

ROMTEC UTILITIES SCOPE OF SUPPLY AND DESIGN SUBMITTAL

FOR:

BAY MEADOWS **(SAN MATEO, CA)**

DATE: March 6, 2014

REVISION: 5

CUSTOMER CONTACT INFORMATION:

Customer Name
Company Name
Company Address
(555) 555-5555
customername@companyname.com



18240 North Bank Road ~ Roseburg ~ OR ~ 97470
541.496.9678(ph) / 541.496.0804(fx)
romtec3@romtecutilities.com



March 6, 2014

To: Customer Name
Company Name

From: Romtec Utilities Document Control

Re: Documentation for the proposed pump station project identified as

Project Name: Bay Meadows

Based on Design Criteria dated: 2/24/14

Revision #: 5

Romtec Utilities is pleased to offer this Scope of Supply and Design Submittal for the project listed above. All parties with an interest in this project must carefully read and comprehend the information contained herein.

1. Introduction

Includes information about this document and how to use it, typical Romtec Utilities process AND Submittal Approval –Notice to Proceed form.

2-3. Scope of Supply

Lists products and services to be supplied by Romtec Utilities and those products and services not supplied by Romtec Utilities.

4-5. Design Criteria & Project Site

Includes data supplied to Romtec Utilities by Romtec Utilities' direct customer or customer's representative.

6. Warranty & Limitations

Includes warranty details and limitations of Romtec Utilities responsibilities.

7. Operation & Maintenance Manual

Includes description of Operation & Maintenance Manual to be supplied by Romtec Utilities.

8-18. Design Submittal

Includes detailed drawings, descriptions and specifications of products to be supplied by Romtec Utilities.

Please address questions, comments and requests for changes to this document to:

Romtec Utilities Document Control
541-496-9678
romtec3@romtecutilities.com

Romtec Utilities, Inc.

18240 North Bank Rd. • Roseburg, OR 97470
541-496-9678 • www.romtecutilities.com

INDEX

1. **INTRODUCTION**
 - 1.01 ABOUT THIS DOCUMENT
 - 1.02 HOW TO USE THIS DOCUMENT
 - 1.03 TYPICAL ROMTEC UTILITIES PROCESS
 - 1.04 SUBMITTAL APPROVAL FORM & NOTICE TO PROCEED
2. **SCOPE OF SUPPLY – PRODUCTS & SERVICES**
 - 2.01 ROMTEC UTILITIES SCOPE OF SUPPLY: PRODUCTS
 - 2.02 ROMTEC UTILITIES SCOPE OF SUPPLY: SERVICES
 - 2.03 START-UP, TESTING & TRAINING OUTLINE
 - 2.04 PRE START-UP CHECKLIST
 - 2.05 PRE START-UP SCHEDULING INFORMATION
3. **PRODUCTS & SERVICES NOT SUPPLIED BY ROMTEC UTILITIES**
 - 3.01 PRODUCTS & MATERIALS NOT SUPPLIED BY ROMTEC UTILITIES
 - 3.02 SERVICES NOT SUPPLIED BY ROMTEC UTILITIES
4. **DESIGN CRITERIA**
 - 4.01 INTRODUCTION TO DESIGN CRITERIA
 - 4.02 LIFT STATION DESIGN CRITERIA FORM
5. **PROJECT SITE**
 - 5.01 SITE DRAWINGS WITH SUGGESTED PUMP STATION LAYOUT
 - 5.02 SITE SPECIFIC CONDUIT & WIRE LAYOUT LIMITATIONS
6. **WARRANTY & LIMITATIONS ON WARRANTY**
 - 6.01 ROMTEC UTILITIES LIMITED WARRANTY
 - 6.02 LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES
7. **OPERATION & MAINTENANCE (O&M) MANUAL**
8. **WET WELL & RELATED EQUIPMENT**
 - 8.01 WET WELL COMPONENT DRAWING(S)
 - 8.02 WET WELL PRODUCTION DRAWING(S)
 - 8.03 WET WELL HATCH DRAWING
 - 8.04 WET WELL WEIGHTS & LIFTING DEVICES
 - 8.05 WET WELL TESTING FOR WATER INGRESS OR EGRESS

INDEX

- 8.06 WET WELL RELATED DATA SHEETS
 - 8.06.1 CONSEAL
 - 8.06.2 TAPECOAT
 - 8.06.3 KOR-N-SEALS
 - 8.06.4 COUPLING ROMAC RFCA
 - 8.06.5 BARREL GASKETS
 - 8.06.6 COATING TNEMEC 61
 - 8.06.7 DEFLECTOR PANEL
- 9. **PUMPS**
 - 9.01 PUMP SPECIFICATIONS
 - 9.02 PUMP DIMENSIONAL DRAWINGS
 - 9.03 PUMP PERFORMANCE CURVES
 - 9.04 PUMP EXTENDED STORAGE
 - 9.05 PUMP RELATED DATA SHEETS
 - 9.05.1 HUBBELL SUPPORT GRIPS
 - 9.05.2 PUMP LIFTING RING
- 10. **LEVEL SENSORS**
 - 10.01 PRIMARY LEVEL SENSOR DATA SHEETS
 - 10.02 SECONDARY LEVEL SENSOR DATA SHEETS
- 11. **VALVE VAULT & ASSOCIATED MECHANICAL**
 - 11.01 VALVE VAULT COMPONENT DRAWING(S)
 - 11.02 VALVE VAULT PRODUCTION DRAWING(S)
 - 11.03 VALVE VAULT HATCH DRAWING
 - 11.04 VALVE VAULT WEIGHTS & LIFTING DEVICES
 - 11.05 VALVE VAULT RELATED DATA SHEETS
 - 11.05.1 VAL-MATIC SWING CHECK VALVE
 - 11.05.2 VAL-MATIC PLUG VALVE
 - 11.05.3 COUPLING ROMAC RFCA
 - 11.05.4 KOR-N-SEALS
 - 11.05.5 BARREL JOINT CONSEAL
 - 11.05.6 COATING TNEMEC 61

INDEX

11.05.7 BALL VALVE

11.05.8 PRESSURE TRANSDUCER

12. METER VAULT & ASSOCIATED MECHANICAL

12.01 METER VAULT COMPONENT DRAWING(S)

12.02 METER VAULT PRODUCTION DRAWING(S)

12.03 METER VAULT HATCH DRAWING

12.04 METER VAULT WEIGHTS & LIFTING DEVICES

12.05 METER VAULT RELATED DATA SHEETS

12.05.1 CONSEAL

12.05.2 TAPECOAT

12.05.3 KOR-N-SEAL

12.05.4 MEGAFLANGE ADAPTER

12.05.5 FLOW TUBE

13. ELECTRICAL INTERCONNECTIONS

13.01 TYPICAL FIELD WIRING PLAN

13.02 ELECTRICAL INSTALLATION RECOMMENDATIONS

13.03 PUMP CABLE INSPECTION AND INSTALLATION RECOMMENDATIONS

13.04 STANDARD PANEL GROUNDING AND BONDING GUIDE

14. CONTROL PANEL & COMMUNICATIONS

14.01 STANDARD TEMPERATURE SPECIFICATIONS

14.02 POWER QUALITY DISCLAIMER

14.03 ELECTRICAL SYSTEM DESIGN VOLTAGE

14.04 SPECIFICATIONS – CONTROL PANEL SCOPE OF SUPPLY

14.05 ONE-LINE DRAWING

14.06 WIRE & CONDUIT SCHEDULE

14.07 SEQUENCE OF OPERATION

14.08 SPEED SETTING CHART

14.09 SCADA REMOTE TERMINAL UNIT

15. PUMP ELECTRICAL ENCLOSURE

15.01 PUMP ELECTRICAL ENCLOSURE DRAWINGS

INDEX

- 16. **GENERATOR**
 - 16.01 GENERATOR SUBMITTAL
- 17. **ODOR CONTROL**
 - 17.01 ODOR CONTROL COMPONENT DRAWINGS
 - 17.02 EXPLOSION PROOF BLOWER
- 18. **PRE-INSTALLATION**
 - 18.01 PRE-INSTALLATION INFORMATION
 - 18.02 PRE-INSTALLATION CHECKLIST
 - 18.03 INSTALLATION DATA SHEETS
- 19. **FIELD START-UP REPORT**
 - 19.01 FIELD START-UP REPORT
- 20. **AUTODESK DESIGN REVIEW**
 - 20.01 AUTODESK DESIGN REVIEW DOWNLOAD PROCEDURE

1. INTRODUCTION

This section contains the necessary information and procedures for the understanding and use of this document by the client and other parties of interest.

This section is structured as follows:

- 1.01 ABOUT THIS DOCUMENT
- 1.02 HOW TO USE THIS DOCUMENT
- 1.03 TYPICAL ROMTEC UTILITIES PROCESS
- 1.04 SUBMITTAL APPROVAL/NOTICE TO PROCEED FORM

1.01

ABOUT THIS DOCUMENT

1. Document identification

This Scope of Supply and Design Submittal provided by Romtec Utilities, Inc., herein referred to as Romtec Utilities contains the information for the project listed below:

Name (herein referred to as "the project"): Bay Meadows

Location (herein referred to as "the site"):

Document Date: 3/6/14

Revision #: 5

2. The Romtec Utilities Scope of Supply & Design Submittal is defined by Romtec Utilities as follows:

a. A Complete document

This document is Romtec Utilities' complete Scope of Supply and Design Submittal for the project referenced above. There is no other document that contains this information. This document supersedes all other documents, written correspondence and verbal communication as to Romtec Utilities scope of supply, products and services.

b. Supplied to customer only

Romtec Utilities supplies this document exclusively to the direct customer (the entity signing Romtec Utilities' purchase order), herein referred to as the customer, and not to any other party associated with this specific project. Any other party reviewing any part of this document is informed that the information within it is Romtec Utilities' communication with the customer and no other party.

c. Based on customer-supplied design criteria

Romtec Utilities has designed the pump station described herein to meet the specific design criteria provided to Romtec Utilities by the customer and/or the customer's representative on the Lift Station Design Form (Section 4). Romtec Utilities' supply of products and services is related exclusively to these design criteria.

d. Entire supply and design for Customer only

Romtec Utilities' entire supply and design, as described in the Scope of Supply and Design Submittal, are for the customer only and no one

else. Romtec Utilities will not provide any other products and/or services related to the project to any other party.

e. Limited to this supply and design

Romtec Utilities agrees only to the supply and design described in this Scope of Supply and Design Submittal. Romtec Utilities expressly states that this document does not meet, and Romtec Utilities does not agree to meet any agency standard, any other specification or any other document and/or statement describing the project.

f. Approval is acceptance of this supply and design

By approving this document, the customer accepts the products and services identified herein to be supplied by Romtec Utilities.

g. Change orders

The customer agrees that, following approval of this document, there can be no modification to the products and services described herein without a written change order issued to Romtec Utilities by the customer and/or the customer's representative on the standard Romtec Utilities Change Order Form. The customer acknowledges that change orders will incur additional charges to the customer and may cause delays in Romtec Utilities' delivery of the products and services described herein as well as any products and services required by the change orders.

3. This Romtec Utilities Scope of Supply & Design Submittal supersedes all prior design and bid documents related to the project as follows:

a. This document negates other pump station documents/statements

Romtec Utilities recognizes that projects often begin with other designs and bid documents, however this document supersedes and makes null and void any other document or statement from any party, including Romtec Utilities' own prior documents and/or statements, as related to the pump station described in this Scope of Supply and Design Submittal.

b. This document does not represent other documents/statements

This document does not represent any specific standards, bid documents, design drawings or any other document and/or statements by any party other than Romtec Utilities.

4. This Scope of Supply and Design Submittal states that the following are not Romtec Utilities' responsibility:

a. Suitability of the pump station

It is not Romtec Utilities' responsibility to determine the suitability of the pump station to the project's site plan, electrical plan, influent line and force main profiles and other documents.

b. Document analysis is Customer's responsibility

This Scope of Supply and Design Submittal is limited to the pump station; however this document must be considered in its relationship with the overall project and site. It must be analyzed along with the project's site plan, electrical plan, influent line and force main profiles and other documents. Romtec Utilities does not provide this analysis, which is the responsibility of the customer and/or the customer's representative.

c. Requested layouts are suggestion only

At the Customer's request, Romtec Utilities will provide suggested layouts of the products to be supplied by Romtec Utilities on the Approved Site Plan provided by the customer. The customer can choose to accept or reject any suggested layouts.

d. No claim or guarantee of site conformance or suitability

Romtec Utilities makes no claim and provides no guarantee that any of the products to be supplied by Romtec Utilities will fit on project's site or within any building associated with the project.

1.02 HOW TO USE THIS DOCUMENT

1. Be sure that the Document Date and Revision # are current

If unsure, contact: **Romtec Utilities Document Control**
18240 North Bank Rd., Roseburg, OR 97470
541-496-9678 (phone); 541-496-0804 (fax)
romtec3@romtecutilities.com

2. Carefully review all sections of this document

If unsure of any information, contact Romtec Utilities Document Control immediately.

3. How to make comments and request changes

Comments and/or requests for changes to this document must be submitted, **in a written document, either MS Word or MS Excel**, to Romtec Utilities Document Control.

Please supply a list of your comments and change requests along with a copy of any marked up drawing, edited specification or any other part of the document to which you are commenting or requesting a change. All redline comments must be numbered on the drawing or specification and have a corresponding written explanation on the written document. Romtec Utilities will send the reviewing authority further instructions and a blank comment log in MS Excel format that can be filled out and sent back after reviewing the SSDS. If the reviewer would rather use their own format, it must have the same information provided as the Romtec Utilities blank comment log.

Romtec Utilities will promptly review your comments and/or change requests, and will contact you to ensure complete understanding. Revisions to the Scope of Supply and Design Submittal for this project are made at the discretion of Romtec Utilities.

4. How to approve the design

The Submittal Approval Form is included with this document. To approve the design, you must check, initial and sign where requested. Email, fax or mail the completed form to Romtec Utilities Document Control.

1.03 TYPICAL ROMTEC UTILITIES PROCESS

Below the typical steps in the process to design, price, approve, produce, deliver, install and start-up a Romtec Utilities pump station are listed:

1. Customer (or customer's representative) sends pump station design criteria to Romtec Utilities.
2. Romtec Utilities produces preliminary pump station design and quotation, sends to Customer.
3. Customer sends Purchase Order to Romtec Utilities.
4. Romtec Utilities produces Scope of Supply and Design Submittal, sends to Customer.
5. Customer reviews Scope of Supply and Design Submittal, sends written comments to Romtec Utilities.
6. Based on Customer comments, Romtec Utilities revises Scope of Supply and Design Submittal and, if necessary, the pump station quotation; sends revised documents to customer.
7. Customer distributes revised Scope of Supply and Design Submittal to all project stakeholders, gathers comments from Stakeholders, sends written comments to Romtec Utilities.
8. Based on stakeholder comments, Romtec Utilities revises Scope of Supply and Design Submittal and, if necessary, the pump station quotation; sends revised documents to customer.
9. Customer and stakeholders send formal approval of Scope of Supply and Design Submittal to Romtec Utilities.
10. Customer sends Notice to Proceed with delivery date to Romtec Utilities.
11. Romtec Utilities begins pump station manufacturing and sends projected delivery date to customer.
12. Customer's contractor prepares project site for installation of pump station.
13. Romtec Utilities delivers pump station to project site.
14. Customer's contractor installs underground portion of pump station.
15. Customer's electrical contractor performs electrical construction/installation.
16. Romtec Utilities performs pump station start-up and testing.

1.03 TYPICAL ROMTEC UTILITIES PROCESS

17. Warranty period commences.
18. Romtec Utilities performs operation and maintenance (O&M) training and delivers O&M manuals to the customer.

1.04 SUBMITTAL APPROVAL & NOTICE TO PROCEED

PROJECT: Bay Meadows
REVISION #: 5
DATE: 3/6/2014

Please initial where indicated and sign below.

1. INTRODUCTION

_____ Approved
_____ Approved with comments
_____ Rejected. Resubmit based on the supplied redlines.

2. SCOPE OF SUPPLY – PRODUCTS & SERVICES

_____ Approved
_____ Approved with comments
_____ Rejected. Resubmit based on the supplied redlines.

3. PRODUCTS & SERVICES NOT SUPPLIED BY ROMTEC UTILITIES

_____ Approved
_____ Approved with comments
_____ Rejected. Resubmit based on the supplied redlines.

4. DESIGN CRITERIA

_____ Approved
_____ Approved with comments
_____ Rejected. Resubmit based on the supplied redlines.

5. PROJECT SITE

_____ Approved
_____ Approved with comments
_____ Rejected. Resubmit based on the supplied redlines.

6. WARRANTY & LIMITATIONS

_____ Approved
_____ Approved with comments
_____ Rejected. Resubmit based on the supplied redlines.

1.04 SUBMITTAL APPROVAL & NOTICE TO PROCEED

PROJECT: Bay Meadows
REVISION #: 5
DATE: 3/6/2014

7. OPERATION & MAINTENANCE (O&M) MANUAL

_____Approved
_____Approved with comments
_____Rejected. Resubmit based on the supplied redlines.

8. WET WELL & RELATED EQUIPMENT

_____Approved
_____Approved with comments
_____Rejected. Resubmit based on the supplied redlines.

9. PUMPS

_____Approved
_____Approved with comments
_____Rejected. Resubmit based on the supplied redlines.

10. LIQUID LEVEL SENSORS

_____Approved
_____Approved with comments
_____Rejected. Resubmit based on the supplied redlines.

11. VALVE VAULT & ASSOCIATED MECHANICAL

_____Approved
_____Approved with comments
_____Rejected. Resubmit based on the supplied redlines.

12. ELECTRICAL INTERCONNECTIONS

_____Approved
_____Approved with comments
_____Rejected. Resubmit based on the supplied redlines.

13. CONTROL PANEL & COMMUNICATIONS

_____Approved
_____Approved with comments
_____Rejected. Resubmit based on the supplied redlines.

1.04 SUBMITTAL APPROVAL & NOTICE TO PROCEED

PROJECT: Bay Meadows
REVISION #: 5
DATE: 3/6/2014

14. PUMP ELECTRICAL ENCLOSURE

_____ Approved
_____ Approved with comments
_____ Rejected. Resubmit based on the supplied redlines.

15. GENERATOR

_____ Approved
_____ Approved with comments
_____ Rejected. Resubmit based on the supplied redlines.

16. PRE-INSTALLATION

_____ Approved
_____ Approved with comments
_____ Rejected. Resubmit based on the supplied redlines.

17. PRE-INSTALLATION

_____ Approved
_____ Approved with comments
_____ Rejected. Resubmit based on the supplied redlines.

18. FIELD START-UP REPORT

_____ Approved
_____ Approved with comments
_____ Rejected. Resubmit based on the supplied redlines.

REVIEWER: _____
(Print name & Company)

REVIEWER: _____
(Signature)

1.04 SUBMITTAL APPROVAL & NOTICE TO PROCEED

PROJECT: Bay Meadows
REVISION #: 5
DATE: 3/6/2014

Upon receipt of your notice to proceed, Romtec Utilities will produce the pump station and deliver it to the project site on or after the date you specify.

Please fill in the form below.

- Yes, I want Romtec Utilities to produce the specified pump station and deliver it to the project site to be installed on _____.
(delivery date)
- No, I don't want Romtec Utilities to produce and deliver the pump station at this time. I will send a separate written notice to proceed at a later date.

(Signature of person authorized to approve submittal)

(Date)

(Print name)

(Title)

By signing the Submittal Approval & Notice to Proceed, I approve the products and services as specified in the Romtec Utilities Scope of Supply and Design Submittal for this project. I understand that any change(s) I have requested may change other Romtec Utilities documents, including but not limited to the pump station quote, the scope or supply and design submittal and the O&M manual. I understand that such changes may cause delays to the project.

Please return the form to: Romtec Utilities, Inc.
18240 North Bank Rd.
Roseburg, OR 97470
Fax: 541-496-0804
Email: romtec3@romtecutilities.com

**END
OF
SECTION**

2. SCOPE OF SUPPLY – PRODUCTS & SERVICES

This section outlines what products and services are provided by Romtec Utilities for this design. In addition, this section includes the Pre Start-Up Preparation Checklist to be filled out by the owner/contractor prior to the scheduled start-up and scheduling information.

This section is structured as follows:

- 2.01 ROMTEC UTILITIES SCOPE OF SUPPLY: PRODUCTS
- 2.02 ROMTEC UTILITIES SCOPE OF SUPPLY: SERVICES
- 2.03 START-UP, TESTING & TRAINING OUTLINE
- 2.04 PRE START-UP CHECKLIST
- 2.05 PRE START-UP SCHEDULING INFORMATION

Send the completed Start-Up Preparation Checklist to:

Romtec Utilities Document Control
18240 North Bank Rd., Roseburg, OR 97470
Phone: 541-496-9678; Fax: 541-496-0804
Romtec8@romtecutilities.com

IMPORTANT!

Various products and services NOT supplied by Romtec Utilities are listed in the Warranty & Limitations section of this Scope of Supply and Design Submittal.

2.01 ROMTEC UTILITIES SCOPE OF SUPPLY: PRODUCTS

COMPLETE PUMP STATION INCLUDES:

WET WELL & RELATED EQUIPMENT

QTY ITEM

2.01 ROMTEC UTILITIES SCOPE OF SUPPLY: PRODUCTS

VALVE VAULT & ASSOCIATED MECHANICAL

QTY	ITEM
-----	------

2.01 ROMTEC UTILITIES SCOPE OF SUPPLY: PRODUCTS

METER VAULT & ASSOCIATED MECHANICAL

QTY	ITEM
-----	------

2.01 ROMTEC UTILITIES SCOPE OF SUPPLY: PRODUCTS

GENERATOR

QTY ITEM

ODOR CONTROL SYSTEM

QTY ITEM

2.01 ROMTEC UTILITIES SCOPE OF SUPPLY: PRODUCTS

CONTROL PANEL/ELECTRICAL & COMMUNICATION

QTY ITEM

2.02**ROMTEC UTILITIES SCOPE OF SUPPLY:
SERVICES****1. Administrative & design services**

- a. Receive pump station design criteria from customer or customer's representative.
- b. Design pump station to meet the design criteria and perform as specified.
- c. Produce all drawings and other documents included in this Scope of Supply and Design Submittal.
- d. Only if ordered by customer or customer's representative, provide optional sealing of drawings, calculations and/or the entire Design Submittal at additional cost to customer.
- e. Receive submittal approval from customer or customer's representative
- f. Receive purchase order and notice to proceed from customer's installation contractor.

2. Production services

- a. Produce the complete pump station as specified in Scope of Supply-Products.

3. Delivery services

- a. Deliver pump station to project site on date(s) specified by customer or customer's representative.
- b. Provide information on weights of parts and lifting devices.

4. Pre-installation & installation advisory services

- a. Provide advisory services to our customer or customer's representative and/or their contractor(s) and others who will install/construct this pump station on the site. One day is provided.
- b. Romtec Utilities personnel at the project site during installation of the pump station's underground components are there only in an advisory capacity. Romtec Utilities does not perform work during this phase of the project, unless such work is specified in the SSDS.

5. Electrical advisory services

- a. Provide advisory services through customer or customer's representative to the licensed electrical contractor installing electrical service to the pump station.

2.02

ROMTEC UTILITIES SCOPE OF SUPPLY: SERVICES

6. Start-up services

- a. Direct all pump station start-up activities at the project site on the designated start-up day. One day is provided.

7. Testing & training services

- a. Perform all pump station tests specified in Field Start-Up Report for the project, report test results to the Customer or Customer's representative, deliver O&M Manuals and train any and all owners.
- b. Training is provided contiguous to the start-up date. If the testing and training is not scheduled and/or completed the day following start-up, there will be additional charges for Romtec Utilities to return and complete the testing and training services.
- c. It is required that the main contact to be in charge of operation and maintenance of the lift station, through the duration of the warranty period, be identified and present at the training. This person is responsible for troubleshooting, with the help of Romtec Utilities over the phone, in the event of a warranty issue throughout the one year warranty period beginning the day Start up Training is completed. All other personnel relevant to the maintenance and operation of the lift station are required to be present for the duration of startup training.

Start-up, testing & training outline

1. Understanding the Complete System (Wet Well-Bottom up)
 - a. Pumps (with assistance from pump manufacturer's representative)
 - b. Guide Rails
 - c. Elbows
 - d. Level devices
 - e. Hatches
 - f. Level sensors

2. Valve Vault
 - a. Valves
 - b. Backflow actuator

3. Control panel (Overview/Power Up)
 - a. Overview (Front Panel)
 - b. Procedure of operating panel
 - c. Overview (inside panel)
 - d. Power up Procedure
 - e. Back-up System Operations
 - f. Primary Level Operation/Lead-lag, Alternations, Starts/Stops.
 - g. Controller Operation

4. System Protection Methods/Devices
 - a. Seal Thermal-Moisture Seals
 - b. Phase Monitor
 - i. Surge Suppression

2.03

START-UP, TESTING & TRAINING OUTLINE

5. Alarms
 - a. Critical Alarms
 - b. Non-critical Alarms

6. Trouble Shooting
 - a. Hands On
 - b. Who to call first

Note: Please see the "Pre Start-up Checklist" following this page and the "Field Start-Up" section of the SSDS for a more detailed example of what is covered on the day of start-up.

Pre Start-Up Checklist

OVERVIEW

This form and associated photos must be completed and returned before Romtec Utilities will schedule or confirm any Start-up Testing and Training dates. Send the completed checklist to romtec8@romtecutilities.com or fax to 541-496-0804.

This document is a checklist. It ensures that all necessary components have been installed and that your lift station is prepared and ready for start-up. We have outlined below the tasks that need to be completed before start-up and training can occur in the following sections:

1. Review of previously completed underground construction
2. Review of electrical construction connecting to the wet well
3. Communication equipment
4. Water availability
5. Wet Well
6. Required photos
7. Personnel required for start-up testing
8. Personnel required for start-up training

All activities and requirements stated in this document have been approved in the Scope of Supply and Design Submittal.

Please follow this checklist to ensure that all appropriate actions have been taken in preparation for start-up and personnel training for your lift station.

ATTENTION!

DO NOT LOWER THE PUMPS INTO THE WET WELL. A Romtec Utilities start-up advisor will lower the pumps into the wet well at start-up, in accordance with the pump warranty. If you lower the pumps on your own you risk voiding the warranty.

1. PREVIOUSLY COMPLETED UNDERGROUND CONSTRUCTION REVIEW

The following wet well and valve vault components must be installed and approved.

	YES	NO
i. Discharge Pipes		
1. Are connected to elbows?	<input type="checkbox"/>	<input type="checkbox"/>
2. Are plumb and connected to discharge pipe brackets?	<input type="checkbox"/>	<input type="checkbox"/>
3. Are connected to valve vault?	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>
ii. Guide Bars		
1. All stainless steel guide bars installed?	<input type="checkbox"/>	<input type="checkbox"/>
2. Upper guide bar brackets are installed and tight?	<input type="checkbox"/>	<input type="checkbox"/>
3. Intermediate guide bar brackets (if equipped) are installed?	<input type="checkbox"/>	<input type="checkbox"/>

2. REVIEW OF ELECTRICAL CONSTRUCTION CONNECTING TO THE WET WELL

Note: High voltage is in use. Only licensed and qualified personnel should perform electrical services in preparation for, and during start-up.

	YES	NO
i. Have the conduits been installed between the wet well and the main control panel (At least one (1) for each pump cable and at least one (1) for the level control device)	<input type="checkbox"/>	<input type="checkbox"/>

Note: Romtec Utilities does not core holes into the wet well for electrical conduit ports or conduit runs. The cored holes in the wet well are the responsibility of the contractor and electrician. Final size, orientation, height, and number are best determined after installation of the wet well and other electrical components.

CAUTION!

All cored holes into the wet well shall be made 8 in. above or 3 in. below any barrel joints in such a manner as not to impact the integrity of the barrel joint and seal.

- | | YES | NO |
|--|--------------------------|--------------------------|
| ii. Have the level control wires been pulled between the pump control panel and the wet well? | <input type="checkbox"/> | <input type="checkbox"/> |
| iii. Have the level control wires been landed on the appropriate terminals inside the control panel? | <input type="checkbox"/> | <input type="checkbox"/> |

*Note: The pump power cables will be pulled through the conduit at the time of start-up. Do **NOT** cut the level control wires; floats/level control devices will be set up at an appropriate level at the time of start up testing.*

- | | | |
|--|--------------------------|--------------------------|
| iv. Have the "meter base" and main disconnect been installed and inspected? | <input type="checkbox"/> | <input type="checkbox"/> |
| v. Have the panel power wires been installed between the main disconnect, automatic transfer switch (if present) and the pump control panel? | <input type="checkbox"/> | <input type="checkbox"/> |
| vi. Has the power company energized the meter? | <input type="checkbox"/> | <input type="checkbox"/> |

Note: Permanent utility power to the job site is required in order to perform start-up, testing, and training.

- | | | |
|--|--------------------------|--------------------------|
| vii. Is all necessary field wiring complete? | <input type="checkbox"/> | <input type="checkbox"/> |
|--|--------------------------|--------------------------|

Note: Romtec Utilities reserves the right to charge for our time required to complete wiring.

3. COMMUNICATION EQUIPMENT

- | | YES | NO |
|--|--------------------------|--------------------------|
| i. Has all required communication equipment (radio, phone, cellular) been installed and confirmed to be operational? | <input type="checkbox"/> | <input type="checkbox"/> |

4. WATER AVAILABILITY

- i. Is enough water available to fill the wet well 1-½ times?

5. WET WELL

- i. Is the wet well clean and free of any debris?
- ii. Have the incoming sewer line(s) and upstream man holes been flushed of all debris?
- iii. Do you have permission from the appropriate parties to pump water out of the pump station into the treatment plant?

IMPORTANT!

All debris must be flushed from all inlet lines and man holes prior to starting the system.

6. REQUIRED PHOTOS

Have the following required photos been taken and prepared to deliver with the checklist?

- | | YES | NO |
|--|--------------------------|--------------------------|
| i. Photo of the inside of the control panel (specifically the terminal blocks at the base of the panel). | <input type="checkbox"/> | <input type="checkbox"/> |
| ii. Photo of the control and disconnect panel from approx. 5 ft. away. | <input type="checkbox"/> | <input type="checkbox"/> |
| iii. Photo of the inside of the wet well. | <input type="checkbox"/> | <input type="checkbox"/> |

7. PERSONNEL REQUIRED FOR START-UP TESTING

Note: It is the contractor's responsibility to invite and schedule all appropriate parties.

Safety Manager:

Name: _____
 Company: _____
 Phone: _____

Site Engineer's Representative:

Name: _____
 Company: _____
 Phone: _____

Owner's Representative:

Name: _____
 Company: _____
 Phone: _____

Electrical Inspector(s):

Name: _____
 Company: _____
 Phone: _____

Site Electrician:

Name: _____
 Company: _____
 Phone: _____

8. PERSONNEL REQUIRED FOR START-UP TRAINING

YES NO

Have the appropriate personnel been informed of the date in which start up training will occur?

Main Contact to be in charge of operation and maintenance of the lift station through the duration of the warranty period:

Name: _____
 Company: _____
 Phone: _____

Note: This person is responsible for troubleshooting with the help of Romtec Utilities over the phone in the event of a warranty issue throughout the one year warranty period beginning the day Start up Training is completed.

Special Note: All other personnel relevant to the maintenance operation of the lift station are required to be present for the duration of startup training.

IMPORTANT!

This form must be completed before Romtec Utilities can schedule travel for your start-up advisor. Your project start-up date can be set with Romtec Utilities at any time. By completing the start-up preparation documents you are acknowledging the following:

- a. Romtec Utilities has provided its customer with two contiguous days for start-up, testing, and training. If you say you are ready for Romtec Utilities to come to the site and perform these services, when in fact you are not ready, Romtec Utilities will charge its customer for another trip and the time (two days) on the job site to perform these services.
- b. The Romtec Utilities system warranty is not provided to its customer and/or the owner unless, and until, the Romtec Utilities system start-up, testing, and training have been completed.
- c. By signing this document you agree to reimburse Romtec Utilities for any costs incurred, whether by Romtec Utilities directly or through a related vendor, due to on-site delays caused by inaccurate representations herein. Typical costs attributed to delays include labor, travel and lodging. However, this list is not meant to be exclusive, and other costs may apply.

Please send this Checklist and the required photos back to Romtec Utilities two (2) weeks before the scheduled start-up and training dates.

PROPOSED START-UP & TRAINING DATES: _____

AUTHORIZED SIGNATURE

DATE

Scheduling for Start-Up and Training:

1. Lead time to schedule start-up.
 - a. Romtec Utilities and all associated technical personnel require four (4) weeks advance notice to schedule a start-up date. The start-up checklist attached must also be completed two weeks prior to the requested start-up date.

2. Duration of start-up and training.
 - a. Start-up begins at **8 am** and will require one (1) full day.
 - b. Training begins the following day at **8 am** and the advisor will be available all day.
 - c. These days **must be contiguous weekdays**. Romtec Utilities does not schedule start-ups over Saturdays or Sundays.
 - d. Please see attached document outlining events performed at start-up and training.

***Note:** These timelines are stated in the approved Romtec Utilities Scope of Supply and Design Submittal.*

3. Scheduling pump and generator services.
 - a. If Romtec Utilities is providing services from a generator or pump supplier to the customer during start-up and training, these vendors will only be available the same days that Romtec Utilities' personnel are on-site.

***Note:** These timelines are stated in the approved Romtec Utilities Scope of Supply and Design Submittal.*

ATTENTION!

PROPER EQUIPMENT MUST BE ON-SITE THE DAY OF START-UP

You must provide equipment to safely lower the pumps into the wet well. Romtec Utilities will not proceed with start-up if there is not equipment to lower the pumps.

**END
OF
SECTION**

3. PRODUCTS & SERVICES NOT SUPPLIED BY ROMTEC UTILITIES

This section outlines what products and services are not provided by Romtec Utilities for this design.

This section is structured as follows:

3.01 PRODUCTS & MATERIALS NOT SUPPLIED BY ROMTEC UTILITIES

3.02 SERVICES NOT SUPPLIED BY ROMTEC UTILITIES

3.01**PRODUCTS & MATERIALS NOT SUPPLIED BY
ROMTEC UTILITIES**

Each Romtec Utilities pump station is designed and supplied for the specific pumping requirement, as determined by the design criteria provided to Romtec Utilities by the customer or the customer's representative.

The specific products and materials to be supplied by Romtec Utilities are unique to this pump station and are listed in the Scope of Supply-Products list. Any component not on the list will not be supplied by Romtec Utilities.

Unless otherwise specified, products and materials NOT supplied by Romtec Utilities include:

- 1. Any item not listed in the Scope of Supply-Products**
 - a. Any fasteners not associated with the pre-assembled systems or components not listed in the Scope of Supply-Products list are NOT supplied.

- 2. Site drawings**
 - a. Any site drawing included in this Scope of Supply and Design Submittal has been supplied by others.

- 3. Construction equipment, materials and labor for:**
 - a. Unloading trucks, traffic control, site safety
 - b. Securing materials delivered to project site: dunnage, fencing, storage
 - c. Excavation, shoring, dewatering, sub-base rock, backfill material
 - d. Installation of supplied pump station systems and components
 - e. Piping to and from pump station
 - f. Piping between pump station systems (i.e. between wet well and valve vault)
 - g. Electrical conduit and wiring (except wires attached to supplied components)
 - h. Concrete poured in place, crushed rock, asphalt paving
 - i. Site lighting, signage, fencing, bollards
 - j. Site drainage control

3.02 SERVICES NOT SUPPLIED BY ROMTEC UTILITIES

The services to be supplied by Romtec Utilities are unique to this pump station and are listed in the Scope of Supply-Services list. Any service not on the list will not be supplied by Romtec Utilities.

Unless otherwise specified, services NOT supplied by Romtec Utilities include:

- 1. Any item not listed in the Scope of Supply-Services**
- 2. Sealing of the Scope of Supply and Design Submittal, including drawings contained herein**
 - a. If required, sealing of this document and/or supply of sealed plans and/or calculations are available from Romtec Utilities at additional cost.
- 3. Design and engineering services for aspects of the project not included in this Scope of Supply and Design Submittal**
 - a. Site engineering, site drawings, electrical service design and plans.
 - b. Construction meetings not directly related to the pump station.
 - c. Design/specification of delivery or installation space, equipment, safety.
 - d. Review of any documents supplied by any party other than Romtec Utilities.
- 4. Construction services**
 - a. Romtec Utilities personnel at the project site during installation of underground components are there only in an advisory capacity.
 - b. Romtec Utilities does not perform work during this phase of the project, unless such work is specified in the Scope of Supply.
- 5. Electrical services**
 - a. Romtec Utilities does not perform or advise on the performance of any electrical services that must be performed by a licensed electrical contractor.

3.02

SERVICES NOT SUPPLIED BY ROMTEC UTILITIES

6. Start-up, testing & training services

- a. Romtec Utilities' standard start-up, testing and training services are based solely on the pre-specified operational parameters contained in this Scope of Supply and Design Submittal.
- b. Additional start-up, testing and/or training services requested or required by the regulatory agency or any other party will not be conducted by Romtec Utilities.

**END
OF
SECTION**

4. DESIGN CRITERIA

The information submitted for the Romtec Utilities design within this document is explained and organized in this section. The design criteria was submitted by the person(s) stated in Section 4.01 not Romtec Utilities itself.

This section is structured as follows:

4.01 INTRODUCTION TO DESIGN CRITERIA

4.02 LIFT STATION DESIGN CRITERIA FORM

4.01

INTRODUCTION TO DESIGN CRITERIA

Romtec Utilities has created this Scope of Supply and Design Submittal solely on the basis of the design criteria listed on the attached Lift Station Design Form. The design criteria are identified as:

Project Name: Bay Meadows

Design criteria supplied by: ARUP

Design criteria date: 2/24/14

CAUTION! By approval of and/or use of this Romtec Utilities Scope of Supply and Design Submittal, the customer and/or the customer's representative agrees that Romtec Utilities has correctly based this scope of supply and this design of the pump station on the exact design criteria listed on the attached Lift Station Design Form.

Romtec Utilities has not checked the information listed on the Lift Station Design Form. Romtec Utilities does not have responsibility for checking this information or confirming its accuracy. This information has been accepted as fact by Romtec Utilities.

NOTE: The pump station will perform as designed, only if the design criteria stated in the Lift Station Design Form represent the actual conditions at the project site. If the project site's actual conditions are, in any way, different from the design criteria supplied to Romtec Utilities, then the pump station could perform differently than stated or not perform at all.

IMPORTANT! Romtec Utilities has relied on the design criteria supplied by the customer and/or the customer's representative (listed on the Lift Station Design Form) as the only information forming the basis for design of the pump station described herein.

Additional information about this project, including agencies' standards, bid documents, design drawings and other documents, may have been available to and/or supplied to Romtec Utilities. Romtec Utilities may have studied such information; however the pump station design represented by this Scope of Supply and Design Submittal is based solely on the design criteria listed on the attached Lift Station Design Form.

Romtec Utilities makes no claim as to whether or not the pump station described herein will meet any agency's standard, any bid document or any other document. Romtec Utilities is not responsible for making such a determination.

Romtec Utilities, Inc.

18240 North Bank Rd. • Roseburg, OR 97470

541-496-9678 • www.romtecutilities.com



4.02 LIFT STATION DESIGN CRITERIA FORM

Romtec Utilities has designed this Scope of Supply and Design Submittal based on the following information:

Design Criteria

Date: 2/24/2014

PART 1: PROJECT CONTACT INFORMATION

Information here in provided by:

Preston Pipeline

Company/Agency Type:

Other

Engineer

Developer

Gov't.
Agency

Other

First Name:

Greg

Last Name:

Gutierrez

Title:

Email Address:

ggutierrez@prestonpipelines.com

Address:

133 Bothelo Avenue

City:

Milpitas

State/Province:

CA

Zip Code:

95826

Country:

USA

Telephone:

408-262-1418

Phone Ext: _____

Mobile/Other Phone:

408-461-1009

Fax: _____

Project Name:

Bay Meadows

Your Client for this project is:

Public Agency

Public Agency

Private Co.

Project Type:

Wastewater

Wastewater

Stormwater

Other

Project City:

San Mateo, CA

Project Zip: _____

Project Engineer:

Greg Gutierrez, Preston Pipeline

Reviewing Entity who reviews/approves this Scope of Supply & Design Submittal:

City of San Mateo Department of Public Works

Final Project Owner and/or Operator:

City of San Mateo

Governing Sewer or Water Authority:

Does Authority have a lift station standard?

SELECT ONE

Yes

No

N/A

Who should Romtec contact about the lift station design standard?

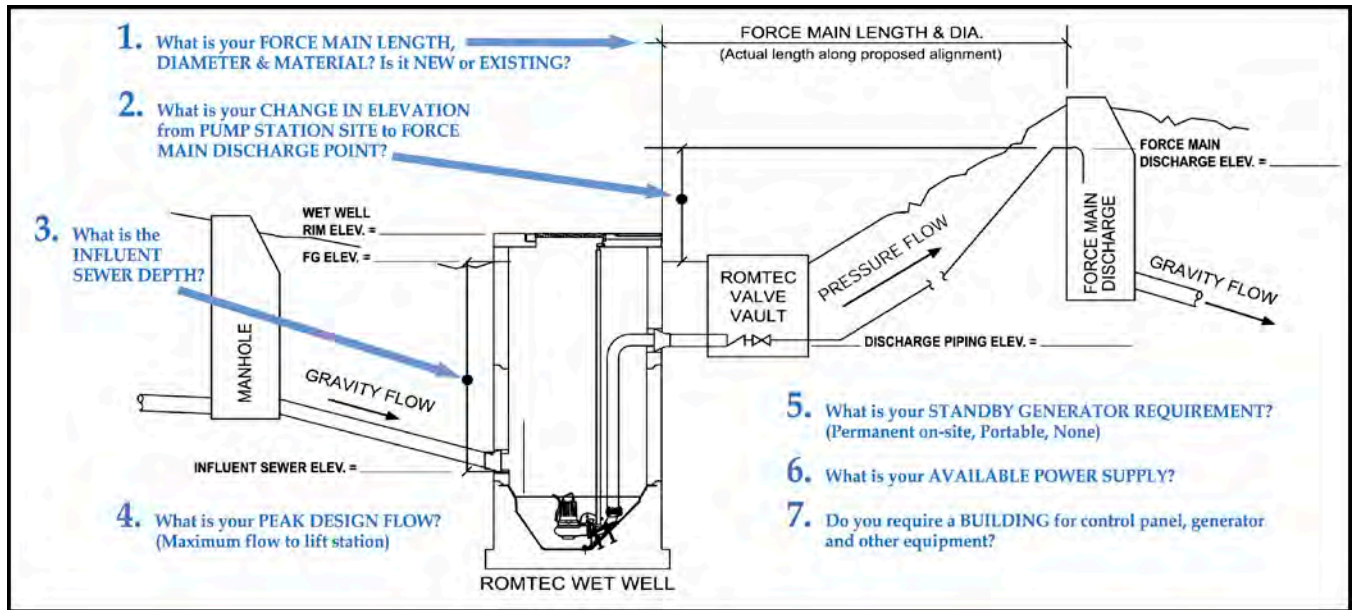
What is the Expected Project Bid Date?

Project Completion Date: _____

4.02 LIFT STATION DESIGN CRITERIA FORM

PART 2: DESIGN DATA

If using assumed elevations, note this in Additional Information.



1. Force main length: 3805.84 ft. (actual length along proposed alignment)

Force main diameter (inside): 10 in. I.D. (12.75 in. O.D.) then discharges into existing 20 in. I.D.

Force main material (i.e., PVC C-900 class 150, ductile iron class 52, HDPE DR17 class 100, etc.): DR 11 HDPE

Force Main is: Existing New Existing

2. Elevation change from discharge piping elevation to force main discharge point: -2.83 ft.

Finish grade elevation at wet well: 102.25 ft.

Centerline discharge piping elevation at valve vault: 95.32 ft.

Force main discharge elevation: 92.49 ft.

3. Influent sewer elevation: 89.1 ft.

4. Peak design inflow (maximum flow to lift station): 1218 g.p.m. @ 96 TDH

5. Standby generator requirement: Permanent Permanent Portable None Don't Know

Standby generator fuel: Diesel Diesel Natural Gas Propane

6. Available power supply: 480V 208V 240V 480V

3-phase Single-phase 3-phase

Additional loads on site (besides the lift station) to be powered by generator: _____ KVA

**END
OF
SECTION**

5. SITE PLAN

The location of any project is critical in design. This section includes a site plan drawing with lift station orientation for the use of the contractor.

This section is structured as follows:

- 5.01 SITE DRAWINGS WITH SUGGESTED PUMP STATION LAYOUT
- 5.02 SITE SPECIFIC CONDUIT & WIRE LAYOUT LIMITATIONS

IMPORTANT!

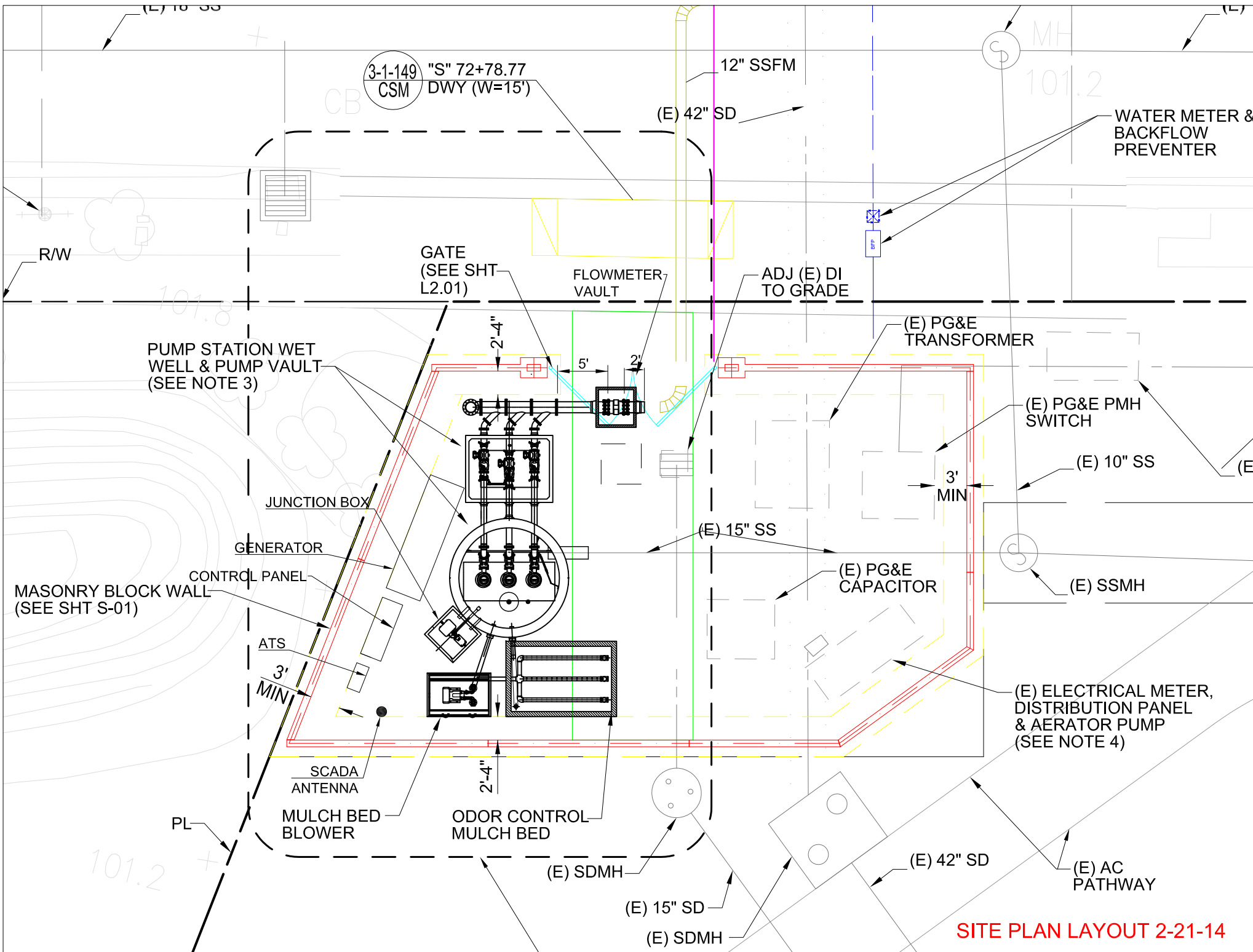
Romtec Utilities has not produced drawings of the project site. Any site drawings in this Scope of Supply and Design Submittal have been produced by others. Romtec Utilities has not checked the site drawings for their accuracy.

Romtec Utilities makes no claim as to the accuracy of information contained in these site drawings.

The layout of the pump station on the site plan is only a suggestion by Romtec Utilities. Receiving final approval of the pump station layout on the approved site plan is the responsibility of the Customer or the Customer's representative.

Romtec Utilities makes no claim as to the suitability of the suggested pump station layout for the project.

If anyone other than Romtec Utilities provides a layout of the Romtec Utilities equipment on the site plan, any difficulties that may arise due to incorrect layout of the equipment is not Romtec Utilities responsibility.



SITE PLAN LAYOUT 2-21-14

5.02

SITE SPECIFIC CONDUIT AND WIRE LAYOUT

Romtec Utilities does not provide a site specific (to scale) layout of the electrical conduit and wire which interconnects the Romtec Utilities supplied equipment on your site.

Each job is site specific and under the jurisdiction of the local utility and local inspectors. We (Romtec Utilities) are not providing the conduit or the wire and we are not licensed electricians who are performing the field installation of the actual conduit and wire.

What Romtec Utilities does provide for you and your electrician is the following.

1. Section 5.01 – Site Drawings with Suggested Pump Station Layout.

Note: An approved (and correctly orientated) site plan layout (of the Romtec Utilities equipment) to scale. Site drawings are by others.

2. Section 12.01 – Typical Field Wiring Plan.

Note: This drawing reflects the electrical interconnection from the Romtec Utilities control panel to the Romtec Utilities supplied field devices.

3. Section 13.05 – One-line drawing.

Note: This drawing aids in the understanding and installation of the overall control system.

CONCLUSION

Complete field wiring and installation instructions are not included in the Romtec Utilities Scope of Supply and Design Submittal. Instead, the correct installation and conformance to all applicable codes is the responsibility of the installer and/or their electrician.

**END
OF
SECTION**

6. WARRANTY & LIMITATIONS ON WARRANTY

This section includes all warranty information for Romtec Utilities products and services.

This section is structured as follows:

- 6.01 ROMTEC UTILITIES LIMITED WARRANTY
- 6.02 LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES

Romtec Utilities Limited Warranty

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

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

Components resold or supplied with Romtec Utilities materials

Certain components are warrantable directly by the original manufacturer for periods between 90 days and 5 years. Replacement for, repair or refund of defective workmanship or material under normal use shall be remunerated directly with the manufacturer of the component. Examples of components would be generators, manual cranes, pumps, pump controls, valves, etc.

Warranty voidable

Romtec Utilities' representative must be on-site for oversight of assembly during installation of the wet well. Wet Well installation that is performed without the presence of a Romtec Utilities' representative shall void all warranties related to the wet well structure and its performance.

Start-up that is performed without the presence of a Romtec Utilities' representative shall void all warranties.

Claims of defective manufacture

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

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

Failure of pump station

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

Action in event of established claim

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

No third party claims

Under no circumstances shall Romtec Utilities be responsible for any damage claims by any party other than claims by Romtec Utilities direct customers.

Release and hold harmless

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

FURTHER LIMITATIONS ON ROMTEC LIABILITY**1. Specific limitations**

- a. Romtec Utilities' liability under the foregoing warranty and under the transaction of which this document is a part is limited as follows:
- b. Romtec Utilities has designed the lift station supplied under this project to meet a specific design standard and specific set of parameters as dictated to Romtec Utilities by its customer as set forth in the "Lift Station Design Form" located in section 4 of the Romtec Utilities Scope of Supply and Design Submittal.
- c. Romtec Utilities' Scope of Supply & Design Submittal is a part of and limited by CUSTOMER'S site civil and electrical plans.
- d. Romtec Utilities makes no guarantees that any of its supply will fit on customer's site and/or building. However, at customer's request, Romtec Utilities will provide suggested layouts for the customer's project. Ultimately, the customer decides to accept or reject any given layout.
- e. Romtec Utilities cannot make final layout or equipment placement judgments at the site (i.e. generator or control panel "fit" in or out of a building). It is the responsibility of customer's site engineer and contractor to check dimensions, etc. If customer has not accepted (or received) final dimensions, etc., please request further definition before approval. Romtec Utilities is not responsible for items that do not fit on the site.

6.01

ROMTEC UTILITIES LIMITED WARRANTY

- f. It is Romtec Utilities' customer's responsibility and obligation to review Romtec Utilities' Scope of Supply & Design Submittal to insure it meets with customer approval relative to any customer third party agreements.
- g. Romtec Utilities is not responsible for any aspect of the construction/installation of the Romtec Utilities lift station. The Contractor bears sole responsibility for installation of products manufactured by Romtec Utilities. The Romtec Utilities Scope of Supply and Design Submittal defines Romtec Utilities scope of supply relative to equipment, documentation, start-up services and warranty.
- h. If Romtec Utilities is on site during the construction/installation of the Romtec Utilities lift station it is only as an advisor. Romtec Utilities is never on site to perform any construction and/or installation tasks.
- i. Romtec Utilities designs and prefabricates its lift station system to enable contractors to install the Romtec Utilities system quickly and completely. However, Romtec Utilities has made no representation and/or claims as to "how long" it will take to construct/install the Romtec Utilities system.
 - i. *Note: If any Romtec Utilities-supplied part is found to be defective and/or has been manufactured in error relative to this document, Romtec Utilities will repair and/or replace that part at Romtec Utilities' expense. Romtec Utilities does not offer, nor will Romtec Utilities accept, any charges and/or claims by anyone relative to the time it takes to install/construct the Romtec Utilities system and or claims for delays relative to a part that has to be repaired and/or replaced by Romtec Utilities.*
- j. Romtec Utilities' responsibility is to its direct customer. We want to help all parties, but we are ultimately responsible only to our direct customer.
 - i. If Romtec Utilities' direct customer has hired a sub-contractor Romtec Utilities will communicate with that sub-contractor through a representative of Romtec Utilities' direct customer.

IN OTHER WORDS

Romtec Utilities will not direct and/or advise any sub-contractor. Instead, Romtec Utilities will communicate directly with its "direct customer" and they will communicate with their sub-contractors, engineers, and/or owners.
- k. The Romtec Utilities design reflects all elevations and/or orientations to an accuracy of and/or minus .10'. Romtec Utilities does not claim to manufacture any aspect of its lift station systems to absolute elevations. It is simply not possible in the general underground construction world to meet absolutes. Therefore, any owner and/or installer of a Romtec Utilities system is accepting the Romtec Utilities system proposed herein to the plus or minus .10' offered by Romtec Utilities.

2. Performance Characteristics and Start-Up.

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

6.01

ROMTEC UTILITIES LIMITED WARRANTY

- i. Note: While there are many ways to vary and/or adjust "operational parameters" within the overall lift station, Romtec Utilities is only prepared to start-up per its own parameters (as specified in the customer's design criteria, see attached).*
 - b. Romtec Utilities' obligation is to show that the station can run as designed to meet specific design criteria as shown in its Scope of Supply & Design Submittal. It is understood that the regulating agency may want to test many other scenarios. This will not be part of the standard Romtec Utilities' start-up procedures and training. At start-up, Romtec Utilities will only prove that the station can run at the pre-specified design parameters.
 - c. Romtec Utilities is not an operator, installer or an electrical interconnector for the lift stations and equipment it supplies.
 - d. During start-up, Romtec Utilities is completely in charge. Romtec Utilities' start-up technician will start-up and "prove" the station per the approved Romtec Utilities Scope of Supply & Design Submittal. After the lift station is accepted other parties may choose to adjust and/or vary the operational parameters to suit their specific preference. However, Romtec Utilities will not be involved with these issues either during or after start-up, and is not responsible for problems arising from any adjustments or variations by such other parties.
- 3. Training.**
- a. Romtec Utilities will perform system training at no additional cost as part of its scope of supply if the training is scheduled for the day after start-up. If training is scheduled for any other time than the day after start-up, Romtec Utilities will require prepayment of the additional costs (incurred as a result of the need to reschedule) prior to confirming the alternate training schedule. If training is scheduled for any other time other than the day after start-up, Romtec Utilities will require prepayment of the additional costs incurred as a result of the need to reschedule.

6.02

LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES

- 1. Romtec Utilities is the equipment supplier only**
 - a. Unless specified otherwise in this document, Romtec Utilities is not a subcontractor and does not perform any installation or construction tasks at the project site, unless those duties are specified in this document.
 - b. Romtec Utilities staff persons at the project site are there strictly to observe and advise.

- 2. Romtec Utilities' responsibilities are to its direct customer only**
 - a. Romtec Utilities will communicate with project subcontractors, engineers, owners and any other parties only through a designated representative of the customer.

- 3. The pump station design is based, solely, on information supplied to Romtec Utilities and listed in the Lift Station Design Form**
 - a. All site-related data are the responsibility of the customer, not Romtec Utilities.

- 4. Complete review of this document will require information contained in other documents not supplied by Romtec Utilities**
 - a. Romtec Utilities does not supply various documents related to the project, such as: the pump station site plan, the area plan, the influent line and force main plan and profile, the electrical plan and many other documents.
 - b. Thorough understanding of the environment in which the pump station will be installed and operated requires complete knowledge of information included in these related documents.
 - c. Romtec Utilities does not know any information included in any of these other documents, except those specific design details included in the Lift Station Design Form.

- 5. Romtec Utilities is not responsible for the review or understanding of this document by the customer, the customer's representatives or agents, engineers and installation contractor/subcontractors**
 - a. The customer, engineers, installation contractor/subcontractors, owner and all other parties interested in the project are urged to contact Romtec Utilities Document Control, at any time, with any questions they may have about the system described herein, or about Romtec Utilities' responsibilities related to the project.
 - b. Romtec Utilities will make every effort to ensure that all parties have access to complete information about the pump station; however, Romtec Utilities is not responsible for the distribution of this document and/or

6.02

LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES

misunderstandings, errors and costs that arise from an incomplete understanding, by any party, of the information contained in this document.

6. Sealing of documents will incur additional charges

- a. Romtec Utilities has not offered to “seal” the Scope of Supply and Design Submittal, including drawings contained herein.
- b. Sealing of this document and/or the providing of sealed plans and/or sealed calculations are available from Romtec Utilities, if required, at additional cost.

7. Installation/construction time is not specified

- a. Romtec Utilities designs and manufactures its pump station systems for quick and complete installation. However, Romtec Utilities makes no representation as to how long it will take to prepare the site, install the system described herein, connect the system to other equipment not supplied by Romtec Utilities or to start-up and complete the system.
 - i. *Note: By approving the Romtec Utilities' Scope of Supply and Design Submittal, the customer agrees to reimburse Romtec Utilities for any cost incurred, whether by Romtec Utilities directly or through a related vendor, due to on-site delays caused by inaccurate representation herein.*

8. Installation time and/or defective or incorrect parts do not justify delay claims

- a. If, at the time of installation, any part supplied by Romtec Utilities is found to be defective or incorrect, relative to this document, Romtec Utilities will repair and/or replace said part at Romtec Utilities' expense.
- b. Romtec Utilities does not accept any charge and/or claim by anyone, related to the time it takes to install/construct the Romtec Utilities system and/or claims for delays related replacement or repair of any part of the system by Romtec Utilities.

9. Final (As Built) size for the control panel enclosure

- a. The size of the final (as built) enclosure for the control panel may change! In other words, the size of the panel enclosure (as proposed) in this Romtec Utilities' Scope of Supply and Design Submittal may not be the actual size and/or mounting style of the final (as built) panel and enclosure.
 - i. *Note: The final as built drawings will not be available until at least 3 to 4 weeks following Romtec Utilities' receipt of Notice to Proceed from its direct customer. Any changes to the enclosure size will result in notification from Romtec Utilities to its direct customer.*

6.02

LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES

- 10. Romtec Utilities Pre-construction Checklist has suggestions only**
 - a. All references to installation preparations, methods and/or equipment contained in the Romtec Utilities Installation Checklist or any other Romtec Utilities document are only suggestions, not directions.

- 11. Romtec Utilities is not responsible for determining the methods and equipment used in site preparation and/or installation/construction**
 - a. All methods and equipment used at the site are the responsibility of the installation contractor/subcontractors, not Romtec Utilities. The contractor/subcontractor bears sole responsibility for installation of products manufactured by Romtec Utilities.
 - b. Romtec Utilities does not know or specify what site preparation methods should or will be used, for example: whether or not excavated areas will require shoring or dewatering, what backfill methods will be required or any other site-related aspects of the project.
 - c. Romtec Utilities does not specify and does not know what types of equipment the installation/construction contractor and/or subcontractors plan to use at the site.
 - d. Romtec Utilities does not know the suitability of any equipment for installation of products supplied by Romtec Utilities.

- 12. Romtec Utilities is not responsible for structural testing done after backfill**
 - a. The customer is responsible for any water or vacuum testing conducted on underground vessels.
 - b. Romtec Utilities recommends any and all testing of the underground structures occur prior to backfill. Romtec Utilities is available to assist with any repairs after testing is done, prior to backfilling the structures.
 - c. If testing takes place after backfilling has occurred, Romtec Utilities ability to assist with repairs is severely limited. Romtec Utilities will not assume costs caused by testing after backfill.

- 13. Installing a level and "plumb" wet well that will not "settle"**
 - a. The specification for and the process for creating a stable compacted "footing" or "base" for the Romtec Utilities wet well to be placed on is by others.
 - b. In other words, creating a compacted base that will not allow the Romtec Utilities wet well to "settle" and/or "tilt" during or after installation is not the responsibility of Romtec Utilities.

6.02

LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES

- c. Romtec Utilities wants every installation contractor to be successful. We want every wet well to be plumb, level and to never settle. Romtec Utilities however is not responsible for any of these "installation" related problems if they occur.
- 14. A Romtec Utilities advisor will be at the project site during installation of the pump station's underground components**
- a. Any Romtec Utilities personnel at the project site during installation of the pump station's underground components are there only in an advisory capacity. Romtec Utilities does not perform work during this phase of the project, unless such work is specified in the Scope of Supply.
 - b. To facilitate communication about the project, the Romtec Utilities Advisor may be at the project site or available by telephone or other electronic means.
- 15. Getting ready for the Romtec Utilities construction advisor and the delivery of the Romtec Utilities system for installation**
- a. Typically the Romtec Utilities delivery of the underground portion of the Romtec Utilities system is done in conjunction with its installation. In other words, the Romtec Utilities system is unloaded from the Romtec Utilities trucks and installed directly into the prepared hole.
 - b. Our goal is to save you (or your contractor) time and money. One way to do this is to deliver and install the underground portion of the Romtec Utilities system on the same day (from the Romtec Utilities' delivery truck to the prepared excavation).
 - c. Therefore, when Romtec Utilities schedules its construction advisor to be on-site we assume that the hole will be excavated, the base of the hole prepared, and any shoring will be installed.
 - i. *Note: The Romtec Utilities "Installation Checklist" is the document that Romtec Utilities is relying on. We assume that all of the work on the Installation Checklist will be done and all equipment, etc will be on site and ready to install on the day Romtec Utilities arrives.*
 - ii. *Note: Normally our trucks will arrive the night before and along with our construction advisor, we will be "ready to go" on the day of the scheduled delivery and installation.*
 - iii. *Special Note: If the job as scheduled and as defined in the Romtec Utilities' "Installation Checklist" located in this Romtec Utilities' Scope of Supply and Design Submittal is not really "ready to install", Romtec Utilities will require a change order to reschedule its construction advisor at a later date.*

6.02

LIMITATIONS OF ROMTEC UTILITIES'
RESPONSIBILITIES**16. Delivery/Installation/Start-up delays**

- a. When the Customer schedules delivery of the system and/or Romtec Utilities and its suppliers to be on-site for either the “construction” and/or the “start-up and training”, the customer agrees to additional charges if any of the following occur.
 - i. In the event that the shipment is cancelled after the truck has been loaded, there will be a cancellation fee, unless the shipment is rescheduled for the same day.
 - ii. Any undue delay in unloading of trucks (over 2 hours per truck) will result in a waiting time fee.
 - iii. If Romtec Utilities discovers upon arrival that the customer is not ready to construct or start-up.
 1. *Note:* Romtec Utilities works very hard to confirm the customers “readiness” to construct and/or start-up. If we ultimately find (upon arrival) that the system is not ready for either, we will leave the site and reschedule at a later date for an additional charge.
 2. *Special Note:* Having the Romtec Utilities construction advisor and start-up technician on-site helps everyone complete the project without difficulty. We provide these on-site services as part of our price, but we rely on the customer to confirm that they are ready for us to perform.
 - iv. The customer chooses to cancel or reschedule the construction and/or changes the date after Romtec Utilities and/or its vendor have purchased tickets for travel, etc.
 - v. If the installation and/or start-up is delayed for any reason and runs into a weekend or holiday, keep in mind that the Romtec Utilities offices will be closed and there will be no one available for technical support.

17. Romtec Utilities does not perform or advise on performance of any electrical installation work

- a. All electrical installation work on the project site must be performed by a licensed electrical contractor. Romtec Utilities personnel are generally not on the project site during electrical installation.
- b. A licensed electrical contractor must be onsite during the entirety of the Romtec Utilities start-up training (see 6.02.22).

6.02

LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES

- 18. Start-up Preparation Form must be completed by the customer and returned to Romtec Utilities before start-up and testing day will be scheduled**
 - a. To expedite timely and efficient completion of the pump station, Romtec Utilities will schedule start-up and testing approximately two weeks after receipt of the completed Pre Start-up Checklist from the customer indicating all work has been done to prepare for station start-up and testing.

- 19. Romtec Utilities directs the pump station start-up and testing**
 - a. The Romtec Utilities technician directs all station start-up and testing procedures. No other party shall operate the station until after the start-up and testing procedures are completed by Romtec Utilities.
 - b. Romtec Utilities requires the presence of the licensed electrical contractor who installed the pump station's electrical system at the project site during pump station start-up and testing.
 - i. *Note: If all necessary field wiring is not completed at the time of start-up, Romtec Utilities reserves the right to charge for our time required to complete the wiring.*

- 20. System start-up, testing and training services are limited to the operational parameters described in this Scope of Supply and Design Submittal**
 - a. The pump station described herein is a sophisticated device that can be operated in many different ways; however this document defines only a specific set of operational parameters.
 - b. Romtec Utilities' standard start-up, testing and training services are based solely on these pre-specified operational parameters. Additional start-up, testing and/or training services requested or required by the regulatory agency or any other party will not be conducted by Romtec Utilities, unless those services are included in this Scope of Supply and Design Submittal.

- 21. Additional start-up/training time by Romtec Utilities and/or any Romtec Utilities supplier**
 - a. Any additional time required of Romtec Utilities (other than the time and/or services outlined in this Scope of Supply document and/or as part of the purchase order) must be ordered and contracted separately from this purchase order. Romtec Utilities will require a change order or a separate purchase order for any additional time.
 - b. If more time is required of any Romtec Utilities supplier (other than the time and/or services outlined in this Scope of Supply document and/or as part of the purchase order) the Customer must order it directly from that supplier, not Romtec Utilities.

6.02

**LIMITATIONS OF ROMTEC UTILITIES'
RESPONSIBILITIES**

- 22. The schedule for standard pump station start-up and operation and maintenance training is limited**
- a. Romtec Utilities has provided two (2) contiguous days (not including holidays or weekends) for pump station start-up and operation and maintenance training as part of the standard services included in this Scope of Supply.
 - i. Note: *This is only if the operation and maintenance training is scheduled for the day after the pump station start-up is conducted.*
 - b. If training is scheduled for any time other than the day after start-up, Romtec Utilities will charge per day (from the time our technician leaves Romtec Utilities) plus travel and per diem, for the service with a minimum charge of two days. This will result in a change order or additional purchase order.
 - i. Note: *If you have purchased a Romtec Utilities' system and for whatever reason have not elected to have Romtec Utilities "start-up" the system prior to the end of the warranty, start-up services will need to be scheduled and purchased separately.*

In other word

Our "free start-up" services are included with the purchase of the Romtec Utilities' system. We will withdraw the free start-up if you elect to not start-up the system prior to the end of warranty. We will however, be glad to start-up the system at a fee to be quoted when you are ready.
- 23. Pump station owner and/or owner's designated station operator must receive training for warranty to be to be in place**
- a. The Customer must designate, in advance, the persons who will participate in the pump station operation and maintenance training provided by Romtec Utilities.
 - b. The Romtec Utilities Limited Warranty will not be in place until after the pump station owner and/or the owner's designated station operator have participated in and passed the operation and maintenance training supplied by Romtec Utilities unless Romtec Utilities has not started the system.
 - c. Romtec Utilities does not train the installation contractor in the operation and maintenance of the pump station, unless this installation contractor is designated by the owner as the party responsible for station operation.
- 24. Ongoing operation and maintenance training is the responsibility of the station owner/operator, not Romtec Utilities**
- a. Romtec Utilities does not provide ongoing operation and maintenance training, except for the training specified in this Scope of Supply and Design

6.02

LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES

Submittal. It is the responsibility of the pump station owner and/or operator to conduct ongoing operation and maintenance of the pump station and its components.

25. Failure of pump station-warranty

- a. Pump station function is a complex combination of parameters. Sometimes pumps may clog or power may be lost and the pump station will fail to operate. Sometimes the failure is caused by mechanical or sometimes it's electrical. A pump station failure does not constitute a warranty issue. In order to make a warranty claim follow this procedure:
 - i. Trouble-shoot the problem with the help of Romtec Utilities over the phone.
 - ii. If you cannot provide trouble shooting assistance Romtec Utilities can recommend a local company to provide trouble-shooting assistance at your cost.
 - iii. Once the cause of the failure has been determined then a warranty claim can be made. Warranty claims extend to defective parts only. Romtec Utilities does not warranty trouble shooting, service calls, installation or re-installation associated with defective parts or their failure. Romtec Utilities will repair and/or replace per the terms of the Romtec Utilities warranty.

1. *Note:* *If however no parts have failed and let's say that the pumps are simply "clogged" or the power was simply lost, Romtec Utilities will advise the owner that this is not a warranty issue and the owner will be responsible for payment of the service call and the associated services.*

26. Start-up after the warranty expires

- a. Romtec Utilities start-up, testing and training services are included at no additional cost if these services are performed within 18 months of the delivery, or deliverability of the lift station per its accepted purchase order. If start-up services are required after this period they will not be free and/or included as part of the accepted purchase order. Instead they will be quoted and ordered under a new and separate quote and service order.

27. Special cases if start-up is waved

- a. If for any reason an exception is allowed and there is not start-up and training, Romtec Utilities will keep the cost for start-up for engineering burdens that will be associated with not having a Romtec Utilities representative onsite.

6.02

LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES

28. Storage of electrical components and/or pumps prior to start-up

- a. Romtec Utilities will keep the lift station electrical components and/or pumps at its facility prior to start-up. However, if the customer does not schedule start-up within 4 months after the installation of the underground components, and all components are fully paid for, Romtec Utilities will ship these components to the customer.

29. Start-up and training attendance

- a. The Romtec Utilities start-up technician is on-site to train the lift station personnel on operation and maintenance of the lift station. It is vital that these personnel attend the entire session. If the personnel leave before training completion, additional training requested will be quoted and ordered under a new and separate quote and service order.

**END
OF
SECTION**

7. OPERATION & MAINTENANCE (O&M) MANUAL

The Romtec Utilities Operation & Maintenance Manual will be delivered at start-up of the system. This document contains all the as-built drawings and operation, maintenance manuals & manufacturers warranties for the associated mechanical.

One (1) electronic copy and one (1) hard copy (upon request) of the Romtec Utilities Operation & Maintenance Manual will be provided to the customer at start-up of the system.

Any request for additional copies will result in additional fees and a change order.

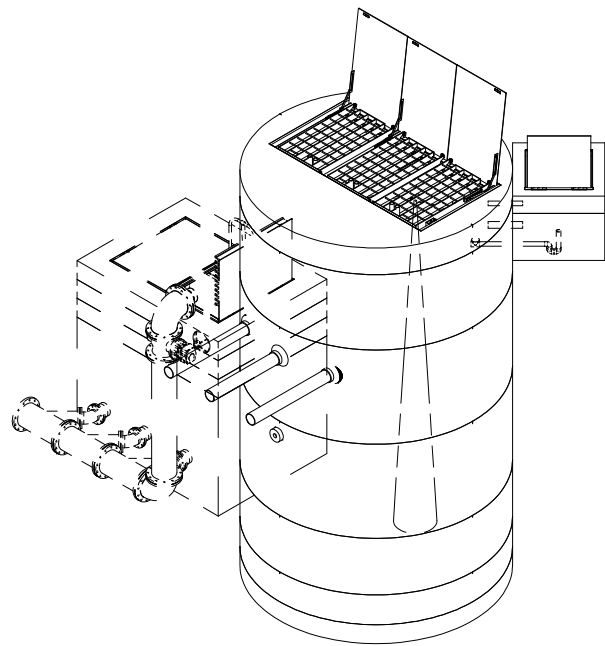
**END
OF
SECTION**

8. WET WELL & RELATED EQUIPMENT

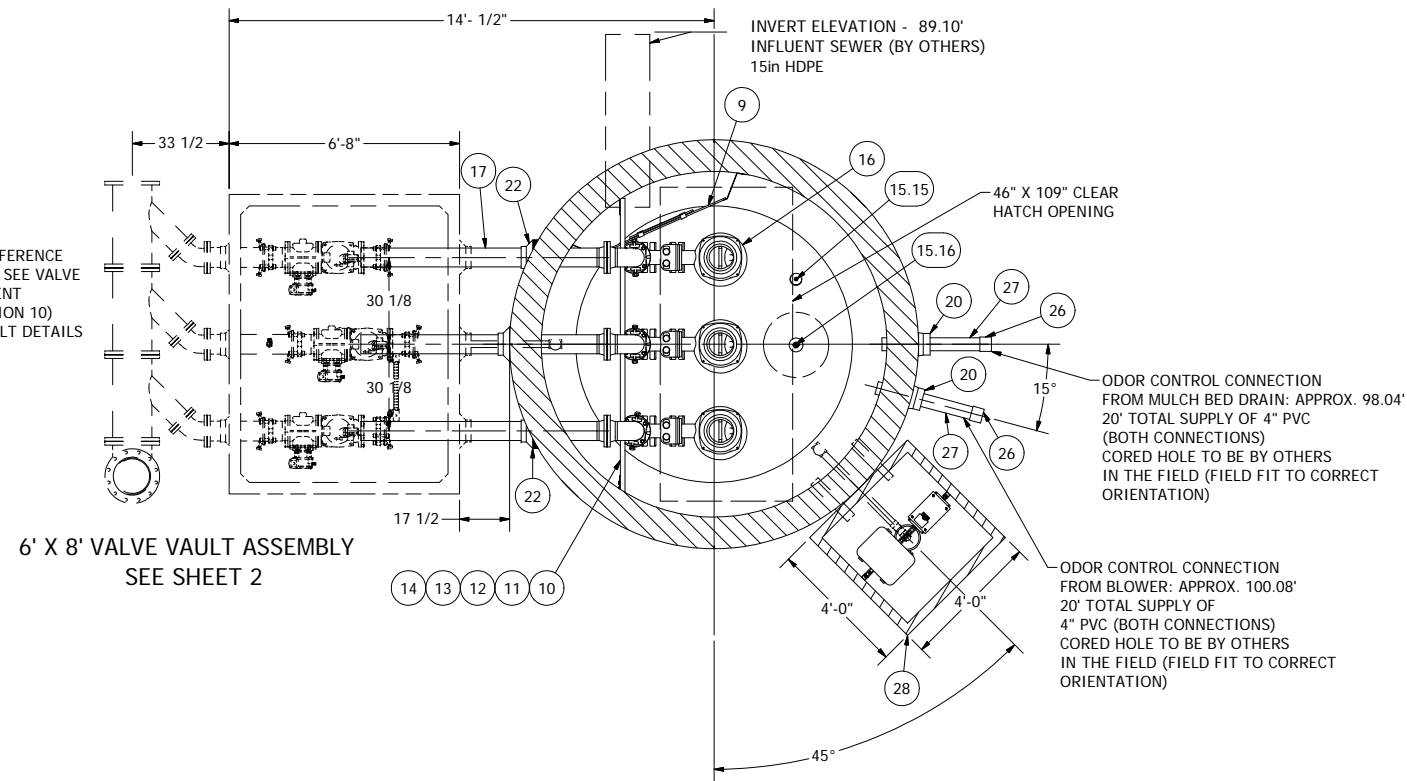
This section contains information pertaining to the wet well. There is both technical information and related drawings necessary for the wet well construction.

This section is structured as follows:

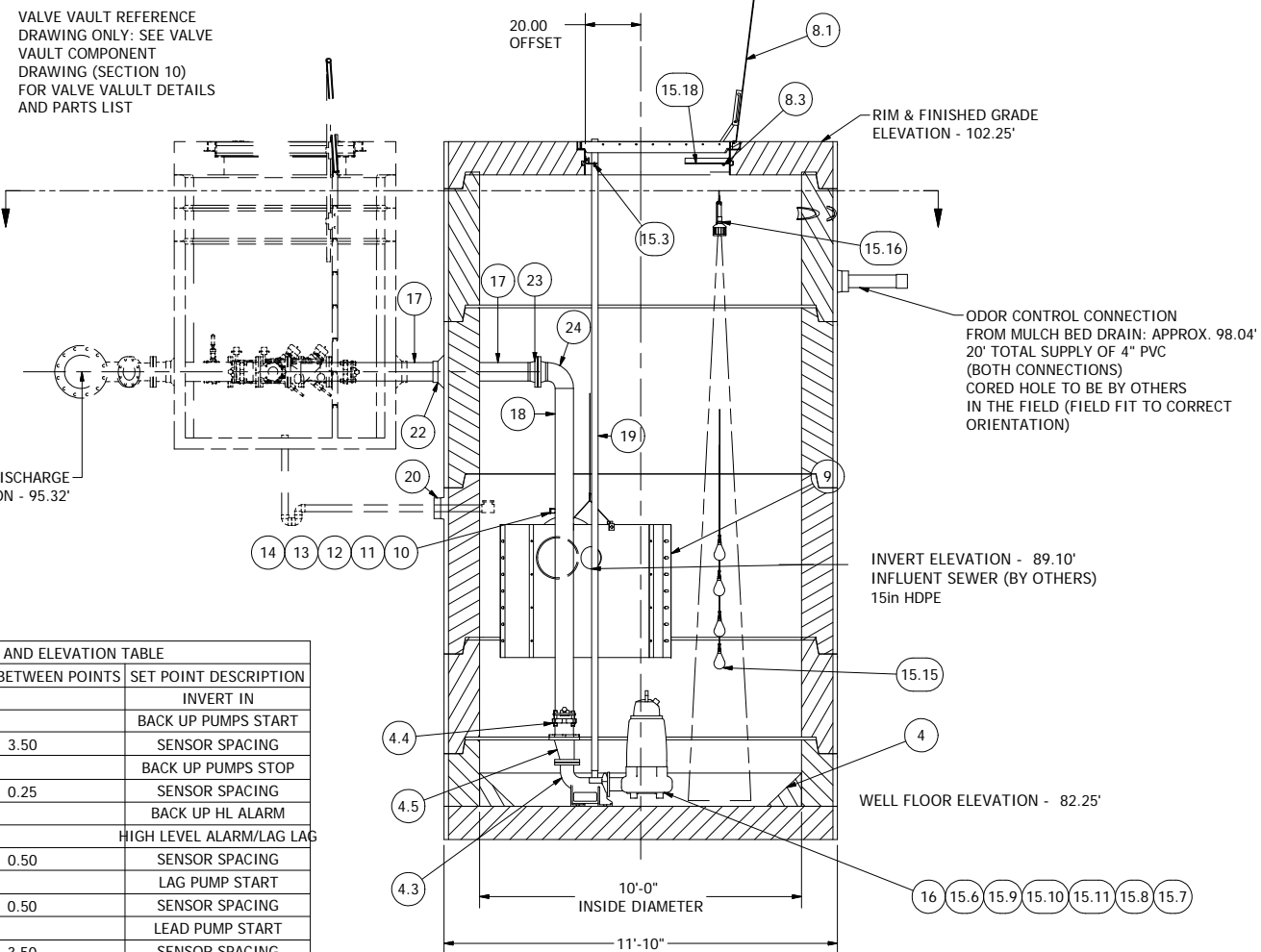
- 8.01 WET WELL COMPONENT DRAWING(S)
- 8.02 WET WELL PRODUCTION DRAWING(S)
- 8.03 WET WELL HATCH DRAWING
- 8.04 WET WELL WEIGHTS & LIFTING DEVICES
- 8.05 WET WELL TESTING FOR WATER INGRESS OR EGRESS
- 8.06 WET WELL RELATED DATA SHEETS
 - 8.06.1 CONSEAL
 - 8.06.2 TAPECOAT
 - 8.06.3 KOR-N-SEALS
 - 8.06.4 COUPLING ROMAC RFCA
 - 8.06.5 BARREL GASKETS
 - 8.06.6 COATING TNEMEC 61
 - 8.06.7 DEFLECTOR PANEL



VALVE VAULT REFERENCE DRAWING ONLY: SEE VALVE VAULT COMPONENT DRAWING (SECTION 10) FOR VALVE VAULT DETAILS AND PARTS LIST



NOTE: WET WELL TOP SLAB IS H-20 OCCASIONAL TRAFFIC RATED



VALVE VAULT REFERENCE DRAWING ONLY: SEE VALVE VAULT COMPONENT DRAWING (SECTION 10) FOR VALVE VAULT DETAILS AND PARTS LIST

DRAIN BACK TO WET WELL:
3" PLAIN HOLE IN VAULT (PROVIDED)
2" PEE TRAP ON VAULT END WITH CHECK VALVE AT END OF PIPE IN WET WELL.
(BY OTHERS) NOT ROMTEC UTILITIES

SENSOR AND ELEVATION TABLE		
LEVEL ELEVATION	DISTANCE BETWEEN POINTS	SET POINT DESCRIPTION
89.10		INVERT IN
93.75	3.50	BACK UP PUMPS START
		SENSOR SPACING
90.25		BACK UP PUMPS STOP
	0.25	SENSOR SPACING
90.00		BACK UP HL ALARM
89.75		HIGH LEVEL ALARM/LAG LAG
	0.50	SENSOR SPACING
89.25		LAG PUMP START
	0.50	SENSOR SPACING
88.75		LEAD PUMP START
	3.50	SENSOR SPACING
85.25		PUMP STOP
	3.00	DISTANCE TO FLOOR
82.25		FLOOR ELEVATION

**10'DIAMETER WET WELL
6" DISCHARGE PIPING
NP3171 FLYGT PUMPS**

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

Parts List			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
1	1	10-5364	GROUT RING - 10ft - 45 DEG
2	1	10-XXXX	INTERIOR COATING - TNEMEC 61
3	1	10-XXXX	EXTERIOR COATING - TNEMEC 61
4	1	10-XXXX	BASE ASSEMBLY
4.1	1	10-XXXX	BASE - WW - 10ft - RU FLAT BASE - NO GROUT - 6in UPLIFT COLLAR
4.2	3	31-6040	ANCHOR KIT - DISCHARGE ELBOW
4.3	3	31-6071	DISCHARGE ELBOW - 4in - 540 13 05
4.4	3	42-5247	COUPLING - ROMAC - RFCA - 6in FBEC - SS HARDWARE
4.5	3	44-XXXX	REDUCER - SS - ECCENTRIC - 6in X 4in
4.6	3	47-6546	GASKET - FLANGE - 4in X 1/8in
5	1	12-4613	BARREL - 10ft DIA X 3ft H
6	1	12-4614	BARREL - 10ft DIA X 4ft H
7	2	12-5905	BARREL - 10ft DIA X 5ft H
8	1	14-XXXX	TOP SLAB ASSEMBLY
8.1	1	13-5380	HATCH - WW - 10ft H2O - TRIPLEX - 54800 - 46 X 109
8.2	1	14-5382	TOP SLAB - WW - 10ft H2O - TRIPLEX
8.3	4	18-6115	CABLE HANGER ASSEMBLY
9	1	15-4591	DEFLECTOR PANEL ASSEMBLY - 4ft
9.1	1	15-5365	GUILLOTINE CABLE ASSEMBLY - 14ft
9.2	1	15-6042	HDPE - 24in X 24in X 1/2in - BLACK - cut from 4ft x 8ft
9.3	2	15-6047	BRACKET - SS GUILLOTINE SET
9.4	1	50-6045	HDPE - 4ft X 8ft X 1-2in - BLACK
9.5	8	50-6139	ANGLE - 316SS 11GA FORMED (10ftww)
10	1	18-5145	DISCHARGE PIPE SUPPORT - UNISTRUT
11	2	18-6009	DISCHARGE PIPE SUPPORT - WALL BRACKET SET
12	3	18-6078	DISCHARGE CLAMP - TOLSTRUT - 6in 316SS
13	3	18-FAST	DISCHARGE CLAMP BOLT - 1-2 X 1 SS BOLT, WASHER, FIBER LOCK NUT
14	1	18-FAST	DISCHARGE PIPE SUPPORT - BOLT KIT
15	1	18-XXXX	SHIPPING CRATE
15.1	5	12-ROM	BARREL GASKET
15.2	1	13-ROM	HATCH KEY
15.3	3	18-6015	BRACKET - UPPER GUIDE BAR - 2in SS
15.4	4	18-6020	LIFTING CLUTCH - 8 TON
15.5	3	18-6031	BOLT & NUT KIT - UPPER GUIDE BAR BRACKET - 3-8in
15.6	3	32-5942	BOW SHACKLE - 3-8in - SS W-SCREW PIN
15.7	3	32-5943	BOW SHACKLE - 1-2in - SS W-SCREW PIN
15.8	1	32-6016	GRIP EYE UNIT
15.9	3	32-6065	CORD GRIP - 1.000in - 1.240 DIA SS
15.10	3	32-6354	LIFTING SLING - .125in SS CABLE - 3 @ 20ft
15.11	6	32-6600	CHAIN - S5 9-32in 316SS 3 @ 2ft
15.12	196	51-5949	TAPECOAT - 6in X .65mils X LFT
15.13	217.5	51-6081	SEALANT - 1in X 1in X 14.5ft CS-202
15.14	1	51-ROM	NEVER SIEZE - TUBE
15.15	4	60-4574	FLOAT - NOLTA - MS1 - 20m
15.16	1	60-5044	ULTRASONIC TRANSDUCER - XPS-15
15.17	1	62-4561	BRACKET - ULTRASONIC TRANSDUCER
15.18	1	62-4564	HANGING BRACKET - 16in - SS
16	3	30-5500	PUMP - FLYGT - NP3171 HT 452 30HP
17	3	40-6049	PIPE - 316SS - 6in SCH40 X 82in
18	30	40-6049	PIPE - 316SS - 6in SCH40 (3 @ 10ft)
19	114	40-6253	PIPE - 316SS - 2in SCH40 (6 @ 19ft)
20	4	43-5186	KOR-N-SEAL - 8in CORE - 1.70 THRU 4.80 PIPE
21	1	43-5193	KOR-N-SEAL - 16in CORE - 12in PIPE
22	3	43-6113	KOR-N-SEAL - 12in CORE - 6in PIPE
23	6	44-6123	FLANGE - 316SS - 6in - 150# WELD NECK
24	3	46-XXXX	ELBOW - 316SS - 6in - 90 DEG - SHORT
25	3	47-6547	GASKET - FLANGE - 6in X 1/8in
26	2	48-4297	COUPLING - 4in SCH40 - SLP X SLIP
27	20	48-5464	PIPE - 4in PVC - SCH40 - 20ft TOTAL
28	1	65-XXXX	JUNCTION BOX ASSEMBLY
28.1	1	20-4875	BASE - VV - 444B X 30in TALL
28.2	1	23-4713	HATCH - FLOODTIGHT - H2O - 24X30
28.3	1	24-4716	TOP SLAB - VV - 444 - H2O
28.4	21	51-5510	SEALANT - .75in X .75in X 21ft CS-202
28.5	17	51-5949	TAPECOAT - 6in X .65mils X LFT
28.6	1	61-4851	ADLET ENCLOSURE - EXPLOSION PROOF
28.7	1	61-4852	ADALET ENCLOSURE - LEVEL SENSING
28.8	1	62-XXXX	JUNCTION BOX SUPPORT BRACKET
28.9	3	62-XXXX	CONDUIT UNIONS
28.10	3	62-XXXX	CMP CABLE CONNECTOR - 1.16in - 1.5in
28.11	3	62-5528	SEAL OFFS - 40% FILL - 1in NPT
28.12	2	62-XXXX	SEAL OFFS - 40% FILL - .75in NPT
28.13	4	62-XXXX	CORD GRIP - PLASTIC - 1_2in - .125-.275
28.14	3	62-XXXX	NIPPLE - GALV - 1in X CLOSE
28.15	2	62-XXXX	NIPPLE - GALV - .75in X CLOSE

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

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REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROV
1	REVISED HATCH LAYOUT TO 20in	10-21-13	AD
2	REVISED PER COMMENTS UP THROUGH 11-13-13	11-13-13	AD
3	REVISED TO REFLECT THE REVISIONS TO THE VALVE VAULT AND 2-6-14 COMMENTS	2-6-14	AD

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES PROPORTIONALLY

DSN - NG
DRN - NG
CKD - AD

DATE - 7-10-13

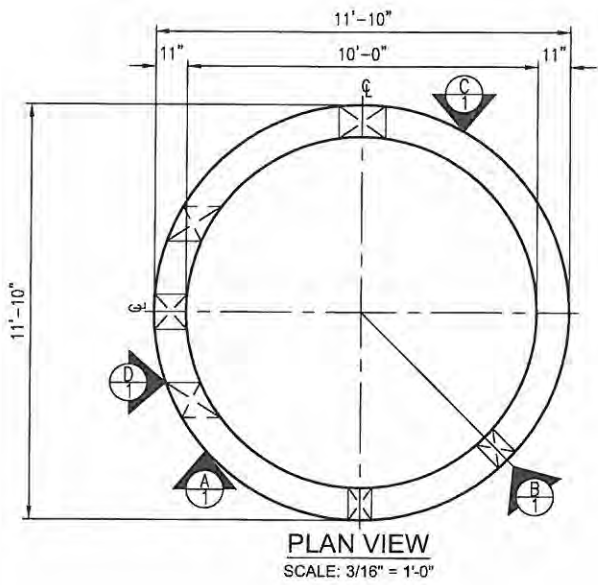
COMPONENT DRAWING

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

**BAY MEADOWS
10' WET WELL - 6" PIPING**

SHEET
1 OF 4

JOB NUMBER
**RMTC
0000**



THIS HOLE TO BE
CORED IN FIELD
(BY OTHERS) FOR
FEILD FIT

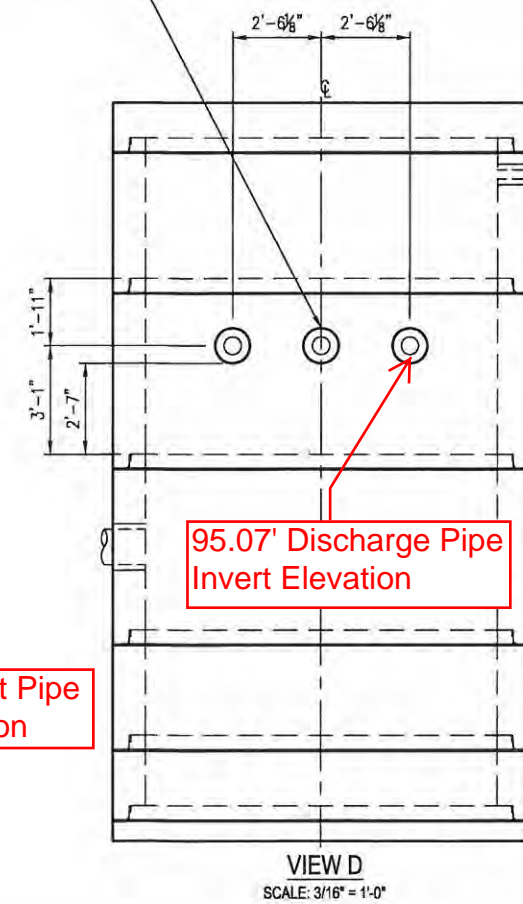
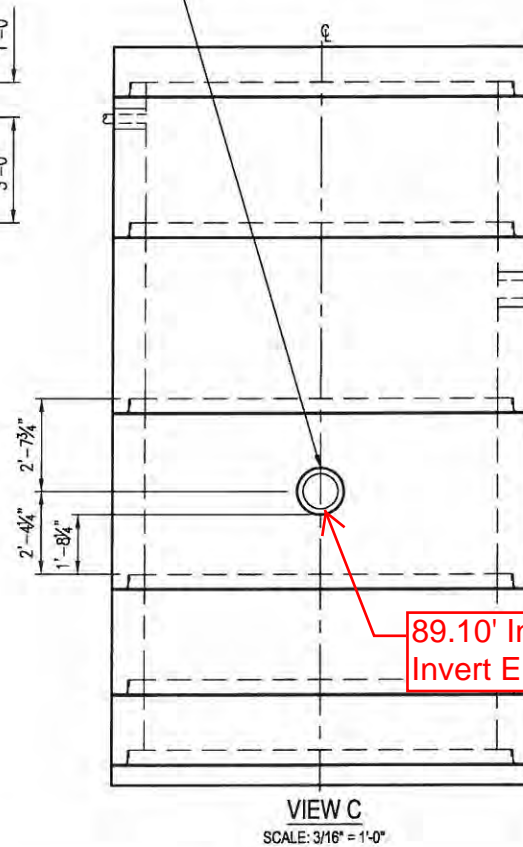
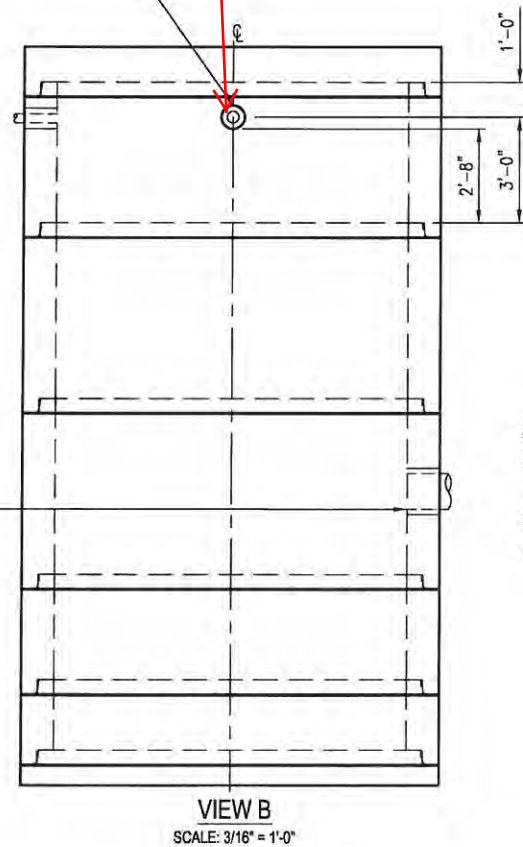
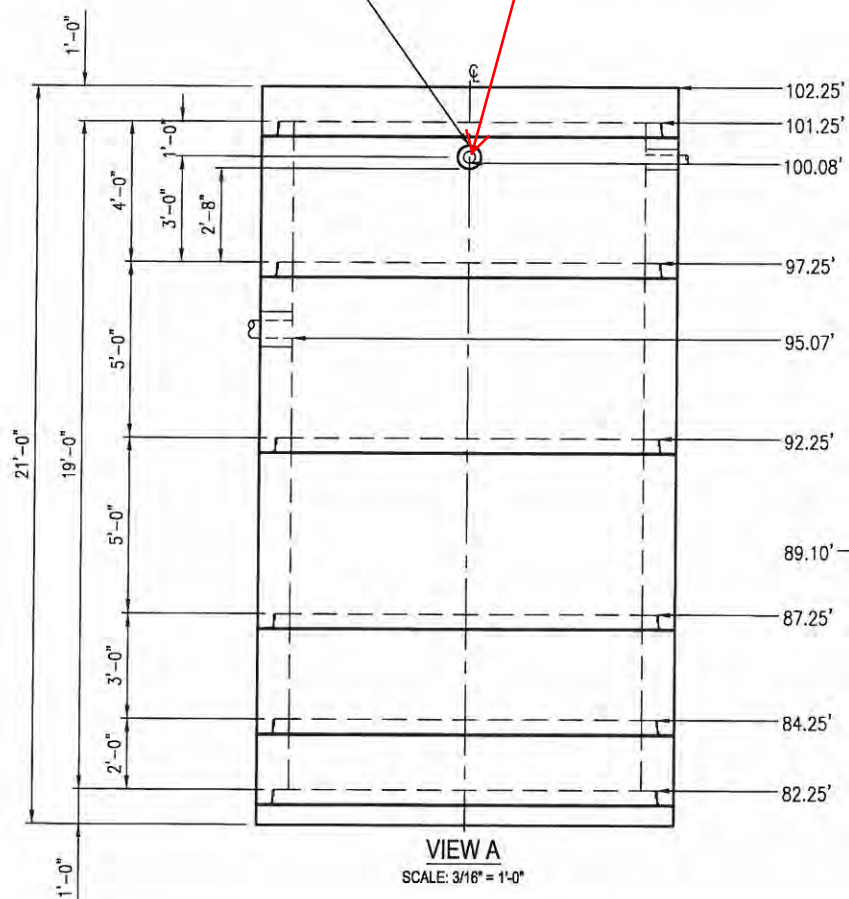
THIS HOLE TO BE
CORED IN FIELD
(BY OTHERS) FOR
FEILD FIT

8"Ø HOLE
FOR 4"Ø PVC PIPE @ 90"
WITH S106-8S BOOT

8"Ø HOLE
FOR 4"Ø PVC PIPE @ 135"
WITH S106-8S BOOT

16"Ø HOLE
FOR 12"Ø PVC PIPE @ 270"
WITH S106-16A BOOT

3EA. 12"Ø HOLES
FOR 6"Ø SS PIPES @ 0"
WITH S406-12A BOOTS



95.07' Discharge Pipe
Invert Elevation

89.10' Influent Pipe
Invert Elevation

STRUCTURAL NOTES:

- LOADS:**
- H2O TRAFFIC
 - 150 PCF CONCRETE DENSITY; 120 PCF SOIL DENSITY
 - H2O SURCHARGE: 2 FT ABOVE FILL TO 8 FT BELOW GRADE
 - DRY SOIL LATERAL LOAD - 40 PCF
 - WET SOIL LATERAL LOAD - 80 PCF
 - WATER TABLE - BELOW VAULT

- DESIGN SPECIFICATIONS**
- ACI-318-11 BUILDING CODE
 - ASTM C 478 STANDARD SPECIFICATIONS FOR REINFORCED CONCRETE MANHOLE SECTIONS

- MATERIALS:**
- CONCRETE - 28 DAY COMPRESSIVE STRENGTH $f_c = 6000$ PSI
 - REBAR - ASTM A 706 GRADE 60
 - CEMENT - ASTM C150
 - FLYASH - ASTM C818

- GENERAL NOTES:**
- 1) CONTRACTOR TO:
VERIFY ALL DIMENSIONS AND OPENING LOCATIONS
 - 2) REBAR MAY BE TACK WELDED OR TIED
 - 3) TOLERANCES PER ASTM C 478 STANDARD SPECIFICATIONS FOR REINFORCED CONCRETE MANHOLE SECTIONS

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

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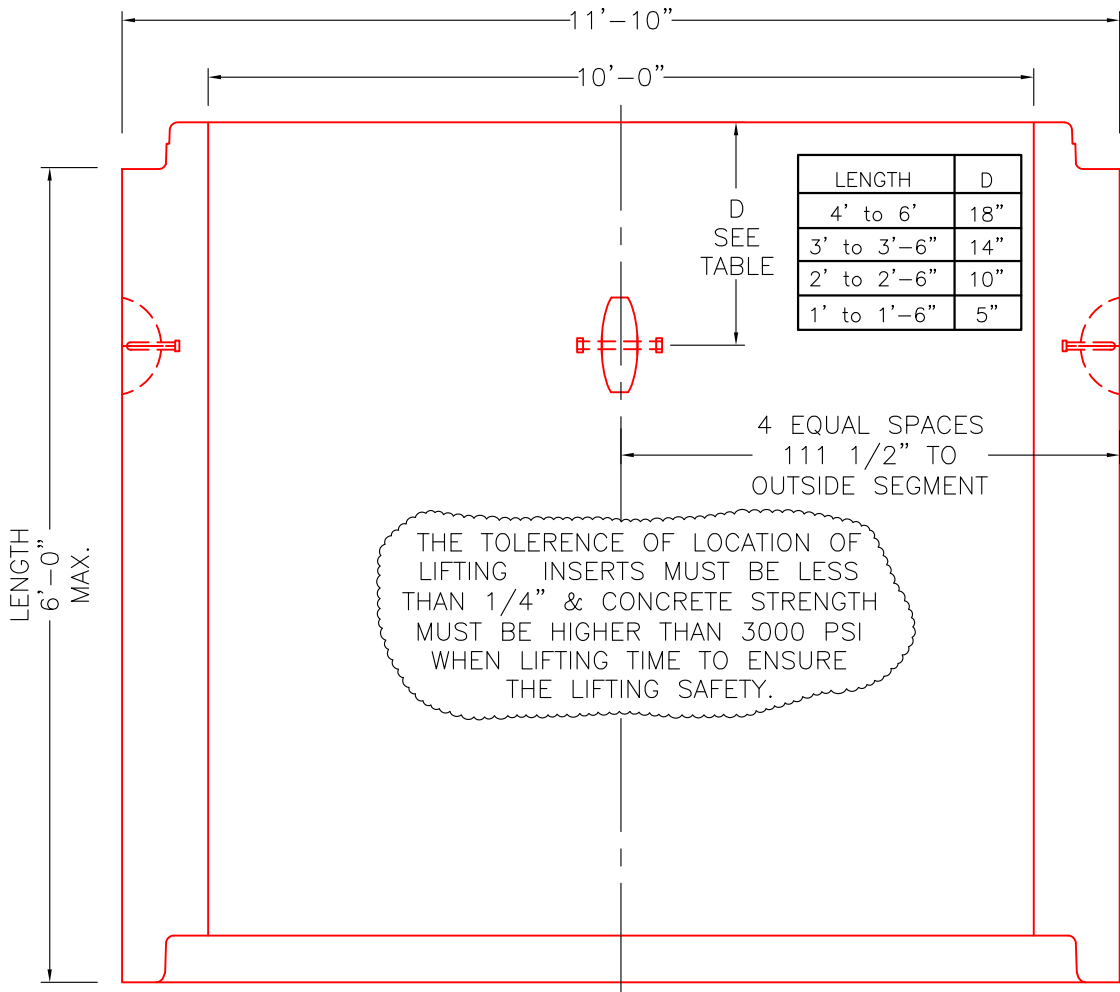
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10'Ø X 19'-0" (I.D.) WET WELL

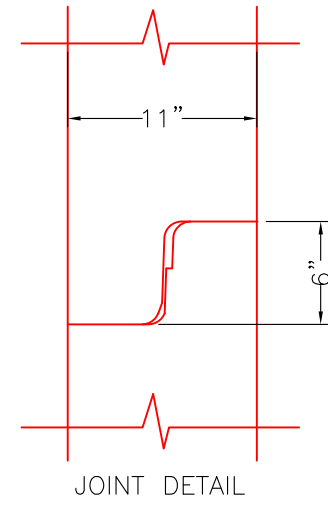
BAY MEADOWS
STOCKTON, CA

CUSTOMER
ROMTEC

DATE	SALES	DRAWN	ENGINEER	CHECKED	SALES ORDER
7/16/13	BD	VK	JM	JM	S18973
DRAWING NUMBER				REVISION	SHEET
030-S18973-085				REV DATE	1 OF 1

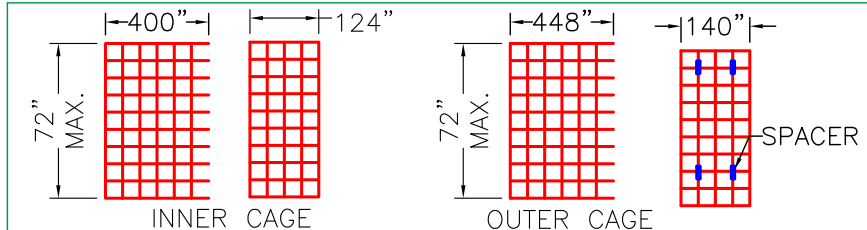
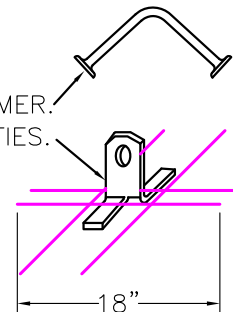


7.	CHANGED TITLE, JOINT, MAX.LENGTH & HOOKS LOCATION	QLG	6/2/08
6.	CHANGED BACK TO CAGE GAP SPEC.	QLG	8/23/07
5.	CHANGED CAGE LAP, ADDED LIFTING INSERTS & SPEC.	QLG	7/30/07
4.	CHANGED INNER & OUTER CAGES TO 3x8-d4.0xw2.0	QLG	7/20/07
3.	TURNUED RISER UP SIDE DOWN & ADDED 5" FOR JOINT	QLG	2/27/07
2.	THICKER LINE FOR REBAR & CHANGED APPROVE STAMP	QLG	6/1/04
1.	ADDED CONCRETE VOLUME	QLG	7/18/03
0.	RELEASED FOR APPROVAL	RAS	6/5/01
	Revision Description	BY	DATE



NOTE: (1) CONAC 8CA18 FOR ORDINARY CUSTOMER.
 (2) CONAC FFA 0806 FOR ROMTEC UTILITIES.
 WITH 4 #4 LENGTH 18" REBARS.

