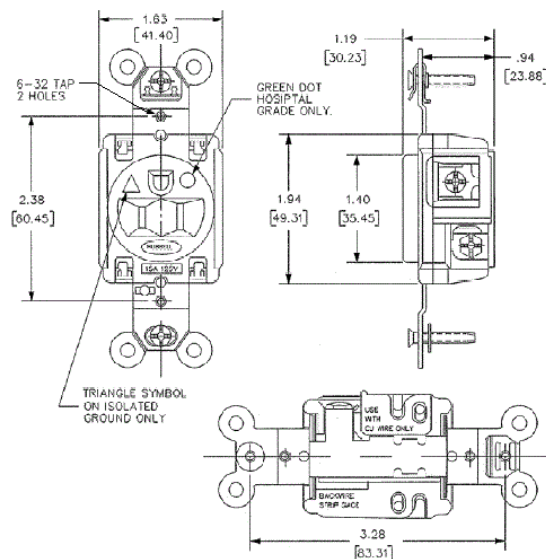
Face	Nylon
Base	PBT
Power Contacts	.037 in. (.9) Brass
Ground Contact	Brass
Mounting Strap	.050" (1.3) Brass
Auto Self-grounding Clip	Stainless steel
Mounting Screws	Zinc plated steel

Performance

Electrical	
Current Interrupting	Certified for current interrupting at full rated current
Dielectric Voltage	Withstands 2,000V minimum
Mechanical	
Product Identification	Ratings are a permanent part of the device
Terminal Accommodation	#14-#10 AWG copper stranded or solid conductor only
Terminal Identification	Terminals identified in accordance with UL 498 and CSA
Environmental	
Flammability	Top: UL 94V-2, Base: UL 94V-0
Operating Temperatures	Maximum continuous 75°C; minimum -40°C (w/o impact)



15A 125V
NEMA 5-15R
UL CSA
0.5 HP



Online Resources

Customer Use Drawing
eCatalog
Installation Instructions

Accessories

Wallplate or Weatherproof Cover

1.40" Opening

Dimensions in Inches (mm)

Hubbell Wiring Device-Kellems • Hubbell Incorporated (Delaware) • 40 Waterview Drive • Shelton, CT 06484

Phone (800) 288-6000 • Fax (800) 255-1031 • Specifications subject to change without notice.



WP5000 Series

The WP5000 extra-duty plastic Series While-In-Use Covers are easy to install and shipped with a gasket, mounting screws, base and cover assembly, and inserts for a variety of applications.

Features

- Complies with 2014 Article 406.9(B)(1) for Wet Locations and extra-duty Applications
- Heavy-Duty UV stabilized polycarbonate construction ensures long-lasting durability
- Single-gang covers mount vertically or horizontally
- Single Gang Models:
 - 3 inserts provided with all models that allow each model to meet multiple installations (up to 16 configurations)
- Double Gang Models:
 - 6 inserts provided with all models that allow each model to meet multiple installations (up to 70 configurations)
 - 2 round inserts accommodate from 1.375" to 2.656" plugs for the 30/50 amp applications.
- Reinforced Hinge Pin - designed to exceed 40lb Hinge Hang/Stress Test
- Impact Rated: 12 lb impact test to ensure cover remains in-tact
- Lockable Hasp: All models accept up to 0.25" Dia Shank
- Meets requirements for cold impact testing: -60°F (-51°C)
- 5000, 5100, 5200 Series Available in 10 different colors
- 5500 Series available in Clear, Gray, and Yellow

Ratings

Cover: UV stabilized polycarbonate
 UL Certified for Type 3R
 Outdoor Enclosures

Single Gang : Horizontal – 3 cord outlets 0.5" wide by 0.9" high.
 Vertical – 1 cord outlet 0.75" wide by 0.9" high

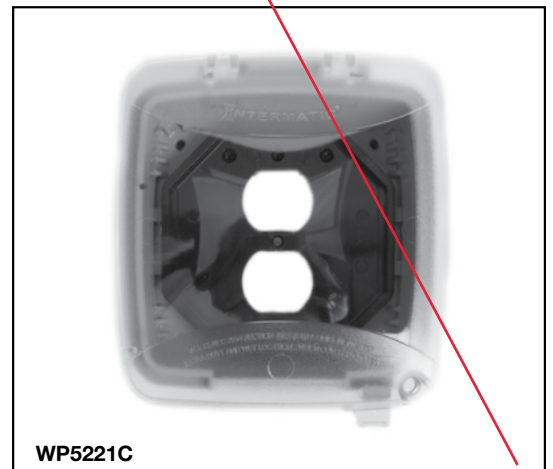
Double Gang : 1 cord outlet 1.50" wide by 1.25" high
 30/50 Amp – 1 Cord outlet 1.1" wide by 3.0" high

Mounting Base and Inserts: UV stabilized polycarbonate

Gasket: Neoprene - 1/8" (4.8 mm) thick with slits for mounting screws

Max Cord Size: Single Gang – (2) 14 Gauge or (1) 12 Gauge
 Double Gang – (2) 12 Gauge or (1) 10 Gauge
 30/50 Amp Double Gang – (1) 6 Gauge (3 wire ground)

Warranty: Limited 1 year



Model Number	Type	Hinge	FlexiGuard Insert #	Depth (in)
WP5000 Available in C, G, B, BL, BR, GN, OR, R, W, Y	Single-Gang	Vertical/Horizontal	WP17	2 ¼
WP5100 Available in C, G, B, BL, BR, GN, OR, R, W, Y	Single-Gang	Vertical/Horizontal	WP17	2 ¾
WP5110 Available in C, G, B, BL, BR, GN, OR, R, W, Y	Single-Gang	Vertical/Horizontal	WP17	3 ⅝
WP5220 Available in C, G, B, BL, BR, GN, OR, R, W, Y	Double-Gang	Vertical	WP217	2 ¼
WP5221C Available in Clear	Double-Gange	Vertical	WP101 and WP102	2 ¼
WP5225 Available in C, G, B, BL, BR, GN, OR, R, W, Y	Double-Gang	Vertical	WP217	2 ¾
WP5240 Available in C, G, B, BL, BR, GN, OR, R, W, Y	Double-Gang	Vertical	WP217	3 ⅝
WP5500 Available in C, G, Y	Double-Gang 30/50 Amp Service	Vertical	WP107 and WP213	4 ¾

1. Choose a WP model number
2. Choose WP color- see below

- C= Clear
- G= Gray
- B= Beige
- BL= Black
- BR= Bronze
- GN= Green
- OR= Orange
- R= Red
- W= White
- Y= Yellow

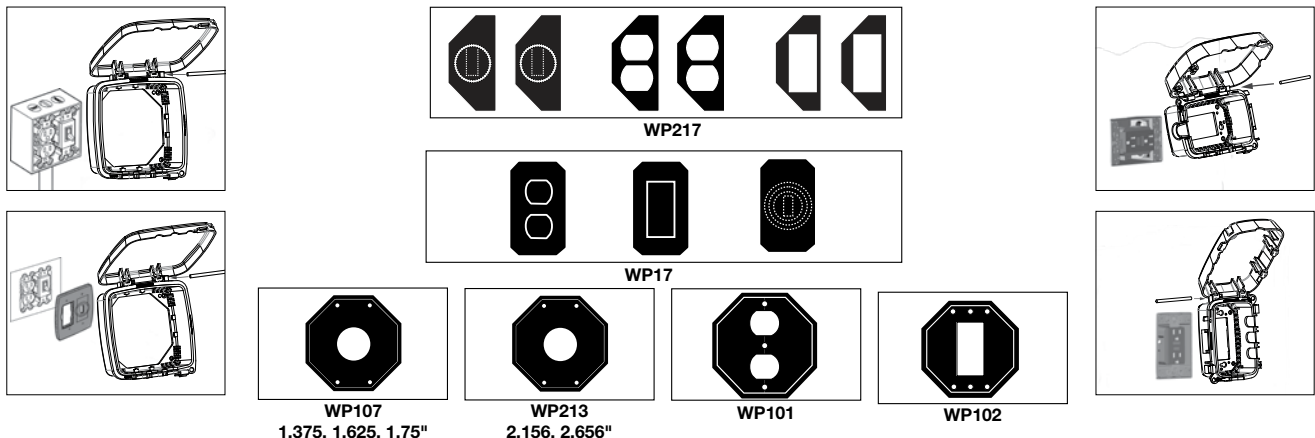
Specification for Single Gang

The weatherproof cover shall be designed to mount on a single gang _____, junction box to ensure while in use weather protection for a standard receptacle. The cover shall mount on indoor or outdoor junction boxes and shall include a weatherproof cover/base assembly, a gasket, three universal inserts, and mounting hardware. The outlet cover shall meet UL requirements for wet locations. The weatherproof cover shall be designed to meet requirements of with 2014 NEC Article 406.9(B)(1) for wet locations and extra-duty applications and shall be UL Type 3R listed. The weatherproof cover shall be constructed entirely of UV stabilized high impact polycarbonate material. The cover, which encloses the cord set, shall be _____ (Clear to allow inspection)(Opaque Gray). The cover shall meet agency requirements for cold impact at -60°F (-51°C). The cover shall provide usable inside depth of _____ (2 ¼")(2 ¾")(3 ⅝"). The weatherproof cover shall be Intermatic model _____ (See Model Numbers Listed).

Specification for Double Gang

The weatherproof cover shall be designed to mount on a two gang _____ (Vertical), junction box to ensure weather protection for a standard receptacle. The cover shall mount on indoor or outdoor junction boxes and shall include a weatherproof cover/base assembly, a gasket, six universal inserts, and mounting hardware. The inserts must provide flexibility for mounting at any angle including: 90°, 180°, or 270°. The outlet cover shall meet UL requirements for wet locations. The weatherproof cover shall be designed to meet requirements of 2014 NEC Article 406.8(B)(1) for wet locations and extra-duty applications and shall be UL Type 3R listed. The weatherproof cover and base shall be constructed entirely of UV stabilized polycarbonate material. The cover, which encloses the cord set, shall be _____ (Clear to allow inspection)(Opaque Gray). The cover shall meet agency requirements for cold impact at -60°F (-51°C). The cover shall provide a useable inside depth of _____ (2 ¼")(2 ¾")(3 ⅝")(4 ¾"). The Weatherproof cover shall be Intermatic model _____ (See Model Numbers Listed).

Diagrams



PRODUCT DATA SHEET

CONDUIT AND WIRING SCHEDULE

SERVICE ENTRANCE - Rigid, heavy wall, steel conduit with threaded watertight connections adequately sized to handle the type, number and size of the incoming service conductors - in compliance with Article 344 of the National Electrical Code.

EQUIPMENT CAPSULE CONDUIT - Rigid, heavy wall, Schedule 40 PVC with solvent weld moisture-proof connections adequately sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article 352 of the National Electrical Code and NEMA TC-2, NEMA TC-3, UL514B, UL514C and UL-651 Underwriters Laboratory Specifications.

FLEXIBLE CONNECTIONS - Where flexible conduits connections are necessary, the conduit used shall be liquid-tight flexible totally nonmetallic, corrosion resistant, nonconductive, UL listed conduit with a sunlight resistant jacket over an inner, flexible core, sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article 356 of the National Electrical Code.

MOTOR CIRCUIT/POWER CONDUCTORS - Sized for load. All branch circuit conductors supplying a single motor on one (1) horsepower or more shall have an ampacity of not less than 125 percent of the motor full load current rating, dual rated type THHN/THWN, as set forth in Article 310 of the National Electrical Code, Table 310.104(A) for flame retardant, heat resistant thermoplastic, copper conductors in a nylon or equivalent outer covering.

CONTROL AND ACCESSORY WIRING - Sized for load, type MTW/AWM (machine tool wire/appliance wiring material) as set forth in Article 310 and 670 of the National Electrical Code, Table 310.104(A) and NFPA Standard 79 for flame retardant, moisture, heat and oil resistant thermoplastic, copper conductors in compliance with NMTBA and as listed by Underwriters Laboratories (AWM), except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug.



ENGINEERED FLUID, INC.

P.O. DRAWER 723 · CENTRALIA, ILLINOIS 62801

JOB REF. N^o STANDARD
PAGE N^o 1713-051981-01.3

CONCEPT, TYPE 4 AND 12



INDUSTRY STANDARDS

Wall-mounting brackets required to maintain UL/CSA external mounting requirement.

Concept solid single-door, door with window and flush-mount models

UL 508A Listed; Type 4, 12; File No. E61997
 cUL Listed per CSA C22.2 No. 94; Type 4, 12; File No. E61997

NEMA/EEMAC Type 4, 12, 13
 CSA, File No. 42186: Type 4, 12
 VDE IP66
 IEC 60529, IP66

Concept two-door models

UL 508A Listed; Type 12; File No. E61997
 cUL Listed per CSA C22.2 No. 94; Type 12; File No. E61997

NEMA/EEMAC Type 12
 CSA, File No. 42186, Type 12
 VDE IP 55
 IEC 60529, IP55

APPLICATION

Concept Enclosures are ideal for machine control applications. With streamlined styling, flush quarter-turn latches and an attractive, durable finish. Available in solid or window single-door and two-door landscape, flush-mount and sloped-top versions for application and mounting flexibility. Two-door landscape models provide full-width access and easy panel installation.

SPECIFICATIONS

- 16 or 14 gauge steel
- Seams continuously welded and ground smooth
- Corner-formed doors
- Simple easy-to-remove and install hinge pins with captivation clip
- High-torque threadless studs and fasteners on door
- Minimum-width body flange provides maximum door opening
- Door opens 210 degrees
- External formed body flange
- Panel mounting studs fit optional CONCEPT panels and other accessories
- Mounting holes in back of body for direct mounting or optional external mounting brackets
- Removable door with hidden hinges for clean, aesthetic appearance
- Seamless foam-in-place gasket
- Quarter-turn slotted latch(es)
- Door alignment device on doors wider than 30 in.
- Four hinges on 60-in.-high enclosures
- Grounding stud on body; bonding provision on door (except window-door models)
- Provisions on door for optional high-impact thermoplastic data pocket
- Hardware kit with panel mounting nuts, panel grounding hardware and sealing washers
- Installation instructions provided

Single-Door and Window-Door Models:

- 3-point latch system on enclosures with height equal to or greater than 42-in. with quarter-turn, slotted latch

Flush-Mount Models:

- Mounting frame extends completely around enclosure

Two-Door Models:

- Overlapping door design provides full-width access
- Three-point latch system on right-hand hinged door with quarter-turn, slotted latch

FINISH

Two standard finishes are available: ANSI 61 gray or RAL 7035 textured light-gray polyester powder paint inside and out.

ACCESSORIES

- Concept Panels
- Door Stop Kit
- Handles
- Lock Inserts
- Mounting-Bracket Kits
- Padlock Insert
- Padlock Handle
- HF Side-Mount Filter Fans

MODIFICATION AND CUSTOMIZATION

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

BULLETIN: CW1

Catalog Number	AxBxC in./mm	Finish	Door Ga.	Body Ga.	CONCEPT Panel	Conductive CONCEPT Panel	Panel Size D x E in./mm	Mounting G x H in./mm	Latches qty.	Latches style	J in./mm	K in./mm
CSD16128LG	16.00 x 12.00 x 8.00 406 x 305 x 203	RAL 7035 Lt. Gray	16	16	CP1612	CP1612G	14.20 x 10.20 361 x 259	14.50 x 10.50 368 x 267	1	Quarter-turn	8.00 203	1.45 37
CSD16168	16.00 x 16.00 x 8.00 406 x 406 x 203	ANSI 61 Gray	16	16	CP1616	CP1616G	14.20 x 14.20 361 x 361	14.50 x 14.50 368 x 368	1	Quarter-turn	8.00 203	1.45 37
CSD16168LG	16.00 x 16.00 x 8.00 406 x 406 x 203	RAL 7035 Lt. Gray	16	16	CP1616	CP1616G	14.20 x 14.20 361 x 361	14.50 x 14.50 368 x 368	1	Quarter-turn	8.00 203	1.45 37
CSD16208	16.00 x 20.00 x 8.00 406 x 508 x 203	ANSI 61 Gray	16	16	CP2016	CP2016G	18.20 x 14.20 462 x 361	14.50 x 18.50 368 x 470	1	Quarter-turn	8.00 203	1.45 37
CSD16208LG	16.00 x 20.00 x 8.00 406 x 508 x 203	RAL 7035 Lt. Gray	16	16	CP2016	CP2016G	18.20 x 14.20 462 x 361	14.50 x 18.50 368 x 470	1	Quarter-turn	8.00 203	1.45 37
CSD20128	20.00 x 12.00 x 8.00 508 x 305 x 203	ANSI 61 Gray	16	16	CP2012	CP2012G	18.20 x 10.20 462 x 259	18.50 x 10.50 470 x 267	1	Quarter-turn	10.00 254	1.45 37
CSD20128LG	20.00 x 12.00 x 8.00 508 x 305 x 203	RAL 7035 Lt. Gray	16	16	CP2012	CP2012G	18.20 x 10.20 462 x 259	18.50 x 10.50 470 x 267	1	Quarter-turn	10.00 254	1.45 37
CSD20168	20.00 x 16.00 x 8.00 508 x 406 x 203	ANSI 61 Gray	16	16	CP2016	CP2016G	18.20 x 14.20 462 x 361	18.50 x 14.50 470 x 368	1	Quarter-turn	10.00 254	1.45 37
CSD20168LG	20.00 x 16.00 x 8.00 508 x 406 x 203	RAL 7035 Lt. Gray	16	16	CP2016	CP2016G	18.20 x 14.20 462 x 361	18.50 x 14.50 470 x 368	1	Quarter-turn	10.00 254	1.45 37
CSD20208	20.00 x 20.00 x 8.00 508 x 508 x 203	ANSI 61 Gray	16	16	CP2020	CP2020G	18.20 x 18.20 462 x 462	18.50 x 18.50 470 x 470	1	Quarter-turn	10.00 254	1.45 37
CSD20208LG	20.00 x 20.00 x 8.00 508 x 508 x 203	RAL 7035 Lt. Gray	16	16	CP2020	CP2020G	18.20 x 18.20 462 x 462	18.50 x 18.50 470 x 470	1	Quarter-turn	10.00 254	1.45 37
CSD20248	20.00 x 24.00 x 8.00 508 x 610 x 203	ANSI 61 Gray	16	16	CP2420	CP2420G	22.20 x 18.20 564 x 462	18.50 x 22.50 470 x 572	1	Quarter-turn	10.00 254	1.45 37
CSD20248LG	20.00 x 24.00 x 8.00 508 x 610 x 203	RAL 7035 Lt. Gray	16	16	CP2420	CP2420G	22.20 x 18.20 564 x 462	18.50 x 22.50 470 x 572	1	Quarter-turn	10.00 254	1.45 37
CSD24128	24.00 x 12.00 x 8.00 610 x 305 x 203	ANSI 61 Gray	16	16	CP2412	CP2412G	22.20 x 10.20 564 x 259	22.50 x 10.50 572 x 267	1	Quarter-turn	12.00 305	1.45 37
CSD24128LG	24.00 x 12.00 x 8.00 610 x 305 x 203	RAL 7035 Lt. Gray	16	16	CP2412	CP2412G	22.20 x 10.20 564 x 259	22.50 x 10.50 572 x 267	1	Quarter-turn	12.00 305	1.45 37
CSD24168	24.00 x 16.00 x 8.00 610 x 406 x 203	ANSI 61 Gray	16	16	CP2416	CP2416G	22.20 x 14.20 564 x 361	22.50 x 14.50 572 x 368	1	Quarter-turn	12.00 305	1.45 37
CSD24168LG	24.00 x 16.00 x 8.00 610 x 406 x 203	RAL 7035 Lt. Gray	16	16	CP2416	CP2416G	22.20 x 14.20 564 x 361	22.50 x 14.50 572 x 368	1	Quarter-turn	12.00 305	1.45 37
CSD24208	24.00 x 20.00 x 8.00 610 x 508 x 203	ANSI 61 Gray	16	16	CP2420	CP2420G	22.20 x 18.20 564 x 462	22.50 x 18.50 572 x 470	1	Quarter-turn	12.00 305	1.45 37
CSD24208LG	24.00 x 20.00 x 8.00 610 x 508 x 203	RAL 7035 Lt. Gray	16	16	CP2420	CP2420G	22.20 x 18.20 564 x 462	22.50 x 18.50 572 x 470	1	Quarter-turn	12.00 305	1.45 37
CSD24248	24.00 x 24.00 x 8.00 610 x 610 x 203	ANSI 61 Gray	14	16	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127	1.45 37
CSD24248LG	24.00 x 24.00 x 8.00 610 x 610 x 203	RAL 7035 Lt. Gray	14	16	CP2424	CP2424G	22.20 x 22.20 564 x 564	22.50 x 22.50 572 x 572	2	Quarter-turn	5.00 127	1.45 37
CSD24308	24.00 x 30.00 x 8.00 610 x 762 x 203	ANSI 61 Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	22.50 x 28.50 572 x 724	2	Quarter-turn	5.00 127	1.45 37
CSD24308LG	24.00 x 30.00 x 8.00 610 x 762 x 203	RAL 7035 Lt. Gray	14	16	CP3024	CP3024G	28.20 x 22.20 716 x 564	22.50 x 28.50 572 x 724	2	Quarter-turn	5.00 127	1.45 37
CSD30128	30.00 x 12.00 x 8.00 762 x 305 x 203	ANSI 61 Gray	14	16	CP3012	CP3012G	28.20 x 10.20 716 x 259	28.50 x 10.50 724 x 267	2	Quarter-turn	5.00 127	1.45 37
CSD30128LG	30.00 x 12.00 x 8.00 762 x 305 x 203	RAL 7035 Lt. Gray	14	16	CP3012	CP3012G	28.20 x 10.20 716 x 259	28.50 x 10.50 724 x 267	2	Quarter-turn	5.00 127	1.45 37
CSD30168	30.00 x 16.00 x 8.00 762 x 406 x 203	ANSI 61 Gray	14	16	CP3016	CP3016G	28.20 x 14.20 716 x 361	28.50 x 14.50 724 x 368	2	Quarter-turn	5.00 127	1.45 37
CSD30168LG	30.00 x 16.00 x 8.00 762 x 406 x 203	RAL 7035 Lt. Gray	14	16	CP3016	CP3016G	28.20 x 14.20 716 x 361	28.50 x 14.50 724 x 368	2	Quarter-turn	5.00 127	1.45 37
CSD30208	30.00 x 20.00 x 8.00 762 x 508 x 203	ANSI 61 Gray	14	16	CP3020	CP3020G	28.20 x 18.20 716 x 462	28.50 x 18.50 724 x 470	2	Quarter-turn	5.00 127	1.45 37
CSD30208LG	30.00 x 20.00 x 8.00 762 x 508 x 203	RAL 7035 Lt. Gray	14	16	CP3020	CP3020G	28.20 x 18.20 716 x 462	28.50 x 18.50 724 x 470	2	Quarter-turn	5.00 127	1.45 37
CSD30248	30.00 x 24.00 x 8.00 762 x 610 x 203	ANSI 61 Gray	14	14	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127	1.45 37
CSD30248LG	30.00 x 24.00 x 8.00 762 x 610 x 203	RAL 7035 Lt. Gray	14	14	CP3024	CP3024G	28.20 x 22.20 716 x 564	28.50 x 22.50 724 x 572	2	Quarter-turn	5.00 127	1.45 37
CSD30308	30.00 x 30.00 x 8.00 762 x 762 x 203	ANSI 61 Gray	14	14	CP3030	CP3030G	28.20 x 28.20 716 x 716	28.50 x 28.50 724 x 724	2	Quarter-turn	5.00 127	1.45 37
CSD30308LG	30.00 x 30.00 x 8.00 762 x 762 x 203	RAL 7035 Lt. Gray	14	14	CP3030	CP3030G	28.20 x 28.20 716 x 716	28.50 x 28.50 724 x 724	2	Quarter-turn	5.00 127	1.45 37
CSD30368	30.00 x 36.00 x 8.00 762 x 914 x 203	ANSI 61 Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	28.50 x 34.50 724 x 876	2	Quarter-turn	5.00 127	1.45 37
CSD30368LG	30.00 x 36.00 x 8.00 762 x 914 x 203	RAL 7035 Lt. Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	28.50 x 34.50 724 x 876	2	Quarter-turn	5.00 127	1.45 37
CSD36248	36.00 x 24.00 x 8.00 914 x 610 x 203	ANSI 61 Gray	14	16	CP3624	CP3624G	34.20 x 22.20 869 x 564	34.50 x 22.50 876 x 572	2	Quarter-turn	5.00 127	1.45 37
CSD36248LG	36.00 x 24.00 x 8.00 914 x 610 x 203	RAL 7035 Lt. Gray	14	16	CP3624	CP3624G	34.20 x 22.20 869 x 564	34.50 x 22.50 876 x 572	2	Quarter-turn	5.00 127	1.45 37
CSD36308	36.00 x 30.00 x 8.00 914 x 762 x 203	ANSI 61 Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127	1.45 37
CSD36308LG	36.00 x 30.00 x 8.00 914 x 762 x 203	RAL 7035 Lt. Gray	14	14	CP3630	CP3630G	34.20 x 28.20 869 x 716	34.50 x 28.50 876 x 724	2	Quarter-turn	5.00 127	1.45 37
CSD36368	36.00 x 36.00 x 8.00 914 x 914 x 203	ANSI 61 Gray	14	14	CP3636	CP3636G	34.20 x 34.20 869 x 869	34.50 x 34.50 876 x 876	2	Quarter-turn	5.00 127	1.45 37
CSD36368LG	36.00 x 36.00 x 8.00 914 x 914 x 203	RAL 7035 Lt. Gray	14	14	CP3636	CP3636G	34.20 x 34.20 869 x 869	34.50 x 34.50 876 x 876	2	Quarter-turn	5.00 127	1.45 37
CSD42248	42.00 x 24.00 x 8.00 1067 x 610 x 203	ANSI 61 Gray	14	14	CP2442	CP2442G	22.20 x 40.20 564 x 1021	40.50 x 22.50 1029 x 572	1	3-point	21.00 533	1.70 43

SU201M-K6



Miniature Circuit Breaker - SU200M - 1P - K - 6 ampere

General Information

Extended Product Type	SU201M-K6
Product ID	2CDS271337R0377
EAN	4016779930062
Catalog Description	Miniature Circuit Breaker - SU200M - 1P - K - 6 ampere
Long Description	SU201M-K6 Miniature Circuit Breaker K-Char., 10kA, 6A, 1P UL489

Ordering

Minimum Order Quantity	1 piece
Customs Tariff Number	85362010

Popular Downloads

Data Sheet, Technical Information	2CDC002177D0202
Instructions and Manuals	2CDC002177D0202

Dimensions

Product Net Width	17.5 mm
Product Net Depth / Length	69 mm
Product Net Height	111 mm
Product Net Weight	0.125 kg

Technical

Standards	CSA 22.2 No. 5 IEC/EN 60947-2 UL 489
Number of Poles	1
Tripping Characteristic	K
Rated Current (I_n)	6 A
Rated Operational Voltage	acc. to IEC 60947-2 230 V AC
Power Loss	2,0 W at Rated Operating Conditions per Pole 2,0 W
Rated Insulation Voltage (U_i)	acc. to IEC/EN 60664-1 440 V
Rated Frequency (f)	50 Hz

	60 Hz DC Hz
Rated Ultimate Short-Circuit Breaking Capacity (I_{cu})	(230 V AC) 15 kA
Rated Service Short-Circuit Breaking Capacity (I_{cs})	(230 V AC) 11.2 kA
Overvoltage Category	III
Pollution Degree	3
Rated Impulse Withstand Voltage (U_{imp})	4 kV (6.2 kV @ sea level) (5.0 kV @ 2000 m)
Dielectric Test Voltage	50 / 60 Hz, 1 min: 2 kV
Housing Material	Insulation Group I, RAL 7035
Contact Position Indication	Red ON / Green OFF
Degree of Protection	IP20
Remarks	IP40 in enclosure with cover
Electrical Endurance	20000 AC cycle 20000 cycle
Terminal Type	Screw Terminals
Screw Terminal Type	Failsafe Bi-directional Cylinder-lift Terminal
Connecting Capacity	Busbar 10 / 10 mm ² Flexible with Ferrule 0.75 ... 25 mm ² Flexible 0.75 ... 25 mm ² Rigid 0.75 ... 35 mm ² Stranded 0.75 ... 35 mm ²
Tightening Torque	2.8 N·m
Recommended Screw Driver	Pozidriv 2
Mounting on DIN Rail	TH35-7.5 (35 x 7.5 mm Mounting Rail) acc. to IEC 60715 TH35-15 (35 x 15 mm Mounting Rail) acc. to IEC 60715
Mounting Position	Any

Environmental

Ambient Air Temperature	Operation -25 ... +55 °C Storage -40 ... +70 °C
Resistance to Shock acc. to IEC 60068-2-27	25g / 2 shocks / 13 ms
Resistance to Vibrations acc. to IEC 60068-2-6	5g, 20 cycles at 5 ... 150 ... 5 Hz with load 0.8 In
Environmental Conditions	28 cycles with 55 °C / 90-96 % and 25 °C / 95-100 %
RoHS Status	Following EU Directive 2002/95/EC August 18, 2005 and amendment

Technical UL/CSA

Maximum Operating Voltage UL/CSA	277 V AC 48 V DC
Connecting Capacity UL/CSA	Busbar 18-8 AWG Conductor 18-4 AWG
Interrupting Rating acc. to UL1077	(277 V AC) 10 kA

Certificates and Declarations (Document Number)

Declaration of Conformity - CE	2CDK400595D2702
Instructions and Manuals	2CDC002177D0202
RoHS Information	2CDK400596D0203




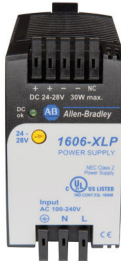

Product Overview

- Quick mounting and connecting, DIN rail mount, smallest in class
- UL Listed NEC Class 2 'Limited Power' options; Class 1, Div. 2; Semi F47; ODVA Approved
- Low inrush current limiting
- PFC Active or Passive
- Wide range input; auto-select input
- Enhanced overload design (continuous current, no hiccup)
- Selectable operating mode (single/parallel)
- Excellent efficiency and temperature rating



Special Modules

- Buffer Modules
- Redundancy Modules (1+1 or N+1 redundancies)
- DC UPS
 - Traditional UPS with battery
 - Capacitor-based UPS without batteries - Electrochemical Double Layer Capacitors (EDLC)

Power Supply Family/ Attributes ⁽¹⁾	Performance Power Supply 1606-XLS	Essential Power Supply 1606-XLE	DC-DC Converter 1606-XLD	Compact Power Supply 1606-XLP	Basic Power Supply 1606-XLB
					
Input Voltage	Single/multi-phase	Single/multi-phase	DC Voltage	Single/multi-phase	Single-phase
Watt Range	80...960 W	80...960 W	92...240 W	15...100 W	36...480 W
Multiple Output Voltages	12, 24, 30, 36, 48V DC	12, 24, 48V DC	24, 48V DC	5, 12, 15, 24, 48V DC	12, 24V DC
Terminations	Screw, Cam Lock Spring	Screw, Cam Lock Spring, Plug, and Push-in	Screw, Cam Lock Spring	Screw, Cam Lock Spring, Plug	Screw, Push-in
Auto Select Input	Yes	Yes	–	Yes	Yes
Power Boost	150% / 5 s	120%	120%	–	–
DC OK Relay Output	Yes	Yes	Yes	Yes	Yes
DC OK Status Indicator	Yes	Yes	Yes	Yes	Yes
Wide Range	Yes	Yes	–	Yes	Yes
Product Selection Page	5	7	9	10	11
Specifications Page	13	21	27	28	34
Certifications and Standards Compliance Page	38	39	40	40	41

(1) Not all features apply to all power supplies; see individual power supply descriptions for specifics.