CONCRETE VOLUME = 1.17 C.Y./Ft.
 6' TOTAL = 7.02 C.Y. WEIGHT = 28900#



	INNER CAGE	OUTER CAGE	SPACER	
width	400"	448"	124"	140"
height	72" MAX.	72" MAX.		
mesh	3x8	3x8		
spaces	56	50	2 1/2" OVER	
gap	0"		A9.0	
spacer qty.			38	
con. strength (psi)				4000

Oldcastle PRECAST

CALIFORNIA CONCRETE PIPE

2960 S. HIGHWAY 99 (209) 466-4212
 STOCKTON, CA. 95215 FAX: (209) 466-2552

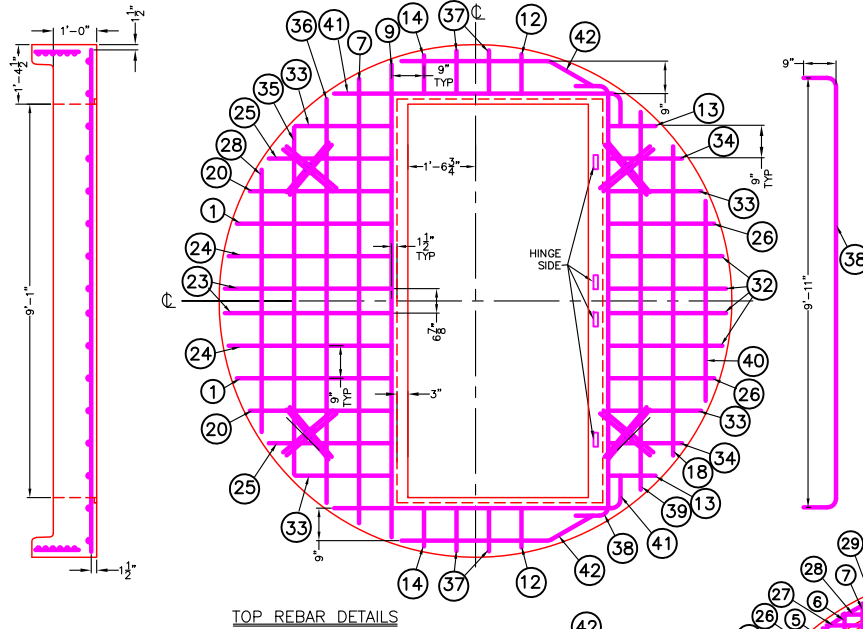
120" DIA. REINFORCED MANHOLE RISER
 11" WALL , UP TO 72" LONG
 CONFORMS TO: ASTM C478

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	REVISED	QLG	DATE	6/2/08	REVISION NO.	7	MH-120	
					SCALE	NO SCALE	SHEET	1 OF 1

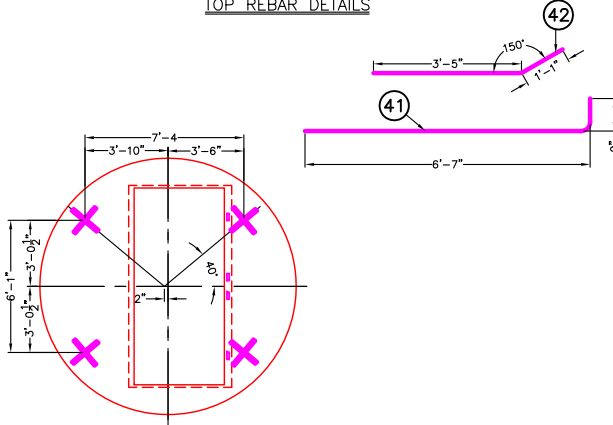
Revision	Description	BY	DATE
-	-	-	-

ASTM GRADE 60 STEEL REBAR

ITEM NO.	BAR SIZE	BAR LENGTH	QTY.	TOTAL LENGTH	TOTAL WEIGHT
TOP 2 & BOTTOM 3	1 #5	3'-6"	5	17'-6"	18.3#
2	#5	5'-9"	1	5'-9"	6.0#
3	#5	7'-3"	1	7'-3"	7.6#
4	#5	8'-3"	2	16'-6"	17.2#
5	#5	9'-2"	1	9'-2"	9.6#
6	#5	9'-11"	2	19'-10"	20.7#
TOP 1 & BOTTOM 1	7 #5	10'-3"	2	20'-6"	21.4#
7	#5	10'-8"	1	10'-8"	11.1#
TOP 1 & BOTTOM 1	9 #5	10'-11"	2	21'-10"	22.8#
9	#5	11'-1"	1	11'-1"	11.6#
10	#5	11'-3"	2	2'-6"	2.6#
TOP 2 & BOTTOM 4	12 #5	11"	6	5'-6"	5.7#
TOP 2 & BOTTOM 8	13 #5	1'-1"	10	10'-10"	11.3#
TOP 2 & BOTTOM 2	14 #5	10"	4	3'-4"	3.5#
15	#5	11'-3"	1	11'-3"	11.7#
16	#5	9'-6"	1	9'-6"	9.9#
17	#5	9'-0"	1	9'-0"	9.4#
TOP 1 & BOTTOM 1	18 #5	7'-1"	2	14'-2"	14.8#
19	#5	5'-7"	1	5'-7"	5.8#
TOP 2 & BOTTOM 3	20 #5	3'-2"	5	15'-10"	16.5#
21	#5	4'-1"	4	16'-4"	17.0#
22	#5	4'-0"	2	8'-0"	8.3#
TOP 2 & BOTTOM 2	23 #5	3'-10"	4	15'-4"	16.0#
TOP 2 & BOTTOM 2	24 #5	3'-8"	4	14'-8"	15.3#
TOP 2 & BOTTOM 4	25 #5	2'-9"	9	16'-6"	17.2#
TOP 2 & BOTTOM 4	26 #5	2'-4"	6	14'-0"	14.6#
27	#5	7'-4"	2	14'-8"	15.3#
TOP 1 & BOTTOM 2	28 #5	6'-1"	3	18'-3"	19.0#
29	#5	4'-10"	2	9'-8"	10.1#
30	#5	3'-1"	10	30'-10"	32.2#
31	#5	2'-11"	4	11'-8"	12.2#
TOP 4 & BOTTOM 2	32 #5	2'-7"	6	15'-6"	16.2#
TOP 4 & BOTTOM 2	33 #5	2'-1"	6	12'-6"	13.0#
TOP 2 & BOTTOM 2	34 #5	1'-8"	4	6'-8"	7.0#
TOP ONLY	35 #5	8'-0"	1	8'-0"	8.3#
36	#5	9'-4"	1	9'-4"	9.7#
37	#5	1'-0"	4	4'-0"	4.2#
38	#5	11'-5"	1	11'-5"	11.9#
39	#5	8'-8"	1	8'-8"	9.0#
40	#5	4'-7"	1	4'-7"	4.8#
41	#5	7'-4"	2	14'-8"	15.3#
42	#5	4'-6"	2	9'-0"	9.4#
TOTAL			127	501'-10"	523.4#
43	MESH 2x8-d5xw2.5	12" HIGH		37'-2" LONG, CIRCLE D=11'-6"	

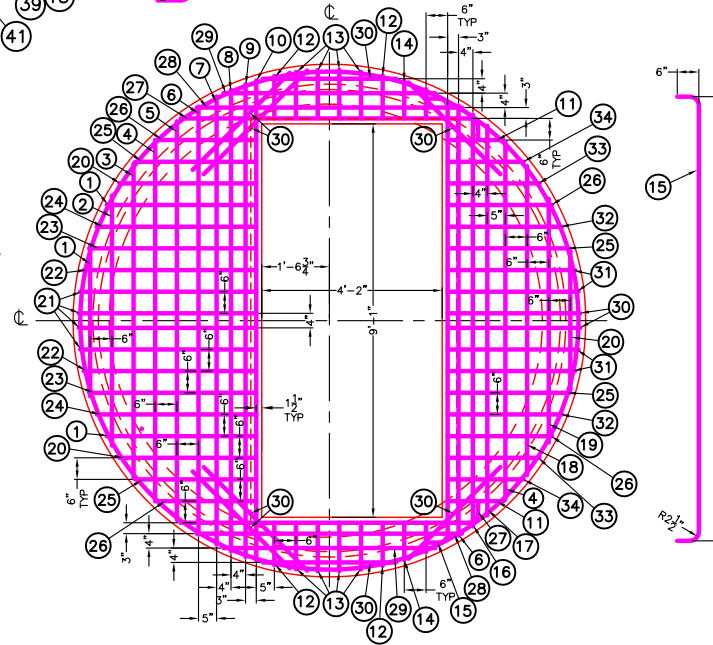
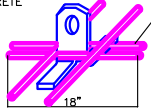


TOP REBAR DETAILS

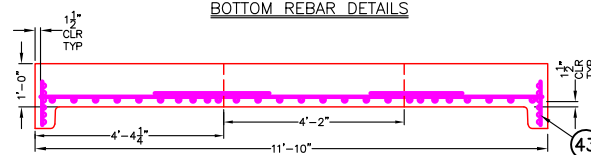


ANCHOR POSITION

4 LIFTING INSERTS SEE NOTE
EACH INSERT WITH 4 #4 REBAR
LENGTH 18" FOR ANCHORING TO
CONCRETE



BOTTOM REBAR DETAILS



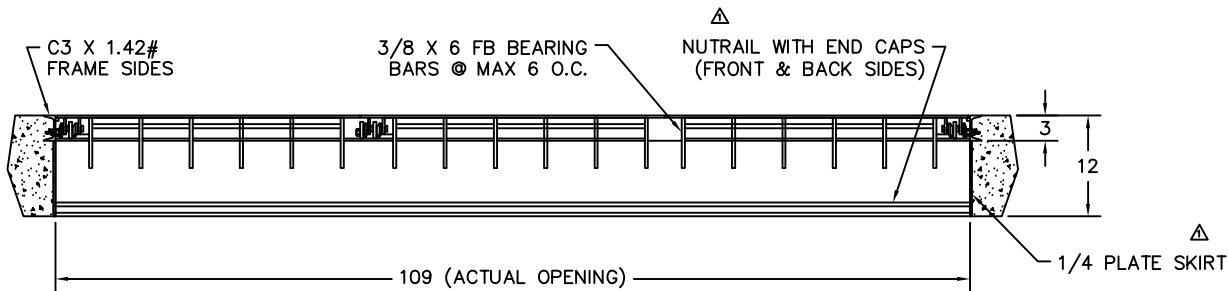
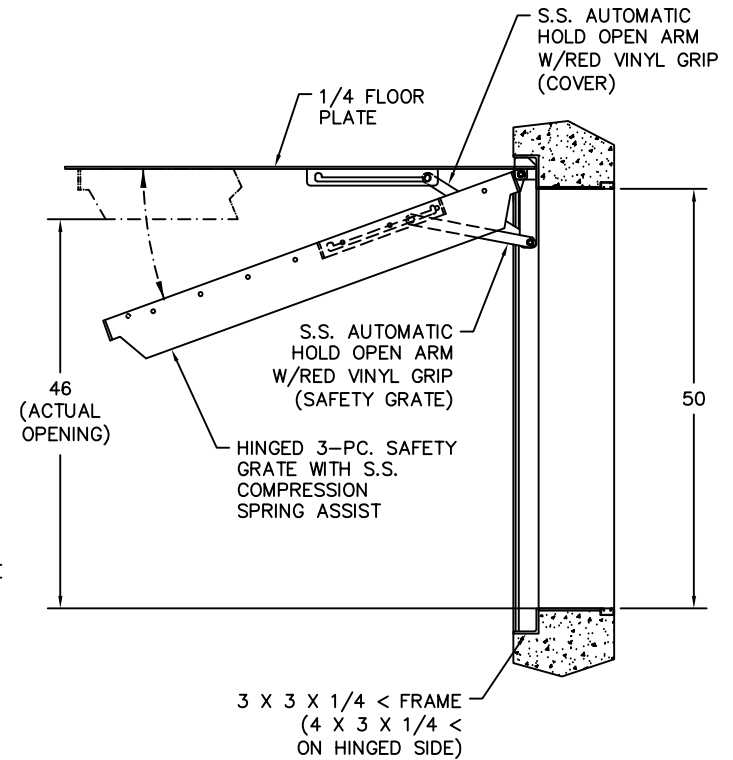
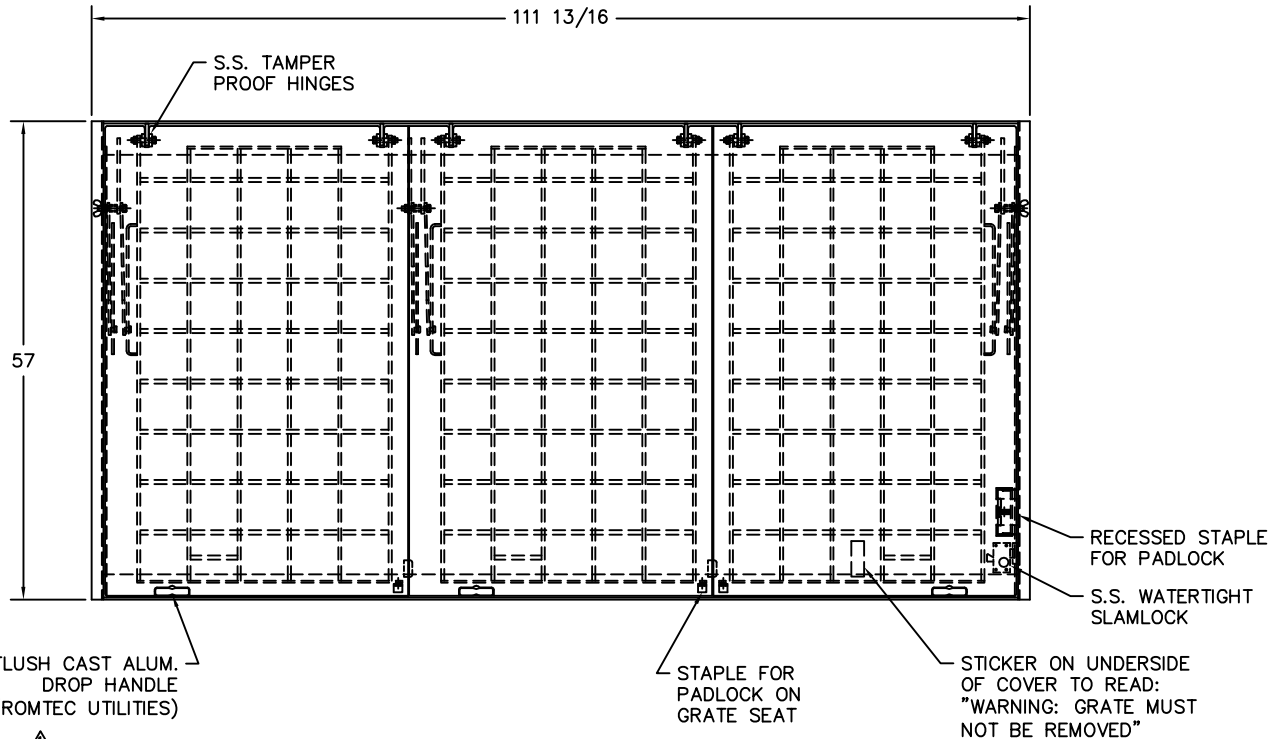
NOTE: CONAC LIFTING ANCHOR FFA08063 8 TON LOAD CAPACITY WITH REBARS REINFORCEMENT.

CONCRETE QUANTITY = 3.0 C.Y. HATCH W = 1000#

Oldcastle PRECAST
CALIFORNIA CONCRETE PIPE 2860 S. HIGHWAY 99 (209) 466-4212
STOCKTON, CA. 95215 FAX: (209) 466-2552

120" DIA. REINFORCED MH FLAT TOP FOR ROMTEC UTILITIES
"HATCH ASGD-50X109(46X109). H-20 LOAD WITH LOW IMPACT
CONFORMS TO: ASTM C478. HATCH DWG. NO. 54800

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	REVISED		REVISION NO. 09-R0M-120FH-H20-TX	SHEET 1 OF 1



NOTES:

- 1- MATERIAL: ALUMINUM
- 2- LOADING: 16,000 LBS. WHEEL LOADS
- 3- 316 STAINLESS STEEL NUTS & BOLTS
- 4- AREA OF FRAME IN CONTACT WITH CONCRETE TO BE PAINTED WITH BITUMINOUS COATING
- 5- SAFETY GRATE TO BE PAINTED WITH SAFETY ORANGE POWDER COAT

ROMTEC 10 FT. DIA. WET WELL

U.S.F. FABRICATION INC.
HIALEAH, FLORIDA

HATCH ASGT-16K 50 X 109 ALUMINUM
(46 X 109 ACTUAL OPENING)

W/SLAMLOCK, RECESSED PADLOCK, NUTRIL, SKIRT & BIT. PAINT

REV.	DATE	BY	CHK.	DESCRIPTION	DRAWN BY: DAV	SCALE: 1=12	QUOTE#	DATE: 9/11/08
					CHK. BY:	DWG. NO: 54800	SHEET 1 of 1	REV: Δ

STRUCTURAL DESIGN AND WET WELL WEIGHTS

All Romtec Utilities concrete wet well pre-cast components conform to ASTM C 478. Wet Well components are pre-cast with 4,000 psi. concrete and 60,000 psi. steel.

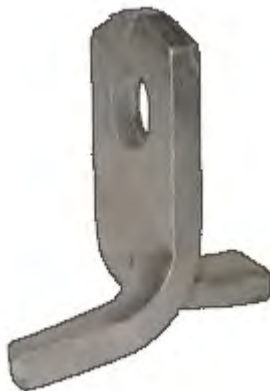
Romtec Utilities has not done any site specific structural calculations for this project. Romtec Utilities has not done any site specific up-lift calculations for this project. General uplift calculations for fully saturated soil have been completed and are available upon request.

LIFTING ANCHORS PROVIDED BY ROMTEC UTILITIES

Wet Well concrete components are equipped with Conac lifting system anchors and ring clutches. Wet Well 120" diameter manhole base slab is pre-cast with four (4) Conac Flat Foot Anchors (Model F FA 08 063 – Eight (8) ton anchor) located in the extended base. Wet Well 120" diameter manhole riser is pre-cast with four (4) Conac Flat Foot Anchors (Model F FA 04 038 – Four (4) ton anchor) located on the outside of the barrel. Wet Well 120" diameter top slab is pre-cast with Four (4) Conac Flat Anchors (Model F FA 04 038 – Four (4) ton anchor) located on the top.

FLAT FOOT ANCHOR

Ideal for back stripping or lifting thin precast panels.



<i>Ton</i>	<i>Part Number</i>	<i>Length</i>	<i>Thickness</i>	<i>Allowable Reinforced Tension Load S.F. 4:1 (lbs)</i>	<i>Ultimate Mech. Load Tension * (lbs)</i>	<i>System Code</i>
2	F FA 02 028A	2.8"	3/16"	2,000	8,000	2.5
2	F FA 02 034A	3.4"	3/16"	2,000	8,000	2.5
2	F FA 02 028B	2.8"	3/8"	4,000	16,000	2.5
2	F FA 02 034B	3.4"	3/8"	4,000	16,000	2.5
4	F FA 04 038	3.8"	1/2"	6,000	24,000	5
8	F FA 08 063	6.3"	5/8"	12,000	48,000	10

LIFTING RING CLUTCHES PROVIDED BY ROMTEC UTILITIES

Wet Well concrete components are designed to be lifted with the Romtec Utilities provided Conac lifting clutches. Romtec Utilities will provide eight (8) Conac Ring Clutches (Model F RC 08 B – Eight (8) ton anchors).

RING CLUTCH

Designed to be used specifically for flat steel lifting. Handle allows for a safer locking of clutch into position.



<i>Ton</i>	<i>Item No.</i>	<i>Weight lbs</i>	<i>System Code</i>
2T	F RC 02 B	4.0	2.5T
4T	F RC 04 B	9.0	5.0T
8T	F RC 08 B	20.0	10.0T
22T	F RC 22 B	56.0	22.0T



ROMTEC UTILITIES RECOMMENDED WET WELL LIFTING METHOD

All wet well concrete components are designed to be lifted and set in the excavated hole by use of the Romtec Utilities supplied anchors and ring clutches. The installation contractor shall excavate the wet well hole, place the base rock as specified by the **SITE ENGINEER (not Romtec Utilities)**, provide a **safe OSHA approved cave-in protection method (shoring) and a crane of adequate size to lift and set the heaviest piece**. The excavation contractor and/or his subcontractor crane company must provide the appropriate lifting cables, straps or chains and connection devices to attach the cables to the crane and the ring clutches. All lifting cables, straps or chains must be long enough that when lifting the concrete components the lifting rigging does not put pressure on the upper concrete joint potentially breaking the concrete. **The use of a spreader bar will greatly reduce the risk of the lifting rigging breaking the concrete upper joint.**

WET WELL CONCRETE COMPONENT WEIGHTS:

ITEM	SIZE	WEIGHT
120" Manhole Base	11'-10" Outside Diameter	44,000 lbs.
120" Manhole Riser	11'-10" Outside Diameter	4,700 lbs. Per Foot
120" Manhole Top Slab	11'-10" Outside Diameter	14,000 lbs.



8.05**WET WELL TESTING FOR WATER INGRESS OR
EGRESS**

Romtec Utilities wet wells are water tight. If testing is required, then the testing is to be performed as follows.

Romtec Utilities recommends performing the testing prior to backfilling. This helps with identifying any leakage and locating the area of leakage.

If the testing is performed after backfilling, Romtec Utilities is not responsible for any excavation than has to be done to fix any leaks.

The recommended test methods are per ASTM C497-05 Section 8. Hydrostatic Test Method or Section 9. Permeability Test Method.

8. Hydrostatic Test Method**8.1 Summary of Test Method**

The section of pipe or manhole is subjected to hydrostatic pressure and observed for leakage at the joint or on the surface of the wall. The joint is defined as a connection between the concrete section of pipe or manhole that provides alignment and the flexible watertight seal using either, rubber gaskets, sealing bands, or preformed flexible joint sealant.

8.2 Significance and Use

The test method is a quality control test performed to establish the fact that the finished, shippable pipe or manhole meets the hydrostatic requirements stated in the specifications for the installed wall or joint, or both.

8.3 Procedure:

8.3.1 The equipment for making the test shall be such that, when the specimen under test is filled with water to the exclusion of air and subject to the required hydrostatic pressure, there shall not be enough leakage of water from the ends of the pipe to interfere with the test. The specimen under test shall be free of all visible moisture prior to the initiation of the test.

8.05

WET WELL TESTING FOR WATER INGRESS OR EGRESS

8.3.2 Do not test when the temperature of the specimen, the air around the specimen, or the water within the specimen is below 33°F.

8.3.3 If the joint seal and/or flexible connector are being tested, it shall be the sole element providing joint water tightness. No mortar or concrete coatings, fillings, or packing shall be used prior to the test.

Once the wet well is stacked in the proper sequence, fill the well to the highest operation point in the well or the ground water elevation, whichever is the highest. There shall be no visible leakage. Moisture appearing in the form of patches or beads adhering to the surface shall not be considered leakage. If leakage occurs, the manufacturer is not prohibited from extending the soak time to 24 hour.

9. Permeability Test Method

9.1 Summary of Test Method

A section of pipe is kept filled with water for specified time and the outer surface is tested for moisture.

9.2 Significance and Use

The test method is a quality control test performed to establish the fact that the finished, shippable pipe meets the leakage limits stated in the specifications.

9.3 Procedure

The pipe specimen under test shall be free of all visible moisture prior to the initiation of the test. Perform tests by placing the specimen to be tested, with the spigot end down on a soft rubber mat or its equivalent, weighted if necessary, and kept filled with water to a level of the base of the socket during the test period. Make the initial inspection approximately 15 min after the test has begun. If the pipe shows moist or damp spots on the outer surface of the pipe at that

8.05

WET WELL TESTING FOR WATER INGRESS OR EGRESS

time, continue the tests for period not to exceed 24 h. at the option of the manufacturer. Examine the pipe during the extended period for existence of moist or damp spots.

Prior to either test all inlets and outlets must be plugged.

Repairs

Repair of manhole products shall not be prohibited, if necessary, because of imperfections in manufacture or damage during handling. The repair will be acceptable if, the repaired products conform to the requirements of the ASTM C478-09 specification. Romtec Utilities must be notified if any repairs are necessary.

In other words

If the wet well has any areas of leakage the contractor must report this leakage to Romtec Utilities and then together the contractor and Romtec Utilities will come up with a fix. In the unlikely event of a wet well leaking, this does not warrant a complete replacement. A reasonable effort must be given to fix the leak.

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CONSEAL™
Concrete Sealants INC.

CS-202

Butyl Rubber Sealant

APPLICATIONS

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

SEALING PROPERTIES

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

HYDROSTATIC STRENGTH

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

SPECIFICATIONS

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



CONSEAL™
Concrete Sealants INC.

CS-202

Butyl Rubber Sealant

PHYSICAL PROPERTIES

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

IMMERSION TESTING

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

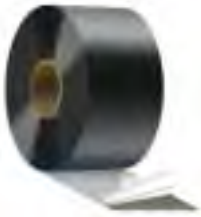
* Requirements of ASTM C-990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

LIMITED WARRANTY

This information is presented in good faith, but we cannot anticipate all conditions under which this information and our products, or the products of other manufacturers in combination with our products, may be used. We accept no responsibility for results obtained by the application of this information or the safety and suitability of our products, either alone or in combination with other products. Users are advised to make their own tests to determine the safety and suitability of each such product or product combinations for their own purposes. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for this own particular use. We sell this product without warranty, and buyers and users assume all responsibility and liability for loss or damage arising from the handling and use of this product, whether used alone or in combination with other products.

TAPECOAT® M860 PAVEMENT REPAIR COATING

Protection for Concrete and Asphalt Surfaces



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



Tapecoat can be used for manhole joint sealing tape.



Tapecoat® M860 Pavement Repair Coating

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

Features/Specifications/Application

Tapecoat® M860

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

Composition

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

Technical Data

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

Surface Preparation

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

Option

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

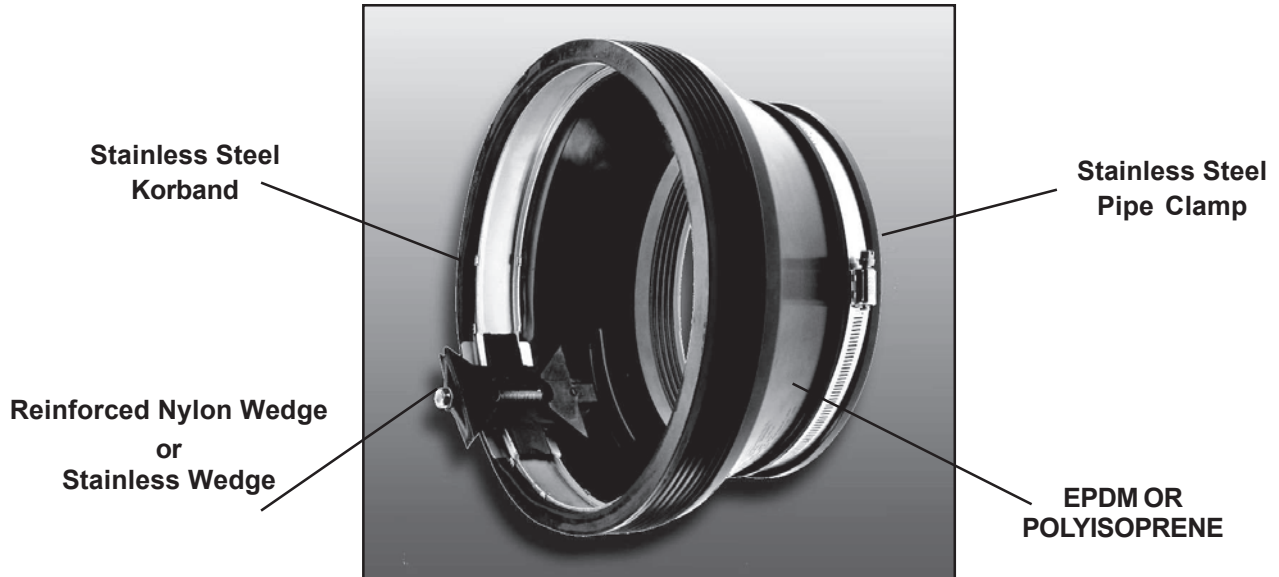


PO Box 631, Evanston, IL 60204-0631 • 1527 Lyons St. Evanston, IL 60201-3551 USA
800/758-6041 847/866-8500 Fax: 800/332-8273 Fax: 847/866-8596 www.tapecoat.com



KOR-N-SEAL® I & II FLEXIBLE PIPE-TO-MANHOLE CONNECTORS

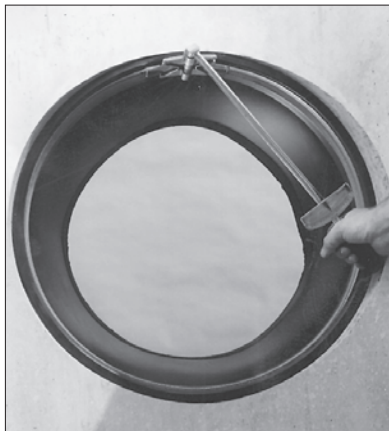
SPECIFICATION SHEET



KOR-N-SEAL I - WEDGE KORBAND CONNECTOR ASSEMBLY



Install Kor-N-Seal I - Wedge Korbond with Socket Wrench & Torque Limiter



Install Kor-N-Seal II - Wedge Korband with Standard Torque Wrench



Install Pipe Clamp(s) with T-Handle Torque Wrench





KOR-N-SEAL® I & II

Flexible Pipe-to-Manhole Connectors

SPECIFICATION SHEET

PERFORMANCE

Test	ASTM Method	Test Requirements	Kor-N-Seal® I & II
Head Pressure	C923 - 7.1	0° - 13 psi (30 ft) for 10 min. 7° - 10 psi (23 ft) for 10 min.	+13 psi for 10 min. +10 psi for 10 min.
Deflection Test	C923 - 7.2.2	7° in any direction	Over 7° in any direction
Load Test	C923 - 7.2.3	150 lbs/in. pipe dia.	Over 150 lbs/in. pipe dia.

Performed on all standard sizes of Kor-N-Seal Connectors.

RESILIENT EPDM OR POLYISOPRENE RUBBER

Conforms to ASTM C923

Test	ASTM Method	Test Requirements	TEST RESULTS Kor-N-Seal® I & II
Chemical Resistance	D543, at 22°C for 48 h		
1 N Sulfuric Acid		No weight loss	No weight loss
1 N Hydrochloric Acid		No weight loss	No weight loss
Tensile Strength	D412	1200 psi	1580 psi
Elongation at Break		350% min.	500%
Hardness	D2240 (shore A durometer)	± 5 from the manufacturer's specified hardness	48 ± 5
Accelerated Oven-Aging	D573 70 ± 1°C for 7 days	Decrease of 15%, max. of original tensile strength, decrease of 20% max. of elongation	10.1% tensile decrease 14.0% elongation decrease
Compression Set	D395, method B, at 70°C for 22 h	Decrease of 25%, max. of original deflection	13% decrease
Water Absorption	D471, immerse 0.75 by 2-in. specimen in distilled water at 70°C for 48 h	Increase of 10%, max. of original by weight	.8% increase
Ozone Resistance	D1171	Rating 0	Rating 0
Low-temperature Brittle Point	D746	No fracture at -40°C	No fracture at -40°C
Tear Resistance	D624, method B	200 lbf/in.	No tear at 210 lbf/in.

INTERNAL KORBAND

Conforms to ASTM C923, ASTM A666, and A240

- Korband Assembly is manufactured of 300 series stainless steel.
- Toggle Expander is made of 300 series stainless steel.
- The 106/406 series Wedge Expander is made from reinforced nylon or 300 series stainless steel.
- The 206/306 series Wedge Expander is made from 300 series stainless steel.

EXTERNAL PIPE CLAMP

Conforms to ASTM C923, ASTM A666, and A240

External take-up clamps are manufactured of 300 series stainless steel.

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NPC Kor-N-Seal Pipe-to-Manhole Connector

Technical Specification

Scope:

This specification describes the function of the NPC Kor-N-Seal pipe-to-manhole connector, its principle of operation, and the component materials that constitute the Kor-N-Seal connector, and their physical properties.

Product Application:

NPC Kor-N-Seal connectors are designed and manufactured to meet or exceed the requirements of ASTM C-923 "Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals". This specification requires the connector to provide a watertight seal under the following conditions:

- 10 PSI (23 feet head) of groundwater pressure
- Minimum 7 Degrees of pipe articulation in any direction
- Radial loading test of 150 pounds per inch diameter of pipe

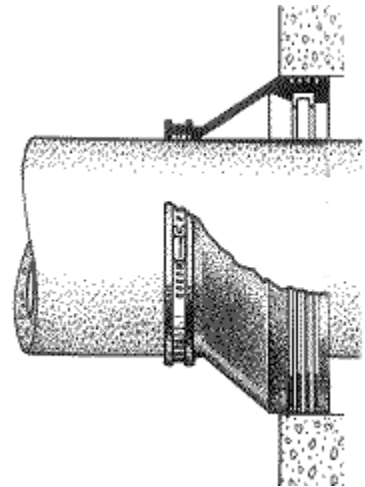
Principle of Operation:

The Kor-N-Seal connector creates a watertight seal between the pipe and manhole by first sealing to the inside of the cored or formed hole in the manhole and then sealing to the outside of the pipe. See illustration at right.

The seal at the inside of the manhole is created by the stainless steel Korband. The Korband is located inside of the end of the Kor-N-Seal connector that fits into the manhole. Once the Kor-N-Seal connector is located in the manhole, the diameter of the Korband is increased. This compresses the Kor-N-Seal connector against the inside wall of the hole in the manhole creating a watertight seal at the manhole.

The seal at the outside of the pipe is created by the stainless steel pipe clamp(s). The pipe clamp is located on the outside of the Kor-N-Seal connector. Once the pipe has been positioned in the connector the diameter of the pipe clamp is decreased. This compresses the Kor-N-Seal connector against the outside wall of the pipe creating a watertight seal at the pipe.

Reference the [Kor-N-Seal Recommended Installation Instructions](#) for a detailed explanation of the preparation and installation of the Kor-N-Seal connector.





KOR-N-SEAL – STAINLESS STEEL WEDGE

Recommended Installation Procedure

Refer to reverse side *Kor-N-Seal I - Wedge Korband Installation Chart* for Hole Size Range, Connector Dimensions, and Suggested Pipe O.D. Range.

CONNECTOR INSTALLATION:

1. Check to be sure Korband is properly located in Connector groove. (Fig. 1)
2. Insert Connector Assembly into hole with Wedge Expander at top of hole. (Fig. 2)
3. Position Connector so it is square to manhole both vertically and horizontally. (Fig. 3)
4. Tighten Wedge Expander using 1/2" [13 mm] socket with a preset torque limiter for each. For each size connector use torque limiter preset to proper torque. (Fig. 4) Retorquing is not required prior to shipment.

CAUTION: DO NOT USE IMPACT WRENCH.

IMPORTANT

RECOMMENDED TORQUE		TORQUE LIMITER
Connector Inches [mm]	Foot Pounds [Newton Meters]	P/N
10 – 24 [254 – 610]	12 [16]	91440-12

Fig. 4

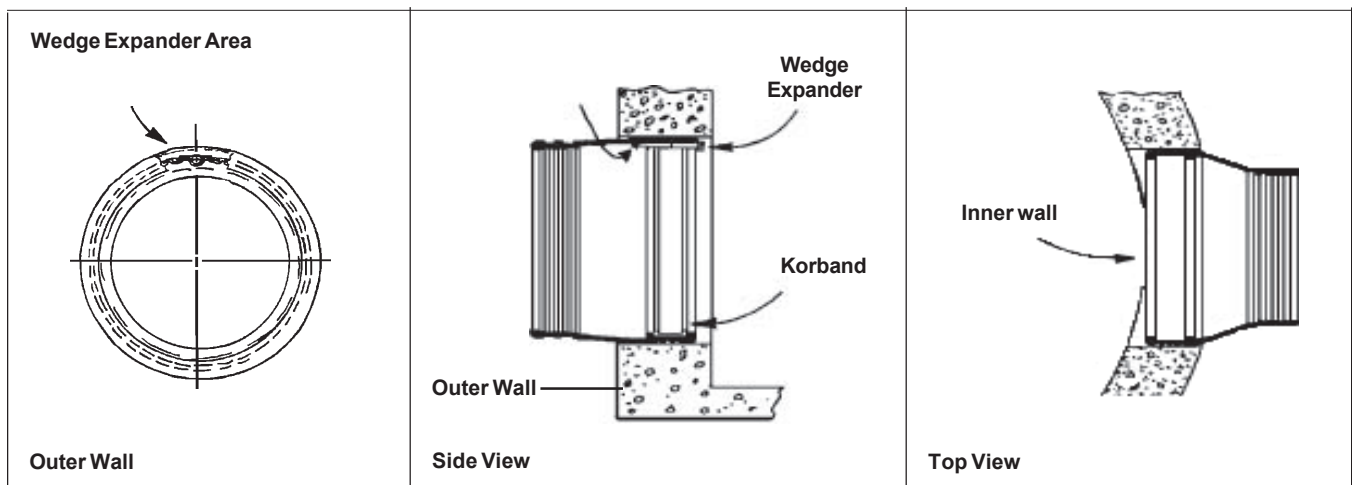


Fig. 1

Fig. 2

Fig. 3

PIPE INSTALLATION:

1. Center pipe in Connector opening.
2. On maximum pipe O.D. installations, use a pipe lubricant on the outside barrel of the pipe and/or the inside ridges of the Connector (under the Pipe Clamp area) to allow the pipe to slide into place more easily.
3. Position the Pipe Clamp in the Connector's Pipe Clamp groove with the screw at the top.
4. Tighten the Pipe Clamp screw to 60 inch pounds [7 Newton Meters] with a T-handle Torque Wrench, P/N 80090.
5. On minimum pipe O.D. installations, lift the rubber up underneath the Pipe Clamp screw so that the Connector contacts the bottom surface of the pipe while the Pipe Clamp screw is being tightened. Application of pipe lubrication on the underside of the clamp will also help assure that an even contraction of rubber is maintained throughout the clamping area.
6. After the Pipe Clamp has been tightened down firmly, move the pipe horizontally and/or vertically to bring it to grade.

CAUTION: Pipe must **NOT** rest on Connector Korband.

CAUTION:

All capped stubs awaiting pipe installation at a later date must be restrained. Assure that a proper backfill material is used in adverse conditions. Prior to any critical usage, contact NPC Customer service at 1-800-626-2180.



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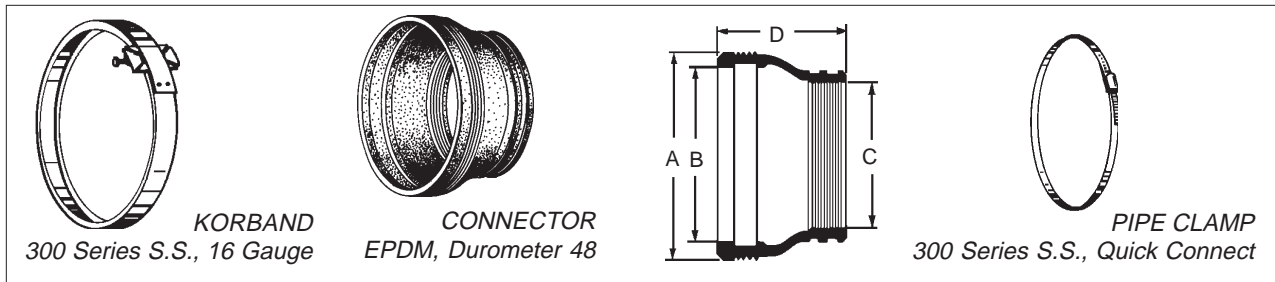
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KOR-N-SEAL – STAINLESS STEEL WEDGE

Recommended Installation Procedure



Kor-N-Seal S106 Series

Connector P/N	Suggested Pipe O.D. Range Inches	Hole Size Range Inches	Connector Dimensions Inches			Pipe Clamp P/N
		A	B	C	D	
S106-12BWS	5.75 — 7.00	12.00 — 12.20	10.30	6.50	8	I-128
S106-12AWS	7.00 — 8.50	12.00 — 12.20	10.30	8.00	8	I-180
S106-12WS	8.25 — 9.75	12.00 — 12.20	10.30	9.25	8	I-180
S106-14AWS	9.50 — 11.25	14.00 — 14.20	12.25	10.50	8	I-190
S106-16BWS	9.50 — 11.25	15.95 — 16.15	14.30	10.50	8	I-190
S106-16AWS	11.25 — 13.00	15.95 — 16.15	14.30	12.25	8	I-218
S106-16WS	13.00 — 14.20	15.95 — 16.15	14.30	14.00	8	I-242
S106-20BWS	14.00 — 15.50	19.95 — 20.10	18.25	15.00	8	I-306
S106-20AWS	15.50 — 17.00	19.95 — 20.10	18.25	16.50	8	I-306
S106-20WS	17.00 — 18.15	19.95 — 20.10	18.25	18.00	8	I-306
S106-22WS	17.75 — 19.25	21.95 — 22.10	20.25	18.75	8	I-318
S106-24WS	19.60 — 21.10	23.95 — 24.10	22.25	20.60	8	I-348

Kor-N-Seal S406 Series

S406-10AWS	6.00 — 6.75	10.00 — 10.20	8.30	6.50	6	I-128
S406-10WS	7.50 — 8.20	10.00 — 10.20	8.30	8.50	6	I-180
S406-10.5AWS	6.00 — 6.75	10.50 — 10.70	8.80	6.50	6	I-128
S406-10.5WS	7.50 — 8.70	10.50 — 10.70	8.80	8.50	6	I-180
S406-11BWS	6.00 — 7.00	11.00 — 11.20	9.30	6.00	6	I-128
S406-11AWS	7.50 — 9.00	11.00 — 11.20	9.30	8.00	6	I-180
S406-12CWS	6.00 — 7.00	12.00 — 12.20	10.30	6.50	6	I-128
S406-12BWS	6.25 — 7.50	12.00 — 12.20	10.30	7.00	6	I-128
S406-12AWS	7.50 — 9.00	12.00 — 12.20	10.30	8.50	6	I-180
S406-12WS	9.00 — 10.20	12.00 — 12.20	10.30	10.00	6	I-180

Suggested pipe O.D. range comes from field experience. Refer to *Recommended Pipe Installation Procedure*.



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08/06



Kor-N-Seal® I Dimension Chart

CONNECTORS FOR SMALL DIAMETER PIPE				
<i>S106 Series — 8" Long Connectors</i>				
NOMINAL HOLE SIZE	MODEL NUMBER	PIPE O.D. RANGE	HOLE SIZE RANGE	
7"	S106-7SWP	1.80 – 4.80	6.995	7.055
7"	S106-7WP	3.50 – 4.50	6.995	7.055
8"	S106-8ST	4.20 – 6.40	7.995	8.055
8"	S106-8T	4.10 – 5.90	7.995	8.055
8"	S106-8M	1.70 – 4.80	7.995	8.055
12"	S106-12BWP*	5.75 – 7.00	12.000	12.200
12"	S106-12AWP*	7.00 – 8.50	12.000	12.200
12"	S106-12WP*	8.25 – 9.75	12.000	12.200
12"	S106-12BT	5.75 – 7.00	12.040	12.130
12"	S106-12AT	7.00 – 8.50	12.040	12.130
12"	S106-12T	8.25 – 9.75	12.040	12.130
12"	S106-12BSL	5.75 – 7.00	12.000	12.250
12"	S106-12ASL	7.00 – 8.50	12.000	12.250
12"	S106-12SL	8.25 – 9.75	12.000	12.250
14"	S106-14AWP*	9.50 – 11.25	14.000	14.200
14"	S106-14AT	9.50 – 11.25	14.025	14.115
14"	S106-14ASL	9.50 – 11.25	14.500	14.250
16"	S106-16BWP*	9.50 – 11.25	15.950	16.150
16"	S106-16AWP*	11.25 – 13.00	15.950	16.150
16"	S106-16WP*	13.00 – 14.20	15.950	16.150
16"	S106-16BT	9.50 – 11.25	15.975	16.070
16"	S106-16AT	11.25 – 13.00	15.975	16.070
16"	S106-16T	13.00 – 14.50	15.975	16.070
16"	S106-16BSL	9.50 – 11.25	15.950	16.200
16"	S106-16ASL	11.25 – 13.00	15.950	16.200
16"	S106-16SL	13.00 – 14.20	15.950	16.200
20"	S106-20BWS	14.00 – 15.50	19.950	20.100
20"	S106-20AWS	15.50 – 17.00	19.950	20.100
20"	S106-20WS	17.00 – 18.15	19.950	20.100
22"	S106-22WS	17.75 – 19.25	21.950	22.100
24"	S106-24WS	19.60 – 21.10	23.950	24.100

* also available in Steel Wedge (WS)



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RFCA (Restrained Flanged Coupling Adapter)

Material Specification

Flange Body: Ductile (nodular) iron, meeting or exceeding ASTM A 536, Grade 65-45-12. Flange meets the dimensional requirements of ANSI Class 125 and 150 bolt circles.

Gaskets: Compounded for water and sewer service in accordance with ASTM D 2000 (Sizes 3 - 12" have flange O-Ring gasket). Other compounds available for petroleum, chemical, or high temperature service.

Gland: Romac RomaGrip™. See page 7-6.

Restraining Bolts: 7/8 –9 roll thread, Ductile (nodular) iron, meeting or exceeding ASTM A 536.

Restraining Lugs: Ductile (nodular) iron, meeting or exceeding ASTM A 536. Heat treated using a proprietary process.

Lug Locators: Polyurethane, a thermal plastic.

T-bolts and Nuts: High strength low alloy steel T-head bolt. National coarse rolled thread and heavy hex nut. Steel meets AWWA C111 composition specifications. **Stainless steel bolts and nuts** available on request.

Coatings: Shop coat applied to cast parts for corrosion protection in transit. **Fusion bonded epoxy** available on request.

Use: Ductile Iron Pipe 3 - 24", cast iron pipe 3" - 24" (same OD's as ductile iron) and IPS size STD steel pipe 3 - 12".

To Order: Specify catalog number. **Example:** For a 12" RFCA Order: **RFCA - 13.20**

NOTE: 3" - 12" special Romac gasket works on both steel and D.I. ODs.



Not for use on PVC, HDPE pipe or plain-end mechanical joint fittings. For applications on PVC, please contact your Romac representative.

NOM. PIPE SIZE	GASKET RANGE	LENGTH	GLAND BOLTS QTY: SIZE	CATALOG NUMBER	LIST PRICE				WEIGHT (lbs.)
					Shopcoat w/Std. B&N	Shopcoat w/304 SS B&N	Fusion Epoxy w/Std. B&N	Fusion Epoxy w/304SS B&N	
3"	3.50-3.96	8.00"	4: 5/8" x 3"	RFCA - 3.96	\$145.45	\$157.56	\$165.10	\$177.20	21
4"	4.50-4.80	9.00"	4: 3/4" x 3 1/2"	RFCA - 4.80	183.32	209.43	207.88	233.99	29
6"	6.63-6.90	9.25"	6: 3/4" x 4"	RFCA - 6.90	233.85	273.01	267.10	306.26	40
8"	8.63-9.05	9.25"	6: 3/4" x 4"	RFCA - 9.05	315.59	354.75	355.82	394.98	53
10"	10.75-11.10	10.25"	8: 3/4" x 4"	RFCA - 11.10	581.96	634.17	669.69	721.91	83
12"	12.75-13.20	10.25"	8: 3/4" x 4"	RFCA - 13.20	632.13	684.34	739.86	792.07	110
14"	15.30	11.70"	10: 3/4" x 4 1/2"	RFCA - 15.30	882.79	947.37	1,020.54	1,085.12	170
16"	17.40	11.70"	12: 3/4" x 4 1/2"	RFCA - 17.40	1,225.93	1,302.91	1,410.23	1,487.21	200
18"	19.50	11.80"	12: 3/4" x 4 1/2"	RFCA - 19.50	1,346.63	1,423.60	1,546.13	1,623.10	217
20"	21.60	11.80"	14: 3/4" x 4 1/2"	RFCA - 21.60	1,521.19	1,611.94	1,772.94	1,863.69	256
24"	25.80	12.00"	16: 3/4" x 5"	RFCA - 25.80	1,845.38	1,959.61	2,130.38	2,244.61	305

! Some initial axial movement may occur in lug style restraints as the lugs seat. Movement is directly related to the size of the piping system and the system pressure. In general terms movement of approximately 0.25" can be expected in restraints under 16". For larger sizes, movement of approximately 0.4" may be seen. If this is critical to your application please contact Romac Engineering for additional information.

INSTALLATION INSTRUCTIONS

Read installation instructions first before installing. Check parts to ensure that no damage has occurred during transit and that no parts are missing. Also check the diameter of the pipe and the size marked on the coupling to ensure you have the proper size.



RFCA Restrained Flange Coupling Adapter

NOT FOR USE ON PVC PIPE OR PLAIN END MECHANICAL JOINT FITTINGS

NOTE: Not for use on polyethylene pipe, plain end mechanical joint fittings or PVC pipe.

The "Stab-Fit" installation technique may also be employed on 3"-10" sizes.

Step 1 • Check the RFCA parts to insure that no damage has occurred during transit and that no parts are missing.

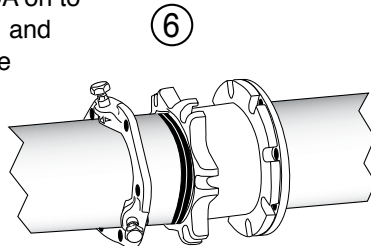
Step 2 • Clean pipe end for a distance of 2" greater than length of the RFCA.

Step 3 • Place RomaGrip gland on pipe end.

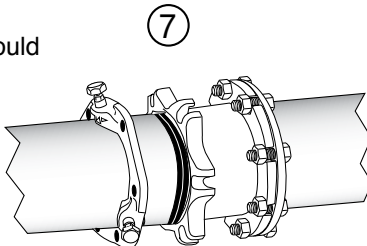
Step 4 • Lubricate the gasket and pipe surface with soapy water or other suitable gasket lubricant.

Step 5 • Place gasket over pipe with beveled edge toward the flange adapter.

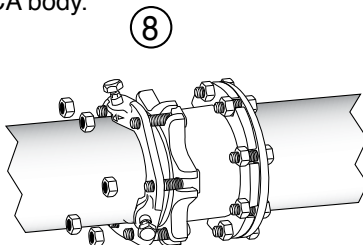
Step 6 • Slide the RFCA on to the pipe. Position the pipe and flanged coupling against the mating flange, inserting flange gasket (14" and larger) between the flange faces. Assemble the flange joint using flange bolts.



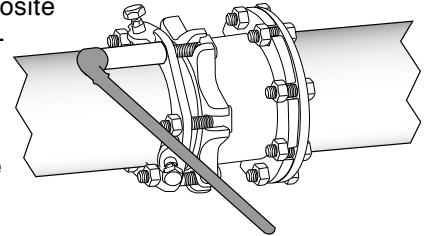
Step 7 • The pipe should be centered such that the space between the OD of the pipe and the ID of the RFCA is even all around the pipe. Slide the RFCA gasket into position with the beveled edge engaging the beveled end of the RFCA body.



Step 8 • Slide the RomaGrip into position against the gasket, and insert T-bolts.



Step 9 • Tighten T-bolts evenly, alternating to diametrically opposite position at approximately 20 ft-lbs increments to the recommended torque for your size RFCA.



Recommended Torque:

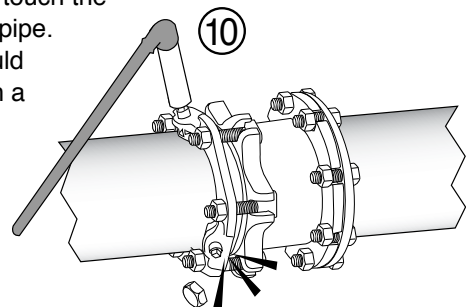
- 3" RomaGrip - 45-65 ft-lbs.
- 4 - 24" RomaGrip - 75 - 90 ft-lbs.

Note:

90 ft-lbs. torque = 12" wrench w/90 lbs. force

For best results, wait 10 minutes and retighten bolts to proper torque.

Step 10 • Hand tighten the restrainer bolts until the restraining pads touch the surface of the pipe. The bolts should be tightened in a uniform criss-cross pattern, until the heads break off above the notch.



NOTE: Do not turn a bolt more than one turn before alternating to the next bolt.

Step 11 • Pressure test for leaks before backfilling.

RFCA Restrained Flange Coupling Adapter

NOT FOR USE ON PVC PIPE OR PLAIN END MECHANICAL JOINT FITTINGS

PRECAUTIONS

1. Check flange to make sure the bolt holes match the RFCA.
2. Make sure a flange gasket is used between the mating flanges on sizes 14" and larger.
3. Check diameter of pipe to make sure you are using the correct size RFCA; also check gasket to make sure it is the size you think it is.
4. Be sure to clean pipe of as much dirt and corrosion as possible in the area that the gasket will seal.
5. Lubricate both the gasket and the pipe end with soapy water or approved pipe lubricant per ANSI/AWWA C111/A21.11.
6. Make sure no foreign materials lodge between gasket and pipe.
7. Avoid loose fitting wrenches, or wrenches too short to achieve proper torque.
8. Keep threads free of foreign material to allow proper tightening.
9. Take extra care to follow proper bolt tightening procedures and torque recommendations. Bolts are often not tightened enough when a torque wrench is not used.
10. Be sure that the gland is centered around the pipe.
11. Pressure test for leaks before backfilling.
12. Backfill and compact carefully around pipe and fittings.
13. Some initial axial movement may occur in lug style restraints as the lugs seat. Movement is directly related to the size of the piping system and the system pressure. In general terms movement of approximately 0.25" can be expected in restraints under 16". For larger sizes, movement of approximately 0.4" may be seen. If this is critical to your application please contact Romac Engineering for additional information.

COMMON INSTALLATION PROBLEMS

1. Flange gasket not installed on sizes 14" and larger.
2. T-Bolts are not tightened to the proper torque.
3. Rocks or debris between pipe and gasket.
4. Dirt or debris between pipe and restraining pad.
5. Dirt on threads of bolts or nuts.
6. Restraining bolt heads not snapped off.
7. Not enough pipe inserted into bell.
8. Using the RFCA on IPS size steel pipe with wall thickness thinner than schedule 40 steel pipe. (3-12 inch sizes)

IF RFCA MUST BE REMOVED

1. Make sure pipe is not pressurized. Removing the restrainer could cause the pipe joint to separate.
2. To remove the RFCA, use a $\frac{5}{8}$ " hex wrench or socket.
3. To reassemble, follow installation procedures. Tighten the restraining bolts using a $\frac{5}{8}$ " hex wrench to 75-ft-lbs minimum.

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

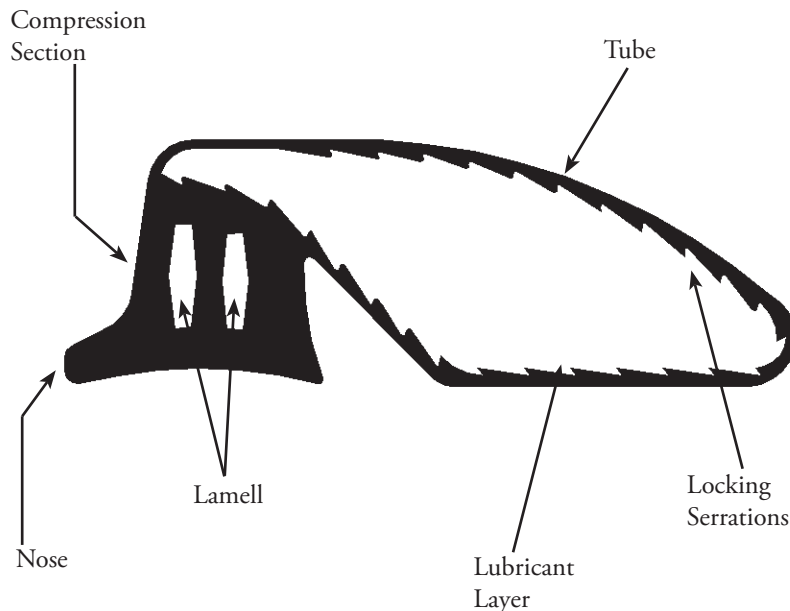
Requiring no field lubrication, the Tylox[®] SuperSeal[™] gasket* has a layer of silicone lubricant installed on the inner surface of the tube during the manufacturing process; saving you time, and money, on the job-site.

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

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

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

For Single Offset Joints ...



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

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

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

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

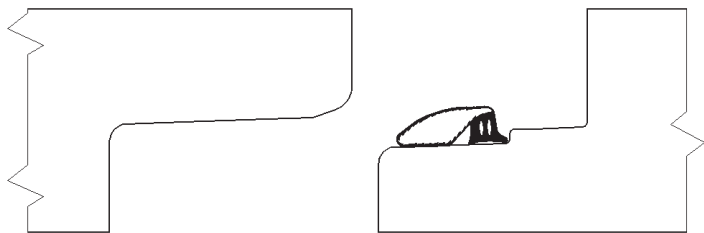
ASTM C361, ASTM C425, ASTM C443, AASHTO M198.4 and CSA A-257 material requirement compliance.

Pipe sizes to 144" can be accommodated.

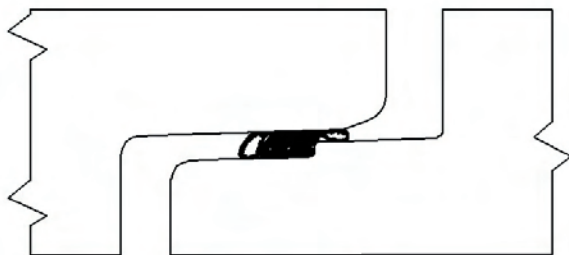
INSTALLATION

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

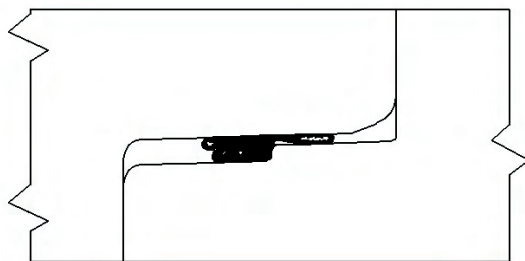
Stretch the gasket around the spigot, with the nose against the step, and the tube laying flat against the spigot. **DO NOT LUBRICATE.**



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



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



MATERIALS

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

- Isoprene

Optional Materials

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

Other materials may be available as special order.

Consult your Hamilton Kent agent for your specific requirements.

SPECIFICATIONS

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

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

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

CONTACT US

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M9W 5J6

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E-Mail sales@hamiltonkent.com

*Tylox SuperSeal Gaskets are patented under US Patent 4934716

All Tylox® SuperSeal™ gaskets are warranted for 12 months from date of purchase (Invoice Date) in accordance with the details as outlined in Hamilton Kent's Standard Terms and Conditions of Sale.

**NO
LUBRICANT
REQUIRED**

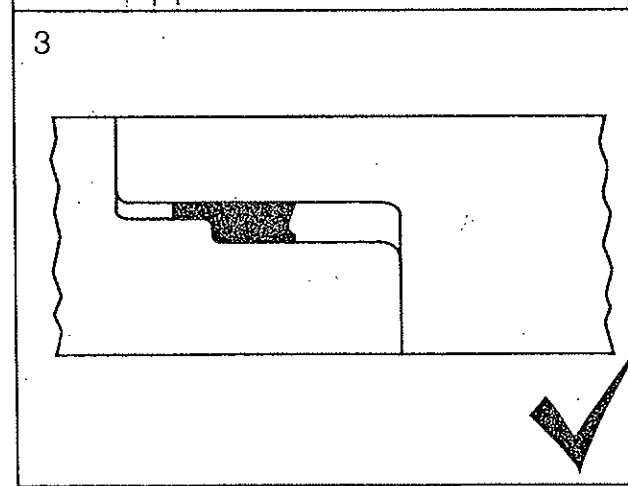
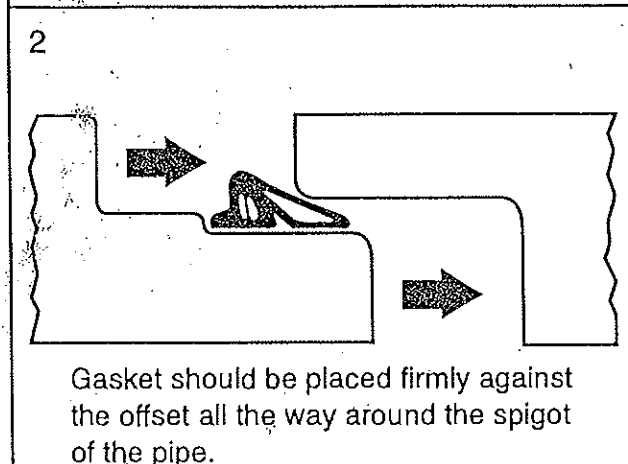
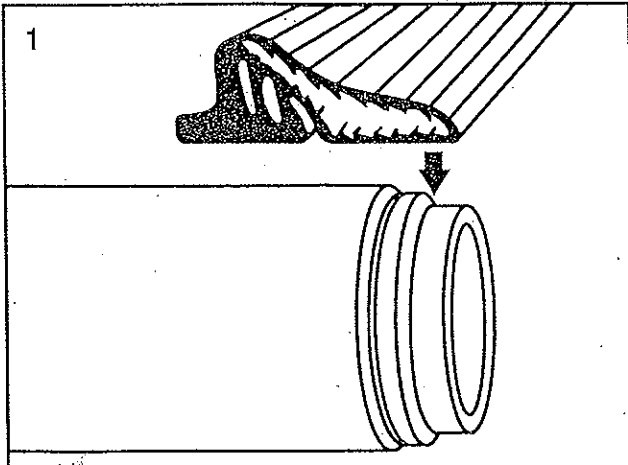
**TYLOX
SuperSeal**

HK Hamilton Kent

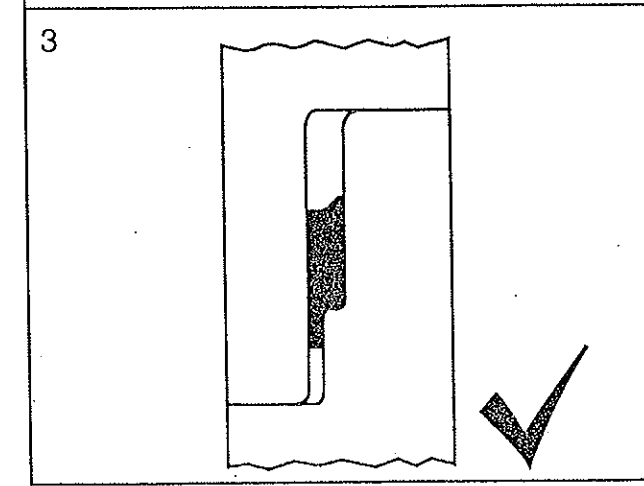
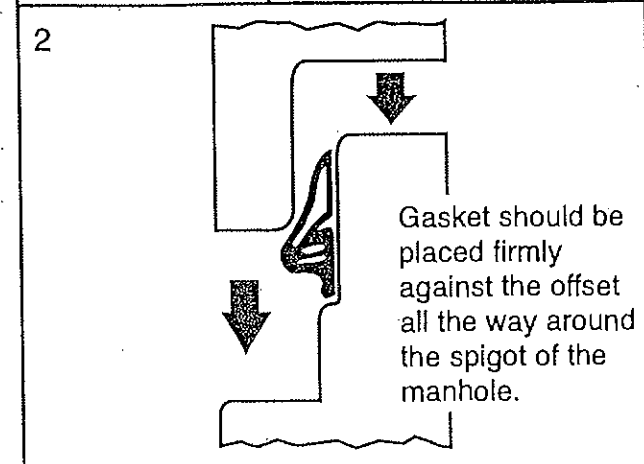
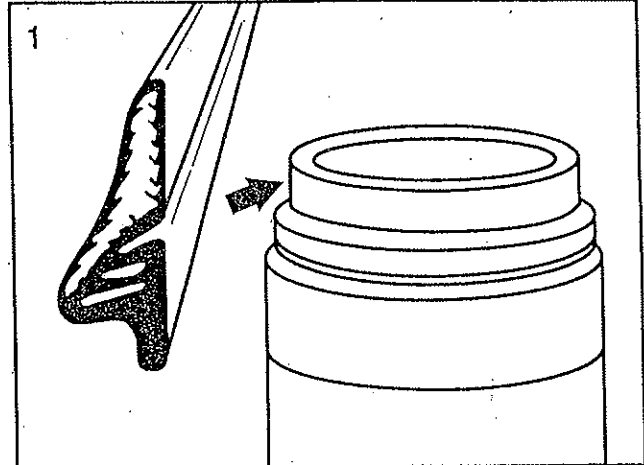
make the connection

Pipe & Manhole Pre-lubricated Gasket Installation

Pipe



Manhole





TNEME-LINER SERIES 61

PRODUCT PROFILE

GENERIC DESCRIPTION	Cycloaliphatic Amine Epoxy
COMMON USAGE	Tightly cross-linked epoxy with excellent corrosion and chemical resistance. Principally used for immersion service, including fuel and crude oil storage, chemical containment and wastewater treatment.
COLORS	5001 Gray and 5002 Beige
FINISH	Semi-gloss
SPECIAL QUALIFICATIONS	A two-coat system of Series 61 at 4.0 to 6.0 dry mils (100-150 dry microns) per coat passes the performance requirements of MIL-PRF-4556F .
PERFORMANCE CRITERIA	Extensive test data available. Contact your Tnemec representative for specific test results.

COATING SYSTEM

PRIMERS	Steel: Self-priming Concrete: Self-priming or Series 215, 217, 218 CMU: Series 215, 218
TOPCOATS	Note: Series 61 can be topcoated with select Tank Armor linings depending on service conditions. Contact Tnemec Technical Service for recommendations.

SURFACE PREPARATION

STEEL	Immersion Service: SSPC-SP10/NACE 2 Near-White Blast Cleaning obtaining a minimum angular anchor profile of 2.0 mils (50 microns).
CONCRETE	Allow new concrete to cure for 28 days. Abrasive blast referencing SSPC-SP13/NACE 6, ICRI-CSP3-5 Surface Preparation of Concrete and Tnemec's Surface Preparation and Application Guide.
ALL SURFACES	Must be clean, dry and free of oil, grease and other contaminants.

TECHNICAL DATA

VOLUME SOLIDS	82.0 ± 2.0% (mixed) †
RECOMMENDED DFT	1. For JP-4, JP-5, JP-8, Aviation Gas and Jet A-1: 4.0 to 6.0 mils (100 to 150 microns) per coat (minimum of two coats). 2. Most Other Applications: 8.0 to 12.0 mils (205 to 305 microns) per coat (minimum of two coats). Contact your Tnemec representative for specific recommendations.

CURING TIME	Temperature	To Handle	To Recoat	Immersion
	75°F (24°C) at 4.0 mils (100 microns)	6 hours	16-18 hours •	5 to 7 days
	75°F (24°C) at 12.0 mils (305 microns)	11 hours	16-18 hours •	5 to 7 days

Curing time varies with surface temperature, air movement, humidity and film thickness.
• Maximum recoat time is 72 hours. If more than 72 hours have elapsed between coats, the coated surface must be scarified before topcoating.

VOLATILE ORGANIC COMPOUNDS	EPA Method 24 Unthinned: 0.36 lbs/gallon (45 grams/litre) Thinned 6%: 0.71 lbs/gallon (85 grams/litre) Thinned 10%: 1.21 lbs/gallon (145 grams/litre) †
-----------------------------------	---

HAPS	Unthinned: 1.53 lbs/gal solids Thinned 10%: 2.42 lbs/gal solids
-------------	--

THEORETICAL COVERAGE 1,315 mil sq ft/gal (32.3 m²/L at 25 microns). See APPLICATION for coverage rates. †

NUMBER OF COMPONENTS Two: Part A (amine) and Part B (epoxy)

MIXING RATIO By volume: One (Part A) to one (Part B)

PACKAGING	PART A	PART B	Yield (mixed)
Large Kit	5 gallon pail (18.9 L)	5 gallon pail (18.9 L)	10 gallons (37.85 L)
Small Kit	1 gallon can (3.79 L)	1 gallon can (3.79 L)	2 gallons (7.57 L)

NET WEIGHT PER GALLON 13.10 ± 0.25 lbs (5.94 ± .11 kg) †

STORAGE TEMPERATURE Minimum 20°F (-7°C) Maximum 110°F (43°C)
For optimum application properties, material temperature should be above 60°F (16°C) prior to application.

TEMPERATURE RESISTANCE (Dry) Continuous 250°F (121°C) Intermittent 275°F (135°C)
Performance in high temperature immersion applications depends on liquid media, temperature and substrate. Contact your Tnemec representative for more information.

SHELF LIFE 24 months at recommended storage temperature.

FLASH POINT - SETA Parts A & B: 81°F (27°C)

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

APPLICATION

TNEME-LINER | SERIES 61

COVERAGE RATES

For JP-4, JP-5, JP-8
Aviation Gas, Jet A-1 Service

	Dry MILS (Microns)	Wet MILS (Microns)	Sq Ft/Gal (m ² /Gal)
Suggested	5.0 (125)	6.0 (150)	263 (24.4)
Minimum	4.0 (100)	5.0 (125)	329 (30.6)
Maximum	6.0 (150)	7.5 (190)	219 (20.4)

Most Other Applications

	Dry MILS (Microns)	Wet MILS (Microns)	Sq Ft/Gal (m ² /Gal)
Suggested	10.0 (255)	12.0 (305)	132 (12.2)
Minimum	8.0 (205)	10.0 (255)	164 (15.3)
Maximum	12.0 (305)	14.5 (355)	110 (10.2)

Allow for overspray and surface irregularities. Film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance. †

MIXING

Power mix contents of each container, making sure no pigment remains on the bottom. Pour a measured amount of Part B into a clean container large enough to hold both components. Add an equal volume of Part A to Part B while under agitation. Continue agitation until the two components are thoroughly mixed. Do not use mixed material beyond pot life limits. **Note:** Both components must be above 60°F (16°C) prior to mixing. Mixing ratio is one to one by volume. A large volume of material will set up quickly if not applied or reduced in volume. **Caution: Do not reseal mixed material. An explosion hazard may be created.**

THINNING

Use No. 2 Thinner. For air spray, thin up to 10% or 12 oz (354 mL) per gallon. For airless spray or brush, thin up to 5% or 6 oz (177 mL) per gallon. **Note:** A maximum of 6% or 7 oz (207 mL) per gallon of No. 2 Thinner may be used to comply with VOC regulations.

POT LIFE

2 1/2 hours at 60°F (16°C) 1 1/2 hours at 77°F (25°C) 45 minutes at 100°F (38°C)

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	60-90 psi (4.1-6.2 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.015"-0.021" (380-535 microns)	3000-3800 psi (207-262 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

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

Brush: Recommended for small areas only. Use high quality natural or synthetic bristle brushes. **Note:** Two or more coats may be required to obtain recommended film thicknesses.

SURFACE TEMPERATURE

Minimum 60°F (16°C) Maximum 135°F (57°C)

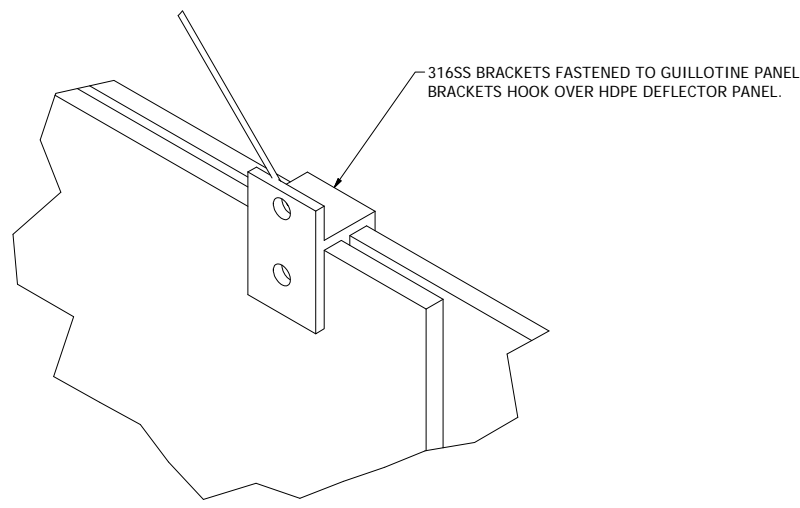
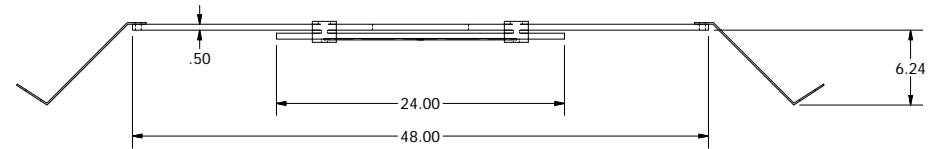
The surface should be dry and at least 5°F (3°C) above the dew point. Coating will not cure below minimum surface temperature.

CLEANUP

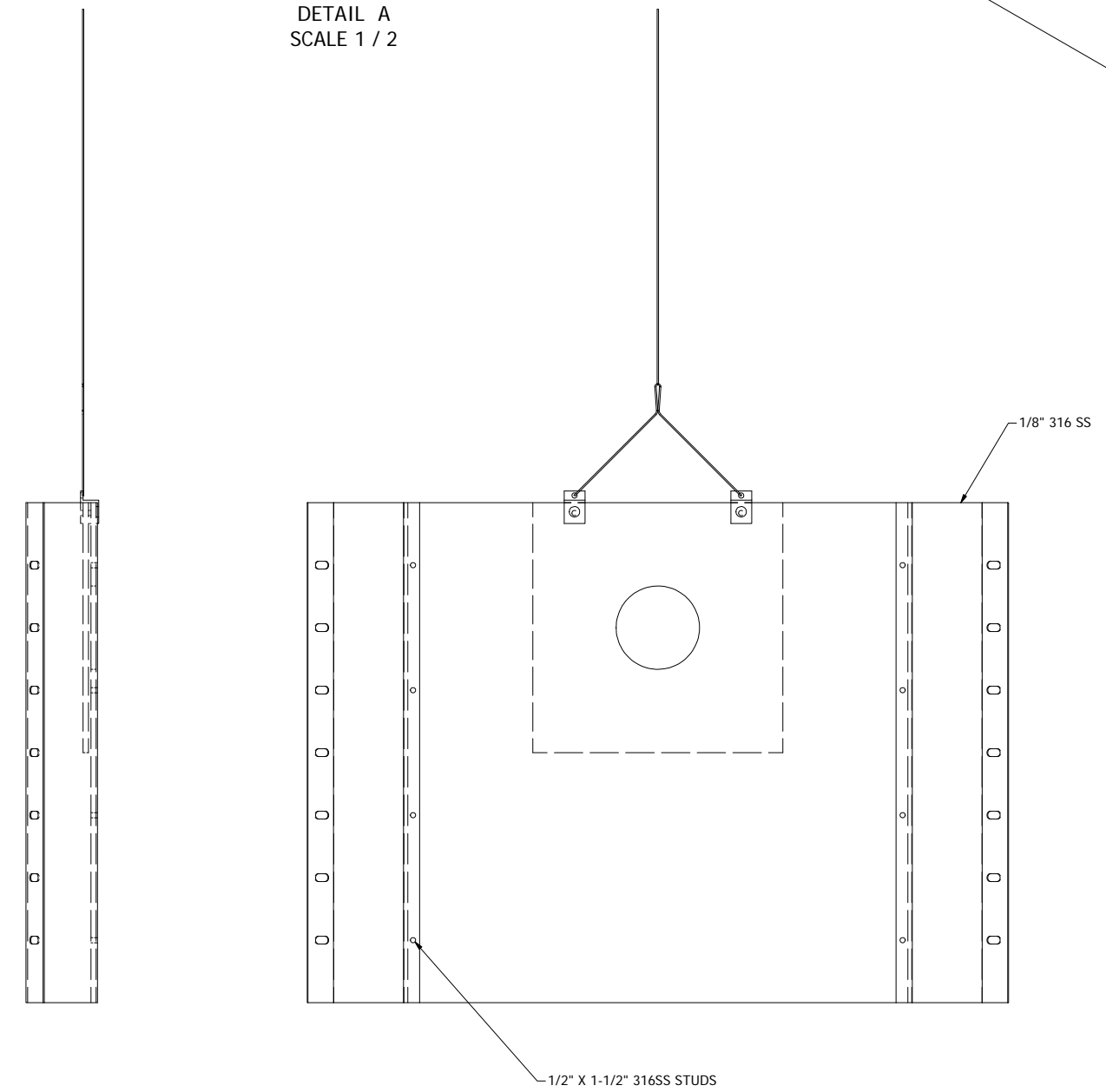
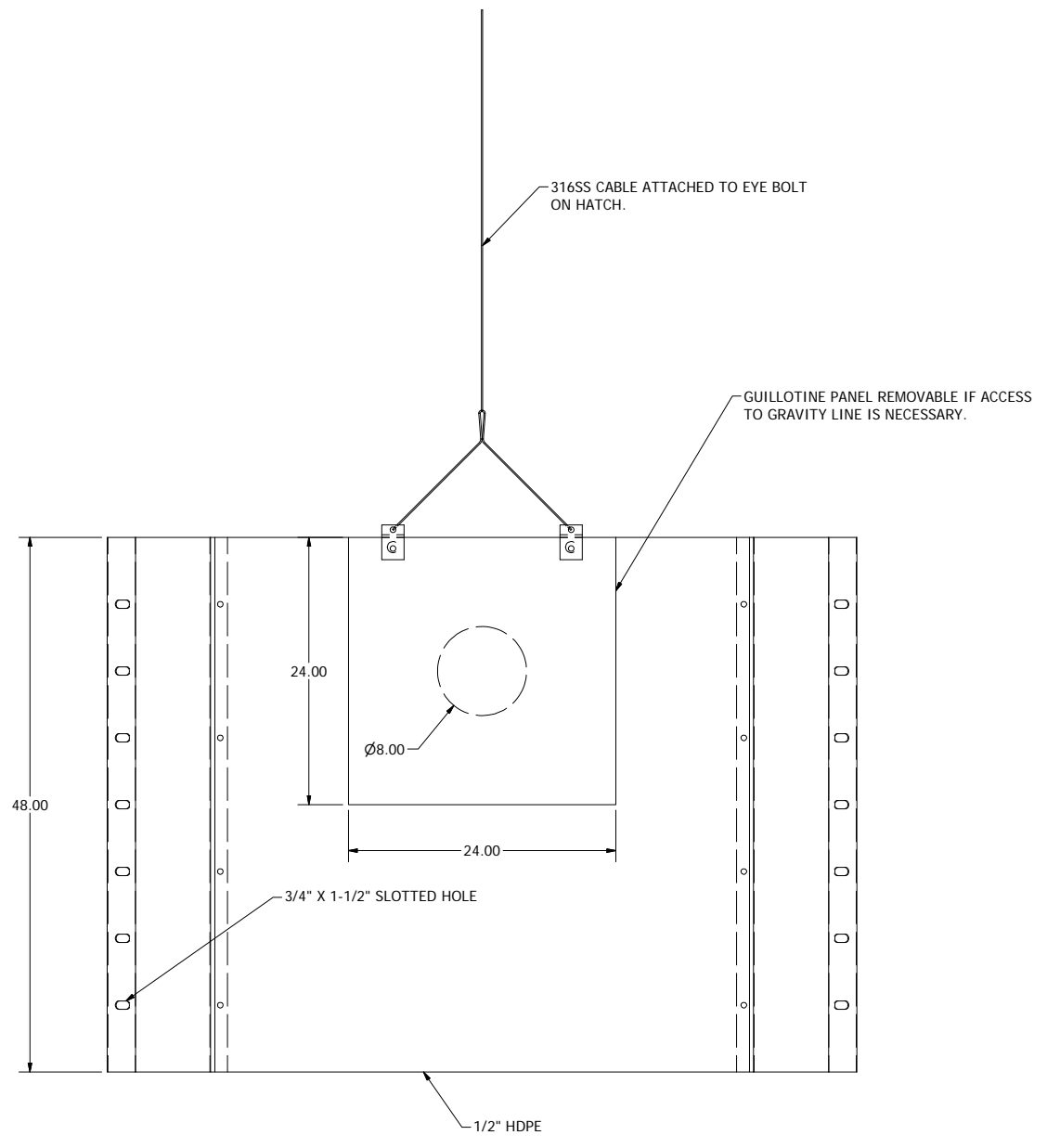
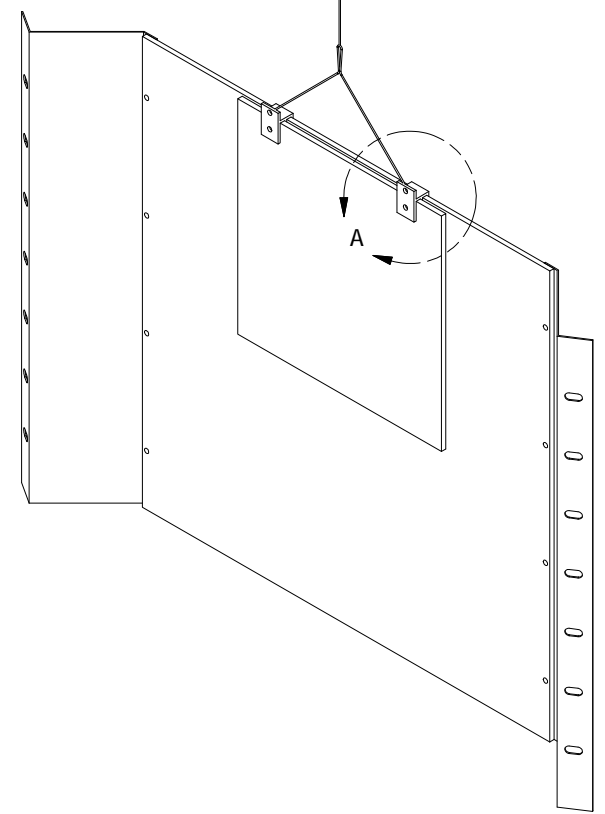
Flush and clean all equipment immediately after use with the recommended thinner, xylol or MEK.

† Values may vary with color.

WARRANTY & LIMITATION OF SELLER'S LIABILITY: Tnemec Company, Inc. warrants only that its coatings represented herein meet the formulation standards of Tnemec Company, Inc. THE WARRANTY DESCRIBED IN THE ABOVE PARAGRAPH SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. The buyer's sole and exclusive remedy against Tnemec Company, Inc. shall be for replacement of the product in the event a defective condition of the product should be found to exist and the exclusive remedy shall not have failed its essential purpose as long as Tnemec is willing to provide comparable replacement product to the buyer. NO OTHER REMEDY (INCLUDING, BUT NOT LIMITED TO, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY, ENVIRONMENTAL INJURIES OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS) SHALL BE AVAILABLE TO THE BUYER. Technical and application information herein is provided for the purpose of establishing a general profile of the coating and proper coating application procedures. Test performance results were obtained in a controlled environment and Tnemec Company makes no claim that these tests or any other tests, accurately represent all environments. As application, environmental and design factors can vary significantly, due care should be exercised in the selection and use of the coating.



DETAIL A
SCALE 1 / 2



VERIFY SCALE
BAR IS ONE INCH ON
ORIGINAL DRAWING
1"
IF NOT ONE INCH ON
THIS SHEET ADJUST
SIZES PROPORTIONALLY

DSN - AD	REV	DESCRIPTION	DATE	APPROV
DRN - AD	1			
CKD - AD				
DATE - 2-11-14				

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

10FT DEFLECTOR PANEL
DETAIL X 48" TALL

SHEET
1 OF 1

JOB NUMBER
RMTC
0000

**END
OF
SECTION**

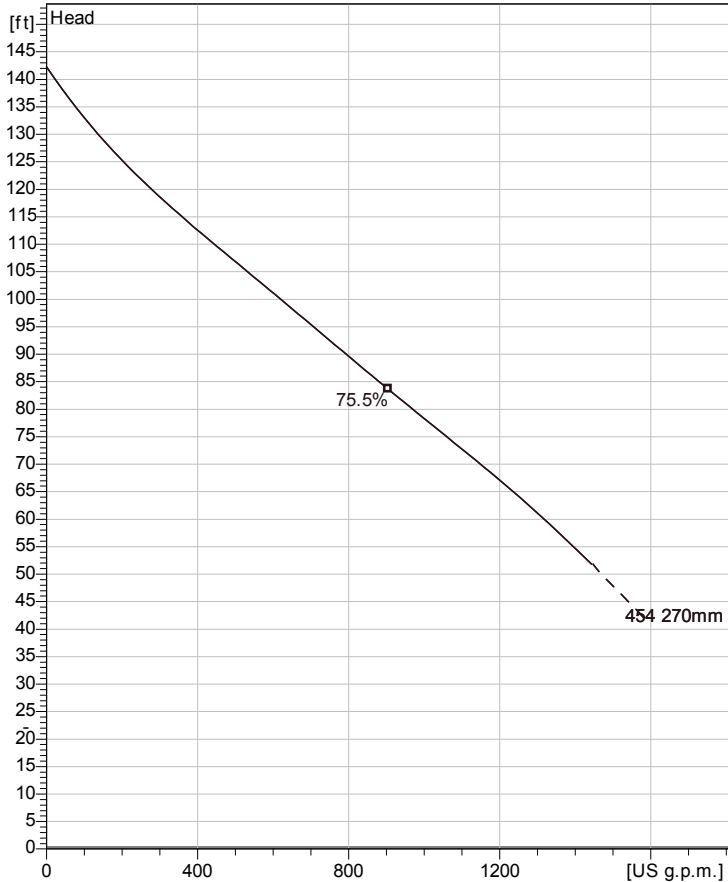
9. PUMPS

This section provides the information pertaining to the pumps for this project.

This section is structured as follows:

- 9.01 PUMP SPECIFICATIONS
- 9.02 PUMP DIMENSIONAL DRAWINGS
- 9.03 PUMP PERFORMANCE CURVES
- 9.04 PUMP EXTENDED STORAGE
- 9.05 PUMP RELATED DATA SHEETS
 - 9.05.1 HUBBELL SUPPORT GRIPS
 - 9.05.2 PUMP LIFTING EYE

NP 3171 HT 3~ 454
Technical specification



Curve according to: ISO 9906 grade 2 annex 1 or 2



Note: Picture might not correspond to the current configuration.

General

Patented self-cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.

Impeller

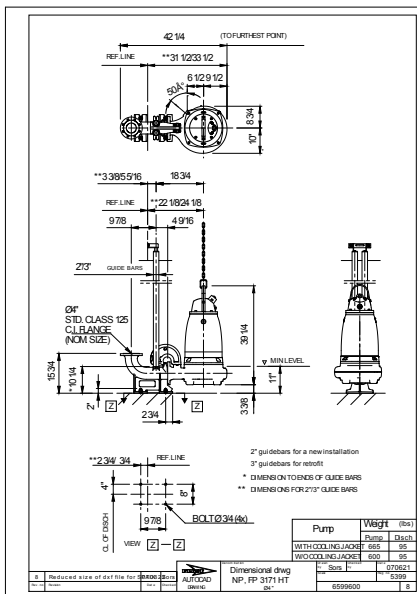
Impeller material	Grey cast iron
Outlet width	3 15/16 inch
Inlet diameter	150 mm
Impeller diameter	270 mm
Number of blades	2
	0 inch

Motor

Motor #	N3171.181 25-17-4AA-W 30hp
Stator variant	1
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	30 hp
Rated current	36 A
Starting current	231 A
Rated speed	1755 rpm
Power factor	
1/1 Load	0.87
3/4 Load	0.83
1/2 Load	0.73
Efficiency	
1/1 Load	89.0 %
3/4 Load	90.0 %
1/2 Load	90.5 %

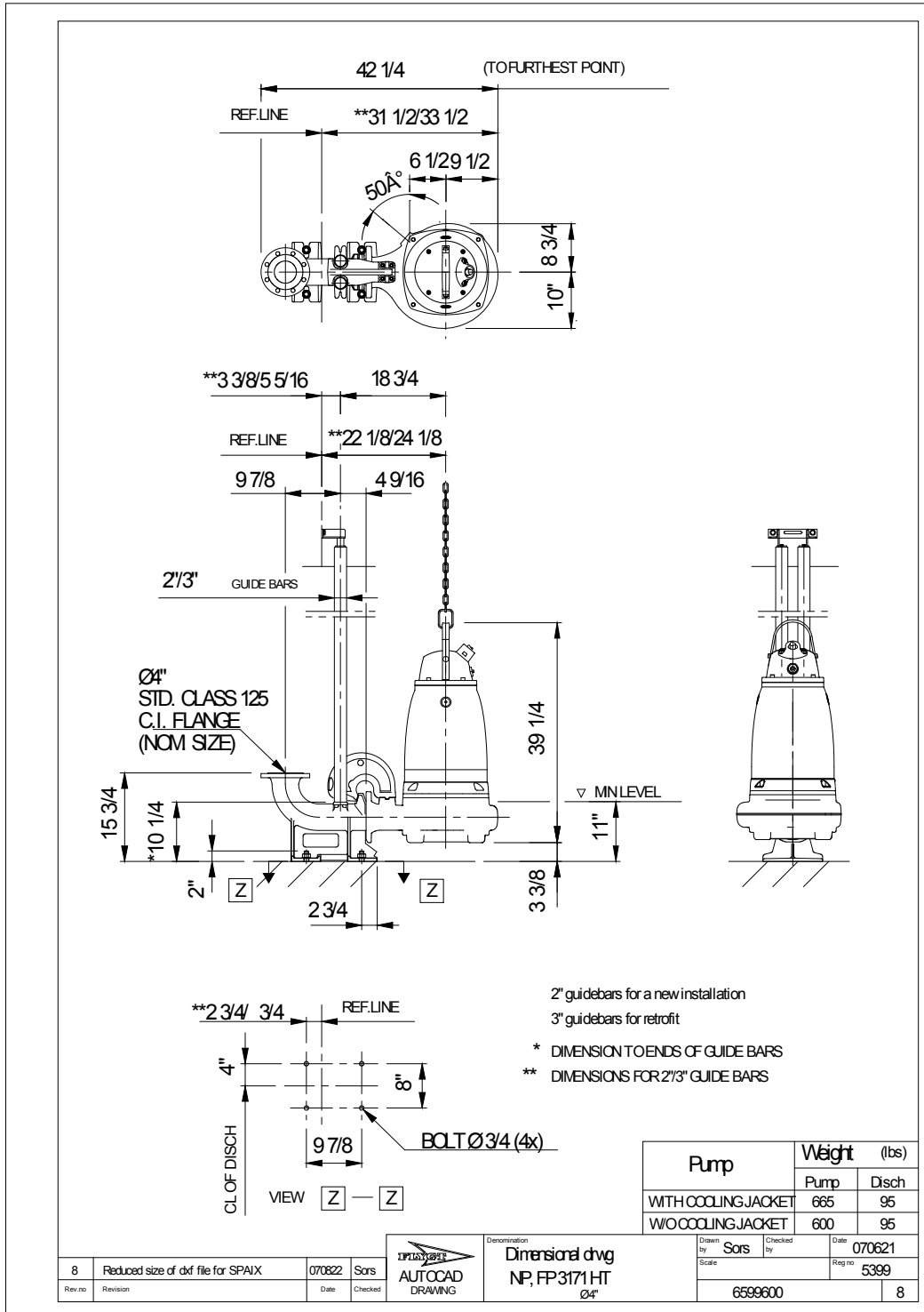
Configuration

Installation: P - Semi permanent, Wet



Project	Project ID	Created by	Created on	Last update
			2013-07-19	

NP 3171 HT 3~ 454
Dimensional drawing



Project	Project ID	Created by	Created on 2013-07-19	Last update
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NP 3171 HT 3~ 454

Performance curve

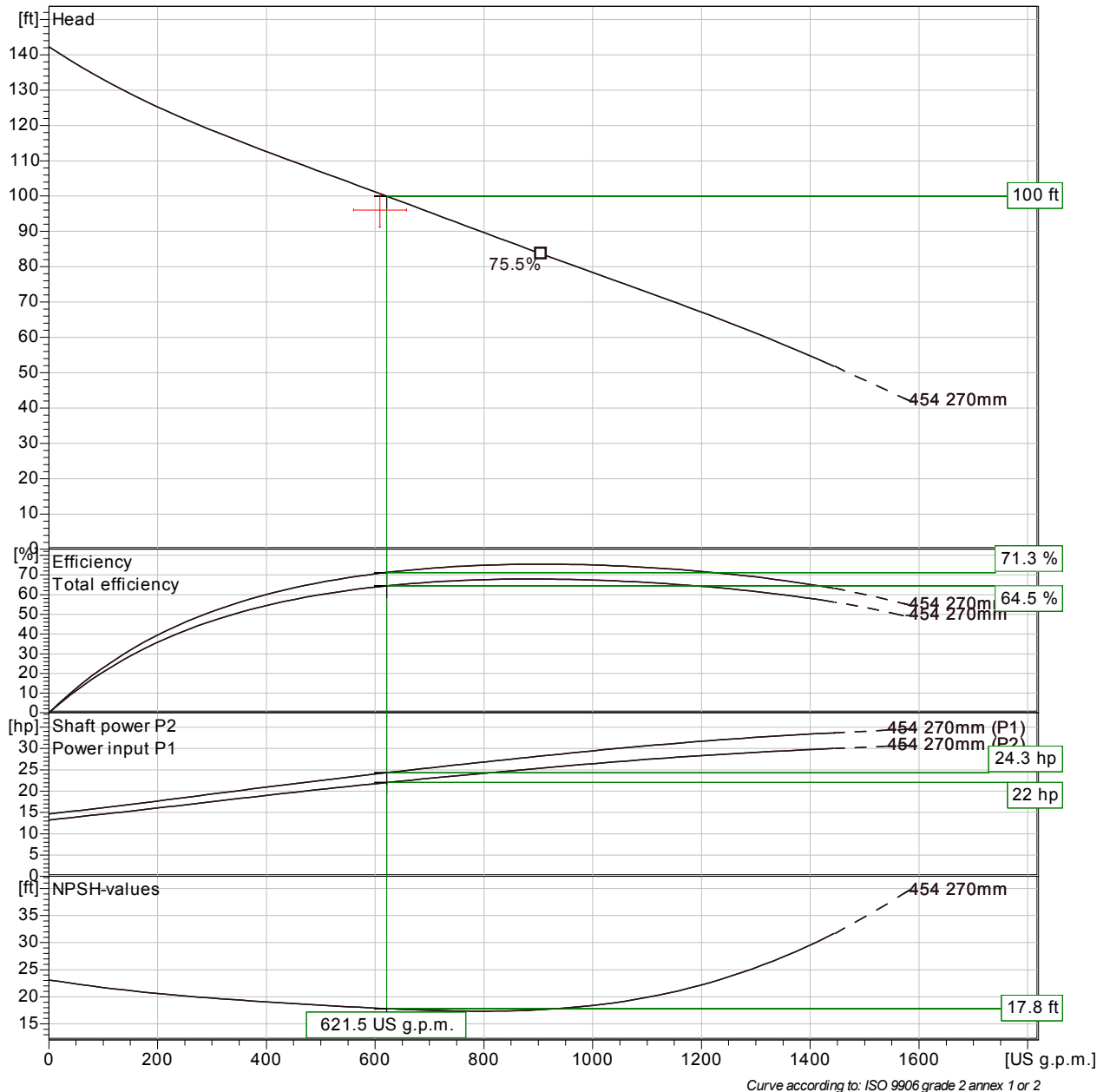
Pump

Outlet width 3 15/16 inch
Inlet diameter 150 mm
Impeller diameter 10 5/8"
Number of blades 2
0 inch

Motor

Motor # N3171.181 25-17-4AA-W 30hp
Stator variant 1
Frequency 60 Hz
Rated voltage 460 V
Number of poles 4
Phases 3~
Rated power 30 hp
Rated current 36 A
Starting current 231 A
Rated speed 1755 rpm

Power factor
1/1 Load 0.87
3/4 Load 0.83
1/2 Load 0.73
Efficiency
1/1 Load 89.0 %
3/4 Load 90.0 %
1/2 Load 90.5 %



Curve according to: ISO 9906 grade 2 annex 1 or 2

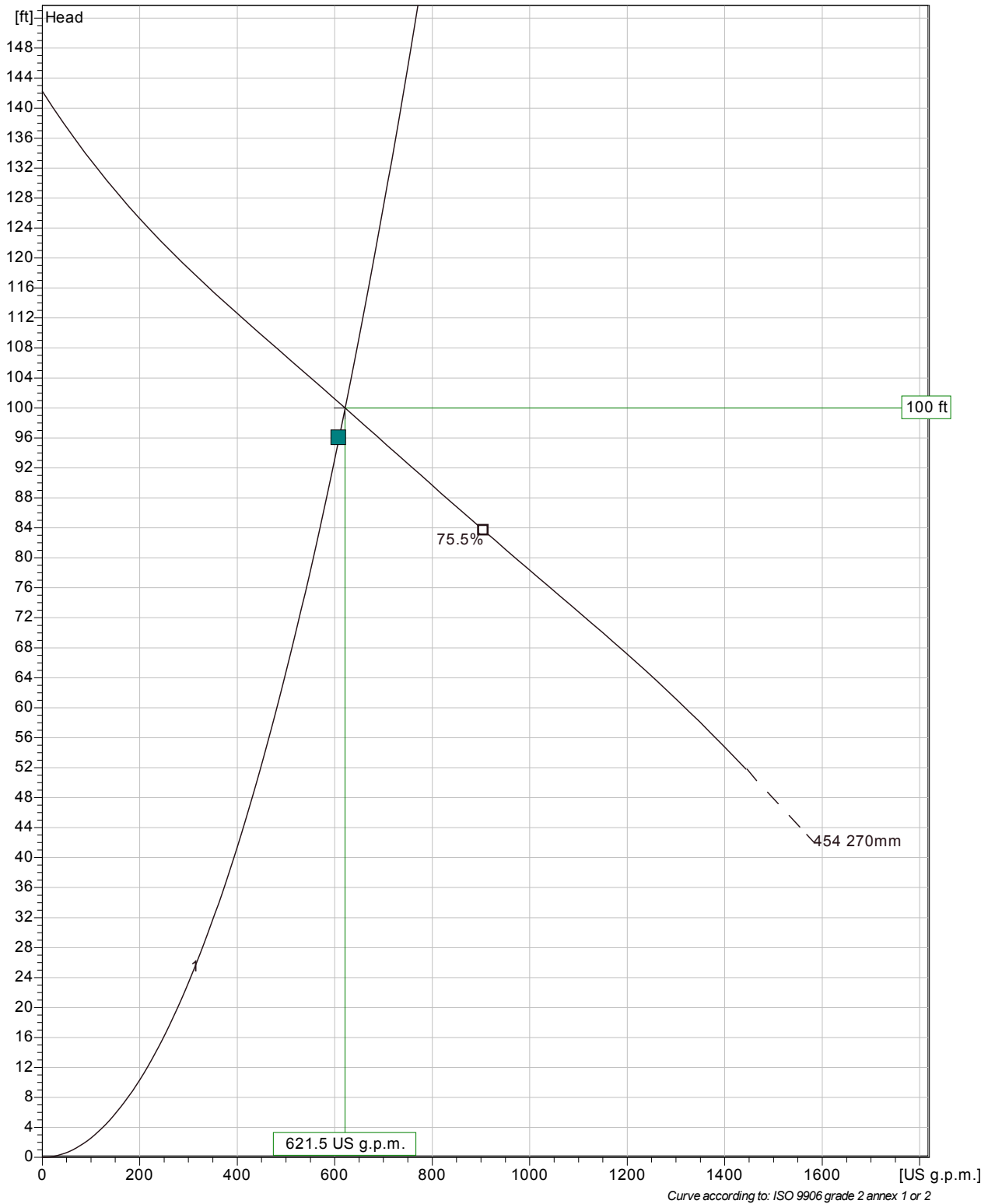
Duty point	
Flow	Head
609 US g.p.m.	96 ft

Shaft power	NPSHre	Hyd eff.	Guarantee
		%	ISO_9906_Grade_2
			No

Project	Project ID	Created by	Created on 2013-07-19	Last update
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NP 3171 HT 3~ 454

Duty Analysis



Pumps running /System	Individual pump			Total					
	Flow	Head	Shaft power	Flow	Head	Shaft power	Hyd. eff.	Specific energy	NPSHre
1	621 US g.p.m.	100 ft	22 hp	621 US g.p.m.	100 ft	22 hp	71.3 %	487 kWh/US MG	17.8 ft

Project	Project ID	Created by	Created on 2013-07-19	Last update
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9.04 PUMP EXTENDED STORAGE

Recommendations:

1. Store pumps upright in a dry location free of extreme temperatures and direct sunlight.
2. To insure that all rotating parts (seals, bearings, and impellers) are free for final installation and start-up the pump impeller should be rotated by hand every month.
3. Use silicone spray or rust inhibiting oil and spray into the lower casing completely coating the impeller and inner lower case. In addition, fully coat the discharge flange face.
4. Protect pump cables from damage and moisture. Cables should be placed so that there is no tension on the cable entry point into the pump. The free end of the cable should be protected from moisture at all times during storage and handling.
5. Never store pumps in the wet well.
6. Never lift the pump by the power cable.
7. Consult pump manufacture for further recommendations for pumps stored longer than one year.

PERIODS OF EXTENDED STORAGE FOR FLYGT PUMPS

For long periods of storage, the pump must be protected against moisture and heat. The impeller should be rotated by hand (for example every month) to prevent the Seal Rings from sticking together.

Storing for 6 Months:

In general, rotating machinery left idle for extended periods of time tend to establish a "set" position due to inaction of the moving parts. Some of these areas may be damaged (especially seals) from the sudden fast breakaway of start-up after a prolonged idle time.

To insure that all rotating parts are free for final installation and start-up, it is good practice to **rotate the Impeller/Propeller by hand once a month**. If the pump is stored for more than a six (6) month period, this rotation is mandatory.

For very long periods of storage it is good practice to relieve the tension on the Cable Entry sealing Grommet by backing off the Cable Entry compression screws slightly. If this is done, it is most important that a clear note be attached as a reminder to:

"Re-Tighten Cable Entry Compression Screws Before Installation"

Note: The backing off of the Cable Entry screws should only be done if the pump is stored in a dry protected area.

Up to 12 months:

In addition to the above it is recommended the use of a silicon spray or rust inhibiting oil be sprayed through the pump outlet and up through the pump inlet so as to coat the Impeller/Propeller and the inside of the Discharge with a protective coating.

Any pump that is stored in a place where the ambient temperature may drop below freezing must be emptied of any water what so ever. It is particular important that the Seal Oil Chamber only contain clean oil (no free water or oil-water emulsion would be allowed).

After a long periods of storage the pump should be fully inspected before it is put into operation. Pay special attention to the Shaft Seal and the Cable Entry making sure the compression screws are tight.

Pumps stored in their original shipping cartons/crates must be periodically removed in order to meet the storage mandate.

A log showing dates in which the proper maintenance was performed is essential and will be required for review in the event a failure occurs after start-up following a prolonged period of storage.

Further considerations that should appear in "the log" when storing product for prolonged periods greater that twelve (12) months:

- 1) Drives should be stored without coolant
- 2) The pump Drives should be stored in the horizontal position
- 3) Impellers should be removed from the Shaft along with the Volute. Shaft should be rotated monthly to protect Seals.
- 4) The Power Cables should be set off of the pump and positioned in such a way that all strain removed from the cables

PERIODS OF EXTENDED STORAGE FOR FLYGT PUMPS

Before installation the operator:

- 1) Inspect the unit for corrosion around the pump and under the Junction Chamber Cap for indications of condensation.
- 2) Reinstall the Impeller in accordance with Flygt procedures
- 3) Fill with new coolant with a mix of 30% mono-propylene glycol and 70% water
- 4) Manually rotate the Impeller after introducing new coolant
- 5) Perform all static electrical checks of the Drive and Motor
- 6) Ensure that all bolts and fasteners on the pump are tight and secure
- 7) Install pump, run for fifteen (15) minutes.
- 8) Remove pump and check oil in Oil Housing. If discolored or contains water, change Shaft Seals as described in Flygt service manual.
- 9) Inspect Stator for moisture as indicated in manual.
- 10) Before returning the pump for operation, check that the direction of rotation is correct.

The ability to keep Flygt product clean, out of the elements and free of rust and/or corrosion should maintain the integrity of the Flygt pump components for extended periods of time and reduce the deterioration probability to a point where it would no longer be a consideration.

In conjunction with the steps outlined above there are three O-Rings that should be replaced (if equipped on the unit) after prolonged periods of storage:

- The two (2) inspection O-Rings and the O-Rings located in the Junction Cover.

By introducing proper maintenance, cleanliness and some common sense in the "equation"... the integrity of a Flygt pump will be long lasting.

Regarding warranty... the standard is... Start-up must occur within one (1) year from ship date unless previous arrangements and costs have been negotiated with the Flygt Quality/Warranty Department.

Quality/Warranty
prodqual@itt.com

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Support Grips

Standard Duty Support

Single Eye, Single Weave, ~~Tin Coated Bronze~~



Single Eye, Closed Mesh*

For permanent support when cable end is available to be installed through grip.

Cable Diameter Range Inches (cm)	Approx. Breaking Strength Lbs. (N)	E Inches (cm)	M Inches (cm)	Catalog Numbers
.50"-.62" (1.27-1.57)	530 (2,357)	7" (17.78)	10" (25.40)	02201013
.63"-.74" (1.60-1.88)	790 (3,514)	8" (20.32)	10" (25.40)	02201014
.75"-.99" (1.90-2.51)	1,020 (4,537)	8" (20.32)	13" (33.02)	02201015
1.00"-1.24" (2.54-3.15)	1,610 (7,161)	9" (22.86)	14" (35.56)	02201017
1.25"-1.49" (3.17-3.78)	1,610 (7,161)	10" (25.40)	15" (38.10)	02201018
1.50"-1.74" (3.81-4.42)	1,610 (7,161)	12" (30.48)	17" (43.18)	02201019
1.75"-1.99" (4.44-5.05)	2,150 (9,563)	14" (35.56)	19" (48.26)	02201020
2.00"-2.49" (5.08-6.32)	3,260 (14,500)	16" (40.64)	21" (53.34)	02201021
2.50"-2.99" (6.35-7.59)	3,260 (14,500)	18" (45.72)	23" (58.42)	02201022
3.00"-3.49" (7.62-8.86)	4,900 (21,795)	21" (53.34)	25" (63.50)	02201023
3.50"-3.99" (8.89-10.13)	4,900 (21,795)	24" (60.96)	27" (68.58)	02201024

Single Eye, Split Mesh, Lace Closing*

For permanent support when cable end is not available.

Cable Diameter Range Inches (cm)	Approx. Breaking Strength Lbs. (N)	E Inches (cm)	M Inches (cm)	Catalog Numbers
.50"-.62" (1.27-1.57)	530 (2,357)	7" (17.78)	10" (25.40)	02202013
.63"-.74" (1.60-1.88)	790 (3,514)	8" (20.32)	10" (25.40)	02202014
.75"-.99" (1.90-2.51)	1,020 (4,537)	8" (20.32)	13" (33.02)	02202015
1.00"-1.24" (2.54-3.15)	1,610 (7,161)	9" (22.86)	14" (35.56)	02202017
1.25"-1.49" (3.17-3.78)	1,610 (7,161)	10" (25.40)	15" (38.10)	02202018
1.50"-1.74" (3.81-4.42)	1,610 (7,161)	12" (30.48)	17" (43.18)	02202019
1.75"-1.99" (4.44-5.05)	2,150 (9,563)	14" (35.56)	19" (48.26)	02202020
2.00"-2.49" (5.08-6.32)	3,260 (14,500)	16" (40.64)	21" (53.34)	02202021
2.50"-2.99" (6.35-7.59)	3,260 (14,500)	18" (45.72)	23" (58.42)	02202022
3.00"-3.49" (7.62-8.86)	4,900 (21,795)	21" (53.34)	25" (63.50)	02202023
3.50"-3.99" (8.89-10.13)	4,900 (21,795)	24" (60.96)	27" (68.58)	02202024

Single Eye, Split Mesh, Rod Closing*

For support when cable end is not available.

Cable Diameter Range Inches (cm)	Approx. Breaking Strength Lbs. (N)	E Inches (cm)	M Inches (cm)	Catalog Numbers
.50"-.62" (1.27-1.57)	790 (3,514)	7" (17.78)	8 1/2" (21.59)	02203013
.63"-.74" (1.60-1.88)	790 (3,514)	8" (20.32)	8 1/2" (21.59)	02203014
.75"-.99" (1.90-2.51)	1,020 (4,537)	8" (20.32)	10 1/2" (26.67)	02203015
1.00"-1.24" (2.54-3.15)	1,610 (7,161)	9" (22.86)	12 1/2" (31.75)	02203017
1.25"-1.49" (3.17-3.78)	1,610 (7,161)	10" (25.40)	14 1/2" (36.83)	02203018
1.50"-1.74" (3.81-4.42)	1,610 (7,161)	12" (30.48)	15 1/2" (39.37)	02203019
1.75"-1.99" (4.44-5.05)	2,150 (9,563)	14" (35.56)	16 1/2" (41.91)	02203020
2.00"-2.49" (5.08-6.32)	3,260 (14,500)	16" (40.64)	19 1/2" (49.53)	02203021
2.50"-2.99" (6.35-7.59)	3,260 (14,500)	18" (45.72)	21 1/2" (54.61)	02203022
3.00"-3.49" (7.62-8.86)	5,750 (25,576)	21" (53.34)	23 1/2" (59.69)	02203023
3.50"-3.99" (8.89-10.13)	5,750 (25,576)	24" (60.96)	25 1/2" (64.77)	02203024

F-Eye length M-Mesh length at nominal diameter

* Change catalog number from 022 to 024 for stainless steel. Consult factory for availability.

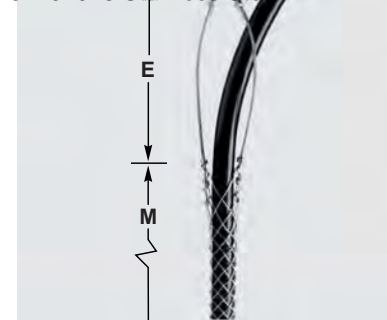
IMPORTANT!

It is important that you read all breaking strength, safety and technical data relating to this product on pages T-43 through T-48.

02401015 Stainless Steel

02401017 Stainless Steel

02401018 Stainless Steel



Single Eye, Closed Mesh



Single Eye, Split Mesh, Lace Closing



Single Eye, Split Mesh, Rod Closing

Flygt Grip-Eye System

The normal method of lowering and raising a CP pump in and out of a lift station is by use of a chain or cable attached to the pump. The length of the chain or cable is dependent on the depth of the station. The average length would probably be between 18 to 20 ft. and in certain cases may be much longer. In many cases, depending on the lifting device (usually a hoist), the operator may have to take a second or third bite on the pump chain in order to lift the pump clear of the station.

An added accessory to the Flygt line is the patented Flygt Grip-Eye System which consists of 33 ft. of nylon line, a short length of high tensile strength stainless steel chain and a forged "Grip-Eye" of wrought alloy steel.

The operation of this positive recovery system is as follows:

1. Connect the small eye of the grip-eye to the end of the hoist cable.
2. Slip the end of the nylon line through the large eye of the grip-eye. The nylon line simply acts as a guide for the grip-eye on its way down to the short length of the pump lifting chain.
3. While keeping the nylon line (guide line) taut, proceed to lower the grip-eye until it is well positioned over the pump lifting chain.
4. Release the tension on the nylon guide line. The lifting chain will now take a position to become engaged in the grip-eye.
5. Gradually take up tension on the hoist cable and the grip-eye will make a positive grip on the pump lifting chain. Continue hoisting until the pump is clear of the station.

Caution: The Grip-Eyes may only be used with the corresponding special Flygt Chain Sling Units.

Grip-Eyes are not warranted if other chains are used.

Refer to the following pages for pump models and correct assembly.

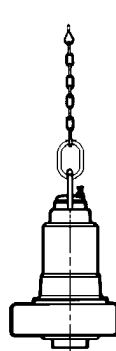
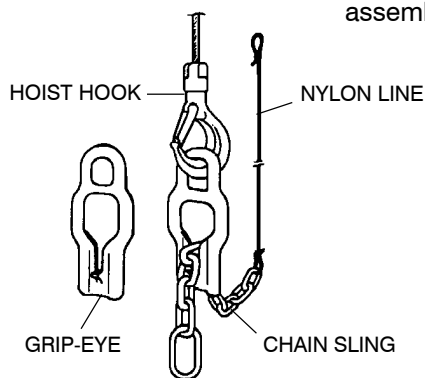


FIG. 1
(Standard) The end ring of the Chain Sling is slipped over the pump lifting handle.

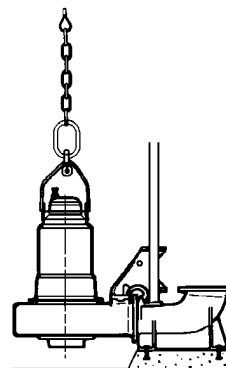


FIG. 2
(Customer to supply extra shackle) A shackle can be used in conjunction with the standard ring should customer choose not to remove and replace pump handle.

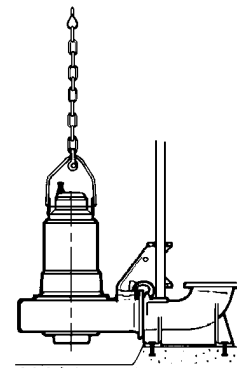


FIG. 3
(Standard) This type comes with a shackle as part of the Chain Sling for connecting to pump lifting handle.

**END
OF
SECTION**

10. LIQUID LEVEL SENSORS

This section provides the information pertaining to the level sensing for this project.

This section is structured as follows:

10.01 PRIMARY LEVEL SENSOR DATA SHEETS

10.02 SECONDARY LEVEL SENSOR DATA SHEETS

Level Measurement

Continuous level measurement – Ultrasonic transducers

Echomax XPS and XCT

Overview



Echomax XPS/XCT transducers use ultrasonic technology to measure level in a wide range of liquids and solids.

Benefits

- Integral temperature compensation
- Low ringing effect reduces blanking distance
- Optional foam facing for dusty applications
- Self-cleaning and low-maintenance
- Chemically resistant
- Hermetically sealed

Application

The transducers can be fully immersed, are resistant to steam and corrosive chemicals, and can be installed without flanges.

The XPS series offers versions for various measuring ranges up to 40 m (130 ft) and up to a max. temperature of 95 °C (203 °F).

The XCT series can be used in applications at higher temperatures to measure level up to a distance of 12 m (40 ft) and at a max. temperature of 95 °C (203 °F).

During operation, the Echomax transducers emit acoustic pulses in a narrow beam. The level monitor measures the propagation time between pulse emission and its reflection (echo) to calculate the distance.

Level Measurement

Continuous level measurement – Ultrasonic transducers

Echomax XPS and XCT

Technical specifications

Input	XPS-10 (standard and F models)	XPS-15 (standard and F models)	XPS-30	XPS-40	XCT-8 (standard and sanitary models)	XCT-12
Measuring range	0.3 ... 10 m (1 ... 33 ft)	Standard: 0.3 ... 15 m (1 ... 50 ft) Flanged: 0.45 ... 15 m (1.5 ... 50 ft)	0.6 ... 30 m (2 ... 100 ft)	0.9 ... 40 m (3 ... 130 ft)	0.6 ... 8 m (2 ... 26 ft)	0.6 ... 12 m (2 ... 40 ft)
Output						
Frequency	44 kHz	44 kHz	30 kHz	22 kHz	44 kHz	44 kHz
Beam angle	12°	6°	6°	6°	12°	6°
Environmental						
Location	Indoors/outdoors					
Ambient temperature	Standard: -40 ... +95 °C (-40 ... +203 °F) F: -20 ... +95 °C (-4 ... +203 °F)				Standard: -40 ... +145 °C (-40 ... +293 °F) Sanitary: -40 ... +125 °C (-40 ... +260 °F)	-40 ... +145 °C (-40 ... +293 °F)
Pollution degree	4					
Pressure	8 bar g (120 psi g) Flanged: 0.5 bar g (7.25 psi g)	8 bar g (120 psi g) Flanged: 0.5 bar g (7.25 psi g)	0.5 bar g (7.25 psi g) Flanged: 0.5 bar g (7.25 psi g)	0.5 bar g (7.25 psi g)	Standard: 4 bar g (60 psi g): -40 ... +138 °C (-40 ... +280 °F) Standard: 8 bar g (120 psi g): -40 ... +95 °C (-40 ... +203 °F) Flanged: 0.5 bar g (7.25 psi g) Sanitary: XCT-8: 0.5 bar g (7.25 psi g)	
Design						
Weight	0.8 kg (1.8 lbs)	1.3 kg (2.8 lbs) Flanged: 2 kg (4.4 lbs)	4.3 kg (9.5 lbs)	8 kg (18 lbs)	0.8 kg (1.7 lbs)	1.3 kg (2.8 lbs)
Power supply	Operation of transducer only with approved Siemens Milltronics controllers					
Material	Standard: PVDF Flanged: PVDF with CPVC flange Option: PTFE face with CPVC flange	Standard: PVDF Flanged: PVDF with CPVC flange Option: PTFE face with CPVC flange	Standard: PVDF Flanged: PVDF with CPVC flange Option: PTFE face with CPVC flange	PVDF	Standard: PVDF Options: DERAKANE flange; PTFE face with universal PVDF flange	
Color	Standard: blue F: gray	Standard: blue F: gray	blue	blue	white	
Process connection	Standard: 1" NPT or 1" BSPT F: 1" NPT	Standard: 1" NPT or 1" BSPT F: 1" NPT	1.5" universal thread (NPT or BSPT)		1" NPT or R 1" (BSPT), EN 10226	
Degree of protection	IP66/68		IP66/68	IP66/68	IP66/68	IP66/68
Cable	2 wire twisted pair/braided and foil shielded 0.5 mm ² (20 AWG) PVC jacket				2 wire twisted pair/braided and foil shielded 0.5 mm ² (20 AWG) silicone jacket	
Separation	Max. 365 m (1200 ft)					
Certificates and approvals	Standard: CE ¹⁾ , CSA, FM, ATEX II 2GD F: FM Class I, Div 1, Groups A, B, C and D, Class II Div 1, Groups E, F and G, Class III	Standard: CE ¹⁾ , CSA, FM, ATEX II 2GD F: FM Class I, Div 1, Groups A, B, C and D, Class II Div 1, Groups E, F and G, Class III	CE ¹⁾ , CSA, FM, ATEX II 2G 1D	CE ¹⁾ , CSA, FM, ATEX II 2G 1D	Standard: CE ¹⁾ , CSA, FM, ATEX II 2GD Sanitary: CE, CTICK, CSA _{US/C}	CE ¹⁾ , CSA, FM, ATEX II 2GD

¹⁾ EMC certificate available on request.

Level Measurement

Continuous level measurement – Ultrasonic transducers

Echomax XPS and XCT

Selection and Ordering data	Order No.	Selection and Ordering data	Order code
Echomax XPS-10 ultrasonic transducer High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. Measuring range: min. 0.3 m, max. 10 m	C) 7ML1115-0	Further designs Please add "-Z" to Order No. and specify Order code(s). Acrylic coated, stainless steel tag [13 x 45 mm Stainless steel tag [69 x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 27 characters) specify in plain text	Y15
Mounting thread and facing 1" NPT [(Taper), ANSI/ASME B1.20.1] 1" NPT [(Taper), ANSI/ASME B1.20.1] with foam facing ¹⁾ 1" NPT [(Taper), ANSI/ASME B1.20.1] with PTFE facing ²⁾ R 1" [(BSPT), EN 10226] R 1" [(BSPT), EN 10226] with foam facing ¹⁾ R 1" [(BSPT), EN 10226] with PTFE facing ²⁾	0 1 2 3 4 5	Operating Instructions Quick Start guide, multi-language C) 7ML1998-5QM82 Applications Guidelines, multi-language C) 7ML1998-5HV61 Note: The Applications Guidelines should be ordered as a separate line item on the order. This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.	Order No.
Cable length 5 m (16.40 ft) 10 m (32.81 ft) 30 m (98.43 ft) 50 m (164.04 ft) 100 m (328.08 ft)	B C E F K	Accessories Tag, stainless steel with hole, 12 x 45 mm (0.47 x 1.77"), one text line for fastening on sensors Submergence shield kit Easy Aimer 2, with 3/4" x 1" NPT PVC coupling Easy Aimer 2, aluminum with M20 adapter and 1" and 1 1/2" BSPT aluminum couplings Easy Aimer 304, with stainless steel coupling Easy Aimer 304, with M20 adapter and 1" and 1 1/2" BSPT 304 SS couplings Universal box bracket, mounting kit Channel bracket, wall mount Extended channel bracket, wall mount Channel bracket, floor mount Extended channel bracket, floor mount Bridge channel bracket, floor mount (see Mounting Brackets on page 5/198 for more information)	7ML1930-1BJ 7ML1830-1BH 7ML1830-1AQ 7ML1830-1AX 7ML1830-1AU 7ML1830-1GN 7ML1830-1BK 7ML1830-1BL 7ML1830-1BM 7ML1830-1BN 7ML1830-1BP 7ML1830-1BQ
Mounting flange None 3" ASME, 150 lb, flat faced 4" ASME, 150 lb, flat faced 6" ASME, 150 lb, flat faced 8" ASME, 150 lb, flat faced DN 80, PN 10/16, Type A, flat faced DN 100, PN 10/16, Type A, flat faced DN 150, PN 10/16, Type A, flat faced JIS10K3B Style JIS10K4B Style JIS10K6B Style (Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5 or EN 1092-1, or JIS B 2220 standard.)	A C D E F G J L M P R	1" NPT locknut, plastic 1" BSPT locknut, plastic C) Subject to export regulations AL: N, ECCN: EAR99.	7ML1830-1DS 7ML1830-1DR
Approvals ATEX II 2 GD, FM Class I Div. 2, SAA Class I CSA Class I Div. 1 ³⁾	3 4		

1) Not available with flanged versions

2) Available with flanged versions only

3) Valid with mounting thread and facing options 0 to 2 only

C) Subject to export regulations AL: N, ECCN: EAR99.

Level Measurement

Continuous level measurement – Ultrasonic transducers

Echomax XPS and XCT

Selection and Ordering data

Echomax XPS-10F ultrasonic transducer
High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor.
Measuring range: min. 0.3 m, max. 10 m

Mounting thread and facing

1" NPT [(Taper), ANSI/ASME B1.20.1]

Cable length

5 m (16.40 ft)
10 m (32.81 ft)
30 m (98.43 ft)
50 m (164.04 ft)
100 m (328.08 ft)

Mounting flange, flush mount

None

3" ASME, 150 lb, flat faced

4" ASME, 150 lb, flat faced

6" ASME, 150 lb, flat faced

8" ASME, 150 lb, flat faced

(Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5, or EN 1092-1, or JIS B 2220 standard.)

Approvals

FM Class I Div. 1

C) Subject to export regulations AL: N, ECCN: EAR99.

Order No.

C) 7ML1170-

0

1

B

C

D

E

F

A

B

C

D

E

1

Selection and Ordering data

Order code

Further designs

Please add "-Z" to Order No. and specify Order code(s).

Acrylic coated, stainless steel tag [13 x 45 mm

Stainless steel tag [69 x 50 mm (2.71 x 1.97")]:

Measuring-point number/identification (max. 27 characters) specify in plain text

Y15

Operating Instructions

Order No.

Quick Start guide, multi-language

C) 7ML1998-1DU01

Applications Guidelines, multi-language

C) 7ML1998-5HV61

Note: The Applications Guidelines should be ordered as a separate line item on the order.

This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.

Accessories

Tag, stainless steel with hole, 12 x 45 mm

(0.47 x 1.77"), one text line for fastening on sensors

7ML1930-1BJ

Submergence shield kit

7ML1830-1BH

Easy Aimer Z, with 3/4" x 1" NPT PVC coupling

7ML1830-1AQ

Easy Aimer 304, with stainless steel coupling

7ML1830-1AU

Universal box bracket, mounting kit

7ML1830-1BK

Channel bracket, wall mount

7ML1830-1BL

Extended channel bracket, wall mount

7ML1830-1BM

Channel bracket, floor mount

7ML1830-1BN

Extended channel bracket, floor mount

7ML1830-1BP

Bridge channel bracket, floor mount (see Mounting Brackets on page 5/198 for more information)

7ML1830-1BQ

1" NPT locknut, plastic

7ML1830-1DS

C) Subject to export regulations AL: N, ECCN: EAR99.

5

Level Measurement

Continuous level measurement – Ultrasonic transducers

Echomax XPS and XCT

Selection and Ordering data	Order No.	Selection and Ordering data	Order code
Echomax XPS-15 ultrasonic transducer High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. Measuring range: min. 0.3 m, max. 15 m	C) 7ML1118-0	Further designs Please add "-Z" to Order No. and specify Order code(s). Acrylic coated, stainless steel tag [13 x 45 mm Stainless steel tag [69 x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 27 characters) specify in plain text	Y15
Mounting thread and facing 1" NPT [(Taper), ANSI/ASME B1.20.1] 1" NPT [(Taper), ANSI/ASME B1.20.1] with foam facing ¹⁾ 1" NPT [(Taper), ANSI/ASME B1.20.1] with PTFE facing ²⁾ R 1" [(BSPT), EN 10226] R 1" [(BSPT), EN 10226] with foam facing ¹⁾ R 1" [(BSPT), EN 10226] with PTFE facing ²⁾	0 1 2 3 4 5	Operating Instructions Quick Start guide, multi-language C) 7ML1998-5QM82 Applications Guidelines, multi-language C) 7ML1998-5HV61 Note: The Applications Guidelines should be ordered as a separate line item on the order. This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.	Order No.
Cable length 5 m (16.40 ft) 10 m (32.81 ft) 30 m (98.43 ft) 50 m (164.04 ft) 100 m (328.08 ft)	B C E F K	Accessories Tag, stainless steel with hole, 12 x 45 mm (0.47 x 1.77"), one text line for fastening on sensors Submergence shield kit Universal box bracket, mounting kit Channel bracket, wall mount Extended channel bracket, wall mount Channel bracket, floor mount Extended channel bracket, floor mount Bridge channel bracket, floor mount (see Mounting Brackets on page 5/198 for more information) 1" NPT locknut, plastic 1" BSPT locknut, plastic Easy Aimer 2, with ¾" x 1" NPT PVC coupling Easy Aimer 2, aluminum with M20 adapter and 1" and 1½" BSPT aluminum couplings Easy Aimer 304 with stainless steel coupling Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings	7ML1930-1BJ 7ML1830-1BJ 7ML1830-1BK 7ML1830-1BL 7ML1830-1BM 7ML1830-1BN 7ML1830-1BP 7ML1830-1BQ 7ML1830-1DS 7ML1830-1DR 7ML1830-1AQ 7ML1830-1AX 7ML1830-1AU 7ML1830-1GN
Mounting flange None 6" ASME, 150 lb, flat faced 8" ASME, 150 lb, flat faced DN 150, PN 10/16, Type A, flat faced DN 200, PN 10/16, Type A, flat faced JIS10K 6B JIS10K 8B (Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5 or EN 1092-1, or JIS B 2220 standard.)	A D E J K N P		
Approvals ATEX II 2GD, FM Class I Div. 2, SAA Class I CSA Class I Div. 1 ³⁾	3 4		
¹⁾ Not available with flanged versions ²⁾ Available with flanged versions only ³⁾ Available with mounting options 0 to 2 only C) Subject to export regulations AL: N, ECCN: EAR99.			
			C) Subject to export regulations AL: N, ECCN: EAR99.

Level Measurement

Continuous level measurement – Ultrasonic transducers

Echomax XPS and XCT

Selection and Ordering data	Order No.
Echomax XPS-15F ultrasonic transducer High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. Measuring range: min. 0.3 m, max. 15 m	C) 7ML1171-0
Mounting thread and facing 1" NPT [(Taper), ANSI/ASME B1.20.1]	1
Cable length 5 m (16.40 ft) 10 m (32.81 ft) 30 m (98.43 ft) 50 m (164.04 ft) 100 m (328.08 ft)	B C D E F
Mounting flange, flush mount None 6" ASME, 150 lb, flat faced 8" ASME, 150 lb, flat faced (Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5, or EN 1092-1, or JIS B 2220 standard.)	A B C
Approvals FM Class I Div. 1	1
C) Subject to export regulations AL: N, ECCN: EAR99.	

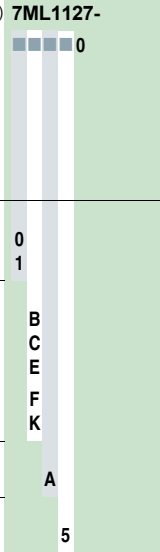
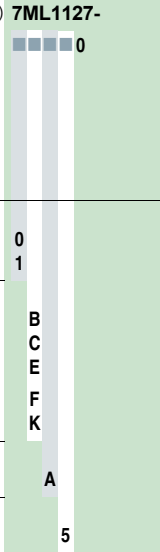
Selection and Ordering data	Order No.
Echomax XPS-30 ultrasonic transducer High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. 1½" universal thread compatible with 1½" NPT and R 1½" [(BSPT), EN 10226] Measuring range: min. 0.6 m (1.97 ft), max. 30 m (98.43 ft)	C) 7ML1123 -0
Mounting thread and facing 1½" universal thread 1½" universal thread, foam facing ¹⁾ 1½" universal thread, PTFE facing ²⁾	0 1 2
Cable length 5 m (16.40 ft) 10 m (32.81 ft) 30 m (98.43 ft) 50 m (164.04 ft) 100 m (328.08 ft)	B C E F K
Mounting flange None 6" ASME, 150 lb, flat faced 8" ASME, 150 lb, flat faced DN 150, PN 10/16, Type A, flat faced DN 200, PN 10/16, Type A, flat faced	A D E J K N P
JIS10K 6B JIS10K 8B (Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5 or EN 1092-1, or JIS B 2220 standard.)	5
Approvals ATEX II 2G 1D, FM Class I Div 2, SAA	
¹⁾ Not available with flanged versions ²⁾ Available with flanged versions only C) Subject to export regulations AL: N, ECCN: EAR99.	

Selection and Ordering data	Order code
Further designs Please add "-Z" to Order No. and specify Order code(s). Acrylic coated, stainless steel tag [13 x 45 mm Stainless steel tag [69 x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 27 characters) specify in plain text	Y15
Operating Instructions Quick Start guide, multi-language Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order. This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.	Order No. C) 7ML1998-1DU01 C) 7ML1998-5HV61
Accessories Tag, stainless steel with hole, 12 x 45 mm (0.47 x 1.77"), one text line for fastening on sensors Submergence shield kit Universal box bracket, mounting kit Channel bracket, wall mount Extended channel bracket, wall mount Channel bracket, floor mount Extended channel bracket, floor mount Bridge channel bracket, floor mount (see Mounting Brackets on page 5/198 for more information) 1" NPT locknut, plastic Easy Aimer 2, with ¾" x 1" NPT PVC coupling Easy Aimer 304 with stainless steel coupling	7ML1930-1BJ 7ML1830-1BJ 7ML1830-1BK 7ML1830-1BL 7ML1830-1BM 7ML1830-1BN 7ML1830-1BP 7ML1830-1BQ 7ML1830-1DS 7ML1830-1AQ 7ML1830-1AU
C) Subject to export regulations AL: N, ECCN: EAR99.	

Level Measurement

Continuous level measurement – Ultrasonic transducers

Echomax XPS and XCT

Selection and Ordering data	Order code	Selection and Ordering data	Order No.
Further designs Please add "-Z" to Order No. and specify Order code(s)		Echomax XPS-40 ultrasonic transducer High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. 1½" universal thread compatible with 1½" NPT and R 1½" [(BSPT), EN 10226] Measuring range: min. 0.9 m (2.95 ft), max. 40 m (131.23 ft)	C) 7ML1127-0 
Acrylic coated, stainless steel tag [13 x 45 mm] Stainless steel tag [69 x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 27 characters) specify in plain text	Y15	Mounting thread and facing 1½" universal thread 1½" universal thread, foam facing	
Operating Instructions Quick Start guide, multi-language Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order. This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.	Order No. C) 7ML1998-5QM82 C) 7ML1998-5HV61	Cable length 5 m (16.40 ft) 10 m (32.81 ft) 30 m (98.43 ft) 50 m (164.04 ft) 100 m (328.08 ft)	
Accessories Tag, stainless steel with hole, 12 x 45 mm (0.47 x 1.77"), one text line for fastening on sensors 1½" BSPT locknut, plastic Easy Aimer 2, 1½" NPT galvanized coupling Easy Aimer 304, NPT with 1½" coupling Easy Aimer 2, aluminum with M20 adapter and 1" and 1½" BSPT aluminum couplings Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings C) Subject to export regulations AL: N, ECCN: EAR99.	7ML1930-1BJ 7ML1830-1DP 7ML1830-1AN 7ML1830-1AT 7ML1830-1AX 7ML1830-1GN	Mounting flange None Approvals ATEX II 2G 1D, FM Class I Div 2, SAA C) Subject to export regulations AL: N, ECCN: EAR99	
		Selection and Ordering data	Order code
Further designs Please add "-Z" to Order No. and specify Order code(s).		Echomax XPS-40 ultrasonic transducer High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. 1½" universal thread compatible with 1½" NPT and R 1½" [(BSPT), EN 10226] Measuring range: min. 0.9 m (2.95 ft), max. 40 m (131.23 ft)	C) 7ML1127-0 
Acrylic coated, stainless steel tag [13 x 45 mm] Stainless steel tag [69 x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 27 characters) specify in plain text	Y15	Mounting thread and facing 1½" universal thread 1½" universal thread, foam facing	
Operating Instructions Quick Start guide, multi-language Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order. This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.	Order No. C) 7ML1998-5QM82 C) 7ML1998-5HV61	Cable length 5 m (16.40 ft) 10 m (32.81 ft) 30 m (98.43 ft) 50 m (164.04 ft) 100 m (328.08 ft)	
Accessories Tag, stainless steel with hole, 12 x 45 mm (0.47 x 1.77"), one text line for fastening on sensors 1½" BSPT locknut, plastic Easy Aimer 2, 1½" NPT galvanized coupling Easy Aimer 304, NPT with 1½" coupling Easy Aimer 2, aluminum with M20 adapter and 1" and 1½" BSPT aluminum couplings Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings C) Subject to export regulations AL: N, ECCN: EAR99. J) Subject to export regulations AL: 91999, ECCN: EAR99.	7ML1930-1BJ 7ML1830-1DP 7ML1830-1AN 7ML1830-1AT 7ML1830-1AX 7ML1830-1GN	Mounting flange None Approvals ATEX II 2G 1D, FM Class I Div 2, SAA C) Subject to export regulations AL: N, ECCN: EAR99. J) Subject to export regulations AL: 91999, ECCN: EAR99.	

Level Measurement

Continuous level measurement – Ultrasonic transducers

Echomax XPS and XCT

Selection and Ordering data	Order No.	Selection and Ordering data	Order code
Echomax XCT-8 ultrasonic transducer High frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. Ambient temperatures up to 145 °C (293 °F) Measuring range: min. 0.6 m (2 ft), max. 8 m (26 ft)	C) 7ML1132-0	Further designs Please add "-Z" to Order No. and specify Order code(s). Acrylic coated, stainless steel tag [13 x 45 mm Stainless steel tag [69 x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 27 characters) specify in plain text	Y15
Mounting thread and facing 1" NPT [(Taper), ANSI/ASME B1.20.1] 1" NPT [(Taper), ANSI/ASME B1.20.1], PTFE facing ¹⁾ R 1" [(BSPT), EN 10226] R 1" [(BSPT), EN 10226], PTFE facing ¹⁾	0 1 2 3	Operating Instructions Quick start manual, multi-language XCT-8 with Sanitary Flange, multi-language Note: This manual should be ordered as a separate line item with Mounting Option V.	Order No. C) 7ML1998-5QM82 C) 7ML1998-5HX62
Cable length 1 m (3.28 ft) 5 m (16.40 ft) 10 m (32.81 ft) 30 m (98.43 ft) 50 m (164.04 ft) 100 m (328.08 ft)	A B C E F K	Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order. This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.	C) 7ML1998-5HV61
Mounting flange None 3" ASME, 150 lb, flat faced 4" ASME, 150 lb, flat faced 6" ASME, 150 lb, flat faced DN 80, PN 10/16, Type A, flat faced DN 100, PN 10/16, Type A, flat faced DN 150, PN 10/16, Type A, flat faced JIS10K 3B JIS10K 4B JIS10K 6B (Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5 or EN 1092-1 or JIS B 2220 standard.) 3" universal ^{2) 3)} 4" universal ^{4) 3)} 6" universal ^{5) 3)} 4" sanitary flange ⁶⁾	A C D E G J L M P R S T U V	Accessories Tag, stainless steel with hole, 12 x 45 mm (0.47 x 1.77"), one text line for fastening on sensors Submersible hood Universal box bracket, mounting kit Channel bracket, wall mount Extended channel bracket, wall mount Channel bracket, floor mount Extended channel bracket, floor mount Bridge channel bracket, floor mount (see Mounting Brackets on page 5/198 for more information) 1" NPT locknut, plastic 1" BSPT locknut, plastic Easy Aimer 304 with stainless steel coupling Easy Aimer, aluminum, with M20 adapter and ¾ ... 1" and 1½" BSPT couplings Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings Sanitary, 4" mounting clamp Sanitary, isolating gasket	7ML1930-1BJ 7ML1830-1BH 7ML1830-1BK 7ML1830-1BL 7ML1830-1BM 7ML1830-1BN 7ML1830-1BP 7ML1830-1BQ 7ML1830-1DS 7ML1830-1DR 7ML1830-1AU 7ML1830-1AX 7ML1830-1GN 7ML1830-1BR J) 7ML1830-1KC
Approvals ATEX II 2GD, FM Class I, Div. 2, SAA CSA Class I Div. 1 ⁷⁾ CE, C-TICK, CSA _{US/C} ⁸⁾	4 5 7		

¹⁾ Available with flange versions S, T, U and, V only

²⁾ Universal fits 3" ASME, DN 80, JIS 10K3B style

³⁾ Available for mounting thread and facing options 1 and 3 only

⁴⁾ Universal fits 4" ASME, DN 100, JIS 10K4B style

⁵⁾ Universal fits 6" ASME, DN 150, JIS 10K6B style

⁶⁾ Available with Mounting thread and facing options 1 and 3, and approval option 7 only

⁷⁾ Available with mounting thread and facing option 0 only

⁸⁾ Available with 4" mounting flange option V only

C) Subject to export regulations AL: N, ECCN: EAR99.

C) Subject to export regulations AL: N, ECCN: EAR99.

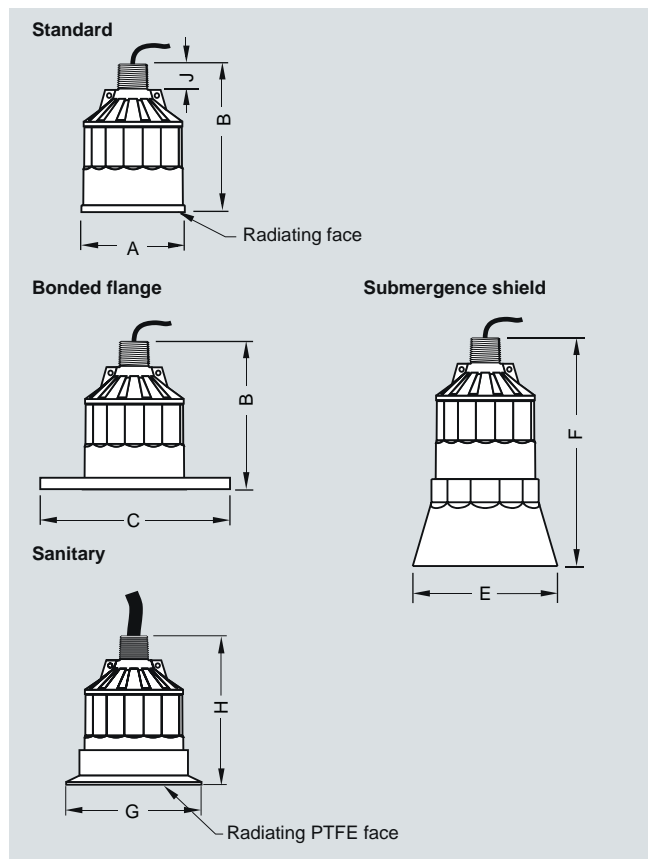
J) Subject to export regulations AL: 91999, ECCN: EAR99.

Level Measurement

Continuous level measurement – Ultrasonic transducers

Echomax XPS and XCT

Dimensional drawings

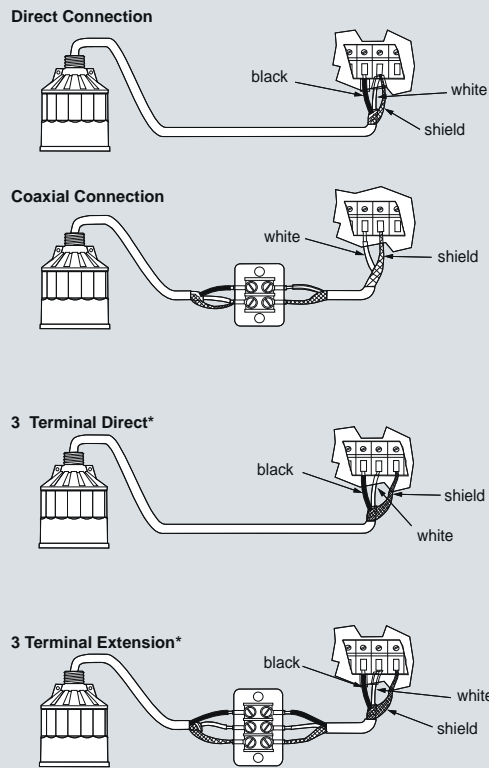


XPS and XCT ultrasonic transducer, dimensions, in mm (inch)

Version	XPS-10	XPS-15	XPS-30	XPS-40
A	88 mm (3.464")	121 mm (4.764")	175 mm (6.890")	206 mm (8.110")
B	122 mm (4.803")	132 mm (5.197")	198 mm (7.795")	229 mm (9.016")
C	According to ASME, DIN and JIS			n/a
E	124 mm (4.882")	158 mm (6.220")	n/a	n/a
F	152 mm (5.984")	198 mm (7.795")	n/a	n/a
J	28 mm (1.1")	28 mm (1.1")	28 mm (1.1")	28 mm (1.1")

Version	XCT-8	XCT-12
A	88 mm (3.464")	121 mm (4.764")
B	122 mm (4.803")	132 mm (5.197")
C	According to ASME, DIN and JIS	
E	n/a	n/a
F	n/a	n/a
G	Sanitary version: 119 mm (4.68")	n/a
H	Sanitary version: 122 mm (4.8")	n/a
J	28 mm (1.1")	28 mm (1.1")

Schematics



* For SITRANS LUC500, MultiRanger 100/200, HydroRanger 200

Mounting

Make particularly sure that the radiating face of the transducer is protected from damage. Mount the transducer so that it is above the maximum material level by at least the blanking value. On liquid applications, the transducer must be mounted so that the axis of transmission is perpendicular to the liquid surface. On solids applications, a Milltronics Easy Aimer should be used to facilitate aiming the transducer. Consider the optional temperature sensor when mounting the transducer.

Interconnection

Do not route cable openly or near high voltage or current runs, contactors and SCR control drives. For optimum isolation against electrical noise, run cable separately in a grounded metal conduit. Seal all thread connections to prevent ingress of moisture.

XPS and XCT ultrasonic transducer connections

5

Level Measurement

Continuous level measurement – Ultrasonic transducers

Echomax XPS and XCT

Selection and Ordering data

Order No.

Echomax XCT-12 ultrasonic transducer

C) 7ML1136-

High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor.

Ambient temperatures up to 145 °C (293 °F)

Measuring range: min. 0.6 m (2 ft), max. 12 m (40 ft)

Mounting thread and facing

1" NPT [(Taper), ANSI/ASME B1.20.1]

1" NPT [(Taper), ANSI/ASME B1.20.1], PTFE facing, available for flange options U only¹⁾

R 1" [(BSPT), EN 10226]

R 1" [(BSPT), EN 10226], PTFE facing, available for flange options U only¹⁾

Cable length

1 m (3.28 ft)

5 m (16.40 ft)

10 m (32.81 ft)

30 m (98.43 ft)

50 m (164.04 ft)

100 m (328.08 ft)

Mounting flange

None

6" ASME, 150 lb, flat faced

8" ASME, 150 lb, flat faced

DN 150, PN 10/16, Type A, flat faced

DN 200, PN 10/16, Type A, flat faced

JIS10K 6B

JIS10K 8B

(Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5 or EN 1092-1 or JIS B 2220 standard.)

6" universal for 6" ASME, DN 150 or JIS 10K6B style²⁾

Approvals

ATEX II 2GD, FM Class I, Div. 2, SAA

CSA Class I, Div. 1, available with mounting thread and facing option 0 only

¹⁾ Available with universal flanges only

²⁾ For use with mounting thread and facing option 1 and 3 only

C) Subject to export regulations AL: N, ECCN: EAR99.

Selection and Ordering data

Order code

Further designs

Please add "-Z" to Order No. and specify Order code(s).

Acrylic coated, stainless steel tag [13 x 45 mm

Stainless steel tag [69 x 50 mm (2.71 x 1.97")]:

Measuring-point number/identification (max. 27 characters) specify in plain text

Y15

Operating Instructions

Quick start manual, multi-language

C) 7ML1998-5QM82

Applications Guidelines, multi-language

Note: The Applications Guidelines should be ordered as a separate line item on the order.

C) 7ML1998-5HV61

This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.

Accessories

Tag, stainless steel with hole, 12 x 45 mm (0.47 x 1.77"), one text line for fastening on sensors

7ML1930-1BJ

Submergence shield kit

7ML1830-1BJ

Universal box bracket, mounting kit

7ML1830-1BK

Channel bracket, wall mount

7ML1830-1BL

Extended channel bracket, wall mount

7ML1830-1BM

Channel bracket, floor mount

7ML1830-1BN

Extended channel bracket, floor mount

7ML1830-1BP

Bridge channel bracket, floor mount (see Mounting Brackets on page 5/198 for more information)

7ML1830-1BQ

1" NPT locknut, plastic

7ML1830-1DS

1" BSPT locknut, plastic

7ML1830-1DR

Easy Aimer 304 with stainless steel coupling

7ML1830-1AU

Easy Aimer 2, aluminum with M20 adapter and 1" and 1½" BSPT aluminum couplings

7ML1830-1AX

Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings

7ML1830-1GN

C) Subject to export regulations AL: N, ECCN: EAR99.



The NIVA level controller MS 1 is the ideal solution to control liquid levels with limited switching space, e.g. in:

- Pump stations
- Wells
- Pump chambers



The NIVA level controller MS1 is engineered especially for use in sewage works and pumping stations in liquids heavily charged with solid matter such as raw sewage etc. Thanks to the good chemical and thermal properties our level controllers are resistant to lees, uric acid, fecal sewage water, oils, petrol, diesel oil, emulsions, alcohol, fruit acids, and even many chemicals. For use at temperatures up to 80 °C (176 °F). The MS 1 has been submitted for UL certification. Optionally the level controller MS 1 is available with EX-certificate in accordance with EC directive 94/9 (ATEX 95) – see next pages.

Available versions:

Type	Cable	Length (m)	Order-no.
W	TPR/PVC 3 x 0.75	5	40 000105
W	TPR/PVC 3 x 0.75	10	40 000110
W	TPR/PVC 3 x 0.75	20	40 000120
W	TPR/PVC 3 x 0.75	30	40 000130

W = Changeover (SPDT)

Other cable types and lengths are available upon request

Application:

For use in municipal, industrial, commercial and domestic applications.

Electronic connection

Connection of level controllers	Wire		
	grey	black	brown
For emptying a tank	insulate	X	X
For filling a tank	X	insulate	X
Alarm high level	insulate	X	X
Alarm low level	X	insulate	X

Technical data subject to change

Technical data:

Specific weight: 0.95–1.05 or according to specification
 Max. temperature: 80 °C (176 °F)
 Breaking capacity: 1 mA / 4 V - 5 A / 250 V *
 Switch point: 10°
 Protective system: IP 68 / 2 bar
 Equipment group: II
 Cable cross section: 3 x 0.75 mm²
 Height / diameter: 180 / 100 mm (7 in / 3.9 in)
 Housing quality: Polypropylene (PP)
 Housing Colour: Orange
 Cable quality: TPR/PVC
 Cable colour: Orange

* Micro-switch with gold-plated contacts especially for low currents in electronic circuits

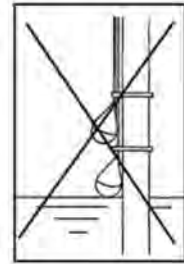
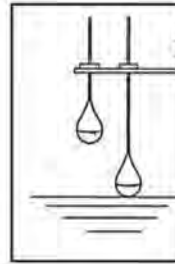
CE
73/23/EEC



1mA/4V-5A/250V

☐ ⚡ +++ μ T80
γ 0,95 - 1,05

MS 1



<p> (GB) Connection of Level Regulators (D) Anschluss der Niveauregler (F) Branchement des régulateurs de niveau (I) Collegamento regolatori di livello (E) Conexión de los reguladores de nivel (P) Conexão dos reguladores de nível (NL) Aansluiting van de niveauregelaar (DK) Tilslutning af niveauregulator (S) Anslutning av nivåregulatorn (N) Forbindelse til nivåregulatoren (FIN) Pinnansäätimien liittäminen (RUS) подсоединение регулятора уровня (PL) Przyłącze regulatorów poziomu (H) A szintszabályozók csatlakoztatása (CZ) Připoj regulátorů hladiny (SK) Připoj regulátorov hladiny (SL) Priključitev regulatorjev nivoja (HR) Cijev za regulator razine (CRO) Cev za spravu za regulisanje nivoa (GR) Σύνδεση ρυθμιστή στάθμης (TR) Seviye regülatörlerinin bağlantısı </p>		<p>① grey grau gris grigio gris cinzento grijs grå grå grå harmaa серый kolor szary szürke šedý sivý siv sivo sivo γκρίζο gri</p>	<p>② black schwarz noir nero negro preto zwart sort svart svart musta чёрный kolor czarny fekete černý čierný črno crni crni μαύρο siyah</p>	<p>③ brown braun brun marrone marrón castanho bruin brun brun brun ruskea коричневый kolor brązowy barna hnědý hnedý rjavo smeđi smeđi καφέ kahverengi</p>
<p> (GB) For emptying a tank (D) Zum Entleeren eines Behälters (F) Pour vider un réservoir (I) Per lo svuotamento (E) Para vaciar un recipiente (P) Para esvaziar um reservatório (NL) Om een reservoir te legen (DK) Til tømning af en beholder (S) För tömning av en behållare (N) For å tomme en beholder (FIN) Säiliön tyhjentämiseen (RUS) для опорожнения резервуара (PL) Opróżnienie pojemnika (H) Egy tartály ürítéséhez (CZ) K vyprázdnění nádrže (SK) K vyprázdneniu nádrže (SL) Za praznjenje posode (HR) Za praznjenje nekog spremnika (CRO) Za praznjenje nekog rezervoara (GR) Για την εκκένωση των περιέκτη (TR) Bir hazneyi/kabi boşaltmak için </p>	<p> Alarm high level Alarm bei hohem Flüssigkeitsstand Alarme au niveau supérieur Allarme di massimo livello Alarma con alto nivel de líquido Alarme de nível máximo Alarm bij een hoog vloeistofpeil Alarm ved høj væskenieau Larm vid hög vätskenivå Alarm ved høyt væskeniå Ylärajahälytys сигнал тревоги при высоком уровне жидкости Alarm w przypadku wysokiego poziomu cieczy Riasztás túl magas töltésszint esetén Poplach při vysokém stavu kapaliny Poplach pri vysokom stave kvapaliny Alarm pri visokem nivoju tekočine Alarm kod visokog stanja tekućine Alarm kod visokog stanja tečnosti Αλάρμ σε πολύ υψηλή στάθμη υγρού Yüksek sıvı seviyesinde alarm </p>	<p> insulate isolieren isoler isolare aislar isolar isoleren isoler isolera isolere eristä изолировать zaizolować szigeteljük izolovat izolovat' izolirati izolirati izolovati μόνωση izole etmek </p>	<p>X</p>	<p>X</p>
<p> (GB) For filling a tank (D) Zum Füllen eines Behälters (F) Pour remplir un réservoir (I) Per il riempimento (E) Para llenar un recipiente (P) Para encher um reservatório (NL) Om een reservoir te vullen (DK) Til fyldning af en beholder (S) För fyllning av en behållare (N) For å fylle en beholder (FIN) Säiliön täyttämiseen (RUS) для наполнения резервуара (PL) Napełnienie pojemnika (H) Egy tartály töltéséhez (CZ) K naplnění nádrže (SK) K naplneniu nádrže (SL) Za polnjenje posode (HR) Za punjenje nekog spremnika (CRO) Za punjenje nekog rezervoara (GR) Για την πλήρωση των περιέκτη (TR) Bir hayneyi/kabi doldurmak için </p>	<p> Alarm low level Alarm bei niedrigem Flüssigkeitsstand Alarme au niveau inférieur Allarme di minimo livello Alarma con bajo nivel de líquido Alarme de nível mínimo Alarm bij een laag vloeistofpeil Alarm ved lav væskenieau Larm vid låg vätskenivå Alarm ved lavt væskeniå Alarajahälytys сигнал тревоги при низком уровне жидкости Alarm w przypadku niskiego poziomu cieczy Riasztás túl alacsony töltésszint esetén Poplach při nízkém stavu kapaliny Poplach pri nízkom stave kvapaliny Alarm pri nizkem nivoju tekočine Alarm kod niskog stanja tekućine Alarm kod niskog stanja tečnosti Αλάρμ σε πολύ χαμηλή στάθμη υγρού Düşük sıvı seviyesinde alarm </p>	<p>X</p>	<p> insulate isolieren isoler isolare aislar isolar isoleren isoler isolera isolere eristä изолировать zaizolować szigeteljük izolovat izolovat' izolirati izolirati izolovati μόνωση izole etmek </p>	<p>X</p>

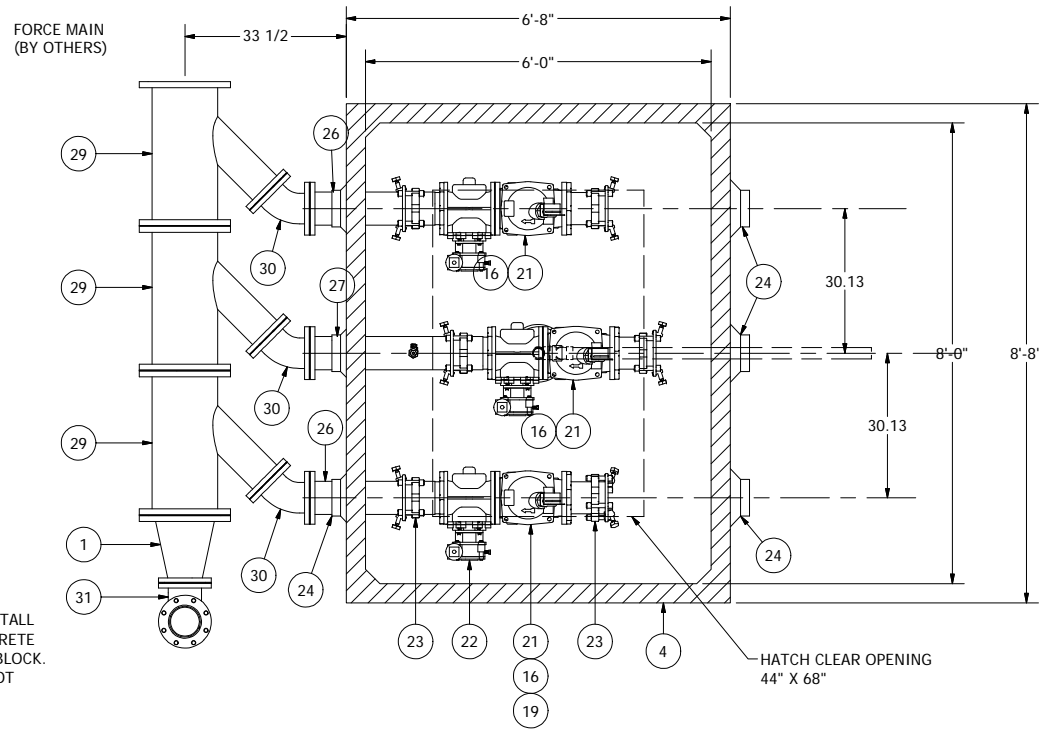
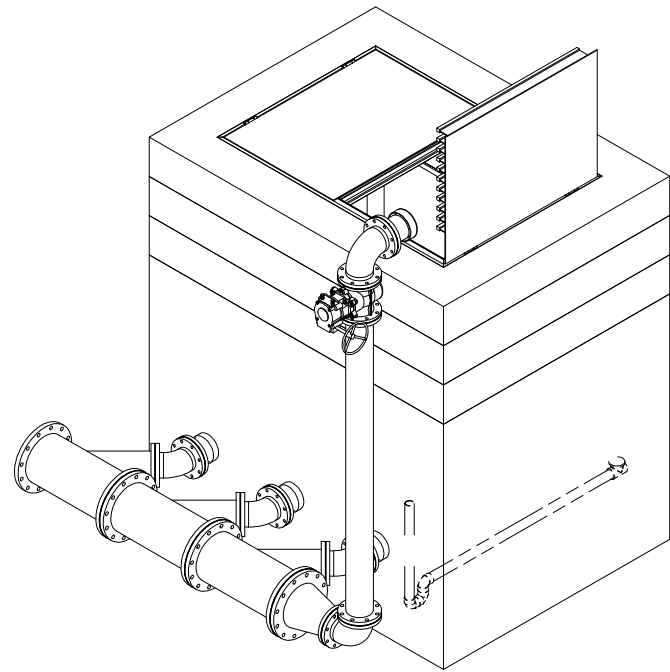
**END
OF
SECTION**

11. VALVE VAULT & ASSOCIATED MECHANICAL

This section provides the information pertaining to the valve vault for this project.

This section is structured as follows:

- 11.01 VALVE VAULT COMPONENT DRAWING(S)
- 11.02 VALVE VAULT PRODUCTION DRAWING
- 11.03 VALVE VAULT HATCH DRAWING
- 11.04 VALVE VAULT WEIGHTS & LIFTING
- 11.05 VALVE VAULT RELATED DATA SHEETS
 - 11.05.1 VAL-MATIC SWING CHECK VALVE
 - 11.05.2 VAL-MATIC PLUG VALVE
 - 11.05.3 COUPLING ROMAC RFCA
 - 11.05.4 KOR-N-SEAL
 - 11.05.5 BARREL JOINT CONSEAL
 - 11.05.6 COATING TNEMEC 61
 - 11.05.7 BALL VALVE
 - 11.05.8 PRESSURE TRANSDUCER



CONTRACTOR TO INSTALL
CAST IN PLACE CONCRETE
THRUST RESTRAINT BLOCK.
(BY CONTRACTOR, NOT
ROMTEC UTILITIES)

Parts List			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
1	1	44-XXXX	REDUCER - CONCENTRIC - 12in X 6in - 150LB - 316SS
2	1	10-XXXX	EXTERIOR COATING - TNEMEC 61
3	1	20-6504	BASE - VV - 687-2
4	2	22-6572	RISER - VV - 687 - 1 FT
5	1	23-5423	HATCH - VV - 687 - H20 - 44 X 68
6	1	24-6505	TOP SLAB - 687 - H20
7	3	25-6531	PIPE STAND - 6in - S89 FLG - NO BASE
8	3	25-6533	PIPE STAND - 6in - S92 SAD - NO BASE
9	2	25-6550	VALVE KEY BRACKET
10	1	25-6605	VALVE KEY - SPECIAL SWIVEL
11	10	40-6253	PIPE - 316SS - 2in SCH40
12	1	40-5095	NIPPLE - BRASS - 1/2in X 2in
13	1	40-XXXX	NIPPLE - 1-4in - BRASS - CLOSE
14	1	40-XXXX	BUSHING - BRASS - 1-2in MALE X 1-4in FEMALE THD
15	1	41-5093	VALVE - BALL - 1/2in BRASS - 1/4 TURN
16	3	41-5108	MECHANICAL INDICATOR - 6in
17	1	41-XXXX	CAM LOCK - 6in MIPTXM - 316SS
18	1	41-XXXX	DUST CAP - 6in 316SS CAMLOCK
19	1	41-6566	BACKFLOW ACTUATOR - 4in & 6in
20	1	41-6568	VALVE - PLUG - 6in - WITH HANDWHEEL
21	3	41-6569	VALVE - SWING CHECK - 6in - 506A
22	3	41-6583	VALVE - PLUG - 6in - GEAR OP
23	6	42-5247	COUPLING - ROMAC - RFCA - 6in FBEC - SS HARDWARE
24	6	43-6113	KOR-N-SEAL - 12in CORE - 6in PIPE
25	1	44-XXXX	FLANGE - 316SS - 6in - COMPANION W-6in TAP
26	2	45-4604	SPOOL - FLG X PE - 6in X 26in - 316SS
27	1	45-XXXX	SPOOL - FLG X PE - 6in X 36in - 316SS
28	1	45-XXXX	SPOOL - FLG X FLG - 6in X 92.25in - 316SS
29	3	46-XXXX	WYE - 316SS - 12in X 6in - FLG
30	3	46-XXXX	ELBOW - 316SS - 6in - 45 DEG - FLG X FLG
31	2	46-6521	ELBOW - 316SS - 6in - 90 DEG - FLG X FLG
32	3	47-5267	GASKET - FLANGE - 12in X 1/8in
33	14	47-6547	GASKET - FLANGE - 6in X 1/8in
34	130.5	51-6081	SEALANT - 1in X 1in X 14.5ft CS-202
35	1	60-XXXX	PRESSURE TRANSDUCER - ASHCROFT - 1/4in NPT
36	1	60-XXXX	PRESSURE TRANSDUCER ISOLATOR

REV	DESCRIPTION	DATE	APPROV
1	REVISED PER ALL LATEST COMMENTS	11-15-13	AD
2	ELECTRICAL	11-20-13	NNA
3	ADDED PRESSURE TRANSDUCER FOR	2-6-14	AD
4	REVISED PER 1-17 & 1-24 COMMENTS	2-24-14	AD
3	REVISED PER SITE LAYOUT CHANGES	3-4-14	AD

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

1" = 1'-0"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES APPROPRIATELY

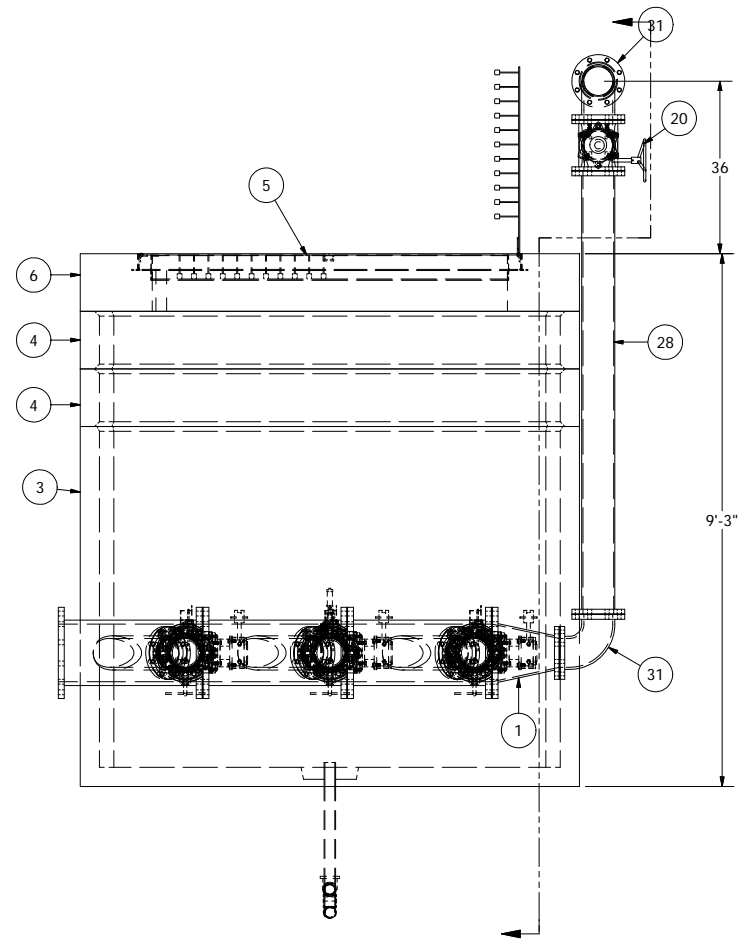
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REVISION HISTORY

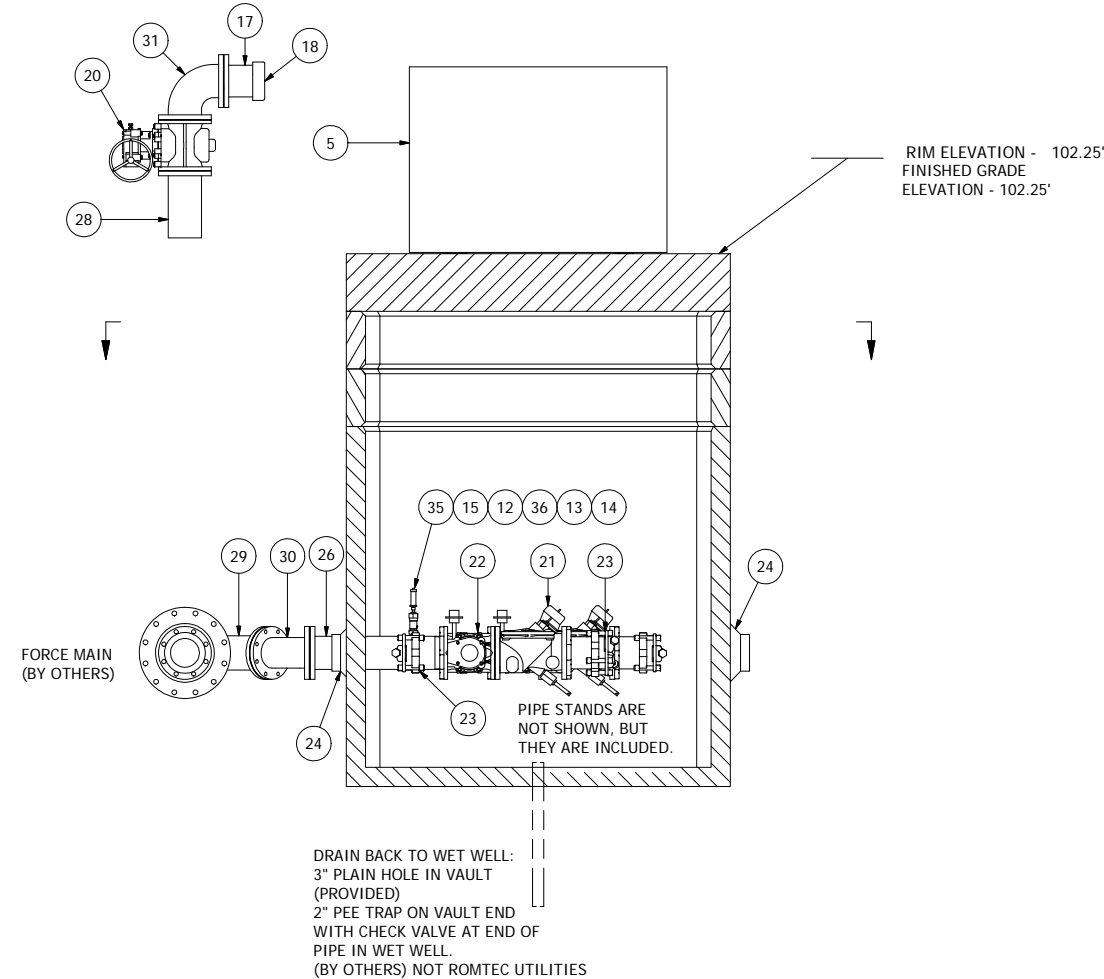
COMPONENT DRAWING

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

NOTE: VAULT TOP SLAB IS H-20 OCCASIONAL RATED



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

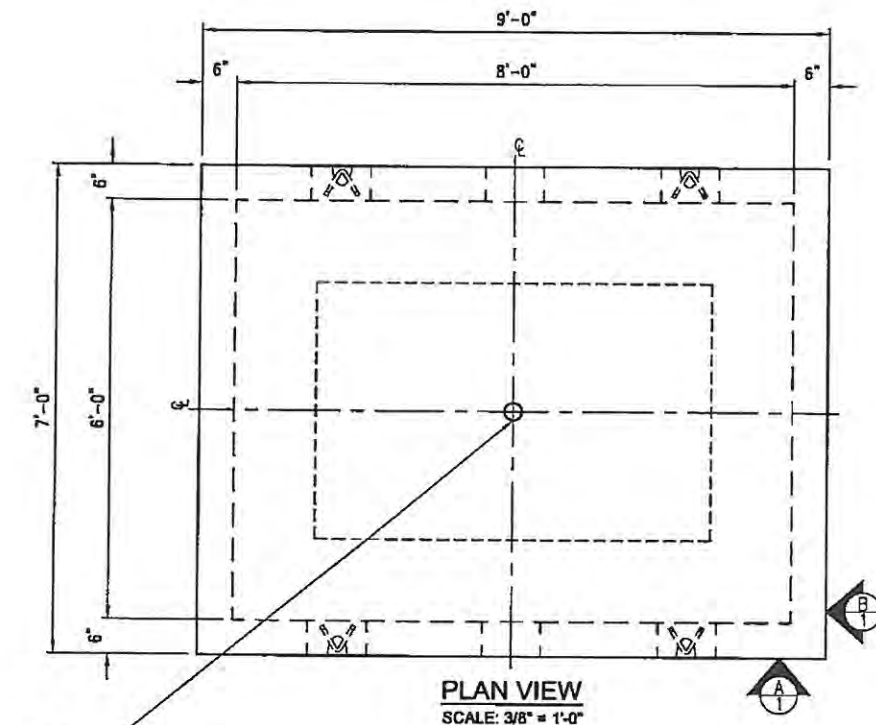
6' X 8' VALVE VAULT
6" PIPING AND VALVES
12" PUMPING PORT

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

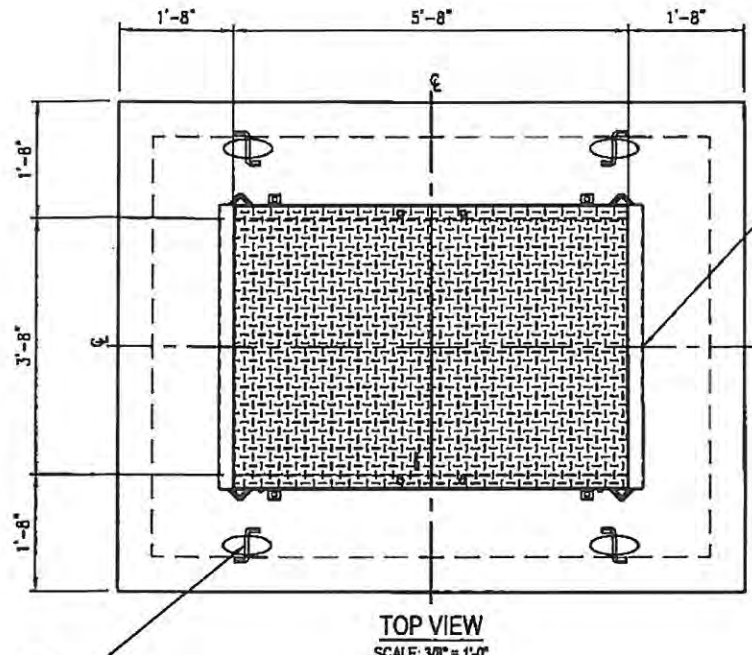
BAY MEADOWS
6' X 8' VV - 6" PIPING

SHEET
2 OF 4

JOB NUMBER
RMTC 0000



PLAN VIEW
SCALE: 3/8" = 1'-0"



TOP VIEW
SCALE: 3/8" = 1'-0"

44"X68" CAST IN,
H-20 TRAFFIC RATED
FRAME AND COVER
CUSTOMER TO SUPPLY

Preliminary

3"Ø HOLE

16EA. M879U55
HOOK LIFTS

**SIGN HERE TO
OK PRODUCTION**

X _____

- STRUCTURAL NOTES:**
- LOADS:**
- H20 TRAFFIC VAULT
 - MAXIMUM SOIL COVER: 0 FT
 - 150 PCF CONCRETE DENSITY; 120 PCF SOIL DENSITY
 - H20 SURCHARGE: 2 FT ABOVE FILL, 8 FT BELOW GRADE
 - DRY SOIL LATERAL LOAD - 40 PCF
 - WET SOIL LATERAL LOAD - 80 PCF
 - WATER TABLE - BELOW VAULT

- DESIGN SPECIFICATIONS**
- ACI-318-11 BUILDING CODE
 - ASTM C 857 MINIMUM STRUCTURAL DESIGN LOADING FOR UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES.

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

- GENERAL NOTES:**
- 1) CONTRACTOR TO: VERIFY ALL DIMENSIONS AND OPENING LOCATIONS
 - 2) REBAR MAY BE TACK WELDED OR TIED
 - 3) TOLERANCES PER ASTM C-858
- STANDARD SPECIFICATION FOR UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES

WEIGHTS / CONCRETE YD ³	
SECTION	WEIGHT
TOPSLAB	7,040 LBS / 1.704 CYD
RISER	2,300 LBS / 0.557 CYD
RISER	2,300 LBS / 0.557 CYD
BASE SECTION	18,020 LBS / 4.382 CYD
TOTAL LBS	29,660 LBS
TOTAL CYD	7.180 CYD

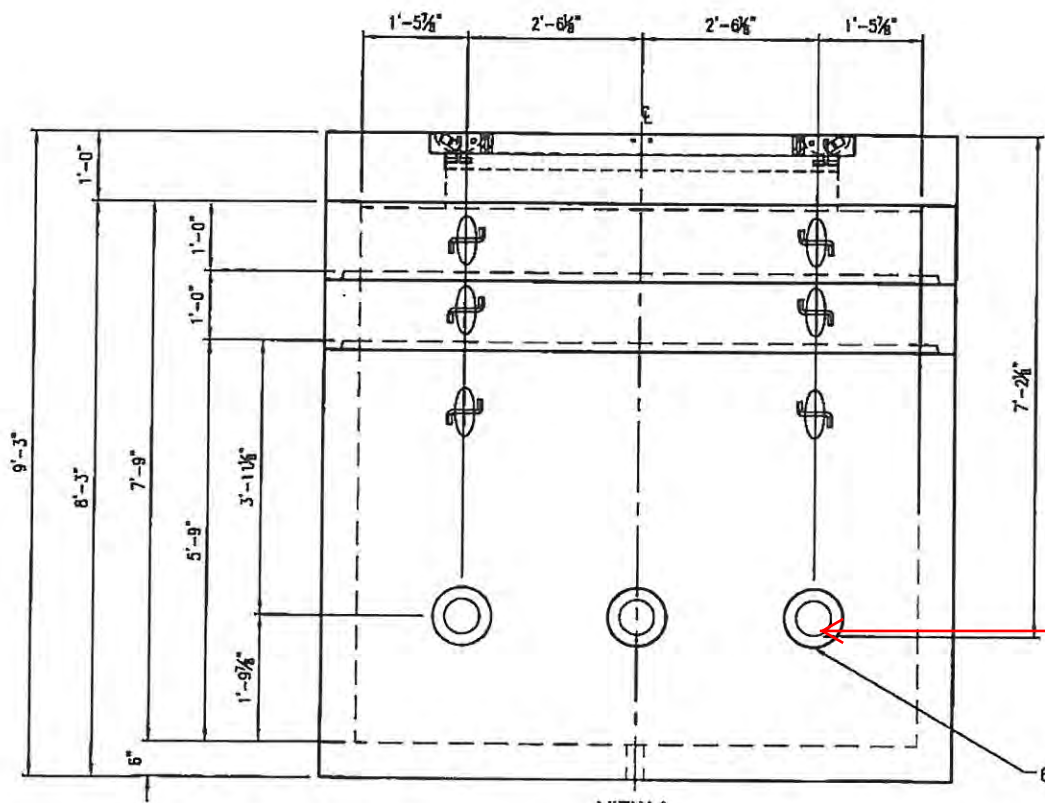
Oldcastle Precast
P.O. BOX 727 PLEASANTON, CA 94566
PHONE 925-464-1103 FAX 925-464-1904

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6'-0"x8'-0"x7'-9" (I.D.) PRECAST VAULT

BAY MEADOWS ORDER CONTROL VAULT
PLEASANTON, CA

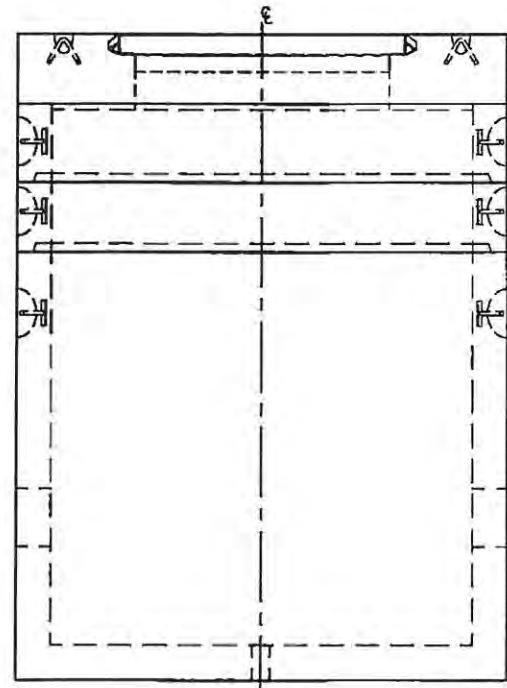
CUSTOMER ROMTEC UTILITIES					
DATE	SALES	DRAWN	ENGINEER	CHECKED	SALES ORDER
7/18/13	JG	VK	JM	JM	S166318
DRAWING NUMBER 030-S166318-002				REVISION 5 REV DATE	SHEET 1 OF 1



VIEW A
SCALE: 3/8" = 1'-0"

95.07' Discharge
Pipe Invert
Elevation (6")

6EA. 10"Ø HOLES



VIEW B
SCALE: 3/8" = 1'-0"

Discharge Pipe Invert (12")
Elevation - 94.82"
Note: this is not seen on View A
or View B below. Please see the
Valve Vault Component drawing
for layout/orientation (Section
11.01).

Style "DTD-HD-AO" access hatch, as manufactured by Syracuse Castings, Tooele UT. Tel: 801-544-5728. Fax: 801-544-9571.

Material shall be 6061-T6 aluminum for bars, angles, and extrusions. 1/4" diamond plate shall be 5086 aluminum.

Unit designed heavy duty, for H-20 wheel loads, where not subject to high density traffic. Channel frame and bearing plate must be cast into and supported by concrete.

Each door shall be supplied with a heavy duty, stainless steel pneu-spring, for ease of operation when opening cover.

Each door shall be equipped with a grade 316 stainless steel hold open arm. Door shall lock open in the 90 degree position.

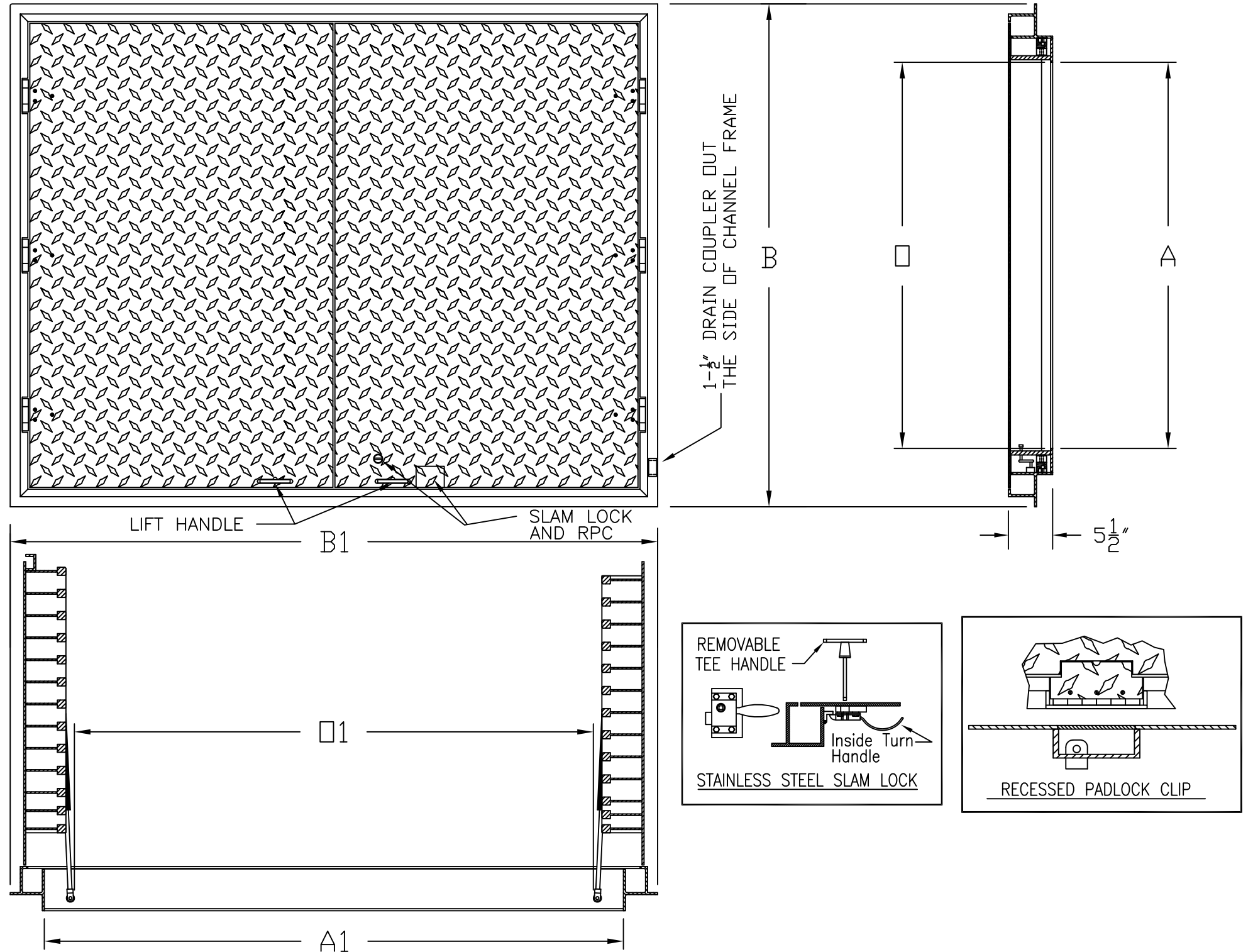
Channel frame shall be of extruded aluminum, with a continuous 1-1/4" anchor flange.

Each "DTD-HD-AO" style hatch is supplied with a 1-1/2" threaded drain coupler out the side of channel frame.

All hardware shall be stainless steel.

Each hatch shall be supplied with a grade 316 stainless steel slam lock and a recessed padlock clip.

Each hatch shall be equipped with a stainless steel lift handle. The lift handle shall be flush with the top of the 1/4" diamond plate.



687-VALVE VAULT-H20

"DTD-HD-AO" HEAVY DUTY H-20 ALUMINUM HATCH W/ RPC AND SLAM
 DRAWN BY: C.M.A. DATE: 07-10-09 DRAW # DTDHD4468A

PATTERN NO.	DIMENSIONS IN INCHES		UNOBSTRUCTED CLEAR OPENING
	A x A1	B x B1	
ALUMINUM			0 x 01
DTD-HD-44X68AD	44" X 74"	58-1/2" X 82-1/2"	44" X 68"

Syracuse Castings West
Better By Design
 58 SOUTH 1200 WEST
 P.O. BOX 488
 TOOELE, UT 84074-0488
 TEL: 801-544-5728 FAX: 801-544-9571 www.syracast.com

VALVE VAULT LIFTING ANCHORS PROVIDED BY ROMTEC UTILITIES

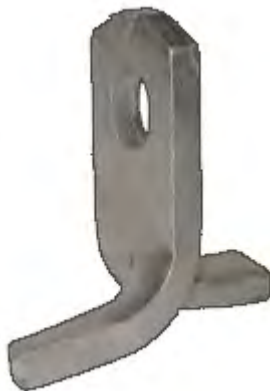
Valve vault concrete components are equipped with Conac lifting system anchors and ring clutches.

Valve vault base is pre-cast with four (4) Conac Flat Foot Anchors located in the inside wall. Model F FA 04 038 – Four (4) ton anchor

Valve vault top slab is pre-cast with four (4) Conac Flat Foot Anchors located on the top surface of the top slab. Model F FA 04 038 – Four (4) ton anchor

FLAT FOOT ANCHOR

Ideal for back stripping or lifting thin precast panels.



<i>Ton</i>	<i>Part Number</i>	<i>Length</i>	<i>Thickness</i>	<i>Allowable Reinforced Tension Load S.F. 4:1 (lbs)</i>	<i>Ultimate Mech. Load Tension * (lbs)</i>	<i>System Code</i>
2	F FA 02 028A	2.8"	3/16"	2,000	8,000	2.5
2	F FA 02 034A	3.4"	3/16"	2,000	8,000	2.5
2	F FA 02 028B	2.8"	3/8"	4,000	16,000	2.5
2	F FA 02 034B	3.4"	3/8"	4,000	16,000	2.5
4	F FA 04 038	3.8"	1/2"	6,000	24,000	5
8	F FA 08 063	6.3"	5/8"	12,000	48,000	10

VALVE VAULT LIFTING RING CLUTCHES PROVIDED BY ROMTEC UTILITIES

Valve vault concrete components are designed to be lifted with the Romtec Utilities provided Conac lifting clutches. Romtec Utilities will provide four (4) Conac Ring Clutches.

Model F RC 04 B – Four (4) ton anchors

RING CLUTCH

Designed to be used specifically for flat steel lifting. Handle allows for a safer locking of clutch into position.



<i>Ton</i>	<i>Item No.</i>	<i>Weight lbs</i>	<i>System Code</i>
2T	F RC 02 B	4.0	2.5T
4T	F RC 04 B	9.0	5.0T
8T	F RC 08 B	20.0	10.0T
22T	F RC 22 B	56.0	22.0T



ROMTEC UTILITIES RECOMMENDED WET WELL LIFTING METHOD

All valve vault concrete components are designed to be lifted and set in the excavated hole by use of the Romtec Utilities supplied anchors and ring clutches. The installation contractor shall excavate the valve vault hole, place the base rock as specified by the **SITE ENGINEER (not Romtec Utilities)**, provide a **safe OSHA approved cave-in protection method (shoring) and a piece of lifting equipment of adequate size to lift and set the heaviest piece**. The excavation contractor and/or his subcontractor crane company must provide the appropriate lifting cables, straps or chains and connection devices to attach the cables to the crane and the ring clutches. All lifting cables, straps or chains must be long enough that when lifting the concrete components the lifting rigging does not put pressure on the upper concrete joint potentially breaking the concrete. **The use of a spreader bar will greatly reduce the risk of the lifting rigging breaking the concrete upper joint.**

VALVE VAULT CONCRETE COMPONENT WEIGHTS:

ITEM	SIZE	WEIGHT
687 Valve Vault Base	6' – 8" X 8' – 8"	13,570 lbs.
687 Valve Vault Riser	6' – 8" X 8' – 8"	1,892 lbs. per foot
687 Valve Vault Top	6' – 8" X 8' – 8"	6,570 lbs.



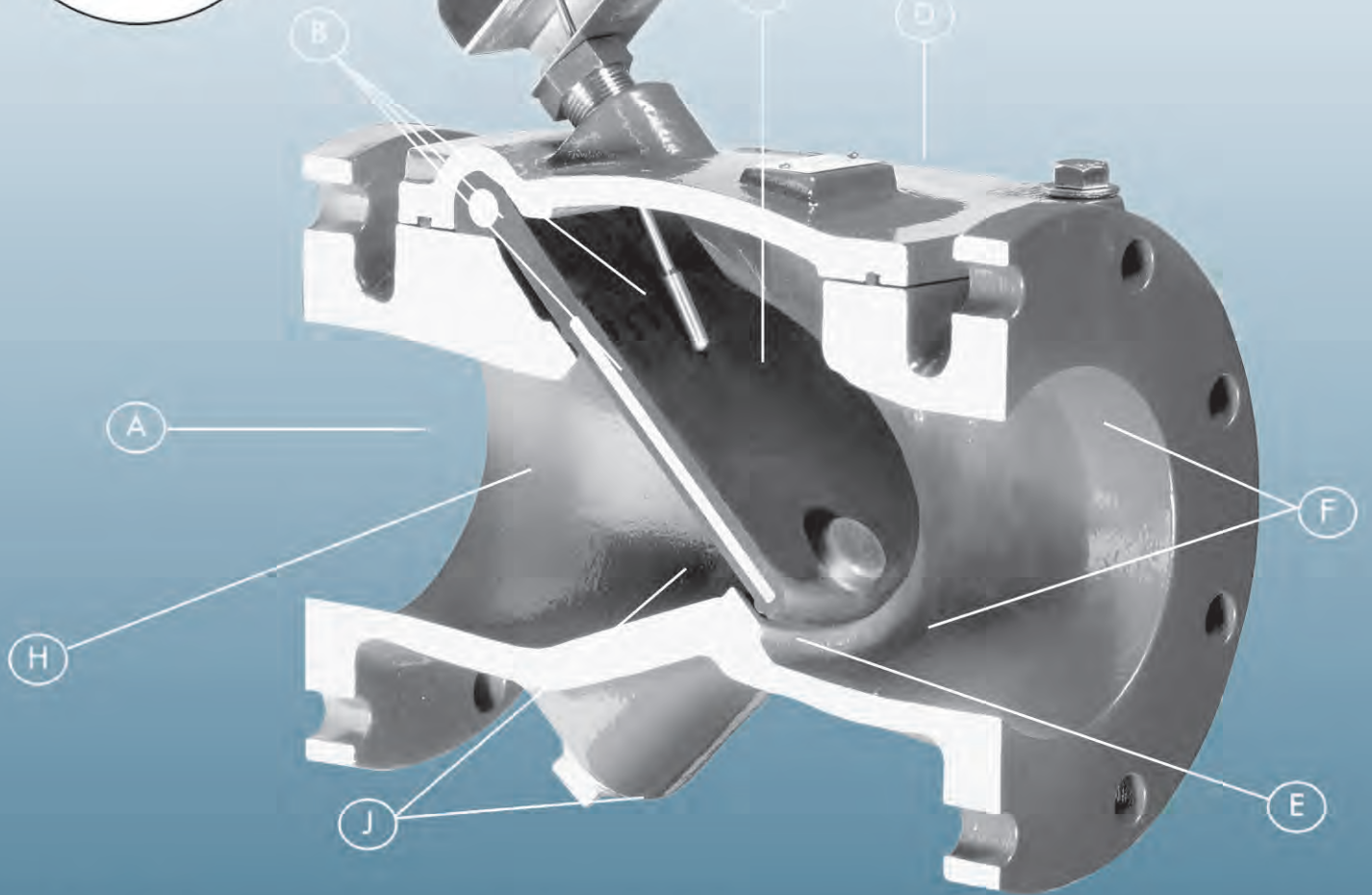
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VAL-MATIC[®]



**EFFICIENCY &
RELIABILITY
THROUGH
SIMPLICITY
OF DESIGN**

Swing-Flex[®] Check Valve



A. 100% FLOW AREA

For improved flow characteristics and lower head loss, the Val-Matic Swing-Flex® Check Valve provides 100% unrestricted flow area.

B. REINFORCED DISC

The one piece precision molded disc is steel and nylon reinforced to provide years of trouble free performance. It is backed by a 25 year warranty for the flex portion of the disc. (Tested for proof of design - see page 5.)

C. ONE MOVING PART

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

D. DOMED ACCESS PORT

Full size top access port allows removal of disc without removing valve from line. Access cover includes a drilled and tapped port for installation of optional Disc Position Indicator.

E. DROP TIGHT SEATING

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

F. NON-SLAM CLOSURE

"Short Disc Stroke" combined with Memory-Flex™ Disc Action reduces potentially destructive water hammer.

G. BACKFLOW ACTUATOR (Not Shown)

Body is drilled and tapped for installation of optional backflow actuator (see options).

H. NON-CLOG DESIGN

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

I. MECHANICAL DISC POSITION INDICATOR* (Optional)

Provides clear indication of the valve's disc position. Can also be provided with a SCADA compatible limit switch for off site monitoring (see options).

J. FUSION BONDED EPOXY

Fusion Bonded Epoxy (FBE) is provided standard on the interior and exterior of the valve. The FBE is ANSI/NSF 61 certified. Other coatings are available on request.

EFFICIENCY..... RELIABILITYBY DESIGN!

Efficiency and reliability through simplicity of design is the key to the superior performance and long life of the Val-Matic **Swing-Flex**[®] Check Valve.

ENERGY EFFICIENT BY DESIGN

The streamlined contour of the **Swing-Flex**[®] body provides 100% flow area with no restrictions at any point through the valve (Figure 1.) Flow tests performed by an independent laboratory have shown that this unique body design produces minimal head loss through the valve. Flow and head loss charts, developed from the test data, are shown on Page 4.

DISC STABILIZATION BY DESIGN

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

NON-CLOGGING BY DESIGN

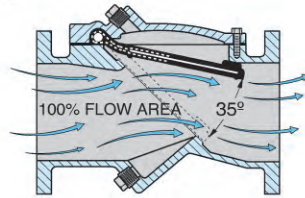
Clog resistant performance is achieved by maintaining an unobstructed 100% flow area, smooth streamlined body contouring and the simplicity of one moving part. The entrapment or hang-up of solids and stringy materials is minimized by the elimination of mechanical devices in the valve design. The standard 4" **Swing-Flex**[®] is designed to pass a 3" solid.

NON-SLAM CLOSING BY DESIGN

The non-slam closing characteristic of the **Swing-Flex**[®] Check Valve is achieved by utilizing a "Short Disc Stroke" in conjunction with the unique "**Memory-Flex**"[™] action" of the valve's disc. The 35° stroke, a result of the angled seat, is less than half the typical 80° to 90° stroke of a conventional swing check valve. (Figures 1 & 2) The feature is similar to that found in high performance tilted disc check valves.

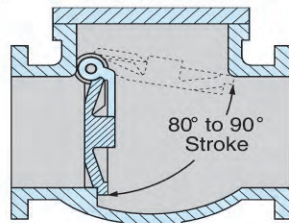
VAL-MATIC SWING-FLEX[®] VALVE

Figure 1



CONVENTIONAL SWING CHECK VALVE

Figure 2



The short disc stroke and "**Memory-Flex**"[™] action" (Figure 1) serve to reduce the closing time of the valve. This reduced closing time minimizes flow reversal and the resultant water hammer normally associated with the sudden stoppage of reverse flow.

RELIABILITY BY DESIGN

Operational reliability is achieved by utilizing just one moving part, the **Memory-Flex**[™] disc. Extended life is --

designed into the disc by the inclusion of steel and nylon reinforcements. The steel and nylon are precision molded into the disc, providing a tough, durable disc with a 25-year warranty*.

(Figure 3) Unlike a conventional horizontal swing check valve, the **Swing-Flex**[®] has no packing or O-rings, mechanical hinges, shafts, pivot pins, or bearings to wear out (Figure 3.) Upon conclusion of a 1,000,000 (one million) cycle test, an independent testing laboratory reported that the valve had no visible signs of wear and remained drop tight. (See Page 5.)

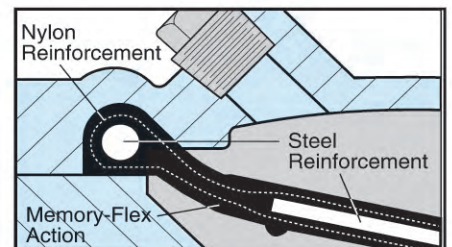


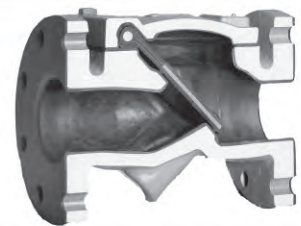
Figure 3

POSITIVE SHUT OFF BY DESIGN

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

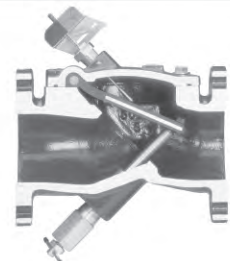
OPTIONAL ACCESSORIES

RUBBER LINING -- Unlike conventional swing check valves, the **Swing-Flex**[®] Check Valve is designed to accept synthetic or natural rubber lining. Body lining coupled with synthetic **Memory-Flex**[™] discs makes the **Swing-Flex**[®] ideally suited for systems containing abrasive or corrosive fluids.



DISC POSITION INDICATOR -- The cover mounted disc position indicator provides clear indication of the valve's disc position. A SCADA compatible limit switch can also be provided. Both can be provided at the time of valve purchase or for field installation at a later date.

BACKFLOW ACTUATOR -- Available for use when manual backflow operation is required. Most commonly used for priming pumps, back flushing, draining lines, and system testing. The Val-Matic Backflow Actuator can be provided at the time of valve purchase or for field installation at a later date.

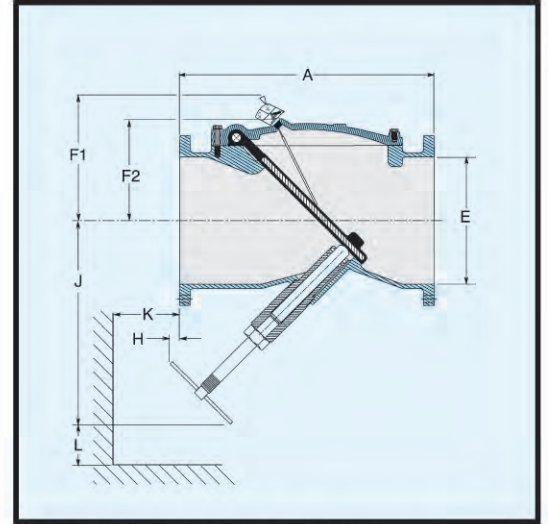


* The Val-Matic warranty and its remedies are available for 25 years covering the flex portion of the disc.

INSTALLATION DIMENSIONS AND CONSTRUCTION

VALVE SIZE	MODEL #	A	E	F1	F2	H	J	K	L
2	502A	8.00	2.00	N/A	3.38	-0.50	6.75	1.50	1.50
2 1/2	525A	8.50	2.50	N/A	3.38	-0.50	7.00	1.50	1.50
3	503A	9.50	3.00	8.69	5.12	-0.38	7.50	1.50	1.50
4	504A	11.50	4.00	10.63	5.75	3.38	10.75	2.50	2.50
6	506A	15.00	6.00	11.69	6.88	1.38	11.38	3.00	3.00
8	508A	19.50	8.00	13.23	8.38	2.00	13.75	3.75	3.75
10	510A	24.50	10.00	15.63	10.75	0.50	17.00	5.75	5.75
12	512A	27.50	12.00	17.19	12.50	3.50	22.50	6.50	6.50
14	514A	31.00	14.00	17.81	13.00	4.00	26.25	6.50	6.50
16	516A	32.00	16.00	19.06	14.25	4.63	30.00	6.50	6.50
18	518A	36.00	18.00	20.25	15.25	5.25	33.75	6.50	6.50
20	520A	40.00	20.00	21.69	16.88	5.88	37.50	8.00	8.00
24	524A	48.00	24.00	24.50	19.25	1.81	45.00	8.00	8.00
30	530A	56.00	30.00	27.81	23.00	-0.63	41.25	8.00	8.00
36	536A	63.00	36.00	32.63	27.38	-0.38	49.00	9.75	9.75
42	542A	70.00	42.00	39.63	36.88	-5.50	53.50	9.75	9.75
48	548A	76.00	48.00	43.41	40.66	-2.90	41.98	10.00	10.00

Dimensions "L" and "K" represent the clearance required to remove backflow actuator.



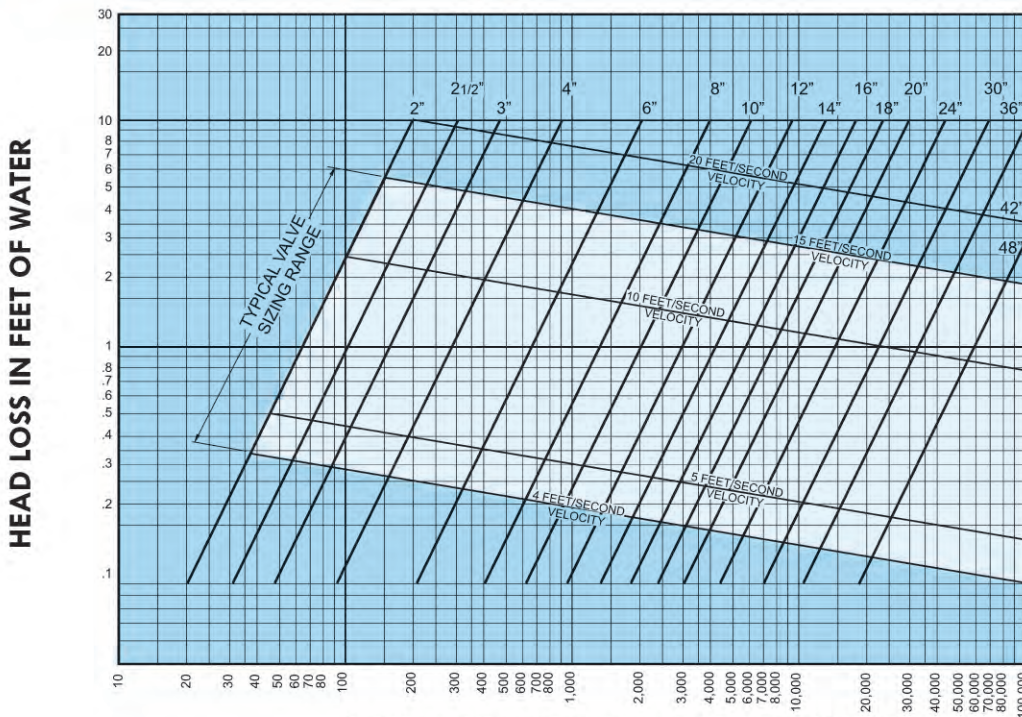
*Dimension "E" represents nominal valve size.
Note: Flanged ends conform to ANSI B16.1 Class 125.

MATERIALS OF CONSTRUCTION		
Component	Standard	Optional
Body and Cover	Ductile Iron ASTM A536 Grade 65-45-12	Stainless Steel, Bronze
Disc	Buna-N (NBR), ASTM D2000-BG	Viton (FKM), ASTM D2000-HK
Coatings	Interior	Fusion Bonded Epoxy*
	Exterior	Fusion Bonded Epoxy*
		Rubber Lining
		Consult Factory

Consult factory for additional material and coating options.
*ANSI/NSF 61 Certifications

ANSI MAXIMUM PRESSURE-TEMPERATURE RATING		
Maximum Non-Shock Working Pressure (P.S.I.) ANSI Class 125		
Temperature °F	2" - 48"	30" - 48"
100°	250	150
150°		
200°	235	135
Hydrostatic Test Pressures	500	300

HEAD LOSS CHART



FLOW OF WATER IN GALLONS PER MINUTE

Consult factory for Digester Gas Service

Flow Tests performed by the Utah Water Research Laboratory of Utah State University.

SAMPLE SPECIFICATIONS

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

The valve body shall have full flow equal to nominal pipe diameter at any point through the valve. The seating surface shall be on a 45° angle to minimize disc travel. The top access port shall be full size, allowing removal of the disc without removal of the valve from the pipeline and shall include a port for installation of an optional mechanical position indicator.

The disc shall be of one piece construction, precision molded with an integral O-ring type sealing surface and contain steel and nylon reinforcements in both the **Memory Flex**™ and central disc areas. The flex portion of the disc shall be warranted for 25 years. Non-slam closing characteristic shall be provided through a short 35° disc stroke and a

Memory-Flex™ disc return action.

A mechanical indicator shall be provided when specified to provide disc position indication on valves 3" and larger. The indicator shall have continuous contact with the disc under all operating conditions to assure accurate disc position indication.

A limit switch will be provided when specified to indicate open/closed position to a remote location. The mechanical type limit switch shall be activated by the external position indicator. The switch shall be rated for NEMA 4, 6, or 6P and shall have U.L. rated 5 amp, 125, or 250 VAC contacts.

Backflow capabilities shall be available by means of an optional screw type backflow actuator. Both the disc position indicator and backflow actuator shall be capable of installation without special tools.

The valve body and cover shall be ASTM A536 Grade 65-45-12, Class B Ductile Iron. The disc shall be Buna-N (NBR), ASTM D2000-BG.

The interior and exterior of the valve shall be coated with an ANSI/NSF 61 approved Fusion Bonded Epoxy.

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

The manufacturer shall have a minimum of five years experience in the manufacture of flexible disc type check valves.

The valve shall be Val-Matic **Swing-Flex**® series 500 and shall be designed, manufactured and tested in accordance with ANSI/AWWA Standard C508.

INDEPENDENT PROOF OF DESIGN TEST

In the case of the Val-Matic **Swing-Flex**® Check Valve, we have taken quality assurance one step further by having the valve cycle tested. Utilizing an eight-inch **Swing-Flex**® with optional signal switch, the valve was cycled over 1,000,000 (one million) times.

To place one million cycles in perspective, it would take an average of 100 cycles per day for more than 27 years

to equal the 1,000,000 cycles. Upon conclusion, PSI/Pittsburgh Testing Laboratory Division reported the following results:

1. After 1,000,000 cycles the valve's disc showed no signs of fatigue or stress cracks.
2. After 1,000,000 cycles the valve seating areas showed no signs of wear

or distortion. The valve seating remained drop tight during the low and high pressure hydrostatic tests.

3. After 1,000,000 cycles the signal switch continued to function as designed.

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

QUALITY ASSURANCE

Val-Matic's Quality Assurance is the sum of imaginative design, solid engineering, careful manufacturing and dedicated people.

These all combine to ensure total customer satisfaction. We recognize the need for, and encourage, individual pride and the self-satisfaction, which is gained in producing reliable and quality valves.

This quality attitude permeates through the corporation from the president to our newest employee.

Testing (right) is the backbone of our quality assurance. Every **Swing-Flex**® Check Valve is 100% tested including a seat test to assure drop tight sealing and hydrostatic testing to assure the integrity of the casting.



Swing-Flex® Valve at test.



Make the change to **QUALITY!** Specify **VAL-MATIC®**

Val-Matic's quality of design and meticulous workmanship has set the standards by which all others are measured. Quality design features such as Type 316 stainless steel trim as standard on Air Release, Air/Vacuum and Combination Air Valves...combined resilient/metal to metal seating for Silent Check® Valves...stabilized components that provide extended life of the Dual Disc® Check Valves...high strength and wear resistant aluminum bronze trim as standard for Tilted Disc® Check valves...unrestricted full flow area through Swing-Flex® Check Valves...heavy duty stainless steel screened inlet on Sure Seal® Foot Valves...a Cam-Centric®

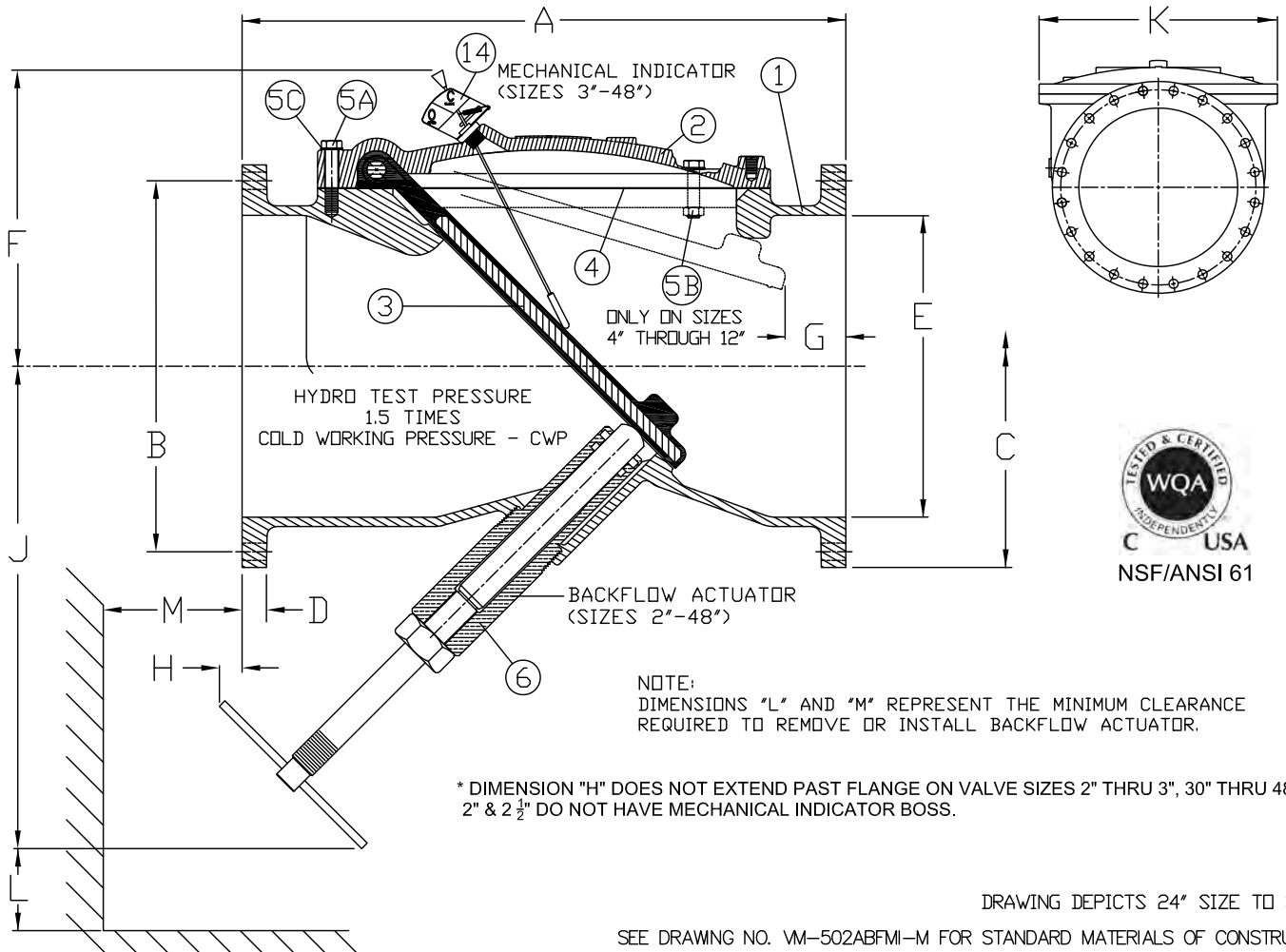
Plug Valve with more requested features than any other eccentric plug valve, and the American-BFV® Butterfly Valve that provides a field replaceable seat without the need for special tools. These features coupled with our attention to detail put Val-Matic valves in a class by themselves.

Val-Matic is totally committed to providing the highest quality valves and outstanding service to our customers. Complete customer satisfaction is our goal.

VAL-MATIC®

VAL-MATIC VALVE AND MANUFACTURING CORP.

905 RIVERSIDE DRIVE * ELMHURST, IL 60126
630/941-7600 * FAX: 630/941-8042
www.valmatic.com valves@valmatic.com



NOTE:
DIMENSIONS "L" AND "M" REPRESENT THE MINIMUM CLEARANCE
REQUIRED TO REMOVE OR INSTALL BACKFLOW ACTUATOR.

* DIMENSION "H" DOES NOT EXTEND PAST FLANGE ON VALVE SIZES 2" THRU 3", 30" THRU 48".
2" & 2 1/2" DO NOT HAVE MECHANICAL INDICATOR BOSS.