Catalog Number Explanation

1606
-
XLE
480
E
-
P
-
D

a
b
c
d
e

a	
Power Supply Type	
Code	Description
XLB	Basic Power Supply
XLD	DC-DC Converter
XLE	Essential Power Supply
XLP	Compact Power Supply
XLS	Performance Power Supply
XLX	Regional Power Supply

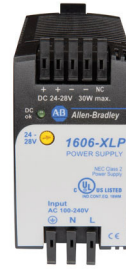
e	
Multi-phase Variations	
Code	Description
blank	—
2	Two phase
3	Three phase
3C	Three-phase, conformal coating
3E	Three-phase, input voltage 400V AC
3N	Three-phase, input voltage 480V AC
D	360...900V DC Only

b	
Rated Output	
Code	Description
15	15 W
25	25 W
30	30 W
36	36 W
40	40 W
50	50 W
60	60 W
72	72 W
80	80 W
90	90 W
95	95 W
100	100 W
120	120 W
180	180 W
192	192 W
240	240 W
260	260 W
480	480 W
720	720 W
960	960 W

c	
Output Voltage	
Code	Description
A	5V DC
B	10...12 or 12...15V DC
C	Dual ± 12V and 15V DC
D	24V
E	24...28V DC
F	48...56V DC
G	36...43V DC
M	48V DC

d	
Special Features	
Code	Description
blank	No special features
A	ATEX
C	Conformal Coated
CH	Push-in Terminal, Conformal Coated
CL	Spring Terminals, Conformal Coated
CR	Screw Terminals, Conformal Coated, Redundancy Built-in
CRH	Push-in Terminal, Conformal Coated, Redundancy Built-in
CRL	Spring Terminals, Conformal Coated, Redundancy Built-in
CRZ	Plug/Removable, Conformal Coated, Redundancy Built-in
CZ	Plug/Removable, Conformal Coated
D	Extended DC Input
DRZ	Plug/Removable, Redundancy Built-in, Extended DC input
E	Regional Unit - Europe
H	Push-in Terminals
L	Spring-clamp Terminals
M	Remote Shutdown
N	Regional Unit - North America
P	Power Factor Correction
Q	NEC Class 2
R	Redundancy Built-in
RH	Push-in Terminal, Redundancy built-in
RL	Spring Terminals, Redundancy built-in
RZ	Plug / Removable, Redundancy built-in
S	Output Signal
T	Extended Temperature
X	Semi-regulated
Y	Load Sharing
Z	Plug / Removable Terminals

1606-XLP Compact Power Supplies



Output	Power	Input AC	Input DC	Special Features	Catalog Number		
100...240V AC/DC Converters							
5V	3 A	15 W	AC 100...240V	DC 110...300V	1606-XLP15A		
	5 A	25 W			1606-XLP25A		
12V	1.3 A	15 W			1606-XLP15B		
	2.5 A	30 W			1606-XLP30B		
	4.2 A	50 W			1606-XLP50B		
	4.5 A	54 W			1606-XLP60BQ		
	4.5 A				-40 °C (-40 °F) operation	1606-XLP60BQT	
±12V	7.5 A	90 W			DC 290V	1606-XLP90B	
	2.5 A	36 W			DC 110...300V	Dual-output voltage	1606-XLP36C
24V	0.63 A	15 W			DC 110...300V	1606-XLP15E	
	1.3 A	30 W	DC 110...300V	1606-XLP30E			
			DC 110...300V	1606-XLP30EQ			
	2.1 A	50 W	DC 110...300V	1606-XLP50E			
			DC 110...300V	With plug connector	1606-XLP50EZ		
	2.5 A	60 W	DC 110...300V	1606-XLP60EQ			
			DC 110...300V	-40°C (-40 °F) operation	1606-XLP60EQT		
		3 A	72 W	AC 100...120 / 220...240V	DC 290V	1606-XLP72E	
		3.9 A	95 W	AC 100...120 / 220...240V	DC 290V	NEC Class 2	1606-XLP95E
		4.2 A	100 W	AC 100...240V	DC 290V	1606-XLP100E	
48V	1.1 A	50 W	AC 100...240V	DC 110...300V	1606-XLP50F		
	2.1 A	100 W	AC 100...120V/AC 200...240V	DC 290V	1606-XLP100F		
100...240V AC/DC Converters							
24V	3.75 A	90 W	2 AC 380...480V	—	NEC Class 2	1606-XLP90E-2	
	4.2 A	100 W	2 AC 380...480V	—	—	1606-XLP100E-2	

Diode Redundancy Modules

Output	Input DC	Description	Catalog Number
DC 12...48V	10 A	Dual-input diode redundancy module	1606-XLPRED

Specifications - 1606-XLP Compact Power Supplies

100....240V AC/DC

Catalog Number/ Attribute	1606-XLP15A	1606-XLP25A	1606-XLP15B	1606-XLP30B	1606-XLP50B	1606-XLP60BQ	1606-XLP60BQT
Output Voltage, Nom	5V	5V	12V	12V	12V	12V	12V
Output Current, Nom	3 A	5 A	1.3 A	3.0 A	4.2 A	4.5 A	4.5 A
Adjustment Range	5...5.5V	5...5.5V	12...15V	10...12V	12...15V	12...15V	12...15V
Output Current Range	3.0 A	5.0 A	1.3...1.0 A	3...2.5 A	4.2...3.4 A	4.5...3.6 A	4.5...3.6 A
Output Power	15 W	25 W	15 W	30 W	50 W	54 W	54 W
Power Reserves	-	-	-	-	-	-	-
Ripple and Noise Max [mVpp]	50 mV	50 mV	75 mV	10 mV	100 mV	50 mV	50 mV
AC Input Voltage	AC100...240V	AC100...240V	AC100...240V	AC 100...240V	AC100...240V	AC100...240V	AC100...240V
DC Input Voltage	DC 110...300V	DC 110...300V	DC 110...300V	DC 110...300V	DC 110...300V	DC 110...300V	DC 110...300V
Power Factor, Typ	0.44	0.44	0.44	0.53	0.52	0.5	0.44
Input Inrush Current Limiter	NTC	NTC	NTC	NTC	NTC	NTC	Active
Input Inrush Current ⁽¹⁾	16 A/31 A	17 A/35 A	16 A/31 A	17 A/35 A	17 A/35 A	16 A/32 A	16 A/32 A
External Input Fuse, Min	B - 6 A or C - 3 A	B - 10 A or C - 6 A	B - 6 A or C - 3 A	B - 10 A or C - 6 A	B - 10 A or C - 6 A	B - 10 A or C - 6 A	B - 6 A or C - 3 A
Efficiency, Typ	77.2%	80.0%	82.5%	84.0%	90.0%	87.2%	87.6%
Power Losses, Typ	4.5 W	6.3 W	3.2 W	5.8 W	6.0 W	7.9 W	7.6 W
MTBF ⁽²⁾	2686 kh	600 kh	3811 kh	650 kh	600 kh	1690 kh	1571 kh
Lifetime Min (+40 °C)	93 kh	-	125 kh	-	-	56 kh	56 kh
Temperature Range, operating	-10...+70°C (14...158 °F)	-10...+70°C (14...158 °F)	-10...+70°C (14...158 °F)	-10...+70°C (14...158 °F)	-10...+70°C (14...158 °F)	-10...+70°C (14...158 °F)	-40...+70°C (-40...+158 °F)
Derating ⁽³⁾	0.4 W/°C	0.5 W/°C	0.4 W/°C	0.8 W/°C	1.3 W/°C	1.4 W/°C	1.4 W/°C
Connection Terminals	Screw	Spring	Screw	Spring	Spring	Screw	Screw
Dimensions, W x H x D	22.5 x 75 x 91 mm (0.86 x 2.95 x 3.58 in.)	45 x 75 x 91 mm (1.77 x 2.95 x 3.58 in.)	22.5 x 75 x 91 mm (0.86 x 2.95 x 3.58 in.)	45 x 75 x 91 mm (1.77 x 2.95 x 3.58 in.)	45 x 75 x 91 mm (1.77 x 2.95 x 3.58 in.)	45 x 75 x 91 mm (1.77 x 2.95 x 3.58 in.)	45 x 75 x 91 mm (1.77 x 2.95 x 3.58 in.)
Weight	130 g (0.29 lb)	240 g (0.53 lb)	130 g (0.29 lb)	250 g (0.55 lb)	260 g (0.57 lb)	250 g (0.55 lb)	250 g (0.55 lb)
Special Features	-	-	-	-	-	-	-40 °C operation

(1) Output transient current

(2) +40 °C, SN29500

(3) From 60...70 °C (140...158 °F).

100...240V AC/DC, Continued

Catalog Number	1606-XLP90B	1606-XLP36C	1606-XLP15E	1606-XLP30E	1606-XLP30EQ
Output Voltage, Nom	12V	12V	24V	24V	24V
Output Current, Nom	7.5 A	2.5 A	0.63 A	1.3 A	1.3 A
Adjustment Range	12...15V	± 12...15V	24...28V	24...28V	24...28V
Output Current Range	7.5...6 A	2.5 A ⁽¹⁾	0.63...0.54 A	1.3...1.1 A	1.3...1.1 A
Output Power	90 W	36 W	15 W	30 W	30 W
Power Reserves	—	—	—	—	—
Ripple and Noise Max [mVPP]	50 mV	50 mV	50 mV	50 mV	50 mV
AC Input Voltage	AC 100...120V/ 220...240V auto-select	AC 100...240V	AC 100...240V	AC 100...240V	AC 100...240V
DC Input Voltage	DC 220...375V	DC 110...300V	DC 110...300V	DC 110...300V	DC 110...300V
Power Factor, Typ	0.55	0.53	0.44	0.53	0.49
Input Inrush Current Limiter	NTC	NTC	NTC	NTC	NTC
Input Inrush Current ⁽²⁾	22 A/37 A	17 A/35 A	13 A/26 A	17 A/35 A	18 A/35 A
External Input Fuse, Min	B-10 A or C-6 A	B-10 A or C-6 A	B - 6 A or C - 3 A	B - 10 A or C - 6 A	B - 6 A or C - 3 A
Efficiency, Typ	88.5%	86.0%	85.1%	87.5%	89.4%
Power Losses, Typ	11.7 W	5.9 W	2.7 W	4.5 W	3.7 W
MTBF ⁽³⁾	500 kh	600 kh	4369 kh	650 kh	2405 kh
Lifetime Min (+40 °C)	—	—	196 kh	—	174 kh
Temperature Range, Operating	-25...+70 °C (-13...+158 °F)	-25...+70 °C (-13...+158 °F)	-10...+70 °C (14...158 °F)	-10...+70 °C (14...158 °F)	-10...+70 °C (14...158 °F)
Derating ⁽⁴⁾	2.5 W/°C	1 W/°C	0.4 W/°C	0.8 W/°C	0.8 W/°C
Connection Terminals	Spring	Spring	Screw	Spring	Screw
Dimensions W x H x D	73 x 75 x 103 mm (2.87 x 2.95 x 4.06 in.)	45 x 75 x 91 mm (1.77 x 2.95 x 3.58 in.)	23 x 75 x 91 mm (0.91 x 2.95 x 3.58 in.)	45 x 75 x 91 mm (1.77 x 2.95 x 3.58 in.)	23 x 75 x 91 mm (0.91 x 2.95 x 3.58 in.)
Weight	360 g (0.79 lb)	240 g (0.53 lb)	130 g (0.29 lb)	230 g (0.51 lb)	140 g (0.31 lb)
DC OK Relay Contact	—	—	—	—	—

(1) Both outputs can flexibly be loaded up to this current as long as the output power remains less than 36 W. The current at the output with the lower load should be at least 5% of the output with the higher load.

(2) Output transient current

(3) +40 °C, SN29500

(4) From 60...70 °C (140...158 °F).

Catalog Number	CE	UL 508	UL 60950-1	UL 61010-2-201	IEC 60950-1 CB-Scheme	IEC 61010-2-201 CB-Scheme	IECEX	ATEX	Class I Div. 2 HazLoc	DNV GL Marine	ABS Marine	EAC Registration	NEC Class 2	EN 61000-3-2 Harmonics (PFC) Ⓢ	EN 61000-6-1 Immunity for residential	EN 61000-6-2 Immunity for industrial	EN 61000-6-3 Emission for residential	EN 61000-6-4 Emission for industrial environments	EN 55011 / EN 55022 class B Disturbance characteristics
1606-XLE240EP	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		2	✓	✓	✓	✓	✓
1606-XLE240EDRZ	✓			✓	✓									2	✓	✓	✓	✓	✓
1606-XLE260F	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		2	✓	✓	✓	✓	✓
1606-XLE480EP	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		2	✓	✓	✓	✓	✓
1606-XLE480EPC	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		2	✓	✓	✓	✓	✓
1606-XLE480ERL	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		2	✓	✓	✓	✓	✓
1606-XLE480ERZ	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		2	✓	✓	✓	✓	✓
1606-XLE480ECRZ	✓	✓	✓	✓	✓	✓	✓	✓	✓					2	✓	✓	✓	✓	✓
1606-XLE480EL	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		2	✓	✓	✓	✓	✓
1606-XLE480EH	✓		✓	✓	✓	✓	✓	✓	✓			✓		2	✓	✓	✓	✓	✓
1606-XLE480EM	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		2	✓	✓	✓	✓	✓
1606-XLE480EP-D	✓	✓	✓			✓	✓	✓	✓			✓		2	✓	✓	✓	✓	✓
1606-XLE480EDRZ	✓	✓	✓			✓	✓	✓	✓			✓		2	✓	✓	✓	✓	✓
1606-XLE480FP	✓			✓		✓	✓	✓				✓		2	✓	✓	✓	✓	✓
1606-XLE480EP	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2	✓	✓	✓	✓	✓
1606-XLE480EPC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2	✓	✓	✓	✓	✓
1606-XLE480EP-D	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		5	✓	✓	✓	✓	✓
1606-XLE480FP	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		2	✓	✓	✓	✓	✓
1606-XLE480FP-D	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		5		✓	✓	✓	✓
1606-XLE96B-2	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		1	✓	✓	✓	✓	✓
1606-XLE120E-2	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		1	✓	✓	✓	✓	✓
1606-XLE240E-3	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		1	✓	✓	✓	✓	✓
1606-XLE240F-3	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		1	✓	✓	✓	✓	✓
1606-XLE960DX-3N	✓	✓	✓	✓	✓	✓						✓		1	✓	✓	✓	✓	✓
1606-XLE960MX-3N	✓	✓	✓	✓	✓	✓						✓		1	✓	✓	✓	✓	✓
1606-XLERED	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		5	✓	✓	✓	✓	✓
1606-XLD DC-DC Power Supplies																			
1606-XLDC92D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	5	✓	✓	✓	✓	✓
1606-XLDF120E	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		5	✓	✓	✓	✓	✓
1606-XLDD240E	✓			✓	✓	✓	✓	✓				✓		5	✓	✓	✓	✓	✓
1606-XLDF240F	✓			✓	✓	✓	✓	✓				✓		5	✓	✓	✓	✓	✓
1606-XLP Compact Power Supplies																			
1606-XLP15A		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	3	✓	✓	✓	✓	✓
1606-XLP15B	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	3	✓	✓	✓	✓	✓
1606-XLP15E	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	3	✓	✓	✓	✓	✓
1606-XLP30E	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	3	✓	✓	✓	✓	✓
1606-XLP25A	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	3	✓	✓	✓	✓	✓
1606-XLP30B	✓	✓	✓	✓	✓	✓			✓			✓	✓	3	✓	✓	✓	✓	✓
1606-XLP36C	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	3	✓	✓	✓	✓	✓
1606-XLP30EQ	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	3	✓	✓	✓	✓	✓
1606-XLP50E	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	3	✓	✓	✓	✓	✓

Ⓢ 1 = meets class A limits (passive) 2= meets class A limits (active) 3= not applicable (<75VA) 4= not applicable (<220V AC) 5= not applicable for this type of unit

Product data sheet

Specifications



Panelboard accessory, NQ, ground bar kit, 12 circuits, 225A max



PK9GTA

Main

Product line	QO
Product type	Bar

Complementary

Number of connectors	9
Wire size	AWG 14...AWG 10 copper AWG 12...AWG 10 aluminium AWG 8 aluminium/copper AWG 6...AWG 4 aluminium/copper AWG 14...AWG 12
Provided equipment	2 screw
Bar length	3.78 in (96 mm)
Maximum length of segment	3.15 in (80 mm)
Device mounting	Direct mounting back of enclosure
Height	0.437 in (11.10 mm)
Depth	0.312 in (7.92 mm)
Tightening torque	20 lb.in, AWG 14...AWG 10, copper 20 lb.in, AWG 12...AWG 10, aluminium 35 lb.in, AWG 6...AWG 4

Ordering and shipping details

Category	00102 - QO LC ACCESSORIES
Discount Schedule	DE3A
GTIN	785901026396
Nbr. of units in pkg.	1
Package weight(Lbs)	0.80 oz (22.68 g)
Returnability	Yes
Country of origin	US

Packing Units

Unit Type of Package 1	PCE
Package 1 Height	0.30 in (0.762 cm)

Package 1 width	0.70 in (1.778 cm)
Package 1 Length	3.80 in (9.652 cm)
Unit Type of Package 2	PAL
Number of Units in Package 2	2160
Package 2 Weight	314.00 lb(US) (142.428 kg)
Package 2 Height	26.80 in (68.072 cm)
Package 2 width	40.00 in (101.6 cm)
Package 2 Length	48.00 in (121.92 cm)

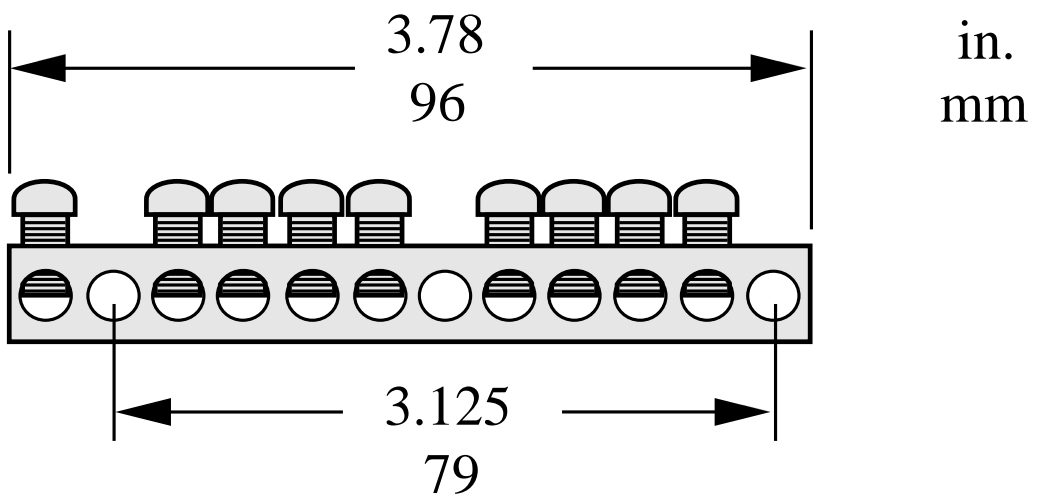
Offer Sustainability

California proposition 65	WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov
REACH Regulation	REACH Declaration
REACH free of SVHC	Yes
EU RoHS Directive	Pro-active compliance (Product out of EU RoHS legal scope) EU RoHS Declaration
Toxic heavy metal free	Yes
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS declaration Pro-active China RoHS declaration (out of China RoHS legal scope)

Contractual warranty

Warranty	18 months
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Dimensions



GGC/GGC-V

- Glass body
- Fast-acting
- 1/4" x 1-1/4"
- 1-1/2" Axial leads optional

1/10A through 10A,
250VAC, UL Listed
and CSA Certified

12A and 15A, 125VAC,
UL Listed and CSA
Certified

20A through 30A, 32VAC



STANDARD FUSE
AMPERE RATINGS

Catalog Number	Axial Lead Cat. No	Ampere Rating	Volts	I.R.
GGC1/10	GGC-V1/10	1/10A	250V	2
GGC1/8	GGC-V1/8	1/8A	250V	2
GGC15/100	GGC-V15/100	15/100A	250V	2
GGC175/1000	GGC-V175/1000	175/1000A	250V	2
GGC3/16	GGC-V3/16	3/16A	250V	2
GGC2/10	GGC-V2/10	2/10A	250V	2
GGC1/4	GGC-V1/4	1/4A	250V	2
GGC3/10	N/A	3/10A	250V	2
GGC3/8	GGC-V3/8	3/8A	250V	2
GGC4/10	GGC-V4/10	4/10A	250V	2
GGC1/2	GGC-V1/2	1/2A	250V	2
GGC6/10	GGC-V6/10	6/10A	250V	2
GGC3/4	GGC-V3/4	3/4A	250V	2
GGC8/10	GGC-V8/10	8/10A	250V	2
GGC1	GGC-V1	1A	250V	2
GGC1-1/4	GGC-V1-1/4	1-1/4A	250V	2
GGC1-1/2	GGC-V1-1/2	1-1/2A	250V	2
GGC1-3/4	N/A	1-3/4A	250V	2
GGC1-6/10	GGC-V1-6/10	1-6/10A	250V	2
GGC2	GGC-V2	2A	250V	2
GGC2-1/4	GGC-V2-1/4	2-1/4A	250V	2
GGC2-1/2	GGC-V2-1/2	2-1/2A	250V	2
GGC3	GGC-V3	3A	250V	2
GGC3-2/10	GGC-V3-2/10	3-2/10A	250V	3
GGC4	GGC-V4	4A	250V	2
GGC5	GGC-V5	5A	250V	2
GGC6	GGC-V6	6A	250V	2
GGC6-3/10	GGC-V6-3/10	6-3/10A	250V	2
GGC7	GGC-V7	7A	250V	2
GGC7-1/2	N/A	7-1/2A	250V	2
GGC8	GGC-V8	8A	250V	2
GGC10	GGC-V10	10A	250V	2
GGC12	GGC-V12	12A	125V	4
GGC15	GGC-V15	15A	125V	4
GGC20	GGC-V20	20A	32V	5
GGC25	GGC-V25	25A	32V	5
GGC30	GGC-V30	30A	32V	5

- 250VAC @ 200A I.R./125VAC @ 10kA I.R.
- 250VAC @ 10kA I.R.
- 125VAC @ 10kA I.R.
- 32VAC @ 1000A I.R.

GGM/GGM-V

- Glass body
- Fast-acting
- 5 mm x 20 mm
- 1-1/2" Axial leads optional

1/16A through 3A,
250VAC, UL Listed and
CSA Certified

4A through 8A,
125VAC, UL Listed and CSA Certified

10A and 15A, 250VAC,
UL Recognized



STANDARD FUSE
AMPERE RATINGS

Catalog Number	Axial Lead Cat. No	Ampere Rating	Volts	I.R.
GGM1/16	GGM-V1/16	1/16A	250V	2
GGM1/10	GGM-V1/10	1/10A	250V	3
GGM1/8	GGM-V1/8	1/8A	250V	3
GGM2/10	GGM-V2/10	2/10A	250V	3
GGM1/4	GGM-V1/4	1/4A	250V	3
GGM3/10	GGM-V3/10	3/10A	250V	3
GGM4/10	GGM-V4/10	4/10A	250V	1
GGM1/2	GGM-V1/2	1/2A	250V	3
GGM6/10	GGM-V6/10	6/10A	250V	1
GGM7/10	GGM-V7/10	7/10A	250V	3
GGM3/4	GGM-V3/4	3/4A	250V	3
GGM8/10	GGM-V8/10	8/10A	250V	1
GGM1	GGM-V1	1A	250V	3
GGM1-2/10	N/A	1-2/10A	250V	2
GGM1-1/4	GGM-V1-1/4	1-1/4A	250V	3
GGM1-1/2	GGM-V1-1/2	1-1/2A	250V	3
GGM2	GGM-V2	2A	250V	3
GGM2-1/2	GGM-V2-1/2	2-1/2A	250V	3
GGM3	GGM-V3	3A	250V	3
GGM4	GGM-V4	4A	125V	4
GGM5	GGM-V5	5A	125V	4
GGM6	GGM-V6	6A	125V	4
GGM7	GGM-V7	7A	125V	4
GGM8	GGM-V8	8A	125V	4
GGM15	GGM-V15	15A	250V	5

- 250VAC @ 35A I.R./125VAC @ 10kA I.R.
- 250VAC @ 100A I.R./125VAC @ 10kA I.R.
- 250VAC @ 200A I.R./125VAC @ 10kA I.R.
- 125VAC @ 10kA I.R.
- 250VAC @ 100A I.R.

MF

Screw Connection Terminal Blocks

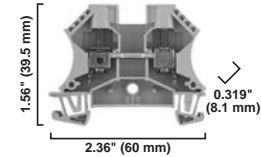
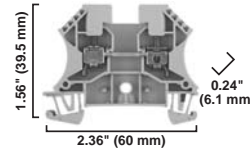
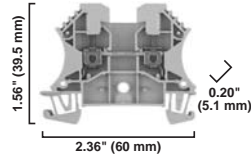
Standard Feed-Through Blocks

1492-J3

1492-J4

1492-J6

Dimensions are not intended to be used for manufacturing purposes.
Note: Height dimension is measured from top of rail to top of terminal block.



Specifications	Feed-Through Terminal Block				Feed-Through Terminal Block				Feed-Through Terminal Block			
Certifications		CSA	IEC	ATEX		CSA	IEC	ATEX		CSA	IEC	ATEX
Voltage Rating	600V AC/DC				600V AC/DC				600V AC/DC			
Maximum Current	65 A	50 A	24 A	21 A	35 A	25 A	32 A	28 A	50 A	41 A	36 A	36 A
Wire Range (Rated Cross Section)	#22... 12 AWG	#26... 12 AWG	2.5 mm ²	2.5 mm ² (#20... 14 AWG)	#22... 10 AWG	#26... 10 AWG	4 mm ²	4 mm ² (#20... 12 AWG)	#22...8 AWG	6 mm ²	6 mm ² (#20... 10 AWG)	6 mm ² (#20... 10 AWG)
Wire Strip Length	0.39 in. (10 mm)				0.39 in. (10 mm)				0.47 in (12 mm)			
Recommended Tightening Torque	4.5...7.1 lb•in. (0.5...0.8 N•m)				9.0 lb•in. (1.0 N•m)				14.2 lb•in (1.6 N•m)			
Density	59 pcs/ft (196 pcs/m)				49 pcs/ft (163 pcs/m)				37 pcs/ft (123 pcs/m)			
Housing Temperature Range	-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)			
Short-Circuit Current Rating	See page 12-43											

Terminal Blocks		Cat. No.	Pkg Qty.	Cat. No.	Pkg Qty.	Cat. No.	Pkg Qty.
Color:	Grey	1492-J3	100	1492-J4	100	1492-J6	100
	Red	1492-J3-RE	100	1492-J4-RE	100	1492-J6-RE	100
	Blue	1492-J3-B	100	1492-J4-B	100	1492-J6-B	100
	Black	1492-J3-BL	100	1492-J4-BL	100	1492-J6-BL	100
	Green	1492-J3-G	100	1492-J4-G	100	1492-J6-G	100
	Yellow	1492-J3-Y	100	1492-J4-Y	100	1492-J6-Y	100
	Orange	1492-J3-OR	100	1492-J4-OR	100	1492-J6-OR	100
	Brown	1492-J3-BR	100	1492-J4-BR	100	1492-J6-BR	100
	White	1492-J3-W	100	1492-J4-W	100	1492-J6-W	100

Accessories		Cat. No.	Pkg Qty.	Cat. No.	Pkg Qty.	Cat. No.	Pkg Qty.
Mounting Rails:							
1 m Symmetrical DIN (Steel)		199-DR1	10	199-DR1	10	199-DR1	10
1 m Symmetrical DIN (Aluminum)		1492-DR5	10	1492-DR5	10	1492-DR5	10
1 m Hi-Rise Sym. DIN (Aluminum)		1492-DR6	2	1492-DR6	2	1492-DR6	2
1 m Angled Hi-Rise Sym. DIN (Steel)		1492-DR7	2	1492-DR7	2	1492-DR7	2
End Barriers	Grey	1492-EBJ3	50	1492-EBJ3	50	1492-EBJ3	50
	Blue	1492-EBJ3-B	50	1492-EBJ3-B	50	1492-EBJ3-B	50
	Yellow	1492-EBJ3-Y	50	1492-EBJ3-Y	50	1492-EBJ3-Y	50
End Anchors and Retainers:							
Screwless End Retainer		1492-ERL35	20	1492-ERL35	20	1492-ERL35	20
DIN Rail — Normal Duty		1492-EAJ35	100	1492-EAJ35	100	1492-EAJ35	100
DIN Rail — Heavy Duty		1492-EAHJ35	50	1492-EAHJ35	50	1492-EAHJ35	50
Jumpers:*							
Screw Center Jumper — 10-pole		1492-CJJ5-10	20	1492-CJJ6-10	20	1492-CJJ8-10	20
Screw Center Jumper — 4-pole		1492-CJJ5-4	50	1492-CJJ6-4	50	1492-CJJ8-4	50
Screw Center Jumper — 3-pole		1492-CJJ5-3	50	1492-CJJ6-3	50	1492-CJJ8-3	50
Screw Center Jumper — 2-pole		1492-CJJ5-2	50	1492-CJJ6-2	50	1492-CJJ8-2	50
Plug-in Center Jumper — 50-Pole		1492-CJLJ5-50	10	1492-CJLJ6-41 (41-pole)	10	—	—
Plug-in Center Jumper — 10-Pole		1492-CJLJ5-10	20	1492-CJLJ6-10	20	—	—
Plug-in Center Jumper — 9-Pole		1492-CJLJ5-9	20	—	—	—	—
Plug-in Center Jumper — 8-Pole		1492-CJLJ5-8	20	—	—	—	—
Plug-in Center Jumper — 7-Pole		1492-CJLJ5-7	20	—	—	—	—
Plug-in Center Jumper — 6-Pole		1492-CJLJ5-6	20	—	—	—	—
Plug-in Center Jumper — 5-Pole		1492-CJLJ5-5	20	—	—	—	—
Plug-in Center Jumper — 4-Pole		1492-CJLJ5-4	60	1492-CJLJ6-4	60	—	—
Plug-in Center Jumper — 3-Pole		1492-CJLJ5-3	60	1492-CJLJ6-3	60	—	—
Plug-in Center Jumper — 2-Pole		1492-CJLJ5-2	60	1492-CJLJ6-2	60	—	—
Insulated Side Jumper — 24-Pole		1492-SJ5B-24	50	—	—	—	—
Insulated Side Jumper — 10-Pole		1492-SJ5B-10	50	—	—	—	—
Screw Type Jumper Notching Tool		1492-T1	1	1492-T1	1	1492-T1	1
Other Accessories:							
Partition Plate		1492-EBJ16	20	1492-EBJ16	20	1492-EBJ16	20
Test Plug Socket		1492-TPS23	20	1492-TPS23L	50	1492-TPS23L	50
Test Plug		1492-TP23	20	1492-TP23	20	1492-TP23	20
Test Plug (Stackable)		1492-TPJ5	25	1492-TPJ6	25	—	—
Electrical Warning Plate		1492-EWPJ5	25	1492-EWPJ5	25	1492-EWPJ8	50
Group Marking Carrier		1492-GM35	25	1492-GM35	25	1492-GM35	25
Marking Systems:							
Snap-in Marker Cards		1492-M5X12 (144/card)	5	1492-M6X12 (120/card)	5	1492-MR8X12 (84/card)	5
		1492-M5X5 (200/card)	5	1492-M6X5 (200/card)	5	1492-M8X5 (160/card)	5

* Use of center jumpers may affect spacings, requiring derating of terminal blocks. See page 12-78 for details.