DRAWING DEPICTS 24" SIZE TO SCALE

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

ANSI CLASS 125

VALVE SIZE	MODEL NO.	CWP (PSI)	A	B	C	D	E	F	G	*H	J	K	L	M	BOLT SIZE	NO. OF BOLTS	SHPG. WT.
2	502ABF	250	8.00	4.75	6.00	0.63	2.00	N/A	1.63	-0.50	6.75	5.18	1.50	1.50	5/8	4	27
2 1/2	525ABF	250	8.50	5.50	7.00	0.68	2.50	N/A	1.63	-0.50	7.00	5.18	1.50	1.50	5/8	4	32
3	503ABFMI	250	9.50	6.00	7.50	0.75	3.00	8.69	1.63	-0.38	7.50	7.50	1.50	1.50	5/8	4	45
4	504ABFMI	250	11.50	7.50	9.00	0.75	4.00	10.63	2.12	3.38	10.75	8.25	2.50	2.50	5/8	8	70
6	506ABFMI	250	15.00	9.50	11.00	0.75	6.00	11.69	2.12	1.38	11.38	11.12	3.00	3.00	3/4	8	130
8	508ABFMI	250	19.50	11.75	13.50	0.88	8.00	13.25	2.88	2.00	15.75	16.00	5.75	5.75	3/4	8	250
10	510ABFMI	250	24.50	14.25	16.00	1.18	10.00	15.63	3.12	0.50	17.00	21.00	5.75	5.75	7/8	12	430
12	512ABFMI	250	27.50	17.00	19.00	1.25	12.00	17.19	3.43	3.50	22.50	24.00	6.50	6.50	7/8	12	660
14	514ABFMI	250	31.00	18.75	21.00	1.38	14.00	17.81	3.63	4.00	26.25	23.25	6.50	6.50	1	12	750
16	516ABFMI	250	32.00	21.25	23.50	1.43	16.00	19.06	3.25	4.63	30.00	25.25	6.50	6.50	1	16	900
18	518ABFMI	250	36.00	22.75	25.00	1.56	18.00	20.25	3.12	5.25	33.75	28.25	6.50	6.50	1 1/8	16	1230
20	520ABFMI	250	40.00	25.00	27.50	1.68	20.00	21.69	3.50	5.88	37.50	30.63	8.00	8.00	1 1/8	20	1750
24	52A4BFMI	250	48.00	29.50	32.00	1.88	24.00	24.50	5.00	1.81	45.00	36.00	8.00	8.00	1 1/4	20	2400
30	530BFMI	150	56.00	36.00	38.75	2.12	30.00	27.81	5.75	-0.63	41.25	45.88	8.00	8.00	1 1/4	28	4350
30	530ABFMI	250	56.00	36.00	38.75	2.12	30.00	27.81	5.75	-0.63	41.25	45.88	8.00	8.00	1 1/4	28	4350
36	536BFMI	150	63.00	42.75	46.00	2.38	36.00	32.63	3.88	-.38	49.00	55.00	9.75	9.75	1 1/2	32	7000
36	536ABFMI	250	63.00	42.75	46.00	2.38	36.00	32.63	3.88	-.38	49.00	55.00	9.75	9.75	1 1/2	32	7000
42	542BFMI	150	70.00	49.50	53.00	2.63	42.00	39.63	0.12	-5.50	53.50	60.18	9.75	9.75	1 1/2	36	9410
42	542ABFMI	250	70.00	49.50	53.00	2.63	42.00	39.63	0.12	-5.50	53.50	60.18	9.75	9.75	1 1/2	36	9410
48	548BFMI	150	76.00	56.00	59.50	2.75	48.00	43.41	0.12	-2.90	41.98	68.00	10.00	10.00	1 1/2	44	12700
48	548ABFMI	250	76.00	56.00	59.50	2.75	48.00	43.41	0.12	-2.90	41.98	68.00	10.00	10.00	1 1/2	44	12700

Revised 3-31-11

SWING-FLEX CHECK VALVE W/ BACKFLOW ACTUATOR AND MECHANICAL INDICATOR

DATE 6-9-09

VAL-MATIC VALVE AND MANUFACTURING CORP.

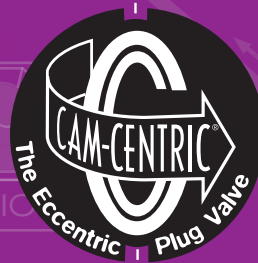
DRWG. NO.
VMC-502ABFMI

VALMATIC®

Proven Design

Preferred Features

Advanced Technology



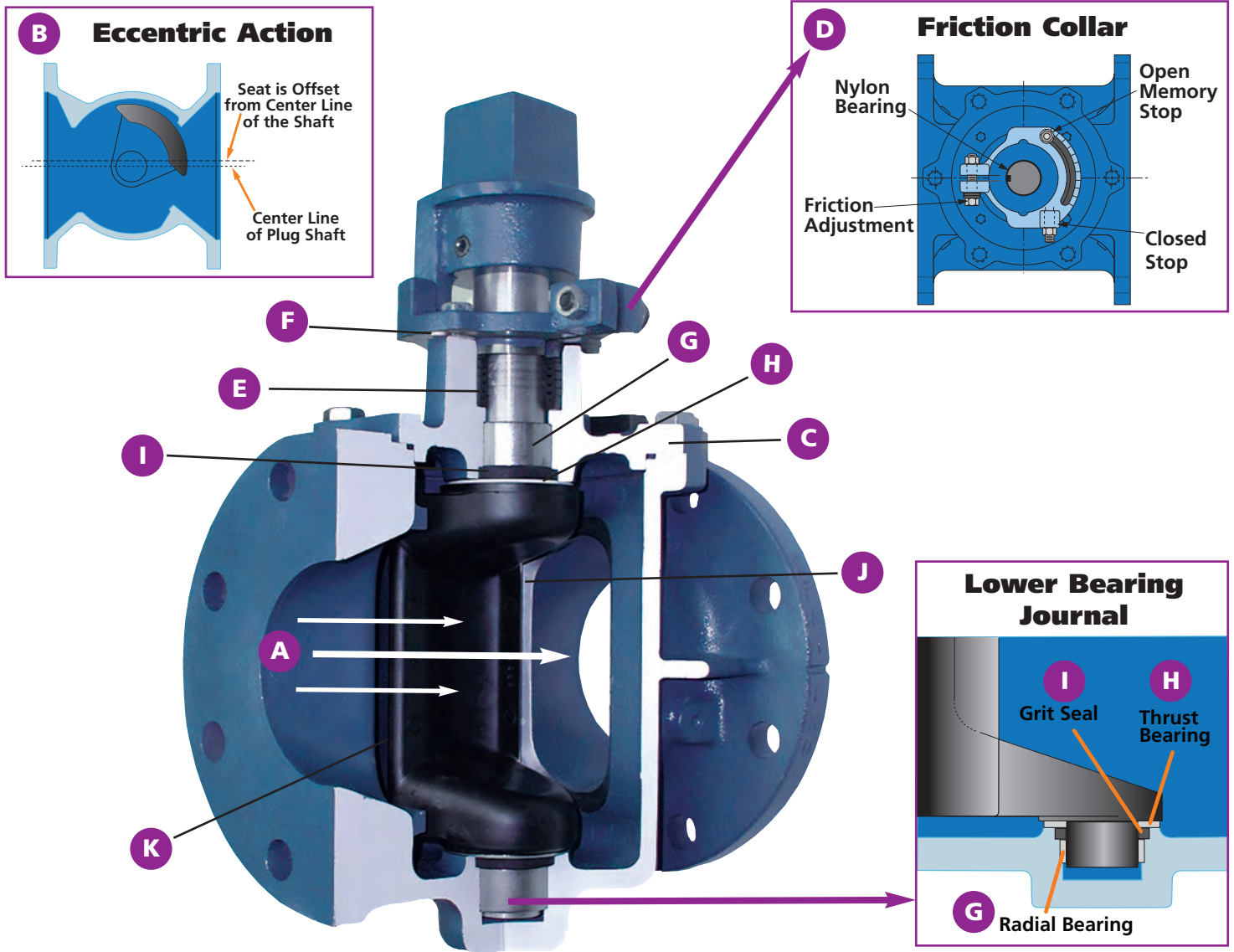
Cam-Centric®
Plug Valves



www.valmatic.com

Meets AWWA C517
NSF/ANSI 372 Certified

Feature Highlights



A. Non-Clog Design

The unrestricted flow area combined with smooth streamline contouring allows passage of large solids to prevent potential clogging and provide low headloss.

B. Eccentric Action

Provides positive shut off with wear resistant action and low torque.

C. Full Top Access Cover

Provides accessibility for inspection without removal of the valve from the line.

D. Friction Collar with Memory Stop

Secures valve plug in any position and includes a nylon bearing for ease of operation.

E. V-Type Packing

Field adjustable and replaceable without removal of worm gear or motor actuators.

F. Removable POP™ Shims

Packing Overload Protection Shims protect packing by preventing overload during field adjustment.

G. Radial Bearings

Heavy Duty, T316 Stainless Steel, Permanently Lubricated.

H. Thrust Bearing

Upper: PTFE - Provides ease of actuation during operating conditions.
Lower: Stainless Steel - Prevents wear to plug and Grit-Guard.

I. Grit-Guard™ Shaft Seal

The *Val-Matic Exclusive* Grit-Guard™ shaft seal extends packing and bearing life by minimizing contact with abrasive line media.

J. Seat

Welded overlay of 95% pure nickel applied directly to the body using a state-of-the-art robotic welding system for a consistent, high quality weld. Machined and ground to a smooth finish.

K. Plug

Fully rubber encapsulated molded plug eliminates exposed surfaces preventing corrosion and delamination.

Proven Design

With installations worldwide, the Val-Matic Cam-Centric® Plug Valve has proven itself as the preferred valve for wastewater, industrial waste and process applications. The Cam-Centric® Plug Valve is a ¼ turn eccentric plug valve allowing cost effective, low torque actuation for pump control, shut-off and throttling service. The valve's eccentric action rotates the plug in and out of the seated position with minimal contact, thereby preventing high torque and wear to the valve seat and plug. The combination of the eccentric action, stainless steel bearings, Grit-Guard™ seals and heavy duty nickel seat assures long life with minimal maintenance.

Preferred Features

The Cam-Centric® Plug Valve features a shaft sealing system that utilizes V-Type packing, a packing follower and a Grit-Guard™ seal for ease of maintenance and to reduce wear. The Grit-Guard™ seals reduce wear by preventing grit and media from reaching the bearings and packing to prevent plug lock up. The seals are standard in both the upper and lower journals (Figures 1 & 2). To prevent the packing from being over tightened, the shaft seal incorporates POP™ (Packing Overload Protection) Shims. The packing is easily adjusted by removing the POP™ shims as necessary utilizing the pull tab feature (Figure 1). Adjustment or

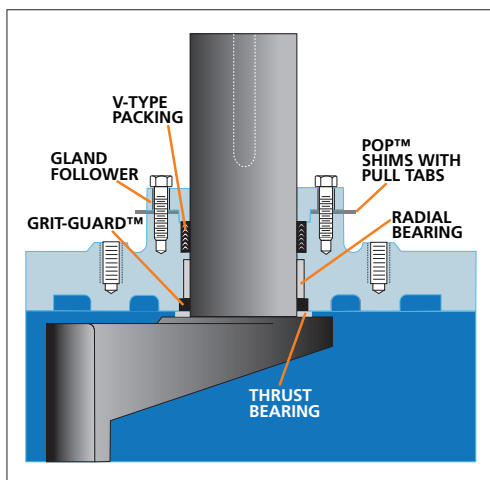


Figure 1. Upper Bearing Journal

replacement of the V-Type packing can be done without removal of the gear, motor or cylinder actuator.

The Cam-Centric® bearing package consists of permanently lubricated, T316 stainless steel radial bearings in both the upper and lower journals. The upper thrust bearing is made of Teflon and the lower thrust bearing is T316 stainless steel. The bearings

are protected from grit related wear by the Grit-Guard™ seals (Figures 1 & 2).

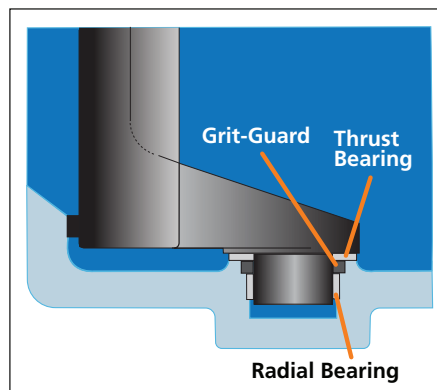


Figure 2. Lower Bearing Journal

The Cam-Centric® Plug Valve utilizes a totally encapsulated molded plug to protect exposure to corrosion and delamination in severe abrasive applications.



Figure 3. Robotic welding of nickel seat

The valve seat is a welded overlay of 95% pure nickel applied directly to the body on a machined surface using a state-of-the-art robotic welding system for a consistent, high quality weld (Figure 3).

Advanced Technology

Incorporating the latest in valve technology assures a high-quality valve that will provide long service. The design process utilized solid Modeling and Finite Element Analysis (FEA) of the key structural components. Flow and torque data was derived from flow tests, mathematical models and Computational Fluid Dynamics (CFD). Manufacturing technology uses automated process control in the foundry and ISO 9001 controlled manufacturing processes. Every valve is tested in accordance with AWWA C517 and MSS SP-108 on automated hydraulic test rigs with gauges calibrated per ISO standards.

Actuation

The Cam-Centric® Plug Valve is available with a wide range of actuation options, from simple lever operation to advanced pump control systems. Options include 2" operator nuts, worm gears, chainwheels, electric motor and cylinder actuation. A wide variety of accessories such as floor stands and extended bon-

nets are also available (see accessories on page 7). Val-Matic Engineering personnel work closely with cylinder and electric actuation manufacturers to assure actuator/valve compatibility. This assures the actuator you specify will deliver the performance you expect when utilized with a Cam-Centric® Plug Valve.



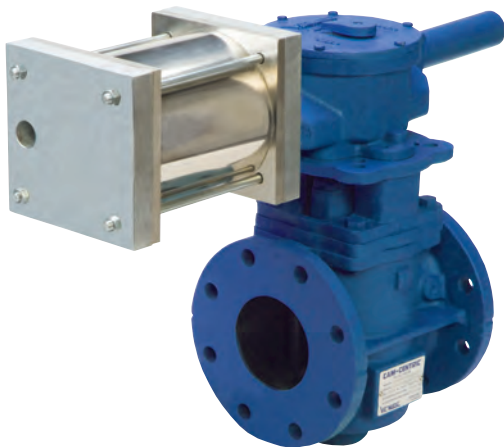
Direct Nut operated valve with memory stop:

- Adjustable open memory stop for system balancing
- Adjustable close stop
- Adjustable friction collar
- For use with lever accessories



Val-Matic Worm Gears:

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



Val-Matic Cylinder Actuation:

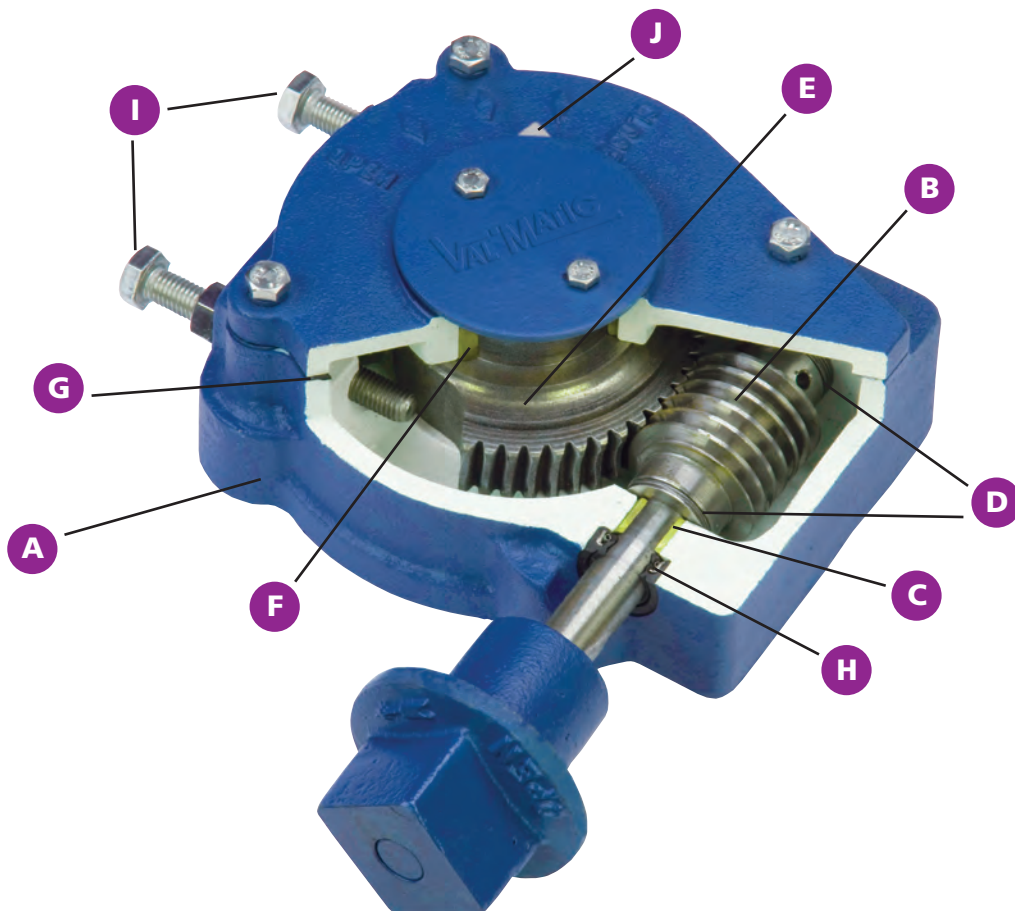
- Compliance with AWWA C541 for Power Actuation
- Pneumatic/Hydraulic
- Single Acting or Double Acting
- Fail Open/Closed for power failure
- Modulating Service
- Throttling Service
- Limit Switches, Solenoid Valves, Positioners
- Manual Overrides
- Pump Control



Electric Actuation:

- 110 Single Phase, 230/460 Three Phase
- Compliance with AWWA C542 for Power Actuation
- Modulating Service
- Throttling Service
- Remote push button control and indication
- Torque Switches, Limit Switches
- De-clutchable handwheels
- Available from a wide variety of manufacturers

Worm Gear Features



Val-Matic Worm Gear

A valve actuator must perform to the same level as the valve. The Val-Matic worm gear is designed and built to provide the same long term service as our Cam-Centric® Plug Valve. The exclusive bearing package in the worm gear includes four bronze sleeve bearings and two roller thrust bearings. This exclusive package assures smooth operation and long life regardless of the valve's orientation or application. The ductile iron segment gear coupled with the upper and lower bronze radial bearings exceed the requirements of AWWA C517 for strength and durability. All worm gears are designed to exceed, a rim pull of 200 pounds on handwheels and input torques of 300 foot pounds for operator nuts without damage. Buried service worm gears are grease packed, sealed and include stainless steel shafts. Worm gears can be provided with handwheels, chainwheels or 2" operator nuts.

A. Housing

Heavy duty, totally enclosed and sealed.

B. Worm

Hardened steel for durability and long life.

C. Radial Shaft Bearings

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

D. Roller Thrust Bearings

Provides smooth operation and extends life.

E. Segment Gear

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

F. Segment Gear Radial Bearings

Upper and lower bronze bearings provide ease of operation and extend life (lower bearing not visible).

G. Cover Gasket

Seals housing and prevents foreign material from entering actuator and prevents loss of grease.

H. Shaft Seal

Prevents foreign material from entering the actuator.

I. External Stops

Both open and closed stops are external and easily adjustable.

J. Position Indicator

Displays precise plug position on above ground service.

PRESSURE RATINGS

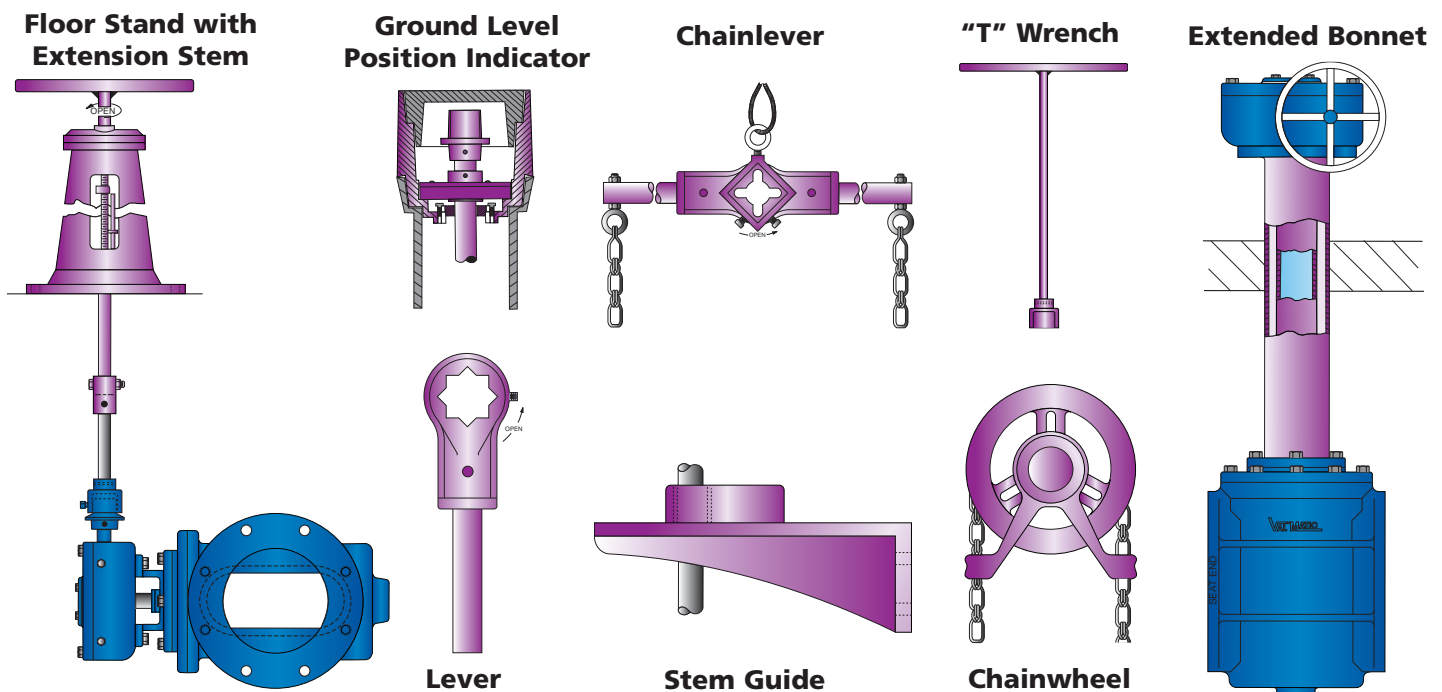
MAXIMUM PRESSURE RATINGS			
SERIES	CONNECTION	SIZE RANGE	CWP (psig)
5400	ANSI Class 125 Flanged 4-Way	4" - 12"	175
5500	ANSI Class 125 Flanged 3-Way	4" - 12"	175
5600R	ANSI Class 125 Flanged 100% Port	4" - 10"	175
		12" - 48"	150
5700R	AWWA C111 Mechanical Joint 100% Port	4" - 10"	175
		12" - 48"	150
5800RTL	ASME NPT Threaded	1/2" - 2"	175
5800R	ANSI Class 125 Flanged	2" - 12"	175
		14" - 54"	150
5800HP	ANSI Class 125 Flanged High Pressure	3" - 24"	250
5900R	AWWA C111 Mechanical Joint	3" - 12"	175
		14" - 54"	150
5900HP	AWWA C111 Mechanical Joint High Pressure	3" - 48"	250

MATERIALS OF CONSTRUCTION

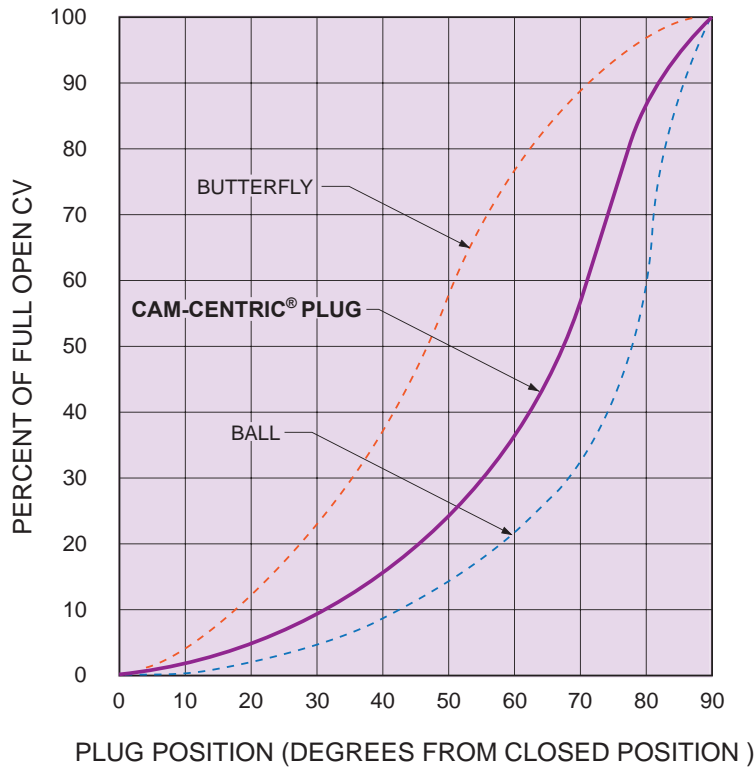
COMPONENT	STANDARD
Body (5600R, 5700R, 5800R, 5900R)	Cast Iron ASTM A126, Class B
Body (5400, 5500, 5800HP, 5900HP)	Ductile Iron ASTM A536, Grade 65-45-12
Plug (5600R, 5700R, 5800R, 5900R)	Cast Iron ASTM A126, Class B, Buna-N Encapsulated, ASTM D2000
Plug (5400, 5500, 5800HP, 5900HP)	Ductile Iron ASTM A536, Grade 65-45-12, Buna-N Encapsulated, ASTM D2000
Radial Shaft Bearings	T316 Stainless Steel
Top Thrust Bearing	Teflon
Bottom Thrust Bearing	T316 Stainless Steel
Available Coatings	Two-Part Epoxy, Fusion Bonded Epoxy, Glass Lining, Rubber Lining

Accessories

Space limitations and application specifics often require special accessories. In addition to those shown below, Val-Matic offers a wide range of accessories to meet your application requirements.



Flow Characteristics



INHERENT PUMP CONTROL FLOW CHARACTERISTICS

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

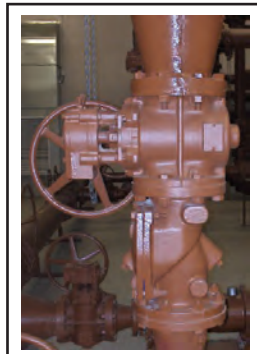
The graph at left shows the inherent flow characteristics at a constant ΔP for various valves.

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

Installations



Cam-Centric® Plug Valve with worm gear actuator and chainwheel



Cam-Centric® Plug Valve with Val-Matic Swing-Flex®



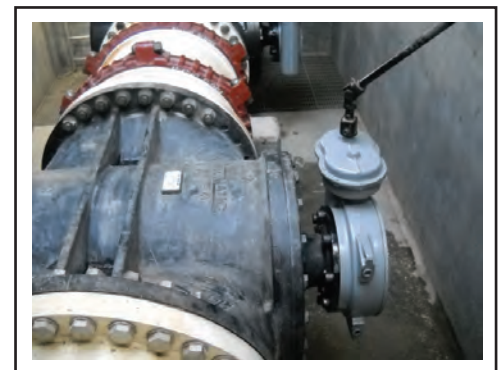
3-Way Cam-Centric® Plug Valves with worm gear actuators



Cam-Centric® Plug Valve with motor actuator



Cam-Centric® Plug Valve with worm gear actuator



Cam-Centric® Plug Valve with worm gear actuator and extension stem

2-Way Specification

SCOPE

- 1.1 This specification covers the design, manufacture, and testing of 1/2 in. (15 mm) through 3 in. (80 mm) Threaded Eccentric Plug Valve, 2 1/2 in. (60 mm) through 60 in. (1500 mm) Eccentric Plug Valve, and 4 in. (100 mm) through 60 in. (1500 mm) 100% Port Eccentric Plug Valve suitable for water or wastewater service with pressures up to 250 psig (1725 kPa).
- 1.2 Plug Valves shall be quarter-turn, non-lubricated with resilient encapsulated plug.

STANDARDS AND APPROVALS

- 2.1 2 1/2 in. (60 mm) through 60 in. (1500 mm) plug valves shall be designed, manufactured and tested in accordance with American Water Works Association Standard ANSI/AWWA C517.
- 2.2 All Plug Valves shall be certified Lead-Free in accordance with NSF/ANSI 372.
- 2.3 Manufacturer shall have a quality management system that is certified to ISO 9001 by an accredited, certifying body.

CONNECTIONS

- 3.1 Threaded valves shall have threaded NPT full size inlets. The connection shall be hexagonal for a wrench connection.
- 3.2 Flanged valves shall have flanges with drilling to ANSIB16.1, Class 125.
- 3.3 Mechanical Joint valves shall fully comply with ANSI/AWWA C111/A21.11.

DESIGN

- 4.1 Threaded and all other valves under 4" (100mm) shall have port areas of not less than 100% of pipe area. Port areas on other sizes are 85% on 16" (400 mm) and smaller, 80% on 18"-24" (150 mm- 600 mm), and 75% on 30" (800 mm) and larger.
- 4.2 Threaded valve seat shall be a machined seating surface.
- 4.3 2 1/2 in. (60 mm) through 60 in. (1500 mm) plug valves shall have a valve seat that is a welded overlay of 95% pure nickel applied directly to the body on a pre-machined, cast seating surface and machined to a smooth finish.
- 4.4 Threaded valves shall have shaft seals which consist of V-type lip seal in a fixed gland with a resilient O-ring spring.
- 4.5 2 1/2 in. (60 mm) through 60 in. (1500 mm) plug valves shall have shaft seals which consist of V-type packing in a fixed gland with an adjustable follower designed to prevent over compression of the packing and to meet design parameter of the packing manufacturer. Removable POP™ shims shall be provided under the follower flanges to provide for adjustment and prevent over tightening.
- 4.6 Permanently lubricated, radial shaft bearings shall be supplied in the upper and lower bearing journals. Thrust bearings shall be provided in the upper and lower journal areas, except for threaded type which only have upper thrust bearings.
- 4.7 Both the packing and bearings in the upper and lower journals shall be protected by a Grit-Guard™ "drip tight" Buna-N shaft seal located on the valve shaft to minimize the entrance of grit into the bearing journal and shaft seal areas.
- 4.8 The threaded valve body shall have 1/8" NPT upstream and downstream pressure ports.

MATERIALS

- 5.1 Valve bodies and covers shall be constructed of ASTM A126 Class B cast iron for working pressures up to 175 psig (1200 kPa) and ASTM A536 Grade 65-45-12 for working pressures up to 250 psig (1725 kPa). The words "SEAT END" shall be cast on the exterior of the body seat end.
- 5.2 Threaded valve plugs in sizes 1/2 in. (15 mm) through 3 in. (80 mm) shall be of one-piece construction and made of ASTM A126 Class B cast iron fully

- encapsulated with a resilient facing per ASTM D2000-BG and ANSI/AWWA C517 requirements.
- 5.3 2 1/2 in. (60 mm) through 60 in. (1500 mm) plugs shall be of one-piece construction and made of ASTM A126 Class B cast iron or ASTM A536 Grade 65-45-12 ductile iron and fully encapsulated with resilient facing per ASTM D2000-BG and ANSI/AWWA C517 requirements.
- 5.4 Threaded valves shall have radial shaft bearings constructed of self-lubricating Type 316 stainless steel. The top thrust bearing shall be Teflon.
- 5.5 2 1/2 in. (60 mm) through 60 in. (1500 mm) plug valves shall have radial shaft bearings constructed of self-lubricating Type 316 stainless steel. The top thrust bearing shall be Teflon. The bottom thrust bearing shall be self-lubricating Type 316 stainless steel. Cover bolts shall be corrosion resistant with zinc plating.

ACTUATION

- 6.1 Threaded valves shall be equipped with a hand lever with a dial indicator and open memory stop.
- 6.2 Valves 2 1/2 in. (60 mm) to 8 in. (200 mm) and 4 in. (100mm) to 6 in. (150 mm) 100% ported shall be equipped with a 2 inch square nut for direct quarter turn operation. The packing gland shall include a friction collar and an open position memory stop. The friction collar shall include a nylon sleeve to provide friction without exerting pressure on the valve packing.
- 6.3 When specified valves 4 in. (100 mm) and larger shall include a totally enclosed and sealed worm gear actuator with position indicator (above ground service only) and externally adjustable open and closed stops. The worm segment gear shall be ASTM A536 Grade 65-45-12 ductile iron with a precision bore and keyway for connection to the valve shaft. Bronze radial bearings shall be provided for the segment gear and worm shaft. Alloy steel roller thrust bearings shall be provided for the hardened worm.
- 6.4 All gear actuators shall be designed to withstand, without damage, a rim pull of 200 lb. on the hand wheel and an input torque or 300 ft-lbs. for nuts.
- 6.5 Buried service actuators shall be packed with grease and sealed for temporary submergence to 20 feet of water. Exposed worm shafts shall be stainless steel.

OPTIONS

- 7.1 When specified, the valve port area shall have not less than 100% of pipe area.
- 7.2 The interior and exterior of the valve shall be coated with an NSF/ANSI 61 approved fusion bonded epoxy.
- 7.3 The interior of the valve shall be coated with 8 mils SG-14 glass lining or 1/8" soft rubber lining.

MANUFACTURE

- 8.1 Manufacturer shall demonstrate a minimum of ten (10) years' experience in the manufacture of plug valves. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings and operation and maintenance manuals.
- 8.2 The exterior of the valve for above ground service shall be coated with a universal alkyd primer. Valve exterior for buried service shall be coated with an epoxy coating.
- 8.3 Valve shall be marked with the Serial Number, Manufacturer, Size, Cold Working Pressure (CWP) and the Direct and Reverse Actuator Pressure Ratings on a corrosion resistant nameplate.
- 8.4 Plug Valves shall be Series # 5600R (100% Port Flanged), 5700R (100% Port Mechanical Joint), 5800RTL (Threaded), 5800R (Flanged), 5800HP (Flanged), 5900R (Mechanical Joint) or 5900HP (Mechanical Joint) as manufactured by Val-Matic Valve and Mfg. Corporation, Elmhurst, IL. USA or approved equal.

VAL-MATIC®

Val-Matic's quality of design and meticulous workmanship has set the standards by which all others are measured. Quality design features such as the AWWA **Ener•G® Ball Valve** with its energy efficient design, fusion bonded epoxy and adjustable resilient seating....**Cam-Centric® Plug Valves** have more requested features than any other eccentric plug valve....**American-BFV® Butterfly Valves** include a field replaceable seat without the need for special tools....**Tilted Disc® Check Valves** with high strength and wear resistant aluminum bronze trim as standard....**Silent Check Valves** featuring combined resilient/metal-to-metal seating and are **NSF/ANSI 61 & 372 Certified**....**Sure Seal Foot Valves** provided with a heavy duty stainless steel screened inlet....**Swing-Flex® and Surgebuster® Check Valves** designed with an unrestricted full flow area....**Swing Check Valves** with field adjustable closure versatility....**Dual Disc® Check Valves** utilizing stabilized components to provide extended life....**Air Release, Air/Vacuum and Combination Air Valves** provided standard with Type 316 stainless steel trim....**VaultSafe®** family of products includes the **FloodSafe® Inflow Preventer, FrostSafe®** two-way damper and the **VentSafe®** vent pipe security cage. These features coupled with our attention to detail put Val-Matic Valves in a class by themselves. All products are WQA certified Lead-Free in accordance with NSF/ANSI 372.

Val-Matic is totally committed to providing the highest quality valves and outstanding service to our customers. Complete customer satisfaction is our goal.

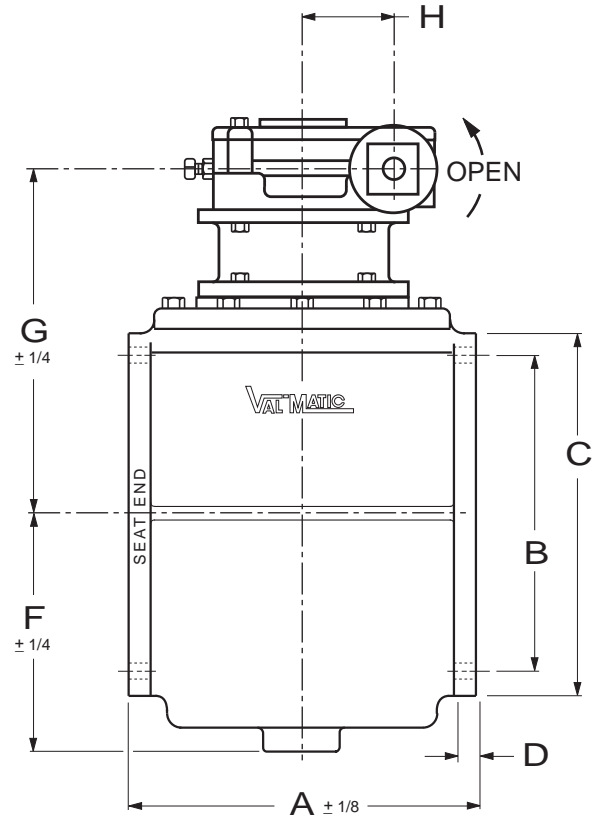
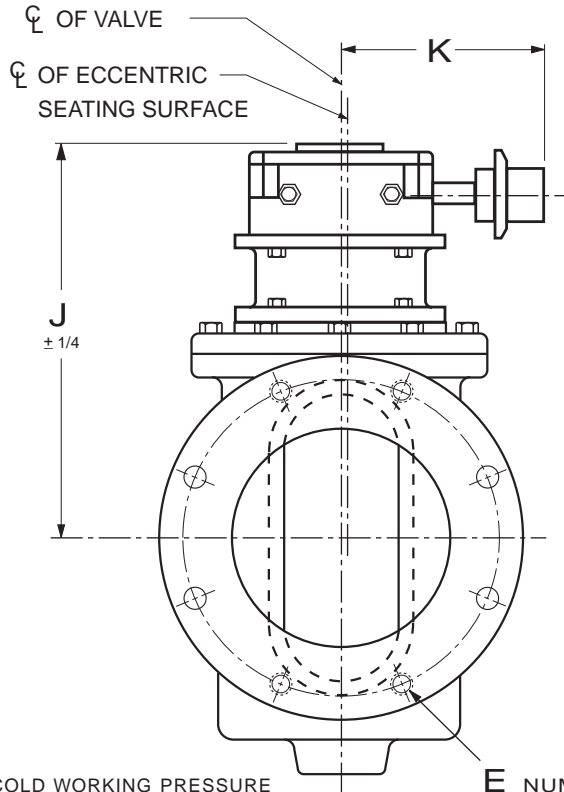
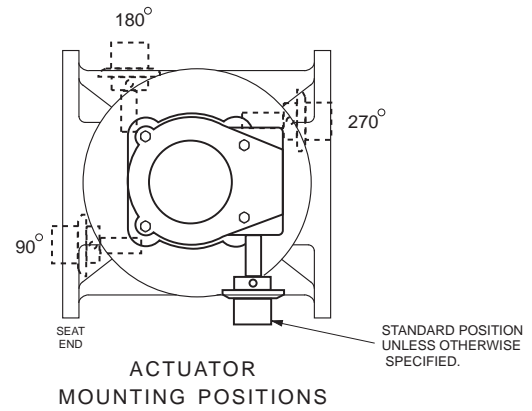
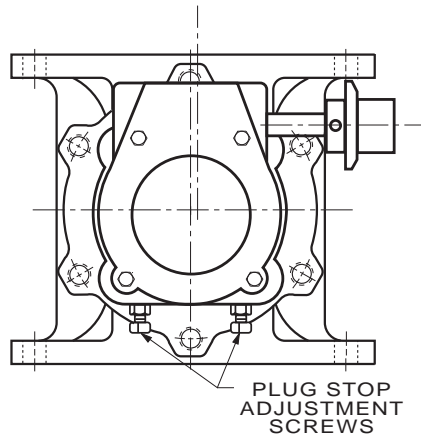
Make the Change
to Quality!

Specify

VAL-MATIC®

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www.valmatic.com
valves@valmatic.com

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ISO 9001:2008 certified company



COLD WORKING PRESSURE
175 P.S.I.
HYDRO TEST PRESSURE
265 P.S.I.

E NUMBER OF TAPPED HOLES PER FLANGE.

SEE DRAWING NO. VM-5804RN-M FOR STANDARD MATERIAL OF CONSTRUCTION.

VALVE SIZE	MODEL NO.	RATING, P.S.I.		A	B	C	D	E QTY	E TAP	E DEEP	F	G	H	J	K	NO. OF TURNS	BOLT SIZE	NO. OF BOLTS
		REV	DIR															
3	5803R/8A02	175	175	8.00	6.00	7.50	0.75	2	5/8-11	0.75	4.50	7.78	4.75	9.66	9.00	12.5	5/8	4
4	5804R/8A02	175	175	9.00	7.50	9.00	0.75	0	—	—	5.56	9.31	4.75	11.19	9.00	12.5	5/8	8
6	5806R/8A02	175	175	10.50	9.50	11.00	0.75	4	3/4-10	1.25	7.06	11.06	4.75	12.94	9.00	12.5	3/4	8
8	5808R/8A02	175	175	11.50	11.75	13.50	0.88	4	3/4-10	1.25	8.75	12.62	4.75	14.50	9.00	12.5	3/4	8
10	5810R/8C02	100	175	13.00	14.25	16.00	1.00	4	7/8-9	1.25	10.44	16.25	4.75	19.00	7.88	20	7/8	12
	5810R/8D02	175	175															
12	5812R/8C02	100	175	14.00	17.00	19.00	1.25	4	7/8-9	1.25	12.25	17.68	4.75	20.44	7.88	20	7/8	12
	5812R/8D02	175	175															

ANSI CLASS 125 CAM-CENTRIC® FLANGED PLUG VALVE WITH BURIED WORM GEAR ACTUATOR

DATE Revised 5-17-10
5-15-97

VAT MATIC® VALVE AND MANUFACTURING CORP.

DRWG. NO.

VM-5804R/BWGA



RFCA (Restrained Flanged Coupling Adapter)

Material Specification

Flange Body: Ductile (nodular) iron, meeting or exceeding ASTM A 536, Grade 65-45-12. Flange meets the dimensional requirements of ANSI Class 125 and 150 bolt circles.

Gaskets: Compounded for water and sewer service in accordance with ASTM D 2000 (Sizes 3 - 12" have flange O-Ring gasket). Other compounds available for petroleum, chemical, or high temperature service.

Gland: Romac RomaGrip™. See page 7-6.

Restraining Bolts: 7/8 -9 roll thread, Ductile (nodular) iron, meeting or exceeding ASTM A 536.

Restraining Lugs: Ductile (nodular) iron, meeting or exceeding ASTM A 536. Heat treated using a proprietary process.

Lug Locators: Polyurethane, a thermal plastic.

T-bolts and Nuts: High strength low alloy steel T-head bolt. National coarse rolled thread and heavy hex nut. Steel meets AWWA C111 composition specifications. **Stainless steel bolts and nuts** available on request.

Coatings: Shop coat applied to cast parts for corrosion protection in transit. **Fusion bonded epoxy** available on request.

Use: Ductile Iron Pipe 3 - 24", cast iron pipe 3" - 24" (same OD's as ductile iron) and IPS size STD steel pipe 3 - 12".

To Order: Specify catalog number. **Example:** For a 12" RFCA Order: **RFCA - 13.20**

NOTE: 3" - 12" special Romac gasket works on both steel and D.I. ODs.



Not for use on PVC, HDPE pipe or plain-end mechanical joint fittings. For applications on PVC, please contact your Romac representative.

NOM. PIPE SIZE	GASKET RANGE	LENGTH	GLAND BOLTS QTY: SIZE	CATALOG NUMBER	LIST PRICE				WEIGHT (lbs.)
					Shopcoat w/Std. B&N	Shopcoat w/304 SS B&N	Fusion Epoxy w/Std. B&N	Fusion Epoxy w/304SS B&N	
3"	3.50-3.96	8.00"	4: 5/8" x 3"	RFCA - 3.96	\$145.45	\$157.56	\$165.10	\$177.20	21
4"	4.50-4.80	9.00"	4: 3/4" x 3 1/2"	RFCA - 4.80	183.32	209.43	207.88	233.99	29
6"	6.63-6.90	9.25"	6: 3/4" x 4"	RFCA - 6.90	233.85	273.01	267.10	306.26	40
8"	8.63-9.05	9.25"	6: 3/4" x 4"	RFCA - 9.05	315.59	354.75	355.82	394.98	53
10"	10.75-11.10	10.25"	8: 3/4" x 4"	RFCA - 11.10	581.96	634.17	669.69	721.91	83
12"	12.75-13.20	10.25"	8: 3/4" x 4"	RFCA - 13.20	632.13	684.34	739.86	792.07	110
14"	15.30	11.70"	10: 3/4" x 4 1/2"	RFCA - 15.30	882.79	947.37	1,020.54	1,085.12	170
16"	17.40	11.70"	12: 3/4" x 4 1/2"	RFCA - 17.40	1,225.93	1,302.91	1,410.23	1,487.21	200
18"	19.50	11.80"	12: 3/4" x 4 1/2"	RFCA - 19.50	1,346.63	1,423.60	1,546.13	1,623.10	217
20"	21.60	11.80"	14: 3/4" x 4 1/2"	RFCA - 21.60	1,521.19	1,611.94	1,772.94	1,863.69	256
24"	25.80	12.00"	16: 3/4" x 5"	RFCA - 25.80	1,845.38	1,959.61	2,130.38	2,244.61	305



Some initial axial movement may occur in lug style restraints as the lugs seat. Movement is directly related to the size of the piping system and the system pressure. In general terms movement of approximately 0.25" can be expected in restraints under 16". For larger sizes, movement of approximately 0.4" may be seen. If this is critical to your application please contact Romac Engineering for additional information.

INSTALLATION INSTRUCTIONS

Read installation instructions first before installing. Check parts to ensure that no damage has occurred during transit and that no parts are missing. Also check the diameter of the pipe and the size marked on the coupling to ensure you have the proper size.



RFCA Restrained Flange Coupling Adapter

NOT FOR USE ON PVC PIPE OR PLAIN END MECHANICAL JOINT FITTINGS

NOTE: Not for use on polyethylene pipe, plain end mechanical joint fittings or PVC pipe.

The "Stab-Fit" installation technique may also be employed on 3"-10" sizes.

Step 1 • Check the RFCA parts to insure that no damage has occurred during transit and that no parts are missing.

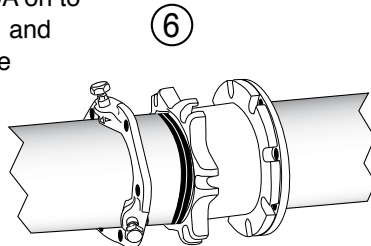
Step 2 • Clean pipe end for a distance of 2" greater than length of the RFCA.

Step 3 • Place RomaGrip gland on pipe end.

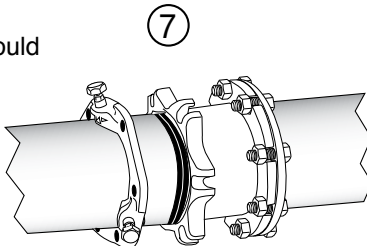
Step 4 • Lubricate the gasket and pipe surface with soapy water or other suitable gasket lubricant.

Step 5 • Place gasket over pipe with beveled edge toward the flange adapter.

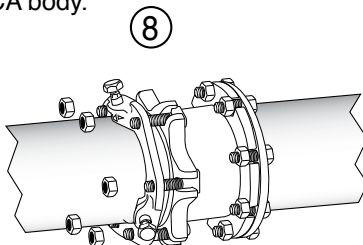
Step 6 • Slide the RFCA on to the pipe. Position the pipe and flanged coupling against the mating flange, inserting flange gasket (14" and larger) between the flange faces. Assemble the flange joint using flange bolts.



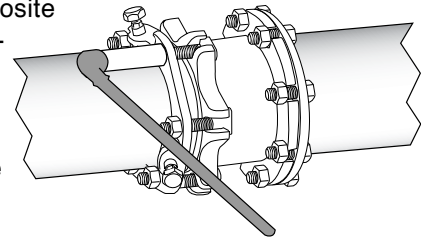
Step 7 • The pipe should be centered such that the space between the OD of the pipe and the ID of the RFCA is even all around the pipe. Slide the RFCA gasket into position with the beveled edge engaging the beveled end of the RFCA body.



Step 8 • Slide the RomaGrip into position against the gasket, and insert T-bolts.



Step 9 • Tighten T-bolts evenly, alternating to diametrically opposite position at approximately 20 ft-lbs increments to the recommended torque for your size RFCA.



Recommended Torque:

3" RomaGrip - 45-65 ft-lbs.

4 - 24" RomaGrip - 75 - 90 ft-lbs.

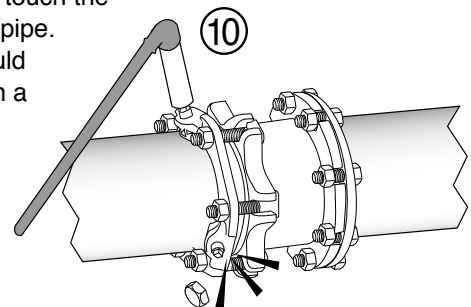
Note:

90 ft-lbs. torque = 12" wrench w/90 lbs. force

For best results, wait 10 minutes and retighten bolts to proper torque.

Step 10 • Hand tighten the restrainer bolts until the restraining pads touch the surface of the pipe.

The bolts should be tightened in a uniform criss-cross pattern, until the heads break off above the notch.



NOTE: Do not turn a bolt more than one turn before alternating to the next bolt.

Step 11 • Pressure test for leaks before backfilling.

RFCA Restrained Flange Coupling Adapter

NOT FOR USE ON PVC PIPE OR PLAIN END MECHANICAL JOINT FITTINGS

PRECAUTIONS

1. Check flange to make sure the bolt holes match the RFCA.
2. Make sure a flange gasket is used between the mating flanges on sizes 14" and larger.
3. Check diameter of pipe to make sure you are using the correct size RFCA; also check gasket to make sure it is the size you think it is.
4. Be sure to clean pipe of as much dirt and corrosion as possible in the area that the gasket will seal.
5. Lubricate both the gasket and the pipe end with soapy water or approved pipe lubricant per ANSI/AWWA C111/A21.11.
6. Make sure no foreign materials lodge between gasket and pipe.
7. Avoid loose fitting wrenches, or wrenches too short to achieve proper torque.
8. Keep threads free of foreign material to allow proper tightening.
9. Take extra care to follow proper bolt tightening procedures and torque recommendations. Bolts are often not tightened enough when a torque wrench is not used.
10. Be sure that the gland is centered around the pipe.
11. Pressure test for leaks before backfilling.
12. Backfill and compact carefully around pipe and fittings.
13. Some initial axial movement may occur in lug style restraints as the lugs seat. Movement is directly related to the size of the piping system and the system pressure. In general terms movement of approximately 0.25" can be expected in restraints under 16". For larger sizes, movement of approximately 0.4" may be seen. If this is critical to your application please contact Romac Engineering for additional information.

COMMON INSTALLATION PROBLEMS

1. Flange gasket not installed on sizes 14" and larger.
2. T-Bolts are not tightened to the proper torque.
3. Rocks or debris between pipe and gasket.
4. Dirt or debris between pipe and restraining pad.
5. Dirt on threads of bolts or nuts.
6. Restraining bolt heads not snapped off.
7. Not enough pipe inserted into bell.
8. Using the RFCA on IPS size steel pipe with wall thickness thinner than schedule 40 steel pipe. (3-12 inch sizes)

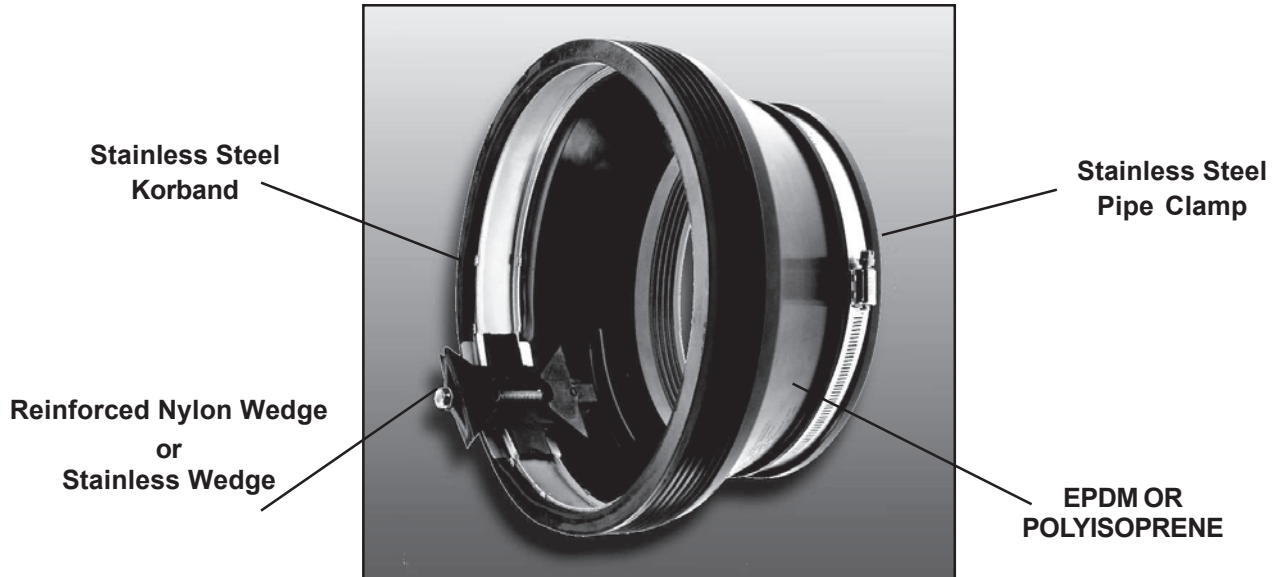
IF RFCA MUST BE REMOVED

1. Make sure pipe is not pressurized. Removing the restrainer could cause the pipe joint to separate.
2. To remove the RFCA, use a $\frac{5}{8}$ " hex wrench or socket.
3. To reassemble, follow installation procedures. Tighten the restraining bolts using a $\frac{5}{8}$ " hex wrench to 75-ft-lbs minimum.



KOR-N-SEAL® I & II FLEXIBLE PIPE-TO-MANHOLE CONNECTORS

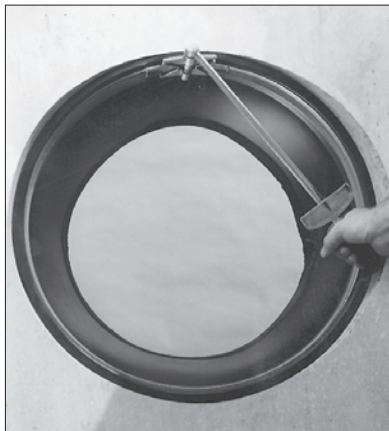
SPECIFICATION SHEET



KOR-N-SEAL I - WEDGE KORBAND CONNECTOR ASSEMBLY



Install Kor-N-Seal I - Wedge Korband with Socket Wrench & Torque Limiter



Install Kor-N-Seal II - Wedge Korband with Standard Torque Wrench



Install Pipe Clamp(s) with T-Handle Torque Wrench





KOR-N-SEAL® I & II

Flexible Pipe-to-Manhole Connectors

SPECIFICATION SHEET

PERFORMANCE

Test	ASTM Method	Test Requirements	Kor-N-Seal® I & II
Head Pressure	C923 - 7.1	0° - 13 psi (30 ft) for 10 min. 7° - 10 psi (23 ft) for 10 min.	+13 psi for 10 min. +10 psi for 10 min.
Deflection Test	C923 - 7.2.2	7° in any direction	Over 7° in any direction
Load Test	C923 - 7.2.3	150 lbs/in. pipe dia.	Over 150 lbs/in. pipe dia.

Performed on all standard sizes of Kor-N-Seal Connectors.

RESILIENT EPDM OR POLYISOPRENE RUBBER

Conforms to ASTM C923

Test	ASTM Method	Test Requirements	TEST RESULTS Kor-N-Seal® I & II
Chemical Resistance	D543, at 22°C for 48 h		
1 N Sulfuric Acid		No weight loss	No weight loss
1 N Hydrochloric Acid		No weight loss	No weight loss
Tensile Strength	D412	1200 psi	1580 psi
Elongation at Break		350% min.	500%
Hardness	D2240 (shore A durometer)	± 5 from the manufacturer's specified hardness	48 ± 5
Accelerated Oven-Aging	D573 70 ± 1°C for 7 days	Decrease of 15%, max. of original tensile strength, decrease of 20% max. of elongation	10.1% tensile decrease 14.0% elongation decrease
Compression Set	D395, method B, at 70°C for 22 h	Decrease of 25%, max. of original deflection	13% decrease
Water Absorption	D471, immerse 0.75 by 2-in. specimen in distilled water at 70°C for 48 h	Increase of 10%, max. of original by weight	.8% increase
Ozone Resistance	D1171	Rating 0	Rating 0
Low-temperature Brittle Point	D746	No fracture at -40°C	No fracture at -40°C
Tear Resistance	D624, method B	200 lbf/in.	No tear at 210 lbf/in.

INTERNAL KORBAND

Conforms to ASTM C923, ASTM A666, and A240

- Korband Assembly is manufactured of 300 series stainless steel.
- Toggle Expander is made of 300 series stainless steel.
- The 106/406 series Wedge Expander is made from reinforced nylon or 300 series stainless steel.
- The 206/306 series Wedge Expander is made from 300 series stainless steel.

EXTERNAL PIPE CLAMP

Conforms to ASTM C923, ASTM A666, and A240

External take-up clamps are manufactured of 300 series stainless steel.

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250 Elm Street • P.O. Box 301
Milford, NH 03055, U.S.A.

Tel: 603-673-8680 • 800-626-2180 • Fax: 603-673-7271

NPC Kor-N-Seal Pipe-to-Manhole Connector

Technical Specification

Scope:

This specification describes the function of the NPC Kor-N-Seal pipe-to-manhole connector, its principle of operation, and the component materials that constitute the Kor-N-Seal connector, and their physical properties.

Product Application:

NPC Kor-N-Seal connectors are designed and manufactured to meet or exceed the requirements of ASTM C-923 "Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals". This specification requires the connector to provide a watertight seal under the following conditions:

- 10 PSI (23 feet head) of groundwater pressure
- Minimum 7 Degrees of pipe articulation in any direction
- Radial loading test of 150 pounds per inch diameter of pipe

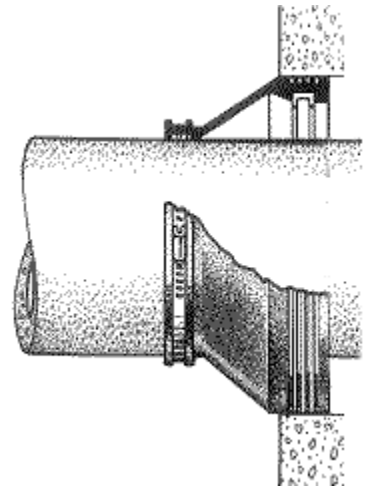
Principle of Operation:

The Kor-N-Seal connector creates a watertight seal between the pipe and manhole by first sealing to the inside of the cored or formed hole in the manhole and then sealing to the outside of the pipe. See illustration at right.

The seal at the inside of the manhole is created by the stainless steel Korband. The Korband is located inside of the end of the Kor-N-Seal connector that fits into the manhole. Once the Kor-N-Seal connector is located in the manhole, the diameter of the Korband is increased. This compresses the Kor-N-Seal connector against the inside wall of the hole in the manhole creating a watertight seal at the manhole.

The seal at the outside of the pipe is created by the stainless steel pipe clamp(s). The pipe clamp is located on the outside of the Kor-N-Seal connector. Once the pipe has been positioned in the connector the diameter of the pipe clamp is decreased. This compresses the Kor-N-Seal connector against the outside wall of the pipe creating a watertight seal at the pipe.

Reference the [Kor-N-Seal Recommended Installation Instructions](#) for a detailed explanation of the preparation and installation of the Kor-N-Seal connector.





KOR-N-SEAL – STAINLESS STEEL WEDGE

Recommended Installation Procedure

Refer to reverse side *Kor-N-Seal I - Wedge Korband Installation Chart* for Hole Size Range, Connector Dimensions, and Suggested Pipe O.D. Range.

CONNECTOR INSTALLATION:

1. Check to be sure Korband is properly located in Connector groove. (Fig. 1)
2. Insert Connector Assembly into hole with Wedge Expander at top of hole. (Fig. 2)
3. Position Connector so it is square to manhole both vertically and horizontally. (Fig. 3)
4. Tighten Wedge Expander using 1/2" [13 mm] socket with a preset torque limiter for each. For each size connector use torque limiter preset to proper torque. (Fig. 4) Retorquing is not required prior to shipment.

CAUTION: DO NOT USE IMPACT WRENCH.

IMPORTANT

RECOMMENDED TORQUE		TORQUE LIMITER
Connector Inches [mm]	Foot Pounds [Newton Meters]	P/N
10 – 24 [254 – 610]	12 [16]	91440-12

Fig. 4

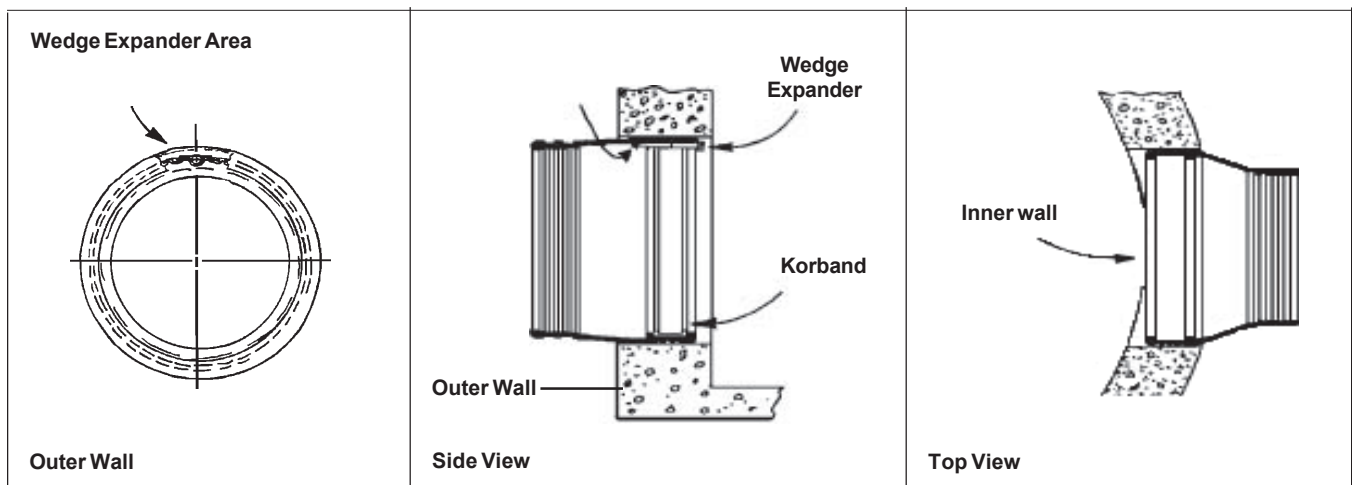


Fig. 1

Fig. 2

Fig. 3

PIPE INSTALLATION:

1. Center pipe in Connector opening.
2. On maximum pipe O.D. installations, use a pipe lubricant on the outside barrel of the pipe and/or the inside ridges of the Connector (under the Pipe Clamp area) to allow the pipe to slide into place more easily.
3. Position the Pipe Clamp in the Connector's Pipe Clamp groove with the screw at the top.
4. Tighten the Pipe Clamp screw to 60 inch pounds [7 Newton Meters] with a T-handle Torque Wrench, P/N 80090.
5. On minimum pipe O.D. installations, lift the rubber up underneath the Pipe Clamp screw so that the Connector contacts the bottom surface of the pipe while the Pipe Clamp screw is being tightened. Application of pipe lubrication on the underside of the clamp will also help assure that an even contraction of rubber is maintained throughout the clamping area.
6. After the Pipe Clamp has been tightened down firmly, move the pipe horizontally and/or vertically to bring it to grade.

CAUTION: Pipe must **NOT** rest on Connector Korband.

CAUTION:

All capped stubs awaiting pipe installation at a later date must be restrained. Assure that a proper backfill material is used in adverse conditions. Prior to any critical usage, contact NPC Customer service at 1-800-626-2180.



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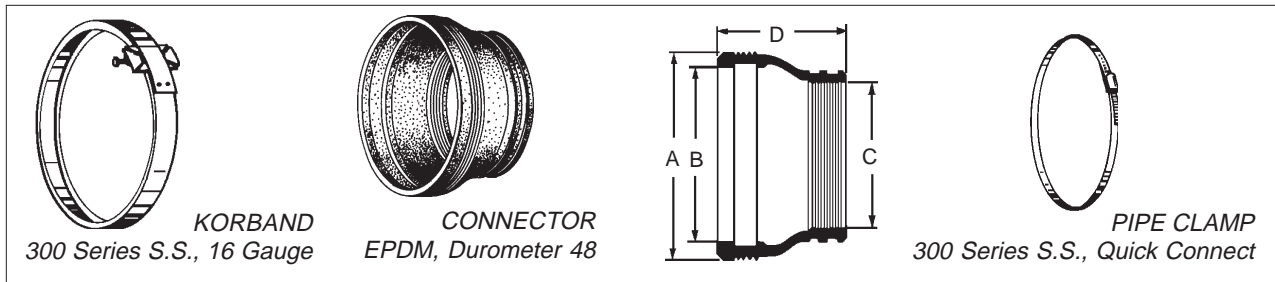
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KOR-N-SEAL – STAINLESS STEEL WEDGE

Recommended Installation Procedure



Kor-N-Seal S106 Series

Connector P/N	Suggested Pipe O.D. Range Inches	Hole Size Range Inches	Connector Dimensions Inches			Pipe Clamp P/N
		A	B	C	D	
S106-12BWS	5.75 — 7.00	12.00 — 12.20	10.30	6.50	8	I-128
S106-12AWS	7.00 — 8.50	12.00 — 12.20	10.30	8.00	8	I-180
S106-12WS	8.25 — 9.75	12.00 — 12.20	10.30	9.25	8	I-180
S106-14AWS	9.50 — 11.25	14.00 — 14.20	12.25	10.50	8	I-190
S106-16BWS	9.50 — 11.25	15.95 — 16.15	14.30	10.50	8	I-190
S106-16AWS	11.25 — 13.00	15.95 — 16.15	14.30	12.25	8	I-218
S106-16WS	13.00 — 14.20	15.95 — 16.15	14.30	14.00	8	I-242
S106-20BWS	14.00 — 15.50	19.95 — 20.10	18.25	15.00	8	I-306
S106-20AWS	15.50 — 17.00	19.95 — 20.10	18.25	16.50	8	I-306
S106-20WS	17.00 — 18.15	19.95 — 20.10	18.25	18.00	8	I-306
S106-22WS	17.75 — 19.25	21.95 — 22.10	20.25	18.75	8	I-318
S106-24WS	19.60 — 21.10	23.95 — 24.10	22.25	20.60	8	I-348

Kor-N-Seal S406 Series

S406-10AWS	6.00 — 6.75	10.00 — 10.20	8.30	6.50	6	I-128
S406-10WS	7.50 — 8.20	10.00 — 10.20	8.30	8.50	6	I-180
S406-10.5AWS	6.00 — 6.75	10.50 — 10.70	8.80	6.50	6	I-128
S406-10.5WS	7.50 — 8.70	10.50 — 10.70	8.80	8.50	6	I-180
S406-11BWS	6.00 — 7.00	11.00 — 11.20	9.30	6.00	6	I-128
S406-11AWS	7.50 — 9.00	11.00 — 11.20	9.30	8.00	6	I-180
S406-12CWS	6.00 — 7.00	12.00 — 12.20	10.30	6.50	6	I-128
S406-12BWS	6.25 — 7.50	12.00 — 12.20	10.30	7.00	6	I-128
S406-12AWS	7.50 — 9.00	12.00 — 12.20	10.30	8.50	6	I-180
S406-12WS	9.00 — 10.20	12.00 — 12.20	10.30	10.00	6	I-180

Suggested pipe O.D. range comes from field experience. Refer to *Recommended Pipe Installation Procedure*.



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CONSEAL™
Concrete Sealants INC.

CS-202

Butyl Rubber Sealant

APPLICATIONS

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

SEALING PROPERTIES

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

HYDROSTATIC STRENGTH

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

SPECIFICATIONS

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



CONSEAL™
Concrete Sealants INC.

CS-202

Butyl Rubber Sealant

PHYSICAL PROPERTIES

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

IMMERSION TESTING

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

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

LIMITED WARRANTY

This information is presented in good faith, but we cannot anticipate all conditions under which this information and our products, or the products of other manufacturers in combination with our products, may be used. We accept no responsibility for results obtained by the application of this information or the safety and suitability of our products, either alone or in combination with other products. Users are advised to make their own tests to determine the safety and suitability of each such product or product combinations for their own purposes. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for this own particular use. We sell this product without warranty, and buyers and users assume all responsibility and liability for loss or damage arising from the handling and use of this product, whether used alone or in combination with other products.



TNEME-LINER SERIES 61

PRODUCT PROFILE

GENERIC DESCRIPTION	Cycloaliphatic Amine Epoxy
COMMON USAGE	Tightly cross-linked epoxy with excellent corrosion and chemical resistance. Principally used for immersion service, including fuel and crude oil storage, chemical containment and wastewater treatment.
COLORS	5001 Gray and 5002 Beige
FINISH	Semi-gloss
SPECIAL QUALIFICATIONS	A two-coat system of Series 61 at 4.0 to 6.0 dry mils (100-150 dry microns) per coat passes the performance requirements of MIL-PRF-4556F .
PERFORMANCE CRITERIA	Extensive test data available. Contact your Tnemec representative for specific test results.

COATING SYSTEM

PRIMERS	Steel: Self-priming Concrete: Self-priming or Series 215, 217, 218 CMU: Series 215, 218
TOPCOATS	Note: Series 61 can be topcoated with select Tank Armor linings depending on service conditions. Contact Tnemec Technical Service for recommendations.

SURFACE PREPARATION

STEEL	Immersion Service: SSPC-SP10/NACE 2 Near-White Blast Cleaning obtaining a minimum angular anchor profile of 2.0 mils (50 microns).
CONCRETE	Allow new concrete to cure for 28 days. Abrasive blast referencing SSPC-SP13/NACE 6, ICRI-CSP3-5 Surface Preparation of Concrete and Tnemec's Surface Preparation and Application Guide.
ALL SURFACES	Must be clean, dry and free of oil, grease and other contaminants.

TECHNICAL DATA

VOLUME SOLIDS	82.0 ± 2.0% (mixed) †
RECOMMENDED DFT	1. For JP-4, JP-5, JP-8, Aviation Gas and Jet A-1: 4.0 to 6.0 mils (100 to 150 microns) per coat (minimum of two coats). 2. Most Other Applications: 8.0 to 12.0 mils (205 to 305 microns) per coat (minimum of two coats). Contact your Tnemec representative for specific recommendations.

CURING TIME	Temperature	To Handle	To Recoat	Immersion
	75°F (24°C) at 4.0 mils (100 microns)	6 hours	16-18 hours •	5 to 7 days
	75°F (24°C) at 12.0 mils (305 microns)	11 hours	16-18 hours •	5 to 7 days

Curing time varies with surface temperature, air movement, humidity and film thickness.
• Maximum recoat time is 72 hours. If more than 72 hours have elapsed between coats, the coated surface must be scarified before topcoating.

VOLATILE ORGANIC COMPOUNDS	EPA Method 24 Unthinned: 0.36 lbs/gallon (45 grams/litre) Thinned 6%: 0.71 lbs/gallon (85 grams/litre) Thinned 10%: 1.21 lbs/gallon (145 grams/litre) †
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HAPS	Unthinned: 1.53 lbs/gal solids Thinned 10%: 2.42 lbs/gal solids
-------------	--

THEORETICAL COVERAGE 1,315 mil sq ft/gal (32.3 m²/L at 25 microns). See APPLICATION for coverage rates. †

NUMBER OF COMPONENTS Two: Part A (amine) and Part B (epoxy)

MIXING RATIO By volume: One (Part A) to one (Part B)

PACKAGING	PART A	PART B	Yield (mixed)
Large Kit	5 gallon pail (18.9 L)	5 gallon pail (18.9 L)	10 gallons (37.85 L)
Small Kit	1 gallon can (3.79 L)	1 gallon can (3.79 L)	2 gallons (7.57 L)

NET WEIGHT PER GALLON 13.10 ± 0.25 lbs (5.94 ± .11 kg) †

STORAGE TEMPERATURE Minimum 20°F (-7°C) Maximum 110°F (43°C)
For optimum application properties, material temperature should be above 60°F (16°C) prior to application.

TEMPERATURE RESISTANCE (Dry) Continuous 250°F (121°C) Intermittent 275°F (135°C)
Performance in high temperature immersion applications depends on liquid media, temperature and substrate. Contact your Tnemec representative for more information.

SHELF LIFE 24 months at recommended storage temperature.

FLASH POINT - SETA Parts A & B: 81°F (27°C)

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

APPLICATION

TNEME-LINER | SERIES 61

COVERAGE RATES

For JP-4, JP-5, JP-8
Aviation Gas, Jet A-1 Service

	Dry MILS (Microns)	Wet MILS (Microns)	Sq Ft/Gal (m ² /Gal)
Suggested	5.0 (125)	6.0 (150)	263 (24.4)
Minimum	4.0 (100)	5.0 (125)	329 (30.6)
Maximum	6.0 (150)	7.5 (190)	219 (20.4)

Most Other Applications

	Dry MILS (Microns)	Wet MILS (Microns)	Sq Ft/Gal (m ² /Gal)
Suggested	10.0 (255)	12.0 (305)	132 (12.2)
Minimum	8.0 (205)	10.0 (255)	164 (15.3)
Maximum	12.0 (305)	14.5 (355)	110 (10.2)

Allow for overspray and surface irregularities. Film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance. †

MIXING

Power mix contents of each container, making sure no pigment remains on the bottom. Pour a measured amount of Part B into a clean container large enough to hold both components. Add an equal volume of Part A to Part B while under agitation. Continue agitation until the two components are thoroughly mixed. Do not use mixed material beyond pot life limits. **Note:** Both components must be above 60°F (16°C) prior to mixing. Mixing ratio is one to one by volume. A large volume of material will set up quickly if not applied or reduced in volume. **Caution: Do not reseal mixed material. An explosion hazard may be created.**

THINNING

Use No. 2 Thinner. For air spray, thin up to 10% or 12 oz (354 mL) per gallon. For airless spray or brush, thin up to 5% or 6 oz (177 mL) per gallon. **Note:** A maximum of 6% or 7 oz (207 mL) per gallon of No. 2 Thinner may be used to comply with VOC regulations.

POT LIFE

2 1/2 hours at 60°F (16°C) 1 1/2 hours at 77°F (25°C) 45 minutes at 100°F (38°C)

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	60-90 psi (4.1-6.2 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.015"-0.021" (380-535 microns)	3000-3800 psi (207-262 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

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

Brush: Recommended for small areas only. Use high quality natural or synthetic bristle brushes. **Note:** Two or more coats may be required to obtain recommended film thicknesses.

SURFACE TEMPERATURE

Minimum 60°F (16°C) Maximum 135°F (57°C)

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

CLEANUP

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

† Values may vary with color.

WARRANTY & LIMITATION OF SELLER'S LIABILITY: Tnemec Company, Inc. warrants only that its coatings represented herein meet the formulation standards of Tnemec Company, Inc. THE WARRANTY DESCRIBED IN THE ABOVE PARAGRAPH SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. The buyer's sole and exclusive remedy against Tnemec Company, Inc. shall be for replacement of the product in the event a defective condition of the product should be found to exist and the exclusive remedy shall not have failed its essential purpose as long as Tnemec is willing to provide comparable replacement product to the buyer. NO OTHER REMEDY (INCLUDING, BUT NOT LIMITED TO, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY, ENVIRONMENTAL INJURIES OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS) SHALL BE AVAILABLE TO THE BUYER. Technical and application information herein is provided for the purpose of establishing a general profile of the coating and proper coating application procedures. Test performance results were obtained in a controlled environment and Tnemec Company makes no claim that these tests or any other tests, accurately represent all environments. As application, environmental and design factors can vary significantly, due care should be exercised in the selection and use of the coating.

Figure 420 BRASS BODY BALL VALVES



2 PC FULL PORT 600 WOG

Features:

- 600 WOG
- 150 WSP
- Full Port
- Meets NSF-61 Standards (to 2")
- Meets MSS SP-110 Standards
- Blow-out Proof Stem
- Adjustable Packing
- Threaded NPT Ends (ANSI B 1.20.1)
- Forged Brass Body & End Cap
- 100% Electronically Tested in Open and Closed Position at 80 PSI
- Optional Lock Lever
- Optional Stem Extension
- Optional Tee Handle (to 1")
- Optional Oval Handle (to 2")
- Optional SS Ball & Stem (to 2")
- Optional Memory Stop (to 2")



OPTIONS



Lock Lever



Stem Extension



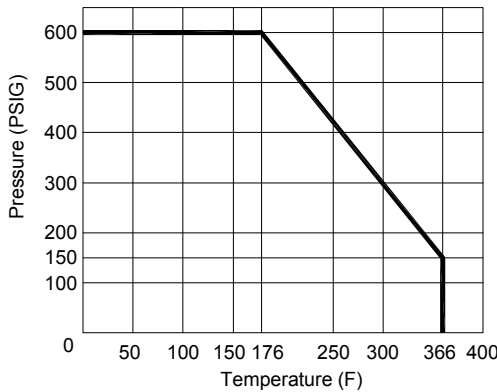
Tee or Oval Handle



SS Ball & Stem



Memory Stop



Up to 2"



C US

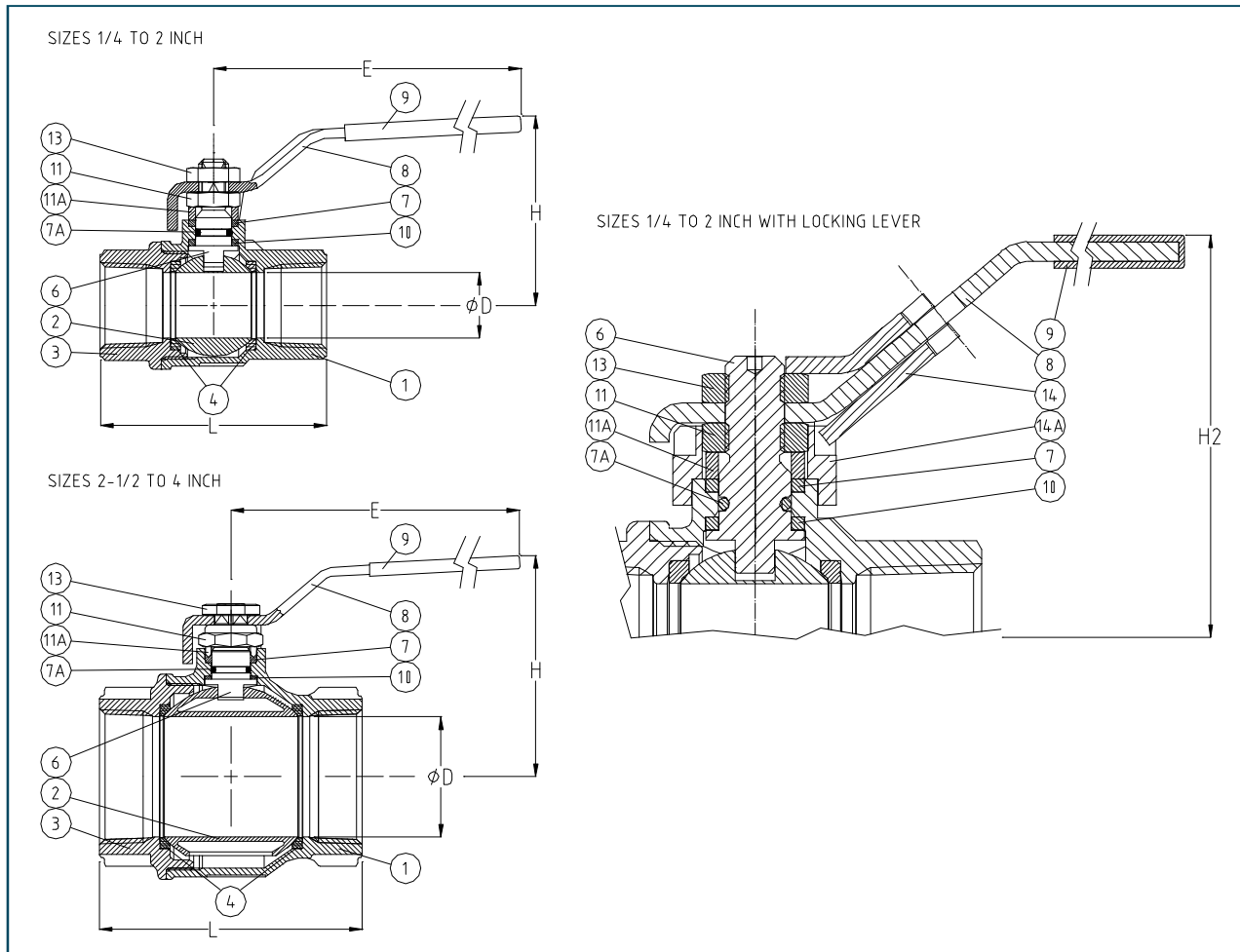
Gas Approvals:

- CSA Class 3371-10, CGA 3.16, 125 PSIG, -40°F - 149°F, 1/2"-2"
- CSA Class 3371-88, ANSI Z21.15/CSA9.1, 1/2 PSIG, 32°F - 188.6°F, 1/2"-4"
- CSA Class 3371-90, ASME B16.33/b16.38, 125 PSIG, -40°F - 149°F, 1/4"-4"
- CSA Class 3371-92, ASME B16.44, 5 PSIG, -40°F - 149°F, 1/2"-2"
- CSA Class 3371-94, ASME B16.33, 125 PSIG, -40°F - 149°F, 1/2"-4"
- CSA Class 3371-97, UL-125, 250 PSIG, -40°F - 130°F, 1/4"-3/8"
- UL Class YRPV, ANSI/UL-842, 250 PSIG, -20°F - 125°F, 1/4"-4"
- UL Class YSDT, AMSI/UL-125, 250 PSIG, -40°F - 130°F, 1/4"-4"

Figure Number Matrix

FNW 420 Trim Lever Size	Kit Codes (Order Separately)		
<p>TRIM TYPES</p> <p>BLANK = BRASS (CHROME BALL) SS = SS BALL & STEM (INCL. LL)</p> <p>LEVER TYPES</p> <p>BLANK = STANDARD LL = LOCK LEVER (STNDRD. w/SS)</p> <p>SIZE CODES</p> <p>1/4 = B 1 = G 2-1/2 = L 3/8 = C 1-1/4 = H 3 = M 1/2 = D 1-1/2 = J 4 = P 3/4 = F 2 = K</p>	<p>LOCKING LEVER</p> <p>1/4 - 1/2 = FNW420LHKBD 3/4 - 1 = FNW420LHKFG 1-1/4 - 1-1/2 = FNW420LHKHJ 2 = FNW420LHKK 2-1/2 = FNW420LHKL 3 = FNW420LHKM 4 = FNW420LHKP</p> <p>TEE HANDLES</p> <p>1/4 - 1/2 = FNW420THKBD 3/4 - 1 = FNW420THKFG</p>	<p>EXTENSIONS</p> <p>1/4 - 1/2 = FNW420SEBD 3/4 - 1 = FNW420SEFG 1-1/4 - 1-1/2 = FNW420SEHJ 2 = FNW420SEK 2-1/2 - 3 = FNW420SELM 4 = FNW420SEP</p> <p>OVAL HANDLES</p> <p>1/4 - 1/2 = FNW420OHKBCD 3/4 - 1 = FNW420OHKFG 1-1/4 - 1-1/2 = FNW420OHKHJ 2 = FNW420OHKK</p>	<p>REPLACEMENT LEVER</p> <p>1/4 - 1/2 = FNW420HKBD 3/4 - 1 = FNW420HKFG 1-1/4 - 1-1/2 = FNW420HKHJ 2 = FNW420HKK 2-1/2 - 3 = FNW420HKLM 4 = FNW420HKP</p> <p>MEMORY STOPS</p> <p>1/4 - 1/2 = FNW420MSKBD 3/4 - 1 = FNW420MSKFG 1-1/4 - 1-1/2 = FNW420MSKHJ 2 = FNW420MSKK</p>

2 PC FULL PORT 600 WOG



Cv & Weights

Dimensions (Inches)

Standard Materials

Size	Cv	Wt. (Lbs)
1/4	6	0.3
3/8	7	0.3
1/2	19	0.5
3/4	34	0.7
1	50	1.1
1-1/4	104	2.0
1-1/2	268	3.1
2	309	4.2
2-1/2	629	8.0
3	1018	12.9
4	1622	22.0

Size	ØD	E	L	H	H2
1/4	0.39	3.78	2.02	1.65	1.83
3/8	0.39	3.78	2.02	1.65	1.83
1/2	0.59	3.78	2.44	1.81	1.99
3/4	0.78	4.76	2.71	2.28	2.48
1	0.98	4.76	3.07	2.44	2.64
1-1/4	1.25	5.94	3.42	3.00	3.15
1-1/2	1.57	5.94	3.89	3.23	3.38
2	1.94	6.30	4.33	3.74	3.74
2-1/2	2.56	8.11	5.59	4.84	-
3	3.15	8.11	6.45	5.23	-
4	3.94	10.27	7.60	6.49	-

Ref. No.	Description	Material	Qty
1	Body	Brass CW 617N UNI EN 12165	1
2	Ball	Brass CW 617N UNI EN 12165 (Nickel-Chrome Plated)	1
3	End Cap	Brass CW 617N UNI EN 12165	1
4	Seat	PTFE	2
6	Stem	Brass CW 614N UNI EN 12164	1
7	Stem Packing	PTFE	1
7A	Stem O-ring	NBR 75 Shore A	1
8	Handle	Fe P 11 UNI 5867	1
9	Handle Cover	Vinyl	1
10	Thrust Washer	PTFE	1
11	Gland Nut	Zinc Plated Steel 6S	1
11A	Packing Gland	Brass CW 614N UNI EN 12164	1
13	Handle Nut	Zinc Plated Steel 6S	1
14	Locking Pad	Fe P 11 UNI EN 10111	1
14A	Bushing	ZAMA G Zn A14 UNI EN1774	1

DOC: FNWBV420SSLL07 Ver. 7/09

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Model A4 Intrinsically Safe and Non-Incendive Pressure Transmitter



APPLICATIONS:

Oil field equipment, upstream oil and gas production, natural gas compression and transfer control, alternative energy projects

FEATURES:

- FM and CSA listings
- Choice of 0.25, 0.50 or 1.0% accuracy
- Pressure ranges from 5 psi through 10,000 psi
- CE mark
- 316L SS wetted materials, 17-4 PH optional
- 304 SS case in standard, welded or explosion proof construction
- Optional absolute pressure ranges available
- Zero and span access (Basic Enclosure)

The Ashcroft® A4 pressure transmitter is ideal for a broad spectrum of pressure sensing requirements where Intrinsically Safe or Non-Incendive hazardous location ratings are required.

The Ashcroft® A4 is designed and manufactured to provide the user with accurate, reliable, and stable output data. This is accomplished through the use of an on board microprocessor, that is programmed during a unique digital compensation process, to provide extremely linear and precise performance over the entire specified pressure and temperature range.

PERFORMANCE SPECIFICATIONS

Reference temperature 70°F (21°C)

Accuracy, Three Classes (% Span): ±.25 ±0.5 ±1.0

Includes non-linearity (Terminal Point Method), hysteresis, non-repeatability, zero offset and span setting errors

Best Fit Straight Line* (BFSL): ±.20 ±.40 ±.50

Includes non-linearity hysteresis, non-repeatability errors

*Add ±.05% for ranges above 5000 psi

Stability:

≤ ±0.25% Span/year @ reference conditions

Durability: Greater than 10 million cycles

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits:

Storage:	-40 to +125°C	(-40 to 257°F)
Process:	-40 to +125°C	(-40 to 257°F)
Operating:	-40 to +125°C	(-40 to 257°F)
Compensated*:	-20 to +85°C	(-4 to 185°F)

*Consult factory for other options

Temperature Effects: -20 to +85°C (-4 to 185°F)

• 1.0% of Span for .25% Accuracy Class

• 2.0% of Span for .50% and 1.0% Accuracy Classes

Humidity Effects: No performance effects from

0 to 95% relative humidity, non-condensing, 0-100% RH with "W" enclosure.

*Consult factory

FUNCTIONAL SPECIFICATIONS

Response Time: <2ms

Pressure Ranges: Vacuum, gauge, compound and absolute pressure from 0-5 psi through 0-10,000. Equivalent ranges in bar available. See order guide section (reverse).

Vibration Effect:

Shock: 100g Peak, 11ms

Random: 10g RMS, 20-2000Hz

Sweep: 50-2000Hz, 5g peak

Position Effect: ±0.02% Typical

CE Mark (standard): EN 61326:1997 + A1: 1998 Annex A

Heavy Industrial Immunity (Annex A, Table A.1)

Light Industrial/Residential Emission (Table 4)

Overpressure (F.S.):*

	Proof	Burst
0#/vac. to 300 psi	1.5 x F.S.	min. 2 x F.S.
500-10,000 psi	1.2 x F.S.	1.5 x F.S.

*For higher overpressure ratings use XK8 option.

See page 2 for additional option.

ELECTRICAL SPECIFICATIONS

Output Signal: **Supply Voltage: (unregulated)**

	Minimum	Maximum
4-20mA* (2 Wire)	12Vdc	30Vdc

*For Intrinsically Safe see entity parameters for supply voltage and load limits. Refer to Ashcroft A4 Installation & Maintenance document "I&M011-10166-A4."

Power Requirements:

See load chart page 2

Electrical Terminations: See To Order section (reverse.) for options

Circuit Protection: Reverse polarity and mis-wire protected

Insulation Resistance (Circuit to Case): 100Mohm @ 30Vdc

PHYSICAL SPECIFICATIONS

Case: Material 304SS

Wetted Materials: 316L SS diaphragm and pressure port, optional 17-4PH SS diaphragm and 316L SS pressure port (see How to Order Section).

Ingress Protection Rating:

Enclosure	Code	Rating
Basic	(S)	IP65, NEMA 4X
All Welded (w/o Z/S)	(W)	IP67, NEMA 6

HAZARDOUS AREA CERTIFICATIONS

Intrinsically Safe – FM/CSA:

Intrinsic Safety: Class I, II and III Div.1 and 2, Groups A, B, C, D, F and G per entity requirements see Ashcroft drawing # 825A022

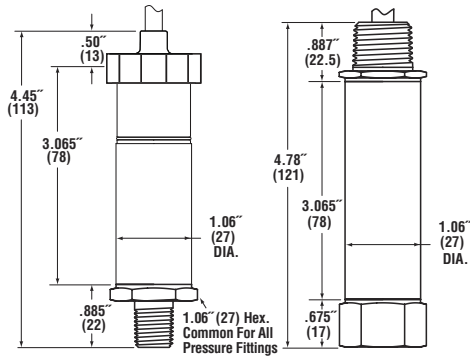
Non-Incendive: Class I, II and III Div.2, Groups A, B, C, D, F and G, no barriers needed

NOTE:

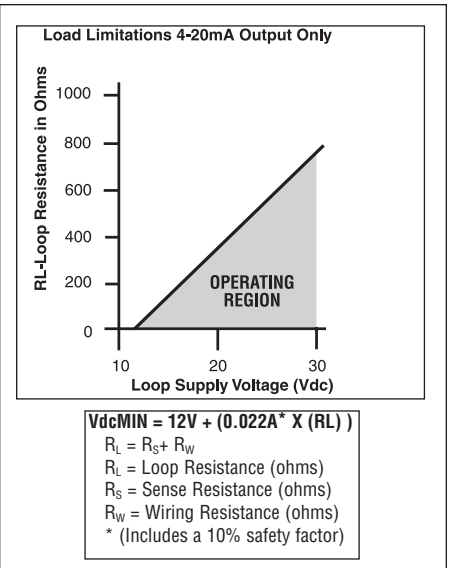
Refer to Ashcroft Model A2 for Heavy Industrial, non-hazardous rated configurations and Ashcroft Model A2X for Explosion/Flame Proof applications.

Model A4 Intrinsically Safe and Non-Incendive Rated Pressure Transmitter

DIMENSIONS dimensions in () are mm



INTRINSICALLY SAFE (ENCLOSURE S, W)



XK8 OVERPRESSURE (F.S.)

	Proof	Burst
0 to 2000 psi	200%	800%
3000 to 5000 psi	150%	300%
7500 to 10,000 psi	120%	150%

NOTE:

Refer to Ashcroft Model A2 for Heavy Industrial, non-hazardous rated configurations and Ashcroft Model A2X for Explosion / Flame Proof applications.

How To Order

A 4	S	A	M 0 2	4 2	D 1	6 0 #	G	X	
Type Configuration (A4)	Accuracy / Temp. EffectS (A) 0.25%±1.0% (-20°C to +85°C) (B) 0.50%±2.0% (-20°C to +85°C) (C) 1.00%±2.0% (-20°C to +85°C)	Enclosure (S) Basic (W) Welded w/out Zero & Span Access (See electrical termination coding for available selections)	Pressure Connection (M01) 1/8 NPT-M (F04) 1/2 NPT-F (M02) 1/4 NPT-M (MG4) G 1/2 M (F02) 1/4 NPT-F (VM2) VCR inlet fitting (MEK) 3/16-20 SAE-M 1/4" VCR gland with 3/16-18 male nut (F09) 3/16-18 (1/4)-F (VF2) VCR inlet fitting (Aminco) 1/4" VCR gland with 3/16-18 female nut (M04) 1/2 NPT-M (others available upon request)	Output Signal (42) 4-20mA	Electrical Termination Integral Cable (Pigtail) (F2) 3 shielded cable ⁽¹⁾ (P1) (specify length) ⁽¹⁾ Hirschmann Style Form A DIN 43650-A (DN) w/o mating conn. ⁽¹⁾ (D0) with mate, no cable ⁽¹⁾ (D2) with mate, 3 cable ⁽¹⁾ (D1) with mate, (specify length) ⁽¹⁾ 4-Pin Bendix Style (B4) w/o mating conn. ⁽²⁾ (H1) with mate, no cable ⁽²⁾ (L1) with mate, 3 cable ⁽²⁾ (P2) with mate, (specify length) ⁽²⁾ 1/2 NPT-M Conduit (C1) 3 shielded cable ⁽³⁾ (P7) (specify length) ⁽³⁾ 1/2 NPT-M Conduit (C2) 3 flying leads ⁽³⁾ (C4) 15 flying leads ⁽³⁾ M12 Threaded (EW) w/o mating conn. ⁽¹⁾ (E0) with mate, no cable ⁽¹⁾ (E2) with mate, 3 cable ⁽¹⁾ (E1) with mate, (specify length) ⁽¹⁾	Pressure Range (1.5#) 1.5 psi ^{(5),(6)} (750#) 750 psi (5#) 5 psi ^{(5),(6)} (1000#) 1000 psi (10#) 10 psi ^{(5),(6)} (1500#) 1500 psi (15#) 15 psi ⁽⁵⁾ (2000#) 2000 psi (30#) 30 psi ⁽⁵⁾ (3000#) 3000 psi (50#) 50 psi (5000#) 5000 psi (60#) 60 psi (7500#) 7500 psi (75#) 75 psi (10,000#) 10,000 psi ⁽⁴⁾ (100#) 100 psi (0# & vac.) 0 psi/vac. ^{(5),(6)} (150#) 150 psi (15# & vac.) Vac./15 psi ^{(5),(6)} (200#) 200 psi (30# & vac.) Vac./30 psi ^{(5),(6)} (300#) 300 psi (45# & vac.) Vac./45 psi ⁽⁵⁾ (500#) 500 psi (60# & vac.) Vac./60 psi ⁽⁵⁾	Measurement Type (G) (G) Gauge Pressure Sensor (A) Absolute Pressure Sensor	Optional X-Variations (XCL) Non-standard ⁽⁷⁾ calibration (XK8) 17-4PH SS Sensor Material (X6B) Cleaned For Oxygen Service	
NOTE: All A4 pressure transmitters include a 9 pt. NIST traceable calibration certificate					⁽¹⁾ Available with enclosure code (S) ⁽²⁾ Available with enclosure code (S, W) ⁽³⁾ Available with enclosure code (W)				

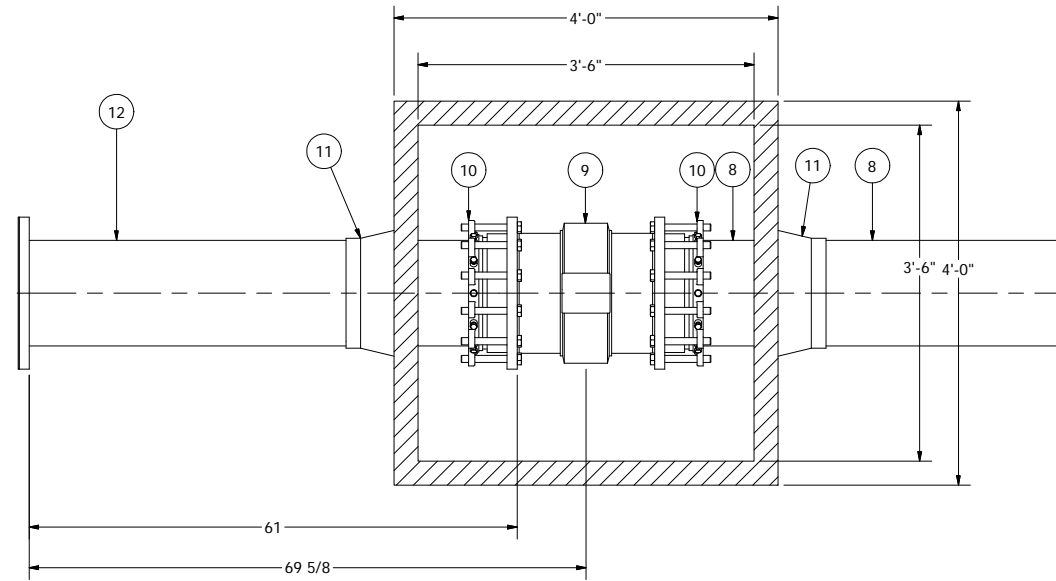
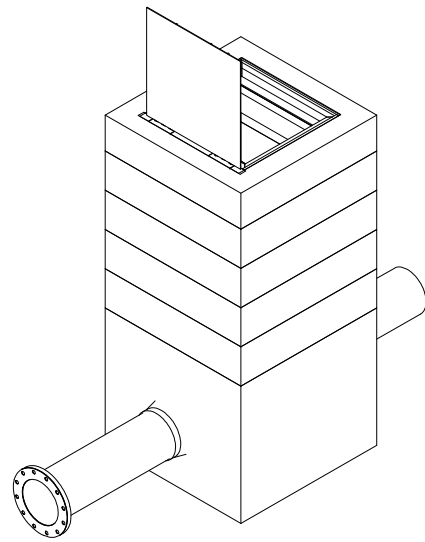
**END
OF
SECTION**

12. METER VAULT & ASSOCIATED MECHANICAL

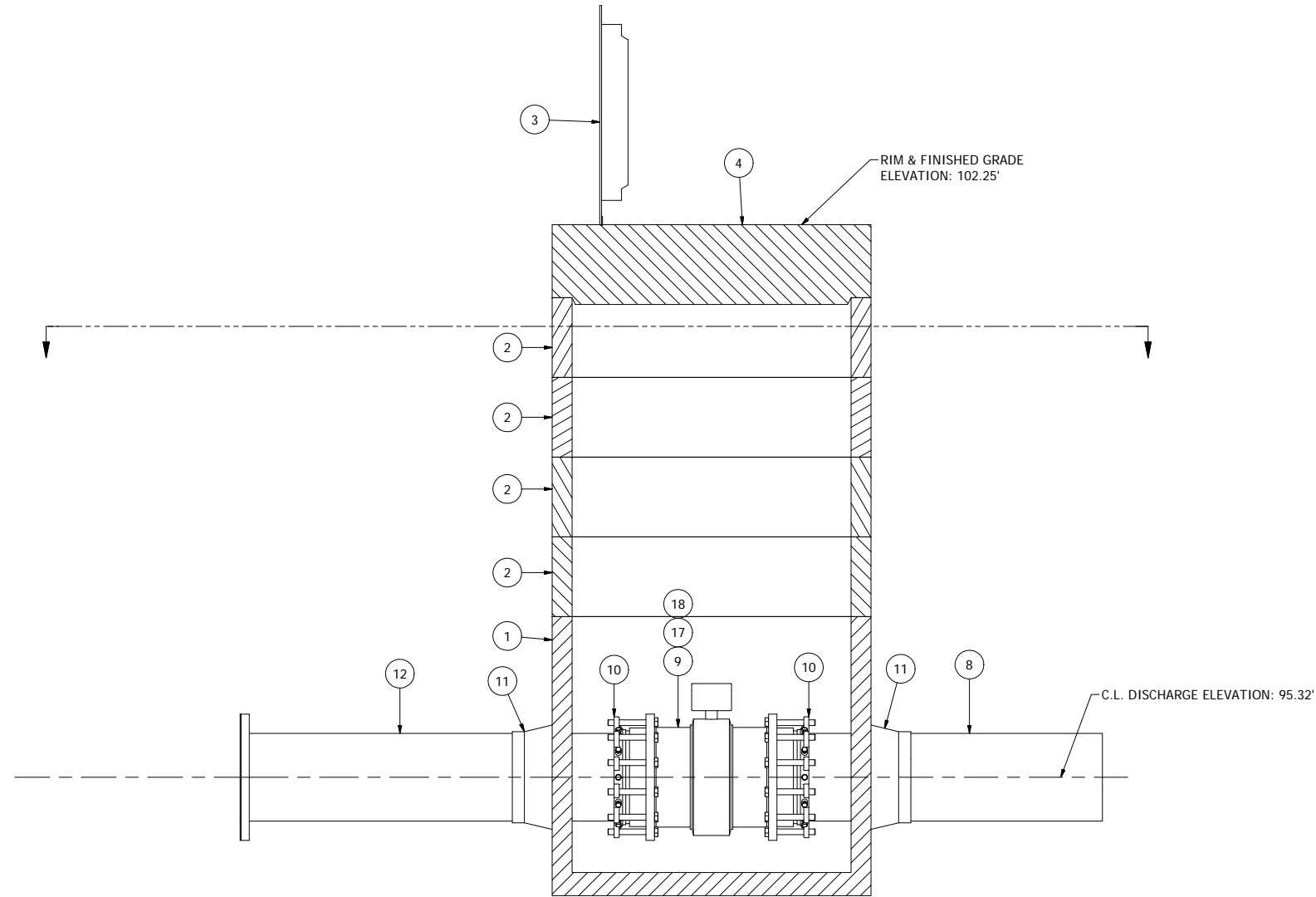
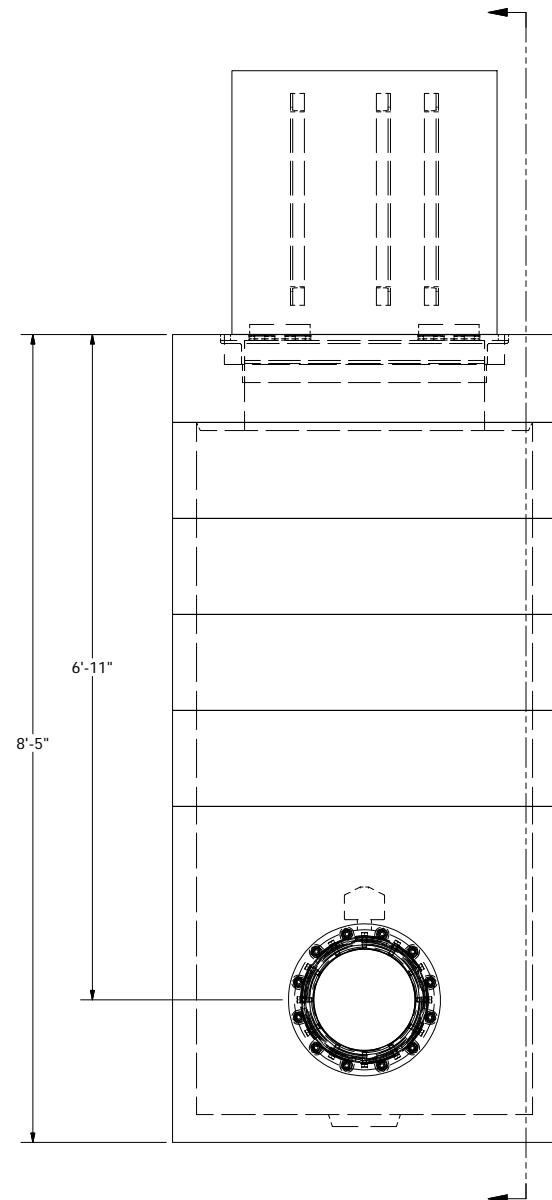
This section provides the information pertaining to the meter vault for this project.