	1492-JG4				1492-JG4TW			1492-JG4Q						
Dimensions are not intended to be used for manufacturing purposes. Note: Height dimension is measured from top of rail to top of terminal block.														
	Feed-through grounding terminal block				Single-level grounding terminal block with 3 connection points, 2 on one side			Single-level grounding terminal block with two connection points on each side						
Specifications														
Certifications														
Voltage Rating	—				—			—						
Maximum Current	Grounding				Grounding			Grounding						
Wire Range (Rated Cross Section)	#22...10 AWG		4 mm ²		4 mm ² (#20...12 AWG)		#30...10 AWG		0.5...4 mm ²		#30...10 AWG		0.5...4 mm ²	
Wire Strip Length	0.39 in. (10 mm)				0.394 in. (10 mm)			0.394 in. (10 mm)						
Recommended Tightening Torque	9 lb•in (1.0 N•m)				6.2 lb•in (0.7 N•m)			6.2 lb•in (0.7 N•m)						
Mounting Torque - Center Screw	4.4...7.1 lb•in (0.5...0.8 N•m)				—			—						
Density	49 pcs/ft (163 pcs/m)				49 pcs/ft (163 pcs/m)			49 pcs/ft (163 pcs/m)						
Housing Temperature Range	-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)			-58...+248 °F (-50...+120 °C)						

	1492-JG6				1492-JG10							
Dimensions are not intended to be used for manufacturing purposes. Note: Height dimension is measured from top of rail to top of terminal block.												
	Feed-through grounding terminal block				Feed-through grounding terminal block							
Specifications												
Certifications												
Voltage Rating	—				—							
Maximum Current	Grounding				Grounding							
Wire Range (Rated Cross Section)	#22...8 AWG		6 mm ²		6 mm ² (#20...10 AWG)		#16...6 AWG		10 mm ²		10 mm ² (#16...8 AWG)	
Wire Strip Length	0.47 in. (12 mm)				0.47 in. (12 mm)							
Recommended Tightening Torque	14.2 lb•in (1.6 N•m)				20.4 lb•in (2.3 N•m)							
Mounting Torque — Center Screw	4.4...8.9 lb•in (0.5...1.0 N•m)				4.4...8.9 lb•in (0.5...1.0 N•m)							
Density	37 pcs/ft (123 pcs/m)				30 pcs/ft (100 pcs/m)							
Housing Temperature Range	-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)							

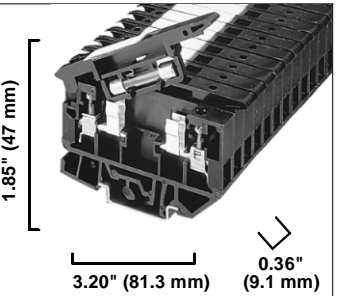
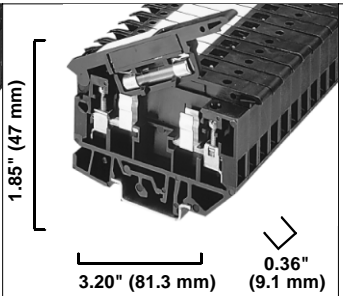
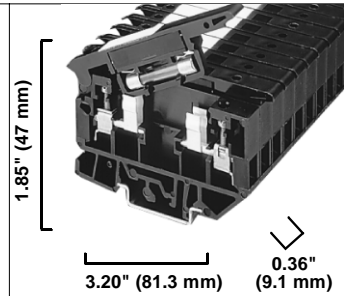
	1492-JG16				1492-JG35				1492-JG50													
Dimensions are not intended to be used for manufacturing purposes. Note: Height dimension is measured from top of rail to top of terminal block.																						
	Feed-through grounding terminal block				Feed-through grounding terminal block				Feed-through grounding terminal block													
Specifications																						
Certifications																						
Voltage Rating	—				—				—													
Maximum Current	Grounding				Grounding				Grounding													
Wire Range (Rated Cross Section)	#24...4 AWG		16 mm ²		16 mm ² (#16...6 AWG)		#12...1 AWG		#12...2 AWG		35 mm ²		35 mm ² (#14...2 AWG)		#10...1/0 AWG		#14...1/0 AWG		50 mm ²		50 mm ² (10...1/0 AWG)	
Wire Strip Length	0.63 in. (16 mm)				0.70 in. (18 mm)				0.94 in. (24 mm)													
Recommended Tightening Torque	35.0 lb•in (4.0 N•m)				51.0 lb•in (5.8 N•m)				31.5 lb•in (3.6 N•m)													
Mounting Torque — Center Screw	10.6...21.2 lb•in (1.2...2.4 N•m)				10.6...21.2 lb•in (1.2...2.4 N•m)				17.7...35.4 lb•in (2.0...4.0 N•m)													
Density	25 pcs/ft (83 pcs/m)				19 pcs/ft (62 pcs/m)				16 pcs/ft (54 pcs/m)													
Housing Temperature Range	-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)				-58...+248 °F (-50...+120 °C)													

1492-H4

1492-H5

1492-H6

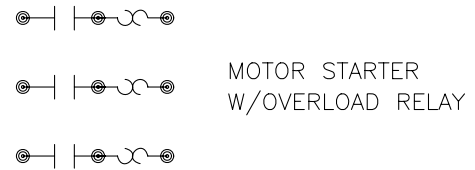
Dimensions are not intended to be used for manufacturing purposes.
Note: Height dimension is measured from top of rail to top of terminal block.



Specifications	Single-circuit fusible terminal block with neon blown fuse indicator.			Single-circuit fusible terminal block with LED blown fuse indicator.			Single-circuit fusible terminal block without a blown fuse indicator.		
Approvals		CSA	IEC		CSA	IEC		CSA	IEC
Voltage Rating	300V AC/DC	300V AC/DC	500V AC/DC	300V AC/DC	300V AC/DC	500V AC/DC	300V AC/DC	300V AC/DC	500V AC/DC
Maximum Current	12 A	12 A	12 A	12 A	12 A	12 A	12 A	12 A	12 A
Wire Range (Rated Cross Section)	#30... #12 AWG	#30... #12 AWG	0.05... 4 mm ²	#30... #12 AWG	#30... #12 AWG	0.05... 4 mm ²	#30... #12 AWG	#30... #12 AWG	0.05... 4 mm ²
Indicator Type	Neon			LED			Non-Indicating		
Leakage Current	2 mA @ 300V			2 mA @ 24V			—		
Working Voltage	100...300V AC			10...57V AC/DC			Per Fuse Rating		
Fuse Size (Not Supplied)	1/4" x 1-1/4"			1/4" x 1-1/4"			1/4" x 1-1/4"		
Wire Strip Length	0.38" (9.7 mm)			0.38" (9.7 mm)			0.38" (9.7 mm)		
Recommended Tightening Torque	3...7 lb-in. (0.3...0.8 Nm)			3...7 lb-in. (0.3...0.8 Nm)			3...7 lb-in. (0.3...0.8 Nm)		
Density	33 pcs./ft (109/m)			33 pcs./ft (109/m)			33 pcs./ft (109/m)		
Insulation Temperature Range	-40...+221°F (-40...+105°C)			-40...+221°F (-40...+105°C)			-40...+221°F (-40...+105°C)		
Terminal Blocks	Cat. No.	Pcs./Pkg.		Cat. No.	Pcs./Pkg.		Cat. No.	Pcs./Pkg.	
Terminal Block	1492-H4	25		1492-H5	25		1492-H6	25	
Accessories (page 185)	Cat. No.	Pcs./Pkg.		Cat. No.	Pcs./Pkg.		Cat. No.	Pcs./Pkg.	
Mounting Rails:									
1 m Symmetrical DIN (Steel)	199-DR1	10		199-DR1	10		199-DR1	10	
1 m Symmetrical DIN (Aluminum)	1492-DR5	10		1492-DR5	10		1492-DR5	10	
1 m Hi-Rise Sym. DIN (Aluminum)	1492-DR6	2		1492-DR6	2		1492-DR6	2	
1 m Angled Hi-Rise Sym. DIN (Steel)	1492-DR7	2		1492-DR7	2		1492-DR7	2	
End Barrier	1492-N37	50		1492-N37	50		1492-N37	50	
End Anchors:									
DIN Rail — Normal Duty	1492-EA35	50		1492-EA35	50		1492-EA35	50	
DIN Rail — Heavy Duty	1492-EAH35	10		1492-EAH35	10		1492-EAH35	10	
Jumpers:									
Side Jumper — 10-pole Uninsulated	1492-N49	10		1492-N49	10		1492-N49	10	
Side Jumper — Insulating Sleeve	1492-SJS	10		1492-SJS	10		1492-SJS	10	
Other Accessories:									
Group Marking Carrier	1492-GM35	10		1492-GM35	10		1492-GM35	10	
Marking Systems:									
Snap-in Marker Card	1492-SM8X12	5		1492-SM8X12	5		1492-SM8X12	5	

ELECTRICAL SCHEMATIC STANDARD SYMBOLS

	GROUND
	RELAY CONTACTS (no) NORMALLY OPEN
	RELAY CONTACTS (nc) NORMALLY CLOSED
	TIME DELAY CONTACTS (tc) TIMED CLOSED
	TIME DELAY CONTACTS (to) TIMED OPEN
	MOTOR STARTER CONTACTS (no) NORMALLY OPEN (ON MOTOR STARTER NO.1)
	MOTOR STARTER CONTACTS (nc) NORMALLY CLOSED (ON MOTOR STARTER NO.1)



	TIME DELAY No.1(OH DELAY COIL)
	RELAY No.1(COIL)
	MOTOR STARTER No.1(COIL)
	LIGHT
	ALARM LIGHT W/HORN
	ELAPSED TIME METER
	ALTERNATOR
	TIME CLOCK
	EXHAUST FAN
	HEATER
	CONTACTOR NO.1
	DIGITAL READOUT
	CHART RECORDER
	POWER SUPPLY
	PRESSURE TRANSDUCER
	OVERLOAD (MOTOR STARTER)
	LIGHTNING ARRESTOR
	GROUND FAULT INTERRUPTER
	PHASE MONITOR
	PHASE CONVERTER CONTACTOR
	ENERGIZE TO CLOSE
	ENERGIZE TO OPEN
	TERMINAL BLOCK

REV 05/22/02



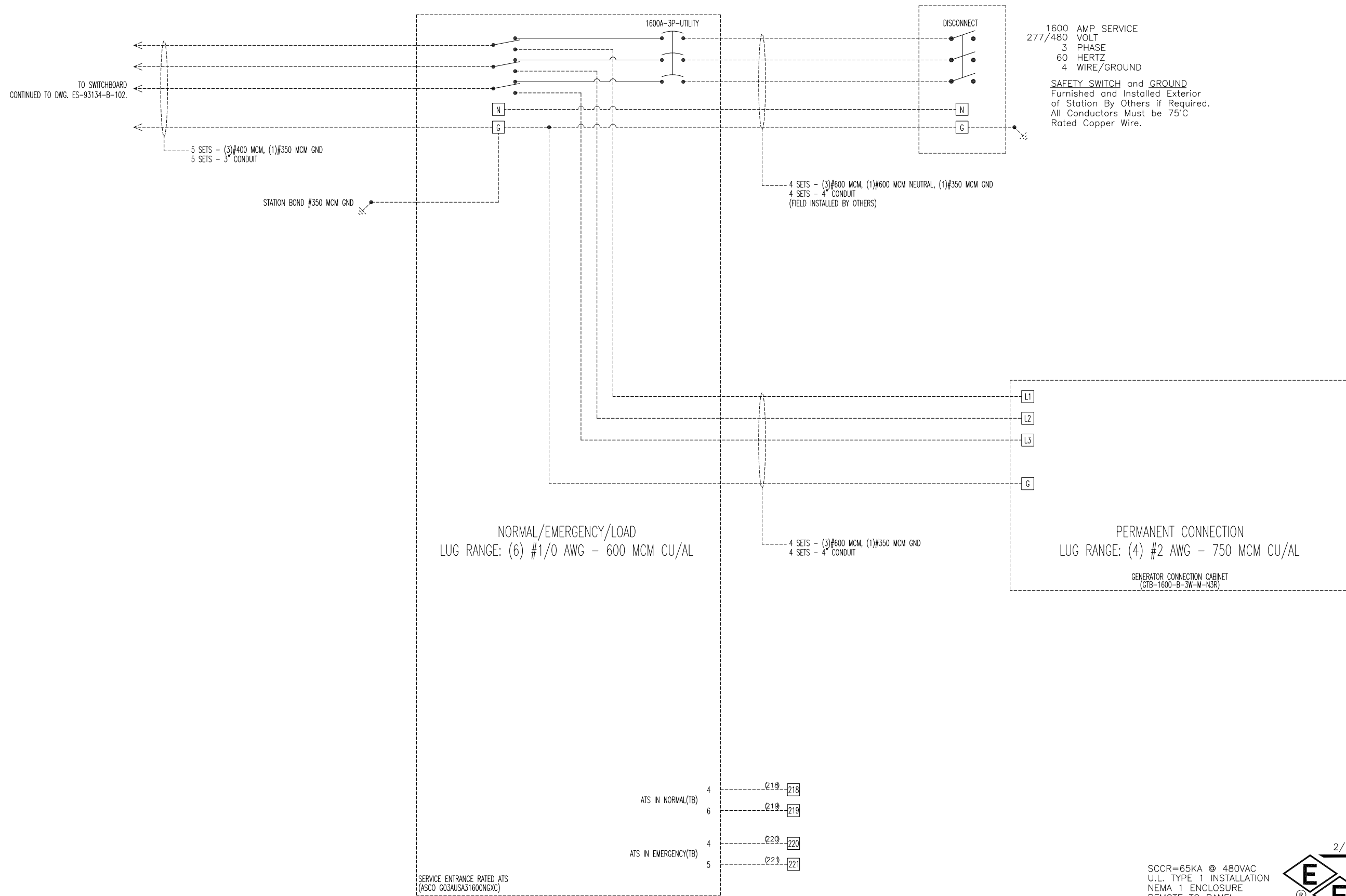
ENGINEERED FLUID, INC.

P.O. DRAWER 723 * CENTRALIA, ILLINOIS 62801

JOB REF. NO. ES-073192

DRAWING NO. ESYMB1a

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- NOTES:
1. CONDUIT TO BE SCHEDULE 40 PVC(3/4" MIN.)
 2. UNISTRUT TO BE GALVANIZED STEEL
 3. WIRE LABELS TO BE SELF LAMINATING/ADHESIVE TYPE
 4. WIRE WITHIN STATION TO BE TYPE THHN/THWN, MINIMUM #14 AWG
 5. WIRE WITHIN CONTROL PANEL TO BE MTW/AWM, MINIMUM #18 AWG
 6. ANALOG WIRE TO BE TWISTED/SHIELDED PAIR #9318 OR #KT31802

2/28/23

7 D

SCCR=65KA @ 480VAC
U.L. TYPE 1 INSTALLATION
NEMA 1 ENCLOSURE
REMOTE TO PANEL-----
CONTROL PANEL WILL BE LISTED AND
LABELED UNDER ENGINEERED FLUID'S
U.L. FILE NUMBER E85917



ENGINEERED FLUID, INC.