This section is structured as follows:

- 12.01 METER VAULT COMPONENT DRAWING(S)
- 12.02 METER VAULT PRODUCTION DRAWING
- 12.03 METER VAULT HATCH DRAWING
- 12.04 METER VAULT WEIGHTS & LIFTING DEVICES
- 12.05 METER VAULT RELATED DATA SHEETS
 - 12.05.1 CONSEAL
 - 12.05.2 TAPECOAT
 - 12.05.3 KOR-N-SEAL
 - 12.05.4 MEGAFLANGE ADAPTER
 - 12.05.5 FLOW TUBE



NOTE: METER VAULT TOP SLAB IS H2O OCCASIONAL TRAFFIC RATED



Parts List			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
1	1	20-6221	BASE - VV - 444B
2	4	22-5245	RISER - VV - 444 - 1 FT
3	1	23-4713	HATCH - FLOODTIGHT - H20 - 24X30
4	1	24-4716	TOP SLAB -VV - 444 - H20
5	2	25-5158	PIPE STAND - 12in - S92 SAD - NO BASE
6	2	25-6550	VALVE KEY BRACKET
7	1	25-6552	VALVE KEY - EXT GATE WRENCH
8	1	40-XXXX	PIPE - 316SS - 12in X 48 IN
9	1	41-XXXX	FLOW TUBE - 12in - ABB WATER MASTER
10	2	42-5271	MEGAFLANGE ADAPTER - 12in - SERIES2100
11	2	43-5193	KOR-N-SEAL - 16in CORE - 12in PIPE
12	1	45-5589	SPOOL - FLG X PE - 12in X 60in - SCH40 316SS
13	1	47-5267	GASKET - FLANGE - 12in X 1/8in
14	105	51-5510	SEALANT - .75in X .75in X 21ft CS-202
15	85	51-5949	TAPECOAT - 6in X .65mils X LFT
16	1	51-ROM	NEVER SIEZE - TUBE
17	1	62-XXXX	TRANSMITTER - ABB - IP68 RATED
18	1	62-XXXX	SIGNAL CABLE - ABB - 100FT

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

0
DSN - AD
DRN - AD
CKD - AD
DATE - 2-7-14

**COMPONENT
DRAWING**

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

**BAY MEADOWS
12" METER VAULT**

SHEET
5 OF 5
JOB NUMBER
**RMTC
0000**

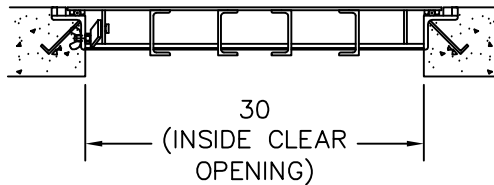
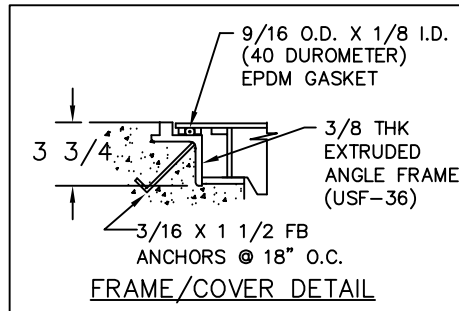
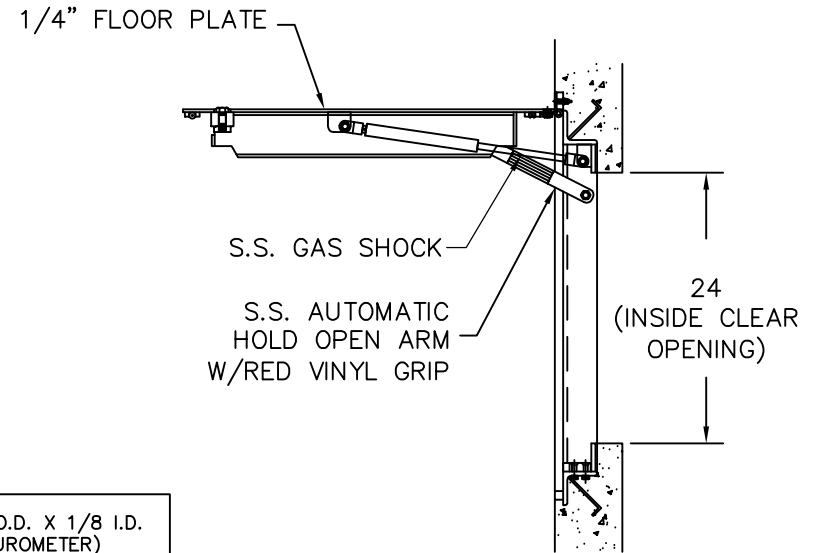
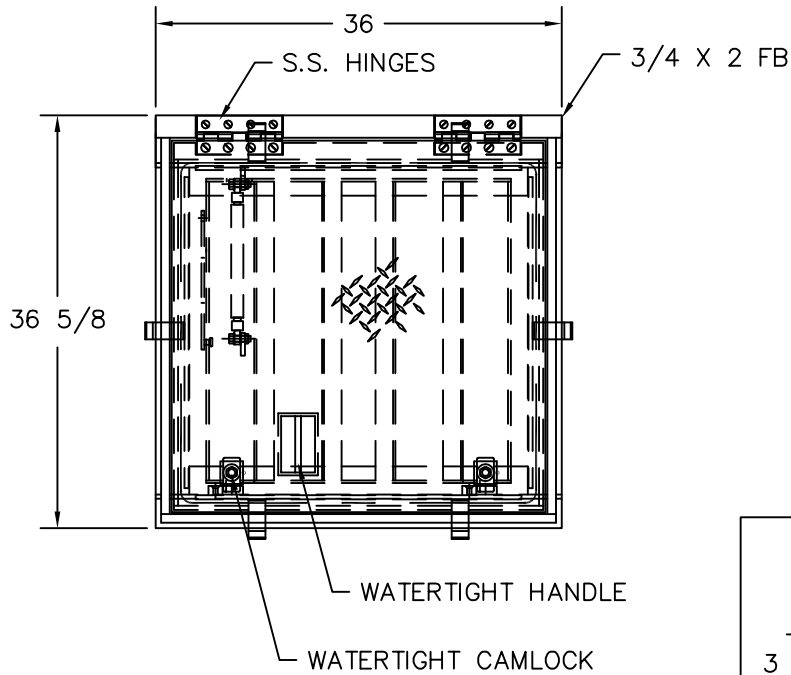
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NOTE: ALL DIMENSIONS AND ELEVATIONS SHOWN ARE NOMINAL DIMENSIONS. IT IS THE RESPONSIBILITY OF THE ON-SITE CONTRACTOR OR ROMTEC UTILITIES CUSTOMER (NOT ROMTEC UTILITIES) TO VERIFY THE ACCURACY OF ANY CRITICAL DIMENSIONS OR ELEVATIONS PRIOR TO SETTING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

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

REV	DESCRIPTION	DATE	APPROV
1	REMOVED 12in SHUT OFF VALVE	2-24-14	AD

**PRODUCTION DRAWINGS WILL BE INCLUDED IN THE NEXT REVISION OF
THE SSDS**



- NOTES:**
- 1- MATERIAL: ALUMINUM
 - 2- LOADING: DESIGNED FOR OFF STREET LOCATIONS WHICH MAY OCCASIONALLY RECEIVE H-20 WHEEL LOADS. (CAPABLE OF HOLDING UP TO 25 FEET HEAD OF WATER)
 - 3- 316 STAINLESS STEEL BOLTS & NUTS
 - 4- APPROX. HATCH WEIGHT: 115 LBS.
 - 5- AREA OF FRAME IN CONTACT WITH CONCRETE TO BE PAINTED WITH BITUMINOUS COATING

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INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M

TOLERANCES UNLESS OTHERWISE SPECIFIED

FRACTIONAL
 1/16 = ± 1/32
 1/32 = ± 1/64

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U.S.F. FABRICATION INC.
 HIALEAH, FLORIDA

HATCH W-AHS 24 X 30 ALUMINUM
 W/316.S.S.GAS SHOCKS & BIT. PAINT

DWN. BY: RT	SCALE: 1=12	QUOTE# 226818	DATE: 03/11/13
CHK. BY: A.Q.	DWG.# 78206	SHEET SIZE: B	SHEET No: 1 OF 1 REV:

12.04 METER VAULT WEIGHTS & LIFTING DEVICES

RECOMMENDED METER VAULT LIFTING METHOD

All meter vault concrete components are designed to be lifted and set in the excavated hole by use of the Romtec Utilities supplied anchors and ring clutches. The installation contractor shall excavate the meter vault hole, place the base rock as specified by the **SITE ENGINEER (not Romtec Utilities)**, provide a **safe OSHA approved cave-in protection method (shoring) and a piece of lifting equipment of adequate size to lift and set the heaviest piece**. The excavation contractor and/or his subcontractor crane company must provide the appropriate lifting cables, straps or chains and connection devices to attach the cables to the crane and the ring clutches. All lifting cables, straps or chains must be long enough that when lifting the concrete components the lifting rigging does not put pressure on the upper concrete joint potentially breaking the concrete. **The use of a spreader bar will greatly reduce the risk of the lifting rigging breaking the concrete upper joint.**

METER VAULT CONCRETE COMPONENT WEIGHTS:

ITEM	SIZE	WEIGHT
444 Meter Vault	4'-0" X 4'-0"	5,140 lbs.
444 Meter Vault Riser	4'-0" X 4'-0"	1,600 LBS.



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CONSEAL™
Concrete Sealants INC.

CS-202

Butyl Rubber Sealant

APPLICATIONS

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

SEALING PROPERTIES

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

HYDROSTATIC STRENGTH

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

SPECIFICATIONS

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



CONSEAL™
Concrete Sealants INC.

CS-202

Butyl Rubber Sealant

PHYSICAL PROPERTIES

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

IMMERSION TESTING

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

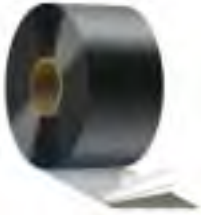
* Requirements of ASTM C-990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

LIMITED WARRANTY

This information is presented in good faith, but we cannot anticipate all conditions under which this information and our products, or the products of other manufacturers in combination with our products, may be used. We accept no responsibility for results obtained by the application of this information or the safety and suitability of our products, either alone or in combination with other products. Users are advised to make their own tests to determine the safety and suitability of each such product or product combinations for their own purposes. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for this own particular use. We sell this product without warranty, and buyers and users assume all responsibility and liability for loss or damage arising from the handling and use of this product, whether used alone or in combination with other products.

TAPECOAT® M860 PAVEMENT REPAIR COATING

Protection for Concrete and Asphalt Surfaces



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



Tapecoat® M860 Pavement Repair Coating

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

Features/Specifications/Application

Tapecoat® M860

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

Composition

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

Technical Data

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

Surface Preparation

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

Option

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



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



KOR-N-SEAL® I & II FLEXIBLE PIPE-TO-MANHOLE CONNECTORS

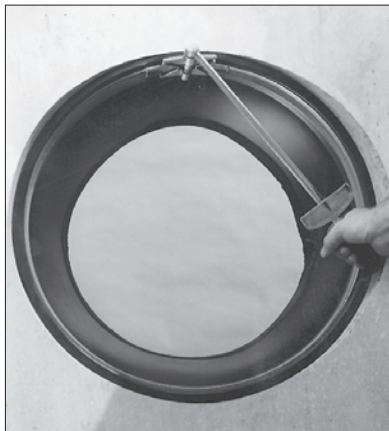
SPECIFICATION SHEET



KOR-N-SEAL I - WEDGE KORBAND CONNECTOR ASSEMBLY



Install Kor-N-Seal I - Wedge Korbond with Socket Wrench & Torque Limiter



Install Kor-N-Seal II - Wedge Korband with Standard Torque Wrench



Install Pipe Clamp(s) with T-Handle Torque Wrench





KOR-N-SEAL® I & II

Flexible Pipe-to-Manhole Connectors

SPECIFICATION SHEET

PERFORMANCE

Test	ASTM Method	Test Requirements	Kor-N-Seal® I & II
Head Pressure	C923 - 7.1	0° - 13 psi (30 ft) for 10 min. 7° - 10 psi (23 ft) for 10 min.	+13 psi for 10 min. +10 psi for 10 min.
Deflection Test	C923 - 7.2.2	7° in any direction	Over 7° in any direction
Load Test	C923 - 7.2.3	150 lbs/in. pipe dia.	Over 150 lbs/in. pipe dia.

Performed on all standard sizes of Kor-N-Seal Connectors.

RESILIENT EPDM OR POLYISOPRENE RUBBER

Conforms to ASTM C923

Test	ASTM Method	Test Requirements	TEST RESULTS Kor-N-Seal® I & II
Chemical Resistance	D543, at 22°C for 48 h		
1 N Sulfuric Acid		No weight loss	No weight loss
1 N Hydrochloric Acid		No weight loss	No weight loss
Tensile Strength	D412	1200 psi	1580 psi
Elongation at Break		350% min.	500%
Hardness	D2240 (shore A durometer)	± 5 from the manufacturer's specified hardness	48 ± 5
Accelerated Oven-Aging	D573 70 ± 1°C for 7 days	Decrease of 15%, max. of original tensile strength, decrease of 20% max. of elongation	10.1% tensile decrease 14.0% elongation decrease
Compression Set	D395, method B, at 70°C for 22 h	Decrease of 25%, max. of original deflection	13% decrease
Water Absorption	D471, immerse 0.75 by 2-in. specimen in distilled water at 70°C for 48 h	Increase of 10%, max. of original by weight	.8% increase
Ozone Resistance	D1171	Rating 0	Rating 0
Low-temperature Brittle Point	D746	No fracture at -40°C	No fracture at -40°C
Tear Resistance	D624, method B	200 lbf/in.	No tear at 210 lbf/in.

INTERNAL KORBAND

Conforms to ASTM C923, ASTM A666, and A240

- Korband Assembly is manufactured of 300 series stainless steel.
- Toggle Expander is made of 300 series stainless steel.
- The 106/406 series Wedge Expander is made from reinforced nylon or 300 series stainless steel.
- The 206/306 series Wedge Expander is made from 300 series stainless steel.

EXTERNAL PIPE CLAMP

Conforms to ASTM C923, ASTM A666, and A240

External take-up clamps are manufactured of 300 series stainless steel.

www.npc.com

250 Elm Street • P.O. Box 301
Milford, NH 03055, U.S.A.

Tel: 603-673-8680 • 800-626-2180 • Fax: 603-673-7271

NPC Kor-N-Seal Pipe-to-Manhole Connector

Technical Specification

Scope:

This specification describes the function of the NPC Kor-N-Seal pipe-to-manhole connector, its principle of operation, and the component materials that constitute the Kor-N-Seal connector, and their physical properties.

Product Application:

NPC Kor-N-Seal connectors are designed and manufactured to meet or exceed the requirements of ASTM C-923 "Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals". This specification requires the connector to provide a watertight seal under the following conditions:

- 10 PSI (23 feet head) of groundwater pressure
- Minimum 7 Degrees of pipe articulation in any direction
- Radial loading test of 150 pounds per inch diameter of pipe

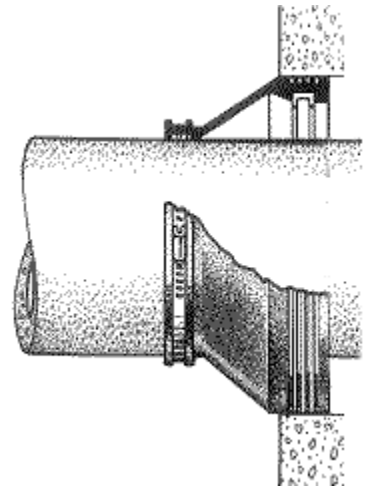
Principle of Operation:

The Kor-N-Seal connector creates a watertight seal between the pipe and manhole by first sealing to the inside of the cored or formed hole in the manhole and then sealing to the outside of the pipe. See illustration at right.

The seal at the inside of the manhole is created by the stainless steel Korband. The Korband is located inside of the end of the Kor-N-Seal connector that fits into the manhole. Once the Kor-N-Seal connector is located in the manhole, the diameter of the Korband is increased. This compresses the Kor-N-Seal connector against the inside wall of the hole in the manhole creating a watertight seal at the manhole.

The seal at the outside of the pipe is created by the stainless steel pipe clamp(s). The pipe clamp is located on the outside of the Kor-N-Seal connector. Once the pipe has been positioned in the connector the diameter of the pipe clamp is decreased. This compresses the Kor-N-Seal connector against the outside wall of the pipe creating a watertight seal at the pipe.

Reference the [Kor-N-Seal Recommended Installation Instructions](#) for a detailed explanation of the preparation and installation of the Kor-N-Seal connector.





KOR-N-SEAL – STAINLESS STEEL WEDGE

Recommended Installation Procedure

Refer to reverse side *Kor-N-Seal I - Wedge Korband Installation Chart* for Hole Size Range, Connector Dimensions, and Suggested Pipe O.D. Range.

CONNECTOR INSTALLATION:

1. Check to be sure Korband is properly located in Connector groove. (Fig. 1)
2. Insert Connector Assembly into hole with Wedge Expander at top of hole. (Fig. 2)
3. Position Connector so it is square to manhole both vertically and horizontally. (Fig. 3)
4. Tighten Wedge Expander using 1/2" [13 mm] socket with a preset torque limiter for each. For each size connector use torque limiter preset to proper torque. (Fig. 4) Retorquing is not required prior to shipment.

CAUTION: DO NOT USE IMPACT WRENCH.

IMPORTANT

RECOMMENDED TORQUE		TORQUE LIMITER
Connector Inches [mm]	Foot Pounds [Newton Meters]	P/N
10 – 24 [254 – 610]	12 [16]	91440-12

Fig. 4

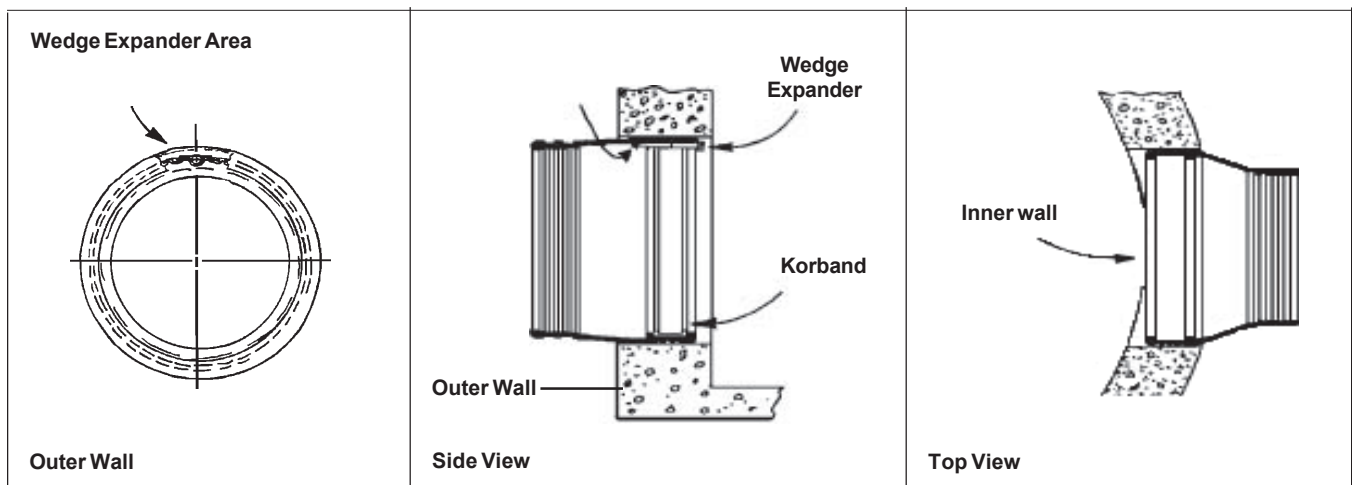


Fig. 1

Fig. 2

Fig. 3

PIPE INSTALLATION:

1. Center pipe in Connector opening.
2. On maximum pipe O.D. installations, use a pipe lubricant on the outside barrel of the pipe and/or the inside ridges of the Connector (under the Pipe Clamp area) to allow the pipe to slide into place more easily.
3. Position the Pipe Clamp in the Connector's Pipe Clamp groove with the screw at the top.
4. Tighten the Pipe Clamp screw to 60 inch pounds [7 Newton Meters] with a T-handle Torque Wrench, P/N 80090.
5. On minimum pipe O.D. installations, lift the rubber up underneath the Pipe Clamp screw so that the Connector contacts the bottom surface of the pipe while the Pipe Clamp screw is being tightened. Application of pipe lubrication on the underside of the clamp will also help assure that an even contraction of rubber is maintained throughout the clamping area.
6. After the Pipe Clamp has been tightened down firmly, move the pipe horizontally and/or vertically to bring it to grade.

CAUTION: Pipe must **NOT** rest on Connector Korband.

CAUTION:

All capped stubs awaiting pipe installation at a later date must be restrained. Assure that a proper backfill material is used in adverse conditions. Prior to any critical usage, contact NPC Customer service at 1-800-626-2180.



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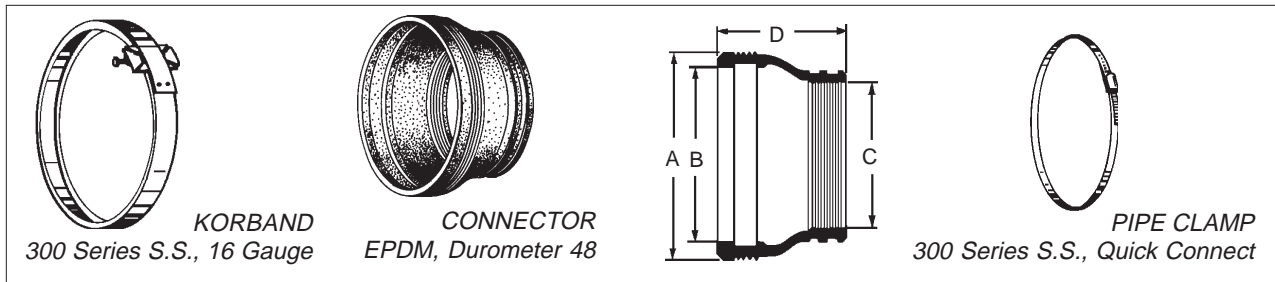
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KOR-N-SEAL – STAINLESS STEEL WEDGE

Recommended Installation Procedure



Kor-N-Seal S106 Series

Connector P/N	Suggested Pipe O.D. Range Inches	Hole Size Range Inches	Connector Dimensions Inches			Pipe Clamp P/N
		A	B	C	D	
S106-12BWS	5.75 — 7.00	12.00 — 12.20	10.30	6.50	8	I-128
S106-12AWS	7.00 — 8.50	12.00 — 12.20	10.30	8.00	8	I-180
S106-12WS	8.25 — 9.75	12.00 — 12.20	10.30	9.25	8	I-180
S106-14AWS	9.50 — 11.25	14.00 — 14.20	12.25	10.50	8	I-190
S106-16BWS	9.50 — 11.25	15.95 — 16.15	14.30	10.50	8	I-190
S106-16AWS	11.25 — 13.00	15.95 — 16.15	14.30	12.25	8	I-218
S106-16WS	13.00 — 14.20	15.95 — 16.15	14.30	14.00	8	I-242
S106-20BWS	14.00 — 15.50	19.95 — 20.10	18.25	15.00	8	I-306
S106-20AWS	15.50 — 17.00	19.95 — 20.10	18.25	16.50	8	I-306
S106-20WS	17.00 — 18.15	19.95 — 20.10	18.25	18.00	8	I-306
S106-22WS	17.75 — 19.25	21.95 — 22.10	20.25	18.75	8	I-318
S106-24WS	19.60 — 21.10	23.95 — 24.10	22.25	20.60	8	I-348

Kor-N-Seal S406 Series

S406-10AWS	6.00 — 6.75	10.00 — 10.20	8.30	6.50	6	I-128
S406-10WS	7.50 — 8.20	10.00 — 10.20	8.30	8.50	6	I-180
S406-10.5AWS	6.00 — 6.75	10.50 — 10.70	8.80	6.50	6	I-128
S406-10.5WS	7.50 — 8.70	10.50 — 10.70	8.80	8.50	6	I-180
S406-11BWS	6.00 — 7.00	11.00 — 11.20	9.30	6.00	6	I-128
S406-11AWS	7.50 — 9.00	11.00 — 11.20	9.30	8.00	6	I-180
S406-12CWS	6.00 — 7.00	12.00 — 12.20	10.30	6.50	6	I-128
S406-12BWS	6.25 — 7.50	12.00 — 12.20	10.30	7.00	6	I-128
S406-12AWS	7.50 — 9.00	12.00 — 12.20	10.30	8.50	6	I-180
S406-12WS	9.00 — 10.20	12.00 — 12.20	10.30	10.00	6	I-180

Suggested pipe O.D. range comes from field experience. Refer to *Recommended Pipe Installation Procedure*.



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Series 2100

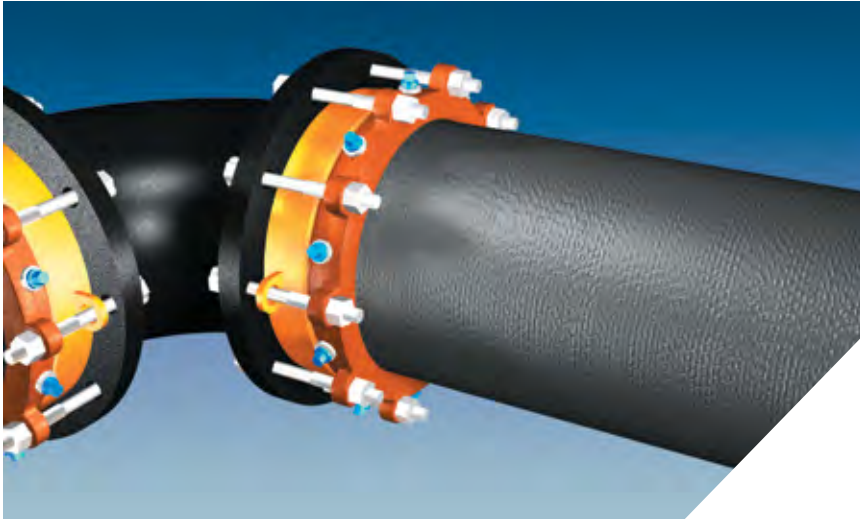
MEGAFLANGE®

Restrained Flange Adapter

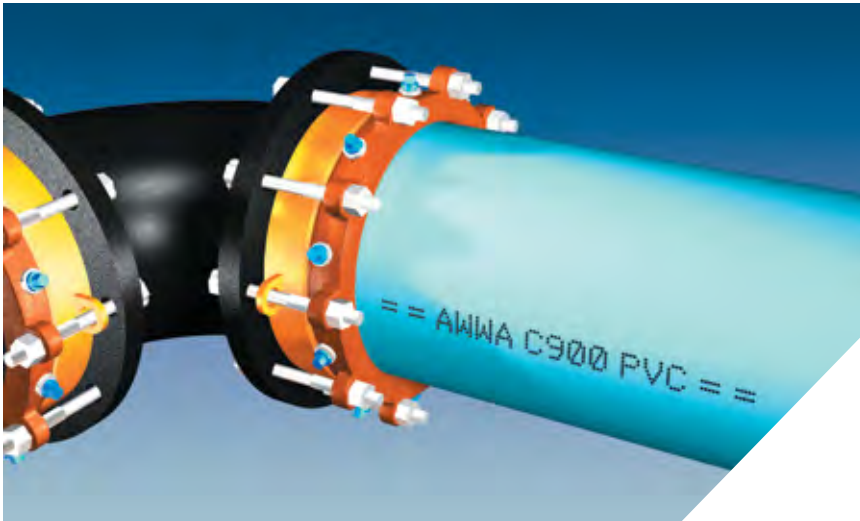
U.S. Patent Nos. 4627774 and 5071175

Features and Applications:

- For adapting and restraining a plain end of ductile iron, PVC, or Steel pipe to a flange, conforming to ANSI/AWWA C110/A21.10. Not for use on plain end fittings.
- **MEGA-BOND®** Restraint Coating System
For more information regarding MEGA-BOND, refer to our web site @ www.ebaa.com
- Minimum 2 to 1 Safety Factor
- Fully Restrained
- Constructed of ASTM A536 Ductile Iron
- **UL** listed on sizes 3 inch through 12 inch
- **FM** approved on sizes 4 inch through 12 inch on C900 Class 150 and Class 200 PVC Pipe
- Pipe can be cut to length in the field
- Joint deflection up to 5°
- Easy dismantling allows fast removal of valves, meters or fittings for replacement or repair
- For use on water or wastewater pipelines subject to hydrostatic pressure and tested in accordance with either AWWA C600 or ASTM D2774.



Series 2112 on Ductile Iron Pipe



Series 2112 on C900 PVC Pipe



Sample Specification

Restrained flange adapters shall be used in lieu of threaded or welded flanged spool pieces. Flanged adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10 (125#/Class 150 Bolt Pattern).

Restraint for flange adapter shall consist of a plurality of individual actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial set of gripping wedges.

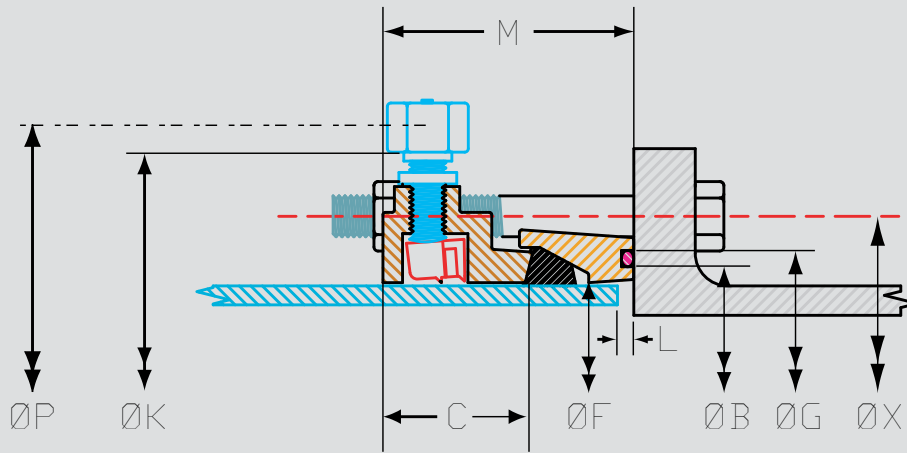
The flange adapters shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6 inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

All internal surfaces of the gasket ring (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61. Exterior surfaces of the gasket ring shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.

Pressure ratings shall be a minimum of those shown in the adjacent tables.

The flange adapter shall be the Series 2100 MEGAFLANGE® Restrained Flange Adapter as produced by EBAA Iron, Inc. or approved equal.

Series 2100 Submittal Reference Drawing



Nominal Pipe Size	Series Number	Restraint Ring			Gasket Ring			Bolts				L MAX.	Assembly Deflection	M	P*	Ship Weight (lbs.)
		K	F	C	F	B	G	No.	Dia.	Length	X					
3	2103	7.5	4.1	2.2	4.1	4.3	4.9	4	5/8	5½	6.00	0.7	5.0	4.0	9.2	14
4	2104	9.0	4.9	2.2	4.9	5.4	6.0	8	5/8	5½	7.50	0.6	5.0	4.0	10.0	20
6	2106	11.0	7.0	2.3	7.0	7.5	8.1	8	¾	6	9.50	0.8	5.0	4.3	12.1	32
8	2108	13.5	9.2	2.4	9.2	9.8	10.4	8	¾	6	11.75	0.9	5.0	4.5	14.3	38
10	2110	16.0	11.2	2.5	11.2	11.8	12.4	12	7/8	7½	14.25	1.0	3.0	4.7	16.3	65
12	2112	19.0	13.3	2.5	13.3	13.8	14.4	12	7/8	7½	17.00	1.0	3.0	4.8	18.4	73
14	2114	21.0	15.5	2.5	15.5	16.1	16.9	12	1	8	18.75	1.3	2.0	5.0	20.6	89
16	2116	23.5	17.6	2.5	17.6	18.2	19.0	16	1	8	21.25	1.3	2.0	5.0	22.6	109
18	2118	25.0	19.7	2.6	19.7	20.2	21.0	16	1½	8½	22.75	1.3	1.5	5.1	24.7	134
20	2120	27.3	21.8	2.6	21.8	22.4	23.2	20	1½	8½	25.00	1.3	1.5	5.1	26.8	157
24	2124	32.0	26.0	2.6	26.0	26.7	27.5	20	1¾	8½	29.50	1.3	1.0	5.1	31.0	192
30	2130	38.5	32.2	3.3	32.2	32.9	34.1	28	1¾	10	36.00	2.0	3.0	6.0	38.8	296
36	2136	45.5	38.5	3.3	38.5	39.2	40.4	32	1½	10½	42.75	2.0	3.0	6.0	44.6	426
42	2142	52.3	44.7	4.1	44.7	45.8	47.0	36	1½	12	49.50	2.0	1.0	8.0	50.8	642
48	2148	58.8	51.0	4.1	51.0	52.1	53.3	44	1½	12	56.00	2.0	1.0	8.0	57.1	797

* The "P" dimensions is measured with torque-limiting nuts twisted off.
Note: Dimensions are in inches and are subject to change without notice.

MEGAFLANGE ADVANTAGES

- Fully Restrained
- Time Saving and Field Adaptable
- Pipe can be cut to length at the job site
- Can be used on Ductile Iron, PVC, and Steel (See pressure Rating chart for details)
- Wedges securely grip the pipe much better than set screws
- Easy disassembly allows fast removal of valves, meters, or fittings for replacement or repair

Pipe Size	Ductile Iron Pipe	Steel Pipe*	C900 PVC Pipe				IPS PVC Pipe*		
	Pressure (PSI)	Pressure (PSI)	DR14 Pressure (PSI)	DR18 Pressure (PSI)	DR25 Pressure (PSI)	DR32.5 Pressure (PSI)	SDR17 Pressure (PSI)	SDR21 Pressure (PSI)	SDR26 Pressure (PSI)
3	350	350	-	-	-	-	250	200	160
4	350	350	200	150	100	-	250	200	160
6	350	350	200	150	100	-	250	200	160
8	350	350	200	150	100	-	250	200	160
10	300	350	200	150	100	-	250	200	160
12	350	350	200	150	100	-	250	200	160
14	350	-	-	235	165	125	-	-	-
16	350	-	-	235	165	125	-	-	-
18	300	-	-	235	165	125	-	-	-
20	250	-	-	235	165	125	-	-	-
24	200	-	-	-	165	125	-	-	-
30	150	-	-	-	-	-	-	-	-
36	150	-	-	-	-	-	-	-	-
42	150	-	-	-	-	-	-	-	-
48	150	-	-	-	-	-	-	-	-

* Transition Gasket Required
 NOTE: For Application on HDPE pipe see EBAA's HDPE Restraint Catalog Sheet.



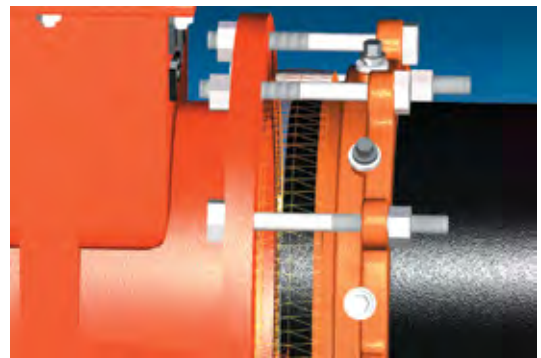


Two, Series 2112 connecting DI pipe and PVC pipe to a gate valve

Some flange adapters use a standard mechanical joint gasket for both the pipe and the flange seal and are prone to leaks.

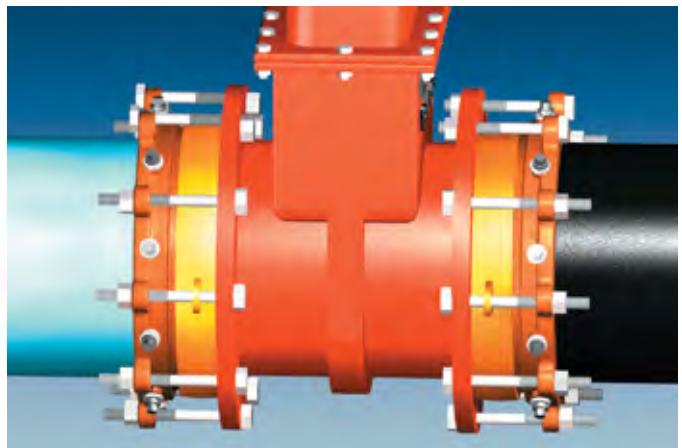
Other flanged coupling adapters separate the pipe seal from the flange seal but are not restrained, and require separate restraining devices.

Still some devices use “set screws” to try to achieve restraint; but set screw restraints are ineffective when compared to the pull-out restraint strength of the standard flanged joint.



Depicting possible gap and deflection capabilities

THE SERIES 2100 MEGAFLANGE RESTRAINED FLANGE ADAPTER IS TOTALLY DIFFERENT!



Series 2100 MEGAFLANGE comes with all the necessary seals and bolts, for a complete and total install.

MEGAFLANGE TESTING RESULTS

PVC TESTING

- Quick Burst Test
- DR18 tested to 755 PSI
- DR14 tested to 985 PSI
- Long Term Pressure Test
- On DR18 PVC pipe at 615 PSI for 1000 hours without failure
- Cyclic Pressure Test
- DR18 tested from 94 to 188 PSI for over 1,000,000 cycles

DUCTILE IRON AND STEEL TESTING

- Leakage Test (one minute required)
- Tested to twice rated pressure without leakage
- Hydrostatic Test (one minute required)
- 3 inch through 6 inch sizes tested to 5 times rated pressure
- 8 inch and 10 inch sizes tested to 4 times rated pressure
- 12 inch size tested to 4 times rated pressure
- Flexural Test
- Tested to with stand a bending moment based on requirements of NFPA 12-1991 “Standard for Installation of Sprinkler Systems”



The **Series 2100 MEGAFLANGE** restrained flange adapter is comprised of two rings. The first is the restraint ring which incorporates wedges around the circumference of the ring to grip the pipe firmly and securely. The wedge style restraint offers enormous pullout strength when compared to set screw restraints. The resiliency of the wedge style restraint allows the Series 2100 to withstand severe moment loads.

The second ring is the gasket ring which separates the seals dedicated to each sealing surface. This ring allows pipe to be cut to lengths in the field at a tolerance of 0.6 inch or more. In addition, the gasket ring also enables the joint to deflect during assembly.

DEFLECTION

Traditional flanged joint connections require a tremendous amount of torque on the bolts to achieve a good seal. The pipe layout must be precisely planned to avoid misalignment errors due to deviations in appurtenances of pipe fabrication.

The Series 2100 MEGAFLANGE is a speedy, on-site fabrication tool which is generous in its deflection limits, from 0.5° to 5° depending on pipe size. The deflection capabilities provided by the gasket ring allow offset of almost nineteen inches of an eighteen foot length of pip through the eight inch size.

1. Identify the pipe. The MEGAFLANGE 2100 Flange Adapter, sizes 4 inch through 12 inch, is designed for use on ductile iron pipe, PVC (C900 & IPS O.D. (ASTM D2241)) pipe, and steel pipe. Check to see if the spacers under the screws are in place. If the pipe is ductile iron or C.I. O.D. PVC (C900) **DO NOT REMOVE THE SPACERS.** If the pipe is steel or IPS O.D. PVC, **REMOVE THE SPACERS** (sizes 4 inch through 12 inch). The 3 inch size is designed for use on ductile iron, IPS O.D. PVC pipe. Sizes 30 inch and larger are designed for ductile iron pipe only. There are no spacers on the 3 inch and the 14 inch and larger sizes.



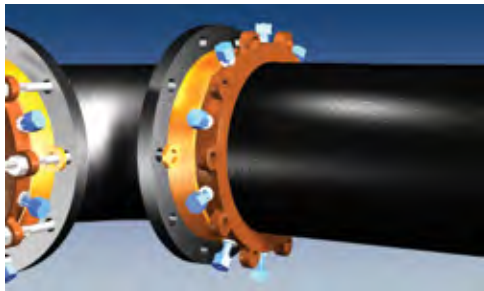
2. Cut the pipe to the required length. Clean the end of the pipe for a length approximately one foot using a wire brush if needed, removing all excess paint and foreign material. Also clean the opposing flange to be connected to the 2100. Place the 2100 restraint ring on the clean pipe with the lip facing the plain end.



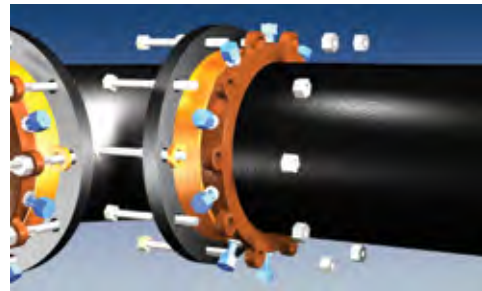
3. Lubricate and place the EBAA-Seal™ Gasket on the clean pipe following the restraint ring. **(USE A TRANSITION GASKET IN PLACE OF THE EBAA-SEAL GASKET FOR STEEL AND IPS O.D. PVC PIPE.)**



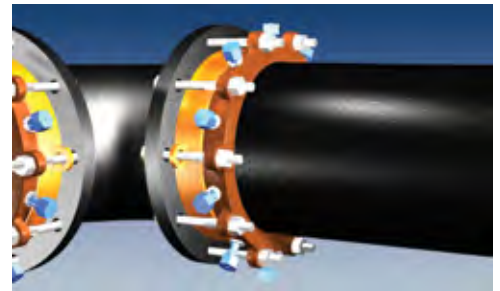
4. Place the O-ring into the groove of the 2100 gasket ring. (This step has already been completed in all sizes except 30 inch and larger.) Place the gasket ring on the pipe with the O-ring facing the pipe end and the gasket recess facing the EBAA-Seal (or transition) Gasket and restraint ring.



5. Bring the pipe and flanges together within the maximum assembled deflection and maximum allowable gap “L” to the flange face. Slide the gasket ring, gasket and restraint ring until contact is made with the opposing flange.



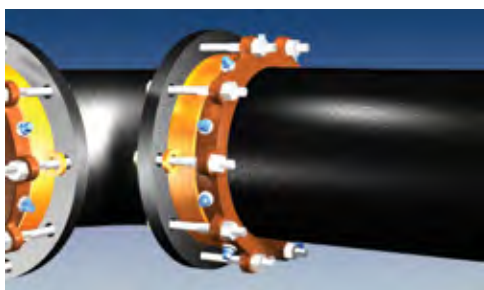
6. Insert and tighten all flange bolts. Torque all flange bolts an alternating manner to the value listed in Table 1.1. Be sure to make any necessary joint deflection before tightening the actuating screws. Joint deflection should not exceed the maximum allowable deflection. Be sure that deflection of the joint does not cause the end of the pipe to be separated from the opposing flange more than the maximum allowable gap “L”.



7. Tighten the actuating screws in an alternating manner until all wedges touch the pipe. Continue tightening the nuts in an alternating pattern until all the torque-limiting nuts have been twisted off.

Table 1.1 Flange Bolt Torques

Nominal Pipe Size	Bolt Torque (ft.-lbs.)
3	45 - 60
4 - 6	75 - 90
8 - 24	90 - 110
30 - 48	110 - 130



8. If removal is necessary, utilize the 5/8 inch hex head provided. For reinstallation, repeat steps 2 through 7, torquing the actuating screws to 70 ft-lbs or until the hex heads bottom out on the spacers or gland.

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WaterMaster Electromagnetic flowmeter

Measurement made easy

The perfect fit for all water industry applications



One solution for all your needs

- designed for use in all water and waste water applications, from sewage plants to distribution networks

State-of-the-art technology

- revolutionary data storage enables transmitter interchange and commissioning without the need for re-configuration
- self-calibrating transmitter with ultra-low temperature coefficient for highest accuracy

Versatile and simple configuration

- 'Through-the-Glass' (TTG) configuration eliminating the need to remove the cover
- smart key based functionality
- 'Easy Setup' function

VeriMaster in situ verification software option

- enables the customer to perform in situ verification of the flowmeter system

Unparalleled service ability

- fault-finding Help texts on the display
- minimized downtime with replaceable electronics cartridges

MID and OIML R49 approved with R49 self-checking

- Type-approved to accuracy Class 1 and Class 2 for any pipe orientation and bidirectional flows
- Type P-approved continuous self-checking of the sensor and transmitter to ensure the highest accuracy and long term performance

Innovative sensors for all applications

- optimized full-bore series for optimum turndown / low pressure drop, irrigation applications
- full-bore series for general-purpose water metering applications
- reduced-bore series for high turn down applications, for example, leakage
- buriable sensors eliminating the need for costly chamber construction

HART, PROFIBUS DP and MODBUS

- Full system and PLC integration

The Company

ABB is an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a world leader in process automation technology our worldwide presence, comprehensive service and application-oriented know-how make ABB a leading supplier of flow measurement products.

Introduction

Setting the standard for the Water Industry

The WaterMaster range, available in sizes 10 to 2400 mm ($\frac{3}{8}$ to 96 in.), is designed specifically for use on the many diverse applications encountered in the Water and Waste-water industry. The modular design concept offers flexibility, cost-saving operation and reliability while providing a long service life and exceptionally low maintenance.

Integration into ABB asset management systems and use of the self-monitoring and diagnostic functions increase the plant availability and reduce downtimes.

VeriMaster – the verification tool

An easy-to-use utility, available through the infra red service port, it uses the advanced self-calibration and diagnostic capability of WaterMaster, coupled with fingerprinting technology, to determine the accuracy status of the WaterMaster flowmeter to within ± 1 % of its original factory calibration. VeriMaster also supports printing of calibration verification records for regulatory compliance.



Diagnostic functions

Using its diagnostic functions, the flowmeter monitors both its own operability and the process. Limit values for the diagnostic parameters can be set locally. When these limits are exceeded, an alarm is tripped. In the event of an error, diagnostic-dependent help text appears on the display and this considerably simplifies and accelerates the troubleshooting procedure.

In accordance with NAMUR NE107, alarms and warnings are classified with the status of 'Maintenance Required', 'Check Function', 'Failure' and 'Out of Specification'.

Flow performance

Utilizing its advanced filtering methods, the WaterMaster improves accuracy even under difficult conditions. WaterMaster has an operating flow range with ± 0.4 % accuracy as standard (± 0.2 % optional) in both forward and reverse flow directions.

Easy and quick commissioning

'Fit-and-Flow' data storage inside WaterMaster eliminates the need to match sensor and transmitter in the field. On initial installation, the self-configuration sequence automatically replicates into the transmitter all calibration factors, meter size and serial numbers, as well as customer site-specific settings, eliminating the potential for error.

Intuitive, convenient navigation

The 'Easy Setup' function reliably guides unpracticed users through the menu step by step. The smart key based functionality makes handling a breeze – it's just like using a cell phone. During configuration, the permissible range of each parameter is indicated on the display and invalid entries are rejected.

Universal transmitter – powerful and flexible

The backlit display can be rotated easily without the need for tools. The contrast is adjustable and the display fully-configurable. The character size, number of lines and display resolution (number of decimal points) can be set as required. In multiplex mode, several different display options can be pre-configured and invoked one after the other.

The smart modular design of the transmitter unit enables easy disassembly without the need to unscrew cables or unplug connectors. HART is used as the standard communications protocol. Optionally, the transmitter is available with PROFIBUS DP or MODBUS communication.

Assured quality

WaterMaster is designed and manufactured in accordance with international quality procedures (ISO 9001) and all flowmeters are calibrated on nationally-traceable calibration rigs to provide the end-user with complete assurance of both quality and performance of the flowmeter.



WaterMaster – always the first choice

WaterMaster sets the standard for the water industry. The specification, features and user benefits offered by this range are based on ABB's worldwide experience in this industry and they are all targeted specifically to the industry's requirements.

Submersible and buriable

WaterMaster sensors have a rugged, robust construction to ensure a long, maintenance-free life under the arduous conditions experienced in the Water and Waste Industry. The sensors are, as standard, inherently submersible (IP68, NEMA 6P), thus ensuring suitability for installation in chambers and metering pits that are susceptible to flooding.

A unique feature of the WaterMaster sensors is that sizes DN40 to DN2400 (1½ to 96 in. NB) are buriable; installation simply involves excavating to the underground pipe, fitting the sensor, cabling back to the transmitter and then backfilling the hole.



The WaterMaster family

Overview of the WaterMaster

A wide range of features and user benefits are built into WaterMaster as standard:

- bi-directional flow
- unique self-calibrating transmitter (patented) for the ultimate in stability and repeatability
- OIML-type continuous self-checking, with alarms, ensures both sensor and transmitter accuracy
- true electrode and coil impedance measurement
- comprehensive simulation mode
- universal switch-mode power supply (options are available for AC and DC supplies)
- comprehensive self-diagnostics compliant with NAMUR NE107
- programmable multiple-alarm capability
- bus options: HART (4 to 20 mA), PROFIBUS DP (RS485), MODBUS (RS485)
- 3 configurable pulse / frequency and alarm outputs
- advanced infrared service port supports remote HMI, HART, cyclic data out and parameter download
- VeriMaster in situ verification software available as option
- read-only switch and ultra-secure service password for total security



OIML / MID approved

WaterMaster has been type tested and Internationally approved to the highest accuracy class 1 and 2 for cold and hot potable water meters – OIML R49-1 (Organisation Internationale de Métrologie Légale). For full details, OIML R49 is available to download from www.oiml.org. Its requirements are very similar to other International standards, such as EN14154 and ISO4064.

WaterMaster has been assessed by type approval at the National Measurement Office (NMO) to OIML R49 and passed to the very highest accuracy designations for sizes DN40 to DN200 (1½ to 8 in. NB).

The approval is for:

- Class 1 and Class 2 accuracy (calibration option)
- Environmental class T50 for water temperatures of 0.1 to 50 °C (32.18 to 122 °F)
- Electromagnetic Environment E2 (10 V/m)
- Any pipe orientation
- 5 Diameters upstream pipe
- 0 Diameters downstream pipe
- Pressure Loss Class <0.25 bar (3.62 psi)
- Integral or remote transmitter (<200 m [<656 ft.] cable)
- DN40 to DN200 (1½ to 8 in. NB), bi-directional flow

A major advance in WaterMaster is the self-checking capabilities that meet and exceed the R49 requirements and is the first electromagnetic flowmeter to be approved to OIML Type P permanent self checking during normal operation (not just at startup) and alarm indication for:

- transmitter and sensor status, with an accuracy alarm
- program ROM and RAM status
- double, independent storage of totalizer values, in both the sensor and transmitter non-volatile memories
- display test

The OIML R49-1 certificate of conformity is available from:

<http://www.abb.com/product/seitp330/b42ec2377d3293cdc12573de003db93b.aspx>

WaterMaster is also approved under the EU Measuring Instruments Directive (MID) 2004/22/EC, that covers putting into use water flowmeters for certain applications. MID WaterMaster is secured against tampering and is available as an option, along with fingerprinting for ABB VeriMaster in situ verification product, with certificate printout to ± 1 % accuracy.

WaterMaster certificates of EC type-examination of a measuring instrument are available from:

<http://www.abb.com/product/seitp330/b42ec2377d3293cdc12573de003db93b.aspx>

Superior control through advanced sensor design

The innovative, patented octagonal sensor design improves flow profile and reduces up- and down-stream piping requirements for the most commonly used sizes of 40 to 200 mm (1½ to 8 in.). This optimized full bore meter provides impressive results in the most difficult of installation requirements.

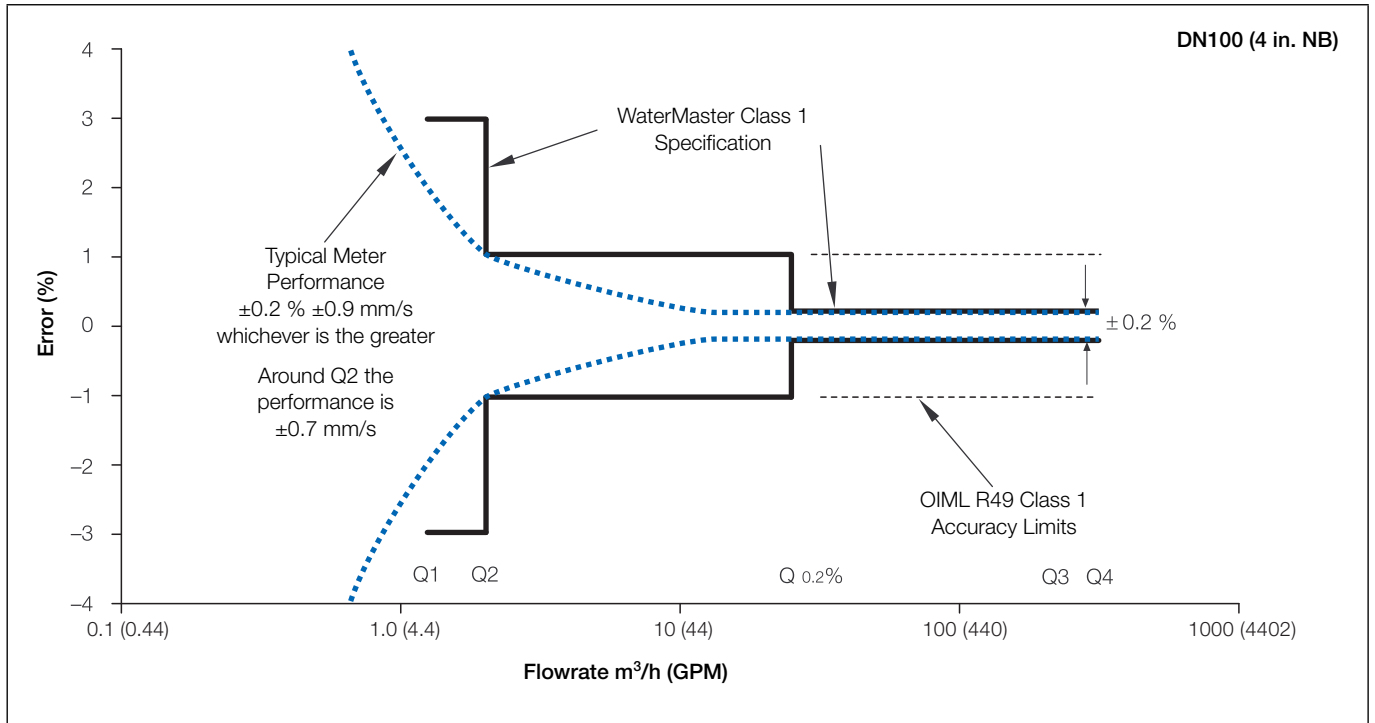


WaterMaster sensors are also available in reduced-bore geometries giving the ultimate in low-flow performance with a very high turn-down range.

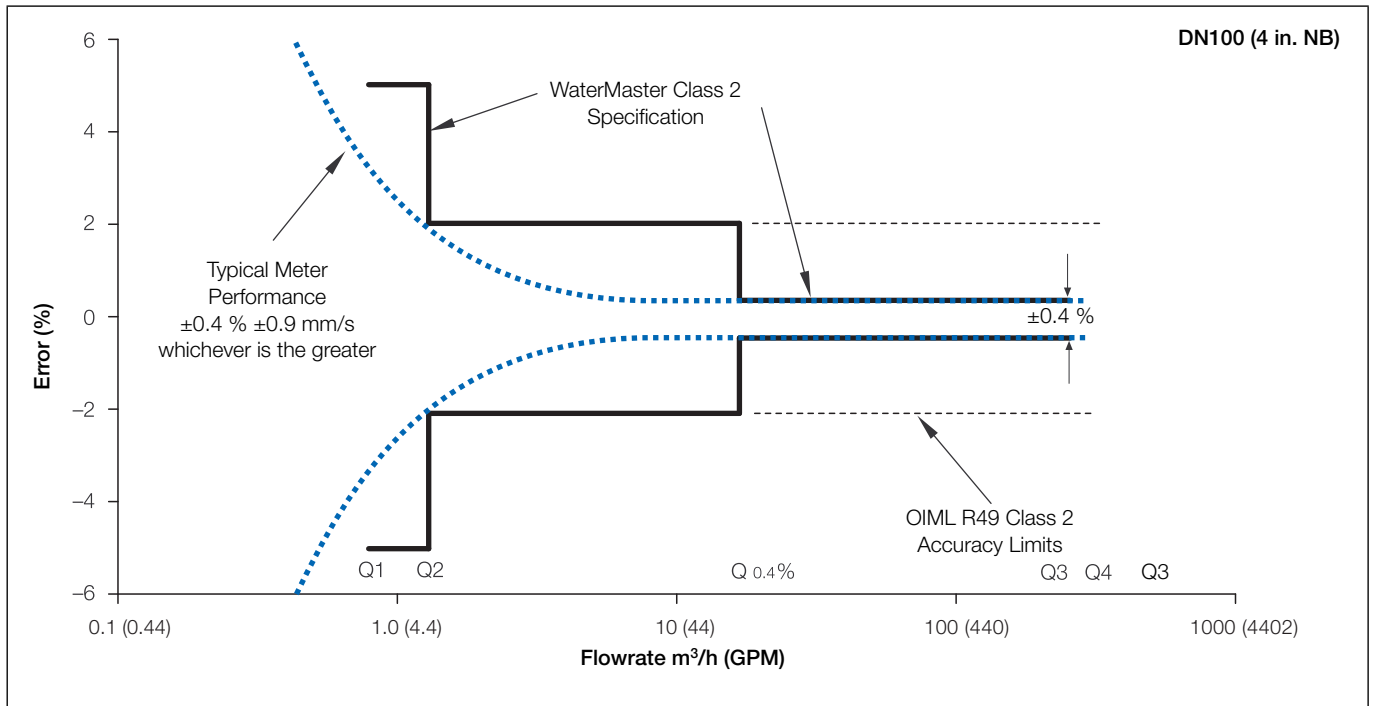
The unique design of the reduced-bore sensor conditions the flow profile in the measuring section so that distortions in the flow profile, either upstream or downstream, are flattened. The result is excellent in situ flowmeter performance, even with very bad hydraulic installation conditions.

Specification

WaterMaster specification to OIML R49 Class 1



WaterMaster specification to OIML R49 Class 2



Although OIML R49 does not define the flow accuracy below Q1, WaterMaster continues to measure flow at lower flow rates down to a cutoff velocity of $\pm 5 \text{ mm/s}$ ($\pm 0.2 \text{ in./s}$). The accuracy between cutoff and Q1 is typically $\pm 0.9 \text{ mm/s}$ ($\pm 0.04 \text{ in./s}$).

WaterMaster optimized full-bore meter (FEV) / full-bore meters (FEF, FEW) flow performance – gal/min

NPS/NB (DN)	Q4	Q3	Standard Calibration 0.4 % Class 2			High Accuracy Calibration 0.2 % Class 1		
			Q0.4%	Q2	Q1	Q0.2%	Q2	Q1
3/8 (10)	13.8	11	0.73	0.06	0.035	1.38	0.09	0.053
1/2 (15)	34.7	27.7	1.85	0.14	0.09	3.48	0.22	0.14
3/4 (20)	55	44	2.94	0.22	0.14	5.5	0.35	0.22
1 (25)	88	70.4	4.7	0.35	0.22	8.8	0.57	0.35
1 1/4 (32)	137.6	110	7.3	0.57	0.35	13.2	0.88	0.57
1 1/2 (40)	220	176	18.5	0.89	0.56	26.4	1.41	0.88
2 (50)	347	277	18.5	1.41	0.88	34.7	2.22	1.39
2 1/2 (65)	550	440	29.4	2.24	1.40	55.0	3.52	2.20
3 (80)	881	704	47.0	3.58	2.24	70.4	5.64	3.52
4 (100)	1,376	1,101	73.4	5.59	3.49	110	8.81	5.50
5 (125)	1,376	1,101	73.4	5.59	3.49	110	8.81	5.50
6 (150)	3,467	2,774	185	14.1	8.81	277	22.2	13.9
8 (200)	5,504	4,403	294	22.4	14.0	440	35.2	22.0
10 (250)	8,806	7,045	470	35.8	22.4	704	56.4	35.2
12 (300)	13,759	11,007	734	55.9	34.9	1,101	88.1	55.0
14 (350)	22,014	17,611	1,174	89.5	55.9	1,761	141	88.1
16 (400)	22,014	17,611	1,174	89.5	55.9	1,761	141	88.1
18 (450)	34,673	27,738	1,849	141	88.1	2,774	222	139
20 (500)	34,673	27,738	1,849	141	88.1	2,774	222	139
24 (600)	55,036	44,029	2,935	224	140	4,403	352	220
27/28" (700)	88,057	70,446	7,045	451	282	7,045	704	440
29 (750)	88,057	70,446	7,045	451	282	7,045	704	440
30 (760)	88,057	70,446	7,045	451	282	7,045	704	440
32 (800)	88,057	70,446	7,045	451	282	7,045	704	440
36 (900)	137,590	110,072	11,007	704	440	11,007	1,100	688
39/40" (1000)	137,590	110,072	11,007	704	440	11,007	1,100	688
42 (1050)	137,590	110,072	11,007	704	440	11,007	1,100	688
44 (1100)	137,590	110,072	11,007	704	440	11,007	1,100	688
48 (1200)	220,143	176,115	17,611	1,127	704	17,611	1,761	1,101
52 (1350)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
54 (1400)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
60 (1500)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
66 (1600)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
68 (1650)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
77 (1800)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
77 (1950)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
78 (2000)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
78 (2000)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
84 (2200)	880,573	704,459	70,446	4,509	2,818	70,446	7,045	4,403
96 (2400)	880,573	704,459	70,446	4,509	2,818	70,446	7,045	4,403

*Size is dependent on flange specification

WaterMaster reduced-bore meter (FER) flow performance – m³/h (gal/min)

Size		Class 2 specification					Class 1 specification				
		Q4	Q3	Q0.4%	Q2	Q1	R	Q0.2%	Q2	Q1	R
mm	in.	m ³ / h (Ugal / min)	m ³ / h (Ugal / min)	m ³ / h (Ugal / min)	m ³ / h (Ugal / min)	m ³ / h (Ugal / min)		m ³ / h (Ugal / min)	m ³ / h (Ugal / min)	m ³ / h (Ugal / min)	
40	1 1/2	31 (138)	25 (110)	0.83 (1.05)	0.063 (0.28)	0.04 (0.18)	630	1.7 (7.48)	0.1 (0.44)	0.063 (0.28)	400
50	2	50 (220)	40 (176)	1.0 (4.40)	0.1 (0.44)	0.063 (0.28)	630	2.0 (8.8)	0.16 (0.7)	0.1 (0.44)	400
65	2 1/2	79 (347)	63 (277)	1.6 (7.04)	0.16 (0.7)	0.1 (0.44)	630	3.2 (10.56)	0.25 (1.1)	0.16 (0.7)	400
80	3	125 (550)	100 (440)	2.0 (8.80)	0.25 (1.1)	0.16 (0.7)	630	4.0 (17.6)	0.4 (1.76)	0.25 (1.1)	400
100	4	200 (880)	160 (704)	3.2 (10.56)	0.41 (1.8)	0.25 (1.1)	630	6.4 (28)	0.64 (2.8)	0.4 (1.76)	400
125	5	200 (880)	160 (704)	3.2 (10.56)	0.41 (1.8)	0.25 (1.1)	630	6.4 (28)	0.64 (2.8)	0.4 (1.76)	400
150	6	500 (2200)	400 (1760)	8.0 (35.20)	1.0 (4.4)	0.63 (2.77)	630	16 (70.4)	1.6 (7)	1.0 (4.4)	400
200	8	788 (3470)	630 (2770)	13.0 (57.2)	1.6 (7.04)	1.0 (4.4)	630	25 (110)	2.5 (11)	1.6 (7)	400
250	10	1250 (5500)	1000 (4400)	20 (88)	2.5 (11.01)	1.6 (7)	630	40 (176)	4.0 (17.6)	2.5 (11)	400
300	12	2000 (8810)	1600 (7045)	32 (140.8)	4.1 (18.05)	2.5 (11)	630	64 (281.6)	6.4 (28)	4.0 (17.6)	200
350	14	2000 (8810)	1600 (7045)	32 (140.8)	6.4 (28.18)	4.0 (17.6)	400	64 (281.6)	12.8 (56)	8.0 (35.2)	200
375	15	2000 (8810)	1600 (7045)	32 (140.8)	6.4 (28.18)	4.0 (17.6)	400	64 (281.6)	12.8 (56)	8.0 (35.2)	200
400	16	3125 (13760)	2500 (11007)	50 (220)	10 (44)	6.3 (27.7)	400	100 (440)	20 (88)	12.5 (55)	200
450	18	3125 (13760)	2500 (11007)	50 (220)	10 (44)	6.3 (27.7)	400	100 (440)	20 (88)	12.5 (55)	200
500	20	5000 (22014)	4000 (17610)	80 (352)	16 (70.45)	10 (44)	400	160 (70.4)	32 (141)	20 (88)	200
600	24	7875 (34670)	6300 (27740)	126 (554.4)	25.2 (110.9)	15.8 (70)	400	252 (1108)	50.4 (222)	31.5 (138.7)	200

Specification – sensor

Functional specification

Pressure limitations

As per flange rating – non approved
PN16 for OIML R49, MID Approved

Pressure equipment directive 97/23/EC

This product is applicable in networks for the supply, distribution and discharge of water and associated equipment and is therefore exempt.

Temperature limitations

Ambient temperature
Remote transmitter –20 to 70 °C (–4 to 158 °F)
Integral transmitter –20 to 60 °C (–4 to 140 °F)

Process temperature See table below.
0.1 to 50 °C (32.2 to 122 °F) – OIML R49 T50
Approved

Code	Lining	Flange material	Medium temperature °C (°F)	
			Minimum	Maximum
FEF, FEW3	Hard rubber	Carbon steel	–10 (14)	90 (194)
		Stainless steel	–10 (14)	90 (194)
FEW1	PTFE	Carbon steel	–10 (14)	130 (266)
		Stainless steel	–25 (–13)	130 (266)
FEW3	PTFE	Carbon steel	–10 (14)	130 (266)
		Stainless steel	–10 (14)	130 (266)
FEW3	Elastomer	Carbon steel	–5 (23)	80 (176)
		Stainless steel	–5 (23)	80 (176)
FEF, FER	Elastomer	Carbon steel	–6 (21)	70 (158)
FEV	Polypropylene	Carbon steel	–6 (21)	70 (158)

IP rating

IP68 (NEMA 6) to 7 m (20 ft.) depth

Note. Not sizes DN10 to DN32 ($\frac{3}{8}$ – $1\frac{1}{4}$ in. NB)

IP67 (NEMA 4X) – DN10 to DN32 ($\frac{3}{8}$ – $1\frac{1}{4}$ in. NB)

Buriable (sensor only)

FEV, FEF and FEW – DN450 to 2400 (18 to 96 in. NB)
to 5 m (16 ft.) depth

Conductivity

>5 μ S cm^{–1}

Transmitter mounting

Integral (not FEF) or remote

Electrical connections

20 mm glands

$\frac{1}{2}$ in. NPT

20 mm armored glands

Sensor cable

ABB WaterMaster cable available in two forms –
standard and armored
Maximum length 200 m (660 ft.)

Physical specification

Wetted parts

Electrode material

Stainless steel 316 L / 316 Ti

Super-austenitic steel

Hastelloy® C-22 and Hastelloy C⁴

(other electrode materials available on request)

Potential equalizing rings

Minimum of 1 recommended

Lining material / potable water approvals

Code	Size Range	Liner	Potable Water Approvals					AZ/ NZZ 4020
			WRAS	WRAS 60°C	ACS	DVGW	NSF	
FEW1	DN10 – 32 ($\frac{3}{8}$ – $1\frac{1}{4}$ in. NB)	PTFE	4					
FEW3	DN10 – 600 ($\frac{3}{8}$ – 24 in. NB)	PTFE						
FEW3	DN40 – 2400 ($1\frac{1}{2}$ – 96 in. NB)	Elastomer	4					4
FEW3	DN40 – 2400 ($1\frac{1}{2}$ – 96 in. NB)	Hard rubber	4	4		4	NSF approved material	
FEV	DN40 – 200 ($1\frac{1}{2}$ – 8 in. NB)	Poly- propylene	4		4	4	NSF-61	4
FEF	DN250 – 600 (10 – 24 in. NB)	Elastomer	4		4	4	NSF-61	4
FEF	DN250 – 600 ($1\frac{1}{2}$ – 24 in. NB)	Hard rubber	4	4		4	NSF approved material	
FER	DN40 – 600 ($1\frac{1}{2}$ – 24 in. NB)	Elastomer	4		4	4		4

*Size is dependent on flange specification

Lining protection plates

Not required

Installation conditions (recommended)

Straight pipe requirements

Upstream Downstream

FEW / FEF 5 x DN 2 x DN

FEV 5x DN 0 x DN

FER 0 x DN 0 x DN

Pressure loss

Negligible at Q3 All full bore meters

<0.25 bar (<3.62 psi) at Q3 FEV (DN40 to 200 [$1\frac{1}{2}$ to 8 in. NB])

<0.63 bar (<9.13 psi) at Q3 FER (DN40 to 600 [$1\frac{1}{2}$ to 24in. NB])

WaterMaster
Electromagnetic flowmeter

Non-wetted parts

Flange material

Carbon steel	DN20 to DN2400 ($\frac{3}{4}$ to 96 in. NB)
Stainless steel	DN10 to DN2400 ($\frac{3}{8}$ to 96 in. NB)
SG iron	FEV – DN40 to DN150 [1 $\frac{1}{2}$ to 6 in. NB) FER – DN40 to DN150 [1 $\frac{1}{2}$ to 6 in. NB)

Housing material

Carbon steel	FEV – DN40 to 200 (1 $\frac{1}{2}$ to 8 in. NB) FEW – DN450 to 2400 (18 to 96 in. NB)
Plastic	FEF – DN250 to 600 (10 to 24 in. NB)
Aluminium	FEW – DN10 to 400 ($\frac{3}{8}$ to 16 in. NB)

Terminal box material

Polycarbonate

Cable gland material

Plastic, brass

Paint specification

Paint coat ≥ 70 μm thick RAL 9002 (light grey)

Specification – transmitter

Functional specification

Power supply

Mains	85 to 265 V AC @ <7 VA
Low voltage	24 V AC +10 % / -30 % @ <7 VA
DC	24 V ±30 % @ <0.4 A

Supply voltage fluctuations within the specified range have no effect on accuracy

Digital Outputs (3)

- Rating 30 V @ 220 mA, open collector, galvanically isolated *
- Maximum output frequency 5250 Hz
- 1 off dedicated to Alarm / Logic, programmable function
- 2 off configurable to either Pulse / Frequency or Alarm/Logic function

Current output – HART FEX100 variant

- 4 to 20 mA or 4 to 12/20 mA, galvanically isolated *
- Maximum loop resistance 750 Ω
- HART protocol Version 5.7 (HART registered)
- Signal levels compliant with NAMUR NE 43 (3.8 to 20.5 mA)
- Low alarm 3.6 mA, High alarm 21.8 mA

Additional accuracy

- ±0.1 % of reading
- Temperature coefficient: typically <±20 ppm/°C

RS485 Communications – PROFIBUS FEX100-DP variant

- Registered name: FEX100-DP
- RS485 (9.6kbps to 1.5Mbps), galvanically isolated
- DPV0, DPV1
- PA Profile 3.01
- Standard idents: 9700, 9740, 9741
- FEX100-DP specific ident: 3431
- 3 Concurrent MS2 master connections

RS485 Communications – MODBUS FEX100-MB variant

- MODBUS RTU protocol
- RS485 (9.6kbps to 115.2kbps), galvanically isolated

Electrical connections

- 20 mm glands 1/2 in. NPT, 20 mm armored glands

Temperature limitations

- Ambient temperature -20 to 60 °C (-4 to 140 °F)
- Temperature coefficient Typically <±10 ppm/°C @ Vel ≥0.5 m/s

Environmental protection

- Humidity: 0 to 100 %
- Rating: IP67 (NEMA 4X) to 1m (3.3 ft.) depth

Tamper-proof security

- Write access prevented by internal switch combined with external security seals for MID applications

Languages

- English, French, German, Italian, Spanish, Polish

Infrared service port

- USB adapter (accessory), USB 1.1. and 2.0 compatible
- Driver software for Windows 2000, XP, 7 (32-bit) and Vista

Housing material

- Powder-coated aluminium with glass window

Paint specification

- Paint coat ≥70 µm thick RAL 9002 (light grey)

Transmitter vibration testing

- Vibration level: 7 m/s²
- Frequency range: 20 to 150 Hz
- No. of sweeps in 3 orthogonal planes: 20
- Undetectable shift in transmitter span or zero performance

Hazardous approvals (HART variant only)

- FM & FMc Class 1 Div 2
- (FM listing NI / 1 / 2 / ABCD / T4, S / II, III / 2 / FG / T4, Ta=60C; Type 4X, IP67 – for transmitter and integral mounting Ta=70C, Type 6P, IP68 – for remote sensor type, IP67 on DN10 to 32 [3/8 to 1 1/4 in.NB])
- (FMc listing NI / 1 / 2 / ABCD / T4, DIP / II, III / 2 / FG / T4, Ta=60C; Type 4X, IP67 – for transmitter and integral mounting Ta=70C, Type 6P, IP68 – for remote sensor type, IP67 on DN10 to 32 [3/8 to 1 1/4 in.NB])

FET, FEV, FEW and FEF DN700 to 2200 (27/28* to 84 in. NB) only

*Size is dependent on flange specification

ATEX* Zone 2, 21 & 22

- II 3 G Ex nA IIC T5 Gc
- II 2 D Ex tb IIIC T100°C Db
- TA = -20°C to +60°C (integral transmitter)
- TA = -20°C to +70°C (remote sensor)

IECEX* Zone 2, 21 & 22

- Ex tb IIIC T100°C Db
- Ex nA IIC T5 Gc
- TA = -20°C to +60°C (integral transmitter)
- TA = -20°C to +70°C (remote sensor)

*FEW, FEV, FET and FEF ≥700 (27/28 in. NB) only

Declaration of Conformance

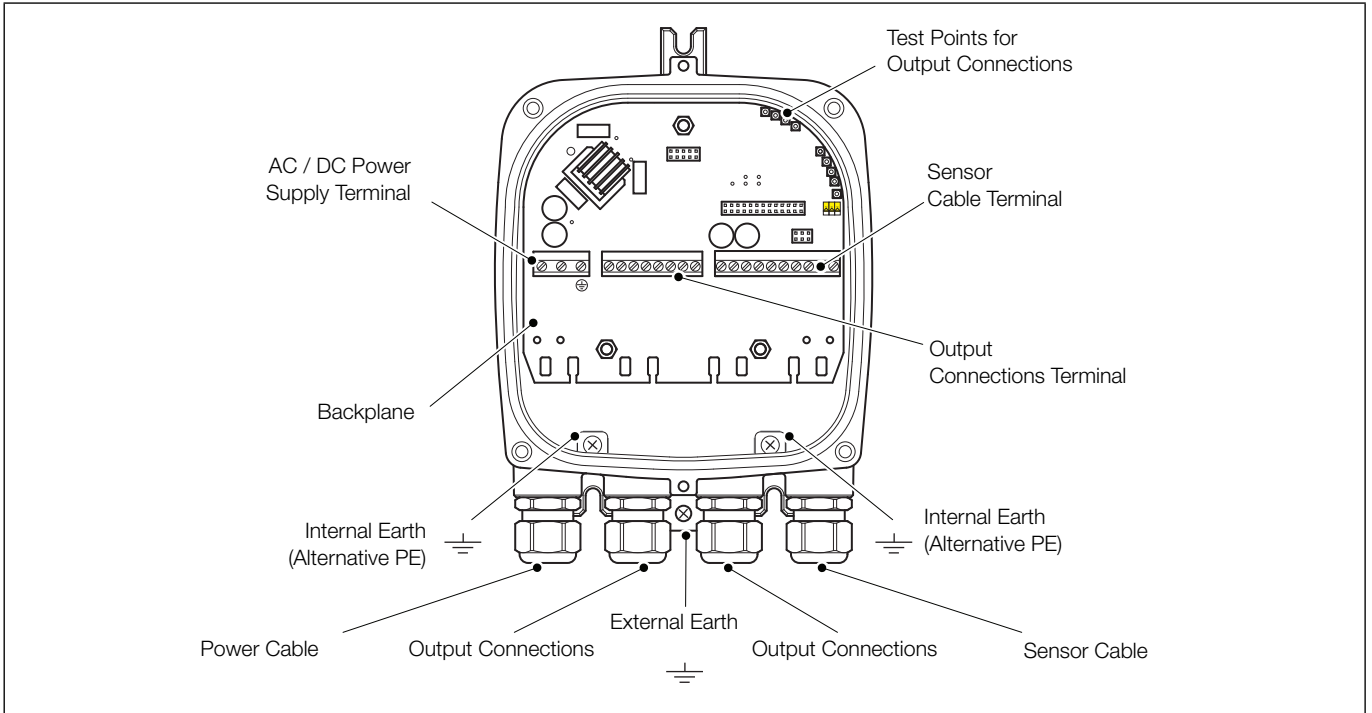
- Copies of CE certification will be available on request.
- WaterMaster has OIML R49 Certificate of Conformity to accuracy class 1 and 2 (FEV DN40 to 200 [1 1/2 to 8 in.NB]). Copies of accuracy certification are available on request.
- WaterMaster (FEV DN40 to 200 [1 1/2 to 8 in.NB]) has been type examined under directive MID 2004/22/EC, Annex MI-001. Copies of this certificate are available on request.

* When installed, do not leave galvanically isolated circuits (pulse and current) floating.

Transmitter connections

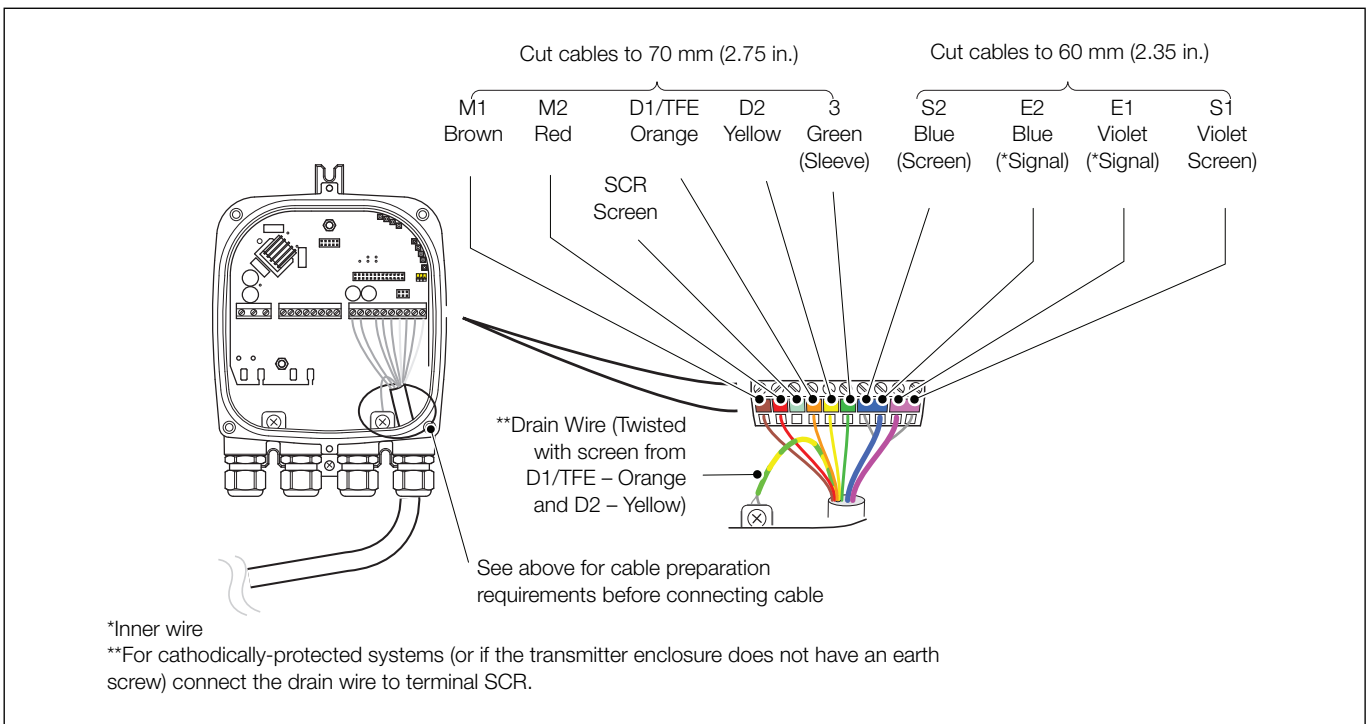
Transmitter terminal connections overview

This section is intended to give an overview of installation of a flowmeter. For Installation requirements, technical information and Health and safety precautions – refer to the User Guide OI/FET100-EN.



Cable gland / conduit entry (Remote transmitter shown)

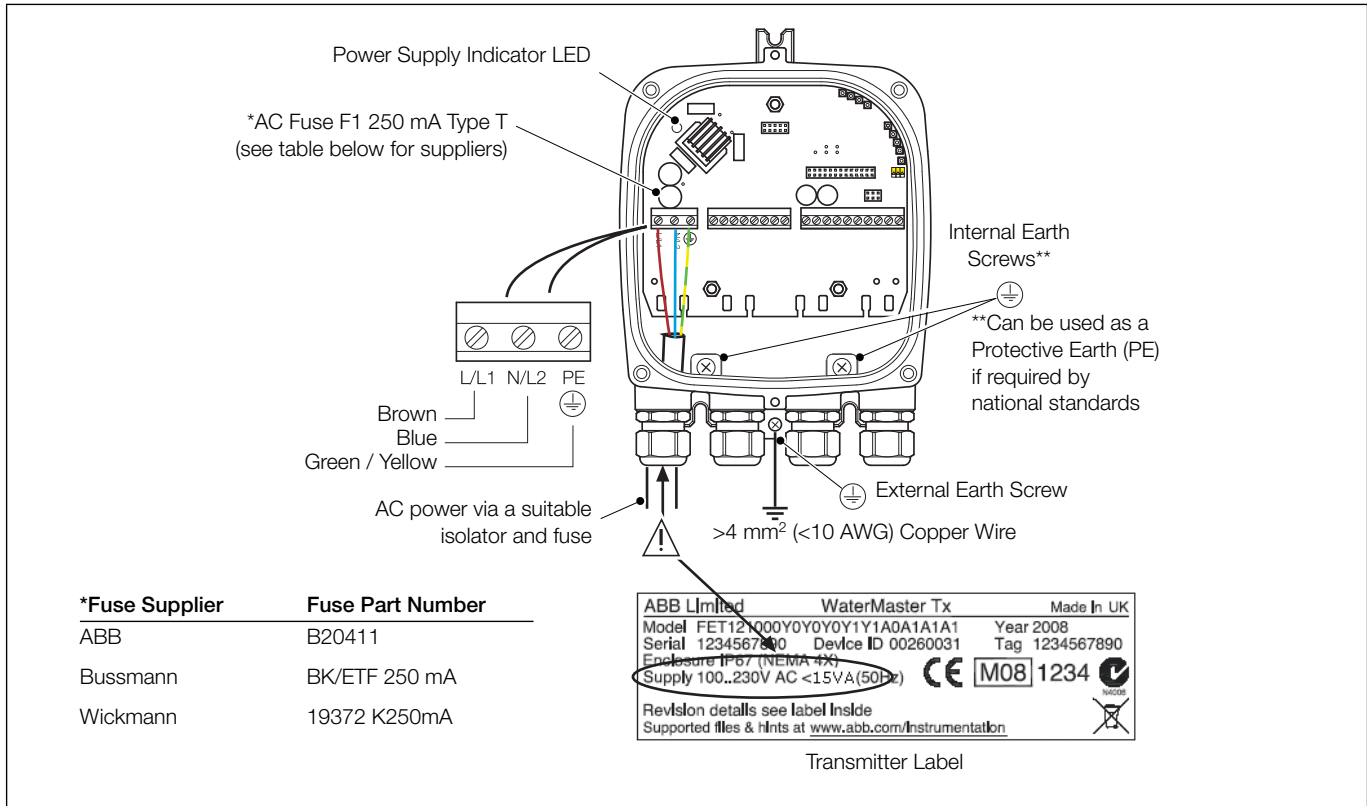
Sensor cable terminal connections and recommended cable lengths



Sensor cable connections at transmitter terminal block – remote transmitter

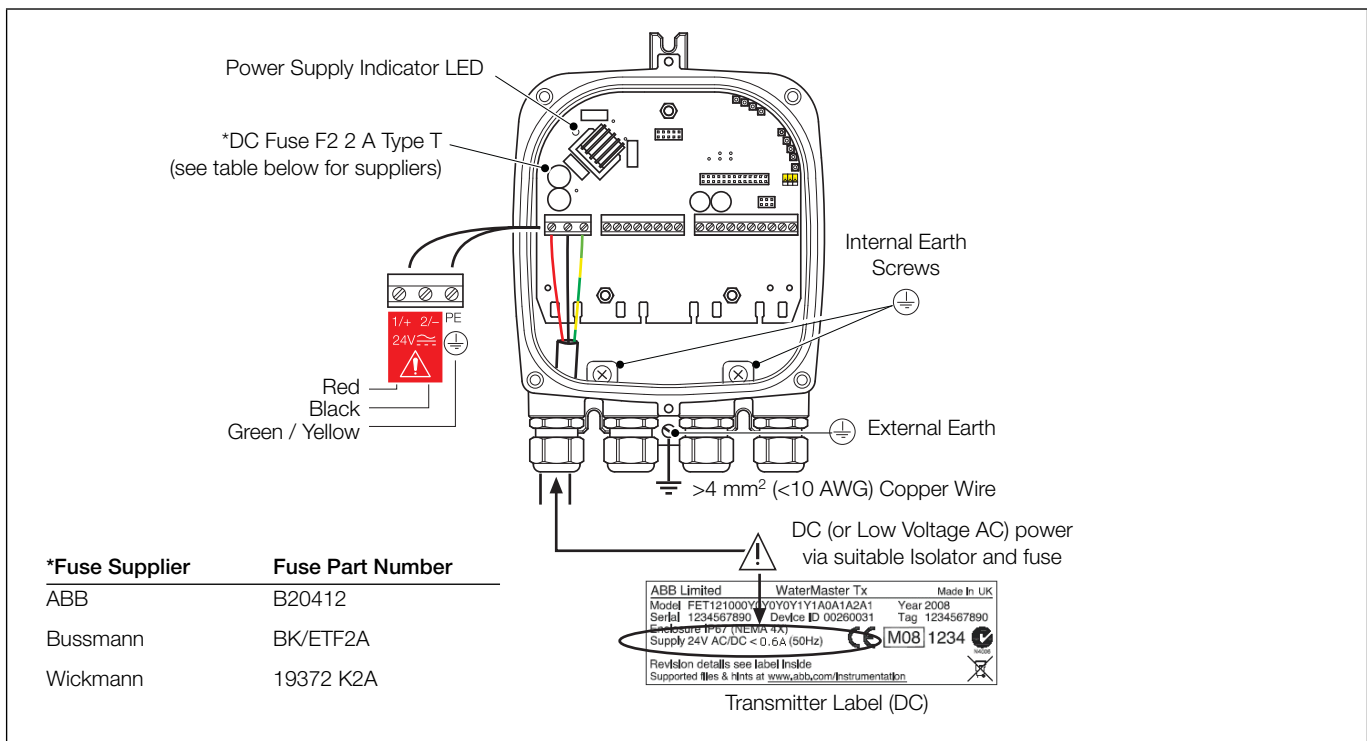
Power supply connections

AC power supply



AC power supply connections

DC (and low voltage AC) power supply



DC (and low voltage AC) power supply connections

Configuration DIP switches

Three configuration DIP switches are mounted on the transmitter backplane board.

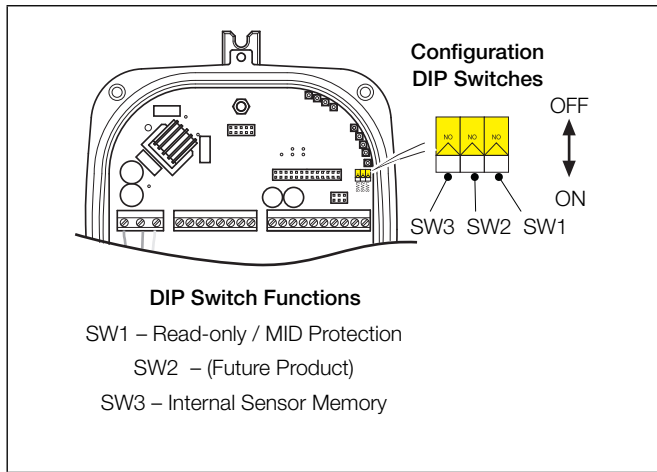
These are factory-set as follows:

- Remote transmitter – all OFF
- Integral transmitter – SW3 ON

For MID-compliant flowmeters the read-only / MID protection switch is set to 'ON' to ensure the meter is secure from tampering.

For HART software versions prior to 01.02.XX, this switch (set after commissioning) prevents login via the keypad or bus at any security level.

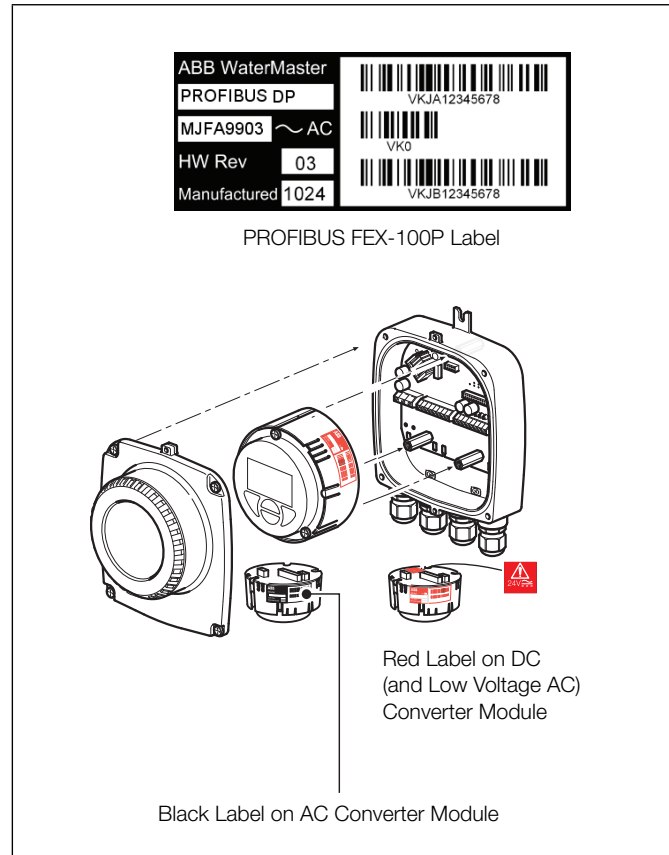
From HART software version 01.03.XX onwards and for all PROFIBUS software versions, on MID meters, all metrological-related parameters are locked and inaccessible at the Service level. Standard and Advanced user level parameters can still be modified via the HMI or bus.



Configuration DIP switches

Transmitter module identification

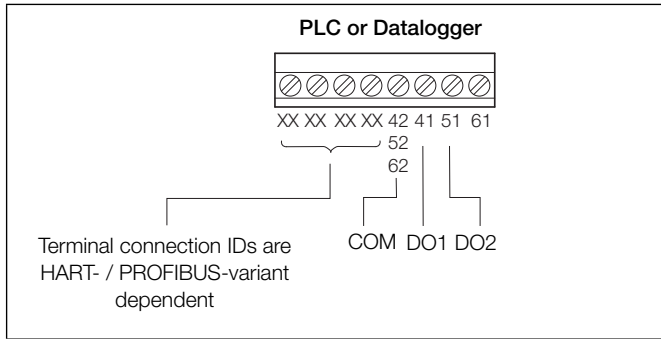
Note. The communications bus type is HART FEX100 if not specified on the transmitter module label. An example of the PROFIBUS FEX100-DP variant transmitter module label is shown below.



Transmitter module identification

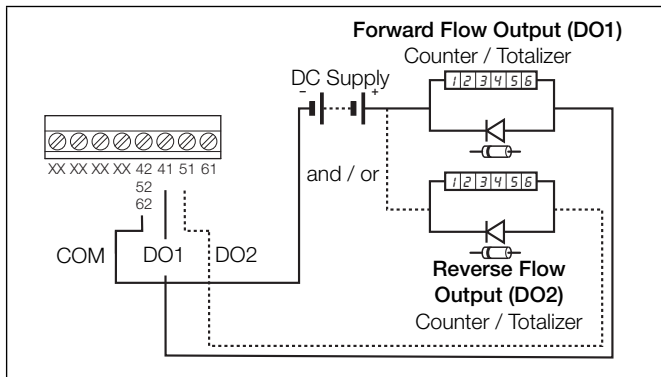
Output connections

Frequency outputs

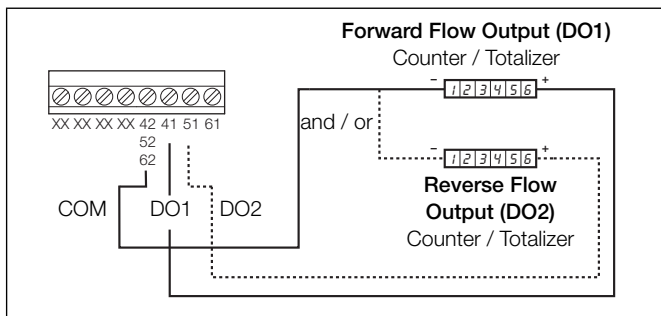


PLC / Datalogger connections

Note. Digital outputs DO1 and DO2 are polarity sensitive. The common (negative) connection for these outputs is designated 'COM'.

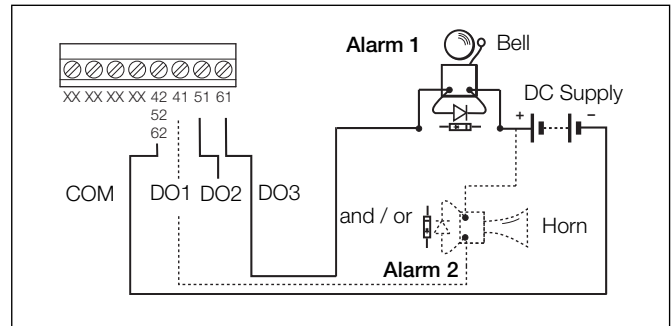
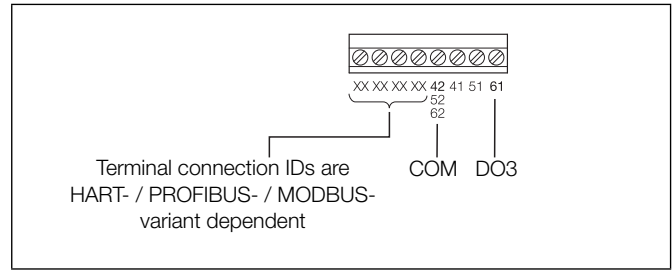


Electromechanical connections



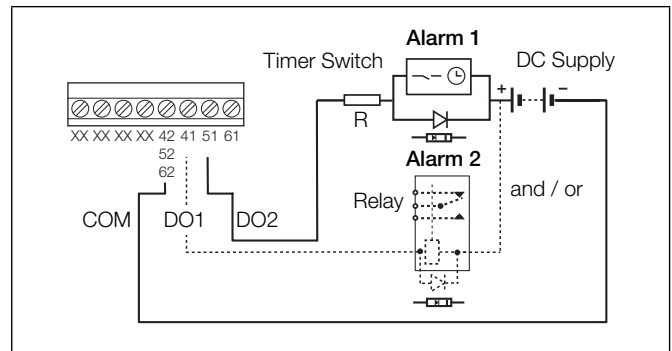
Telemetry / Electronic counters connections

Alarm outputs



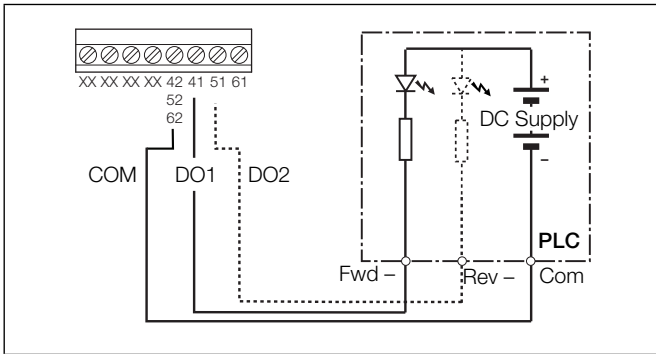
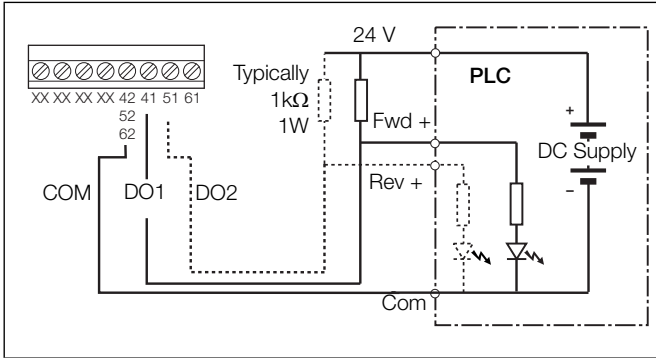
Note.

- Normal alarm / logic output is from DO3 (terminal 61). DO1 (41) and DO2 (51) can also be configured as alarms if required but are then NOT available as frequency / pulse outputs as shown in *Electromechanical connections* and *Telemetry / Electronic counters connections*, opposite.
- Bell and horn shown for example only. Any suitable alarm device may be used (for example, lamp, siren, buzzer etc.).



Note. Relay and timer switch shown for example only.

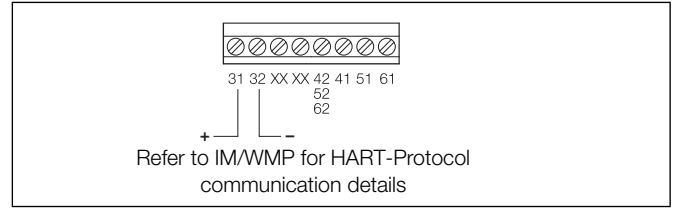
PLC interface



Note.

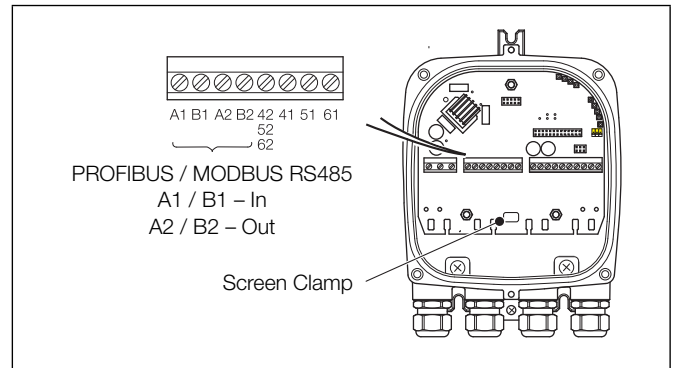
- WaterMaster digital outputs are NPN optocoupled transistors used as switches.
- Maximum allowed voltage at collector is 30 V DC
- Maximum allowed current across transistor is 220 mA.

Current output (4 to 20 ma) – HART (FEX100) variant



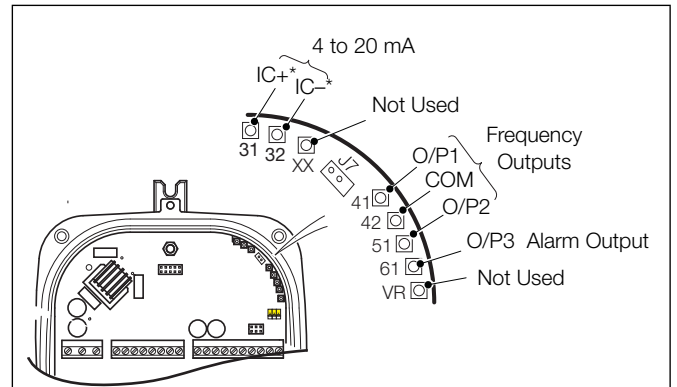
Current output (4 to 20 mA) – HART (FEX100) variant

RS485 communications – PROFIBUS (FEX100-DP) and MODBUS (FEX100-MB) variants



Test point access

Note. A typical DVM probe can access (fit) the PCB's test holes.



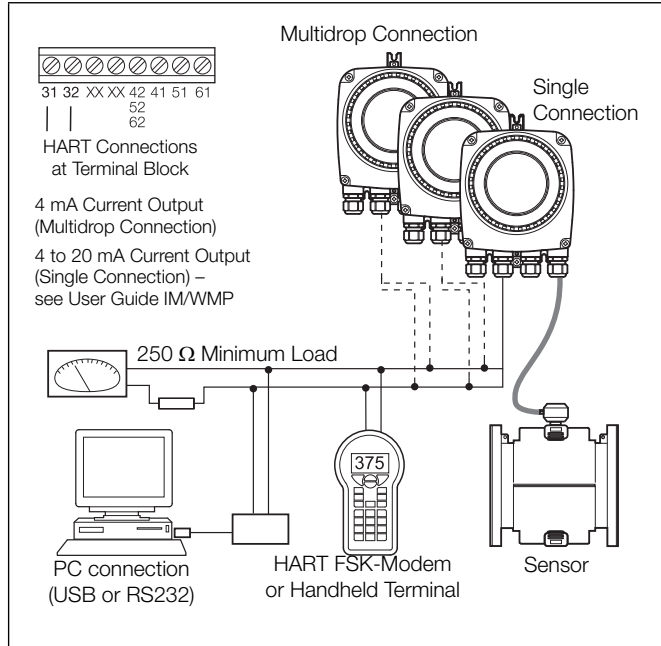
*These 2 test points are connected on the HART FEX100 backplane only (they are present on the PROFIBUS FEX100-DP / MODBUS FEX100-MB backplane but not connected)

Digital communication

The transmitter has the following options for digital communication.

HART protocol

The unit is registered with HART Communication Foundation.



HART protocol	
Configuration	Directly on the Device Software Asset Vision Basic (+ HART -DTM)
Transmission	Install a HART modem (FSK [Frequency Shift Keyed]-Modem) for HART-Communication when connecting to a PC. The HART-Modem converts the analog 4 to 20 mA signal into a digital output signal (Bell Standard 202) and connects to the PC using a USB (or RS232C) connector
Max. signal amplitude	1.2 mA
Current output load	Min. 250 Ω , max. = 560 Ω
Cable	AWG 24 twisted
Max. cable length	1500 m (4921 ft.)
Baud rate	1.200 baud

System integration

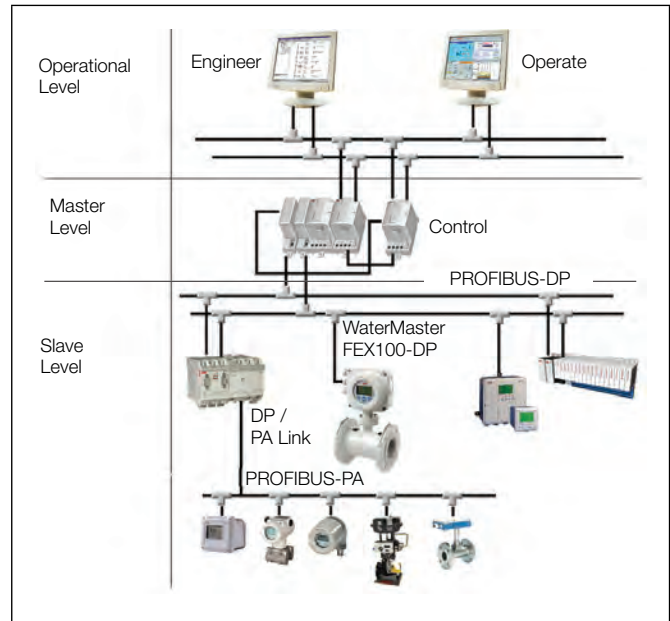
WaterMaster can be integrated into control systems and configuration devices using any Frame application, such as ABB AssetVision or similar third-party applications. ABB Device Type Managers (DTMs) for WaterMaster provide a unified structure for accessing device parameters, configuring and operating the devices and diagnosing problems. FDT (Field Device Tool) technology standardizes the communication and configuration interface between all field devices and host systems.

PROFIBUS DP protocol

PROFIBUS is a manufacturer-independent, open Fieldbus standard for a wide range of applications in manufacturing, process and building automation. Manufacturer independence and openness are ensured by the international standard EN 50170.

PROFIBUS DP ID no.	0x3431
Alternative standard ID no.	0x9701 or 0x9741
Configuration	Directly on the device Software Asset Vision Basic (+PROFIBUS DP-DTM)
Transmission signal	Accuracy to IEC 61158-2
Cable	Shielded, twisted cable (accurate to IEC 61158-2, types A or B)

All devices are connected in a bus structure ('line') as shown in below. Up to 32 stations (master or slaves) can be linked to create one 'segment', although it is recommended not to install more than 16 devices on a single segment. Each end of a segment must be terminated by an active bus terminating resistor. Both bus terminators must always be powered to ensure fault-free operation, therefore it is strongly recommended that they are connected to a back-up power supply. The use of bus amplifiers (repeaters) and segment couplers can be used to extend the network.



System integration

The GSD file for WaterMasters specifies the device-specific Ident No. 3431. It conforms to the PROFIBUS standard, providing a clear and comprehensive description of each instrument in a precisely defined format.

This enables the system configuration tool to use the information automatically when configuring a PROFIBUS bus system.

The ABB GSD file (Ident No. 3431) is divided into 2 sections:

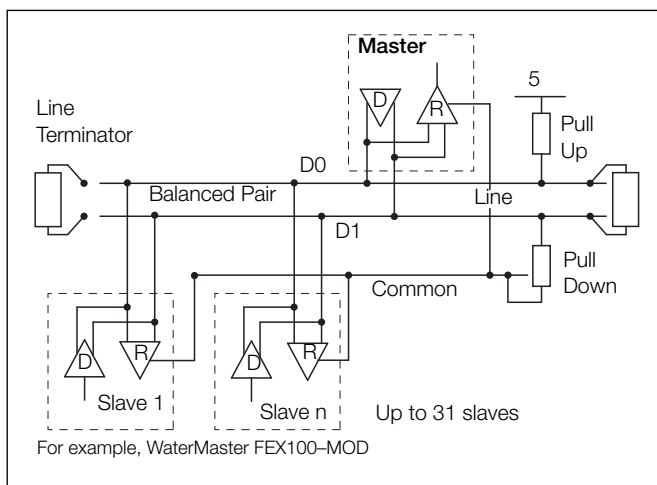
- General specifications
Identification of the device, together with hardware and software versions, baud rates supported and the possible time intervals for monitoring times.
- DP slave-related specifications
Information about the user parameter block for device-specific configuration and modules containing details of the input and output data that can be exchanged cyclically with a PROFIBUS master.

The WaterMaster GSD file (ABB_3431.gsd) is available for download from the ABB website at: www.abb.com/fieldbus (follow the link for PROFIBUS DP field devices).

MODBUS protocol

MODBUS is an open standard that is owned and administered by an independent group of device manufacturers called the Modbus Organization (www.modbus.org).

Using the MODBUS protocol, devices from different manufacturers exchange information on the same communications bus without the need for special interface equipment. WaterMaster FEX100-MB follows the specification for Modbus Over Serial Line V1.02, using 2-wire TIA/EIA-485 (RS485) physical layer.



Cable Properties

The end-to-end length of the trunk cable must be limited. The maximum length depends on the Baud rate, the cable (gauge, capacitance or characteristic impedance), the number of loads on the daisy chain and the network configuration (2-wire or 4-wire).

For 9600 Baud rate and AWG26 (or wider) gauge, the maximum length is 1000 m (3280 ft.). Where 4-wire cabling is used as a 2-wire cabling system the maximum length must be divided by 2. The tap cables must be short, never more than 20 m (65.6 ft.). If a multi-port tap is used with n derivations, each one must have a maximum length of 40 m (131 ft.) divided by n .

The maximum serial data transmission line length for RS485 systems is 1200 m (3937 ft.). The lengths of cable that can be used are determined by the cable type, typically:

- Up to 6 m (19.7 ft.) – standard screened or twisted pair cable.
- Up to 300 m (984 ft.) – twin twisted pair with overall foil screen and an integral drain wire – for example, Belden 9502 or equivalent.
- Up to 1200 m (3937 ft.) – twin twisted pair with separate foil screens and integral drain wires – for example, Belden 9729 or equivalent.