P.O. DRAWER 723 • CENTRALIA, ILLINOIS 62801 • 618-533-1351

WSBPS

ELECTRICAL SCHEMATIC

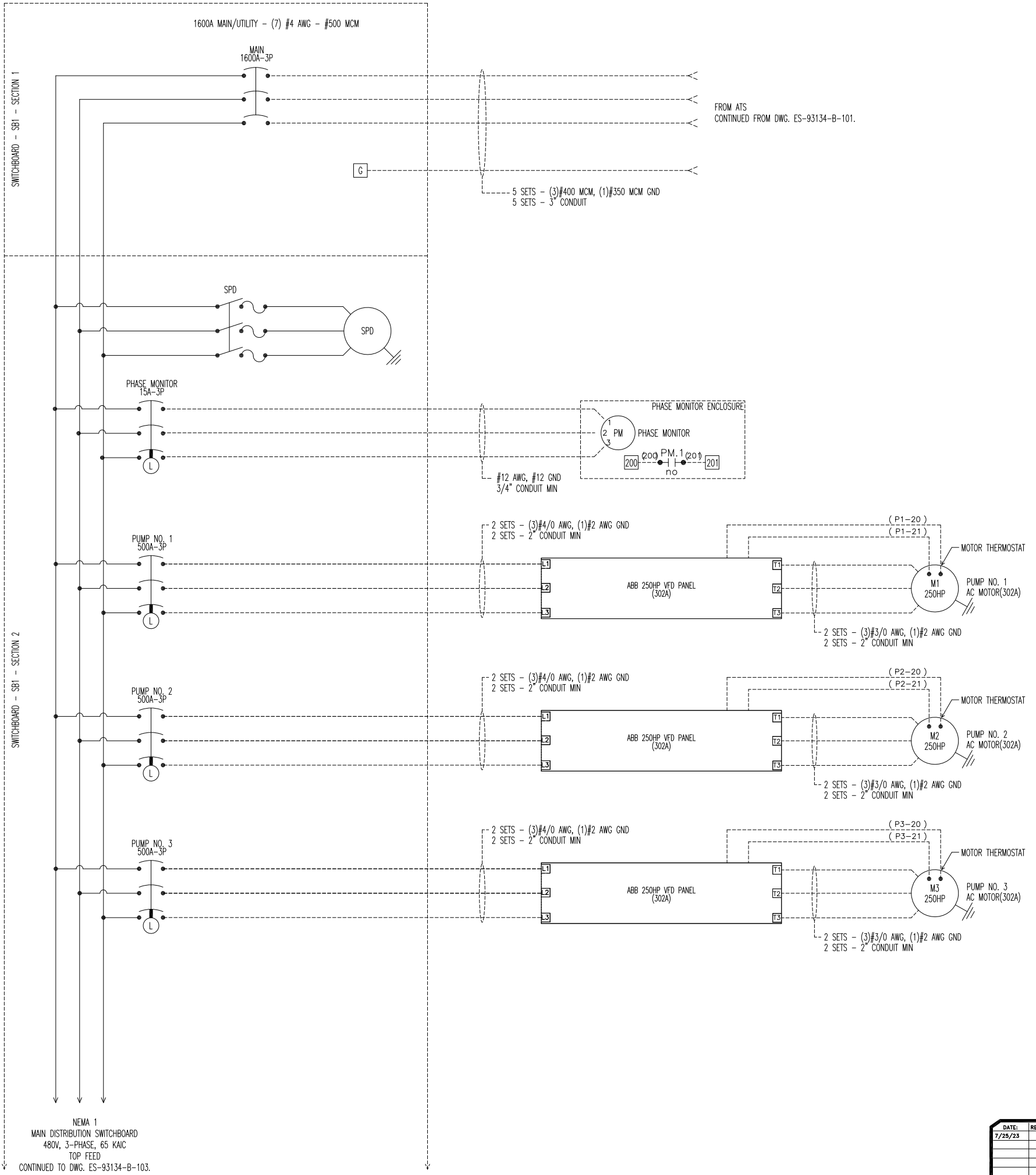
WEST LILAC PUMP STATION

RAINBOW, CA

DATE:	REV. NO.	REVISED BY:	DESCRIPTION:
7/25/23	1	SK	CHANGE TO 250HP

TERMINAL BLOCK		TERMINAL BLOCK		TERMINAL BLOCK		TERMINAL BLOCK		TERMINAL BLOCK	
In.	Out.	In.	Out.	In.	Out.	In.	Out.	In.	Out.
1/8	3/16	1/8	3/16	1/8	3/16	1/8	3/16	1/8	3/16
3/16	1/2	3/16	1/2	3/16	1/2	3/16	1/2	3/16	1/2
1/2	3/4	1/2	3/4	1/2	3/4	1/2	3/4	1/2	3/4
3/4	1	3/4	1	3/4	1	3/4	1	3/4	1
1	1 1/4	1	1 1/4	1	1 1/4	1	1 1/4	1	1 1/4
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3 3/4	4	3 3/4	4	3 3/4	4	3 3/4	4	3 3/4	4
4	4 1/4	4	4 1/4	4	4 1/4	4	4 1/4	4	4 1/4
4 1/4	4 3/4	4 1/4	4 3/4	4 1/4	4 3/4	4 1/4	4 3/4	4 1/4	4 3/4
4 3/4	5	4 3/4	5	4 3/4	5	4 3/4	5	4 3/4	5
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7 3/4	8	7 3/4	8	7 3/4	8	7 3/4	8	7 3/4	8
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FROM ATS
CONTINUED FROM DWG. ES-93134-B-101.

5 SETS - (3)#400 MCM, (1)#350 MCM GND
5 SETS - 3" CONDUIT

#12 AWG, #12 GND
3/4" CONDUIT MIN

2 SETS - (3)#4/0 AWG, (1)#2 AWG GND
2 SETS - 2" CONDUIT MIN

2 SETS - (3)#4/0 AWG, (1)#2 AWG GND
2 SETS - 2" CONDUIT MIN

2 SETS - (3)#4/0 AWG, (1)#2 AWG GND
2 SETS - 2" CONDUIT MIN

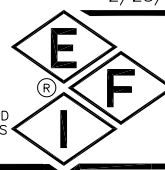
2 SETS - (3)#3/0 AWG, (1)#2 AWG GND
2 SETS - 2" CONDUIT MIN

- NOTES:
1. CONDUIT TO BE SCHEDULE 40 PVC(3/4" MIN.)
 2. UNISTRUT TO BE GALVANIZED STEEL
 3. WIRE LABELS TO BE SELF LAMINATING/ADHESIVE TYPE
 4. WIRE WITHIN STATION TO BE TYPE THHN/THWN, MINIMUM #14 AWG
 5. WIRE WITHIN CONTROL PANEL TO BE MTW/AWM, MINIMUM #18 AWG
 6. ANALOG WIRE TO BE TWISTED/SHIELDED PAIR #9318 OR #KT31802

2/28/23

7 D

SCCR=65KA @ 480VAC
U.L. TYPE 1 INSTALLATION
NEMA 1 ENCLOSURE
REMOTE TO PANEL-----
CONTROL PANEL WILL BE LISTED AND
LABELED UNDER ENGINEERED FLUID'S
U.L. FILE NUMBER E85917



ENGINEERED FLUID, INC.
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WSBPS ELECTRICAL SCHEMATIC

WEST LILAC PUMP STATION
RAINBOW, CA

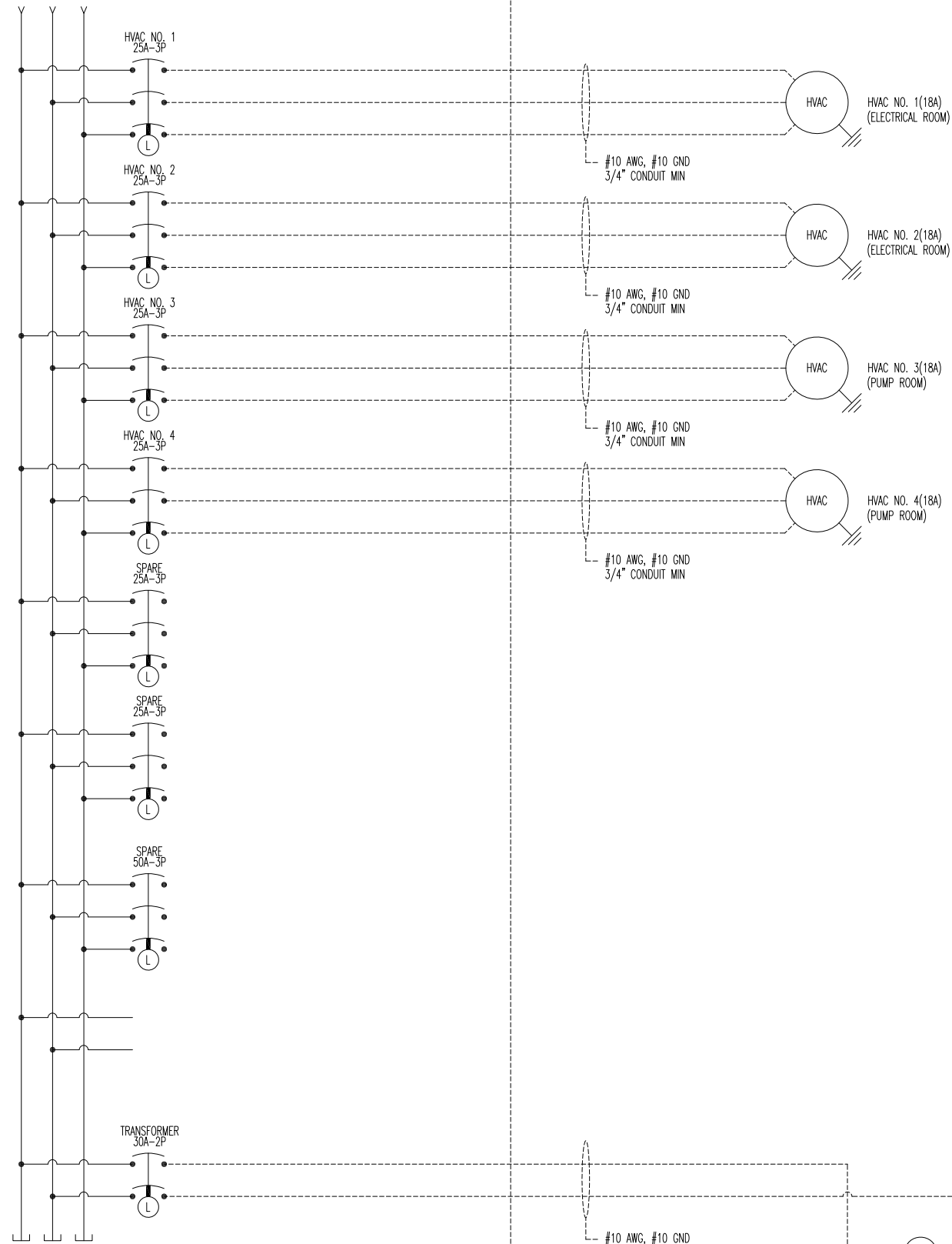
DATE	REV. NO.	REVISED BY	DESCRIPTION
7/25/23	1	SK	CHANGE TO 250HP

NEMA 1
MAIN DISTRIBUTION SWITCHBOARD
480V, 3-PHASE, 65 KAIC
TOP FEED
CONTINUED TO DWG. ES-93134-B-103.

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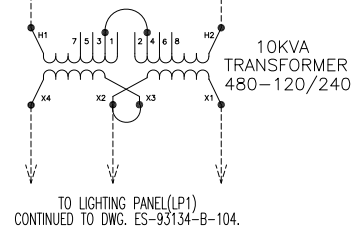
NEMA 1
MAIN DISTRIBUTION SWITCHBOARD
480V, 3-PHASE, 65 KAIC
TOP FEED
CONTINUED FROM DWG. ES-93134-B-102.

SWITCHBOARD - SBT - SECTION 2



NEMA 1
MAIN DISTRIBUTION SWITCHBOARD
480V, 3-PHASE, 65 KAIC
TOP FEED

#10 AWG, #10 GND
3/4" CONDUIT MIN



- NOTES:
1. CONDUIT TO BE SCHEDULE 40 PVC(3/4" MIN.)
 2. UNISTRUT TO BE GALVANIZED STEEL
 3. WIRE LABELS TO BE SELF LAMINATING/ADHESIVE TYPE
 4. WIRE WITHIN STATION TO BE TYPE THHN/THWN, MINIMUM #14 AWG
 5. WIRE WITHIN CONTROL PANEL TO BE MTW/AWM, MINIMUM #18 AWG
 6. ANALOG WIRE TO BE TWISTED/SHIELDED PAIR #9318 OR #KTS1802

2/28/23

7 D

SCCR=65KA @ 480VAC
U.L. TYPE 1 INSTALLATION
NEMA 1 ENCLOSURE
REMOTE TO PANEL-----
CONTROL PANEL WILL BE LISTED AND
LABELED UNDER ENGINEERED FLUID'S
U.L. FILE NUMBER E85917



ENGINEERED FLUID, INC.