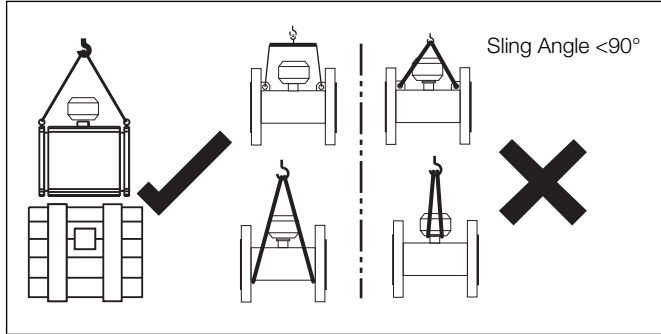
Category 5 cables may be used for RS485-MODBUS to a maximum length of 600 m (1968 ft.). For the balanced pairs used in an RS485-system, a characteristic impedance with value higher than 100Ω is preferred especially for 19200 and higher Baud rates.

Installation requirements

This section is intended to give an overview of installation of a flowmeter. For Installation requirements, technical information and Health and Safety precautions refer to User Guide OI/FEF/FEV/FEW-EN.

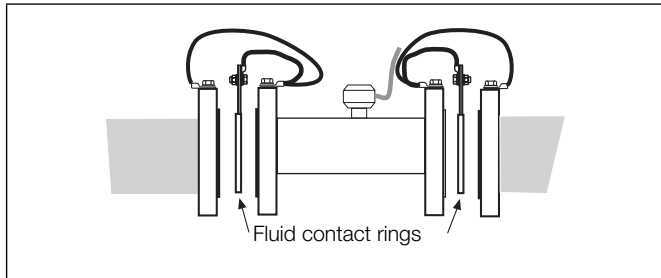
Unpacking the flowmeter

Care must be taken when lifting the flowmeter to use the lifting hooks provided or sling under the body of the meter. Never lift using the terminal connection box of the sensor cable as this will cause damage and invalidate warranty.



Grounding

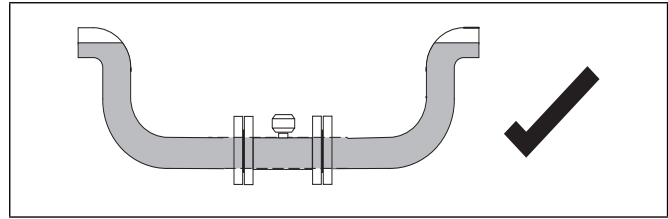
The flowmeter sensor must be cross-bonded to the upstream and downstream pipes and fluid. For technical reasons, this potential should be identical to the potential of the metering fluid. For plastic or insulated lined pipelines, the fluid is grounded by installing a minimum of 1 earthing rings. When there are stray potentials present in the pipeline, an earthing ring is recommended on both ends of the meter sensor.



Mounting

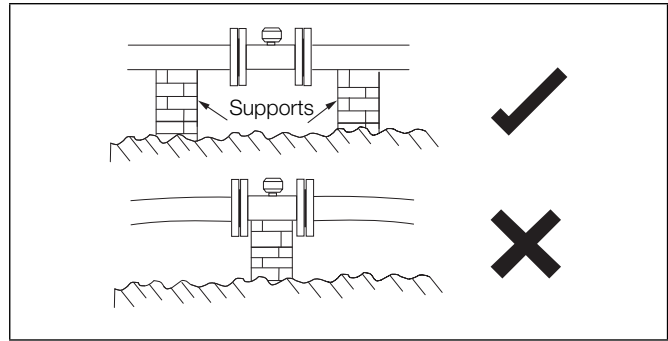
The installation conditions shown below must be observed to achieve the best operational results.

The sensor tube must always be completely full.

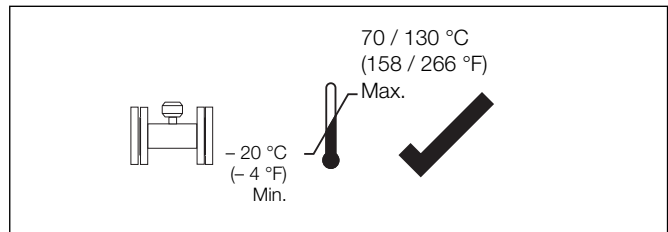


The flow direction must correspond to the identification plate. The device measures the flowrate in both directions. Forward flow is the factory setting.

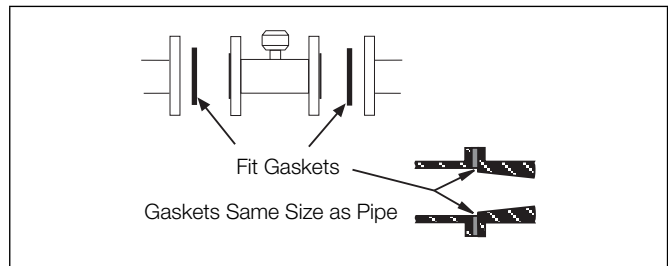
The devices must be installed without mechanical tension (torsion, bending). If required support the pipeline.



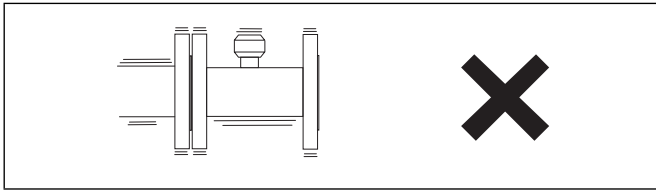
The flange seals must be made from a compatible material for the fluid and fluid temperatures if required.



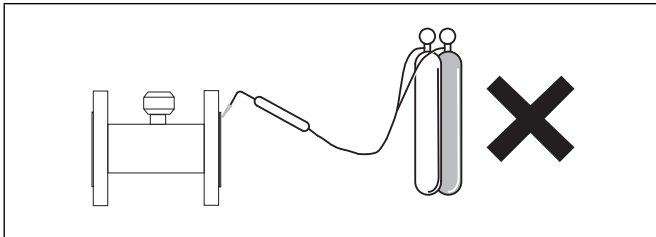
Seals must not extend into the flow area since possible turbulence could influence the device accuracy.



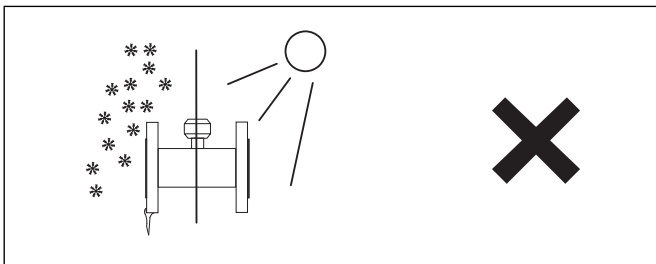
The pipeline may not exert any unallowable forces and torques on the device, such as vibration.



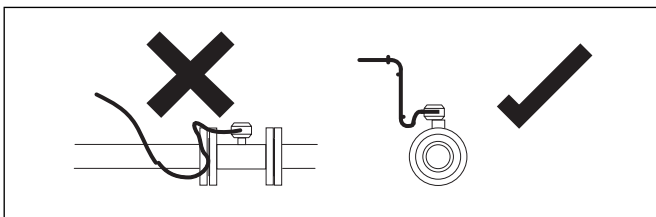
The flowmeter must not be submitted to any localized heat during installation; take care to remember this is a measuring instrument.



The flowmeter must not be exposed to direct sunlight or provide for appropriate sun protection where necessary.

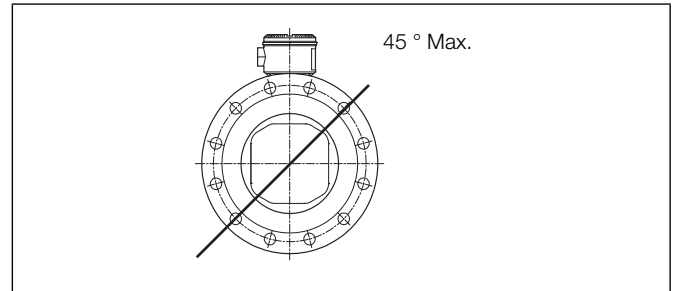


The cable to the flowmeter should be installed neatly or within a conduit, both loose or conduit should have a u shape below the terminal connection box height to allow any water run off to avoid any capillary action into the flowmeter sensor.



Electrode axis

Electrode axis should be horizontal if at all possible or no more than 45° from horizontal.



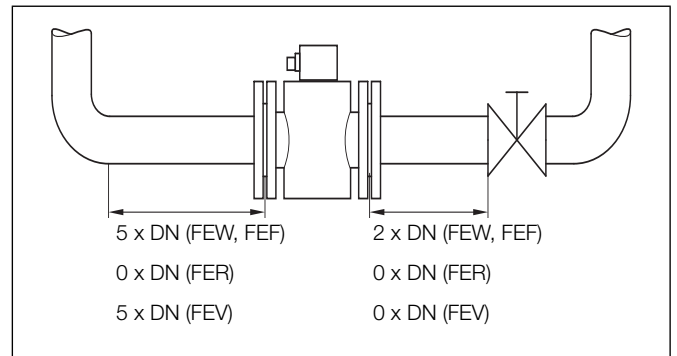
Upstream and Downstream pipe sections

The metering principle is tolerant of the flow profile.

- Wherever possible do not install fittings (for example, manifolds, valves) directly in front of the flowmeter sensor.
- Butterfly valves should be installed so that the valve plate does not extend into the flowmeter sensor.
- Valves or other turn-off components should be installed in the Downstream pipe section.

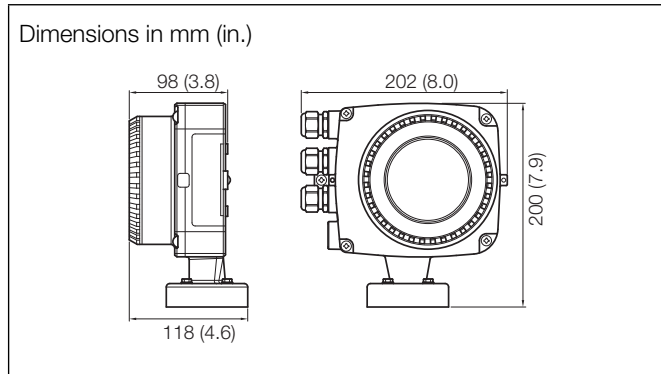
Experience has shown that, in most installations, straight upstream sections 3 x DN long and straight downstream sections 2 x DN long are normally sufficient. We would recommend conditions of 5 x DN straight upstream and 2 x DN straight downstream where possible.

For reduced-bore meters (FER), these straight pipe sections are often not necessary.

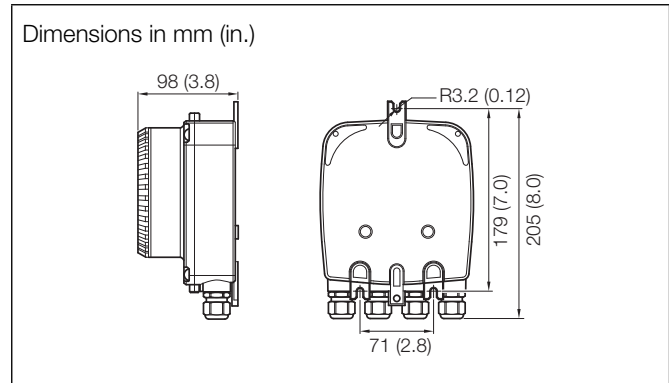


Transmitter dimensions

Integral transmitter

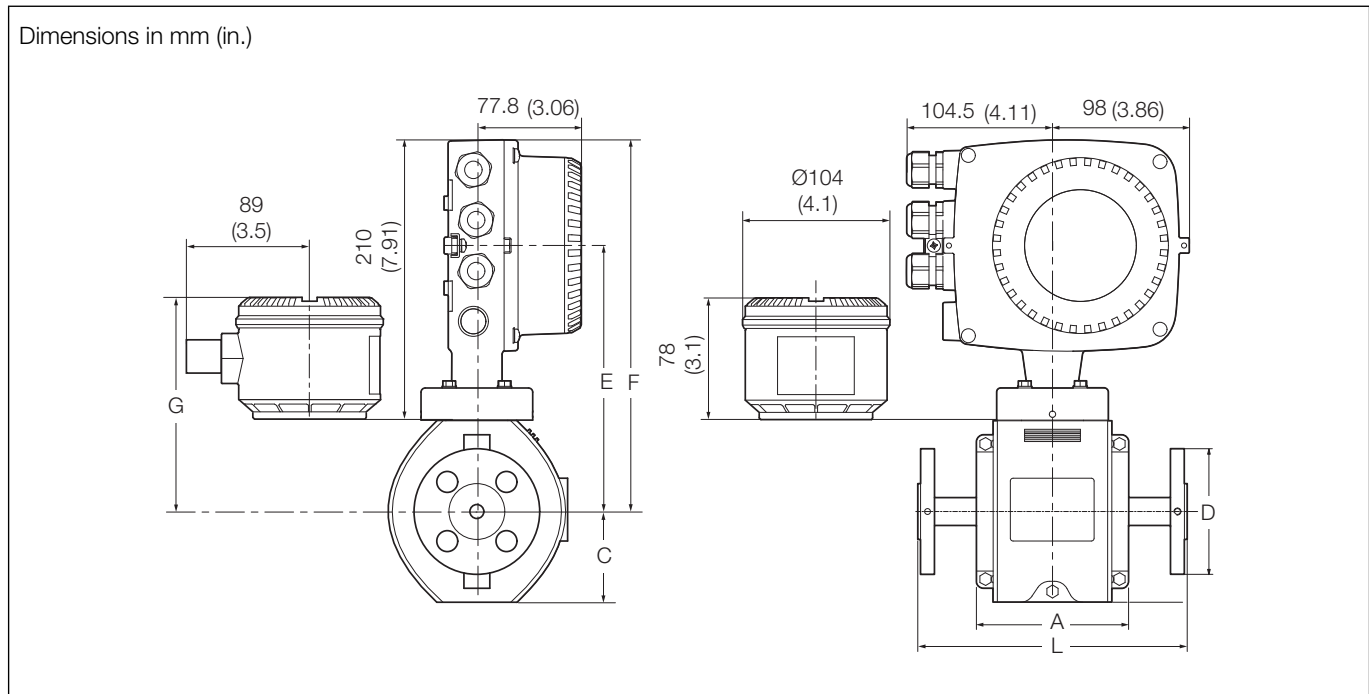


Remote transmitter



Sensor dimensions

FEW – DN10 to 125 (3/8 to 5 in. NB)



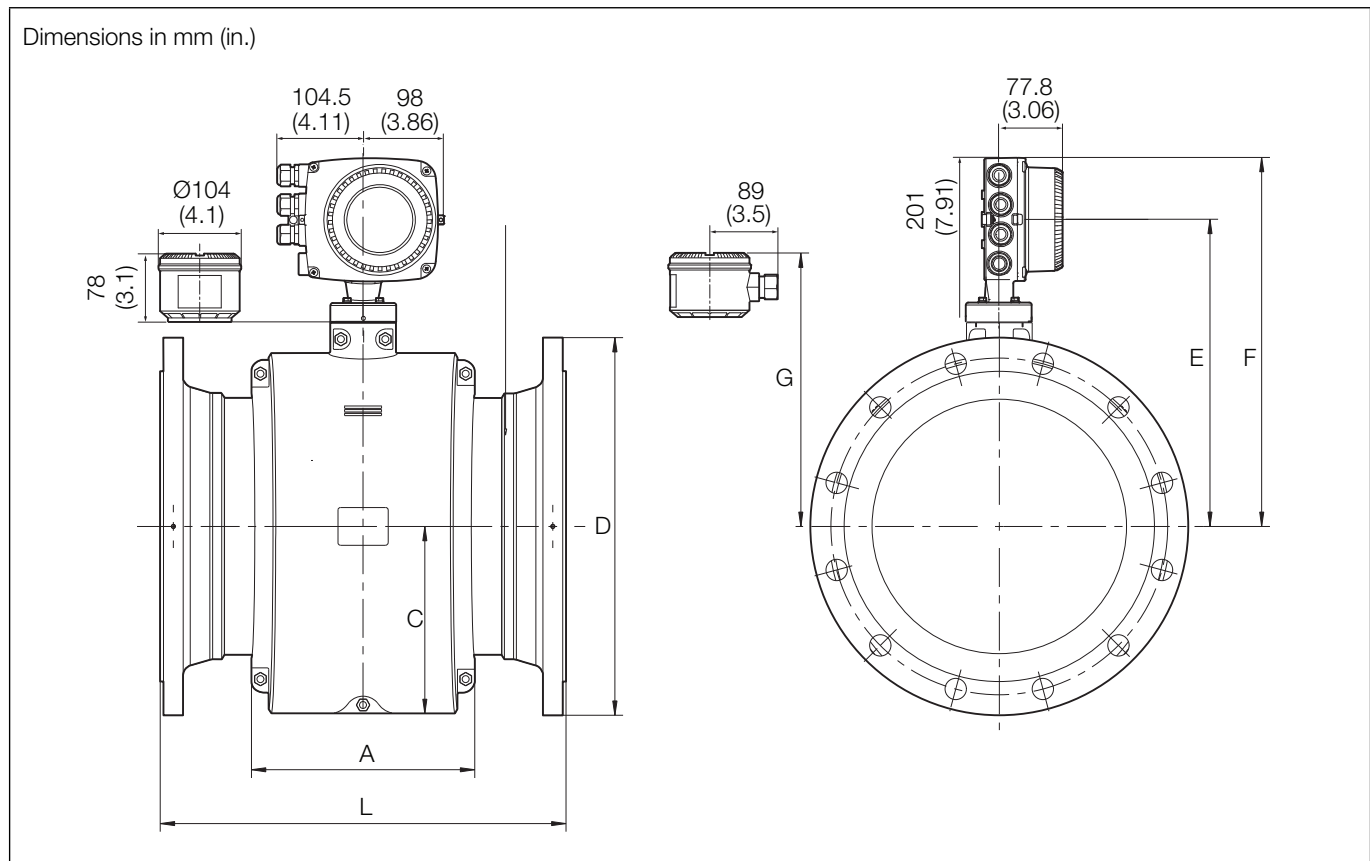
DN10 to 125 (3/8 to 5 in. NB) (FEW)

WaterMaster
Electromagnetic flowmeter

DN	Process connection type	Dimensions in mm (in.)							Approx. weight in kg (lb)	
		D	L	F	C	E	G	A	Integral	Remote
DN10 (³ / ₈ in.)	JIS10K	90 (3.54)	200 (7.87)	268 (10.55)	82 (3.23)	193 (7.6)	148 (5.83)	113 (4.45)	6 (13)	4 (9)
	PN10 to 40	90 (3.54)								
	ASME B16.5 CL150	90 (3.54)								
	ASME B16.5 CL300	96 (3.78)								
DN15 (¹ / ₂ in.)	PN10 to 40	95 (3.74)	200 (7.87)	268 (10.55)	82 (3.23)	193 (7.6)	148 (5.83)	113 (4.45)	6 (13)	4 (9)
	JIS5K	80 (3.15)								
	JIS10K	95 (3.74)								
	ASME B16.5 CL300	95 (3.74)								
	ASME B16.5 CL150	90 (3.54)								
DN20 (³ / ₄ in.)	PN10 to 40	105 (4.13)	200 (7.87)	268 (10.55)	82 (3.23)	193 (7.6)	148 (5.83)	113 (4.45)	8 (18)	6 (13)
	JIS5K	85 (3.35)								
	JIS10K	100 (3.94)								
	ASME B16.5 CL300	115 (4.53)								
	ASME B16.5 CL150	98 (3.86)								
DN25 (1 in.)	PN10 to 40	115 (4.53)	200 (7.87)	268 (10.55)	82 (3.23)	193 (7.6)	148 (5.83)	113 (4.45)	9 (20)	7 (15)
	JIS5K	95 (3.74)								
	JIS10K	125 (4.88)								
	ASME B16.5 CL300	125 (4.88)								
	ASME B16.5 CL150	108 (4.25)								
DN32 (¹ / ₄ in.)	PN10 to 40	140 (5.51)	200 (7.87)	275 (10.83)	92 (3.62)	200 (7.87)	155 (6.10)	113 (4.45)	10 (22)	8 (18)
	JIS5K	115 (4.53)								
	JIS10K	135 (5.31)								
	ASME B16.5 CL300	135 (5.31)								
	ASME B16.5 CL150	117 (4.61)								
DN40 (¹ / ₂ in.)	PN10 to 40	150 (5.91)	200 (7.87)	275 (10.83)	92 (3.62)	200 (7.87)	155 (6.10)	113 (4.45)	11 (24)	9 (20)
	JIS5K	120 (4.72)								
	JIS10K	140 (5.51)								
	ASME B16.5 CL300	155 (6.10)								
	ASME B16.5 CL150	127 (5.00)								
DN50 (2 in.)	PN10 to 40	165 (6.5)	200 (7.87)	281 (11.06)	97 (3.82)	206 (8.11)	161 (6.34)	115 (4.53)	12 (26)	10 (22)
	JIS5K	130 (5.12)								
	JIS10K	155 (6.10)								
	AS4087 PN16	150 (5.91)								
	AS4087 PN35	165 (6.50)								
	ASME B16.5 CL150	152 (5.98)								
	ASME B16.5 CL300	165 (6.50)								
DN65 (² / ₂ in.)	PN10 to 40	185 (7.28)	200 (7.87)	292 (11.50)	108 (4.25)	217 (8.54)	172 (6.77)	104 (4.09)	13 (29)	11 (24)
	JIS5K	155 (6.10)								
	JIS10K	175 (6.89)								
	AS4087 PN16	165 (6.50)								
	AS4087 PN35	185 (7.28)								
	ASME B16.5 CL150	178 (7.01)								
	ASME B16.5 CL300	190 (7.48)								
DN80 (3 in.)	PN10 to 40	200 (7.87)	200 (7.87)	292 (11.5)	108 (4.25)	217 (8.54)	172 (6.77)	104 (4.09)	17 (37)	15 (33)
	JIS5K	180 (7.09)								
	JIS10K	185 (7.28)								
	AS4087 PN16	185 (7.28)								
	AS4087 PN35	205 (8.07)								
	ASME B16.5 CL150	190 (7.48)								
	ASME B16.5 CL300	210 (8.28)								
		19 (42)	17 (37)							
DN100 (4 in.)	PN10 to 16	220 (8.66)	250 (9.84)	314 (12.36)	122 (4.8)	239 (9.41)	194 (7.64)	125 (4.92)	19 (42)	17 (37)
	PN25 to 40	235 (9.25)								
	JIS5K	200 (7.87)								
	JIS10K	210 (8.27)								
	AS4087 PN16	215 (8.46)								
	AS4087 PN35	230 (9.06)								
	ASME B16.5 CL300	255 (1.04)								
	ASME B16.5 CL150	229 (9.00)								
		23 (51)	21 (46)							
		30 (66)	28 (62)							
		21 (51)	19 (42)							
DN125 (5 in.)	PN10 to 16	250 (9.84)	250 (9.84)	324 (12.76)	130 (5.12)	249 (9.8)	204 (8.03)	125 (4.92)	22 (48)	20 (44)
	PN25 to 40	270 (10.63)								
	JIS5K	235 (9.25)								
	JIS10K	250 (9.84)								
	ASME B16.5 CL150	254 (10.00)								
	ASME B16.5 CL300	280 (11.02)								
		22 (48)	20 (44)							
		35 (77)	33 (73)							

DN10 to 125 (³/₈ to 5 in. NB) (FEW) dimensions / weights

FEW – DN150 to 400 (6 to 16 in. NB)

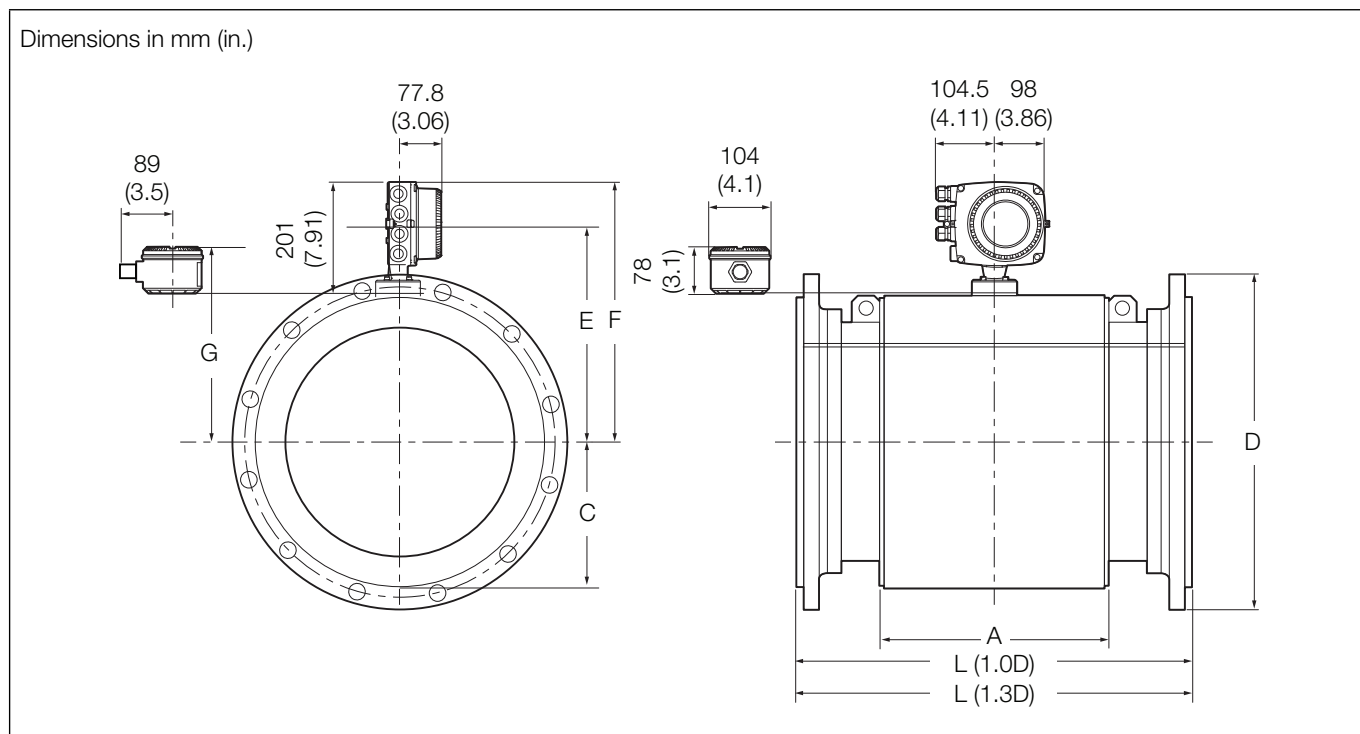


DN150 to 400 (6 to 16 in. NB) (FEW)

DN	Process connection type	Dimensions in mm (in.)							Approx. weight in kg (lb)	
		D	L	F	C	E	G	A	Integral	Remote
DN150 (6 in.)	PN10 to 16	285 (11.22)	300 (11.81)	371 (14.61)	146 (9.88)	296 (11.65)	251 (9.88)	166 (6.54)	33 (73)	31 (68)
	PN25 to 40	300 (11.81)							39 (86)	37 (81)
	JIS5K	265 (10.43)							33 (73)	31 (68)
	JIS10K	280 (11.02)								
	AS4087 PN16	280 (11.02)								
	AS4087 PN35	305 (11.81)							39 (86)	37 (81)
	ASME B16.5 CL300	320 (12.60)							47 (103)	45 (99)
ASME B16.5 CL150	279 (10.98)	33 (73)	31 (68)							
DN200 (8 in.)	PN10	340 (13.39)	350 (13.78)	411 (16.18)	170 (6.69)	336 (13.23)	291 (11.46)	200 (7.87)	41 (90)	39 (86)
	PN16	340 (13.39)								
	PN25	360 (14.17)							55 (121)	53 (117)
	PN40	375 (14.76)							65 (143)	63 (139)
	AS4087 PN16	335 (13.19)							41 (90)	39 (86)
	AS4087 PN35	370 (14.57)							65 (143)	63 (139)
	JIS5K	320 (12.60)							41 (90)	39 (86)
	JIS10K	330 (12.99)								
	ASME B16.5 CL300	380 (14.96)							72 (158)	70 (154)
	ASME B16.5 CL150	345 (13.58)							50 (110)	48 (106)
DN250 (10 in.)	PN10	395 (15.55)	450 (17.72)	426 (16.77)	198 (7.80)	351 (13.82)	306 (12.05)	235 (9.62)	61 (134)	59 (130)
	PN16	405 (15.94)							65 (143)	63 (139)
	PN25	425 (16.73)							84 (185)	82 (180)
	PN40	450 (17.72)							95 (209)	93 (205)
	AS4087 PN16	405 (15.94)							65 (143)	63 (139)
	AS4087 PN35	430 (16.93)							95 (209)	93 (205)
	JIS5K	385 (15.16)							65 (143)	63 (139)
	JIS10K	400 (15.75)								
	ASME B16.5 CL300	445 (17.52)							105 (231)	103 (227)
	ASME B16.5 CL150	405 (15.94)							70 (154)	68 (150)
DN300 (12 in.)	PN10	445 (17.52)	500 (19.69)	449 (17.68)	228 (8.98)	374 (14.72)	329 (12.95)	272 (10.71)	74 (163)	72 (158)
	PN16	460 (18.11)							80 (176)	78 (172)
	PN25	485 (19.09)							100 (220)	98 (216)
	JIS5K	430 (16.93)							80 (176)	78 (172)
	JIS10K	445 (17.52)								
	AS4087 PN16	455 (17.91)								
	AS4087 PN35	490 (19.29)							130 (286)	128 (282)
	ASME B16.5 CL300	520 (20.47)							150 (330)	148 (326)
	ASME B16.5 CL150	485 (19.09)							105 (231)	103 (227)
	PN40	515 (20.28)							600 (23.62)	130 (286)
DN350 (14 in.)	PN10	505 (19.88)	550 (21.65)	464 (18.27)	265 (10.43)	389 (15.31)	344 (13.54)	322 (12.68)	95 (209)	93 (205)
	PN16	520 (20.47)							110 (242)	108 (238)
	PN25	555 (21.85)							145 (319)	143 (315)
	JIS5K	480 (18.90)							95 (209)	93 (205)
	JIS10K	490 (19.29)								
	AS4087 PN16	525 (20.67)							130 (286)	128 (282)
	AS4087 PN35	550 (21.65)							185 (407)	183 (403)
	ASME B16.5 CL300	585 (23.03)							140 (308)	138 (304)
	ASME B16.5 CL150	535 (21.06)							105 (231)	103 (227)
	PN40	580 (22.83)							650 (25.59)	195 (429)
DN400 (16 in.)	PN10	565 (22.24)	600 (23.62)	506 (19.92)	265 (10.43)	431 (16.97)	386 (15.20)	322 (12.68)	103 (227)	101 (222)
	PN16	580 (22.83)							126 (277)	124 (273)
	PN25	620 (24.41)							170 (374)	168 (370)
	JIS5K	540 (21.26)							103 (227)	101 (223)
	JIS10K	560 (22.05)							116 (255)	114 (251)
	AS4087 PN16	580 (22.83)							154 (339)	152 (335)
	AS4087 PN35	610 (24.02)							302 (664)	300 (660)
	ASME B16.5 CL300	650 (25.59)							265 (583)	263 (578)
	ASME B16.5 CL150	600 (23.62)							175 (385)	173 (381)
	PN40	660 (25.98)							650 (25.59)	258 (568)

DN150 to 400 (6 to 5 in. NB) (FEW) dimensions / weights

FEW – DN450 to 2400 (18 to 96 in. NB)



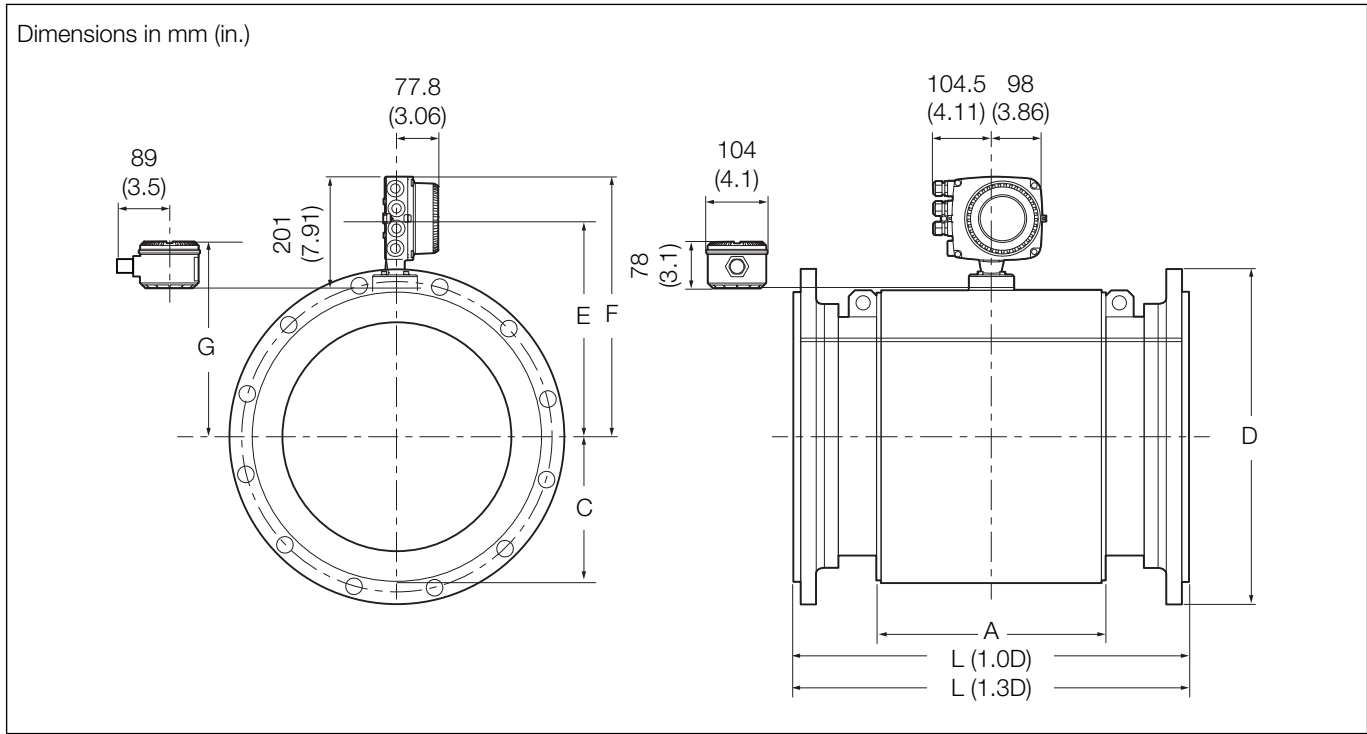
DN450 to 2400 (18 to 96 in. NB) (FEW)

DN	Process connection type	Dimensions in mm (in.)								Approx. weight in kg (lb)	
		D	L (1.0D)	L (1.3D)	F	C	E	G	A	Integral	Remote
DN450 (18 in.)	PN10	615 (24.21)	N/A	600 (23.62)	514 (20.24)	310 (12.20)	439 (17.28)	394 (15.51)	328 (12.91)	173 (381)	171 (377)
	PN16	640 (25.20)								188 (414)	186 (410)
	JIS5K	605 (23.82)								165 (364)	163 (359)
	JIS10K	620 (24.41)								177 (390)	175 (386)
	AS4087 PN16	640 (25.20)								232 (511)	230 (507)
	AS4087 PN35	675 (26.57)								328 (723)	326 (718)
	ASME B16.5 CL300	710 (27.95)								368 (811)	366 (807)
	ASME B16.5 CL150	635 (25.00)								250 (551)	248 (547)
	PN25	670 (26.38)	N/A	686 (27.01)						245 (540)	243 (536)
DN500 (20 in.)	PN40	685 (26.97)			514 (20.24)	310 (12.20)	439 (17.28)	394 (15.51)	367 (14.45)	315 (694)	313 (690)
	PN10	670 (26.38)	N/A	600 (23.62)						190 (418)	188 (413)
	PN16	715 (28.15)								240 (528)	238 (524)
	JIS5K	655 (25.79)								190 (418)	188 (413)
	JIS10K	675 (26.57)								290 (638)	288 (634)
	AS4087 PN16	705 (27.76)								435 (957)	433 (953)
	AS4087 PN35	735 (28.94)								300 (660)	298 (656)
	ASME B16.5 CL150	700 (27.56)								490 (1080)	488 (1076)
	ASME B16.5 CL300	775 (30.51)	N/A	762						300 (661)	298 (657)
DN600 (24 in.)	PN25	730 (28.74)	N/A	700	565 (22.24)	361 (14.21)	490 (19.29)	445 (17.52)	469 (18.46)	392 (864)	390 (860)
	PN40	755 (29.72)	N/A	762						284 (626)	282 (622)
	PN10	780 (30.71)	N/A	800 (31.50)						318 (700)	316 (695)
	PN16	840 (33.07)								460 (1012)	458 (1008)
	PN25	845 (33.27)								275 (605)	273 (600)
	JIS5K	770 (30.31)								306 (673)	304 (668)
	JIS10K	795 (31.30)								382 (840)	380 (835)
	AS4087 PN16	825 (32.48)								452 (994)	450 (990)
	AS4087 PN35	850 (33.46)								550 (1210)	548 (1205)
	ASME B16.5 CL300	915 (36.02)								425 (935)	423 (930)
	ASME B16.5 CL150	815 (32.09)								600 (1320)	598 (1316)
	PN40	890 (35.04)	N/A	890							

DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights

DN	Process connection type	Dimensions in mm (in.)								Approx. weight in kg (lb)									
		D	L (1.0D)	L (1.3D)	F	C	E	G	A	Integral	Remote								
DN700 (28 in.)	JIS 5K	875 (34.45)	700 (27.56)	910 (35.83)	604 (23.77)	403 (15.87)	528 (20.79)	488 (19.21)	444 (17.48)	216 (475)	214 (471)								
	JIS 10K	905 (35.63)								282 (620)	280 (616)								
	PN6	860 (33.86)								225 (495)	223 (491)								
	PN10	895 (35.24)								303 (667)	301 (662)								
	PN16	910 (35.83)								337 (741)	335 (737)								
	AWWA C207 CLASS B	927 (36.50)								249 (548)	247 (543)								
	AWWA C207 CLASS D	927 (36.50)								280 (616)	278 (612)								
	AS4087 PN16	910 (35.83)								359 (790)	357 (785)								
	AS2129 TABLE-D	910 (35.83)								263 (579)	261 (574)								
	AS2129 TABLE-E	910 (35.83)								337 (741)	335 (737)								
	PN25	960 (37.80)								471 (1036)	469 (1032)								
	PN40	995 (39.17)								586 (1289)	584 (1285)								
	AWWA C207 CLASS E	927 (36.50)								472 (1038)	470 (1034)								
	AWWA C207 CLASS F	1035 (40.75)								715 (1573)	713 (1569)								
	AS4087 PN35	935 (36.80)								539 (1186)	537 (1181)								
	ASME CL150 SERIES A	925 (36.42)								503 (1107)	501 (1102)								
ASME CL150 SERIES B	835 (32.87)	323 (711)	321 (706)																
ASME CL300 SERIES B	920 (36.22)	631 (1388)	629 (1384)																
DN750 (30 in.)	JIS 5K	945 (37.20)	750 (29.52)	990 (38.98)	630 (24.79)	429 (16.89)	554 (21.81)	514 (20.23)	444 (17.48)	251 (552)	249 (548)								
	JIS 10K	970 (38.19)								327 (719)	325 (715)								
	AWWA C207 CLASS B	984 (38.74)								273 (601)	271 (596)								
	AWWA C207 CLASS D	984 (38.74)								344 (757)	342 (752)								
	AS4087 PN16	995 (39.17)								467 (1027)	465 (1023)								
	AS2129 TABLE-D	995 (39.17)								340 (748)	338 (744)								
	AS2129 TABLE-E	995 (39.17)								454 (999)	452 (994)								
	AWWA C207 CLASS E	984 (38.74)								496 (1091)	494 (1087)								
	AWWA C207 CLASS F	1092 (43.99)								790 (1738)	788 (1734)								
	AS4087 PN35	1015 (39.96)								663 (1459)	661 (1454)								
	ASME CL150 SERIES A	985 (38.78)								544 (1197)	542 (1192)								
	ASME CL150 SERIES B	885 (34.84)								320 (704)	318 (700)								
	ASME CL300 SERIES B	990 (38.98)								748 (1646)	746 (1641)								
	DN800 (32 in.)	JIS 5K								995 (39.17)	800 (31.49)	1040 (40.04)	654 (25.74)	453 (17.83)	578 (22.76)	538 (21.18)	542 (21.34)	280 (616)	278 (612)
		JIS 10K								1020 (40.16)								364 (801)	362 (796)
		PN6								975 (38.39)								294 (647)	292 (642)
PN10		1015 (39.96)	406 (893)	404 (889)															
PN16		1025 (40.35)	469 (1032)	467 (1027)															
AWWA C207 CLASS B		1060 (41.73)	328 (722)	326 (717)															
AWWA C207 CLASS D		1060 (41.73)	408 (898)	406 (893)															
AS4087 PN16		1060 (41.73)	530 (1166)	528 (1162)															
AS2129 TABLE-D		1060 (41.73)	386 (849)	384 (845)															
AS2129 TABLE-E		1060 (41.73)	519 (1142)	517 (1137)															
PN25		1085 (42.72)	615 (1353)	613 (1349)															
PN40		1140 (44.88)	866 (1905)	864 (1901)															
AWWA C207 CLASS E		1060 (41.73)	634 (1395)	632 (1390)															
AWWA C207 CLASS F		1150 (45.28)	897 (1973)	895 (1969)															
AS4087 PN35		1060 (41.73)	751 (1652)	749 (1648)															
ASME CL150 SERIES A		1060 (41.73)	700 (1540)	698 (1536)															
ASME CL150 SERIES B	940 (37.01)	406 (893)	404 (889)																
ASME CL300 SERIES B	1055 (41.54)	933 (2053)	931 (2048)																
DN900 (36 in.)	JIS 5K	1095 (43.11)	900 (35.43)	1170 (46.06)	705 (27.7)	504 (19.84)	629 (24.76)	589 (23.19)	570 (22.44)	369 (812)	367 (807)								
	JIS 10K	1120 (44.09)								445 (979)	443 (975)								
	PN6	1075 (42.32)								390 (858)	388 (854)								
	PN10	1115 (43.90)								502 (1104)	500 (1100)								
	PN16	1125 (44.29)								589 (1296)	587 (1291)								
	AWWA C207 CLASS B	1168 (45.98)								417 (917)	415 (913)								
	AWWA C207 CLASS D	1168 (45.98)								493 (1085)	491 (1080)								
	AWWA C207 CLASS E	1168 (45.98)								827 (1819)	825 (1815)								
	AWWA C207 CLASS F	1270 (50.00)								1150 (2530)	1148 (2526)								
	AS4087 PN16	1175 (46.26)								706 (1553)	704 (1549)								
	AS2129 TABLE-D	1175 (46.26)								514 (1131)	512 (1126)								
	AS2129 TABLE-E	1175 (46.26)								694 (1527)	692 (1522)								
	PN25	1185 (46.65)								819 (1802)	817 (1797)								
	PN40	1250 (49.21)								1158 (2548)	1156 (2543)								
	AS4087 PN35	1185 (46.65)								1044 (2297)	1042 (2292)								
	ASME CL150 SERIES A	1170 (46.06)								961 (2114)	959 (2110)								
ASME CL150 SERIES B	1055 (41.54)	595 (1309)	593 (1305)																
ASME CL300 SERIES B	1170 (46.06)	1147 (2523)	1145 (2519)																

DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights (Continued)



...DN450 to 2400 (18 to 96 in. NB) (FEW)

DN	Process connection type	Dimensions in mm (in.)								Approx. weight in kg (lb)	
		D	L (1.0D)	L (1.3D)	F	C	E	G	A	Integral	Remote
DN1000 (40 in.)	JIS 5K	1195 (47.05)	1000 (39.37)	1300 (51.18)	755 (29.71)	554 (21.81)	679 (26.73)	639 (25.16)	624 (24.57)	441 (970)	439 (966)
	JIS 10K	1235 (48.62)								572 (1258)	570 (1254)
	PN6	1175 (46.26)								466 (1025)	464 (1021)
	PN10	1230 (48.43)								674 (1483)	672 (1478)
	PN16	1255 (49.41)								879 (1934)	877 (1929)
	AWWA C207 CLASS B	1289 (50.75)								503 (1107)	501 (1102)
	AWWA C207 CLASS D	1289 (50.75)								659 (1450)	657 (1445)
	AWWA C207 CLASS E	1289 (50.75)								1028 (2262)	1026 (2257)
	AWWA C207 CLASS F	1378 (54.25)								1367 (3007)	1365 (3003)
	AS4087 PN16	1255 (49.41)								831 (1828)	829 (1824)
	AS2129 TABLE-D	1255 (49.41)								610 (1342)	608 (1338)
	AS2129 TABLE-E	1255 (49.41)								833 (1833)	831 (1028)
	PN25	1320 (51.97)								1207 (2655)	1205 (2651)
	PN40	1360 (53.54)								1413 (3109)	1411 (3104)
	AS4087 PN35	1275 (50.20)								1244 (2737)	1242 (2732)
	ASME CL150 SERIES A	1290 (50.79)								1149 (2528)	1147 (2523)
ASME CL300 SERIES A	1240 (48.82)								1349 (2968)	1347 (2963)	
ASME CL150 SERIES B	1175 (46.26)								738 (1624)	736 (1619)	
ASME CL300 SERIES B	1275 (50.20)								1487 (3271)	1485 (3267)	
DN1050 (42 in.)	AWWA C207 CLASS B	1346 (52.99)	1050 (41.33)	1365 (53.74)	808 (31.82)	608 (23.92)	733 (28.84)	693 (27.28)	624 (24.57)	564 (1241)	562 (1236)
	AWWA C207 CLASS D	1346 (52.99)								669 (1472)	667 (1467)
	AWWA C207 CLASS E	1346 (52.99)								1143 (2515)	1141 (2510)
	AWWA C207 CLASS F	1448 (57.01)								1568 (3450)	1566 (3445)
	ASME CL150 SERIES B	1225 (48.23)								809 (1780)	807 (1775)
	ASME CL150 SERIES A	1345 (52.95)								1289 (2836)	1287 (2831)
	ASME CL300 SERIES A	1290 (50.79)								1527 (3359)	1525 (3355)
ASME CL300 SERIES B	1335 (52.56)								1704 (3749)	1702 (3744)	
DN1100 (44 in.)	JIS 5K	1305 (51.38)	1100 (43.30)	1430 (56.30)						510 (1122)	508 (1118)
	JIS 10K	1345 (52.95)								689 (1516)	687 (1511)
	AWWA C207 CLASS B	1403 (55.24)								615 (1353)	613 (1349)
	AWWA C207 CLASS D	1403 (55.24)								807 (1775)	805 (1771)
	AWWA C207 CLASS E	1404 (55.26)								1205 (2651)	1203 (2647)
AWWA C207 CLASS F	1505 (59.25)								1719 (3782)	1717 (3777)	

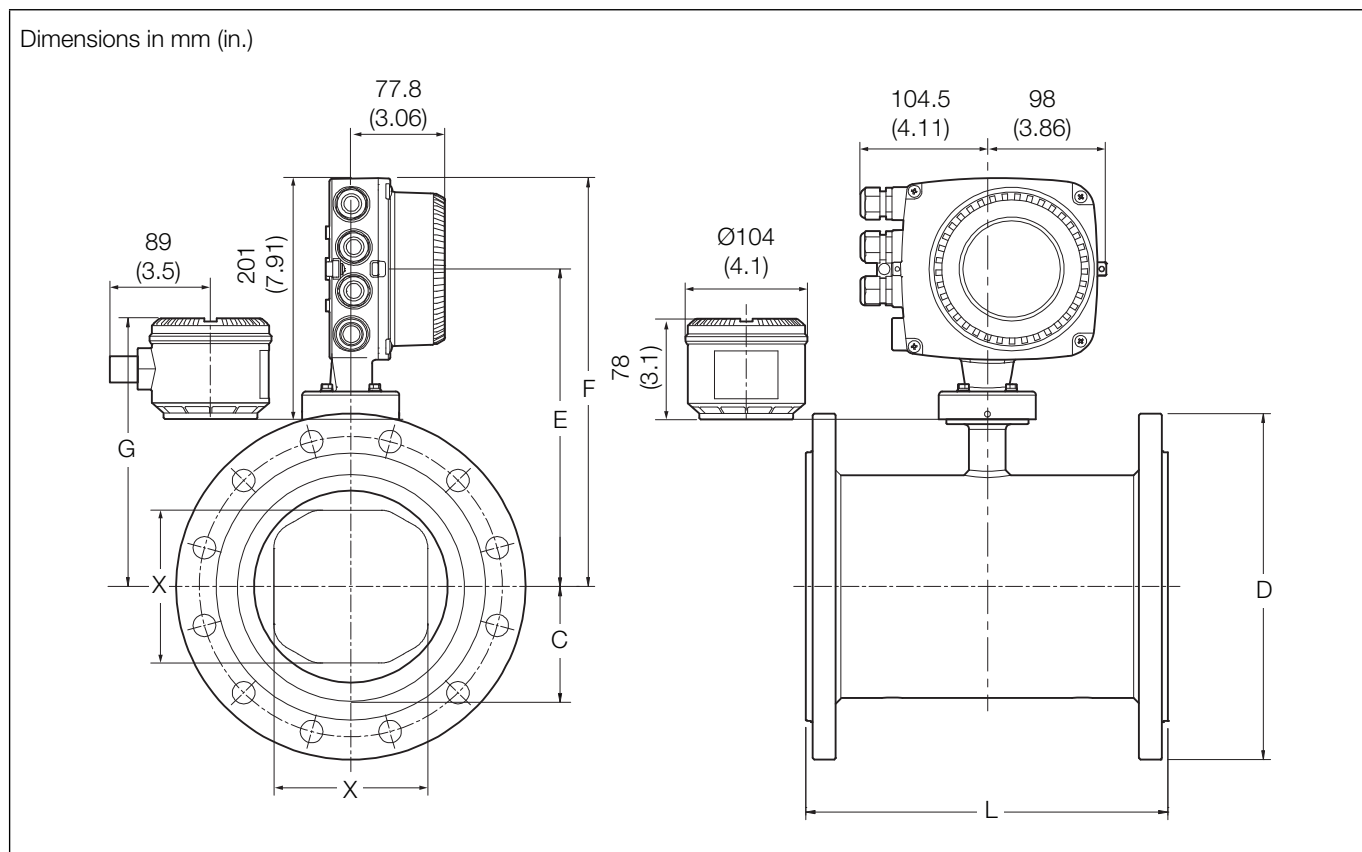
...DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights

WaterMaster
Electromagnetic flowmeter

DN	Process connection type	Dimensions in mm (in.)								Approx. weight in kg (lb)	
		D	L (1.0D)	L (1.3D)	F	C	E	G	A	Integral	Remote
DN1200 (48 in.)	JIS 5K	1420 (55.91)	1200 (47.24)	1560 (61.42)	860 (33.85)	659 (25.94)	784 (30.87)	744 (29.29)	802 (31.57)	651 (1432)	649 (1428)
	JIS 10K	1465 (57.68)								967 (2127)	965 (2123)
	PN6	1405 (55.31)								710 (1562)	708 (1558)
	PN10	1455 (57.28)								1107 (2435)	1105 (2431)
	PN16	1485 (58.46)								1363 (2999)	1361 (2994)
	AWWA C207 CLASS B	1511 (59.49)								772 (1698)	770 (1694)
	AWWA C207 CLASS D	1511 (59.49)								999 (2198)	997 (2193)
	AWWA C207 CLASS E	1511 (59.49)								1458 (3208)	1456 (3203)
	AWWA C207 CLASS F	1651 (65.00)								2400 (5280)	2398 (5276)
	AS4087 PN16	1490 (58.66)								1253 (2757)	1251 (2752)
	AS2129 TABLE-D	1490 (58.66)								1023 (2251)	1021 (2246)
	AS2129 TABLE-E	1490 (58.66)								1272 (2798)	1270 (2794)
	PN25	1530 (60.24)								1559 (3430)	1557 (3425)
	PN40	1575 (62.01)								2133 (4693)	2131 (4688)
	AS4087 PN35	1530 (60.24)								2115 (4653)	2113 (4649)
	ASME CL150 SERIES A	1510 (59.45)								1707 (3755)	1705 (3751)
ASME CL300 SERIES A	1465 (57.68)	2163 (4759)	2161 (4754)								
ASME CL150 SERIES B	1390 (54.72)	1085 (2387)	1083 (2383)								
ASME CL300 SERIES B	1510 (59.45)	2352 (5174)	2350 (5170)								
DN1350 (54 in.)	AWWA C207 CLASS B	1683 (66.26)	1350 (53.15)	1755 (69.09)	955 (37.59)	754 (29.69)	879 (34.61)	839 (33.03)	902 (35.51)	981 (2158)	979 (2154)
	AWWA C207 CLASS D	1683 (66.26)								1213 (2669)	1211 (2664)
	AWWA C207 CLASS E	1683 (66.26)								1942 (4272)	1940 (4268)
DN1400 (56 in.)	PN6	1630 (64.17)	1400 (55.11)	1820 (71.65)						1085 (2387)	1083 (2383)
	PN10	1675 (65.94)								1731 (3808)	1729 (3804)
	PN16	1685 (66.34)								1770 (3894)	1768 (3890)
	ASME CL150 SERIES B	1600 (62.99)								1593 (3505)	1591 (3500)
	PN25	1755 (69.09)								2368 (5210)	2366 (5205)
	PN40	1795 (70.67)								3086 (6789)	3084 (6785)
	ASME CL150 SERIES A	1745 (68.70)								2556 (5623)	2554 (5619)
	ASME CL300 SERIES A	1710 (67.32)								3376 (7427)	3374 (7423)
ASME CL300 SERIES B	1765 (69.49)	3758 (8268)	3756 (8263)								
DN1500 (60 in.)	JIS 5K	1730 (68.11)	1500 (59.05)	1950 (76.77)	1065 (41.92)	864 (34.02)	989 (38.94)	949 (37.36)	910 (35.83)	1029 (2264)	1027 (2259)
	JIS 10K	1795 (70.67)								1504 (3309)	1502 (3304)
	ASME CL150 SERIES B	1725 (67.91)								2031 (4468)	2029 (4464)
	AWWA C207 CLASS B	1854 (72.99)								1229 (2704)	1227 (2699)
	AWWA C207 CLASS D	1854 (72.99)								1514 (3331)	1512 (3326)
	AWWA C207 CLASS E	1854 (72.99)								2544 (5597)	2542 (5592)
	ASME CL150 SERIES A	1855 (73.03)								3084 (6785)	3082 (6780)
	ASME CL300 SERIES A	1810 (71.26)								3875 (8525)	3873 (8521)
ASME CL300 SERIES B	1880 (74.02)	4181 (9198)	4179 (9194)								
DN1600 (64 in.)	PN6	1830 (72.05)	1600 (62.99)	2080 (81.89)	1066 (41.96)	865 (34.06)	990 (38.98)	950 (37.4)	1000 (39.37)	1434 (3155)	1432 (3150)
	PN10	1915 (75.39)								2525 (5555)	2523 (5551)
	PN25	1975 (77.76)								3201 (7042)	3199 (7038)
	PN16	1930 (75.98)								2768 (6090)	2766 (6085)
	PN40	2025 (79.72)								4375 (9625)	4373 (9621)
DN1650 (66 in.)	AWWA C207 CLASS B	2032 (80.00)	N/A	2145 (84.45)	1116 (43.94)	915 (36.02)	1040 (40.94)	1000 (39.37)	1000 (39.37)	1504 (3309)	1502 (3304)
	AWWA C207 CLASS D	2032 (80.00)								2025 (4455)	2023 (4451)
DN1800 (72 in.)	PN6	2045 (80.51)	N/A	2340 (92.13)	1181 (46.50)	980 (38.58)	1105 (43.50)	1065 (41.93)	1100 (43.31)	1853 (4077)	1851 (4072)
	PN10	2115 (83.27)								3180 (6996)	3178 (6992)
	PN16	2130 (83.86)								3657 (8045)	3655 (8041)
	PN25	2195 (86.42)								4422 (9728)	4420 (9724)
	AWWA C207 CLASS B	2197 (86.50)								1773 (3901)	1771 (3896)
	AWWA C207 CLASS D	2197 (86.50)								2387 (5251)	2385 (5247)
DN1950 (78 in.)	AWWA C207 CLASS B	2362 (92.99)	N/A	2535 (99.80)	1291 (50.81)	1090 (42.91)	1215 (47.83)	1175 (46.26)	1180 (46.46)	2309 (5080)	2307 (5075)
	AWWA C207 CLASS D	2362 (92.99)								3037 (6681)	3035 (6677)
DN2000 (80 in.)	PN6	2265 (89.17)	N/A	2600 (102.36)						2581 (5678)	2579 (5674)
	PN10	2325 (91.54)								4254 (9359)	4252 (9354)
	PN16	2345 (92.32)								4556	4554
	PN25	2425 (95.47)								5896	5894
DN2100 (84 in.)	AWWA C207 CLASS B	2534 (99.76)	N/A	2730 (107.48)	1395 (54.91)	1194 (47.01)	1319 (51.93)	1279 (50.35)	1180 (46.46)	2641 (5810)	2639 (5806)
	AWWA C207 CLASS D	2534 (99.76)								3487 (7671)	3485 (7667)
DN2200 (88 in.)	PN6	2475 (97.44)	N/A	2860 (112.60)					1330 (52.36)	3363 (7399)	3361 (7394)
	PN10	2550 (100.39)								5795	5793
DN2400 (96 in.)	PN6	2685 (105.71)	N/A	3120 (122.83)	1495 (58.85)	1294 (50.94)	1419 (55.87)	1379 (54.29)	1450 (57.09)	4100 (9020)	4098 (9016)
	PN10	2760 (108.66)								6968	6966

...DN450 to 2400 (18 to 96 in. NB) (FEW) dimensions / weights (Continued)

FEV – DN40 to 200 (1½ to 8 in. NB)



DN40 to 200 (1½ to 8 in. NB) (FEV)

DN	Process connection type	Dimensions in mm (in.)						Approx. weight in kg (lb)	
		D	L	F	E	G	X	Integral	Remote
DN40 (1½ in.)	EN1092-1 PN10, 16, 25, 40	150 (5.91)	200 (7.87)	260 (10.24)	185 (7.28)	137 (5.39)	30 (1.18)	12.8 (28.16)	11.8 (25.96)
	ASME B16.5 CLASS 150								
DN50 (2 in.)	EN1092-1 PN10, 16, 25, 40	165 (6.50)	200 (7.87)	261 (10.28)	186 (7.32)	138 (5.43)	38 (1.5)	13.75 (30.25)	12.75 (28.05)
	ASME B16.5 CLASS 150								
DN80 (3 in.)	EN1092-1 PN10, 16, 25, 40	200 (7.87)	200 (7.87)	280 (11.04)	205.5 (8.09)	157.5 (6.2)	61 (2.4)	17.2 (37.84)	16.2 (35.64)
	ASME B16.5 CLASS 150								
	AS4087 PN16, 21								
DN100 (4 in.)	EN1092-1 PN10, 16, 25, 40	225 (8.86)	250 (9.84)	300.5 (11.83)	225.5 (8.88)	177.5 (6.98)	70 (2.76)	19.3 (42.5)	18.3 (40.3)
	ASME B16.5 CLASS 150								
	AS4087 PN16								
DN150 (6 in.)	EN1092-1 PN10, 16, 25, 40	300 (11.81)	300 (11.81)	333.5 (13.13)	258.5 (10.18)	210.5 (8.29)	103 (4.06)	35.1 (77.2)	34.1 (75)
	ASME B16.5 CLASS 150								
	AS4087 PN16								
DN200 (8 in.)	EN1092-1 PN10, 16	375 (11.76)	350 (13.78)	358.7 (14.12)	283.7 (11.17)	235.7 (9.28)	150 (5.91)	67 (147.4)	66 (145.2)
	ASME B16.5 CLASS 150								
	AS2129 TABLE C, D, E, F								
	AS4087 PN14, 16, 21								

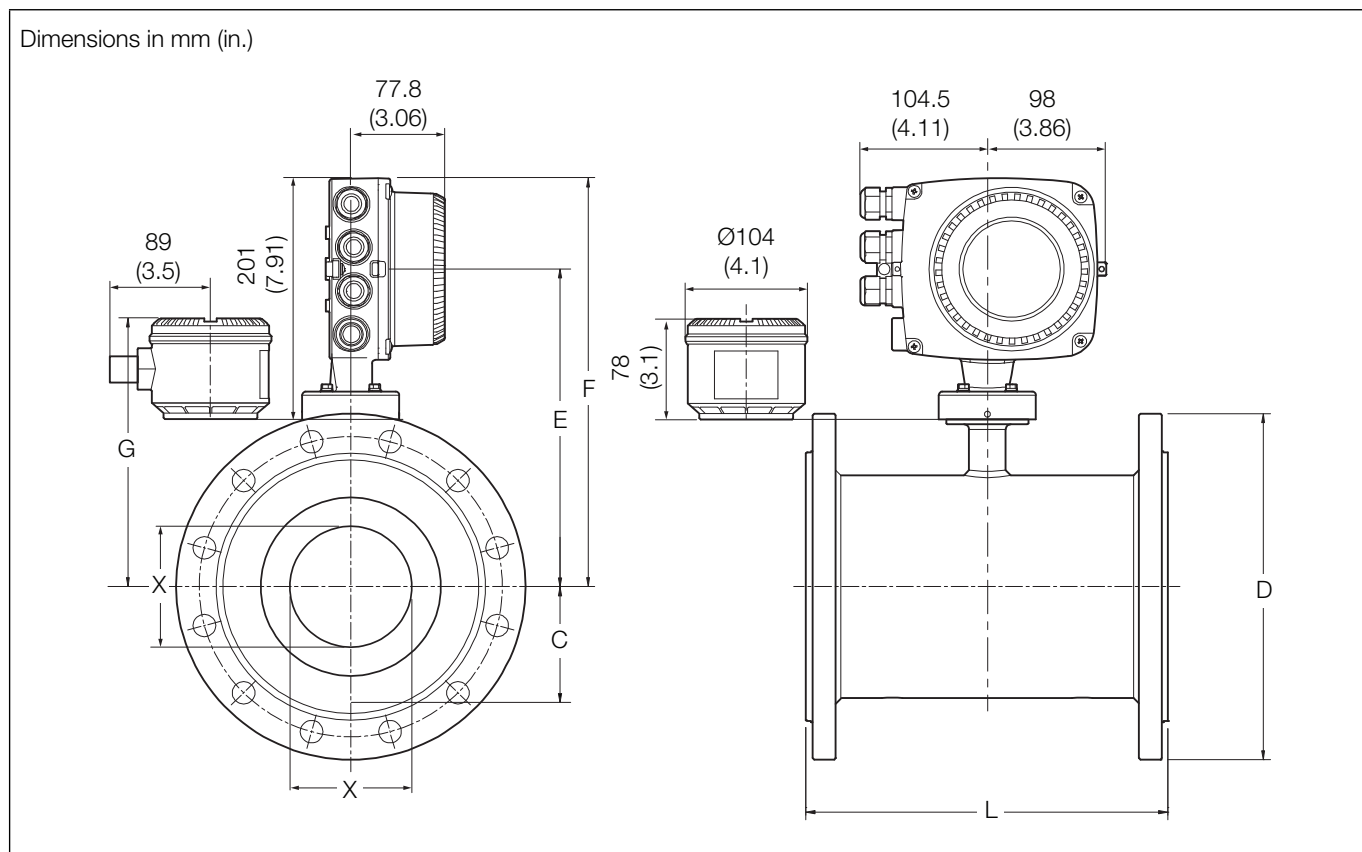
WaterMaster integral / remote FEV – DN40 to 200 (1½ to 8 in.) cast iron sensor dimensions / weights

WaterMaster
Electromagnetic flowmeter

DN	Process connection type	Dimensions in mm (in.)							Approx. weight in kg (lb)	
		D	L	F	C	E	G	X	Integral	Remote
DN40 (1½ in.)	EN1092-1 PN10, PN40	150 (5.91)	200 (7.87)	260 (10.24)	30.4 (1.20)	185 (7.28)	138 (5.43)	30 (1.18)	12 (27)	11 (24)
	ASME B16.5 CLASS 150	127 (5.00)								
	JIS 10K	140 (5.51)								
	AS2129 TABLE F	140 (5.51)								
	AS2129 TABLE C D E	135 (5.31)								
	AS4087 PN14	135 (5.31)								
DN50 (2 in.)	EN1092-1 PN10, PN16	165 (6.50)	200 (7.87)	270 (10.63)	38.3 (1.51)	195 (7.68)	146 (5.75)	38 (1.50)	13 (29)	12 (27)
	ASME B16.5 CLASS 150	152.4 (6.00)								
	JIS 10K	155 (6.10)								
	AS4087 PN21	165 (6.50)								
	AS2129 TABLE F	165 (6.50)								
	AS2129 TABLE C D E	150 (5.91)								
	AS4087 PN14, PN16	150 (5.91)								
DN65 (2½ in.)	AS4087 PN14, PN16	165 (6.50)	200 (7.87)	275 (10.83)	45.2 (1.78)	200 (7.87)	152 (5.98)	48 (1.89)	15 (33)	14 (31)
	AS2129 TABLE C D E	165 (6.50)								
	EN1092-1 PN10	185 (7.28)								
	EN1092-1 PN16	185 (7.28)								
DN80 (3 in.)	EN1092-1 PN10, PN16	200 (7.87)	200 (7.87)	280 (11.02)	51.5 (2.03)	205 (8.07)	156 (6.14)	61 (2.40)	16 (36)	15 (33)
	ASME B16.5 CLASS 150	190 (7.48)								
	JIS 7.5K	211 (8.31)								
	JIS 10K	185 (7.28)								
	AS2129 TABLE C D E	185 (7.28)								
	AS4087 PN14, PN16	185 (7.28)								
	AS2129 TABLE F	205 (8.07)								
	AS4087 PN21	205 (8.07)								
DN100 (4 in.)	EN1092-1 PN10, PN16	220 (8.66)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	196.8 (7.75)	70 (2.76)	19 (42)	18 (40)
	ASME B16.5 CLASS 150	228.6 (9.00)								
	JIS 7.5K	238 (9.37)								
	JIS 10K	210 (8.27)								
	AS2129 TABLE C D	215 (8.46)								
	AS4087 PN14, PN16	215 (8.46)								
	AS2129 TABLE E	215 (8.46)								
	AS4087 PN21	230 (9.06)								
	AS2129 TABLE F	230 (9.06)								
DN125 (5 in.)	EN1092-1 PN10, PN16	250 (9.84)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	197 (7.76)	70 (2.76)	20 (44)	19 (42)
	ASME B16.5 CLASS 150	254 (10.00)								
	JIS 10K	250 (9.84)								
	AS2129 TABLE C D E	255 (10.04)								
	AS2129 TABLE F	280 (11.02)								
DN150 (6 in.)	EN1092 PN10, PN16	285 (11.22)	300 (11.81)	340 (13.39)	84.4 (3.32)	265 (10.43)	217 (8.54)	103 (4.06)	32 (70)	31 (68)
	ASME B16.5 CLASS 150	279 (10.98)								
	JIS 7.5k	290 (11.42)								
	JIS 10K	280 (11.02)								
	AS2129 TABLE C D	280 (11.02)								
	AS4087 PN14, PN16	280 (11.02)								
	AS2129 TABLE E	280 (11.02)								
	AS2129 TABLE F	305 (12.01)								
AS4087 PN21	305 (12.01)									
DN200 (8 in.)	EN1092-1 PN10	340 (13.39)	350 (13.78)	365 (14.37)	109.8 (4.32)	290 (11.42)	243 (9.57)	150 (5.91)	49 (108)	48 (105)
	EN1092-1 PN16	340 (13.39)								
	ASME B16.5 CLASS 150	345 (13.58)								
	JIS 7.5K	342 (13.46)								
	JIS 10K	330 (12.99)								
	AS2129 TABLE C D	335 (13.19)								
	AS4087 PN14, PN 16	335 (13.19)								
	AS2129 TABLE E	335 (13.19)								
	AS2129 TABLE F	370 (14.57)								
	AS4087 PN21	370 (14.57)								

DN40 to 200 (1½ to 8 in. NB) (FEV) dimensions / weights

FER – DN40 to 300 (1½ to 12 in. NB)



DN40 to 300 (1½ to 12 in. NB) (FER)

DN	Process connection type	Dimensions in mm (in.)						Approx. weight in kg (lb)	
		D	L	F	E	G	X	Integral	Remote
DN40 (1½ in.)	EN1092-1 PN10, 16, 25, 40	150 (5.91)	200 (7.87)	260 (10.24)	185 (7.28)	137 (5.39)	23.5 (0.93)	13.4 (29.5)	12.4 (27.3)
	ASME B16.5 CLASS 150								
DN50 (2 in.)	EN1092-1 PN10, 16, 25, 40	165 (6.50)	200 (7.87)	261 (10.28)	186 (7.32)	138 (5.43)	29 (1.14)	14.75 (32.45)	13.75 (30.25)
	ASME B16.5 CLASS 150								
	AS2129 TABLE D, E, F								
DN80 (3 in.)	EN1092-1 PN10, 16, 25, 40	200 (7.87)	200 (7.87)	280 (11.04)	205.5 (8.09)	157.5 (6.2)	47 (1.85)	21.2 (46.64)	20.2 (44.4)
	ASME B16.5 CLASS 150								
	AS4087 PN16, 21								
DN100 (4 in.)	EN1092-1 PN10, 16, 25, 40	225 (8.86)	250 (9.84)	300.5 (11.83)	225.5 (8.88)	177.5 (6.98)	64 (2.52)	27.3 (60)	26.3 (58)
	ASME B16.5 CLASS 150								
	AS4087 PN16								
DN150 (6 in.)	EN1092-1 PN10, 16, 25, 40	300 (11.81)	300 (11.81)	333.5 (13.13)	258.5 (10.18)	210.5 (8.29)	100.2 (3.94)	27.3 (60)	26.3 (58)
	ASME B16.5 CLASS 150								
	AS4087 PN16								
DN200 (8 in.)	EN1092-1 PN10, 16	375 (11.76)	350 (13.78)	358.7 (14.12)	283.7 (11.17)	235.7 (9.28)	126.7 (5.00)	68 (150)	67 (147.4)
	ASME B16.5 CLASS 150								
	AS2129 TABLE C, D, E, F								
	AS4087 PN14, 16, 21								

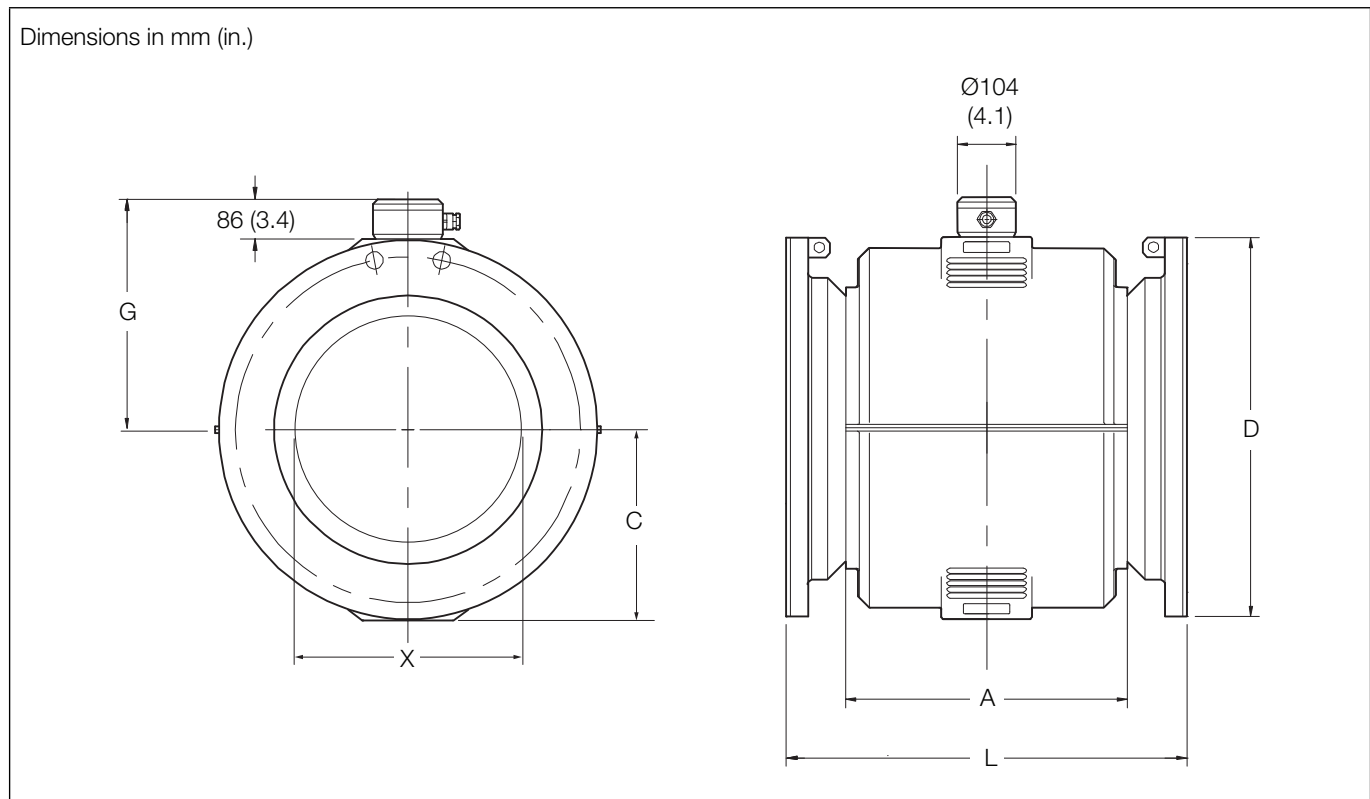
DN40 to 200 (1½ to 8 in.) (FER) cast iron sensor dimensions / weights

WaterMaster
Electromagnetic flowmeter

DN	Process connection type	Dimensions in mm (in.)							Approx. weight in kg (lb)	
		D	L	F	C	E	G	X	Integral	Remote
DN40 (1½ in.)	EN1092-1 PN10, 16, 25, 40	150 (5.91)	200 (7.87)	260 (10.24)	30.4 (1.20)	185 (7.28)	138 (5.43)	23.5 (0.93)	13 (29)	11 (24)
	ASME B16.5 CLASS 150	127 (5.00)								
	JIS 10K	140 (5.51)								
	AS2129 TABLE C D E	135 (5.31)								
	AS2129 TABLE F	140 (5.51)								
	AS4087 PN14	135 (5.31)								
DN50 (2 in.)	EN1092-1 PN10, 16, 25, 40	165 (6.50)	200 (7.87)	270 (10.63)	38.3 (1.51)	195 (7.68)	146 (5.75)	29 (1.14)	14 (31)	12 (27)
	ASME B16.5 CLASS 150	152.4 (6.00)								
	JIS 10K	155 (6.10)								
	AS4087 PN21	165 (6.50)								
	AS2129 TABLE F	165 (6.50)								
	AS2129 TABLE C D E	150 (5.91)								
	AS4087 PN14, PN16	150 (5.91)								
DN65 (2½ in.)	EN1092-1 PN10, 16, 25, 40	185 (7.28)	200 (7.87)	275 (10.83)	45.2 (1.78)	200 (7.87)	152 (5.98)	37 (1.46)	15 (33)	13 (29)
	ASME B16.5 CLASS 150	178 (7.00)								
	JIS10K	175 (6.89)								
	AS2129 TABLE C D E	165 (6.50)								
	AS2129 TABLE F	185 (7.28)								
	AS4087 PN14, 16	165 (6.50)								
	AS4087 PN21	185 (7.28)								
DN80 (3 in.)	EN1092-1 PN10, 16, 25, 40	200 (7.87)	200 (7.87)	280 (11.02)	51.5 (2.03)	205 (8.07)	156 (6.14)	47 (1.85)	20 (44)	18 (40)
	ASME B16.5 CLASS 150	190 (7.48)								
	JIS 10K	185 (7.28)								
	AS2129 TABLE C D E	185 (7.28)								
	AS4087 PN14, 16	185 (7.28)								
	AS2129 TABLE F	205 (8.07)								
	AS4087 PN21	205 (8.07)								
DN100 (4 in.)	EN1092-1 PN10, 16	220 (8.66)	250 (9.84)	320 (12.60)	63.75 (2.51)	245 (9.65)	196.8 (7.75)	64 (2.52)	27 (59)	25 (55)
	EN1092-1 PN25, 40	235 (9.25)								
	ASME B16.5 CLASS 150	228.6 (9.00)								
	JIS 7.5K	238 (9.37)								
	JIS 10K	210 (8.27)								
	AS2129 TABLE C D	215 (8.46)								
	AS4087 PN14, 16	215 (8.46)								
	AS4087 PN21	230 (9.06)								
	DN125 (5 in.)	EN1092-1 PN10, 16								
EN1092-1 PN25, 40		270 (10.63)								
ASME B16.5 CLASS 150		254 (10.00)								
JIS 10K		250 (9.84)								
AS2129 TABLE C D		255 (10.04)								
DN150 (6 in.)	EN1092 PN10, 16	285 (11.22)	300 (11.81)	340 (13.39)	84.4 (3.32)	265 (10.43)	217 (8.54)	100.2 (3.94)	33 (72)	31 (68)
	EN1092 PN25, 40	300 (11.81)								
	ASME B16.5 CLASS 150	279 (10.98)								
	JIS 7.5k	290 (11.42)								
	JIS 10K	280 (11.02)								
	AS2129 TABLE C D	280 (11.02)								
	AS4087 PN14, 16	280 (11.02)								
	AS4087 PN21	305 (12.01)								
DN200 (8 in.)	EN1092-1 PN10, 16	340 (13.39)	350 (13.78)	365 (14.37)	109.8 (4.32)	290 (11.42)	243 (9.57)	126.7 (4.99)	50 (110)	48 (106)
	EN1092-1 PN25, 40	360 (14.17)								
	ASME B16.5 CLASS 150	345 (13.58)								
	JIS 7.5K	342 (13.46)								
	JIS 10K	330 (12.99)								
	AS2129 TABLE C D	335 (13.19)								
	AS4087 PN14, 16	335 (13.19)								
	AS4087 PN21	370 (14.57)								
DN250 (10 in.)	EN1092-1 PN10	395 (15.55)	450 (17.72)	389 (15.31)	136.8 (5.39)	313 (12.33)	268 (10.55)	153.5 (6.04)	77 (169)	75 (165)
	EN1092-1 PN16	405 (15.94)								
	EN1092-1 PN25	425 (16.73)								
	ASME B16.5 CLASS 150	405 (15.94)								
	JIS 7.5K	400 (15.75)								
	JIS 10K	400 (15.75)								
	AS2129 TABLE C D	405 (15.94)								
	AS4087 PN14, 16	405 (15.94)								
	AS4087 PN21	430 (16.93)								
DN300 (12 in.)	EN1092-1 PN10	445 (17.52)	500 (19.69)	414 (16.30)	162.2 (6.39)	338.6 (13.33)	294 (11.57)	203.5 (8.01)	114 (251)	112 (247)
	EN1092-1 PN16	460 (18.11)								
	EN1092-1 PN25	485 (19.09)								
	ASME B16.5 CLASS 150	485 (19.09)								
	JIS 10K	445 (17.52)								
	AS2129 TABLE C D	455 (17.91)								
	AS4087 PN14, 16	455 (17.91)								
	AS4087 PN21	490 (19.29)								

DN40 to 300 (1½ to 12 in. NB) (FER) dimensions / weights

FER – DN350 to 600 (14 to 24 in. NB) remote sensor

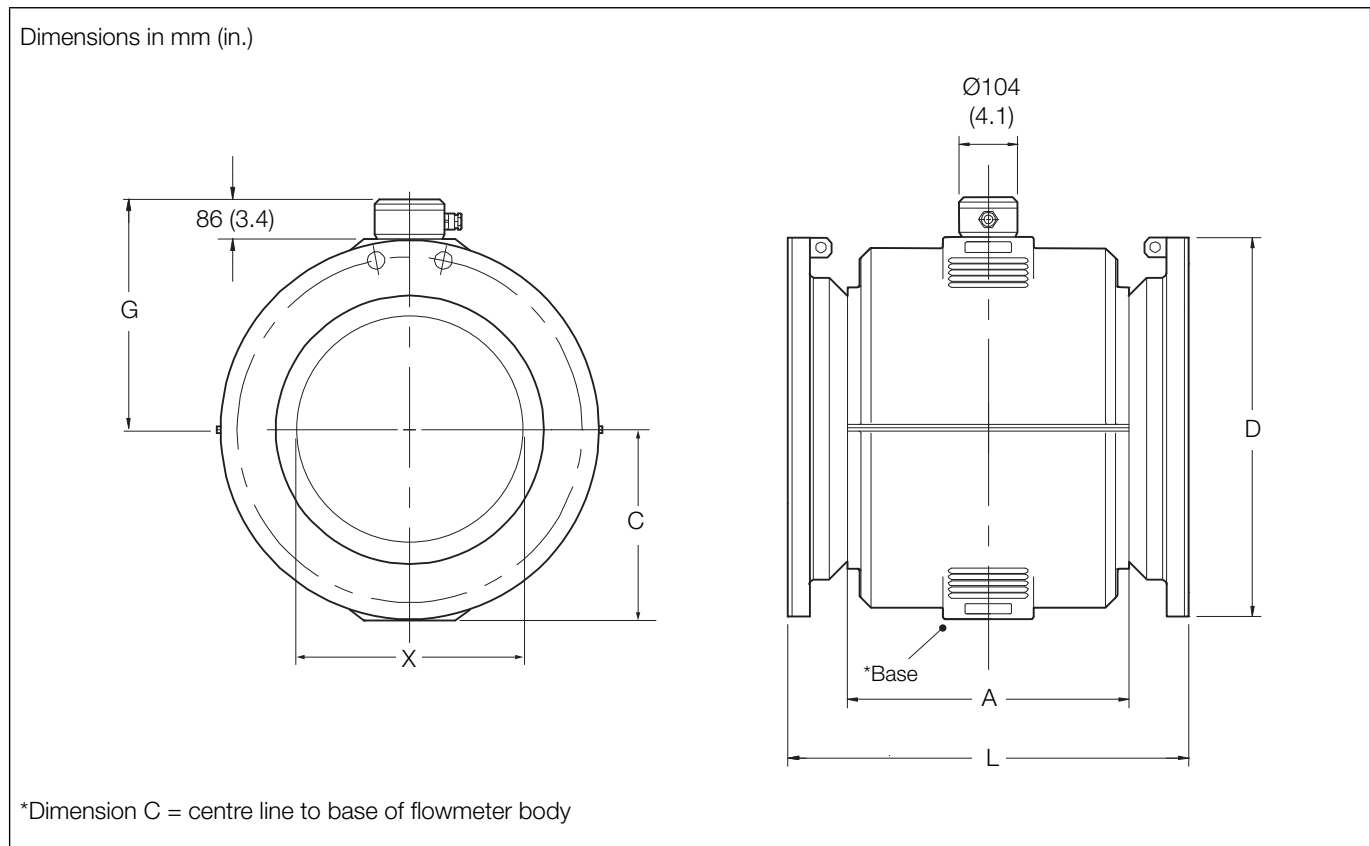


DN350 to 600 (14 to 24 in. NB) (FER) remote sensor

DN	Process connection type	Dimensions in mm (in.)								Approx. weight in kg (lb)
		D	L	F	C	E	G	A	X	Remote
DN350 (14 in.)	EN1092-1 PN10	505 (19.88)	550 (21.65)	472 (18.58)	231 (9.09)	402 (15.83)	325 (12.80)	376 (14.80)	340 (13.39)	100 (220)
	EN1092-1 PN16	520 (20.47)								
	EN1092-1 PN25	555 (21.85)								
	EN1092-1 PN40	580 (22.83)								
	JIS 5K	480 (18.90)								
	JIS 10K	490 (19.29)								
	AS2129 TABLE C D E	525 (20.67)								
	AS2129 TABLE F	550 (21.65)								
	AS4087 PN14, PN16	525 (20.67)								
AS4087 PN21	550 (21.65)									
DN400 (16 in.)	EN1092-1 PN10	565 (22.24)	600 (23.62)	502 (19.76)	257.5 (10.14)	432 (17.01)	355 (13.98)	420 (16.54)	390 (15.35)	115 (253)
	EN1092-1 PN16	580 (22.83)								
	EN1092-1 PN25	620 (24.41)								
	EN1092-1 PN40	660 (25.98)								
	JIS 5K	540 (21.26)								
	JIS 10K	560 (22.05)								
	AS2129 TABLE C D E	580 (22.83)								
	AS2129 TABLE F	610 (24.02)								
	AS4087 PN14, PN16	580 (22.83)								
AS4087 PN21	610 (24.02)									
DN450 (18 in.)	EN1092-1 PN10	615 (24.21)	700 (27.56)	537 (21.14)	285 (11.22)	467 (18.39)	390 (15.35)	480 (18.90)	440 (17.32)	160 (352)
	EN1092-1 PN16	640 (25.20)								
	EN1092-1 PN25	670 (26.38)								
	EN1092-1 PN40	685 (26.97)								
	JIS 5K	605 (23.82)								
	JIS 10K	620 (24.41)								
	AS2129 TABLE C D E	640 (25.20)								
	AS2129 TABLE F	675 (26.57)								
	AS4087 PN14, PN16	640 (25.20)								
AS4087 PN21	675 (26.57)									
DN500 (20 in.)	EN1092-1 PN10	670 (26.38)	770 (30.31)	557 (21.93)	317.5 (12.50)	487 (19.17)	410 (16.14)	520 (20.47)	490 (19.29)	217 (477)
	EN1092-1 PN16	715 (28.15)								
	EN1092-1 PN25	730 (28.74)								
	EN1092-1 PN40	755 (29.72)								
	JIS 5K	655 (25.79)								
	JIS 10K	675 (26.57)								
	AS2129 TABLE C D E	705 (27.76)								
	AS2129 TABLE F	735 (28.94)								
	AS4087 PN14, PN16	705 (27.76)								
AS4087 PN21	735 (28.94)									
DN600 (24 in.)	EN1092-1 PN10	780 (30.71)	920 (36.22)	602 (23.70)	345 (13.58)	532 (20.94)	455 (17.91)	610 (24.02)	591 (23.27)	315 (693)
	EN1092-1 PN16	840 (33.07)								
	EN1092-1 PN25	845 (33.27)								
	EN1092-1 PN40	890 (35.04)								
	JIS 5K	770 (30.31)								
	JIS 10K	795 (31.30)								
	AS2129 TABLE C D E	825 (32.48)								
	AS2129 TABLE F	850 (33.46)								
	AS4087 PN14, PN16	825 (32.48)								
AS4087 PN21	850 (33.46)									

DN350 to 600 (14 to 24 in. NB) (FER) remote sensor dimensions / weights

FEF – DN250 to 600 (10 to 24 in. NB)



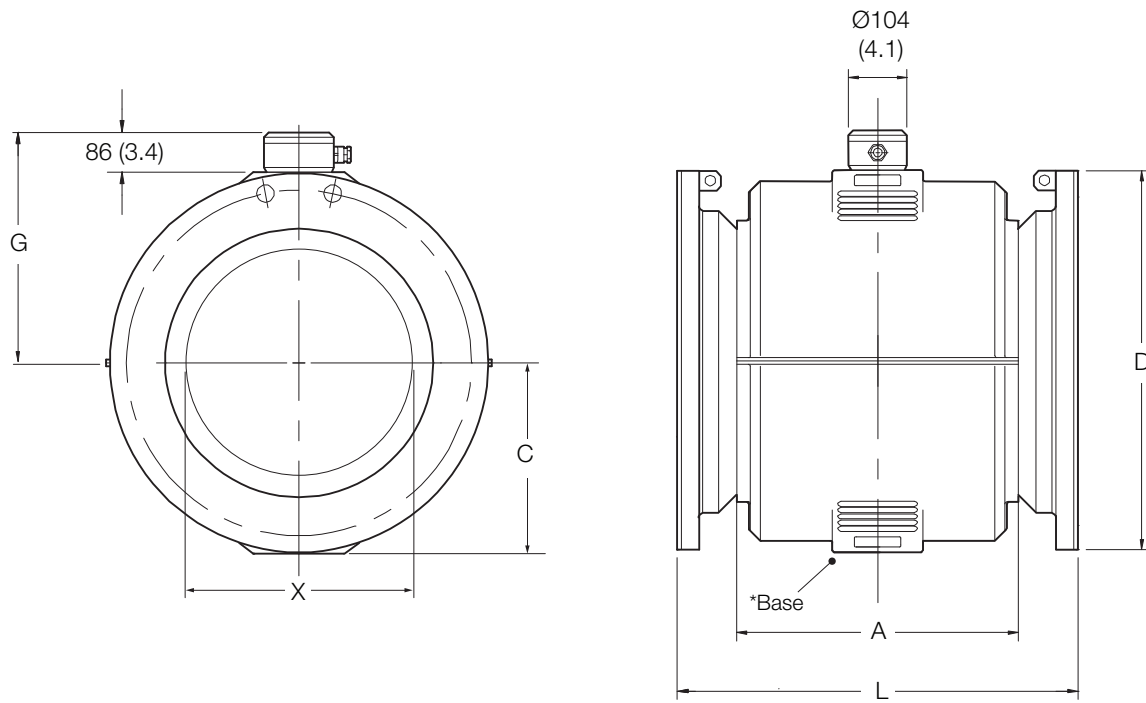
DN250 to 600 (10 to 24 in. NB) (FEF)

WaterMaster
Electromagnetic flowmeter

DN	Process connection type	Dimensions in mm (in.)						Approx. weight in kg (lb)	
		D	L	C	G	A	X		
DN250 (10 in.)	ASME B16.5 CLASS 150	405 (15.94)	450 (17.72)	215 (8.46)	301 (11.85)	300 (11.81)	250 (9.84)	88 (194)	
	ASME B16.5 CLASS 300	445 (17.52)	490 (19.29)						
	EN1092 -1 PN10	395 (15.55)	450 (17.72)						
	EN1092 - 1 PN16	405 (15.94)	490 (19.29)						
	EN1092 - 1 PN25	425 (16.73)							
	EN1092 - 1 PN40	450 (17.72)	450 (17.72)						
	JIS 5K	385 (15.16)							
	JIS 10K	400 (15.75)							
	AS4087 PN14, PN16	405 (15.94)							
	AS2129 TABLE C D	430 (16.93)							
	AS2129 TABLE E								
	AS4087 PN21								
AS2129 TABLE F									
DN300 (12 in.)	ASME B16.5 CLASS 150	485 (19.09)		500 (19.69)	231 (9.09)	317 (12.48)	352 (13.86)	300 (11.81)	128 (282)
	ASME B16.5 CLASS 300	520 (20.47)		540 (21.26)					
	EN1092 - 1 PN10	445 (17.52)	500 (19.69)						
	EN1092 - 1 PN16	460 (18.11)	500 (19.69)						
	EN1092 - 1 PN25	485 (19.09)	540 (21.26)						
	EN1092 - 1 PN40	515 (20.28)	540 (21.26)						
	JIS 5K	430 (16.93)	500 (19.69)						
	JIS 10K	445 (17.52)	500 (19.69)						
	AS4087 PN14, PN16	455 (17.91)	500 (19.69)						
	AS2129 TABLE TABLE C D	455 (17.91)	500 (19.69)						
	AS2129 TABLE E	455 (17.91)	500 (19.69)						
	AS4087 PN21	490 (19.29)	500 (19.69)						
AS2129 TABLE F	490 (19.29)	500 (19.69)							
DN350 (14 in.)	ASME B16.5 CLASS 150	535 (21.06)	550 (21.65)	257.5 (10.14)	346 (13.62)	376 (14.80)	350 (13.78)	100 (220)	
	ASME B16.5 CLASS 300	585 (23.03)	570 (22.44)						
	EN1092 - 1 PN10	505 (19.88)	550 (21.65)						
	EN1092 - 1 PN16	520 (20.47)	550 (21.65)						
	EN1092 - 1 PN25	555 (21.85)	570 (22.44)						
	EN1092 - 1 PN40	580 (22.83)	570 (22.44)						
	JIS 5K	480 (18.90)	550 (21.65)						
	JIS 7.5K	530 (20.87)	550 (21.65)						
	JIS 10K	490 (19.29)	550 (21.65)						
	AS4087 PN14, PN16	525 (20.67)	550 (21.65)						
	AS2129 TABLE C D E	525 (20.67)	550 (21.65)						
	AS4087 PN21	550 (21.65)	550 (21.65)						
	AS2129 TABLE F	550 (21.65)	550 (21.65)						
	AS4087 PN35	550 (21.65)	570 (22.44)						
AS2129 TABLE H	550 (21.65)	570 (22.44)							
DN375 (15 in.)	AS4087 PN14, PN16	550 (21.65)	550 (21.65)	257.5 (10.14)	346 (13.62)	376 (14.80)	350 (13.78)	115 (253)	
	AS2129 TABLE C	550 (21.65)	550 (21.65)						
	AS4087 PN35	580 (22.83)	570 (22.44)						
DN400 (16 in.)	ASME B16.5 CLASS 150	600 (23.62)	600 (23.62)	285 (11.22)	371 (14.61)	420 (16.54)	400 (15.75)	115 (253)	
	ASME B16.5 CLASS 300	650 (25.59)	620 (24.41)						
	EN1092 - 1 PN10	565 (22.24)	600 (23.62)						
	EN1092 - 1 PN16	580 (22.83)	600 (23.62)						
	EN1092 - 1 PN25	620 (24.41)	620 (24.41)						
	EN1092 - 1 PN40	660 (25.98)	620 (24.41)						
	JIS 5K	540 (21.26)	600 (23.62)						
	JIS 7.5K	582 (22.91)	600 (23.62)						
	JIS 10K	560 (22.05)	600 (23.62)						
	AS4087 PN14, PN16	580 (22.83)	600 (23.62)						
	AS2129 TABLE C D E	580 (22.83)	600 (23.62)						
	AS4087 PN21	610 (24.02)	600 (23.62)						
	AS2129 TABLE F	610 (24.02)	600 (23.62)						
	AS4087 PN35	610 (24.02)	620 (24.41)						
AS2129 TABLE H	610 (24.02)	620 (24.41)							

DN250 to 600 (10 to 24 in. NB) (FEF) dimensions / weights

Dimensions in mm (in.)



*Dimension C = centre line to base of flowmeter body

...DN250 to 600 (10 to 24 in. NB) (FEF)

		Dimensions in mm (in.)							
DN	Process connection type	D	L	C	G	A	X	Approx. weight in kg (lb)	
DN450 (18 in.)	ASME B16.5 CLASS 150	635 (25.00)	700 (27.56)	317.5 (12.50)	402 (15.83)	480 (18.90)	450 (17.72)	160 (352)	
	ASME B16.5 CLASS 300	710 (27.95)							
	EN1092 – 1 PN10	615 (24.21)							
	EN1092 – 1 PN16	640 (25.20)							
	EN1092 – 1 PN25	670 (26.38)							
	EN1092 – 1 PN40	685 (26.97)							
	JIS 5K	605 (23.82)							
	JIS 7.5K	652 (25.67)							
	JIS 10K	620 (24.41)							
	AS4087 PN14, PN16	640 (25.20)							
	AS2129 TABLE C D	640 (25.20)							
	AS2129 TABLE E	640 (25.20)							
	AS4087 PN21	675 (26.57)							
	AS2129 TABLE F	675 (26.57)							
AS4087 PN35	675 (26.57)								
AS2129 TABLE H	675 (26.57)								
DN500 (20 in.)	ASME B16.5 CLASS 150	700 (27.56)	770 (30.31)	345 (13.58)	429 (16.89)	520 (20.47)	500 (19.69)	217 (455)	
	ASME B16.5 CLASS 300	775 (30.51)							
	EN1092 – 1 PN10	670 (26.38)							
	EN1092 – 1 PN16	715 (28.15)							
	EN1092 – 1 PN25	730 (28.74)							
	EN1092 – 1 PN40	755 (29.72)							
	JIS 5K	655 (25.79)							
	JIS 7.5K	706 (27.80)							
	JIS 10K	675 (26.57)							
	AS4087 PN 14, PN16	705 (27.76)							
	AS2129 TABLE C D E	705 (27.76)							
	AS4087 PN21	735 (28.94)							
	AS2129 TABLE F	735 (28.94)							
	AS4087 PN35	735 (28.94)							
AS2129 TABLE H	735 (28.94)								
DN600 (24 in.)	ASME B16.5 CLASS 150	815 (32.09)	920 (36.22)	387.5 (15.25)	472 (18.58)	610 (24.02)	600 (23.62)	315 (693)	
	ASME B16.5 CLASS 300	915 (36.02)							
	EN1092 – 1 PN10	780 (30.71)							
	EN1092 – 1 PN16	840 (33.07)							
	EN1092 – 1 PN25	845 (33.27)							
	EN1092 – 1 PN40	890 (35.04)							
	JIS 5K	770 (30.31)							
	JIS 7.5K	810 (31.89)							
	JIS 10K	795 (31.30)							
	AS4087 PN14, PN16	825 (32.48)							
	AS2129 TABLE C D	825 (32.48)							
	AS2129 TABLE E	825 (32.48)							
	AS4087 PN21	850 (33.46)							
	AS2129 TABLE F	850 (33.46)							
AS4087 PN35	850 (33.46)								
AS2129 TABLE H	850 (33.46)								

...DN250 to 600 (10 to 24 in. NB) (FEF) dimensions / weights

Electromagnetic flowmeter WaterMaster FEF12 and FEF18

	6	7 ... 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Product coding field number 1 ... 5																				
Flowmeter system, full bore, remote mount		FEF12																		
Full bore sensor only, for use with WaterMaster transmitter / remote	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	X
Design																				
Non-hazardous areas		1																		
Hazardous areas (DN≥700 [27 in. NB])		5																		
Bore diameter																				
DN250 (10 in.)		250																		
DN300 (12 in.)		300																		
DN350 (14 in.)		350																		
DN375 (15 in.)		375																		
DN400 (16 in.)		400																		
DN450 (18 in.)		450																		
DN500 (20 in.)		500																		
DN600 (24 in.)		600																		
Others		999																		
Liner material																				
Elastomer – DN250 to 600 (10 to 24 in. NB)																				K
Hard rubber – DN250 to 600 (10 to 24 in. NB)																				H
Other																				Z
Electrode design																				
Standard																				1
Others																				9
Measuring electrodes material																				
Stainless steel 316																				S
Hastelloy® C-22																				C
Super-austenitic steel (DN250 to 600 [10 to 24 in. NB])																				U
Others																				Z
Grounding accessories																				
Standard																				1
One potential equalizing ring (stainless steel)																				3
Two potential equalizing rings (stainless steel)																				4
Others																				9
Process connection type (refer to pages 35 to 33)																				
Flanges ASME B16.5 class 150																				A1
Flanges ASME B16.3 class 300																				A3
Flanges AWWA C207 class B																				C1
Flanges AWWA C207 class D																				C2
Flanges AS 4087 PN21																				E0
Flanges AS 4087 PN16																				E1
Flanges AS 4087 PN14																				E2
Flanges AS 2129 Table F																				E3
Flanges AS 2129 Table E																				E4
Flanges AS 2129 Table D																				E5
Flanges AS 2129 Table C																				E6
Flanges AS 2129 Table H																				E7
Flanges AS 4087 PN35																				E8
Flanges JIS G5527 7.5K																				J0
Flanges JIS B2220 10K																				J1
Flanges JIS B2220 5K																				J2
Flanges ISO / EN PN6																				S0
Flanges ISO / EN PN10																				S1
Flanges ISO / EN PN16																				S2
Flanges ISO / EN PN25																				S3
Flanges ISO / EN PN40																				S4
Others																				Z9
Note. DN80 to 200 (3 to 10 in. NB) available only with PN16																				
Process connection material																				
Carbon steel flanges																				B
Others																				Z
Usage certifications																				
Standard																				1
Calibration type																				
Class 2 calibration – standard accuracy 0.4 %																				A
Class 1 calibration – high accuracy 0.2 %																				B
Extended range, class 1 calibration – high accuracy 0.2 %																				N
Extended range, class 2 calibration – standard accuracy 0.4 %																				P

Continued on next page ...

Product coding field number 1 ... 5

	6	7 ... 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27	Options
Flowmeter system, full bore, remote mount	FEF12																			
Full bore sensor only, for use with WaterMaster transmitter / remote FEF18	X	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	X
Temperature range installation / ambient temperature range																				
Standard design / -20 ... 60 °C (-4 ... 140 °F)	1																			
Nameplate																				
Adhesive	A																			
Signal cable length and type*																				
Without signal cable	0																			
5 m (15 ft.) cable	1																			
10 m (30 ft.) cable	2																			
20 m (60 ft.) cable	3																			
30 m (100 ft.) cable	4																			
50 m (165 ft.) cable	5																			
80 m (260 ft.) cable	6																			
100 m (325 ft.) cable	7																			
150 m (490 ft.) cable	8																			
Special Length > 150 m (> 490 ft.) (and / or armored cable)	9																			
Explosion protection certification																				
General purpose (non-Ex design)	A																			
Protection class transmitter / protection class sensor																				
IP67 (NEMA 4X) / IP68 (NEMA 6P) – cable not fitted and not potted	2																			
IP67 (NEMA 4X) / IP68 (NEMA 6P) – cable fitted and potted	3																			
Cable conduits**																				
M20 x 1.5 (plastic)	A																			
NPT 1/2 in. (blanked when cable not fitted)	B																			
M20 SWA (armored)	D																			
M20 SWA sensor, M20 x 1.5 (plastic) power / output	F																			
Without	Y																			
Power supply																				
Without	0																			
100... 230 V AC (50 Hz)	1																			
24 V AC or 24 V DC (50 Hz)	2																			
100... 230 V AC (60 Hz)	3																			
24 V AC or 24 V DC (60 Hz)	4																			
Input and output signal type																				
HART + 20 mA + pulse + contact output	A																			
PROFIBUS DP RS485 physical layer + pulse + contact output (general-purpose design only)	G																			
MODBUS RTU RS485 physical layer + pulse + contact output (general-purpose design only)	M																			
Without	Y																			
Configuration type / diagnostics type																				
Without	0																			
Factory defaults / standard diagnostics	1																			
Options***																				
Accessories																				
Configuration lead	AC																			
Documentation language																				
German	M1	Chinese	M6																	
Italian	M2	Swedish	M7																	
Spanish	M3	Finnish	M8																	
French	M4	Portuguese	MA																	
English	M5 (default)	Danish	MF																	
		Norwegian	MN																	
Verification type																				
Without fingerprint	V0																			
VeriMaster	V3																			
Portable water approvals																				
WRAS cold water approval	CWA																			
NSF 61 meter approval	CWC																			
DVGW	CWD																			
ACS	CWF																			
WRAS 60 °C (140 °F) water approval	CWK																			
Without	CWY																			
Power supply frequency (sensor FEF 18 only)																				
50 Hz	F5																			
60 Hz	F6																			
Number of testpoints																				
1 Point	T1																			
3 Points	T3																			

*Size is dependent on flange specification

**The type of signal cable supplied (standard or armored) depends on the type of cable conduit (variant digit number 24) ordered – for FM or FMC Approved versions, NPT only permitted.