P.O. DRAWER 723 • CENTRALIA, ILLINOIS 62801 • 618-533-1351

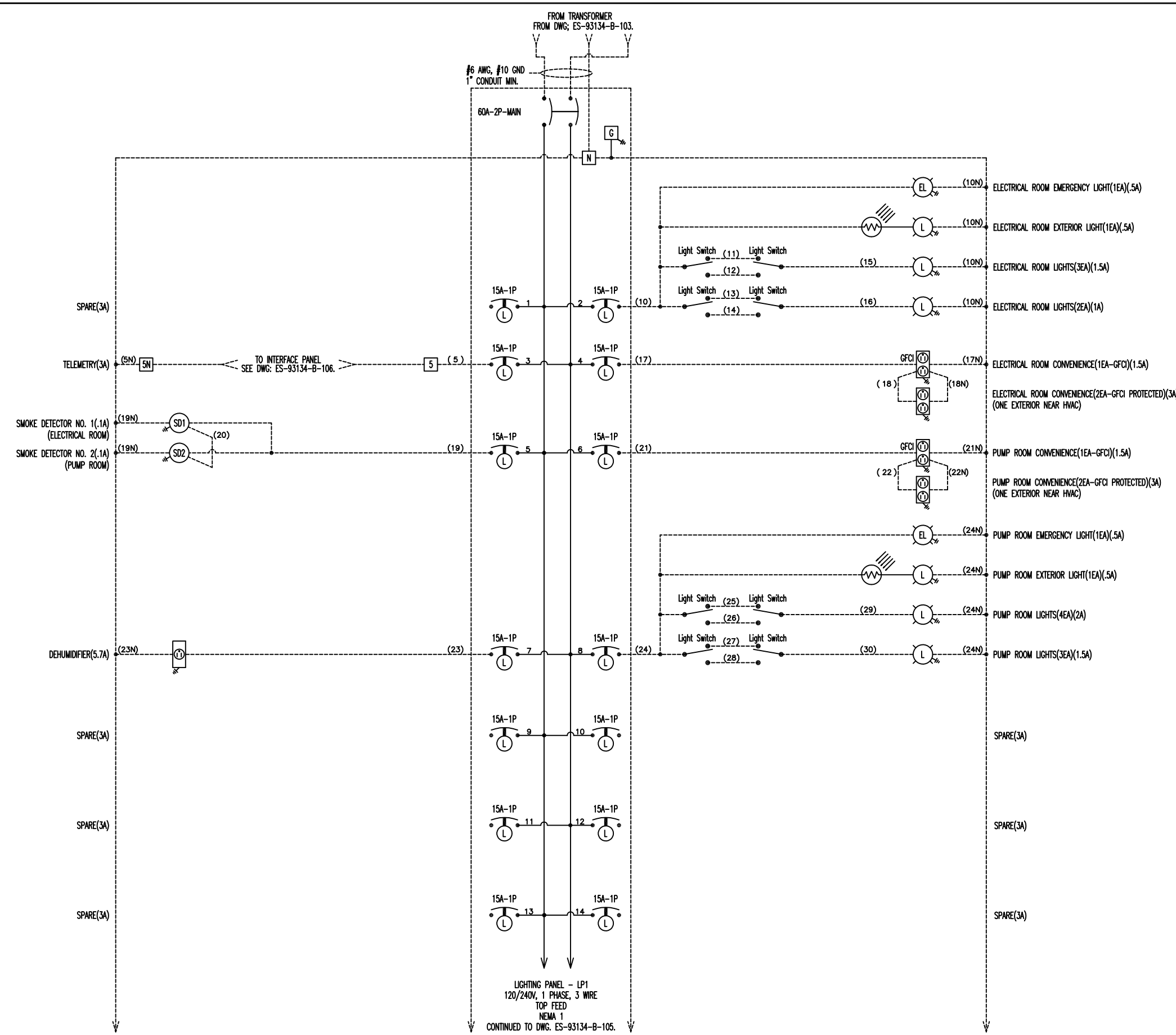
WSBPS

ELECTRICAL SCHEMATIC

WEST LILAC PUMP STATION
RAINBOW, CA

TIGHTENING TORQUE		TIGHTENING TORQUE		TIGHTENING TORQUE		TIGHTENING TORQUE	
In.	lb-ft	In.	lb-ft	In.	lb-ft	In.	lb-ft
1/8	0.5	1/4	1.5	3/8	4.0	1/2	8.0
5/16	2.0	3/4	10.0	7/8	15.0	1	20.0
9/16	3.0	1 1/8	15.0	1 1/4	20.0	1 1/2	30.0
5/8	4.0	1 3/8	20.0	1 3/4	25.0	2	40.0
3/4	5.0	1 7/8	25.0	2 1/4	35.0	2 1/2	50.0
7/8	6.0	2	30.0	2 3/4	45.0	3	60.0
1	7.0	2 1/4	40.0	3 1/4	60.0	4	80.0
1 1/8	8.0	2 3/4	50.0	3 3/4	75.0	4 1/2	100.0
1 1/4	9.0	3	60.0	4 1/4	90.0	5 1/2	120.0
1 3/8	10.0	3 1/4	70.0	4 3/4	105.0	6	140.0
1 1/2	11.0	3 3/4	80.0	5 1/4	120.0	6 1/2	160.0
1 5/8	12.0	4	90.0	5 3/4	135.0	7	180.0
1 3/4	13.0	4 1/4	100.0	6 1/4	150.0	7 1/2	200.0
1 7/8	14.0	4 3/4	110.0	6 3/4	165.0	8	220.0
2	15.0	5	120.0	7 1/4	180.0	8 1/2	240.0
2 1/8	16.0	5 1/4	130.0	7 3/4	195.0	9	250.0
2 1/4	17.0	5 3/4	140.0	8 1/4	210.0	9 1/2	260.0
2 3/8	18.0	6	150.0	8 3/4	225.0	10	270.0
2 1/2	19.0	6 1/4	160.0	9 1/4	240.0	10 1/2	280.0
2 5/8	20.0	6 3/4	170.0	9 3/4	255.0	11	290.0
2 3/4	21.0	7	180.0	10 1/4	270.0	11 1/2	300.0
2 7/8	22.0	7 1/4	190.0	10 3/4	285.0	12	310.0
3	23.0	7 3/4	200.0	11 1/4	300.0	12 1/2	320.0
3 1/8	24.0	8	210.0	11 3/4	315.0	13	330.0
3 1/4	25.0	8 1/4	220.0	12 1/4	330.0	13 1/2	340.0
3 3/8	26.0	8 3/4	230.0	12 3/4	345.0	14	350.0
3 1/2	27.0	9	240.0	13 1/4	360.0	14 1/2	360.0
3 5/8	28.0	9 1/4	250.0	13 3/4	375.0	15	370.0
3 3/4	29.0	9 3/4	260.0	14 1/4	390.0	15 1/2	380.0
3 7/8	30.0	10	270.0	14 3/4	405.0	16	390.0
4	31.0	10 1/4	280.0	15 1/4	420.0	16 1/2	400.0
4 1/8	32.0	10 3/4	290.0	15 3/4	435.0	17	410.0
4 1/4	33.0	11	300.0	16 1/4	450.0	17 1/2	420.0
4 3/8	34.0	11 1/4	310.0	16 3/4	465.0	18	430.0
4 1/2	35.0	11 3/4	320.0	17 1/4	480.0	18 1/2	440.0
4 5/8	36.0	12	330.0	17 3/4	495.0	19	450.0
4 3/4	37.0	12 1/4	340.0	18 1/4	510.0	19 1/2	460.0
4 7/8	38.0	12 3/4	350.0	18 3/4	525.0	20	470.0
5	39.0	13	360.0	19 1/4	540.0	20 1/2	480.0
5 1/8	40.0	13 1/4	370.0	19 3/4	555.0	21	490.0
5 1/4	41.0	13 3/4	380.0	20 1/4	570.0	21 1/2	500.0
5 3/8	42.0	14	390.0	20 3/4	585.0	22	510.0
5 1/2	43.0	14 1/4	400.0	21 1/4	600.0	22 1/2	520.0
5 5/8	44.0	14 3/4	410.0	21 3/4	615.0	23	530.0
5 3/4	45.0	15	420.0	22 1/4	630.0	23 1/2	540.0
5 7/8	46.0	15 1/4	430.0	22 3/4	645.0	24	550.0
6	47.0	15 3/4	440.0	23 1/4	660.0	24 1/2	560.0
6 1/8	48.0	16	450.0	23 3/4	675.0	25	570.0
6 1/4	49.0	16 1/4	460.0	24 1/4	690.0	25 1/2	580.0
6 3/8	50.0	16 3/4	470.0	24 3/4	705.0	26	590.0
6 1/2	51.0	17	480.0	25 1/4	720.0	26 1/2	600.0
6 5/8	52.0	17 1/4	490.0	25 3/4	735.0	27	610.0
6 3/4	53.0	17 3/4	500.0	26 1/4	750.0	27 1/2	620.0
6 7/8	54.0	18	510.0	26 3/4	765.0	28	630.0
7	55.0	18 1/4	520.0	27 1/4	780.0	28 1/2	640.0
7 1/8	56.0	18 3/4	530.0	27 3/4	795.0	29	650.0
7 1/4	57.0	19	540.0	28 1/4	810.0	29 1/2	660.0
7 3/8	58.0	19 1/4	550.0	28 3/4	825.0	30	670.0
7 1/2	59.0	19 3/4	560.0	29 1/4	840.0	30 1/2	680.0
7 5/8	60.0	20	570.0	29 3/4	855.0	31	690.0
7 3/4	61.0	20 1/4	580.0	30 1/4	870.0	31 1/2	700.0
7 7/8	62.0	20 3/4	590.0	30 3/4	885.0	32	710.0
8	63.0	21	600.0	31 1/4	900.0	32 1/2	720.0
8 1/8	64.0	21 1/4	610.0	31 3/4	915.0	33	730.0
8 1/4	65.0	21 3/4	620.0	32 1/4	930.0	33 1/2	740.0
8 3/8	66.0	22	630.0	32 3/4	945.0	34	750.0
8 1/2	67.0	22 1/4	640.0	33 1/4	960.0	34 1/2	760.0
8 5/8	68.0	22 3/4	650.0	33 3/4	975.0	35	770.0
8 3/4	69.0	23	660.0	34 1/4	990.0	35 1/2	780.0
8 7/8	70.0	23 1/4	670.0	34 3/4	1005.0	36	790.0
9	71.0	23 3/4	680.0	35 1/4	1020.0	36 1/2	800.0
9 1/8	72.0	23 3/4	690.0	35 3/4	1035.0	37	810.0
9 1/4	73.0	24	700.0	36 1/4	1050.0	37 1/2	820.0
9 3/8	74.0	24 1/4	710.0	36 3/4	1065.0	38	830.0
9 1/2	75.0	24 3/4	720.0	37 1/4	1080.0	38 1/2	840.0
9 5/8	76.0	25	730.0	37 3/4	1095.0	39	850.0
9 3/4	77.0	25 1/4	740.0	38 1/4	1110.0	39 1/2	860.0
9 7/8	78.0	25 3/4	750.0	38 3/4	1125.0	40	870.0
10	79.0	26	760.0	39 1/4	1140.0	40 1/2	880.0
10 1/8	80.0	26 1/4	770.0	39 3/4	1155.0	41	890.0
10 1/4	81.0	26 3/4	780.0	40 1/4	1170.0	41 1/2	900.0
10 3/8	82.0	27	790.0	40 3/4	1185.0	42	910.0
10 1/2	83.0	27 1/4	800.0	41 1/4	1200.0	42 1/2	920.0
10 5/8	84.0	27 3/4	810.0	41 3/4	1215.0	43	930.0
10 3/4	85.0	28	820.0	42 1/4	1230.0	43 1/2	940.0
10 7/8	86.0	28 1/4	830.0	42 3/4	1245.0	44	950.0
11	87.0	28 3/4	840.0	43 1/4	1260.0	44 1/2	960.0
11 1/8	88.0	28 3/4	850.0	43 3/4	1275.0	45	970.0
11 1/4	89.0	29	860.0	44 1/4	1290.0	45 1/2	980.0
11 3/8	90.0	29 1/4	870.0	44 3/4	1305.0	46	990.0
11 1/2	91.0	29 3/4	880.0	45 1/4	1320.0	46 1/2	1000.0
11 5/8	92.0	30	890.0	45 3/4	1335.0	47	1010.0
11 3/4	93.0	30 1/4	900.0	46 1/4	1350.0	47 1/2	1020.0
11 7/8	94.0	30 3/4	910.0	46 3/4	1365.0	48	1030.0
12	95.0	31	920.0	47 1/4	1380.0	48 1/2	1040.0
12 1/8	96.0	31 1/4	930.0	47 3/4	1395.0	49	1050.0
12 1/4	97.0	31 3/4	940.0	48 1/4	1410.0	49 1/2	1060.0
12 3/8	98.0	32	950.0	48 3/4	1425.0	50	1070.0
12 1/2	99.0	32 1/4	960.0	49 1/4	1440.0	50 1/2	1080.0
12 5/8	100.0	32 3/4	970.0	49 3/4	1455.0	51	1090.0
12 3/4	101.0	33	980.0	50 1/4	1470.0	51 1/2	1100.0
12 7/8	102.0	33 1/4	990.0	50 3/4	1485.0	52	1110.0
13	103.0	33 3/4	1000.0	51 1/4	1500.0	52 1/2	1120.0
13 1/8	104.0	33 3/4	1010.0	51 3/4	1515.0	53	1130.0
13 1/4	105.0	34	1020.0	52 1/4	1530.0	53 1/2	1140.0
13 3/8	106.0	34 1/4	1030.0	52 3/4	1545.0	54	1150.0
13 1/2	107.0	34 3/4	1040.0	53 1/4	1560.0	54 1/2	1160.0
13 5/8	108.0	35	1050.0	53 3/4	1575.0	55	1170.0
13 3/4	109.0	35 1/4	1060.0	54 1/4	1590.0	55 1/2	1180.0
13 7/8	110.0	35 3/4	1070.0	54 3/4	1605.0	56	1190.0
14	111.0	36	1080.0	55 1/4	1620.0	56 1/2	1200.0
14 1/8	112.0	36 1/4	1090.0	55 3/4	1635.0	57	1210.0
14 1/4	113.0	36 3/4	1100.0	56 1/4	1650.0	57 1/2	1220.

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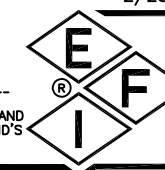


- NOTES:
1. CONDUIT TO BE SCHEDULE 40 PVC(3/4" MIN.)
 2. UNISTRUT TO BE GALVANIZED STEEL
 3. WIRE LABELS TO BE SELF LAMINATING/ADHESIVE TYPE
 4. WIRE WITHIN STATION TO BE TYPE THHN/THWN, MINIMUM #14 AWG
 5. WIRE WITHIN CONTROL PANEL TO BE MTW/AWM, MINIMUM #18 AWG
 6. ANALOG WIRE TO BE TWISTED/SHELDIED PAIR #9318 OR #KT31802

2/28/23

7 D

SCCR=10KA @ 240VAC
 U.L. TYPE 1 INSTALLATION
 NEMA 1 ENCLOSURE
 REMOTE TO PANEL-----
 CONTROL PANEL WILL BE LISTED AND
 LABELED UNDER ENGINEERED FLUID'S
 U.L. FILE NUMBER E85917



ENGINEERED FLUID, Inc.
 P.O. DRAWER 723 • CENTRALIA, ILLINOIS 62801 • 618-533-1351

DATE	REV. NO.	REVISED BY:	DESCRIPTION:

WSBPS ELECTRICAL SCHEMATIC

HUTTON PUMP STATION
 RAINBOW, CA

DRAWN BY: SK CHECKED BY: _____

JOB REF NO. 93134 DRWG. NO. ES-93134-B-104.

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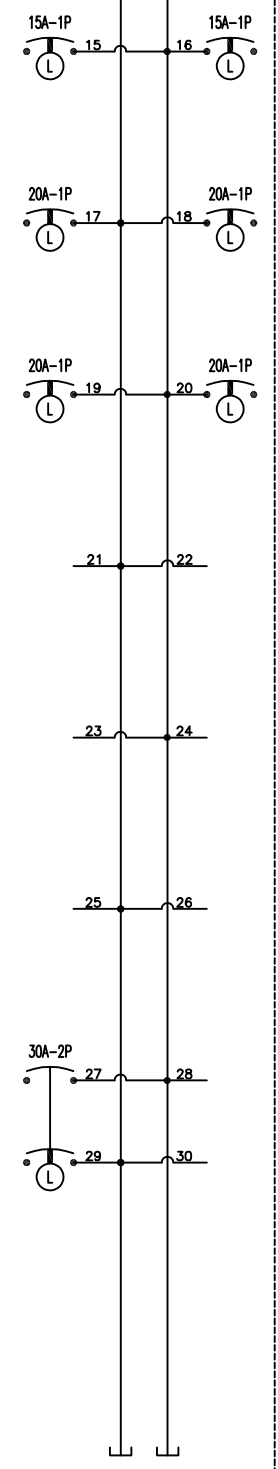
SPARE(3A)

SPARE(3A)

SPARE(3A)

SPARE(3A)

LIGHTING PANEL - LP1
120/240V, 1 PHASE, 3 WIRE
TOP FEED
NEMA 1
CONTINUED FROM DWG. ES-93134-B-104.



LIGHTING PANEL - LP1
120/240V, 1 PHASE, 3 WIRE
TOP FEED
NEMA 1

SPARE(3A)

SPARE(3A)

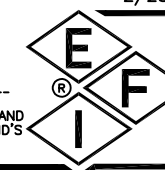
SPARE(3A)

- NOTES:
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2/28/23

7 D

SCCR=10KA @ 240VAC
U.L. TYPE 1 INSTALLATION
NEMA 1 ENCLOSURE
REMOTE TO PANEL-----
CONTROL PANEL WILL BE LISTED AND
LABELED UNDER ENGINEERED FLUID'S
U.L. FILE NUMBER E85917



ENGINEERED FLUID, INC.
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WSBPS

ELECTRICAL SCHEMATIC

HUTTON PUMP STATION
RAINBOW, CA

DATE:	REV. NO.	REVISED BY:	DESCRIPTION:

Code	Quantity	Description	Unit	Notes

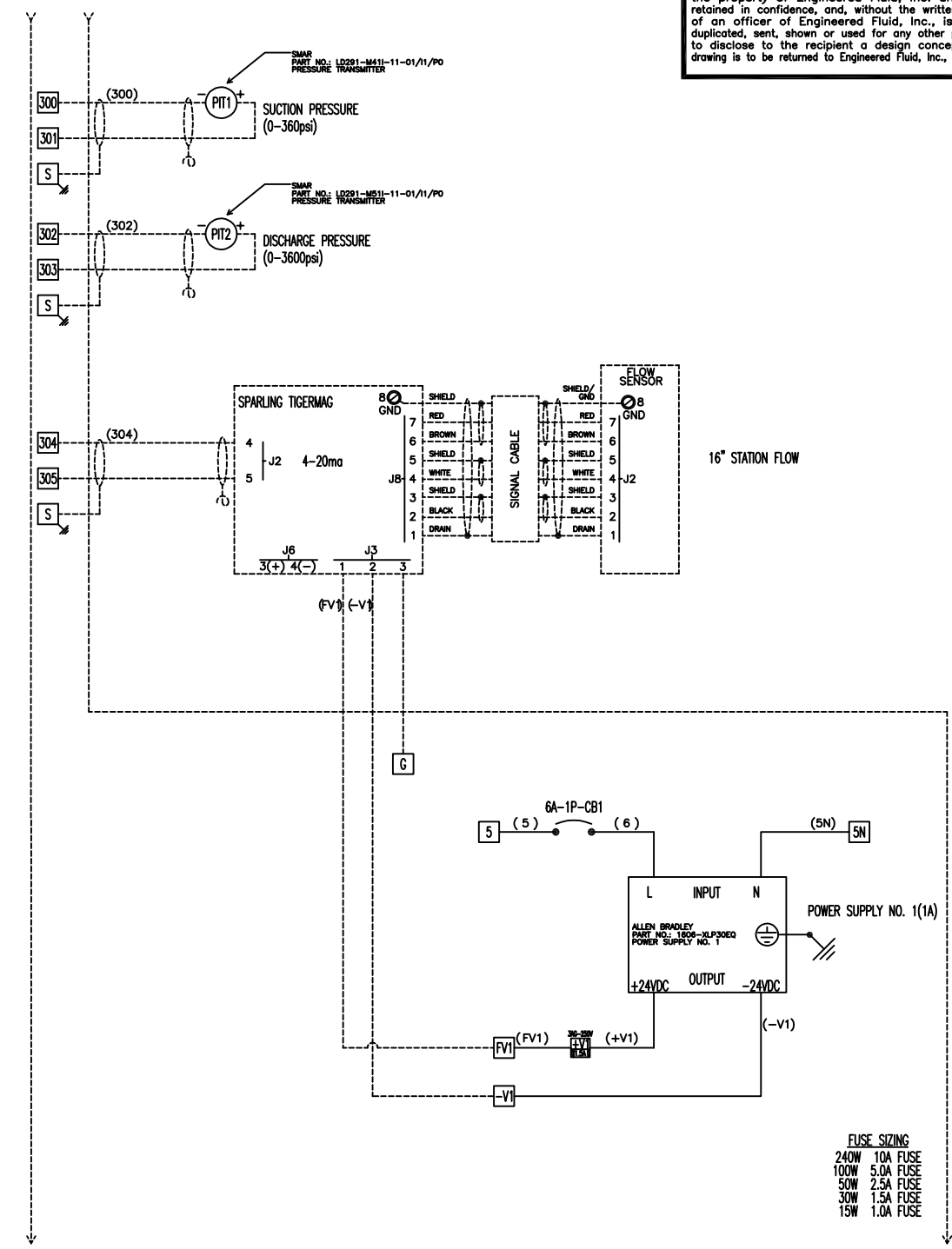
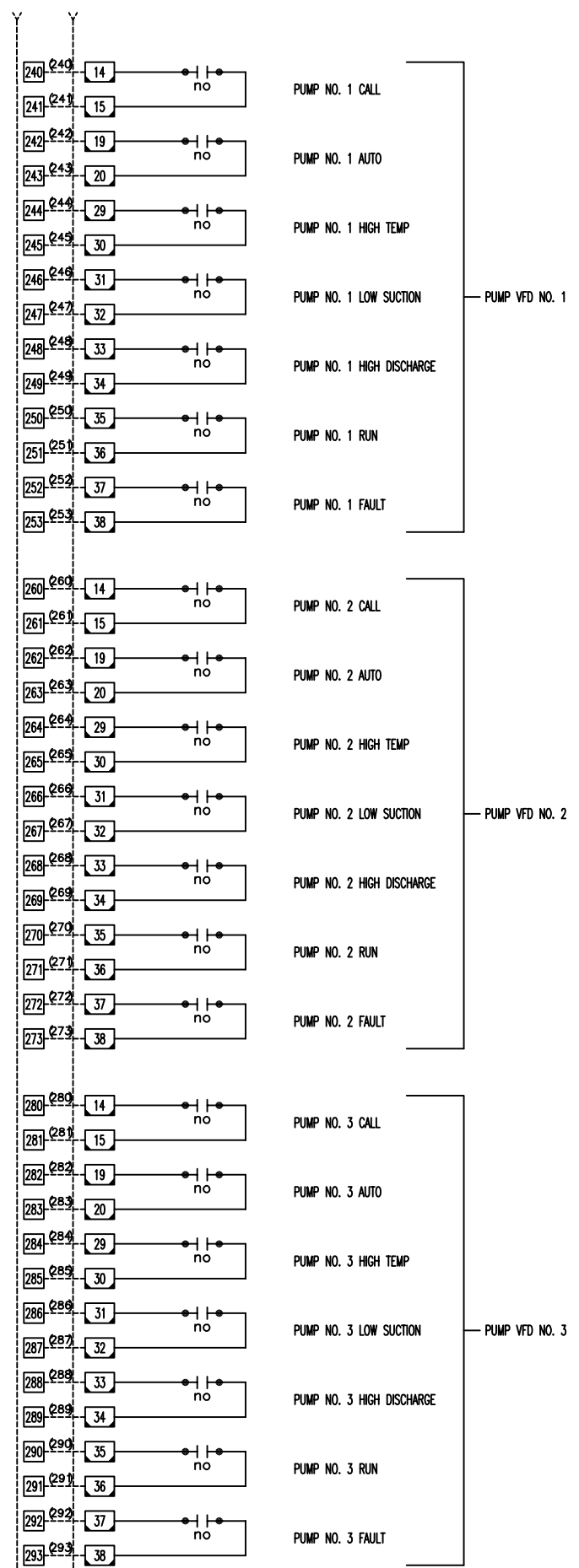
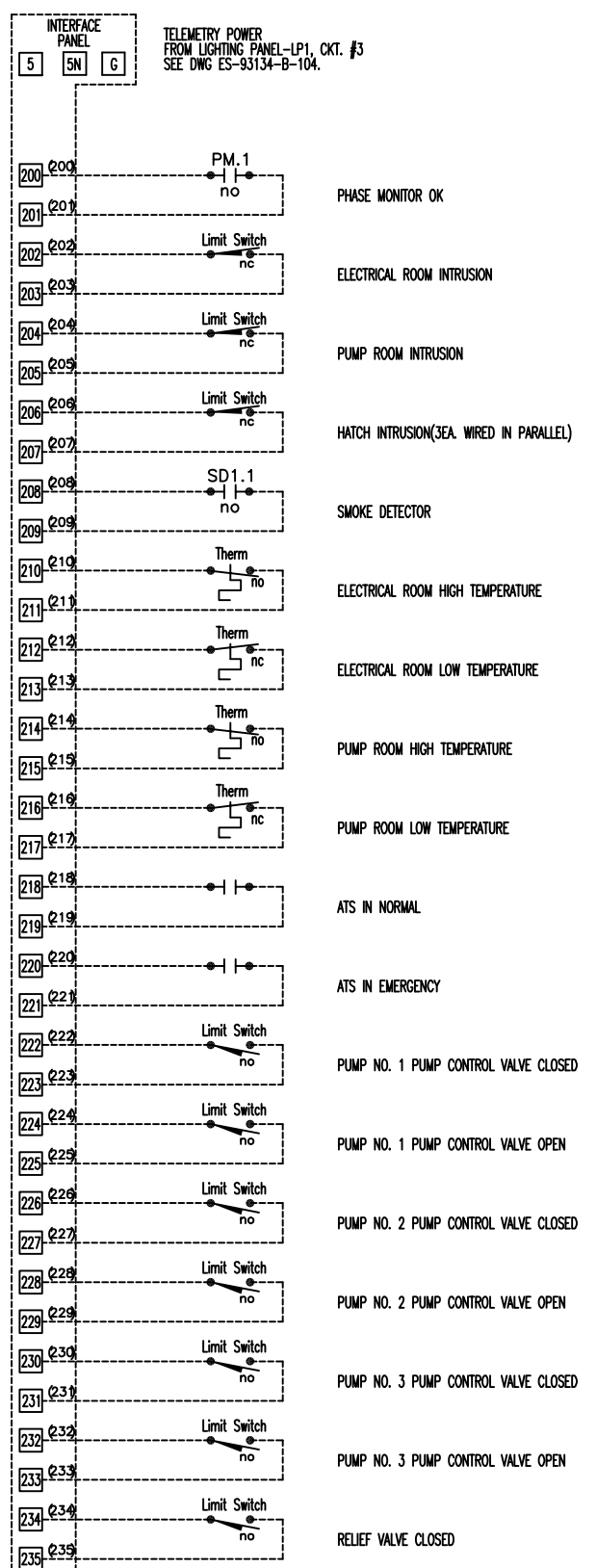
DRAWN BY: SK

CHECKED BY:

JOB REF NO. 93134

DRWG. NO. ES-93134-B-105.

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- NOTES:
1. CONDUIT TO BE SCHEDULE 40 PVC(3/4" MIN.)
 2. UNISTRUT TO BE GALVANIZED STEEL
 3. WIRE LABELS TO BE SELF LAMINATING/ADHESIVE TYPE
 4. WIRE WITHIN STATION TO BE TYPE THHN/THWN, MINIMUM #14 AWG
 5. WIRE WITHIN CONTROL PANEL TO BE MTW/AWM, MINIMUM #18 AWG
 6. ANALOG WIRE TO BE TWISTED/SHIELDED PAIR #9318 OR #KT31802

- LEGEND
- XX STARTER PANEL TERMINAL POINT
 - XX INTERFACE PANEL TERMINAL POINT

DATE:	REV. NO.	REVISED BY:	DESCRIPTION:

Code	Part-Number	QTY	Unit	Notes

2/28/23 7 D

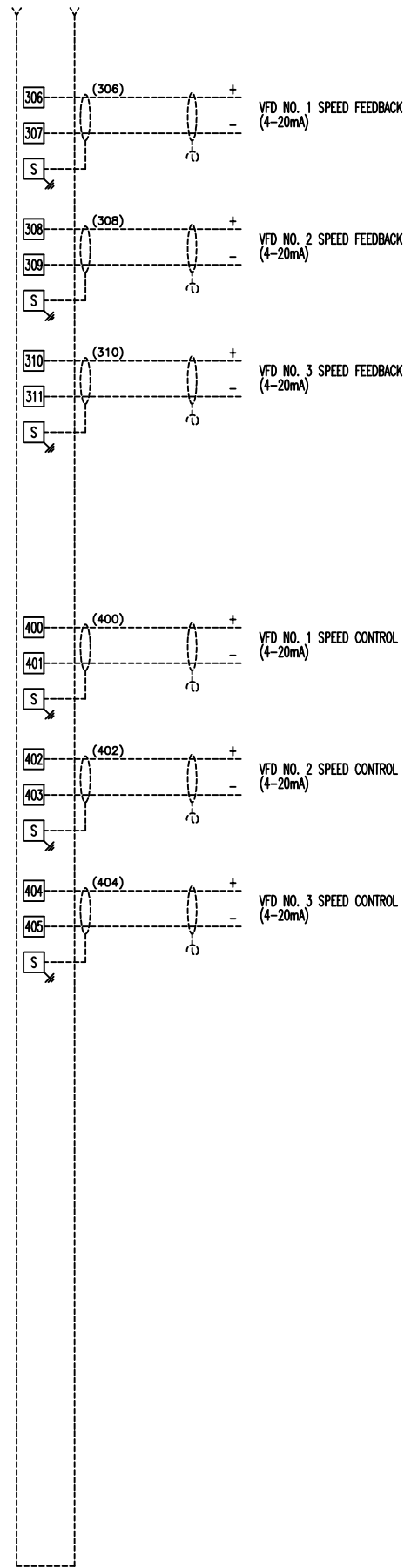
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WSBPS ELECTRICAL SCHEMATIC

HUTTON PUMP STATION
RAINBOW, CA

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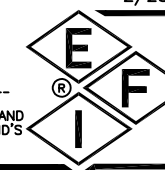


- NOTES:**
1. CONDUIT TO BE SCHEDULE 40 PVC(3/4" MIN.)
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2/28/23

7 D

U.L. TYPE 1 INSTALLATION
NEMA 1 ENCLOSURE
REMOTE TO PANEL-----
CONTROL PANEL WILL BE LISTED AND
LABELED UNDER ENGINEERED FLUID'S
U.L. FILE NUMBER E85917



ENGINEERED FLUID, INC.
P.O. DRAWER 723 • CENTRALIA, ILLINOIS 62801 • 618-533-1351

Code	Quantity	Part Number	Description	Notes
1/2"	40	40	Terminal Block	
3/16"	40	40	Terminal Block	
1/4"	40	40	Terminal Block	
3/8"	40	40	Terminal Block	
1/2"	40	40	Terminal Block	
3/4"	40	40	Terminal Block	
1"	40	40	Terminal Block	
1 1/4"	40	40	Terminal Block	
1 1/2"	40	40	Terminal Block	
1 3/4"	40	40	Terminal Block	
2"	40	40	Terminal Block	
2 1/4"	40	40	Terminal Block	
2 1/2"	40	40	Terminal Block	
2 3/4"	40	40	Terminal Block	
3"	40	40	Terminal Block	
3 1/4"	40	40	Terminal Block	
3 1/2"	40	40	Terminal Block	
3 3/4"	40	40	Terminal Block	
4"	40	40	Terminal Block	
4 1/4"	40	40	Terminal Block	
4 1/2"	40	40	Terminal Block	
4 3/4"	40	40	Terminal Block	
5"	40	40	Terminal Block	
5 1/4"	40	40	Terminal Block	
5 1/2"	40	40	Terminal Block	
5 3/4"	40	40	Terminal Block	
6"	40	40	Terminal Block	
6 1/4"	40	40	Terminal Block	
6 1/2"	40	40	Terminal Block	
6 3/4"	40	40	Terminal Block	
7"	40	40	Terminal Block	
7 1/4"	40	40	Terminal Block	
7 1/2"	40	40	Terminal Block	
7 3/4"	40	40	Terminal Block	
8"	40	40	Terminal Block	
8 1/4"	40	40	Terminal Block	
8 1/2"	40	40	Terminal Block	
8 3/4"	40	40	Terminal Block	
9"	40	40	Terminal Block	
9 1/4"	40	40	Terminal Block	
9 1/2"	40	40	Terminal Block	
9 3/4"	40	40	Terminal Block	
10"	40	40	Terminal Block	

DATE	REV. NO.	REVISED BY	DESCRIPTION

DRAWN BY: SK

CHECKED BY:

WSBPS

ELECTRICAL SCHEMATIC

HUTTON PUMP STATION
RAINBOW, CA

JOB REF NO. 93134

DRWG. NO. ES-93134-B-107.