***Add codes for options.

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3KXF211101R1001



Sales



Service



Software

Specification – sensor

Functional specification

Pressure limitations

As per flange rating – non approved
PN16 for OIML R49 Approved

Temperature limitations

Ambient temperature
Remote transmitter –20 to 70 °C (–4 to 158 °F)
Integral transmitter –20 to 60 °C (–4 to 140 °F)
Process temperature –6 to 70 °C (21 to 158 °F) – non approved
0.1 to 50 °C (32.2 to 122 °F) – OIML R49 T50
Approved

Environmental protection

Rating:
IP68 (NEMA 6) to 10m (33 ft) depth with fully-potted
terminal box – not DN10 to DN32
IP67 (NEMA 4X) – DN10 to DN32

Buriable (sensor only)

FEWNo
FEV and FEFYes

Conductivity

>5µS cm⁻¹

Transmitter mounting

Integral or remote

Electrical connections

20 mm glands
1/2 in NPT
20 mm armored glands

Sensor cable

ABB WaterMaster cable available in two forms – standard and
armored
Maximum length 200 m (660 ft)

Physical specification

Wetted parts

Lining material

PTFE	(sizes DN10 to DN32 [3/8 to 1 1/4 NB])
Polypropylene	(sizes DN40 to 200 [1 1/2 to 8 NB])
Elastomer	(sizes DN250 to 2200 [10 to 84 NB])
WRAS listed – NSF61 approved	(sizes DN40 to 200 [1 1/2 to 8 NB])
NSF	(FEW DN350 to 600) (FEW DN350 to 600) (FEV40 to 200 and FEF250 to 2200)

Electrode material

Stainless steel 316 L
Hastelloy® C-22 (Hastelloy C4 on DN10 to DN32)
(Other electrode materials available on request)

Potential equalizing rings

Optional (recommended)

Lining protection plates

Not required

Installation conditions (recommended)

Upstream ≥ 5D
Downstream ≥ 0D

Pressure loss

<0.25 bar at Q3	(sizes DN40 to 200 [1 1/2 to 8 NB])
Negligible at Q3	(sizes DN10 to 32 [3/8 to 1 1/4 NB], DN250 to 2200 [10 to 84 NB])

Non-wetted parts

Flange material

Carbon steel	(sizes DN20 to DN2200 [3/4 to 84 NB])
Stainless steel	(sizes DN10 to DN15 [3/8 to 1/2 NB])

Housing material

Carbon steel	(sizes DN40 to 200 [1 1/2 to 8 NB] and DN700 to 2200 [28 to 84 NB])
Plastic	(sizes DN250 to 600 [10 to 24 NB])
Aluminium	(FEW, sizes DN10 to DN32 [3/8 to 1 1/4 NB]) (FEW, sizes DN350 to DN400 [14 to 16 NB])
Carbon steel	(FEW, sizes DN450 to DN600 [18 to 24 NB])

Terminal box material

Polycarbonate

Cable gland material

Plastic or brass

Specification – transmitter

Functional specification

Power supply

Mains	85 to 265 V AC @ <7 VA
Low voltage	24 V AC +10 %/-30 % @ <7 VA
DC	24 V ±30 % @ <0.4 A

Supply voltage fluctuations within the specified range have no effect on accuracy

Digital Outputs (3 off)

Rating 30 V @ 220 mA, open collector, galvanically isolated

Maximum output frequency 5250 Hz

1 off dedicated to Alarm / Logic, programmable function

2 off configurable to either Pulse / Frequency or Alarm/Logic function

Current output – HART FEX100 variant

4 to 20 mA or 4 to 12/20 mA, galvanically isolated

Maximum loop resistance 750 Ω

HART protocol Version 5.7 (HART registered)

Signal levels compliant with NAMUR NE 43 (3.8 to 20.5 mA)

Low alarm 3.6 mA, High alarm 21.8 mA

Additional accuracy

±0.1 % of reading

Temperature coefficient: typically <±20 ppm/°C

RS485 Communications – PROFIBUS FEX100-DP variant

Registered name: FEX100-DP

RS485 (9.6kbps to 1.5Mbps), galvanically isolated

DPV0, DPV1

PA Profile 3.01

Standard idents: 9700, 9740, 9741

FEX100-DP specific ident: 3431

3 Concurrent MS2 master connections

Electrical connections

20 mm glands: 1/2 in NPT, 20 mm armored glands

Temperature limitations

Ambient temperature -20 to 60 °C (-4 to 140 °F)

Temperature coefficient Typically <±10 ppm/°C @ Vel ≥0.5 m/s

Environmental protection

Humidity: 0 to 100 %

Rating: IP67 (NEMA 4X) to 1m (3.3 ft) depth

Tamper-proof security

Write access prevented by internal switch combined with external security seals for MID applications

Languages

English, French, German, Italian, Spanish, Polish

Infrared service port

USB adapter (accessory), USB 1.1. and 2.0 compatible

Driver software for Windows 2000, XP, 7 and Vista

Housing material

Powder-coated aluminium with glass window

Hazardous approvals (HART variant only)

FM & FMc Class 1 Div 2

(FM listing NI / 1 / 2 / ABCD / T4, S / II, III / 2 / FG / T4,

Ta=60C; Type 4X, IP67 - for transmitter and integral mounting

Ta=70C, Type 6P, IP68 - for remote sensor type)

(FMc listing NI / 1 / 2 / ABCD / T4, DIP / II, III / 2 / FG / T4,

Ta=60C; Type 4X, IP67 - for transmitter and integral mounting

Ta=70C, Type 6P, IP68 - for remote sensor type)

FET, FEV, FEW and FEF DN700 to 2200 (27/28* to 84) only

*Size is dependent on flange specification

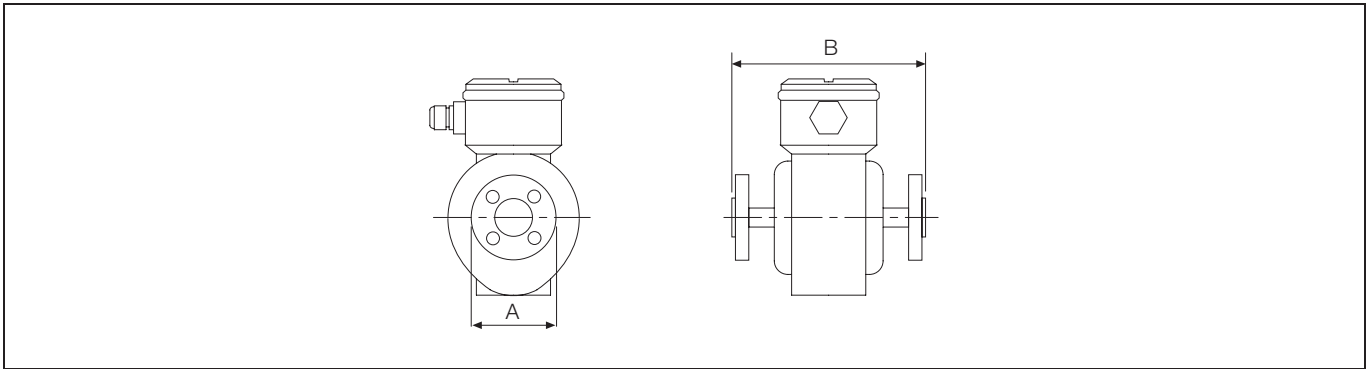
Declaration of Conformance

Copies of CE and PED certification will be available on request.

WaterMaster has OIMLR49 Certificate of Conformity to accuracy class 1 and 2. Copies of accuracy certification are available on request.

WaterMaster has been type examined under directive MID 2004/22/EC, Annex MI-001. Copies of this certificate are available on request.

Sensor dimensions

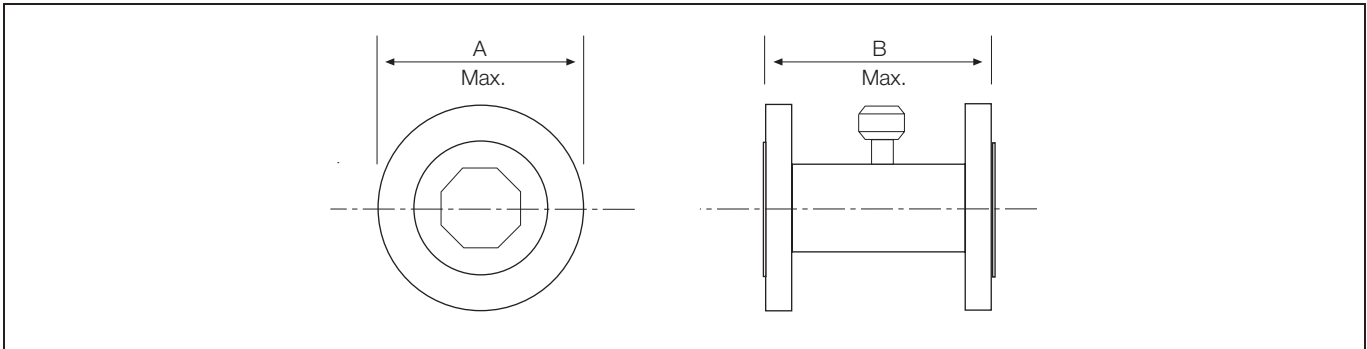


DN10 to 32 (³/₈ to 1¹/₄ NB) full-bore

Meter Size		Dimensions mm (in)		Approximate Weight	
DN	NPS/NB	A*	B	kg	lb
10	³ / ₈	93 (3.7)	200 (7.9)	6	13.2
15	¹ / ₂	95 (3.7)	200 (7.9)	7	15.4
20	³ / ₄	111 (4.4)	200 (7.9)	7	15.4
25	1	120 (4.7)	200 (7.9)	8	17.6
32	1 ¹ / ₄	137 (5.4)	200 (7.9)	10	22

*Dimensions are approximate and vary depending on flange type

DN10 to 32 (³/₈ to 1¹/₄ NB) full-bore



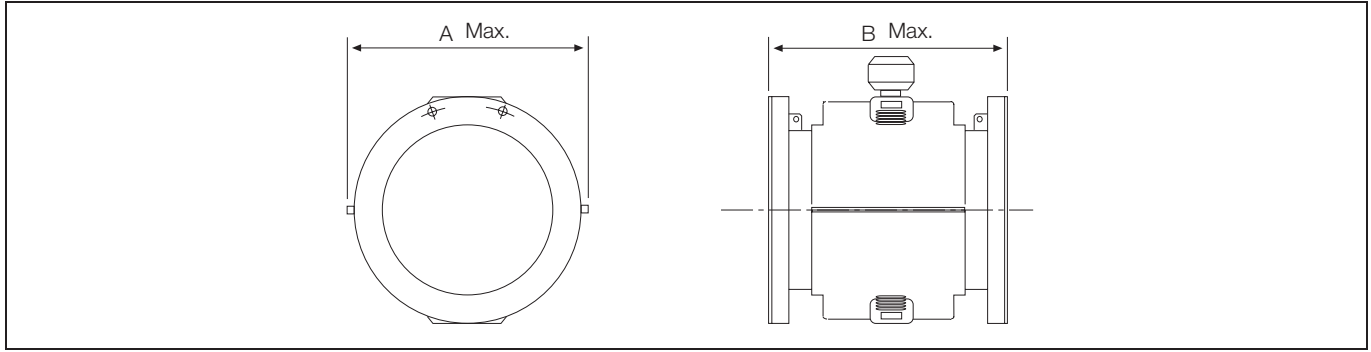
DN40 to 300 (1¹/₂ to 12 NB) full-bore

Meter Size		Dimensions mm (in)		Approximate Weight	
DN	NPS/NB	A*	B	kg	lb
40	1 ¹ / ₂	150 (5.9)	200 (7.9)	11	24
50	2	165 (6.5)	200 (7.9)	12	27
80	3	200 (7.9)	200 (7.9)	15	33
100	4	230 (9.1)	250 (9.8)	18	40
150	6	280 (11.0)	300 (11.8)	31	68
200	8	345 (13.6)	350 (13.8)	48	106
250	10	405 (15.9)	450 (17.7)	75	165
300	12	460 (18.1)	500 (19.7)	112	247

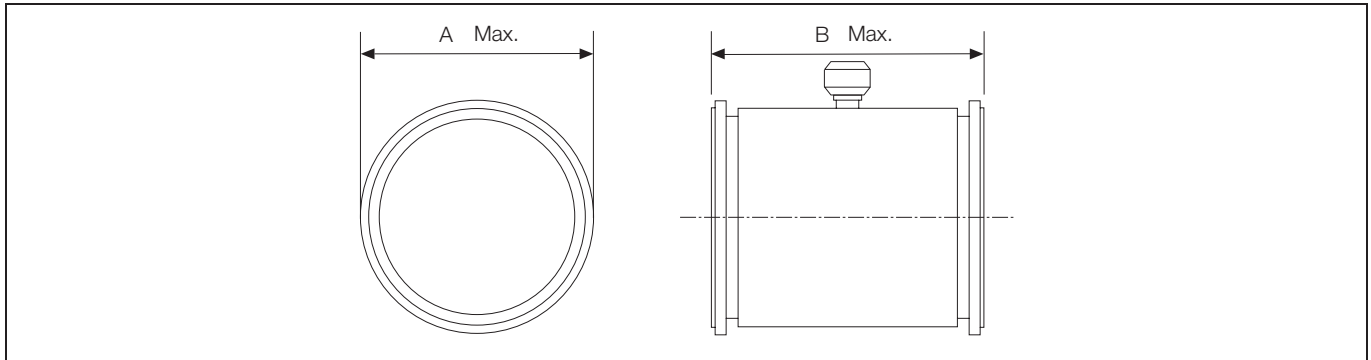
*Dimensions are approximate and vary depending on flange type

DN40 to 300 (1¹/₂ to 12 NB) full-bore

WaterMaster
Electromagnetic flowmeter



DN250 to 600 (10 to 24 NB) full-bore



DN700 to 2200 (28 to 84 NB) full-bore

Meter Size		Dimensions in mm (in)			Approximate Weight	
DN	NPS/NB	A	B (<PN25)	B (PN25, PN40, ASME, CL300)	kg	lb
250	10	405 (15.99)	450 (17.7)**	488 (19.2)	88	194
300	12	460 (18.1)	500 (19.7)**	538 (21.2)	128	282
350	14	535 (21.1)	550 (21.7)**	568 (22.3)	100	220
400	16	600 (23.6)	600 (23.6)**	618 (24.3)	115	253
450	18	640 (25.2)	698 (27.5)**	698 (27.5)	160	352
500	20	715 (28.1)	768 (30.2)**	768 (30.2)	217	455
600	24	840 (33.1)	918 (36.1)**	918 (36.1)	315	693
700	27/28*	927 (36.5)	700 (27.6)***	-	430	945
760	30	985 (38.8)	762 (30)***	-	430	945
800	32	1060 (41.7)	800 (31.5)***	-	430	945
900	36	1170 (46.1)	900 (35.4)***	-	540	1190
1000	39/40*	1290 (50.8)	1000 (39.4)***	-	720	1585
1050	42	1405 (55.3)	1067 (42)***	-	880	1930
1100	44	1405 (55.3)	1067 (42)***	-	880	1930
1200	48	1511 (59.5)	1200 (47.2)***	-	1000	2160
1400	54	1745 (68.7)	1400 (55.1)***	-	1450	3190
1500	60	1855 (73.0)	1524 (59)***	-	1370	3000
1600	66	2032 (80.0)	1600 (63)***	-	2000	4400
1800	72	2197 (86.5)	2250 (88.6)***	-	2400	5280
2000	78	2362 (93.0)	2500 (98.4)***	-	3200	7040
2200	84	2534 (100.0)	2750 (110)***	-	4200	9300

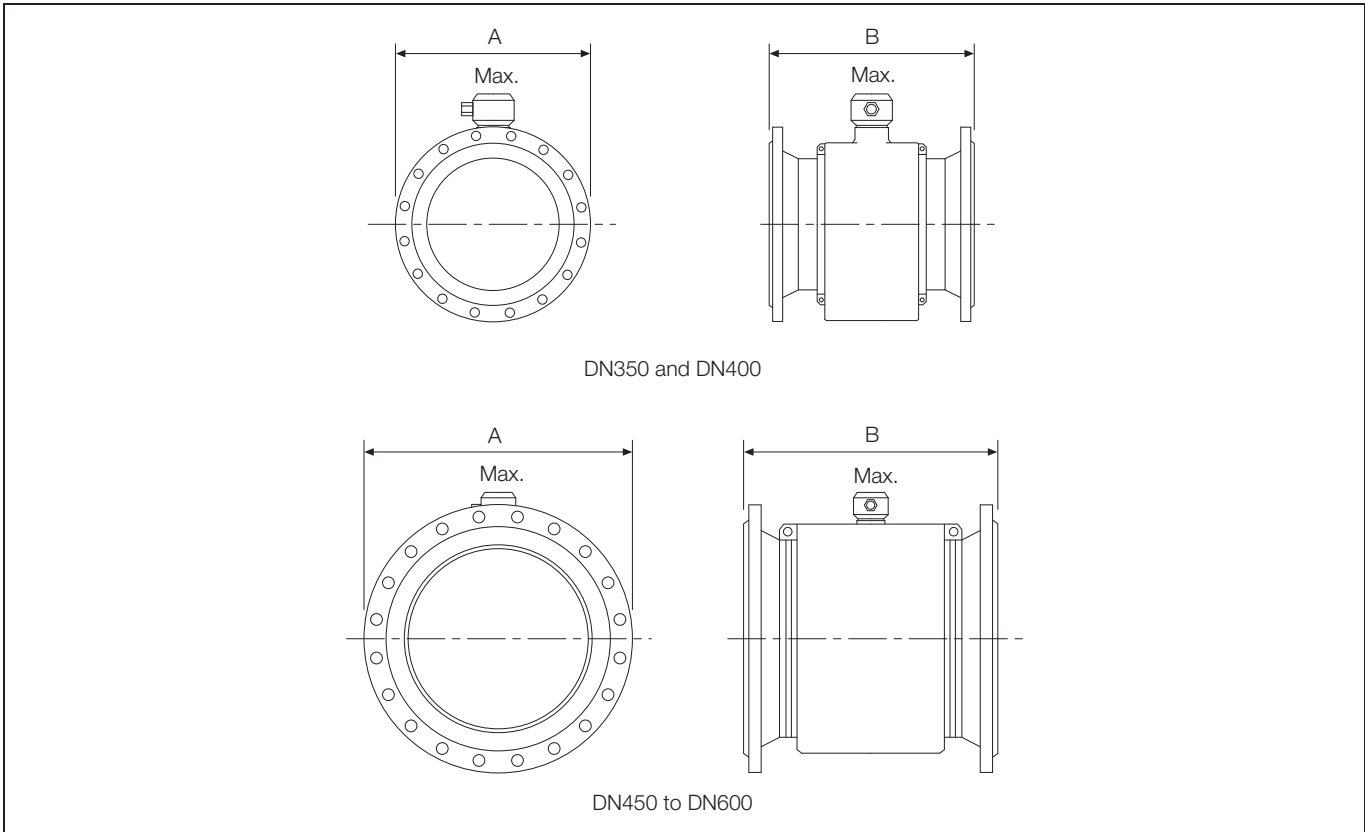
* Size is dependent on flange specification

Typical tolerances:

** +0/-10 mm (0.40 in)

*** +0/-20 mm (1.0 in)

DN250 to 2200 (10 to 84 NB) full-bore



DN350 to 600 (14 to 24 NB) FM – approved version

Meter Size		Dimensions in mm (in)*		Approximate Weight**	
DN	NPS/NB	A	B	kg	lb
350	14	585 (23.0)	550 (21.7)	145	319
400	16	690 (27.2)	600 (23.6)	179	394
450	18	711 (28.0)	686 (27.0)	189	417
500	20	775 (30.5)	752 (29.6)	195	430
600	24	914 (36.0)	914 (36.0)	275	606

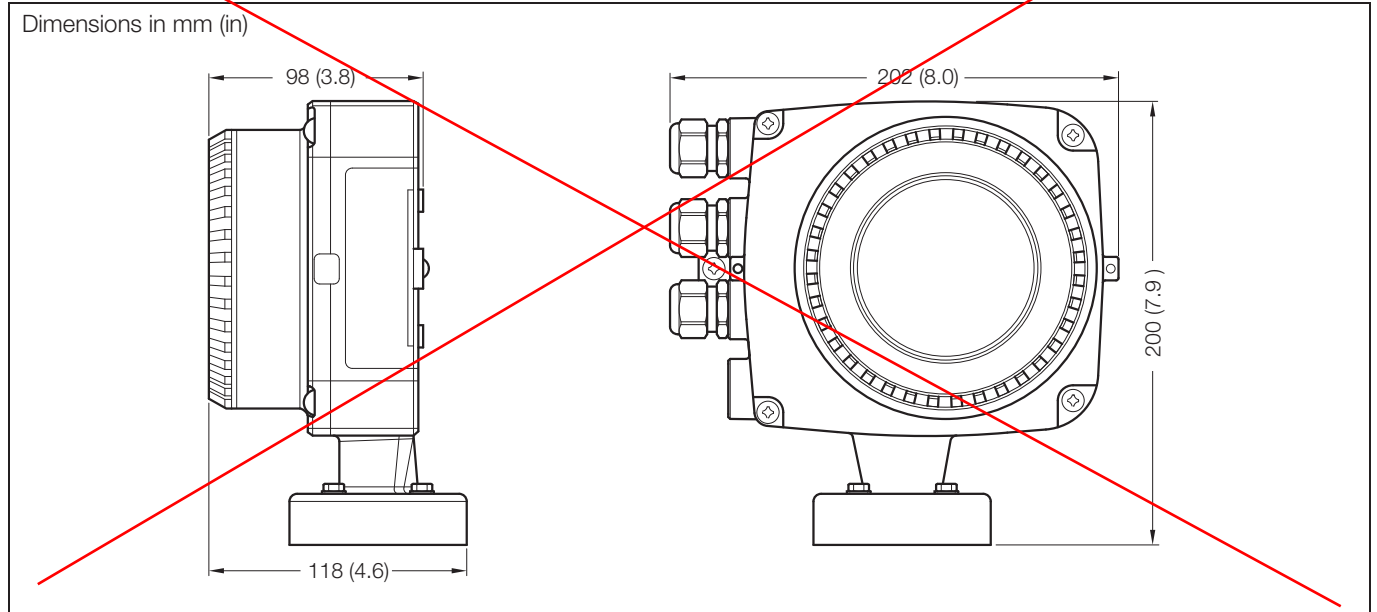
* Sizes are approximate and dependent on flange specification

**Approximate weight for Class 150 flanges

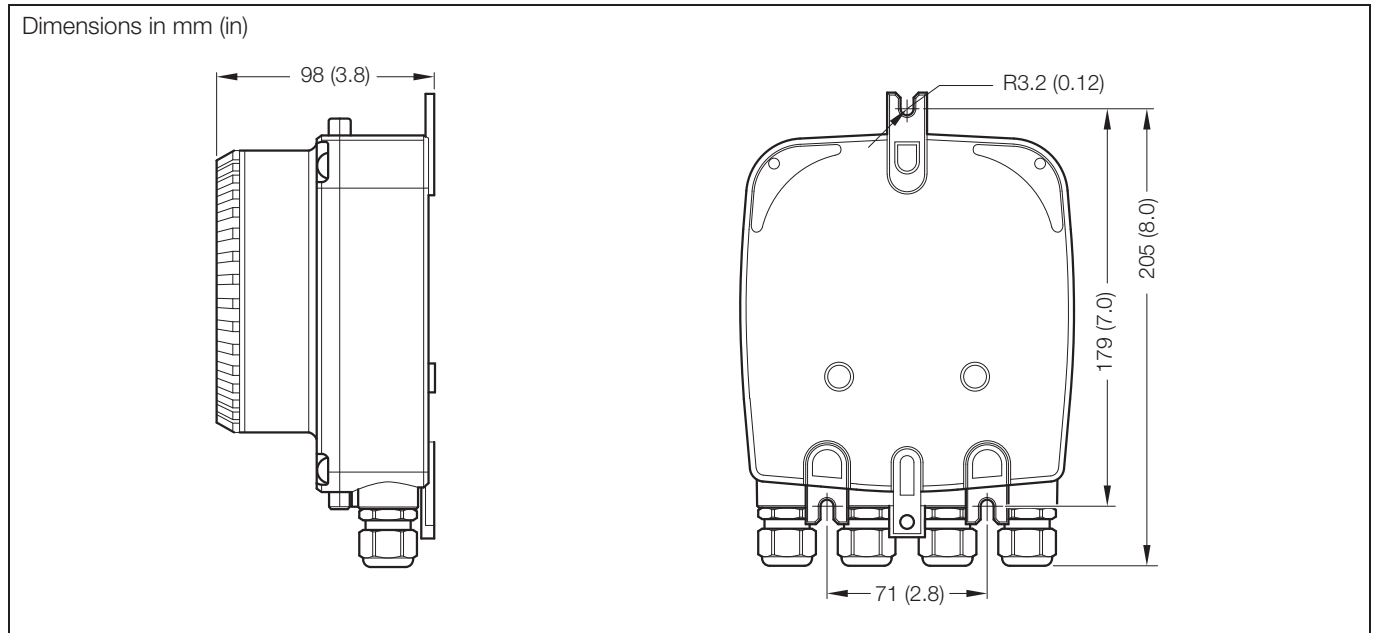
DN350 to 600 (14 to 24 NB) FM – approved version

~~Transmitter dimensions~~

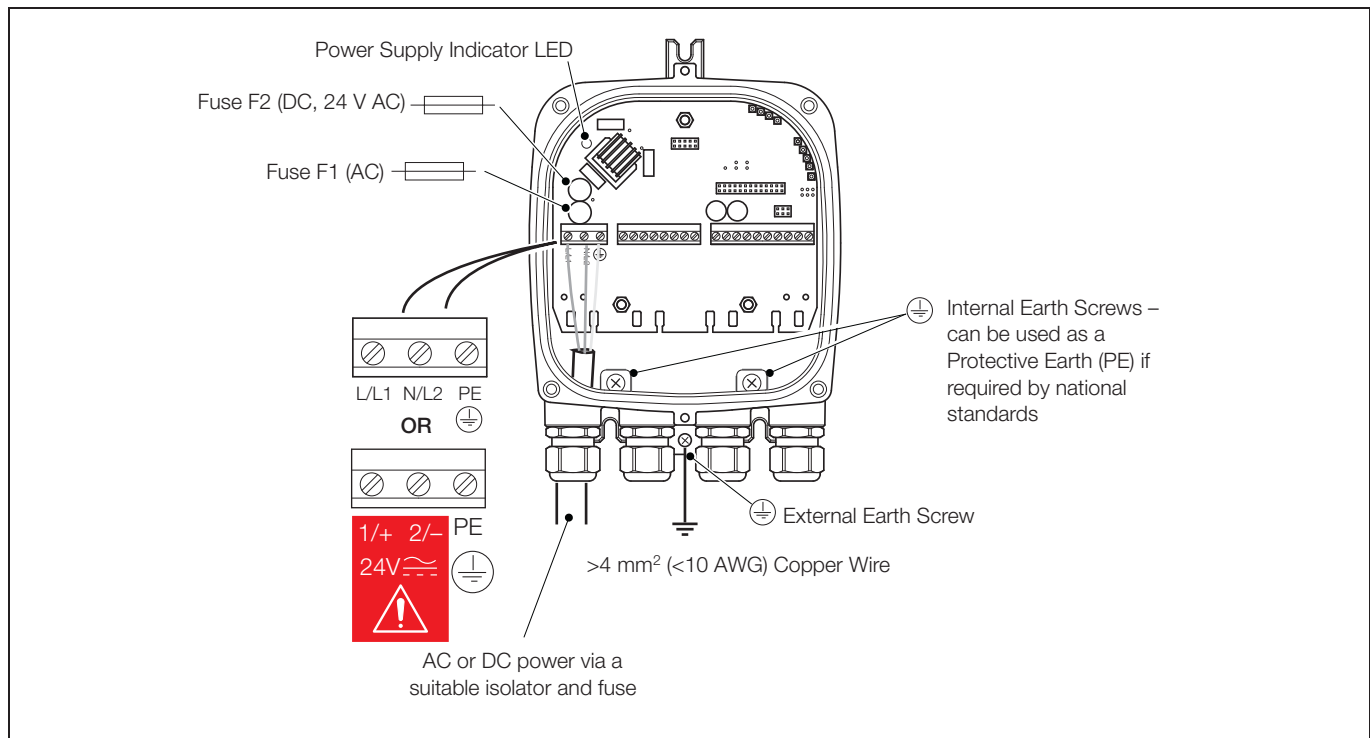
~~Integral transmitter~~



Remote transmitter



Electrical connections



AC and DC power supply connections

**END
OF
SECTION**

13. ELECTRICAL INTERCONNECTIONS

This section includes data and drawings for typical field wiring.

13.01 TYPICAL FIELD WIRING PLAN

13.02 ELECTRICAL INSTALLATION RECOMMENDATIONS

13.03 PUMP CABLE INSPECTION AND INSTALLATION RECOMMENDATIONS

13.04 STANDARD PANEL GROUNDING AND BONDING GUIDE

IMPORTANT!

Romtec Utilities has not produced site electrical drawings. Any site electrical drawings in this Scope of Supply and Design Submittal have been produced by others. Romtec Utilities has not checked the site electrical drawings for their accuracy.

Romtec Utilities makes no claim as to the accuracy of information contained in these site electrical drawings.

The typical field wiring plan is only a suggestion by Romtec Utilities. Receiving final approval of the field wiring on the approved site plan and/or site electrical drawings is the responsibility of the Customer or the Customer's representative.

Romtec Utilities makes no claim as to the suitability of the typical field wiring plan for the project.

IMPORTANT!

Romtec Utilities does not provide cored holes into the wet well for electrical conduit ports or conduit runs. The electrically related cored holes into the wet well are the responsibility of the contractor and electrician.

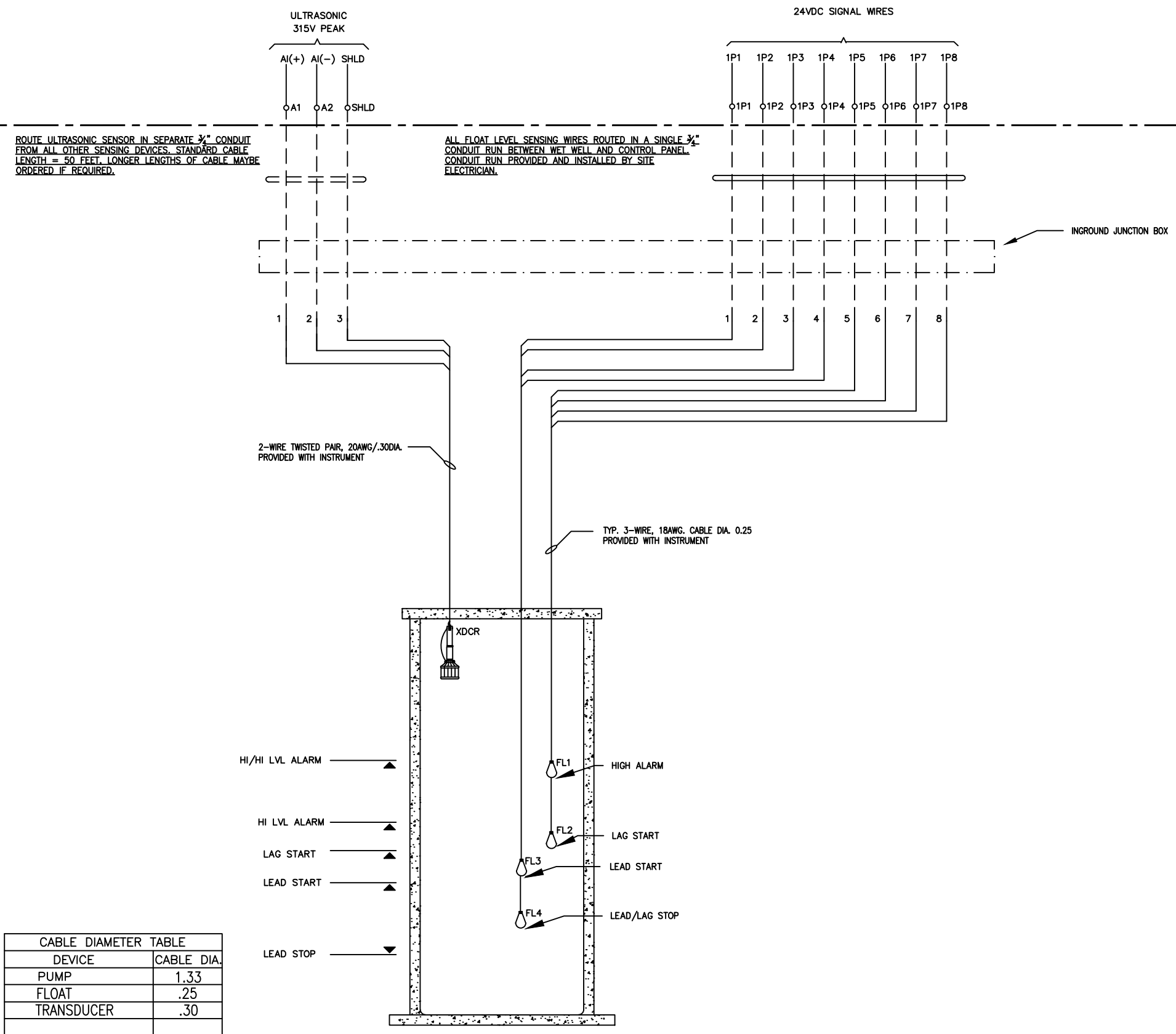
Wet well electrically related cored holes' final size, orientation, height and number are best determined after installation of the wet well and other electrical components.

CONTROL PANEL

FIELD WIRING

LIFT STATION CONTROL PANEL WITH TERMINAL INTERCONNECTS SUPPLIED BY ROMTEC UTILITIES INSTALLED BY SITE ELECTRICIAN

- NOTES 1. CONDUITS AND WIRES TO BE PROVIDED AND SIZED BY ELECTRICAL CONTRACTOR. ACTUAL FIELD WIRING MY VARY FOR YOUR PANEL. CONSULT ASBUILT WIRING DOCUMENTATION. THESE DRAWINGS ARE A SUGGESTION ONLY. ALL STATE AND LOCAL CODES SUPERCEDE THESE SUGGESTIONS.
2. THE CONNECTION DIAGRAM DRAWING AIDS IN THE UNDERSTANDING AND INSTALLATION OF THE CONTROL SYSTEM. COMPLETE FIELD WIRING AND INSTALLATION INSTRUCTIONS ARE NOT INCLUDED HERE. THE CORRECT INSTALLATION AND CONFORMANCE TO ALL APPLICABLE CODES IS THE RESPONSIBILITY OF THE INSTALLER.
3. INSTALL CONDUIT SEALS RATED FOR CLASS 1, DIV 1 AS REQUIRED.



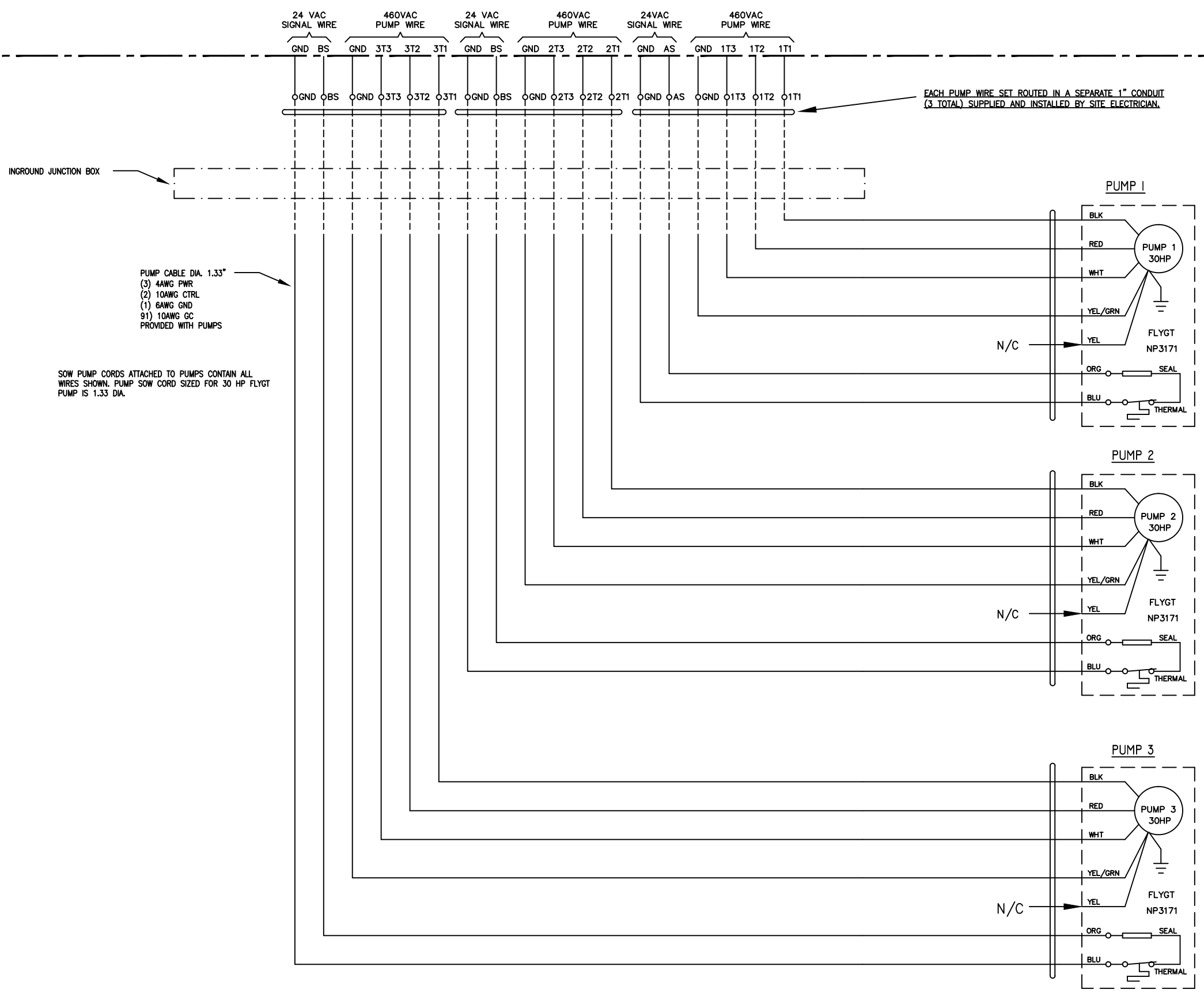
DEVICE	CABLE DIA.
PUMP	1.33
FLOAT	.25
TRANSDUCER	.30

E0114D01	7/9/13
DSN. KAS	DESCRIPTION
DRN. KAS	REVISIONS
CHK. KAS	REV. DATE
	BY

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ROMTEC UTILITIES
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 (541)-496-9678
 FAX (541)-496-0804
 www.romtecutilities.com

BAY MEADOWS
 SAN MATEO
 FIELD CONNECTION DIAGRAM
 PUMPS AND SENSORS



E0114001	REV	DATE	DESCRIPTION	BY
	KAS			
	KAS			
	KAS	7/9/13		

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BAY MEADOWS
 SAN MATEO
 FIELD CONNECTION DIAGRAM
 PUMPS AND SENSORS

13.02 ELECTRICAL INSTALLATION RECOMMENDATIONS

The following information is a recommendation only. It is the responsibility of the installing electrical contractor to review all as-built system information and make the installation as per the National Electrical Code (NEC).

Install all electrical conduits in accordance with the NEC, or as shown, whichever is greater.

Install all branch circuit and feeder conductors in accordance with the NEC, or as shown, whichever is greater.

Install all branch circuit and/or feeder overcurrent protection devices in accordance with the NEC.

Lift Station Control Panel (LCP)						
Volts	480		Largest HP	30		
Phase	3		Largest FLA	36.0		
Frequency	60 HZ		Total FLA	122.2		

13.02 ELECTRICAL INSTALLATION RECOMMENDATIONS

Recommended Conduit Sizes				
Device	HP	Power Dia.	Control Dia.	Conduit Size
<i>Pump 1</i>	<i>30</i>	<i>1.33</i>	<i>N/A</i>	<i>2"</i>
<i>Pump 2</i>	<i>30</i>	<i>1.33</i>	<i>N/A</i>	<i>2"</i>
<i>Pump 3</i>	<i>30</i>	<i>1.33</i>	<i>N/A</i>	<i>2"</i>
<i>Floats</i>			<i>.25</i>	<i>1"</i>
<i>Transducer</i>			<i>.315</i>	<i>1"</i>

Note: All conduit calculations based on rigid metal conduit (RMC) @ 40% maximum fill as per the 2011 National Electrical Code.

Conduits are sized from the control panel to the in-ground junction box utilizing individual copper XHHW-2 conductors.

Size all conduits in accordance with the NEC, or as recommended, whichever is greater.

Special Note: The above information is preliminary information only. It is the installing contractor's responsibility to reference the as-built documentation to verify all information and to confirm that the installation meets the requirements of the National Electrical Code and any local code requirements.

Further Recommendations:

Where the NEC allows, use schedule 40 PVC for all conduits installed underground. Use a long radius rigid steel conduit elbow and rigid steel conduit for transition to above grade terminations. PVC conduit shall not be exposed. All below grade rigid steel conduit shall be PVC coated, half-lap wrapped with corrosion protection tape, or coated with corrosion protection paint.

13.03 PUMP CABLE INSPECTION AND INSTALLATION RECOMMENDATIONS

Recommendations:

1. Inspect the full length of the pump cable for any signs of damage which may include abrasions, cuts, crushed insulation, and signs of moisture entry.
2. If cable damage is found, further testing of the cable and its overall integrity will need to be performed by a qualified technician.

Note: *A high percentage of cable failures are due to mechanical damage, which typically occurs during transportation, handling and installation.*

3. When cables are installed in a raceway, underground electrical duct or cable tray, the following factors should be considered.
 - a. Cable configuration
 - b. Raceway or cable tray fill
 - c. Physical limitations of cables
 - d. Installation equipment
 - e. Ambient temperature and conditions

Note: *Low temperatures are a cause for concern when installing cables.*

4. Prior to performing a low temperature (less than 10°F) cable installation, cables should be pre-conditioned by storing for a minimum of 24 hours at a temperature of 55°F or higher.
5. Do not impact, drop, kink or bend cable sharply in low temperatures.
6. All cables to be installed in a raceway shall be pulled together. They should be trained and guided into the raceway using an approved pulling compound or lubricant when necessary.
7. Conduits shall be cleaned prior to installing cables to ensure that the outer jacket is not damaged.
8. Pump cables shall be supported vertically in the wet well by stainless steel wire mesh support grips sized for the application.

13.03**PUMP CABLE INSPECTION AND
INSTALLATION RECOMMENDATIONS**

- 9.** All hardware including fittings, hangers, supports, and fasteners shall have corrosion protection suitable for the atmosphere.
- 10.** Conduit bushing shall be installed where required to prevent cable damage.
- 11.** Pump cables shall be installed in the wet well with adequate length to allow for removal of the pumps without disconnecting the cables.
- 12.** Extra cable length shall be secured so as not to interfere with pump intake.

13.04

STANDARD PANEL GROUNDING AND BONDING GUIDE

GENERAL

This guide is provided to assist with the design of the grounding and bonding requirements for installing industrial control panels. This guide is not intended to be used in lieu of other regulatory standards. Always consult all pertinent regulatory standards and local standards to ensure full compliance.

SCOPE

In order to understand the reasons for many of the practices that are recommended. It is helpful to segregate these practices into two separate categories as follows:

1. General protective grounding practices as required by the National Electrical Code and local jurisdictions.

Systems and circuit conductors are grounded to limit voltages due to lightning, line surges, or unintentional contact with higher voltage lines, and to stabilize the voltage to ground during normal operation. Systems and circuit conductors are solidly grounded to facilitate overcurrent device operation in case of ground faults.

2. System common signal grounding and wire routing.

Those practices which make the equipment immune to electrical noise originating within or without the equipment. These practices compliment the protective grounding practices in providing noise immunity.

PROTECTIVE GROUNDING

1. All protective grounding practices shall be in compliance with all local, state and National Electrical Codes.
2. Equipment grounding conductors shall be connected to the equipment grounding bus or to an equipment grounding termination point provided in a single-section industrial enclosure.

13.04 STANDARD PANEL GROUNDING AND BONDING GUIDE

3. All panels that are greater than 15 feet in length should be grounded at both ends. The equipment grounding conductor shall be sized from the National Electrical Code and shall be sized in accordance with Table 250.122.
4. There shall be a bonding jumper across the ground bus or floor sill between any shipping splits that is sized in accordance with the National Electrical Code Table 250.122.
5. The equipment grounding terminal shall be a ground stub or bus suitable for aluminum or copper conductors that is bonded to the panel enclosure using brazing or bolting in such a manner that the conducting path has a resistance of one ohm or less.
6. An equipment grounding conductor sized in accordance with the National Electrical Code shall be installed from the control enclosure to the main service grounding electrode system.
7. Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.
 - a. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
 - b. Exothermic-Welded Connections: Used for connections to structural steel and for underground connections.
 - c. Equipment Grounding Conductors: Comply with National Electrical Code, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by National Electrical Code are indicated.
 - d. Install insulated equipment grounding conductors in all raceways.
 - e. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

13.04

**STANDARD PANEL GROUNDING AND
BONDING GUIDE**

- f. Provide insulated copper grounding conductors, in conduit, from main service equipment, or grounding bus, to main metal water service piping (if present). Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - g. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
 - h. Bond metal piping systems to equipment grounding conductors of associated pumps, fans, and blowers.
 - i. Bond each aboveground portion of gas piping system (if present) upstream from equipment shutoff valve.
 - j. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
 - k. Bond the equipment grounding conductor to each pull box, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
 - l. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.
 - m. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
8. Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible

13.04

STANDARD PANEL GROUNDING AND BONDING GUIDE

SYSTEM COMMON SIGNAL GROUNDING

1. The electronic control common signal shall be grounded at one point only.
2. An insulated bonding jumper may be installed between signal common points where necessary due to shipping splits and system layouts.
3. When unlike signal levels must cross they should cross at 90 degree angles and at a maximum spacing.
4. Within the confines of pull boxes and junction boxes, levels should be kept separate, if required grounded barriers should be used to assist level spacing.
5. Care should be taken so that low level signals are not looped around high level control or power conductors.

GENERAL INSTALLATION NOTES

1. Only those connections points required for Romtec Utilities' equipment, including defined tie points or as purchased, will be provided. Customer will be responsible for all other connections.
2. No more than two wires should be connected to any one control terminal point.
3. All raceways entering the control panel from underground shall be sealed.

**END
OF
SECTION**

14. CONTROL PANEL & COMMUNICATIONS

This section includes design and data pertinent to the control panel and electrical communication.

This section is structured as follows:

14.01 STANDARD TEMPERATURE SPECIFICATIONS

14.02 POWER QUALITY DISCLAIMER

14.03 ELECTRICAL SYSTEM DESIGN VOLTAGE

14.04 SPECIFICATIONS – CONTROL PANEL SCOPE OF SUPPLY

14.05 ONE-LINE DRAWING

14.06 WIRE & CONDUIT SCHEDULE

14.07 SEQUENCE OF OPERATION

14.08 SPEED SETTING CHART

14.09 SCADA REMOTE TERMINAL UNIT

14.10 CONTROL PANEL DATA SHEETS

14.01

STANDARD TEMPERATURE SPECIFICATIONS

Standard Temperature Specifications for Electrical Control Panels Without VFDs:

Operating Temperature Ranges Tmin ¹ All = -5°F (-20C)	NEMA 4 Painted Gray	NEMA 4 Painted White	NEMA 4X Stainless Steel	NEMA 3R With Fans
Direct Sun Exposure	Tmax 96°F (35.6°C)	Tmax 109°F (42.8°C)	Tmax 106°F (41.1°C)	Tmax 118°F (41.1°C)
No Sun Exposure (Completely Shaded)	Tmax 109°F (42.8°C)	Tmax 109°F (42.8°C)	Tmax 109°F (42.8°C)	Tmax 120°F (42.8°C)
Direct Sun Exposure Air Conditioned Enclosure	Tmax 112°F (44.4°C)	Tmax 122°F (50°C)	Tmax 118°F (47.8°C)	Not Applicable

1. If lower temperature ranges are required a larger than standard heater can be added at additional cost.
2. If higher temperature ranges are required an air conditioner unit can be added at additional cost.

Application Notes Regarding Temperature:

- Romtec Utilities recommends adding sunshades to all enclosure installations.
- Direct sunlight doubles heat loading in gray painted cabinets as reflected in the above temperature specifications. Romtec Utilities does not recommend using gray painted cabinets in direct sunlight applications.
- Where large temperature swings (less than -5°F to greater than 96°F) are common, consider purchasing a Romtec Utilities shelter or building.
- The above operating temperatures do not reflect cabinets containing VFDs. When VFDs are required the Romtec Utilities suggested enclosure is NEMA 3R with fans. Romtec Utilities can accommodate other VFD enclosure configurations but this will require full design analysis including expected site temperature ranges provided by the customer.
- Romtec Utilities will not warranty panels that are operating outside of the stated temperature ranges.
- Panels that are partially shaded fall into the Direct Sun Exposure temperature ranges listed above. Romtec Utilities cannot quantify the effect of partial shading related to temperature performance.
- Designs do not include air-conditioning unless specifically requested.

Power Quality

Poor power quality can have an adverse effect on the control system operation and reliability. In addition, pump motors can be damaged by sustained application of unbalanced phase voltages and/or balanced phase voltages operating above or below normal nameplate ratings.

Romtec Utilities recommends that the supply voltage to the Romtec Utilities control panel comply with the National Equipment Manufacturers Association (NEMA) Standard MB1-1987-SECTION 14.34B. Any performance issues that arise as a result of the supply voltage not meeting these standards are the responsibility of the owner. Romtec Utilities is not responsible for identifying or mitigating any power quality issues that are result of power quality associated with the utility supply voltage.

NEMA Published Tolerances

Voltage imbalance not to exceed 1% measured at the motor terminals

Current imbalance not to exceed 5% measured at the motor terminals

Voltage levels not to exceed +/- 10% name plate rating.

14.03 ELECTRICAL SYSTEM DESIGN VOLTAGE



3/5/14
BAY MEADOWS
SAN MATEO, CA

Electrical System Design Voltage

This system has been designed to operate on 480V, 3 Phase supplied power.

Please verify that this is the correct voltage configuration available on-site.

14.04 SPECIFICATIONS—CONTROL PANEL SCOPE OF SUPPLY

Control Panel Scope of Supply 3/5/14 BAY MEADOWS SAN MATEO, CA

General information

- ELECTRICAL SERVICE - 480V, 3 Phase
- PUMPS - (3) 30HP, 460V, 3 PH, 36 FLA, TRIPLEX configuration
- PUMPS - MODEL FLYGHT , NP3171
- BLOWER MOTOR - (1) 10HP, 460V, 3PH
- PRIMARY CONTROLLER - MOTOROLA PLC configured for TRIPLEX
- CONTROL PANEL MOUNTING - FLOOR MOUNT

Liquid level sensing

- PRIMARY LEVEL SENSING - HYDRORANGER 400 ULTRASONIC
- BACKUP LEVEL SENSING - (4) NOLTA MS1 FLOATS WIRED FOR INTRINSICALLY SAFE

Station Control Panel General Description

Qty.	Description
1	NEMA 3R PAINTED STAINLESS STEEL, 78"H X 72"W X 30"D enclosure.
-	The enclosure shall be one freestanding enclosure consisting of four different compartments within one footprint.
-	The Service compartment shall be a NEMA Type 3R rated compartment that houses the main service power components.
-	The MCC compartment shall be NEMA Type 3R rated compartment that houses the motor starter components.
-	The Control compartment shall be NEMA Type 4X rated compartment that houses all controls associated with the panel. The maximum voltage within this compartment is to be 120vac.
-	The Skirt compartment is a nonrated vented compartment that provides an area for the entry conduits. All conduits with the exception of line power will come through the Skirt compartment.

Service Compartment

	NEMA 3R PAINTED STAINLESS STEEL, 78"H X36"W X 12"D enclosure.
1	200A Main circuit breaker with lockable operator handle on dead front.
1	Surge arrestor connected to the load side of the main service circuit breaker.
1	Phase monitor to provide phase reversal, overvoltage and under voltage protection.
1	Surge Capacitor connected to the load side of the main circuit breaker disconnect.
1	2KVA control power transformer, 1 phase, 480VAC/120VAC.
1	Meltrics generator receptacle P/N 49-44143

MCC Compartment

- NEMA 3R PAINTED STAINLESS STEEL, 78"H X36"W X 18"D enclosure.
- 1 3-Phase voltage indicator mounted on the door of the MCC compartment.
- 1 Door interlock to prevent access into the MCC compartment unless the main power is disconnected.
- 3 Pump motor circuit breakers.
- 3 Variable frequency drives
- 3 Current Transformers
- 1 Door interlock circuit breaker
- 2 Ventilation fans thermostatically operated w/shrouds
- 1 Compartment service light door operated.
- 1 Blower motor circuit breaker
- 1 Blower Motor Starter
- 1 400W heater w/thermostat
- Pump terminal blocks for field wiring terminations.
- Compartment interconnection seal barrier.

Control Compartment

- NEMA 3R PAINTED STAINLESS STEEL, 60"H X36"W X 12"D enclosure.
- 1 Enclosure light and door activated switch
- 1 HydroRanger LTU 400
- 1 Motorola ACE3600 CPU with radio #F7574A
- 1 Metal Chassis #V056
- 1 DC Power Supply #V261
- 1 10 Ah Backup Battery #V328
- 2 16 DI 4 DO EE 4 AI, +/-20mA Combination Module #V245
- 2 8 DO EE Relay 2A Digital Relay Output Module # V508
- 1 4 AO, Analog output module #V118
- 1 Blank I/O Module #V20
- 4 I/O Module Cables 20-wire #V253
- 2 I/O Module Cables 30-wire #V202
- 3 Variable frequency drive remote mounted keypads
- 1 Redundant back up control system consisting of four floats.
- 1 Separate circuit breakers mounted on the operator interface to control the following
 - 1. Convenience outlet dead front mounted- 5A
- 5 Separate circuit breakers mounted in the control compartment to control the following functions:
 - 1. Main control power
 - 2. Fans
 - 3. Panel Heater
 - 4. Control wiring
 - 5. 24vdc Power supply
- 1 Anti-condensation heater
- 1 Alarm beacon externally mounted.
- 4 HOA selector switches for manual pump control
- 4 "Run" pilot light, green, push to test, located on dead front
- 4 "Reset" illuminated push-buttons, push to reset, located on dead front

- 3 Elapsed run timers
- 1 ABB Flow Meter Transmitter
- 2 Intrinsically safer barrier for four floats.
- 1 UL 698A Label.
- 3 Warning arc flash and shock hazard label Emedco #QS3743 or equivalent.
- 1 Danger 480 volts label Emedco #QS3647 or equivalent.
- 1 Danger this equipment has a back-up power supply label Emedco #QS3569 or equivalent.
- Terminal blocks used for interconnecting field devices
- Panel wiring numbering.
- * PLC and SCADA programming by Thunderbird Communications

SLOT 1 COMBINATION MODULE

- DI1 Pump 1 Auto - HOA
- DI2 Pump 1 Running
- DI3 Pump 1 Seal Fail
- DI4 Pump 1 Overtemp
- DI5 Pump 1 VFD Fault
- DI6 Pump 2 Auto - HOA
- DI7 Pump 2 Running
- DI8 Pump 2 Seal Fail
- DI9 Pump 2 Overtemp
- DI10 Pump 2 VFD Fault
- DI11 Pump 3 Auto - HOA
- DI12 Pump 3 Running
- DI13 Pump 3 Seal Fail
- DI14 Pump 3 Overtemp
- DI15 Pump 3 VFD Fault
- DI16 Panel Intrusion
- DO1 Spare
- DO2 Spare
- DO3 Spare
- DO4 Spare
- AI1 Level Signal from Hydroranger (4-20mA)
- AI2 Pump 1 Motor Current
- AI3 Pump 2 Motor Current
- AI4 Pump 3 Motor Current

SLOT 2 INPUT MODULE

- DI1 Blower Auto - HOA
- DI2 Blower Running
- DI3 Blower Fail Proof Switch
- DI4 Generator Run
- DI5 Generator Fail
- DI6 Generator Low Fuel
- DI7 ATS Normal
- DI8 ATS in Emergency
- DI9 Power Fault (OR combination of Phase and TVSS)
- DI10 Redundant High Level Alarm
- DI11 Pump 1 Reset
- DI12 Pump 2 Reset
- DI13 Pump 3 Reset
- DI14 Hydroranger Faulted

DI15	Spare
DI16	Spare
DO1	Spare
DO2	Spare
DO3	Spare
DO4	Spare
AI1	Force Main Pressure Switch (4-20mA)
AI2	Flow Meter (4-20mA)
AI3	Spare
AI4	Spare

Slot 3 Output Module

Digital Outputs

DO1	Pump 1 Call
DO2	Pump1 Fail
DO3	Pump 2 Call
DO4	Pump 2 Fail
DO5	Pump 3 Call
DO6	Pump 3 Fail
DO7	Blower Call
DO8	Blower Fail

Slot 4 Output Module

Digital Outputs

DO1	High Level Alarm
DO2	System Reset
DO3	System Alarm
DO4	Pump 1 Reset
DO5	Pump 2 Reset
DO6	Pump 3 Reset
DO7	Spare
DO8	Spare

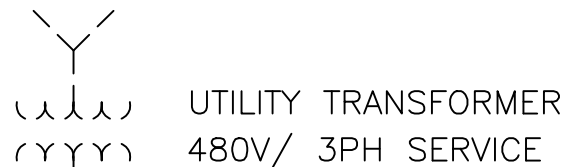
Slot 5 Analog Output Module

Digital Outputs

AO1	Pump 1 Speed Reference
AO2	Pump 2 Speed Reference
AO3	Pump 3 Speed Reference
AO4	Spare

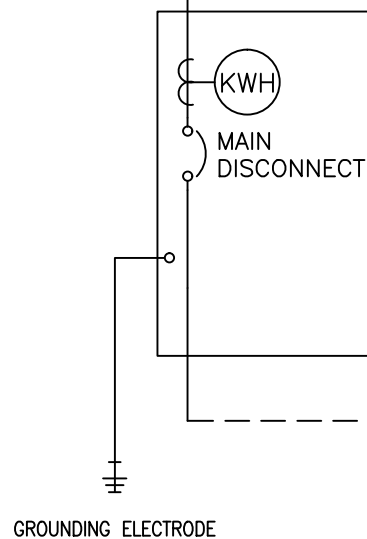
Note: Reviewed I/O requirements with Tom Swick of Thunderbird Communicaitons on 9/5/13. Secondary review of equipment and I/O layout will be conducted prior to construction of the control panel.

① INCOMING POWER
480V/ 3PH/ SERVICE



NOTE:
THE ONE-LINE DRAWINGS AID IN THE UNDERSTANDING AND INSTALLATION OF THE CONTROL SYSTEM. COMPLETE FIELD WIRING AND INSTALLATION INSTRUCTIONS ARE NOT INCLUDED HERE. THE CORRECT INSTALLATION AND CONFORMANCE TO ALL APPLICABLE CODES IS THE RESPONSIBILITY OF THE INSTALLER.

② METER MAIN (BY OTHERS)

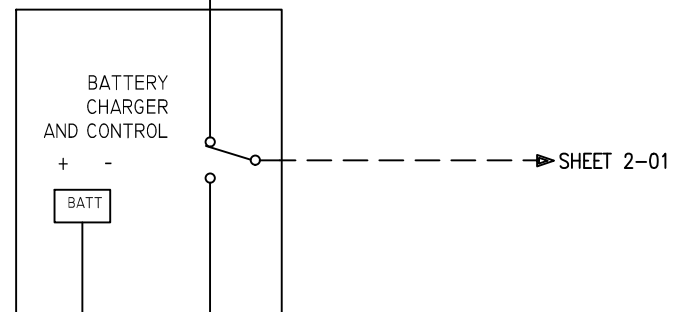


AUTOMATIC TRANSFER SWITCH 225 AMP, 3 PHASE
GENERATOR PERMANENT / DIESEL, 100 kW, 480V, 60Hz

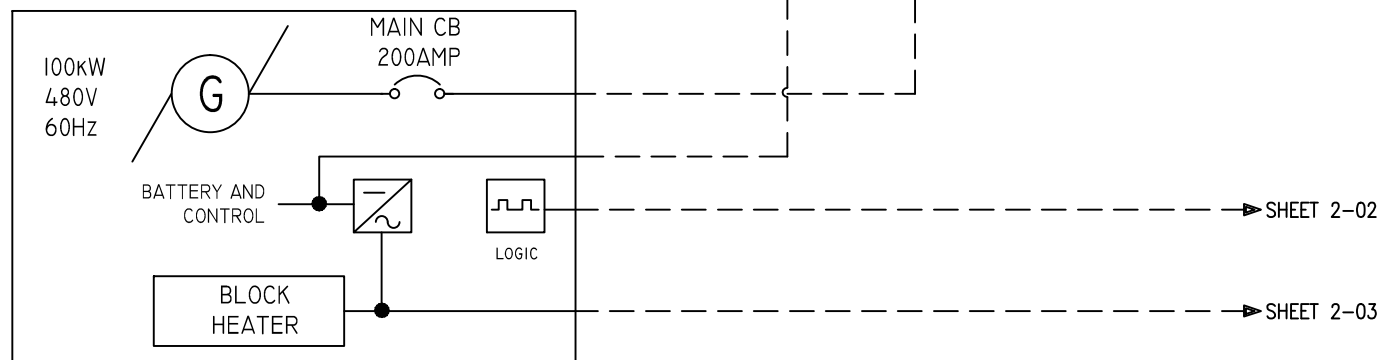
EMERGENCY POWER BACK-UP SYSTEM:

ALL GENERATORS SPECIFIED MEET OR EXCEED CURRENT FEDERAL EPA EMISSION STANDARDS. IT IS THE RESPONSIBILITY OF THE GENERATOR PURCHASER AND / OR INSTALLER TO REVIEW ALL GENERATOR SPECIFICATIONS TO DETERMINE IF THE GENERATOR SPECIFIED MEETS ALL STATE OR LOCAL STANDARDS.

③ A.T.S.
225A,3P



④ GENERATOR PERMANENT/DIESEL
100DSGAA



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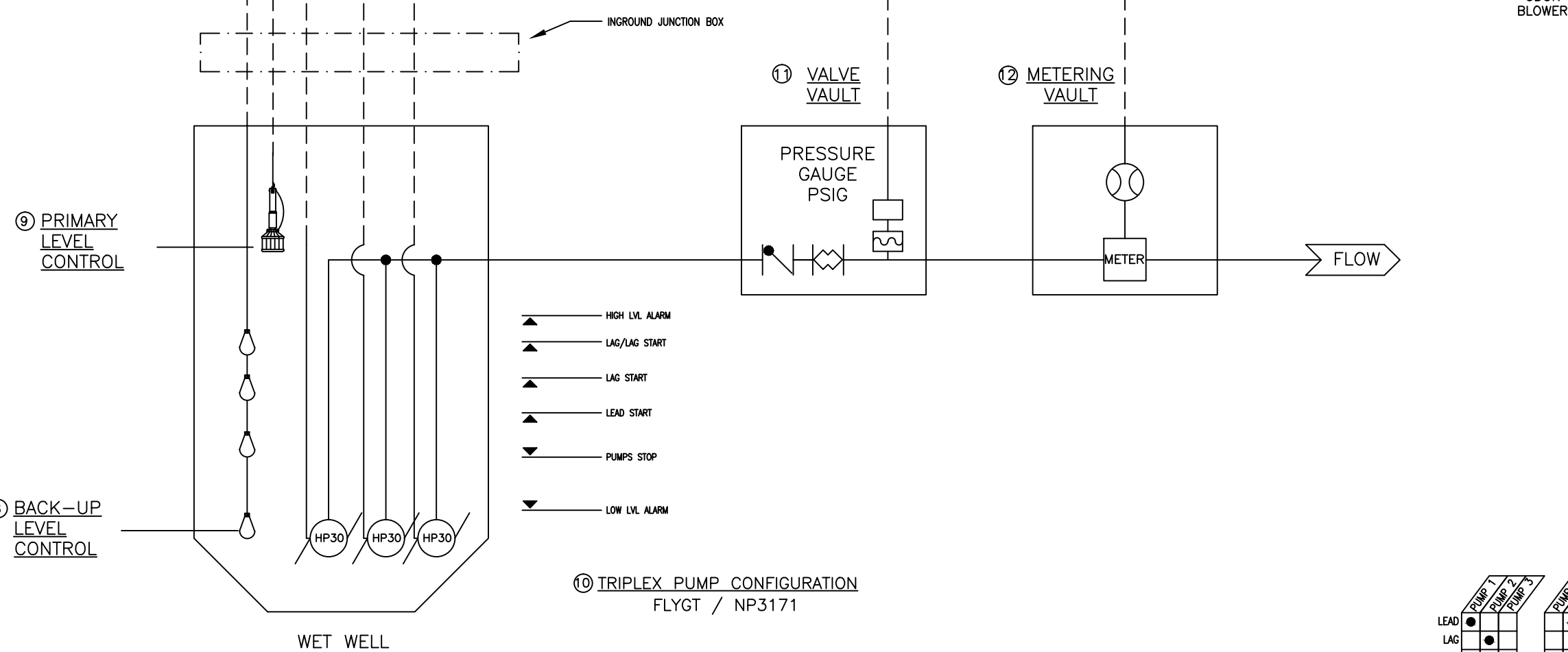
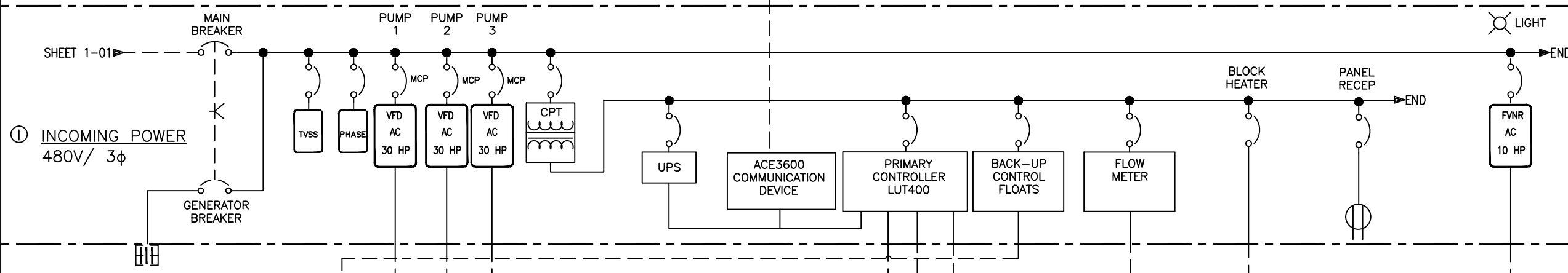
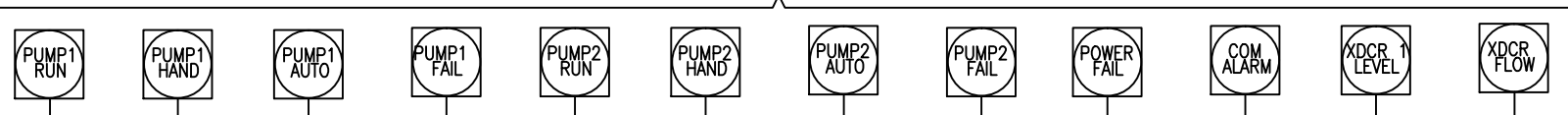
BAY MEADOWS
SAN MATEO
TRIPLEX LIFT STATION SYSTEM
ONE LINE DIAGRAM
DRAWING

SCADA

CONTROL PANEL

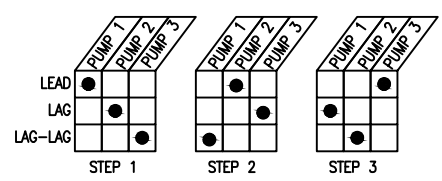
FIELD

OUT FOR CUSTOMER USE



- ▲ HIGH LVL. ALARM
- ▲ LAG/LAG START
- ▲ LAG START
- ▲ LEAD START
- ▼ PUMPS STOP
- ▼ LOW LVL. ALARM

⑩ TRIPLEX PUMP CONFIGURATION
FLYGT / NP3171



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BAY MEADOWS
SAN MATEO
TRIPLEX LIFT STATION SYSTEM
ONE LINE DIAGRAM
DRAWING

GENERAL NOTES:

1. THE ELECTRICAL CONTRACTOR SHALL SUPPLY POWER TO AND MAKE ALL CONNECTIONS TO THE EQUIPMENT SHOWN ON THE ELECTRICAL ENGINEER'S ELECTRICAL SITE PLAN. IT SHALL BE THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO REVIEW ALL THE DRAWINGS FOR THE LOCATION AND SIZE OF EQUIPMENT. IT SHALL BE THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO FAMILIARIZE HIM/HERSELF WITH THE PLANS AND SPECIFICATIONS AND ASK FOR CLARIFICATION, IF ANY IS REQUIRED, BEFORE INSTALLATION BEGINS.
2. THE ELECTRICAL CONTRACTOR SHALL SUPPLY THE INCOMING POWER.
3. ALL ITEMS RELATED TO THE ELECTRICAL SERVICE SUCH AS SERVICE CONDUIT, CONDUCTORS, DUCTS, PAD MOUNT, RISERS, PULL BOXES, PERMITS, FEES, AND PROTECTIVE COVERING FROM THE SERVICE POINT LOCATION SHALL BE VERIFIED WITH THE SERVING UTILITY. THE ELECTRICAL CONTRACTOR SHALL INSTALL THE SERVICE IN COMPLIANCE WITH THE SERVING UTILITY, NATIONAL ELECTRICAL CODE, STATE AND LOCAL ELECTRICAL CODES.
4. THE ELECTRICAL CONTRACTOR SHALL SUPPLY AND INSTALL THE METER BASE AND MEANS OF MAIN DISCONNECT (A METER MAIN IS THE PREFERRED EQUIPMENT).
5. THE ELECTRICAL CONTRACTOR SHALL SUPPLY AND INSTALL ALL REQUIRED CONDUIT AND WIRE TO CONNECT TO THE ROMTEC UTILITIES SUPPLIED EQUIPMENT.
6. IT SHALL BE THE ELECTRICAL CONTRACTOR'S RESPONSIBILITY TO SIZE AND INSTALL ALL CONDUIT AND CONDUCTORS AS PER THE ELECTRICAL ENGINEER'S ELECTRICAL SITE PLAN, NEC, STATE AND LOCAL ELECTRICAL CODES.
7. INSTALLATION OF EQUIPMENT INCLUDING ANY GROUNDING ARRANGEMENT TO BE IN ACCORDANCE WITH NEC ARTICLES 501, 502, 504 AND ANSI/ISA-RP12.06.01-2003 RECOMMENDED PRACTICE FOR WIRING METHODS FOR HAZARDOUS (CLASSIFIED) LOCATIONS INSTRUMENTATION WHEN APPLICABLE.

ELECTRIC NOTES:

1. INCOMING POWER
480V THREE PHASE POWER
2. METER MAIN
POWER UTILITY METER BASE AND METHOD OF MAIN DISCONNECT. METER BASE MUST CONFORM TO THE LOCAL SERVICE PROVIDERS REQUIREMENTS. PROVIDE METHOD OF MAIN DISCONNECT, (A METER MAIN IS PREFERRED).
MOUNTED AS A SEPARATE ENCLOSURE IN COMPLIANCE WITH NEC, STATE, AND LOCAL ELECTRICAL CODES.
3. AUTOMATIC TRANSFER SWITCH
A.T.S. 225 AMP, 3 PHASE
ENCLOSURE TYPE - NEMA 3R
MOUNTED AS A SEPARATE ENCLOSURE IN COMPLIANCE WITH NEC, STATE, AND LOCAL ELECTRICAL CODES.

4. GENERATOR PERMANENT GENERATOR, 100 kW, 480V, 60Hz
FUEL - DIESEL
24HR FUEL TANK AT FULL LOAD
MOUNTED AS A SEPARATE PIECE OF EQUIPMENT IN COMPLIANCE WITH
NEC, STATE, AND LOCAL ELECTRICAL CODE.
5. LIFT STATION CONTROL PANEL
POWER CONFIGURATION:
THREE PHASE INCOMING POWER
TRIPLEX PUMP CONTROL PANEL

PRIMARY SYSTEM CONTROLLER:
- MOTOROLA ACE3600

PRIMARY LEVEL CONTROLLER:
- HYDRORANGER LUT400

BACK-UP LEVEL AND PUMP CONTROLLER:
- NOLTA MS1 FLOATS

CONTROL PANELS ARE UL LISTED AS A COMPLETE CONTROL PANEL.
ENCLOSURE:
- NEMA 3R PAINTED STAINLESS STEEL ENCLOSURE
- ARC ARMOR
- FLOOR MOUNT

OPTIONAL EQUIPMENT:
BEACON
ODOR BLOWER
BLOWER PROOF SWITCH
IN GROUND JUNCTION BOX
6. COMMUNICATIONS
PRIMARY COMMUNICATION UNIT.
- RADIO MODEM
7. PUMP DISCONNECT PANEL
N/A

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	DRN. KAS
	CHK. KAS
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<p>BAY MEADOWS SAN MATEO TRIPLEX LIFT STATION SYSTEM ONE LINE DIAGRAM DRAWING</p>	
SHEET	
3 OF 4	

ELECTRIC NOTES CONTINUED:

8. BACK-UP LEVEL CONTROL
 - FLOATS
 BACK-UP LEVEL SYSTEM WILL OPERATE THE PUMPS IN THE EVENT OF A FAILURE OF THE PRIMARY LEVEL CONTROL SYSTEM AND PUMP CONTROLLER.
 THE BACK-UP SYSTEM IS A COMPLETELY REDUNDANT SYSTEM TO THE PRIMARY SYSTEM AND INCLUDES REDUNDANT HIGH ALARM, PUMPS STOP, AND PUMPS START.
9. PRIMARY LEVEL CONTROL
 - HYDRORANGER (XPS-15 ULTRASONIC)
 PRIMARY LEVEL CONTROL IS USED FOR ALL OPERATIONAL AND ALARM POINTS WITHIN THE WET WELL.
10. TRIPLEX PUMP CONFIGURATION
 FLYGT SUBMERSIBLE PUMPS.
 - NP3171
 - 460V/3PH/60HZ
 - 30HP
 - 36FLA

PIPING AND VALVE NOTES:

11. VALVE VAULT
SEE WET WELL COMPONENT DRAWING FOR DETAILS
12. METER VAULT
SEE METER VAULT COMPONENT DRAWING FOR DETAILS

SPECIAL NOTES:

1. THE PROJECT SITE ENGINEER AND ELECTRICAL ENGINEER ARE RESPONSIBLE FOR ALL ASPECTS OF THIS PROJECT. ROMTEC UTILITIES OFFERS THIS INFORMATION TO CLARIFY OUR PRODUCT OFFERING. THIS INFORMATION REFLECTS A TYPICAL PROJECT. DASHED LINES SHOW TYPICAL SITE WIRING/CONDUIT SUPPLIED AND INSTALLED BY ELECTRICIAN OR CONTRACTOR. PLEASE REFER TO THE PROJECT ENGINEER'S SITE PLANS AND ELECTRICAL LAYOUT FOR THE SPECIFIC DETAILS. THE PROJECT ENGINEER'S PLANS, SPECIFICATIONS AND THE APPROVED SUBMITTAL DOCUMENTS SHALL GOVERN ALL WORK.
2. ROMTEC UTILITIES DOES NOT PROVIDE CORED HOLES INTO THE WET WELL FOR ELECTRICAL CONDUIT RUNS. THE ELECTRICALLY RELATED CORED HOLES INTO THE WET WELL ARE THE RESPONSIBILITY OF THE CONTRACTOR AND ELECTRICIAN.
3. ALL COMMUNICATION DEVICES FOR REMOTE ANNUNCIATION OR SYSTEM CONTROL AND DATA ACQUISITION (SCADA) ARE TO BE CONFIGURED, TESTED, AND MAINTAINED BY OWNER/CONTRACTOR UNLESS OTHERWISE NOTED. ROMTEC UTILITIES WILL INSTALL CUSTOMER SPECIFIED COMMUNICATION DEVICES IN OUR CONTROL PANEL IF REQUESTED.

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BAY MEADOWS
 SAN MATEO
 TRIPLEX LIFT STATION SYSTEM
 ONE LINE DIAGRAM
 DRAWING

CONDUIT/ CABLE		WIRE				FROM		TO		WIRE				CONDUIT/ CABLE	
No.	Size	I.D. No.	TYPE/SIZE	CLR	WIRE NO.	MCC/PNL	TERM NO.	TERM NO.	PNL/DEVICE	WIRE NO.	CLR	TYPE/SIZE	I.D. NO.	SIZE	No.
1	2"		4/0	BRN		SERVICE DISCONNECT			AUTOMATIC TRANSFER SW.						
			4/0	ORG											
			4/0	YEL											
			#2AWG	WHT											
			#2AWG	GRN											
2	2"		4/0	BRN		GENERATOR			AUTOMATIC TRANSFER SW.						
			4/0	ORG											
			4/0	YEL											
			#2AWG	WHT											
			#2AWG	GRN											
3	2"		4/0	BRN		AUTOMATIC TRANSFER SW.			CONTROL PANEL						
			4/0	ORG											
			4/0	YEL											
			#2AWG	GRN											
4	3/4		12AWG	BLK		CONTROL PANEL			GENERATOR						
			12AWG	WHT					BLOCK HEATER CKT.						
			12AWG	GRN											
5	3/4					CONTROL PANEL			GENERATOR CONTROLS						
			14AWG	RED		GENERATOR RUNNING									
			14AWG	RED		GENERATOR FAIL									
			14AWG	RED		GENERATOR LOW FUEL									
			14AWG	RED		COMMON CONTROL									
			14AWG	RED		SPARE									
			14AWG	RED		SPARE									
			14AWG	GRN		EQUIPMENT GROUND									

BAY MEADOWS
TRIPLEX LIFT STATION
WIRE & CONDUIT SCHEDULE
DRAWING

NO.	REV	DATE	DESCRIPTION	BY
1		11/19/13		

DSN:KAS
DRN:KAS
CKD:KAS

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NOTES:

1. ALL CONDUCTORS ARE COPPER XHHW-2 UNLESS OTHERWISE NOTED.
2. (*) DENOTES CABLES SUPPLIED BY ROMTEC UTILITIES.
3. THIS CONDUIT AND WIRE SCHEDULE DOES NOT MAKE ANY PROVISIONS FOR GENERAL PURPOSE UTILITY OUTLETS OR LIGHTING.

CONDUIT/ CABLE		WIRE				FROM	TO	WIRE				CONDUIT/ CABLE					
No.	Size	I.D. No.	TYPE/SIZE	CLR	WIRE NO.	MCC/PNL	TERM NO.	TERM NO.	PNL/DEVICE	WIRE NO.	CLR	TYPE/SIZE	I.D. NO.	SIZE	No.		
6	3/4"					AUTOMATIC TRANSFER SW.			CONTROL PANEL								
			14AWG	RED		ATS NORMAL											
				RED		ATS IN EMERGENCY											
				RED		COMMON CONTROL											
				RED		SPARE											
				GRN		EQUIPMENT GROUND											
7	1"					CONTROL PANEL			JUNCTION BOX – P1								
			8AWG	BRN	1T1												
			8AWG	ORG	1T2												
			8AWG	YELL	1T3												
			10AWG	GRN	GRD												
			14AWG	BLU	CTR 1												
			14AWG	BLU	CTR 2												
7	1"					CONTROL PANEL			JUNCTION BOX – P2								
			8AWG	BRN	2T1												
			8AWG	ORG	2T2												
			8AWG	YELL	2T3												
			10AWG	GRN	GRD												
			14AWG	BLU	CTR 1												
			14AWG	BLU	CTR 2												
7	1"					CONTROL PANEL			JUNCTION BOX – P3								
			8AWG	BRN	3T1												
			8AWG	ORG	3T2												
			8AWG	YELL	3T3												
			10AWG	GRN	GRD												
			14AWG	BLU	CTR 1												
			14AWG	BLU	CTR 2												

NOTES:
4. ALL CONDUITS ARE RIGID METAL CONDUIT UNLESS OTHERWISE NOTED.

BAY MEADOWS
TRIPLEX LIFT STATION
WIRE & CONDUIT SCHEDULE
DRAWING

NO.	DATE	REV	DESCRIPTION	BY
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CONDUIT/ CABLE		WIRE				FROM		TO		WIRE				CONDUIT/ CABLE	
No.	Size	I.D. No.	TYPE/SIZE	CLR	WIRE NO.	MCC/PNL	TERM NO.	TERM NO.	PNL/DEVICE	WIRE NO.	CLR	TYPE/SIZE	I.D. NO.	SIZE	No.
8	1"					CONTROL PANEL			JUNCTION BOX - FLOATS						
			14AWG	BLU		PUMP STOP/ALARM FLOAT									
			14AWG	BLU		PUMP STOP/ALARM FLOAT									
			14AWG	BLU		LEAD PUMP START FLOAT									
			14AWG	BLU		LEAD PUMP START FLOAT									
			14AWG	BLU		LAG PUMP START FLOAT									
			14AWG	BLU		LAG PUMP START FLOAT									
			14AWG	BLU		LAG/LAG PUMP START FLOAT									
			14AWG	BLU		LAG/LAG PUMP START FLOAT									
			14AWG	GRN											
9	1"					CONTROL PANEL			JUNCTION BOX - LEVEL XDCR.						
			CABLE .33 DIA.			HYDRORANGER			HYDRORANGER						
10	* CBL		CABLE .33 DIA.			JUNCTION BOX			WET WELL						
						HYDRORANGER			HYDRORANGER						
11	* CBL		CABLE .25 DIA.			JUNCTION BOX			WET WELL						
						PUMP STOP/ALARM FLOAT			PUMP STOP/ALARM FLOAT						
12	* CBL		CABLE .25 DIA.			JUNCTION BOX			WET WELL						
						LEAD PUMP START FLOAT			LEAD PUMP START FLOAT						
13	* CBL		CABLE .25 DIA.			JUNCTION BOX			WET WELL						
						LAG PUMP START FLOAT			LAG PUMP START FLOAT						
14	* CBL		CABLE .25 DIA.			JUNCTION BOX			WET WELL						
						LAG/LAG PUMP START FLOAT			LAG/LAG PUMP START FLOAT						

BAY MEADOWS
TRIPLEX LIFT STATION
WIRE & CONDUIT SCHEDULE
DRAWING

NO.	REV.	DATE	DESCRIPTION	BY
1				

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NOTES:
5. CONDUIT SLEEVES REQUIRED FROM JUNCTION BOX TO WET WELL TO PROTECT DEVICE CABLES.

BAY MEADOWS
 TRIPLEX LIFT STATION
 WIRE & CONDUIT SCHEDULE
 DRAWING

CONDUIT/ CABLE		WIRE				FROM		TO		WIRE				CONDUIT/ CABLE	
No.	Size	I.D. No.	TYPE/SIZE	CLR	WIRE NO.	MCC/PNL	TERM NO.	TERM NO.	PNL/DEVICE	WIRE NO.	CLR	TYPE/SIZE	I.D. NO.	SIZE	No.
15	* CBL		CABLE DIA. 1.33			JUNCTION BOX			WET WELL						
						PUMP 1			PUMP 1						
16	* CBL		CABLE DIA. 1.33			JUNCTION BOX			WET WELL						
						PUMP 2			PUMP 2						
17	* CBL		CABLE DIA. 1.33			JUNCTION BOX			WET WELL						
						PUMP 3			PUMP 3						
18	1"		BELDEN 9318	BLK WHT SHD		CONTROL PANEL PRESSURE TRANSDUCER			VALVE VAULT PRESSURE TRANSDUCER						
19	1"		* MFG CABLE			CONTROL PANEL FLOW METER			METER VAULT FLOW METER						

NOTES:

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BAY MEADOW SEQUENCE OF OPERATION

Background

The Bay Meadows lift station has three pumps that alternate in operation. Two pumps are required to perform the duty at the full design capacity. The third pump is a standby pump. All three pumps will alternate in order to maintain even runtime and wear on the pumps.

These pumps pump into an existing force main that currently carries the flow from the Flint Avenue Pump Station. There are three separate pump station design and performance requirements of the new pump station.

1. Full designed capacity: 1,218 gallons per minute
 - a. Number of pumps: 3 (2 duty + 1 standby)
 - b. Total dynamic head with Flint Ave Pump Station on = 96'
 - c. Total dynamic head with Flint Ave Pump Station off = 70'

2. Initial average dry weather flow: 185 gallons per minute
 - a. Total dynamic head with Flint Avenue Pump Station on = 35'
 - b. Total dynamic head with Flint Avenue Pump Station off = 34'

3. Initial peak wet weather flow: 554 gallons per minute
 - a. Total dynamic head with Flint Avenue Pump Station on = 62'
 - b. Total dynamic head with Flint Avenue Pump Station off = 42'

Sequence of Operation

The large difference in TDH in this system makes for a challenging pump selection. The best way to accommodate this difference in TDH is to use Variable Frequency Drives (VFD) to run the pumps. The VFDs will change the RPM of the pumps by varying the frequency of the power according to the pressure in the force main. As the pressure goes up the VFD will allow the pump to run at a higher rpm to achieve the pumping rate needed. As the pressure drops the VFD will slow the pump down so the pump doesn't cavitate and to keep the pump motor from overloading.

BAY MEADOW SEQUENCE OF OPERATION

Romtec Utilities proposes to use a control algorithm that incorporates the force main pressure, published variable speed pumping curves, and the wet well level rate of change to control the wet well level. By monitoring the force main pressure and the wet well rate of change data points we will be able to assign the number of pumps and the pump speed required to control the wet well level with the varying total dynamic head requirements.

If the force main pressure switch fails the system will set an alarm to notify personnel. In the event of a force main pressure switch alarm the system will issue the last recorded run speed command and monitor the wet well level rate of change and motor current to set the appropriate speed command.

Initial Average Dry Weather Scenario

The total dynamic head (TDH) requirements for the initial average dry weather flow of 185 gallons per minute equates to a maximum psi of 15.17 with a pressure difference of .43 psi between the two scenarios. This pressure difference will be ignored and the system will call for one pump to run at 41 Hz or 1183 rpm. During the initial pump start there will be a boost added to the speed setpoint to assure the pump is able to clear any solids. After the initial start boost the lead pump will quickly ramp down to the setpoint speed.

Initial Average Wet Weather Scenario

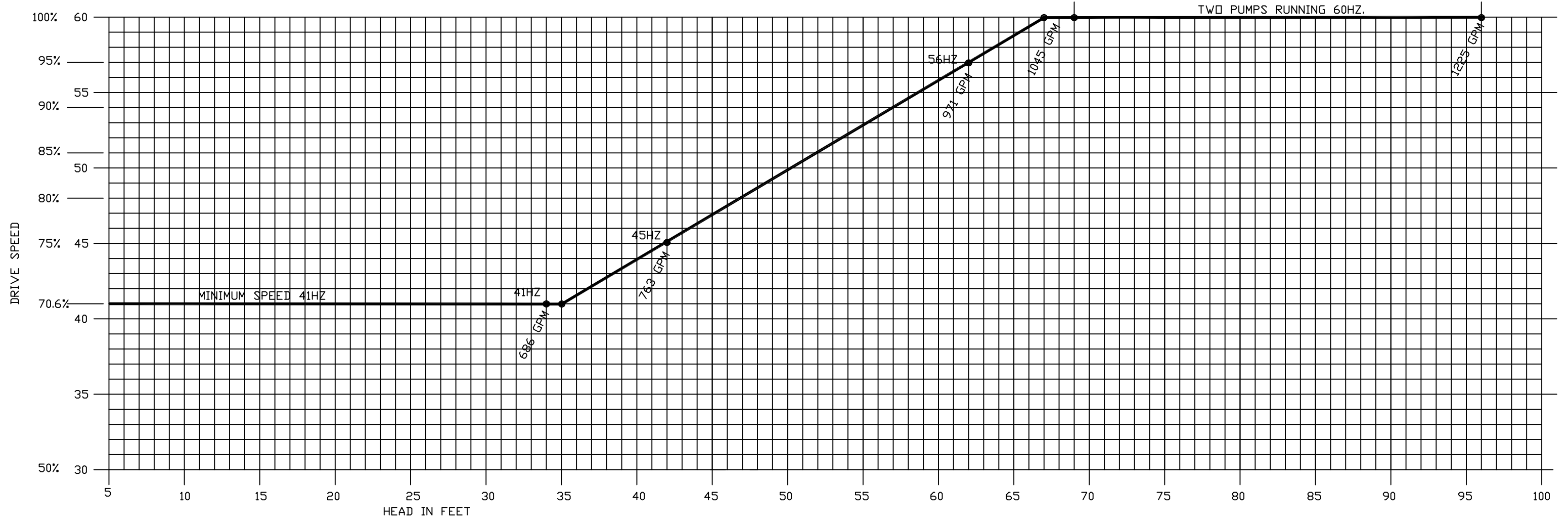
The TDH requirements for the initial peak weather flow of 554 gallons per minute equates to a maximum psi of 26.87 with the Flint Avenue Pump Station running and 18.2 psi with the Flint Avenue Pump Station off. The difference between the two wet weather scenarios is 8.67 psi. With the Flint Avenue Pump Station running and the force main pressure reading approximately 26.87 psi the lead pump will be commanded to run at 56Hz or 1656 rpm. Once the Flint Pump Station drops off line the force main pressure will lower to 18.18 psi and the pump speed command will change to 45Hz or 1331 rpm.

BAY MEADOW SEQUENCE OF OPERATION

Pump Station Design Scenario

The full build out design flow of 1,218 gallons per minute equates to a maximum psi of 41.6 with the Flint Avenue Pump Station running and 30.35 psi with the Flint Avenue Pump Station off. The difference between the two pump station design scenarios is 11.25 psi. With the Flint Avenue Pump Station running and the force main pressure reading approximately 41.56 psi the lead pump will be commanded to run at 60Hz or 1775 rpm. If the level in the wet well continues to rise above the lag pump start setpoint the lag pump will be commanded to run at 60Hz or 1775 rpm.

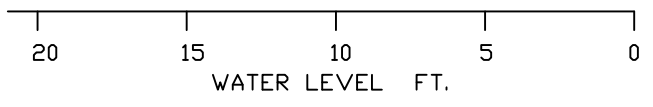
MAXIMUM PUMP SPEED 60 Hz. (1775 RPM) WITH TWO PUMPS RUNNING FOR A MAX FLOW OF 1225 GPM



TWO PUMPS RUNNING 60HZ.

MINIMUM SPEED 41HZ

MINIMUM SPEED IS 41HZ. 70.6%
 MAXIMUM SPEED IS 60HZ. 100%



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ACE3600 is a state-of-the-art high performance Remote Terminal Unit (RTU) with exceptional communication capability. The unit is designed to provide scalability and modularity to optimize the performance of any control system. The unit's rugged design offers compliance for the requirements of most demanding SCADA system environments. Motorola has developed this innovative RTU to provide a cost effective RTU solution by minimizing the installation and configuration time.

Main Features:

- Power PC based processor provides very high performance
- VX-Works based real-time operating system
- Up to three Ethernet ports
- Up to four serial communication ports
- Up to two radio modem ports
- 0,3,5,7 or 8 I/O slot wall mount frames, 19" rack mount on 8 slot frame
- Expansion frames allow up to 110 I/O modules in a single RTU.
- Single and double density I/O modules
- Mixed analog input and output modules
- Hot Swap I/O replacement
- Wide operating temperature range -40 to +70 °C
- NEMA 4 / IP65 Housing, 40 x 40 cm and 50 x 50 cm
- Two-way/trunking/ digital radio models
- AC and DC controlled power supply
- 6.5 or 10 Ah Backup battery, smart battery charger
- GPS and NTP for time synchronization
- System building tool for configuration and programming
- Remote firmware and program download
- Compatible with MOSCAD family of RTUs



ACE3600

Advanced Control Equipment

The ACE3600 is a powerful Remote Terminal Unit (RTU) in Motorola's family of Supervisory Control And Data Acquisition (SCADA) products.

ACE3600 provides an advanced data collection and processing unit with the intelligence required to operate in sophisticated SCADA systems.

Advanced communication and networking capabilities include data transfer via two-way radio, trunked radio, digital radio, data radio, cellular modems, IP networks, line modem and more.

LOCAL INTELLIGENCE

ACE3600 is a microprocessor-based RTU with large memory capacity that can make control decisions on-site, based on status conditions and values from local and remote sources.

Local intelligence permits control decisions without the need for real-time messages from other supervisory centers; ACE3600 can operate in sophisticated control systems.

PROGRAMMABLE

ACE3600 uses an advanced symbolic ladder logic application language to develop the data base conditions, values, and RTU profile that must exist for each control action, message transmission, etc. to occur. Routines written in 'C' may be executed as a whole or part of the total application.

Powerful applications may easily be defined using industry accepted ladder logic and 'C'. The task is made easier by using the SCADA application development software and a PC-style computer.

PROTOCOLS

ACE3600 uses the OSI-based MDLC communication protocol for all data signaling. Third party MODBUS, DNP 3.0 DF1 (Allen Bradley) and IEC 60870-5 protocols are also supported.

MDLC was specifically developed for radio use but is completely applicable to Ethernet, wireline, and other media. It permits large volumes of data to be quickly transferred between units using packet transmission techniques.

The MDLC protocol enables adding the ACE3600 easily to existing MOSCAD systems where system expansion is required.

COMMUNICATIONS

ACE3600 permits communication to occur RTU-to-central and RTU-to-RTU (peer-to-peer). Communication may occur between individual units or may be broadcast to several units simultaneously. Store-&-forward may be employed to pass messages RTU-to-RTU throughout the system. Direct communication, where possible, or repeated messaging over one or multiple communication media, may be intermixed within the system.

UPLOAD/DOWNLOAD

ACE3600, via the MDLC data transfer capability, uploads the data collected and

calculated by the application program to a central site. It also receives downloaded changes to the application program and/or to the parameters that control how the application operates.

The process being supervised does not need to be static; operational variables and limits, and the process definition itself, can be easily changed and transmitted to the RTU from anywhere in the system's network.

A unique feature of ACE3600, also enables remote firmware safe download from anywhere in the system's network. This allows remote firmware upgrades.

The above features minimize site visits by maintenance personnel after the unit's initial installation.

COMMUNICATION PORTS

Connectors on the various CPU modules permit the connection for local application programming, or connection to other on-site devices to supervise their operation, and to the communication media device.

Multiple connectors, multiple communication types, and variable data speeds allow practically all external data devices to be connected to the CPU module.

CHASSIS AND ENCLOSURES

ACE3600 can be provided on a metal chassis or in a painted steel NEMA 4 (IP56) rated outdoor enclosure that can hold the RTU frame, modules, battery and up to two radios (depending on enclosure size). An optional tamper switch can be ordered with the enclosure.



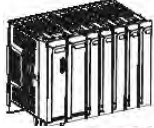

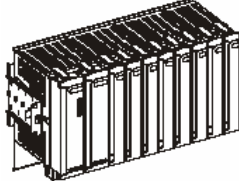
19" RACK MOUNT

ACE3600 may be ordered with frame and mounting accessories that permit direct mounting onto standard 19" equipment racks. The frame contains space for power supply, CPU module and up to eight I/O modules. Optionally, a 19" metal chassis can be ordered for installation of backup battery, accessories and up to two radios.

I/O EXPANSION

The ACE3600 RTU can be expanded to include up to 110 I/O modules controlled from the CPU. The I/O expansion is based on Ethernet LAN connection between the CPU module and the I/O expansion frames. The I/O expansion frames can be co-located with RTU on the main frame (installed in the same 19" rack or cabinet) or distributed in the same site up to 50 meters from the main frame location.

ACE3600 GENERAL SPECIFICATIONS

Frames	No I/O slots - PS and CPU modules only, wall mount 117 W x 209 H x 198* D mm (4.61" x 5.30" x 7.80**), 0.95 Kg (2.1 Lb)	
	3 I/O slots - PS, CPU and up to 3 I/O modules, wall mount 234 W x 244 H x 198* D mm (9.21" x 9.61" x 7.80" *), Approx. 1.9 Kg (4.19 Lb)	
	5 I/O slots - PS, CPU and up to 5 I/O modules, wall mount 314 W x 244 H x 198* D mm (12.36" x 9.61" x 7.80" *), Approx. 2.4 Kg (5.3 Lb)	
	7 I/O slots - PS, CPU and up to 7 I/O modules 391 W x 244 H x 198* D mm (15.39" x 9.61" x 7.80" *), 3. Kg (6.6 Lb)	
	8 I/O slots - PS, CPU and up to 8 I/O modules, wall mount or 19" rack 435 W x 244 H x 198* D mm (17" x 9.61" x 7.80" *), Approx. 3.3 Kg (7.3 Lb)	
<p>* Depth including module panel Note: All frames except No I/O Slots can be used for I/O expansion.</p>		
I/O Expansion Frame	Number of I/O slots - 3, 5, 7, or 8 Default power supply - Expansion power supply Compatible power supplies - All except: 10.8-16V DC low-tier power supply	
Metal Chassis	Large - for PS, CPU and up to 7 I/O slot frame, two radios and 6.5 or 10 Ah backup battery, wall mount, 448 x 468 mm x 200* D mm (17.64" x 18.43" x 7.88**) Small - for PS, CPU and up to 3 I/O slot frame, one radio and 6.5 Ah backup battery, wall mount, 335 W x 355 H x 198* D mm (17.64" x 18.43" x 7.80**)	
* Depth Including Frame and Module		
Housing	Large NEMA 4/IP65 painted metal - up to 7 I/O slot frame, two radios and 6.5 or 10 Ah, backup battery, 500 W x 500 H x 210 D mm (19.7" x 19.7" x 8.26") Small NEMA 4/IP65 painted metal - up to 3 I/O slot frame one radio and 6.5 Ah backup battery, 380 W x 380 H x 210 D mm (15" x 15" x 8.26")	
Power Supply	10.8-16 V DC 10.8-16 V DC low-tier 18-72 V DC 18-72 V DC with 12 V smart battery charger 100- 240 V AC, 50-60 Hz 100- 240 V AC, 50-60 Hz, with 12 V smart battery charger	
Backup Battery	6.5 Ah - Sealed Lead-Acid 10 Ah - Sealed Lead-Acid	
Operating Temperature	-40 °C to +70 °C (-40 °F to 158 °F) Notes: (1) when using a metal housing option, the maximum operating temp. outside the housing is +60 °C (140 °F). (2) Motorola radios and ACT module operating temp. range is: -30 °C to +60 °C (-22 °F to 140 °F)	
Storage Temperature	-55 °C to +85 °C (-67 °F to 185 °F)	
Operating Humidity	5% to 95% RH @ 50 °C without condensation	
Mechanical Vibrations	Per EIA/TIA 603 Base station, Sinusoidal 0.07mm @ 10 to 30 Hz, 0.035 mm @ 30-60 Hz	
Operating Altitude	-400m to +4000 meter (-1312 ft to + 13120 ft) above sea level Note:100-240 V AC and 18-72 V DC PS operating altitude is -400m to +3000 meter (-1312 ft to + 6560 ft)	

REGULATORY STANDARDS

Safety	UL 60950-1:2001 CSA 22.2-60950-1 IEC 60950-1 AS/NZS 60950 FM/cFM certified as Nonincendive Class I, Division 2 - standard FM 3611 (Note: FM approval refers to model F7509 only and most of the ACE3600 options.)
Emission	Emission standards per: CFR 47 FCC part 15, subpart B (class A) EN55022:2003 Class A EN61000-3-2 EN61000-3-3
Immunity	Immunity standards for industrial environments per EN50082-2 /IEC 61000-6-2 IEC 61000-4-2 IEC 61000-4-3 IEC 61000-4-4 IEC 61000-4-5 IEC 61000-4-6 IEC 61000-4-8 IEC 61000-4-11

COMMUNICATIONS

Communication Ports:	Up to 5 ports per CPU Serial - up to 4 x RS-232 ports Multi-drop – up to 3 x RS-485 ports Ethernet - up to 2 x 10/100 MB ports and 1 x 10 MB port Two-way radio/analog trunked radio - up to 2 x modem ports
Motorola Radio Support	Mobile conventional two-way radios - CM200, CM340, GM3188, EM200, CDM750 Portable conventional two way radios – HT750, GP320, GP328, PRO5150 Analog Trunk radios – XTL5000, XTL2500 Digital Trunk radios – XTL5000, XTL2500, XTS2500, MTM800 (Tetra)
Third Party Radio Support	Two way radios, data radios, TETRA radio (PD)
Modem Support	Dial-up modems, cellular modems (dial mode & PD)
Protocols	MDLC, TCP, UDP, IP, PPP, NTP, DHCP
Third Party Protocol Support	MODBUS RTU: master on RS-232 / RS-485 / Ethernet, slave on RS-232 / RS-485 / Ethernet DF1 (Allen Bradley): master on RS-232 DNP 3.0 Plus: master & slave on RS-232 / RS-485 / Ethernet IEC 60870-5-101: slave on RS-232
User Protocol (user program)	Possible on RS-232, RS-485 and Ethernet ports

CPU 3610/CPU 3640 MODULES SPECIFICATIONS

Microprocessor	Freescale – Power PC II, MPC8720, 32-bit, extended communication capability, DMA and floating point calculation support
Microprocessor Clock	200 MHz
Memory	Flash: 16 MB DRAM: 32 MB SRAM plug-in board (optional): 4 MB
Real-Time Clock	Full calendar with leap year support (Year, Month, Day, Hours, Minutes, Seconds) Time drift: max. 2.5 seconds per day (when power is on)
SRAM and RTC Retention	3 V Rechargeable lithium backup battery
Serial Port 1	Configurable RS-232C or RS-485 port: - RS-232C: A synch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS-485, multi-drop 2-Wire up to 230.4 kb/s
Serial Port 2	RS-232C, Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface
Plug-In Port 1	Supports the following Plug-In ports: - Radio Modem, DPSK 1.2 kb/s, FSK 1.2 / 1.8 / 2.4 kb/s, DFM 2.4/3.6/4.8 kb/s - RS-232, Sync/Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS-485, multi-drop 2-wire, up to 230.4 kb/s - Ethernet 10/100 Mb/s
Plug-In Port 2	Supports the following Plug-In ports: - Radio Modem, DPSK 1.2 kb/s, FSK 1.2 / 1.8 / 2.4 kb/s, DFM 2.4/3.6/4.8 kb/s and - RS-232, Sync/Asynch, Full Flow Control, up to 230.4 kb/s, GPS receiver interface - RS-485, multi-drop 2-Wire up to 230.4 kb/s - Ethernet 10 Mb/s
Ethernet Port 1	10/100 Mb/s, (on CPU 3640 only)
LEDs Display	4 CPU diagnostics LEDs, port status LEDs and user application LEDs
Power Consumption	See ACE3600 Maximum Power Ratings below.
Operating Voltage	10. 8 -16 V DC (from the motherboard connector)
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.38 Kg (0.84 Lb)

12 V DC POWER SUPPLY MODULE (DEFAULT)

Input Voltage	10.8 - 16 V DC
Outputs	Motherboard connector (to CPU and I/O modules): equal to input voltage, max. 4 A AUX1A/AUX1B: equal to input voltage, max. 8 A, on/off controlled by user program AUX2A/AUX2B (configurable): equal to input voltage (default), max. 8A, or 3.3, 5, 7.5, 9 V DC $\pm 10\%$, max. 2.5A, on/off controlled by user program Note: max. 8 A total current consumption from all outputs
No Load power consumption	Max. 50 mA
Diagnostics LEDs	Status LED for: input voltage, AUX1 and AUX2 outputs, 12V control for DO modules
Input Protection	Internal Line Fuse, replaceable
Output Protection	AUX2A/B Short Circuit, automatic recovery on 3.3, 5, 7.5, 9 V
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.43Kg (0.95 Lb)

12 V DC LOW-TIER POWER SUPPLY MODULE

Input Voltage	10.8 - 16 V DC
Outputs	Motherboard connector (to CPU and I/O modules): The same as input voltage / max. 4 A AUX1A/AUX1B: equal to input voltage max. 8A Note: max. 8 A total current consumption from all outputs
Input Protection	Internal Line Fuse, replaceable
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.4Kg (0.9 Lb)

18-72 V DC POWER SUPPLY MODULES

Input Voltage	18-72 V DC
Total Power	18-72 V DC: Max. 60 Watt continuous, Max. 105 Watt peak @ 25% duty cycle
Outputs	Motherboard connector (to CPU and I/O modules): 13.2 V DC \pm 20%, max. 4 A AUX1A/AUX1B: equal to input voltage, max. 8 A, on/off controlled by user program AUX2A/AUX2B (configurable): equal to input voltage (default), max. 8A, or 3.3, 5, 7.5, 9 V DC \pm 10%, max. 2.5A, on/off controlled by user program Note: max. 8 A total current consumption from all outputs
Battery Charger	12 V Lead-Acid battery charger (in PS model with charger) Automatic charging of 6.5 or 10 Ah backup battery, battery temperature sensing, overcharging protection, battery capacity test and diagnostics, automatic battery switch-over
Diagnostics LEDs	Status LED for: input voltage, AUX1 and AUX2 outputs, 12V control for DO modules and battery
No Load power consumption	Max. 250 mA
Efficiency	80% typical, 76% with full load
In-rush Current	10 A maximum, for 2 mSec. Max, cold start at 25°C
Protection	Internal line input fuse (replaceable), Short Circuit automatic recover
Output Protection	AUX2A/B Short Circuit, automatic recovery on 3.3, 5, 7.5, 9 V
Insulation	Input to case: 500 V DC, input to output: 500 V DC
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 1Kg (2.2 Lb)

AC POWER SUPPLY MODULES

Input Voltage	100-240 V AC, 50/60 Hz
Total Power	Max. 60 Watt continuous, Max. 105 Watt peak @ 25% duty cycle
Outputs	Motherboard connector (to CPU and I/O modules): 13.2 V DC $\pm 20\%$, max. 4 A AUX1A/AUX1B user connectors: 13.2V DC $\pm 20\%$, max. 8 A, on/off controlled by user program AUX2A/AUX2B: 13.2 V DC $\pm 20\%$, max. 8A or 3.3, 5, 7.5, 9 V DC $\pm 10\%$ (configurable), max. 2.5A , on/off controlled by user program Note: max. 8 A total current consumption from all outputs
Battery Charger	12 V Lead-Acid battery charger (in PS with charger) Automatic charging of 6.5 or 10 Ah backup battery, battery temperature sensing, overcharging protection, battery capacity test and diagnostics, automatic battery switch-over
Diagnostics LEDs	Status LED for: input voltage, AUX1 and AUX2 outputs, 12V control for DO modules and battery
No Load power consumption	130 mA @ 220 V AC
Efficiency	80% typical @230 V AC, 76% typical @115 V AC (full load)
Inrush Current	25 A maximum, for 2 mSec. Max, cold start at 25°C
Power Factor	0.98 typical at 230 V AC, 0.99 typical at 115 V AC
Protection	Internal Line Fuse, replaceable
Output Protection	AUX2A/B Short Circuit, automatic recovery on 3.3, 5, 7.5, 9 V
Insulation	Input to case: 1500 V AC, input to output: 3000 V AC
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 1Kg (2.2 Lb)


24 V DC PLUG-IN POWER SUPPLY

Input Voltage	10.8-16V (from I/O module)
Output	24V floating, max. 150 mA
Efficiency	75% typical
Protection	Automatic output shut down on over-voltage and over-current
Insulation	Input to output: 1500 V AC
Dimensions	78 mm W x 15 mm H x 68 mm D (3.1" W x 0.6" H x 2.7" D)
Weight	Approx. 0.04 Kg (0.09 Lb)

EXPANSION POWER SUPPLY

See below.

16/32 DI FAST 24 V MODULES

Total Number of Inputs	16 DI  32 DI
Input Arrangement	Isolated groups of 16 inputs with shared common
Fast Counter Inputs	Inputs that can be used as fast counters: - All inputs in 16 DI module - First 20 inputs in 32 DI module
AC Input Frequency	45 – 65 Hz
AC Input Delay	Maximum 0.2 mS
Fast Counter Input Frequency	0 - 12.5 KHz, minimum pulse width 40 μ S
Max. DC Input Voltage	Max. \pm 40 V DC (relative to input common)
“ON” DC Voltage Range	+9 to +30 V DC, -30 to -9 V DC
“OFF” DC Voltage Range	-3 to +3 V DC
“ON” AC Voltage Range	10 to 27 V AC (RMS)
“OFF” AC Voltage Range	0 to 5 V AC (RMS)
Input Current	Max. 3.5 mA
Fast Capture Resolution	1 mS (Interrupt upon change of state)
Event Time Tagging Resolution	1 mS (Interrupt upon change of state)
Input Filtering	0 to 50.8 mS (DC, programmable in 0.2 mSec steps)
Counter Input Filtering	0 to 12.75 mS (Programmable in 0.05 mSec steps for inputs configured as high speed counters)
24 V DC Output	Supports optional isolated 24 V plug-in “Wetting” Power Supply (One in 16 DI, two in 32 DI)
Diagnostics LEDs	Status LED per each input, module error LED, Plug-In 24V status LED
User Connection	2 or 4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable & TB Holder	20 or 40 Wire cable with Terminal Block Holder connector, 26 AWG wires
Module Replacement	Hot swap replacement – module extraction/insertion under voltage
Input Isolation	2.5 k V RMS between input and module logic per IEC60255-5
Input Insulation	Insulation resistance 100 M Ω @ 500 V DC, per IEC60255-5
Operating Voltage	10.8 -16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	See ACE3600 Maximum Power Ratings below.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5” W x 8.7” H x 7.1” D)
Weight	16 DI: approx. 0.28 Kg (0.62 Lb), 32 DI: approx. 0.29 Kg (0.63 Lb)


~~16/32 DIGITAL INPUT FAST 24 V IEC 61131-2 TYPE II MODULES~~

Total Number of Inputs	16 DI 32 DI
Input Arrangement	Isolated Groups of 16 inputs with shared common
Fast Counter Inputs	Inputs that can be used as fast counters: - All inputs in 16 DI - First 20 inputs in 32 DI
Fast Counter Input Frequency	0 - 10 KHz, minimum pulse width 50 μ S
Max. DC Input Voltage	Max. \pm 40 V DC
"ON" DC Voltage Range	+11 to +30 V DC, -30 to -11 V DC
"OFF" DC Voltage Range	-5 to +5 V DC
Input Current	6-10 mA
Fast Capture Resolution	1 mS (Interrupt upon change of state)
Event Time Tagging Resolution	1 mS (Interrupt upon change of state)
Input Filtering	0 to 50.8 mS (DC, programmable in 0.2 mSec steps)
Counter Input Filtering	0 to 12.75 mS (Programmable in 0.05 mSec steps for inputs used as high speed counters)
24 V DC Output	Supports isolated 24 V plug-in "Wetting" Power Supply (one in 16 DI, two in 32 DI)
Diagnostics LEDs	LED per each input status, module error LED, 24V Plug-In status LED
User Connection	2 or 4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable & TB Holder	20 or 40 Wire Cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement— module extraction/insertion under voltage
Input Isolation	2.5 kV RMS between input and module logic per IEC60255-5
Input Insulation	Insulation resistance 100 M Ω @ 500 V DC, per IEC60255-5
Operating Voltage	10.8 -16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	See ACE3600 Maximum Power Ratings below.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	16 DI: approx. 0.28 Kg (0.62 Lb), 32 DI: approx. 0.29 Kg (0.63 Lb)

16 DIGITAL INPUT 120/230V MODULE

Total Number of Inputs	16 DI
Input Characteristics	IEC 61131-2 Type 1
Input Arrangement	Two isolated groups of 6 inputs and one isolated group of 4 inputs.
AC Input Frequency	47 - 63 Hz
AC Input Delay	Maximum 25.0 mS
Max. DC Input Voltage	Max. ± 264 V DC (relative to input common)
"ON" DC Voltage Range	+79.0 V DC to +264.0 V DC, -79.0 V DC to -264.0 V DC
"OFF" DC Voltage Range	-40 to +40 V DC
"ON" AC Voltage Range	79.0 to 264.0 V AC (RMS)
"OFF" AC Voltage Range	0 to +40 V AC (RMS)
Input Current	At 110VDC 1.0 to 3.0 mA At 230VDC 0.4 to 2.0 mA At 110VAC > 2.0 mA RMS At 230VAC > 3.0 mA RMS
Input Filtering	0 to 50.8 mS (DC, programmable in 0.2 mSec steps), minimum effective filter value - 7.0 msec.
Diagnostics LEDs	LED per each input status, module error LED
User Connection	3 Terminal Blocks (5.00mm pitch), Maximum 14 AWG
Cable & TB Holder	30 Wire Cable with Terminal Block Holder connector, 20 AWG wires
Module Replacement	Hot swap replacement— module extraction/insertion under voltage
Input Isolation	2.5 kV RMS between input and module logic per IEC60255-5
Input Insulation	Insulation resistance 100 M Ω @ 500 V DC
Operating Voltage	10.8 -16 V DC and 3.3 V DC $\pm 10\%$ (from the motherboard connector)
Power Consumption	See ACE3600 Maximum Power Ratings below.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	approx. 0.367 Kg (0.80 Lb)

8/16 RELAY OUTPUT MODULES

Total Number of Outputs	8 EE relay outputs  16 EE relay outputs 8 ML relay outputs 16 ML relay outputs
Output Arrangement	8 DO: 3 X Form C (SPDT) and 5 X Form A (SPST) 16 DO: 6 X Form C (SPDT) and 10 X Form A (SPST)
Contact Voltage Ratings	Max. 60 V DC, or 30 V AC RMS (42.4 V peak).
Contact Power Ratings	2A @ 30 V DC, 0.6A @ 60V DC or 0.6A @ 30V AC (resistive load)
Relay Back Indication	Contact position - hardware back indication
DO Frequency	Max. 10 Hz
Diagnostics LEDs	LED per each output status, module error LED
User Connection	2 or 4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable & TB Holder	20 or 40 Wire Cable with Terminal Block Holder connector, 26 AWG
Fail State	Configurable relay state on CPU fail: On, Off or 'last value'
All Relays Disable/Enable	Selectable per module, controlled from the power supply
Module Replacement	Hot swap replacement— module extraction/insertion under voltage
Output Isolation	Between open contacts: 1kV, between contact and coil: 1.5 kV, between contact sets: 1.5 kV
Insulation	Insulation resistance 100 M Ω @ 500 V DC per IEC60255-5, Insulation impulse 1.5 kV per IEC60255-5
Operating Voltage	10.8 -16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	See ACE3600 Maximum Power Ratings below.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	8 DO: approx. 0.29 Kg (0.64 Lb), 16 DO: approx. 0.32 Kg (0.7 Lb)

12 RELAY OUTPUT 120/230V MODULES

Total Number of Outputs	12 EE relay outputs 12 ML relay outputs
Output Arrangement	12 x 1 Form A
Contact Power Ratings	3A @ 250 V AC, 3A @ 30 V DC, or 0.20A @ 125 V DC (resistive load).
Minimum Contact Load Current	10.0 mA @ +5.00 V DC.
Maximum Switching Current	3.00 A
Relay Back Indication	Contact position - hardware back indication
DO Frequency	Max. 10 Hz (resistive load)
Diagnostics LEDs	LED per each output status, module error LED
User Connection	3 Terminal Blocks (5.00mm pitch), Maximum 14 AWG
Cable & TB Holder	30 Wire Cable with Terminal Block Holder connector, 20 AWG wires
Fail State	Configurable relay state on CPU fail: On, Off or 'last value'
All Relays Disable/Enable	Selectable per module, controlled from the power supply
Module Replacement	Hot swap replacement— module extraction/insertion under voltage
Output Isolation	Between output and module logic: 2.5 kV, per IEC60255-5
Insulation	Insulation resistance 100 M Ω @ 500 V DC per IEC60255-5, Insulation impulse 5 kV per IEC60255-5
Operating Voltage	10.8 -16 V DC and 3.3 V DC \pm 10% (from the motherboard connector)
Power Consumption	See ACE3600 Maximum Power Ratings below.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	approx. 0.423 Kg (0.90 Lb)

8/16 ANALOG INPUT MODULES

Total Number of Inputs	8 AI, ± 20 mA 16 AI, ± 20 mA 8 AI, ± 5 V 16 AI, ± 5 V
Input Configuration	Isolated (floating) analog inputs
A to D Resolution	16 Bit (including sign)
Input Accuracy	$\pm 0.1\%$ of full scale
Input Sampling Time	10 mSec @ 50 Hz filtering 8.33 mSec @ 60 Hz filtering
Smoothing	Selectable input averaging: 1, 2, 4, 8, 16, 320, 64 or 128 samples (x10 mS)
Permitted potential between Inputs	75 V DC, 60 V AC (RMS)
Input Impedance	± 20 mA input: $R_{in} < 250 \Omega$ ± 5 V input: $R_{in} > 1 M\Omega$
Crosstalk Rejection	Better than 80 dB between any pair of inputs
Temperature Stability	Better than ± 25 PPM/ $^{\circ}$ C
Interference Suppression	Selectable 50 or 60 Hz filtering, Common mode rejection > 80 dB, Differential mode rejection > 50 dB
24 V DC Output	Supports optional isolated 24V Plug-in Power Supply (one in 8 DI, two in 16 DI)
Diagnostics LEDs	Overflow and Underflow LED per each input, module error LED, 24V Plug-In status LED The module Overflow and Underflow levels can be configured to: Current inputs: ± 20 mA/4-20 mA Voltage inputs: ± 5 V/0-5 V/1-5 V
User Connection	2 or 4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable & TB Holder	20 or 40 Wire Cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement— module extraction/insertion under voltage
Input Isolation	1.5 kV RMS between input and module logic, per IEC60255-5
Input Insulation	Insulation resistance 100 M Ω @ 500 V DC, per IEC60255-5
Operating voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	See ACE3600 Maximum Power Ratings below.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	8 AI: approx. 0.32 Kg (0.71 Lb), 16 AI: approx. 0.34 Kg (0.75 Lb)

4 ANALOG OUTPUT MODULE

Total Number of Outputs	4
Output Configuration	Isolated floating channels, each channel can be connected as 0 -20 mA or 0-10 V DC voltage
D to A Resolution	14 Bit
Output Accuracy	±0.1% of full scale @25°C
Temperature Stability	Better than ±25 PPM/°C
Internal Settling Time	Max. 1 ms
Output Load	Voltage: > 1.0 kΩ, < 1.0 μf, Current: < 750 Ω (internal power source)
Crosstalk Rejection	Better than 50 dB between any pair of outputs
Interference Suppression	Common Mode Rejection: > 60 dB
Output protection	Voltage output: short-circuit current, max. 30 mA Current output: No-load voltage max. 22 V DC
Diagnostics LEDs	Module Error LED, Voltage mode LED, Current mode LED, Calibration LED per channel
User Connection	2 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable & TB Holder	20 Wire Cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction/insertion under voltage
Isolation	1.5 kV between output and module logic
Insulation	Insulation resistance 100 MΩ @ 500 V DC, per IEC60255-5
Operating voltage	10.8 -16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	See ACE3600 Maximum Power Ratings below.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	0.29 Kg (0.64 Lb)

MIXED 4 ANALOG OUTPUT 8 ANALOG INPUT MODULES

Total Number of I/Os	4 AO + 8 AI (AI: ± 20 mA or ± 5 V DC)
I/O Arrangement	AO - each channel can be connected as 0 -20 mA or 0-10 V, AI - Isolated (floating) analog inputs
AO D to A Resolution	14 Bit
AO Accuracy	$\pm 0.1\%$ of full scale @25°C
AO Temperature Stability	Better than ± 25 PPM/°C
AO Internal Settling Time	Max. 1 ms
AO Load	Voltage: > 1.0 k Ω , < 1.0 μ f, Current: < 750 Ω
AO Crosstalk Rejection	Better than 50 dB between any pair of outputs
AO Interference Suppression	Common Mode Rejection: > 60 dB
AO Voltage Output Protection	Short-circuits protection, max. 30 mA (all other operating channels remain fully functional)
AO Current output no-load voltage	Max. 22 V DC
AO Isolation	1.5 kV between output and module logic
AO Insulation	Insulation resistance 100 M Ω @ 500 V DC, per IEC60255-5
AI A to D Resolution	16 Bit (including sign)
AI Accuracy	$\pm 0.1\%$ of full scale @ -40°C to +70°C
AI Sampling Time	10 mSec @ 50 Hz filtering 8.33 mSec @ 60 Hz filtering
AI Smoothing	Selectable input averaging: 1, 2, 4, 8, 16, 32, 64 or 128 samples (x10 mS)
Permitted Potential between Inputs	75 V DC, 60 V AC (RMS)
AI Input Impedance	± 20 mA input: Rin < 250 Ω ± 5 V input: Rin > 1 M Ω
AI Crosstalk Rejection	Better than 80 dB between any pair of inputs
AI Temperature Stability	Better than ± 25 PPM/°C
AI Interference Suppression	Selectable 50 or 60 Hz filtering, Common mode rejection > 80 dB, Differential mode rejection > 50 dB
24 V DC Output	Supports one optional isolated 24V Plug-in Power Supply
Diagnostics LEDs	AO - Voltage mode LED, Current mode LED, Calibration LED per channel AI - Overflow and Underflow LED per each input, 24V Plug-in status LED The module Overflow and Underflow levels can be configured to: ± 20 mA/4-20 mA or ± 5 V/0-5 V/1-5 V General - Module error LED
AI Input Isolation	1.5 kV between input and module logic
AI Input Insulation	Insulation resistance 100 M Ω @ 500 V DC, per IEC60255-5
User Connection	4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable & TB Holder	40 Wire Cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction/insertion under voltage
Operating Voltage	10.5-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	See ACE3600 Maximum Power Ratings below.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	Approx. 0.34 Kg (0.75 Lb)

16/32 DIGITAL OUTPUT/DIGITAL INPUT MODULES (16/32 DO/DI)

Total Number of Inputs/Outputs	16/32
I/O Arrangement	2/4 groups of 8 I/Os with shared common Each group can be configured to function as FET DO or dry contact DI
Counter Inputs	20 first inputs can be used as counter inputs
Counter Input Frequency	0 - 1 KHz, minimum pulse width 500 μ S
Max. DC Input Voltage	Max. 30 V DC (relative to input common)
Input "ON" Resistance	0-4 k Ω
Input "OFF" Resistance	\geq 50 k Ω
Fast Capture Resolution	1 mS (Interrupt upon change of state)
Event Time Tagging Resolution	1 mS (Interrupt upon change of state)
Input Current	Max. 0.3 mA (when the input is shorted)
Input Filtering	0 to 50.8 mS (programmable in 0.2 mSec steps) Not relevant, minimum allowed is 1mSec
Counter Input Filtering	0 to 12.75 mS (programmable in 0.05 mSec steps) Not relevant, minimum allowed is 1mSec
Output Type	MOSFET
Output Voltage Range	5-30 V DC (user-supplied voltage)
DO Frequency	Max. 1 KHz (resistive load)
DO Output current	Max. 500 mA sink current (resistive load)
Output Fail State	Configurable output state on CPU fail: On, Off or 'last value'
Diagnostics LEDs	LED per each input/output status, module error LED
User Connection	4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable & TB Holder	20 or 40 Wire Cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement— module extraction/insertion under voltage
Input/Output Isolation	2.5 kV between input/output and module logic
Input Insulation	Insulation resistance 100 M Ω @ 500 V DC per IEC60255-5
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	See ACE3600 Maximum Power Ratings below.
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	Approx. 0.25 Kg (0.55 Lb)

MIXED I/O 16DI + 4DO + 4AI MODULES

Total Number of Inputs/Outputs	16 Digital Inputs + 4 EE Relay Outputs + 4 Analog Inputs, ± 20 mA 16 Digital Inputs + 4 ML Relay Outputs + 4 Analog Inputs, ± 20 mA
I/O Arrangement	1 group of 16 DIs with shared common, 4 relay outputs - Form C, 4 isolated analog inputs
DI Counter Inputs	The first 12 inputs can be configured as fast counters.
DI Frequency	0 - 1 KHz
DI Fast Counter Frequency	0 - 5 KHz minimum pulse width 100 μ S
DI Max. DC Voltage	Max. 40 V DC
DI "ON" DC Voltage Range	+11 to +30 V DC, -30 to -11 V DC
DI "OFF" DC Voltage Range	-5 to +5 V DC
DI Current	6-10 mA
Fast Capture Resolution	1 mS (Interrupt upon change of state)
Event Time Tagging Resolution	1 mS (Interrupt upon change of state)
DI Filtering	0 to 50.8 mS (DC, programmable in 0.2 mSec steps)
DI Counter Filtering	0 to 12.75 mS (programmable in 0.05 mSec steps for inputs configured as high speed counters)
DO Contact Voltage Ratings	Max. 60 V DC or 30 V AC RMS (42.4 V peak).
DO Contact Power Ratings	2A @ 30 V DC, 0.6A @ 60V DC or 0.6A @ 30V AC (resistive load)
DO Relay Back Indication	Contact position - hardware back indication
DO Fail State	Configurable relay state on CPU fail: On, Off or 'last value'
AI Resolution	16 Bit (including sign)
AI Accuracy	$\pm 0.1\%$ @ -40°C to +70°C
AI Sampling time	10 mSec @ 50 Hz filtering, 8.33 mSec @ 60 Hz filtering
AI Smoothing	Selectable input averaging: 1, 2,4,8, 16, 32, 64 or 128 samples (x10 mS)
AI max. Potential between AIs	75 V DC, 60 V AC (RMS)
AI Impedance	Rin < 250 Ω
AI Crosstalk Rejection	Better than 80 dB between any pair of inputs
AI Temperature Stability	Better than ± 25 PPM/°C
AI Interference Suppression	Selectable 50 or 60 Hz filtering, common mode rejection > 80 dB, differential mode rejection > 50 dB
Diagnostics LEDs	LED per each input/output status, module error LED, 24V Plug-in status LED
24 V DC Output	Supports one isolated 24V plug-in "Wetting" Power Supply
User Connection	4 Terminal Blocks (3.5mm pitch), Maximum 18 AWG
Cable & TB Holder	40 Wire Cable with Terminal Block Holder connector, 26 AWG
Module Replacement	Hot swap replacement– module extraction/insertion under voltage
Input / Output Isolation	DI: 2.5 kV RMS between input and module logic per IEC60255-5 DO: Between open contacts: 1kV, between output and module logic: 1.5 kV, per IEC60255-5 AI: 1.5 kV between input and module logic per IEC60255-5
Input Insulation	Insulation resistance 100 M Ω @ 500 V DC per IEC60255-5
Operating Voltage	10.8-16 V DC and 3.3 V DC (from the motherboard connector)
Power Consumption	See ACE3600 Maximum Power Ratings below. EE Relay on : 0.2 W typical (15 mA @ 13.8 V DC at PS) (Not including 24 V Plug-in Power Supply)
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	Approx. 0.31 Kg (0.68 Lb)

EXPANSION POWER SUPPLY MODULE

Input Voltage	DC 10.8-16 V
Outputs	To Motherboard connector – +10.80 to +16.00 VDC, max. 4A To cascaded expansion power supply - +10.80 to +16.00 VDC, max. 8A
Over Current Protection	4.0 A (Slow blow fuse), protecting the expansion frame 8.0 A (Slow blow fuse), protecting the cascaded expansion power supply
Maximum Current via Power IN/OUT circuit	8.0 A (Slow blow fuse)
Over Voltage Protection	+17.00 ±1 VDC (protecting the expansion frame)
Absolute Maximum Voltage	+18.00 VDC
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.43Kg (0.94 Lb)

EXPANSION MODULE

Microprocessor	Freescale – Power PC II, MPC8720, 32-bit
Microprocessor Clock	200 MHz
Serial Port	RS232C Asynch, Full Flow Control port, up to 230.4 kb/s; used for STS only
Ethernet Port	10/100 Mb/s – connection to the main frame
LAN Cable	Category 5E shielded (FTP), up to 50 meter
LEDs Display	4 CPU diagnostic LEDs, Port status LEDs and Expansion Address LEDs
Power Consumption	See ACE3600 Maximum Power Ratings below.
Operating Voltage	10.8-16 V DC (from the motherboard connector)
Dimensions	56 mm W x 225 mm H x 180 mm D (2.2" W x 8.7" H x 7.1" D)
Weight	Approx. 0.38 Kg (0.84 Lb)

EXPANSION LAN SWITCH

Ethernet Port 1-8	8 on board 10/100 Mb/s Ethernet ports (Auto crossover)
LEDs Display	Error LED, Port status LEDs
Power Consumption	See ACE3600 Maximum Power Ratings below.
Module Replacement	Hot swap replacement – module extraction/insertion under voltage
Operating Voltage (from the motherboard connector)	10.8-16 V DC, 3.30 VDC +/-10%
User Connection (Ethernet Ports)	8 shielded RJ45 connectors
LAN Cable	Category 5E shielded (FTP), up to 50 meter
Operating Voltage	10.8-16 V DC (from the motherboard connector)
Dimensions	37 mm W x 225 mm H x 180 mm D (1.5" W x 8.7" H x 7.1" D)
Weight	Approx 0.32 Kg (0.7 Lb)

ACE3600 MAXIMUM POWER RATINGS

The tables below list the typical maximum power consumption (at room temperature) for each of the ACE3600 RTU building blocks (CPU, Power Supply, I/O modules, radios, etc.) and the maximum peak power allowed for a fully loaded RTU, based on the housing type.

The values in the tables below are derived by using the power supply (AC: 100 to 240 VAC or DC: 18 to 72 VDC and 13.8 VDC) and have the power supply efficiency factor included in them.

Before deploying your RTU, add up the power consumption of all components of your system to verify that it is within the maximum peak power for your housing type. In systems with I/O expansion, consider all modules which consume power from their respective AC/DC main power sources when calculating the required power requirements.

Maximum Peak Power Allowed for Fully Loaded RTU

Housing Type Description	Maximum Input Power into Power Supply Module (Watts)
19" Rack (w/out metal enclosure)	100
Large NEMA metal housing (50x50 cm)	120*
Small NEMA metal housing (40x40 cm)	105*

Power Consumption per RTU Module

Module Name	Self Power Consumption, no active I/O (Watts)	Maximum Power Consumption, per Active I/O (Watts)	Self Power Consumption, no active I/O (Watts)	Maximum Power Consumption, per Active I/O (Watts)	Maximum Power Consumption, all I/Os, LEDs Active (Watts)
	AC: 100 to 240 VAC DC: 18 to 72 VDC		Vin = +13.8 VDC		
Power Supply (maximum)	12.60	N/A	2.20 (156 mA) (12 VDC Power Supply Module ONLY)	N/A	N/A
Power Supply (Expansion)	0.0	N/A	0.0	N/A	N/A
CPU (3640/3610)	5.20	N/A	4.20 (304 mA)	N/A	4.00 (290 mA)
Expansion Module	5.20	N/A	4.20 (304 mA)	N/A	4.00 (290 mA)
Expansion LAN Switch	1.50	0.220	1.20 (87 mA)	0.176 (12.75 mA)	3.10 (225 mA) (x8 ports ON)
Digital Input Fast 24V (x16/x32)	0.100	0.100 (powered by internal 24V PS)	0.080 (5.8 mA)	0.100 (7 mA) (powered by internal 24V PS)	3.50 (254 mA) (x32 inputs ON powered by x1 internal 24V PS)
Digital Input Fast 24V IEC Type 2 (x16/x32)	0.100	0.230 (powered by internal 24V PS)	0.080 (5.8 mA)	0.230 (17 mA) (powered by internal 24V PS)	8.20 (594 mA) (x32 inputs ON powered by x2 internal 24V PS)
Digital Input 120/230V	0.100	0.015	0.080 (5.8 mA)	0.012 (1 mA)	0.524 (38 mA) (x16 inputs ON)
Digital Output ML Relay (x8/x16)	0.120	0.010	0.100 (7.2 mA)	0.008 (0.5 mA)	0.483 (35 mA) (x16 relays ON)
Digital Output EE Relay (x8/x16)	0.170	0.200	0.136 (10 mA)	0.160 (11.6 mA)	3.26 (236 mA) (x16 relays ON)
Digital Output ML Relay 120/230V	0.200	0.006	0.160 (11.6 mA)	0.005 (0.4 mA)	0.248 (18.0 mA) (x12 relays ON)
Digital Output EE Relay 120/230V	0.290	0.260	0.232 (17 mA)	0.210 (0.15 mA)	3.12 (226 mA) (x12 relays ON)

Module Name	Self Power Consumption, no active I/O (Watts)	Maximum Power Consumption, per Active I/O (Watts)	Self Power Consumption, no active I/O (Watts)	Maximum Power Consumption, per Active I/O (Watts)	Maximum Power Consumption, all I/Os, LEDs Active (Watts)
	AC: 100 to 240 VAC DC: 18 to 72 VDC		Vin = +13.8 VDC		
FET Digital Output/Digital Input	0.120	DI = 0.014 (per input channel) DO = 0.014 (per output channel)	0.100 (7.2 mA)	DI = 0.011 (per input channel) DO = 0.011 (per output channel)	0.552 (40 mA) (x32 LEDs/ inputs ON)
Mixed I/O (DO ML +DI IEC Type 2)	0.480	DI = 0.250 (powered by internal 24V PS) DO = 0.010	0.384 (28 mA)	DI = 0.250 (powered by internal 24V PS) DO = 0.008	4.70 (341 mA) (x4 relays ON, x16 inputs ON, x4 AI ON, powered by internal 24V PS)
Mixed I/O (DO EE + DI IEC Type 2)	0.480	DI = 0.250 (powered by internal 24V PS) DO = 0.200	0.384 (28 mA)	DI = 0.250 (powered by internal 24V PS) DO = 0.160	5.50 (400 mA) (x4 relays ON, x16 inputs ON, x4 AI ON, powered by internal 24V PS)
Analog Output	1.10	0.600 (per output channel @20.0 mA)	0.880 (64 mA)	0.480 (35 mA) (per output channel @20.0 mA)	3.33 (241 mA) (x4 outputs sourcing 20.0 mA)
Mixed Analog Current/Voltage	1.40	0.600 (per output channel @20.0 mA)	1.12 (81 mA)	0.480 (35 mA) (per output channel @20.0 mA)	3.61 (261 mA) (x4 outputs sourcing 20.0 mA)
Analog Input Current/Voltage (x8/x16)	0.530	N/A	0.440 (32.0 mA)	N/A	0.870 (63.0 mA)
24V Floating Plug-In Power Supply (No load)	0.410	N/A	0.328 (24 mA)	N/A	N/A
24V Floating Plug-In Power Supply (externally loaded 150 mA)	4.80	N/A	3.84 (278 mA)	N/A	N/A

Ordering Information

Note: For detailed ordering information, refer to the ACE3600 Catalog.

ACE3600 MODELS

All RTU models include no I/O slots frame, 10.8-15.5 V DC PS and CPU3610. All radio models require Metal Chassis or Housing option.

No Radio Model

- ACE3600 Basic Model No Radio F7509

Conventional VHF Radio Models

- ACE3600 CM200/CM140/EM200/GM3188 VHF F7573
- ACE3600 with CDM750 136-174 MHz F7563
- ACE3600 with HT750/GP320/GP328 /PRO5150 VHF F7553

Conventional UHF Radio Models

- ACE3600 with CM200/CM140/EM200/GM3188 UHF F7574
- ACE3600 with CDM750 403-512 MHz F7564
- ACE3600 with HT750/GP320/GP328 /PRO5150 UHF F7554

Analog Trunked VHF Radio Models

- ACE3600 with XTL2500 136-174 MHz Analog F7533
- ACE3600 with XTL2500 136-174 MHz Digital F7593
- ACE3600 with XTS2500 136-174 MHz Digital F7543

Trunked UHF Radio Models

- ACE3600 with XTL2500 380-520 MHz Analog F7534
- ACE3600 with XTL2500 380-520 MHz Digital F7594
- ACE3600 with XTS2500 380-520 MHz Digital F7544

Trunked 800 MHz Radio Models

- ACE3600 with XTL2500 800 MHz Analog F7538
- ACE3600 with XTL2500 800 MHz Digital F7598
- ACE3600 with XTS2500 800 MHz Digital F7548

I/O Expansion

- ACE3600 Expansion Frame Unit F7510

Software Tools

- ACE3600 System Tools Suite (STS) F7500
- ACE3600 C Toolkit (CTK) F7600
- ACE3600 Enhanced PID FVN5680

STS add-on Software

- ACE3600 AGA 7+8 CD FVN5510
- ACE3600 DNP 3.0 Plus Master Drivers CD FVN5511
- ACE3600 DNP 3.0 Plus Slave Drivers CD FVN5512
- ACE3600 IEC60870-5-101 Slave driver CD FVN5513

ACE3600 OPTIONS

Regional Radio Options

CM200/CM140/EM200/CM3188

One of the following options must be ordered for models F7573 and F7574:

- CM200 V851
- CM140 V852
- GM3188 V853
- EM200 V854

HT750/GP320/GP328/PRO5150

One of the following options must be ordered for models F7553 and F7554.

- HT750 V951
- GP320 V952
- GP328 V953
- PRO5150 V954

Frames

- 3 I/O slots frame V103
- 5 I/O slots frame V105
- 7 I/O slot frame V107
- 8 I/O slots frame V108
- 19" rack brackets for 8 I/O slots frame V051

Metal Chassis

- 48 x 48 cm Metal Chassis (up to 7 I/O slots) V056
- 38 x 38 cm Metal Chassis (up to 3 I/O slots) V214
- 8 I/O (19") Metal Chassis V269

Housing

- 50 x 50 cm Metal Housing (up to 7 I/O slots) V228
- 50 x 50 cm Metal Housing with padlock accessory VA00405
- 40 x 40 cm Metal Housing (up to 3 I/O slots) V276
- 40 x 40 cm Metal Housing with padlock accessory VA00406
- Housing Tamper Switch V224

Power Supply, Battery Charger and Backup Battery

Note: The default PS is 10.8-16 V DC input

- AC Power Supply 100-240 V V346
- AC PS 100-240 V with Battery charger V261
- DC Power Supply 18-72 V V251
- DC PS 18-72 V with Battery charger V367
- DC Low Tier PS 10.8 -16 V V149
- 6.5 Ah Backup Battery V114
- 10 Ah Backup Battery V328

CPU Upgrade

Note: The default CPU is CPU3610

- ACE CPU3640 V446

CPU Plug-in Ports / Memory

- Plug-in RS-232 Port V184
- Plug-in RS 485 Port V440
- Plug-in Ethernet 10 M Port V204
- Plug-in Ethernet 10/100 M Port V212
- Plug-in Radio Port VA00362
- Plug-in 4 MB SRAM V447

Digital Input Modules

- 16 DI FAST 24V DC V265
- 32 DI FAST 24V DC V379
- 16 DI FAST 24V IEC TP2 V117
- 32 DI FAST 24V IEC TP2 V959
- 16 DI 120/230V VA00331AA

Relay Output Modules

- 8 DO EE relay 2A V508
- 16 DO EE relay 2A V616
- 8 DO ML relay 2A V314
- 16 DO ML relay 2A V516
- 12 DO EE 120/230V VA00348
- 12 DO ML 120/230V VA00332

Analog Modules

- 8 AI ± 20 mA V318
- 16AI ± 20 mA V463
- 8 AI ± 5 V V741
- 16AI ± 5 V V742
- 4 AO V118
- 4 AO / 8 AI (AI = ± 20 mA) V562
- 4 AO / 8 AI (AI = ± 5 V) V460

Mixed Input/Output Modules

- 16 DI/DO FET V480
- 32 DI/DO FET V481
- 16 DI 4 DO EE 4 AI, ± 20 mA V245
- 16 DI 4 DO ML 4 AI, ± 20 mA V453

I/O Modules Cables and Accessories

- 20 wire cable with TB holder 3 m V253
- 30 wire cable with TB holder 3 m V202
- 40 wire cable with TB holder 3 m V358
- 20 pin TB holder kit V158
- 30 pin TB Holder kit V203
- 40 pin TB holder kit V153
- Blank I/O module V20

I/O Expansion

- Expansion LAN Switch VA00226
- LAN Cable 60cm length V529
- LAN Cable 2m length V648
- LAN Cable 3m length V666
- LAN Cross Cable V665

Communications Interface

- RS-485 Junction Box V186

Radio Installation Kits

- CM200/CM140/EM200/GM3188 Installation kit V148
- CDM750 Installation kit V143
- HT750/GP320/GP328 /PRO5150 Installation kit V154
- XTL5000/XTL2500 Digital Installation kit V681
- XTL5000/XTL2500 Analog Installation kit V157
- XTS2500 Digital Installation kit V156
- MDS X710/9810 installation kit V152
- MDS iNET900/Transnet Installation Kit V680
- Transnet 900 OEM Installation Kit VA00225

Software License (RTU options)

- 3rd Party Protocol License (ModBus, DF1) V377
- AGA 8 License V284
- DNP3 License master/slave - RTU V283
- IEC 60870-5 License V242

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Arc Armor® Enclosure – 3 Compartment Enclosures



Arc Armor® Enclosure

Specifications

- 14 gauge Type 304 stainless steel bodies
- 16 gauge Type 304 stainless steel doors
- Individual seams continuously welded and ground smooth
- Compartments sealed via paintable sealant for environmental protection
- Louvered floor stand in 14 gauge Type 304 stainless steel
- Reinforced lifting eyes
- Type 4-rated gasket
- 90-degree external formed flange on top of body opening
- Epoxy Coated Zinc POWERGLIDE Handle and 3-point latching
- Door removed by pulling stainless steel continuous hinge pin
- Data pocket is high-impact thermoplastic
- Collar studs provided for mounting optional panels

Finish

Enclosures have white polyester powder paint finish inside and out.

Ratings

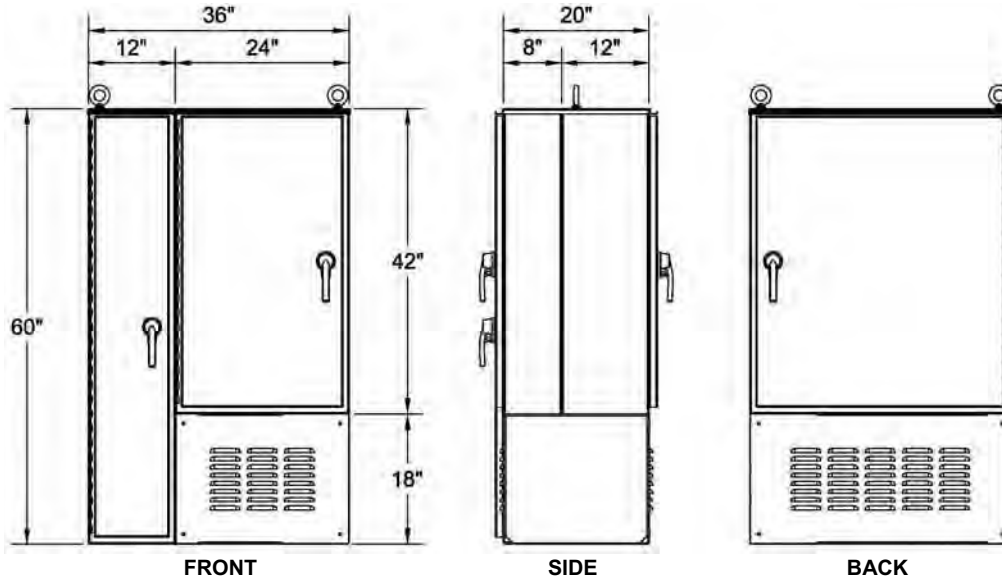
UL 508A Listed; Type 3R, 4, 4X, 12; File No.E61997
 cUL Listed per CSA C22.2 No 94; Type 3R, 4, 4X, 12;
 File No. E61997

Control Cabinet Section meet:
 NEMA/EEMAC Type 3R, 4, 4X, 12, 13
 Meets NEMA Type 3RX requirements

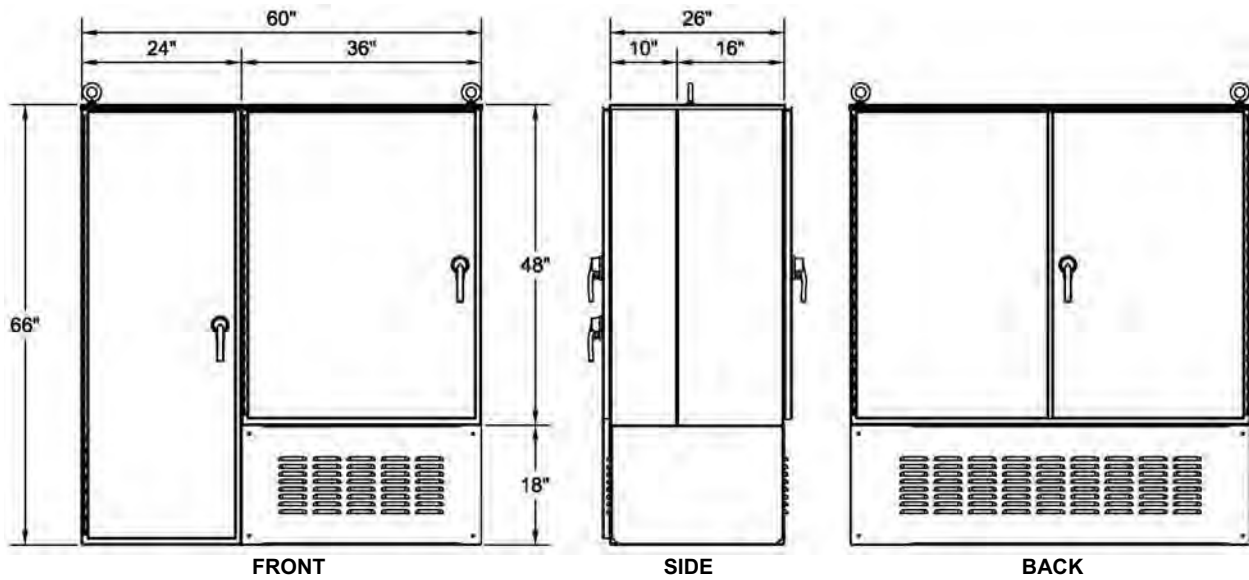
Power and MCC Sections meet:
 NEMA/EEMAC Type 3R
 Meets NEMA Type 3RX requirements

Part Number	Size	AxBxC (in.)	AxBxC (mm)	Stainless Steel Type	Latch Type
1029477	Size 1	60 x 36 x 20	1,524 x 914 x 508	304	3-Point Latch
1030423	Size 2	66 x 60 x 26	1,676 x 1,524 x 660	304	3-Point Latch

Arc Armor® Enclosure – 3 Compartment Enclosures



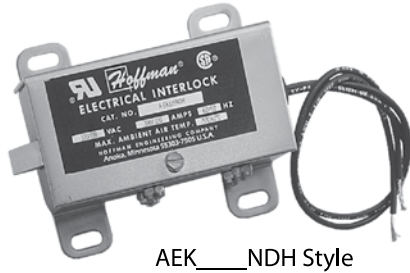
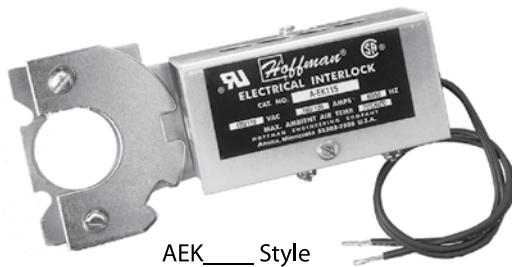
Size 1 Arc Armor® - #1029477



Size 2 Arc Armor® - #1030423

Electrical Interlocks

Electrical Interlocks



The interlocks will fit the following enclosures, but modifications are required. Consult the factory for more information.

1. Two-door Type 12 enclosures for flange-mounted disconnects
2. Heavy duty free-standing Type 12 enclosures for flange-mounted disconnects
3. Modular Type 12 enclosures for flange-mounted disconnects
4. Multi-door Type 12 enclosures

The interlocks will also fit most Hoffman custom enclosures with door latching mechanisms similar to the mechanisms used on the preceding enclosures. Electrical interlocks will not fit CONCEPT® enclosures or Bulletin A25 and A26 enclosures. Interlocks are not designed to be used in place of the standard door or cover latch.

Catalog numbers AEK115NDH, AEK230NDH and AEK460NDH are designed to be used on some Hoffman enclosures and boxes which have exterior latching only. When energized, these interlocks will prevent the enclosure door from being opened. They fit on the door or cover of the following enclosures and maintain UL Type 4, 4X and 12 when properly installed per Hoffman instructions:

1. One-door Type 4 and 4X enclosures
2. Two-door Type 4 and 4X enclosures
3. One-door Type 12 enclosures
4. Larger sizes of CH, CHS, CHNF, CHNFSS and CHAL junction boxes
5. Type 1 and large Type 1 enclosures

The interlocks also fit in most Hoffman custom enclosures and boxes which have doors or covers hinged similar to doors or covers on the preceding enclosures.

Industry Standards

UL 508A Component Recognized; File No. E61997

CSA Certified; File No. 42186

Application

Provide positive internal safety lockout on electrical enclosures while the equipment is energized. Catalog numbers AEK115, AEK230 and AEK460 are used with standard Hoffman door latching mechanisms. When energized, these interlocks prevent the door handle from being turned to open the door. Fit either clockwise or counterclockwise handles in the following enclosures:

1. All two-door Type 4 and 12 enclosures
2. All Type 4X with 3-point latch enclosures
3. Free-standing Type 12 enclosures
4. All one-door Type 12 enclosures with latch kits installed

Installation

AEK115, AEK230 and AEK460 mount on the inside of the enclosure door using the same screws which hold the door handle in place. The strike plate attaches to the existing latch assembly.

Specifications

- Rugged steel construction and plated finish
- Solenoids are rated for continuous duty and will stand up under heavy industrial use
- Packaged complete with a solenoid assembly, strike plate or bracket and instructions for field installation
- Handles and latch mechanisms are not included.

Bulletin: A80

Standard Product A-EK___ Style

Catalog Number	Volts @ 50/60 Hz	Normal/Inrush Amps @ 60Hz	Normal/Inrush Amps @ 50Hz
AEK115	110/120	.100/.63	.120/.69
AEK230	220/240	.050/.32	.060/.35
AEK460	440/480	.025/.16	.030/.18

Standard Product AEK___ NDH Style

Catalog Number	Volts @ 50/60Hz	Normal/Inrush Amps @ 60Hz	Normal/Inrush Amps @ 50Hz
AEK115NDH	110/120	.100/.63	.120/.69
AEK230NDH	220/240	.050/.32	.060/.35
AEK460NDH	440/480	.025/.16	.030/.18



Catalog Numbers
R-3W / R-3W-SR

Thru-Door Voltage Indicator

Flashing and Non-Flashing

Product Data Sheet

VoltageVision® thru-door power warning alerts provide electrical safety information while the panel doors are safely closed. This “one-size-fits-all” solution detects 3-phase AC or DC voltage from 40-750VAC/30-1000VDC. The encapsulated construction and redundant circuit design means rugged reliability. VoltageVision® products are available with flashing LEDs (R-3W) and non-flashing LEDs (R-3W-SR).

Safer Lock-Out Tag-Out (LOTO)

Keeping personnel away from live voltage is foundational to electrical safety. Electrical safety demands a precise answer to the question 'Is voltage present?'. Thru-door voltage indicators provide visibility of voltage from outside the enclosure without exposing personnel to voltage.

More Productivity in Mechanical LOTO

Workers performing mechanical LOTO must isolate electrical energy. An externally-mounted voltage detector provides a means to check voltage inside an electrical panel. Without a voltage indicator, a mechanic performing mechanical LOTO would be required to work in tandem with an electrician using a voltmeter to physically verify voltage inside an electrical panel. In this case, the electrician is exposed to voltage. With thru-door voltage detectors, the mechanic can verify zero electrical energy without any exposure to voltage.

Reduced Voltage Exposure and Arc Flash Risk

Voltage is the common denominator in an electrical accident or an arc flash; no voltage means no accident, no arc flash. While performing electrical LOTO with a thru-door voltage detector installed, the electrician can pre-check the internal voltage state without opening the enclosure. Next, the electrician should replicate a zero voltage reading with his voltmeter as per NFPA 70e 120.1(5). This low-cost, redundant voltage-verification task reduces arc flash risk and increases electrical safety for workers.

Disclaimer: Voltage indicators are a supplement, not a substitute, for establishing electrically safe work conditions when working on potentially live electrical conductors as per NFPA 70E 120.1(1) to (6). Employers must also provide written LOTO procedures and the corresponding training that properly incorporates voltage detectors into their safety programs [NFPA 70E 120.2(C)(2) and 110.6(D)(4)(e)].

Power Warning Alert

with Solid-on LEDs or Flashing LEDs

FEATURES:

- Redundant Circuitry / Long Life LED's
- 40-750VAC / 30-1000VDC / 35-600VAC 1Ø
- Potted Construction with 6' Leads
- Phase Insensitive
- 30mm Pushbutton or Pilot Hole
- High Surge Immunity
- UL Listed, Type 4X, 12, 13



APPLICATIONS:

- Circuit Breaker Disconnects - No Visible Blades
- High Energy Panels (NFPA 70E Category 3 or 4)
- Frequently Accessed Panels
- Mechanical LOTO: Indicating Zero Energy
- Panels with Multiple Power Sources

Three Phase 40-750VAC/30-1000VDC UL-Listed Voltage Indicator for Type 4X/12/13 for 30mm Mounting

R-3W	Flashing
R-3W-KB¹	Flush Mount Assembly with Bezel and R-3W (UL)
R-3W-L	Adhesive-Backed Warning Label (slips over installed R-3W)
R-3W-KB-L	Adhesive-Backed Warning Label (slips over installed R-3W-KB)

R-3W-SR²	Non-Flashing
R-3W-SR-KB¹	Flush Mount Assembly with Bezel and R-3W-SR (UL)
R-3W-SR-L	Adhesive-Backed Warning Label (slips over installed R-3W-SR)
R-3W-KB-L	Adhesive-Backed Warning Label (slips over installed R-3W-SR-KB)

R-3W2³	Hazardous Location Flashing Voltage Indicator (Suitable for use in Class 1, Division 2 (Zone 2), Groups A, B, C, D hazardous Location, or Non-Hazardous Locations Only)
R-3W2-KB¹	Flush Mount Assembly with Bezel and R-3W2 (UL)
R-3W-L	Adhesive-Backed Warning Label (slips over installed R-3W2)
R-3W-KB-L	Adhesive-Backed Warning Label (slips over installed R-3W2-KB)

(1) Must be purchased as an assembly for UL Listing

(2) For the R-3W-SR, the LED appearance for differing voltages as follows: 32-159V (FLASH); 160-329V (SHIMMER); 330V+ (SOLID).

(3) See R-3W2 datasheet for specifications and UL information



The UPA-100 Power Alert **reduces the risk of electrical arc flash** by pre-verifying the electrical isolation from outside of a control panel. Hardwired to the circuit breaker or main disconnect, the UPA flashes whenever voltage is present. Engineered with **redundant circuitry**, the Power Alert is powered by the same voltage that it indicates.

OPERATION

The eight detector UPA-100 visually alerts to the presence of dangerous AC or DC (Stored Energy) potentials occurring between any combination of the four monitored input lines (L1, L2, L3, GND). Two LED indicators are assigned to each input line and are designated "+" and "-". For each input line carrying an AC potential (bi-polar), both the "+" and "-" LEDs will be active. A DC or Stored Energy potential will illuminate the "+" LED for the positive line and the "-" LED for the negative line.

OSHA 1910.147 THE CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Following the application of lockout or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, and otherwise rendered safe. (d)(5)(ii)

If there is a possibility of reaccumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists. (d)(6)

"Verification of Isolation." Prior to starting work on machines or equipment that have been locked out or tagged out, the authorized employee shall verify that isolation and de-energization of the machine or equipment have been accomplished.

SPECIFICATIONS

OPERATIONAL RANGE	AC Single or 3-Phase	40 to 750 VAC, 50/60/400 Hz, (LINE-TO-LINE or LINE-TO-GND)
	DC or Stored Energy	30 to 1000 VDC, (LINE-TO-LINE or LINE-TO-GND)
MAXIMUM RATED VOLTAGE	750 VAC/1000 VDC (LINE-TO-LINE or LINE-TO-GND)	
DETECTION THRESHOLDS	29 VAC 3-Phase, 40 VAC SINGLE-Phase, 27 VDC (TYP Cutoff)	
POWER CONSUMPTION	1.2 Watts @ 750 VAC (Approximately)	
TEMPERATURE RATING	Operate	-4° to 131°F (-20° to +55°C)
	Storage	-40° to 185°F (-40° to +85°C)
ENCLOSURE	NEMA 4X 105°C PVC, Totally Encapsulated for Environment Protection	
TERMINATIONS	(4) 8ft, 18 AWG 1000V, UL-1452	
WEIGHT	9 oz.	

INDICATOR FLASH RATES (L1, L2, L3, GND)

3- Phase Line-To-Line (VAC)	<29	30	120	240	480	600	750
Flashes/Sec (Typical)	0	1.3	4.2	5.8	7.3	8.0	8.8
DC or Stored Energy (VDC)	<27	30	48	110	300	600	1000
Flashes/Sec (Typical)	0	1.6	2.5	4.5	6.9	8.8	9.1

GND DETECTOR THRESHOLDS (LEAKAGE ANY PHASE-TO-GROUND)

3- Phase Line-To-Line (VAC)	30	120	240	480	750
L1, L2, or L3 To Ground Continuity (OHMS)	2M	2M	3M	5M	7M
Detector Included Fault Current (µA)	7	26	38	60	67

DETECTOR INCLUDED FAULT CURRENT (PHASE-TO-GROUND SHORT)

3- Phase Line-To-Line (VAC)	30	120	240	480	750
0 OHM Phase-To-Ground Current (µA)	28	108	219	455	730



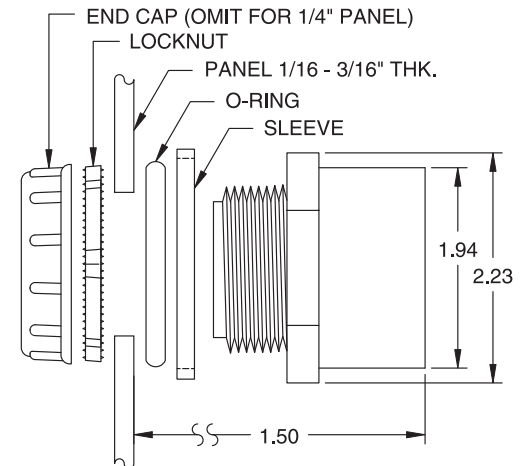
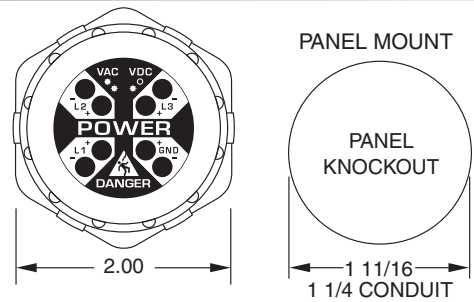
Universal Power Alert

- Detects Single or 3-Phase AC & DC Voltage or Stored Energy
- Redundant Circuitry
- Verification of Zero Energy in a Panel
- Fits 1-1/4" Conduit Knock-Out

ORDERING INFORMATION

MODEL NUMBER	DESCRIPTION
UPA-100	Universal Power Alert

DIMENSIONS (INCHES)



INSTALLATION: INSIDE PANEL SURFACE MUST BE UNIFORM. TIGHTEN LOCKNUT UNTIL SLEEVE BOTTOMS-OUT.

Power Alerts // UPA-100 Series

Door Stop Kit



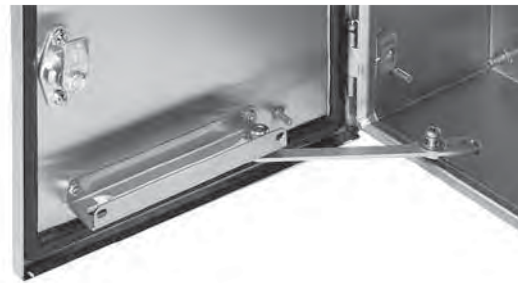
Door Stops

Designed for use on most standard Hoffman Type 4 and 12 enclosures to secure the door in the open position. Enclosures must have a "B" dimension of 16.00 in. (406 mm) or more and a door which opens horizontally. Door Stop Kit can be mounted at the top or bottom of the door opening after drilling two small holes in the body of the enclosure and two small holes in the door. The angle of the door is easily adjusted by means of a wingnut, and the stop arm slides neatly out of the way when the door is closed. All parts are plated. Maintains UL/CSA Type 4 and Type 12 if properly installed in a Hoffman enclosure. Door Stop Kit is not intended for use on CONCEPT® window door enclosures, or enclosures configured with a swing-out panel or swing-out rack frame.

Bulletin: A80

Catalog Number	Description
ADSTOPK	Door Stop Kit

Type 316 Stainless Steel Door Stop Kit



Application

Type 316 stainless steel door stop kit is available for use in applications that require the kind of corrosion protection that only Type 316 stainless steel can provide. Typical applications include water treatment, pulp, paper, petroleum, chemical, food and pharmaceutical processing, and packaging. Kit includes all mounting hardware. Secures doors in the open position. Can be mounted at either top or bottom of door. Can be installed on either left- or right-hinged doors. Maintains an enclosure's Type 4X rating. Easy to install. Mounting hardware is Type 316 stainless steel.

This door stop kit can only be mounted in wall-mount enclosures.

Features

- Can be mounted at either top or bottom of door
- Can be installed on either left- or right-hinged doors
- Maintains an enclosure's Type 4X rating
- Easy to install

Specifications

- Kit, including mounting hardware, constructed of Type 316 stainless steel

Bulletin: A45Y

Catalog Number	Description
ADSTOPKSS6	Type 316 stainless steel door stop kit

Large Enclosure Door Stop Kit



Designed for use with most standard, large mild and stainless steel enclosures to secure the door in the 90 degree open position. Door Stop Kit can be mounted at the top or bottom of the door opening after drilling two small holes in the door and enclosure. All parts are plated. Maintains UL/CSA Type 4 and Type 12 if properly installed in a Hoffman enclosure.

Bulletin: A34Y

Catalog Number	Description
ALGDSTOP2	Large Enclosure Door Stop Kit

FAN SHROUD KIT, TYPE 3R



INDUSTRY STANDARDS

Maintains UL/cUL Type 3R rating when properly installed on a UL/cUL Type 3R enclosure.

UL 508A Listed; Type 3R; File No. E61997
 cUL Listed per CSA C22.2 No. 94; Type 3R; File No. E61997

NEMA/EEMAC Type 3R
 IEC 60529, IP22

APPLICATION

Fan Shroud Kits protect outdoor enclosure openings from rain, sleet and snow.

FEATURES

- Two fan shrouds per package
- Perforated ventilation screen
- Pressure-sensitive adhesive-backed gasket and mounting hardware

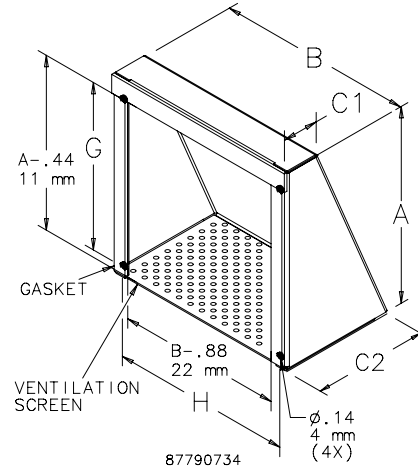
SPECIFICATIONS

- 16 gauge mild steel or Type 304 stainless steel

FINISH

ANSI 61 gray polyester powder coating over mild steel; smooth #4 brushed finish on stainless steel

BULLETIN: D85



Standard Product

Catalog Number	Material	A (in.)	A (mm)	B (in.)	B (mm)	C1 (in.)	C1 (mm)	C2 (in.)	C2 (mm)	G (in.)	G (mm)	H (in.)	H (mm)
T4S3R	Steel	6.00	152	6.00	152	1.44	37	4.69	119	4.69	119	5.25	133
T6S3R	Steel	8.00	203	8.00	203	1.44	37	4.69	119	6.69	170	7.25	184
T10S3R	Steel	12.00	305	12.00	305	1.44	37	4.71	120	10.69	272	11.25	286
T4S3RSS	Stainless Steel	6.00	152	6.00	152	1.44	37	4.69	119	4.69	119	5.25	113
T6S3RSS	Stainless Steel	8.00	203	8.00	203	1.44	37	4.69	119	6.69	170	7.25	184
T10S3RSS	Stainless Steel	12.00	305	12.00	305	1.44	37	4.71	120	10.69	272	11.25	286

Usage Chart

Catalog Number	Compact Cooling (muffin) Fans (4 in.)	Compact Cooling (muffin) Fans (6 in.)	Compact Cooling (muffin) Fans (10 in.)	Cooling and Exhaust Fan Packages (TFP4-)	Cooling and Exhaust Fan Packages (TFP6-)	Filter Fan Packages (SF05-)	Filter Fan Packages (SF09-)	Filter Fan Packages (SF10-)
T4S3R	•							
T6S3R	•	•				•		
T10S3R	•	•	•	•	•	•	•	•
T4S3RSS	•							
T6S3RSS	•	•				•		
T10S3RSS	•	•	•	•	•	•	•	•

120X120X38 mm

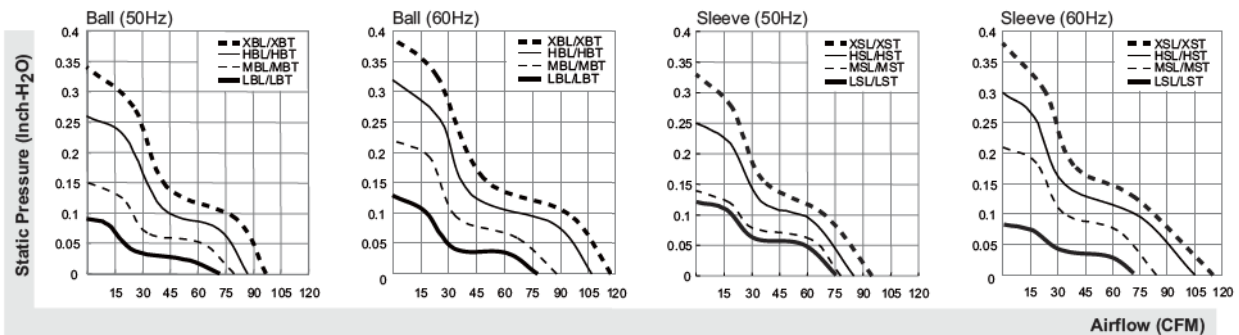
SUNON

70-117 CFM

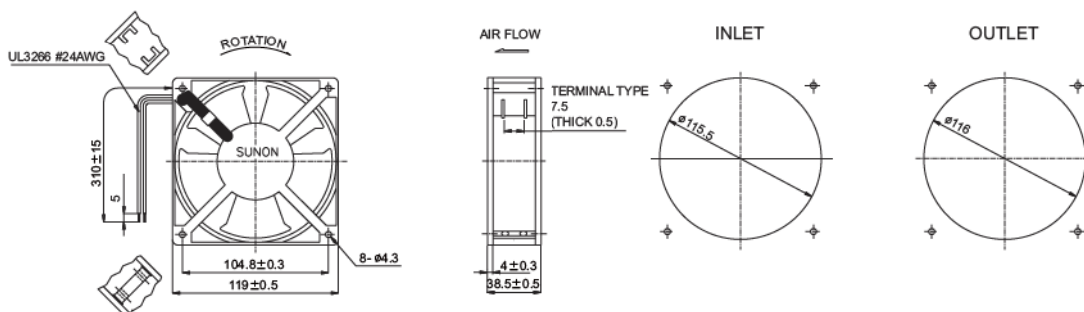


Model	P/N	Bearing	Rating Voltage (VAC)	Freq. (Hz)	Power Current (AMP)	Power Consumption (WATTS)	Speed (RPM)	Air Flow (CFM)	Static Pressure (Inch-H ₂ O)	Noise (dBA)	Weight (g)
SP100A	1123XSL.GN	⊙	115	50/60	0.26/0.24	22/20	2700/3100	95/115	0.33/0.38	44/49	550
SP100A	1123XST.GN	⊙	115	50/60	0.26/0.24	22/20	2700/3100	95/115	0.33/0.38	44/49	550
SP101A	1123HSL.GN	⊙	115	50/60	0.21/0.18	20/18	2550/2900	85/105	0.25/0.30	43/48	550
SP101A	1123HST.GN	⊙	115	50/60	0.21/0.18	20/18	2550/2900	85/105	0.25/0.30	43/48	550
SP102A	1123MSL.GN	⊙	115	50/60	0.17/0.16	15/15	2400/2600	78/84	0.14/0.21	33/38	550
SP102A	1123MST.GN	⊙	115	50/60	0.17/0.16	15/15	2400/2600	78/84	0.14/0.21	33/38	550
SP103A	1123LSL.GN	⊙	115	50/60	0.13/0.11	11/11	2200/2000	76/70	0.12/0.08	38/36	550
SP103A	1123LST.GN	⊙	115	50/60	0.13/0.11	11/11	2200/2000	76/70	0.12/0.08	38/36	550
SP100A	1123YBL.GN	○	115	50/60	0.26/0.24	22/20	2850/3150	97/117	0.34/0.39	45/50	550
SP100A	1123XBT.GN	○	115	50/60	0.26/0.24	22/20	2850/3150	97/117	0.34/0.39	45/50	550
SP101A	1123HBL.GN	○	115	50/60	0.21/0.18	20/18	2750/3050	87/107	0.26/0.32	45/50	550
SP101A	1123HBT.GN	○	115	50/60	0.21/0.18	20/18	2750/3050	87/107	0.26/0.32	45/50	550
SP102A	1123MBL.GN	○	115	50/60	0.17/0.16	16/15	2500/2700	80/88	0.15/0.22	35/40	550
SP102A	1123MBT.GN	○	115	50/60	0.17/0.16	16/15	2500/2700	80/88	0.15/0.22	35/40	550
SP103A	1123LBL.GN	○	115	50/60	0.13/0.11	11/11	2150/2300	72/78	0.09/0.13	37/39	550
SP103A	1123LBT.GN	○	115	50/60	0.13/0.11	11/11	2150/2300	72/78	0.09/0.13	37/39	550

Frame : Aluminum alloy



UNITS:mm

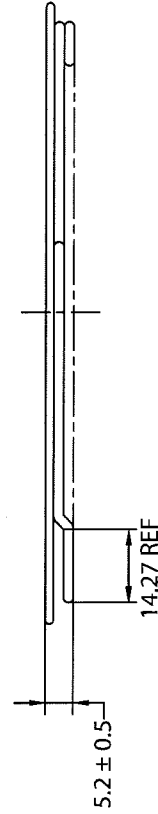
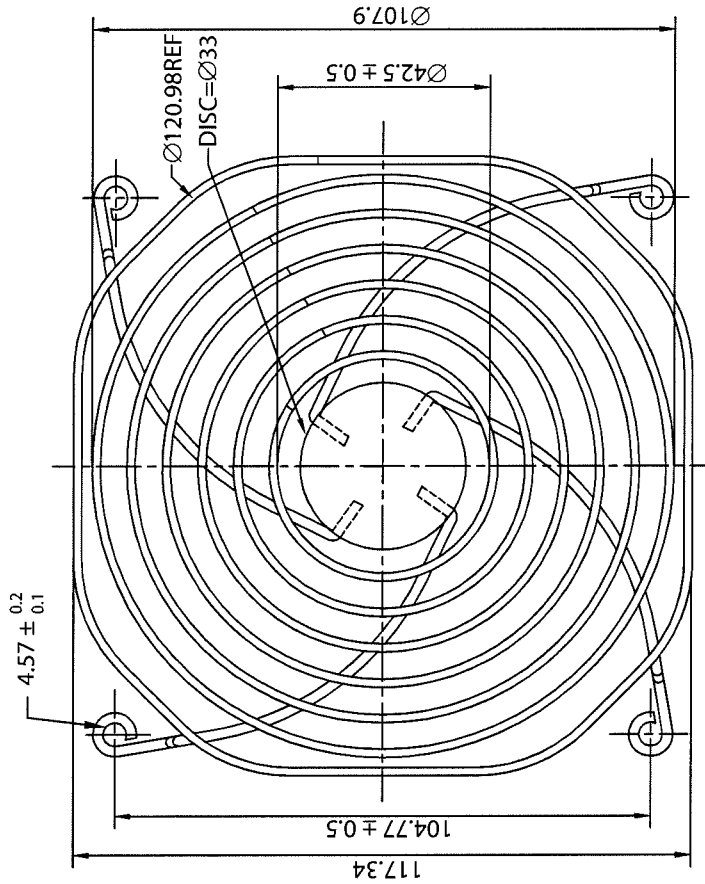


*All model could be customized on voltage or any other requirements to fit your need.

*Specifications subject to change without notice. Please Visit SUNON web site at <http://www.sunon.com> for update information.

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REVISION		DATE	APPROVED
REV.	DESCRIPTION		
B	RoHS Compliancy	06-01-06	DP
C	Updated Specifications	06-09-09	LY



NOTES:

1. MATERIAL: C1008 BRIGHT BASIC WIRE
2. FINISH: BRIGHT NICKEL CHROME PLATING
3. 0.35 ± 0.05 DEPTH OF SERRATIONS ON WIRE
4. RING: Ø1.6 ± 0.1mm
RIB: Ø2.0 ± 0.1mm
DISC: = Ø33 T=0.8mm
5. GENERAL TOLERANCE UNLESS NOTED IS ± 0.7mm
6. RoHS COMPLIANT

CONTROLLED

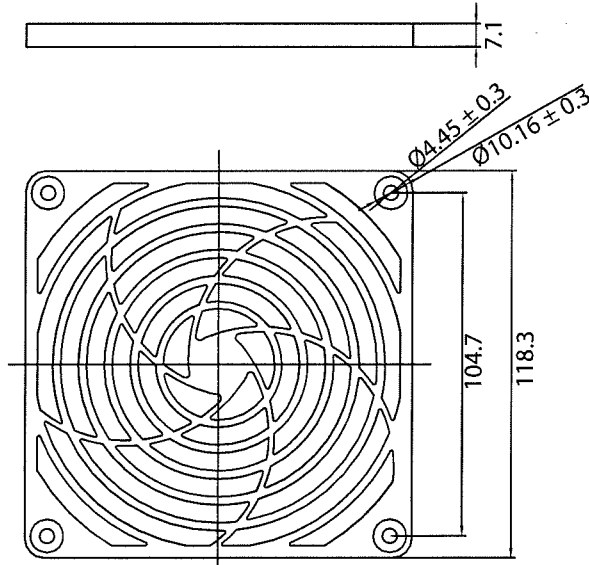
Qualtek Electronics Corp. FAN-S DIVISION		Part Number: 08141		Description: WIRE FORM FAN GUARD (120mm)	
Tolerance +/- (mm)		RoHS Compliant		REV: C	
Dim range (mm)	0-5	5-16	16-64	64-250	250-1000
	0.1	0.15	0.2	0.4	0.5
	1.0				
Drawn / Date	B. ZHANG 03-09-05	Checked / Date	03-09-05	Approved / Date	JJH / 03-09-05
UNIT: mm					

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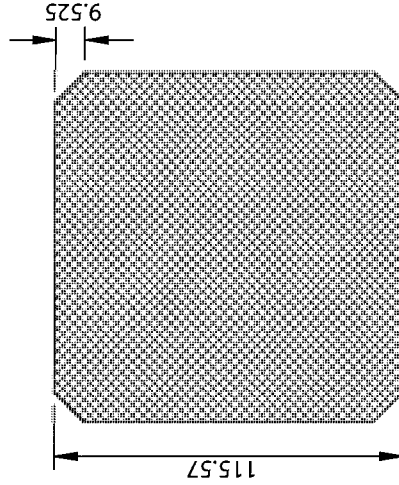
REVISION

REV.	DESCRIPTION	DATE	APPROVED
B	RoHS Compliancy	06-01-06	DP
C	Updated Specifications	12-13-07	DP
D	Updated Notes	09-09-09	LY
E	Updated Graphics and Dimensions	05-21-10	LY

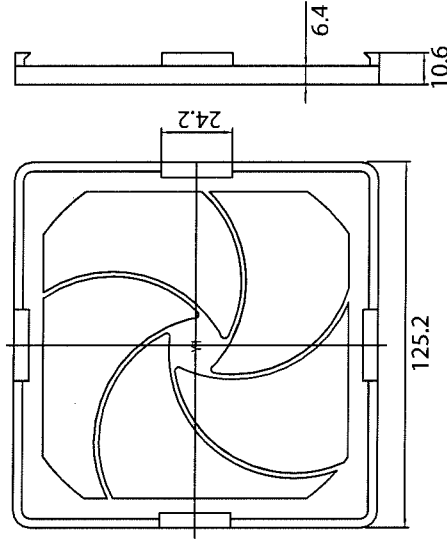
FAN GUARD



MEDIA



RETAINER



NOTES:

- MEDIA* AVAILABLE IN:
- XX=30 PPI **
- 45 PPI **
- 60 PPI **
- 100 PPI **
- * UL 900 CLASS II
- ** Pores Per Inch
- RoHS COMPLIANT

CONTROLLED

Qualtek Electronics Corp.
FAN-5 DIVISION



Part Number: 09450-F/XX

Description: PLASTIC FAN FILTER ASSEMBLY

REV: E

UNIT: mm

Approved / Date

Checked / Date

Drawn / Date

10-10-03

1.0

JJH / 10-10-03

10-10-03

B.ZHANG
10-10-03

0.5

250-1000

64-250

16-64

5-16

0-5

1.0

0.5

0.4

0.2

0.15

0.1

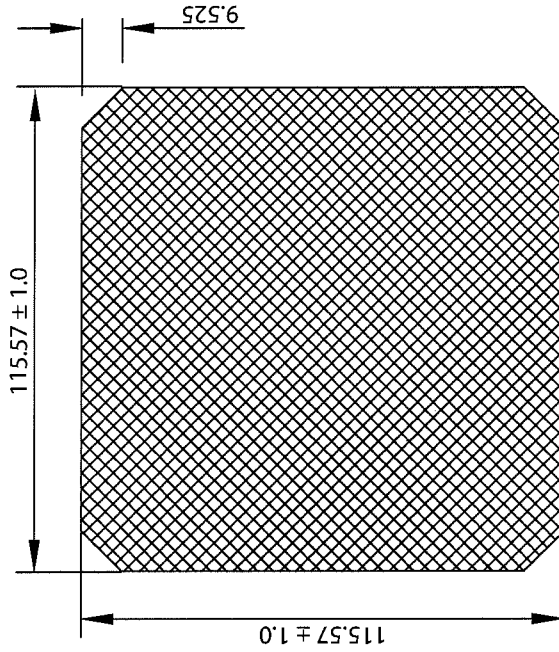
Tolerance +/- (mm)

Dim range (mm)

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REVISION

REV.	DESCRIPTION	DATE	APPROVED
B	RoHS Compliancy	06-01-06	DP



NOTES:

- MEDIA *
- AVAILABLE IN:
- XX = 30 PPI **
- 45 PPI **
- 60 PPI **
- 100 PPI **
- * UL 900 Class II
- ** PORES PER INCH
- RoHS COMPLIANT

CONTROLLED

Qualtek Electronics Corp.
FAN-S DIVISION



Part Number: 09450-M/XX

Description: FAN FILTER MEDIA

UNIT: mm

REV: B

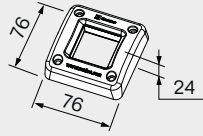
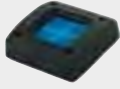
Dim range (mm)	Tolerance +/- (mm)
0-5	0.1
5-16	0.15
16-64	0.2
64-250	0.4
250-1000	0.5
1000-1500	1.0

Drawn / Date
B.ZHANG
03-11-03

Checked / Date
03-11-03

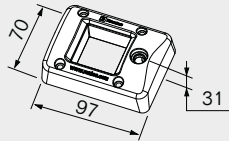
Approved / Date
JH / 03-11-03

Roxtec EzEntry™



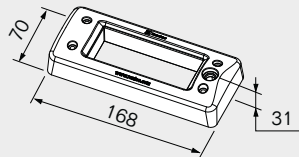
UL/NEMA 12,13 and IP 55

EzEntry 4 mini - Kit	Diameter range and number of cables/pipes		Weight		Art No.
	(kg)	(lb)			
	0+3.5-10.5mm 0+0.138-0.413" (GM 13.3w40)	0+3.5-16.5mm 0+0.138-0.650" (GM 20w40)			
EzEntry 4 mini/4	-	4 cables/pipes	0.100	0.220	EZ00000000440
EzEntry 4 mini/9	9 cables/pipes	-	0.100	0.220	EZ00000000490



UL/NEMA 4, 4x, 12, 13 and IP 66/67

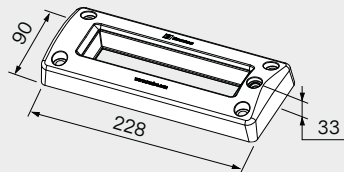
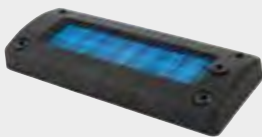
EzEntry 4 - Kit	Diameter range and number of cables/pipes		Weight		Art No.
	(kg)	(lb)			
	0+3.5-16.5mm 0+0.138-0.650" (EM 20w40)				
EzEntry 4/4	4 cables/pipes		0.13	0.28	EZ00000000044



Fits standard multipin connector knock-out.

UL/NEMA 4, 4x, 12, 13 and IP 66/67

EzEntry 10 - Kit	Diameter range and number of cables/pipes		Weight		Art No.
	(kg)	(lb)			
	0+3.5-16.5mm 0+0.138-0.650" (EM 20w40)	0+9.5-32.5mm 0+0.374-1.280" (EM 40 10-32)			
EzEntry 10/4	2 cables/pipes	2 cables/pipes	0.30	0.65	EZ00000001004
EzEntry 10/7	6 cables/pipes	1 cables/pipes	0.30	0.65	EZ00000001007
EzEntry 10/10	10 cables/pipes	-	0.30	0.65	EZ00000001010



Fits FL 21 knock-out.

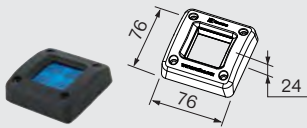
UL/NEMA 4, 4x, 12, 13 and IP 66/67

EzEntry 16 - Kit	Diameter range and number of cables/pipes		Weight		Art No.
	(kg)	(lb)			
	0+3.5-16.5mm 0+0.138-0.650" (EM 20w40)	0+9.5-32.5mm 0+0.374-1.280" (EM 40 10-32)			
EzEntry 16/4	-	4 cables/pipes	0.39	0.86	EZ00000001604
EzEntry 16/10	8 cables/pipes	2 cables/pipes	0.39	0.86	EZ00000001610
EzEntry 16/16	16 cables/pipes	-	0.39	0.86	EZ00000001616

For EzEntry™ 16 please note: When installing the EzEntry™ 16 on a structure thinner than 2 mm or 0.079 inches, you also need a counter frame.

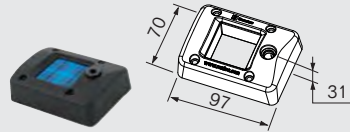
Roxtec EzEntry™

Roxtec EzEntry™ 4 mini/4



For cable/pipe range	0+3.5-16.5 mm / 0+0.138-0.650 in
Number of cables/pipes	4
Weight	0.100 kg / 0.220 lb
Article No.	EZ00000000440
Ratings	UL/NEMA and IP 55

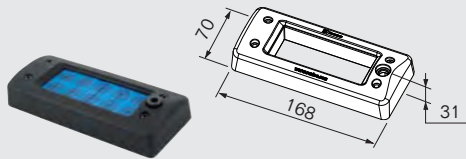
Roxtec EzEntry™ 4/4



For cable/pipe range	0+3.5-16.5 mm / 0+0.138-0.650 in
Number of cables/pipes	4
Weight	0.130 kg / 0.287 lb
Article No.	EZ00000000044
Ratings	UL/NEMA and IP 66/67

Roxtec EzEntry™ 10/10

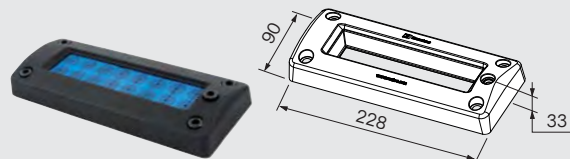
Fits standard multipin connector knock-out.



For cable/pipe range	0+3.5-16.5 mm / 0+0.138-0.650 in
Number of cables/pipes	10
Weight	0.300 kg / 0.650 lb
Article No.	EZ00000001010
Ratings	UL/NEMA and IP 66/67

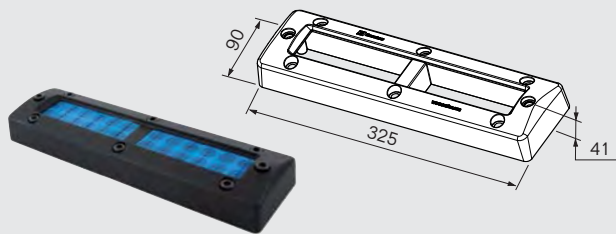
Roxtec EzEntry™ 16/16

Fits FL 21 knock-out.



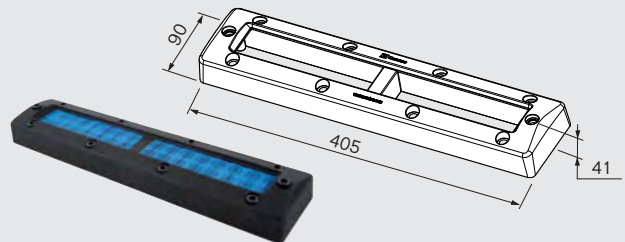
For cable/pipe range	0+3.5-16.5 mm / 0+0.138-0.650 in
Number of cables/pipes	16
Weight	0.387 kg / 0.860 lb
Article No.	EZ00000001616
Ratings	UL/NEMA and IP 66/67

Roxtec EzEntry™ 24/24



For cable/pipe range	0+3.5-16.5 mm / 0+0.138-0.650 in
Number of cables/pipes	24
Weight	0.805 kg / 1.774 lb
Article No.	EZ00000002424
Ratings	UL/NEMA and IP 66/67

Roxtec EzEntry™ 32/32



For cable/pipe range	0+3.5-16.5 mm / 0+0.138-0.650 in
Number of cables/pipes	32
Weight	1.030 kg / 2.270 lb
Article No.	EZ00000003232
Ratings	UL/NEMA and IP 66/67

The kit includes:

- Screws
- Hex key
- Lubricant (Assembly Gel for Roxtec EzEntry™ 4 mini)

Frame material:

Composite (PA 6.6 25% GF)

For more information, such as holecuts and assembly instruction, please visit:

www.roxtec.com/ezentry



Roxtec International AB
 Box 540, 371 23 Karlskrona, SWEDEN
 PHONE +46 455 36 67 00, FAX +46 455 820 12
 EMAIL info@roxtec.com, www.roxtec.com

Main

Commercial Status	Commercialised
Range of product	9080LB
Product or component type	Miniature Power Distribution Block
[In] rated current	90 A aluminium 115 A copper
Product certifications	CE CSA RoHS UL listed
Material	Thermoplastic block
[Ue] rated operational voltage	600 V AC
Number of poles	2
Number of terminals	4 branch 1 main
Electrical connection	Lugs tin plated aluminium
Number of cables	4 18...10 AWG copper or aluminium branch 1 14...2 AWG copper or aluminium main
Short-circuit current	65 kA

Ordering and shipping details

Category	21711 - 9080 LB
Discount Schedule	CP1
GTIN	00785901156956
Nbr. of units in pkg.	1
Package weight(Lbs)	0.16
Returnability	Y
Country of origin	US

Offer Sustainability

Sustainable offer status	Not Green Premium product
RoHS	Compliant - since 0620 - Schneider Electric declaration of conformity

Contractual warranty

Period	18 months
--------	-----------

9080LBA361104

Miniature Power Distribution Block , 115A/90A
(Cu/Al), 600VAC, 3-Pole



List Price \$38.70 USD

Availability **Stock Item:** This item is normally stocked in our distribution facility.

Technical Characteristics

Approvals	UL Recognized File: E60616 CCN XCFR2 - CSA Certified File: LR70361 - CE Marked
Ampere Rating	115A/90A (Cu/Al)
Depth	1.62 Inches
Height	2.29 Inches
Width	2.03 Inches
Block Material	High Impact Thermoplastic
Number of Poles	3-Pole
Lug Material	Tin Plated Aluminum
Maximum Voltage Rating	600VAC
Terminal Type	Lugs
Block Type	Copper or Aluminum Wire
Type	LB
Wire Size	Main: (1)#14 to #2 AWG - Branch: (4)#18 to #10 AWG

Shipping and Ordering

Category	21711 - Blocks, Distribution, Power, Type LB
Discount Schedule	CP1
Article Number	785901097433
Package Quantity	1
Weight	0.22 lbs.
Availability Code	S
Returnability	Y

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

Schneider Electric USA

1415 South Roselle Road

Palatine, IL 60067

Customer Care Center: 1-888-778-2733

Web: www.schneider-electric.us

Item # 9080LBA362106, Power Distribution Block LBA



Power Distribution Block LBA

Power Distribution Block

SPECIFICATIONS

Ampere Rating	175A/135A (Cu/Al)
UL File	E60616 XCFR2
CSA File	70361 6228-01
RoHS	Yes
CE Marked	Yes
Flammability Rating	UL94V-0
Service Class	C
For Use With	Copper or Aluminum Wire
Maximum Voltage Rating	600VAC
Number of Poles	3
Terminal Type	Lugs
Wire Range - Main	(1)#14 to #2/0 AWG
Wire Range - Branch	(6)#14 to #4 AWG
Cover	9080LB23
Short Circuit Current Ratings with Circuit Breakers	Up to 65 kA

Short Circuit Current Ratings with Fuses	Up to 200kA
35mm Track Adapter	9080FBDIN3



Product availability: Stock - Normally stocked in distribution facility
Price*: 25.70 USD

Main

Commercial Status	Commercialised
Range of product	9080LB
Product or component type	Power Distribution Block
[In] rated current	135 A aluminium 175 A copper
Product certifications	CE CSA RoHS UL listed
Material	Phenolic block
[Ue] rated operational voltage	600 V AC
Number of poles	3
Number of terminals	1 main 1 branch
Electrical connection	Lugs tin plated aluminium
Number of cables	1 14...2/0 AWG copper or aluminium main 2 14...2/0 AWG copper or aluminium branch
Product compatibility	9080LB23

Ordering and shipping details

Category	21711 - 9080 LB
Discount Schedule	CP1
GTIN	00785901097440
Nbr. of units in pkg.	1
Package weight(Lbs)	0.47
Product availability	Stock - Normally stocked in distribution facility
Returnability	Y
Country of origin	US

Offer Sustainability

Sustainable offer status	Not Green Premium product
RoHS	Compliant - since 0620 - Schneider Electric declaration of conformity

Contractual warranty

Period	18 months
--------	-----------

Product data sheet

Characteristics

9080LBA162101

POWER DISTRIBUTION BLOCK 600V 175A



Product availability: Stock - Normally stocked in distribution facility
 Price*: 10.40 USD



Main

Commercial Status	Commercialised
Range of product	9080LB
Product or component type	Power Distribution Block
[In] rated current	135 A aluminium 175 A copper
Product certifications	CE CSA RoHS UL listed
Material	Phenolic block
[Ue] rated operational voltage	600 V AC
Number of poles	1
Number of terminals	1 main 1 branch
Electrical connection	Lugs tin plated aluminium
Number of cables	1 14...2/0 AWG copper or aluminium main 2 14...2/0 AWG copper or aluminium branch
Short-circuit current	65 kA
Product compatibility	9080LB21

Ordering and shipping details

Category	21711 - 9080 LB
Discount Schedule	CP1
GTIN	00785901097297
Nbr. of units in pkg.	1
Package weight(Lbs)	0.21
Product availability	Stock - Normally stocked in distribution facility
Returnability	Y
Country of origin	US

Offer Sustainability

Sustainable offer status	Not Green Premium product
RoHS	Compliant - since 0620 - Schneider Electric declaration of conformity

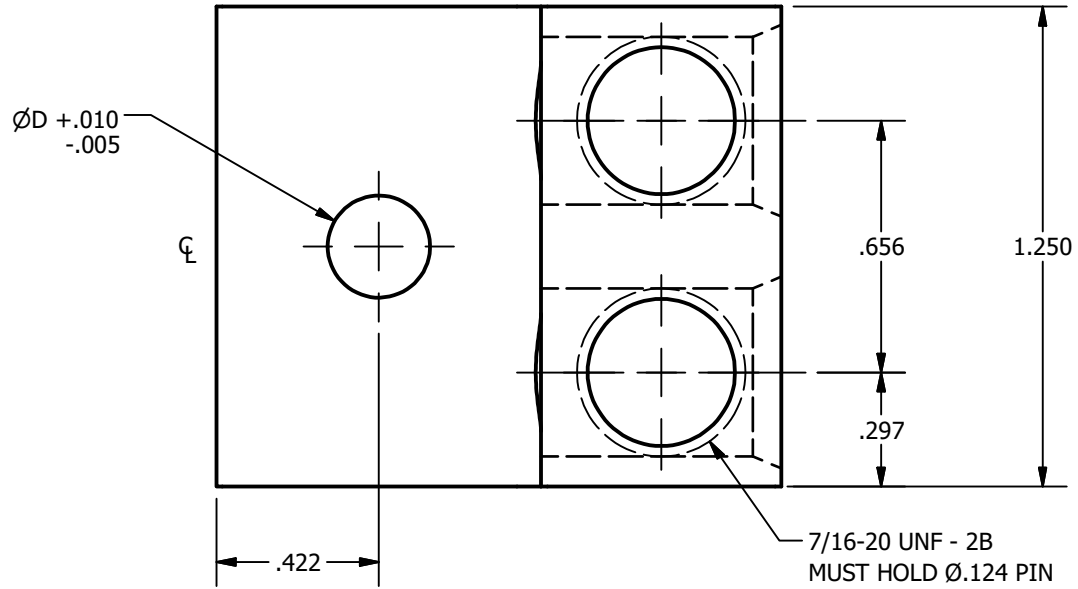
Contractual warranty

Period	18 months
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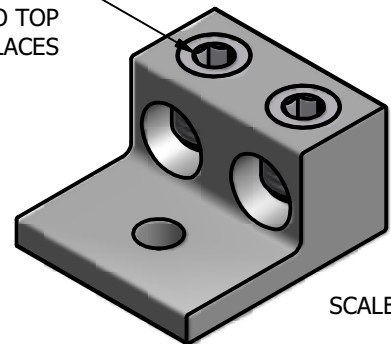
SCREW: E0950	MATERIAL:ALUMINUM, X0031	TOLERANCES-UNLESS OTHERWISE SPECIFIED 2 PL. DEC. ±.015 TRUE C.L. ±.015 3 PL. DEC. ±.015 ANGLES ±1		DWG. NO. D2057		
CAT. NO.:	PLATING: EL-TIN	DRAWN BY: CLH	SCALE: 2:1	SHEET 1 OF 1		
MASS:SEE CHART	MARKING: SEE CHART	DATE:1/16/2008	SIZE: A			
SURFACE AREA: SEE CHART ²		CELL:AMP				
STUFFER SHT: FORM 1					REV.	DESCRIPTION

E	
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Cat #: AU-2/0
AU-2/0-B2



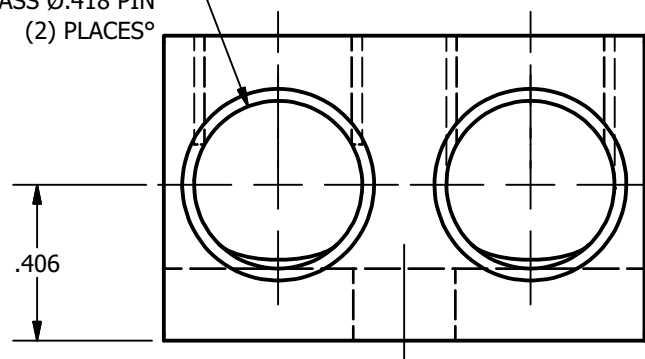
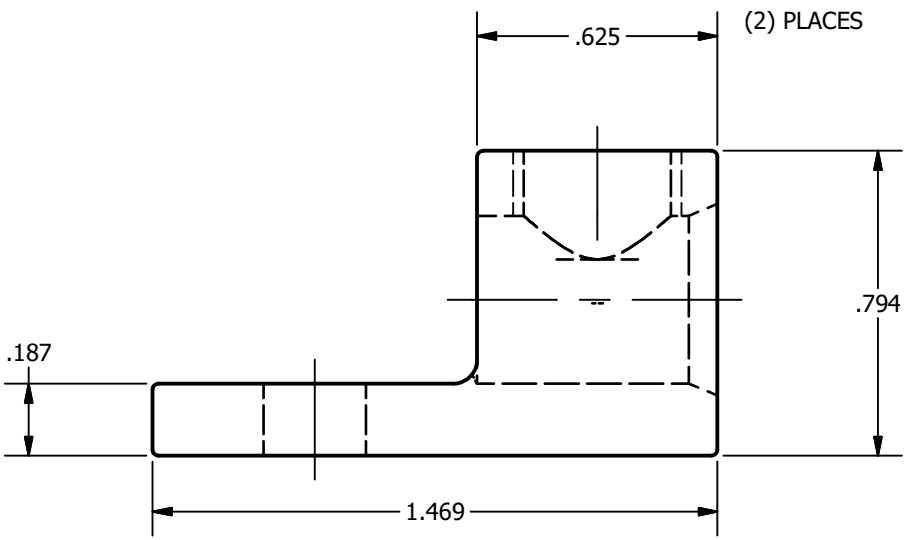
E0950 FLUSH TO TOP
(2) PLACES



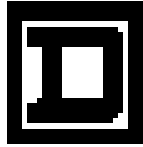
SCALE 1 : 1

7/16-20 UNF - 2B
MUST HOLD Ø.124 PIN
WITH NO LEAD GAGE
(2) PLACES

✓ Ø.437±.005
✓ Ø.499±.040 X 45°
MUST PASS Ø.418 PIN
(2) PLACES°



DEV	D	MASS LBS.	SURFACE AREA IN ²	MARKING
-22	.272	.0555	8.0048	ILSCO, D2057, AU-2/0, 2/0-14, AL9CU

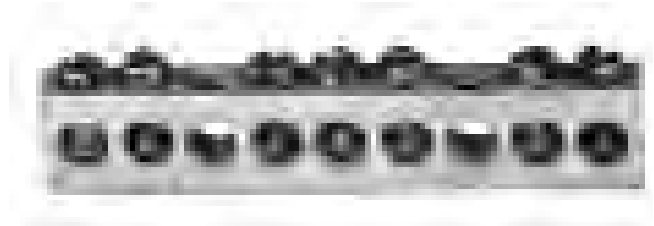


SQUARE D
GROUPE SCHNEIDER

PK7GTA

Grounding Bar Kit

- Field Installable on all panelboards
- Suitable for copper or aluminum wire
- Wire size of terminals (see technical information)



Terminal	Wire Binding Screw	Wire Range AWG CU-AL	Torque lb-in.
Multi hole bar	Slotted	14-10 CU, 12-10 AL	20
		8	25
		6-4	35
		Two 14 or 12 CU, Two 12 or 10 AL	25

Technical Characteristics

For Use With	Industrial Enclosures and Switchboards
Approvals	UL Listed - CSA Certified - IEC Rated
Circuit Breaker Type	Standard
General Application	Provides overload and short circuit protection
Fixed Magnetic Trip	Hold: 800A - Trip: 1450A
Ampere Rating	90A
Frame Type	H-Frame
HACR Rated	Yes
Voltage Rating	600VAC/250VDC
Marketing Trade Name	Powerpact
Mounting Type	Unit Mount
Weight	5 Pounds
Number of Poles	3-Pole
Circuit Breaker Rating	80% Rated
Terminal Type	Line: Lug - Load: Lug
Interrupting Rating	25kA@240VAC - 18kA@480VAC - 14kA@600VAC - 20kA@250VDC
Wire Size	#14 to #3/0 AWG(Al/Cu)
Width	4.12 Inches
Depth	4.36 Inches
Height	6.40 Inches

Shipping and Ordering

Category	01110 -
Discount Schedule	DE2
GTIN	00785901955917
Package Quantity	1
Weight	4 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

PowerPact® Electronic Motor Circuit Protectors

Turn It On: motor circuit protection solutions that offer reliability and flexibility

Delivering more reliable start-ups, better protection for equipment and a wide range of adjustments to meet users' motor starting needs, the Square D® PowerPact® electronic motor circuit protectors (MCP) are available for the PowerPact H- and J-Frame molded case circuit breakers.

To adjust to users' needs, the new PowerPact MCP has a unique design that includes one dial that allows for a wide range of full load amperes (FLA) adjustment and a second dial for motor selection. These adjustments ensure motor circuits are set to the in-rush characteristics of the motor, while achieving National Electrical Code® (NEC®) compliance.

What can PowerPact electronic motor circuit protectors do for you?

■ Reliable equipment start-ups

- Instantaneous trip points align with the motor and NEC requirements to ensure compliant installation
- Two dials allow quick and precise adjustment of settings to ensure proper protection

■ Simple installation

- Wide adjustments range means no need to change devices to cover the starter's horsepower range
- 30 A MCP has an FLA adjustment range of 1.5 A to 27 A, covering the entire range of a NEMA Size 1 starter
- Settings align directly with the information published on the motor nameplate for quick and easy installation

■ Improved equipment protection and safety

- Improved longevity of equipment from quick and decisive tripping when motor limitations are exceeded
- Ensures that breaker contacts correspond to the ON, OFF or tripped indication

■ Lower life cycle costs

- Due to the PowerPact MCPs flexibility, it eliminates the need to stock a wide variety of unique fuses and non-electronic MCPs



Where do you use PowerPact electronic motor circuit protectors?

■ Industrial Control Panels

- Branch Motor Circuits

■ HVAC Equipment

- Branch Motor Circuits

PowerPact® Electronic Motor Circuit Protectors

Product Specifications

Product Feature	Benefit
SCCR Ratings for UL 508A	Up to 100 kA at 480 V SCCR rating with Square D® NEMA and Telemecanique® TeSys® contactors and starters
NEC Code Compliance	Adjustment for standard and energy efficient motors make code compliance simple
Motor In-rush	Trip unit setting to allow dampening for in-rush current from an electric motor
Voltage Ratings	Rated for both wye and delta voltage systems Allowing use on 480 Y/277 V, 480 V delta, 600 Y/347 V and 600 V delta voltages
Certifications	UL, IEC, CSA, NOM and CE

Product Selection

Frame/Current		Full-Load Amperes Range (A)		J Interrupting (see SCCR table)	L Interrupting (see SCCR table)
				Catalog Number	Catalog Number
H-Frame	30A	1.5 – 25	9 – 325	HJL36030M71	HJL36030M71
	50A	14 – 42	84 – 546	HJL36050M72	HJL36050M72
	100A	30 – 80	180 – 1040	HJL36100M73	HJL36100M73
	150A	58 – 130	348 – 1690	HJL36150M74	HJL36150M74
J-Frame	250A	114 – 217	684 – 2500	JJL36250M75	JJL36250M75

For more information

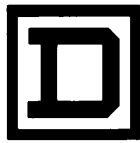
Visit our Web site at www.squared.com/powerpact for more information on the PowerPact MCP. The following literature is available from your authorized Square D® distributor or Schneider Electric sales office:

- Brochure, New Motor Circuit Protectors Improve Start-ups, document number 0106HO0601
- Catalog, PowerPact H- and J-Frame Circuit Breakers, document number 0611CT0401
- Brochure, UL 508A tested SCCR Combinations 0101BR0601
- Application Guide, PowerPact H- and J-Frame Circuit Breakers, document number 0611BR0401
- Brochure, PowerPact MCCB, document number 0611BR0402
- Application Guide, MCP Based Starters, document number 0600DB0701

For technical support, please call 888-SQUARED.

Schneider Electric - North America

2641 Sumner Boulevard
Raleigh, NC 27616
Tel: 800-468-5342
www.us.squared.com



SQUARE D
GROUPE SCHNEIDER

QOU140

Low Ampere 1 Pole Circuit Breaker

- Terminal lug wire size 1 - #14 - #2 AWG Cu or Al.
- Reversible line and load lugs for convenient flush or surface mount wiring.
- DIN mount (symmetrical rail 35 x 7.5 DIN/EN 50 022).
- UL Listed as HACR type
- Field installable quick connectors.
- Single handle with internal common trip.
- UL Listed 48Vdc (5,000 AIR).
- AIR Rating: 10,000
- Voltage Rating: 120/240 VAC
- Ampere Rating: 40 Amps



Mounting Type: Bolt-on

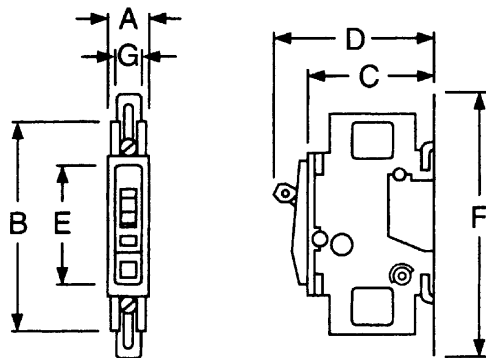
Interrupting Ratings: UL/CSA Rating (kA RMS) (50/60 Hz AC)

120 Vac: 10

120/240 Vac: 10

Special Ratings: Fed. Specs W-C-375B/GEN; Other Standard: HACR NOM

Trip System Type: Thermal-Magnetic



Dimensions - Inches

A	B	C	D	E	F	G
0.75	4.05	2.38	2.98	2.25	5.00	0.62

Multi 9™ System Catalog

Section 2—UL and CSA Rated Protection Devices

UL 489 Listed 480Y/277 Vac C60 Circuit Breakers (AC)

The UL 489 Listed 480Y/277 Vac Multi 9 C60 miniature circuit breakers can be used in 480Y/277 Vac systems. With amperages from 0.5 A to 20 A, they are ideal for fuse replacement, yet carry the UL 489 Listing that is required for branch circuit applications. See specifications on Table 2 for dimensions, weights, and interrupting ratings.



Table 7: Specifications for UL 489 Listed 480Y/277 Vac C60 Circuit Breakers

Interruption Rating	2P and 3P 1P	480Y/277 V @ 10kA 277 Vac @ 10kA
Amperage	0.5 A through 20 A	
Construction	1P, 2P and 3P	
Magnetic Trip Curves	C-curve D-curve	7 to 10 Times Ampere Rating 10 to 14 Times Ampere Rating
UL 486E Listed 2-Barrel Lug	18–16 AWG (1–1.5 mm ²), Cu Only Stranded Wire: 14–10 AWG (2–5 mm ²), Cu Only Solid or Stranded Wire	Torque to 7 lb-in (0.68 N•m) Torque to 14 lb-in (1.6 N•m)
Ring Tongue Screw	5 mm	Torque to 18 lb-in (2 N•m)
Plug-On Auxiliary Modules With Mechanical Linkage:	MN Undervoltage Trip MX + OF Shunt Trip/Auxiliary Switch OF Auxiliary Switch SD Alarm Switch	
Mounting	35 mm DIN Rail	

See selection Table 2 for dimensions, weights, and interrupting ratings.

Benefits

- Satisfies customer's preferences to use circuit breakers instead of fuses.
- Eliminates costs of spare fuses, blown fuse indicators, additional wiring, etc.
- Reduces concerns and uncertainty of misapplying a UL 1077 supplementary protector where a UL 489 branch circuit breaker is required.
- Facilitates one common design for UL 489, CSA and IEC applications.
- Simplifies installation with a compact, DIN-mounted circuit breaker that accepts a wide range of accessories.
- Offers alternative terminations for ring terminals or cable.

Standard Features

- Fast closing: Allows increased withstand to the high inrush currents of some loads.
- Trip-free mechanism: Contacts cannot be held in the I-ON position when the circuit breaker is tripped automatically.
- Positive indication of contact disconnect. Green mechanical indication on front face of device shows that all poles are open.
- C curve: Overcurrent protection for all application types. Magnetic release operates from 7 to 10 times ampere rating. (7 to 14 for dc)
- D curve: Overcurrent protection for loads with high inrush currents (motors, transformers). Magnetic release operates between 10 and 14 times ampere rating (no dc rating for D curve).
- Suitable for reverse feeding
- Allows locking in O-OFF position using padlock attachment.

Connections

Two versions of field wiring connectors are available:

- Two-barrel lug with binding screws for two 18–10 AWG wires.
- Crimp-type ring tongue terminal for up to 8 AWG wire

Both of these terminals provide fingersafe ingress protection per IP20 of IEC EN60529. This feature reduces the potential of incidental contact with live circuit breaker components.

Standards

- UL 489 Listed
- CSA C22.2 No. 5.1
- IEC 60947-2
- CE Marked

Catalog Numbers

Table 8: Catalog Numbers for UL 489 Listed 480Y/277 V C60 Miniature Circuit Breakers (AC)

Rating	2-Barrel Wire Lug			Ring-Tongue Terminal		
	1P	2P	3P	1P	2P	3P
C-curve, 7–10 Times Ampere Rating						
0.5 A	MGN61300	—	—	MGN61366	—	—
1 A	MGN61301	MGN61312	MGN61323	MGN61367	MGN61378	MGN61389
2 A	MGN61302	MGN61313	MGN61324	MGN61368	MGN61379	MGN61390
3 A	MGN61303	MGN61314	MGN61325	MGN61369	MGN61380	MGN61391
4 A	MGN61304	MGN61315	MGN61326	MGN61370	MGN61381	MGN61392
5 A	MGN61305	MGN61316	MGN61327	MGN61371	MGN61382	MGN61393
6 A	MGN61306	MGN61317	MGN61328	MGN61372	MGN61383	MGN61394
8 A	MGN61307	MGN61318	MGN61329	MGN61373	MGN61384	MGN61395
10 A	MGN61308	MGN61319	MGN61330	MGN61374	MGN61385	MGN61396
15 A	MGN61309	MGN61320	MGN61331	MGN61375	MGN61386	MGN61397
20 A	MGN61310	MGN61321	MGN61332	MGN61376	MGN61387	MGN61398
D-curve, 10–14 Times Ampere Rating						
0.5 A	MGN61333	—	—	MGN61399	—	—
1 A	MGN61334	MGN61345	MGN61356	MGN61400	MGN61411	MGN61422
2 A	MGN61335	MGN61346	MGN61357	MGN61401	MGN61412	MGN61423
3 A	MGN61336	MGN61347	MGN61358	MGN61402	MGN61413	MGN61424
4 A	MGN61337	MGN61348	MGN61359	MGN61403	MGN61414	MGN61425
5 A	MGN61338	MGN61349	MGN61360	MGN61404	MGN61415	MGN61426
6 A	MGN61339	MGN61350	MGN61361	MGN61405	MGN61416	MGN61427
8 A	MGN61340	MGN61351	MGN61362	MGN61406	MGN61417	MGN61428
10 A	MGN61341	MGN61352	MGN61363	MGN61407	MGN61418	MGN61429
15 A	MGN61342	MGN61353	MGN61364	MGN61408	MGN61419	MGN61430
20 A	MGN61343	MGN61354	MGN61365	MGN61409	MGN61420	MGN61431



Operating Mechanism

Type L Circuit Breaker Mechanisms

Type L door mounted, variable depth operating mechanisms feature heavy duty, all metal construction with trip indication. All can be padlocked in the "OFF" position when the enclosure door is open. Further, the handle assemblies can be locked "OFF" with up to three padlocks, which also locks when the door is closed. (The 3" handle accepts one padlock.) Complete kits are rated for NEMA Type 1, 3R, and 12 enclosures. They include a handle assembly, operating mechanism, and shaft assembly.

Table 8.47: Complete Kits

Complete Kit Does Not Include Circuit Breaker			Includes Operating Mechanism Standard 6 in. Handle Standard Shaft Kit			Includes Operating Mechanism Standard 6 in. Handle Long Shaft Kit			Includes Operating Mechanism Short 3 in. Handle Long Shaft Kit		
Use With			Type	\$ Price	Mounting Depth ▲ Min. – Max.	Type	\$ Price	Mounting Depth ▲ Min. – Max.	Type	\$ Price	Mounting Depth ▲ Min. – Max.
Circuit Breaker or Interrupter Type	No. of Poles	Frame Size (A)									
GJL	3	75, 100	LG1	140.00	5-1/2-10-1/4	LG4	158.00	5-1/2-20-7/8	LG3	198.00	5-1/2-20-7/8
FAL, FCL, FHL	2-3	100	LN1	140.00	5-1/2-10-7/16	LN4	158.00	5-1/2-21	LN3	198.00	5-1/2-21
KAL, KCL, KHL	2-3	250	LP1	171.00	6-1/4-11-3/16	LP4	189.00	6-1/4-21-3/4	LP3	230.00	6-1/4-21-3/4
NSF, PowerPact® H and J	2-3	250	LJ1	171.00	5-1/2-10-3/4	LJ4	189.00	5-1/2-21-3/8	—	—	—
LAL♦, LHL♦, Q4L	2-3	400	LR1	242.00	6-5/16-10-7/8	LR4	255.00	6-5/16-21-1/2			
MEL, MXL	2-3	800	LT1■	242.00	7-3/16-11-5/8	LT4■	255.00	7-3/16-22-1/4			
MAL, MHL	2-3	1200	LT1■	242.00	7-3/16-11-5/8	LT4■	255.00	7-3/16-22-1/4			
NAL, NCL, NEL, NXL	2-3	1200	LX1■	242.00	8-1/4-12-3/4	LX4■	255.00	8-1/4-23-3/8			
PowerPact M and P ▼	3	1200	LW1★	242.00	7-3/16-11-5/8	LW4★	255.00	7-3/16-22-1/4			

3 in. handles are not recommended for use with these circuit breakers.

Table 8.48: Component Parts

Use With			3 in. Handle Assemblies Type 1, 3R, 12		Standard Handle Assemblies Type 1, 3R, 12		Operating Mechanism Includes Lockout		Standard Shaft (Support Bracket Not Required)			Long Shaft (Support Bracket Included)		
Circuit Breaker or Interrupter Type	No. of Poles	Frame Size (A)	Type	\$ Price	Type	\$ Price	Type	\$ Price	Mounting Depth ▲ Min. – Max.	Type	\$ Price	Mounting Depth ▲ Min. – Max.	Type	\$ Price
GJL	3	75, 100	LH3	90.00	LH6	50.00	LG7	68.00	5-1/2-10-7/16	LS8	21.50	5-1/2-21	LS13	35.60
FAL, FCL, FHL	2-3	100	LH3	90.00	LH6	50.00	LF1	71.00	5-1/2-10-7/16	LS8	21.50	5-1/2-21	LS12	35.60
KAL, KCL, KHL	2-3	250	LH3	90.00	LH6	50.00	LK1	105.00	6-1/4-11-3/16	LS8	21.50	6-1/4-21-3/4	LS12	35.60
NSF, PowerPact H and J	2-3	250	LH3	90.00	LH6	50.00	LJ7	105.00	5-1/2-10-1/4	LS8	21.50	5-1/2-21-3/8	LS13	35.60
LAL♦, LHL♦, Q4L	2-3	400			LH6	50.00	LL1	170.00	6-5/16-10-7/8	LS8	21.50	6-5/16-21-1/2	LS10	35.60
MEL, MXL	2-3	800			LH8	50.00	LM1	170.00	7-3/16-11-5/8	LS8	21.50	7-3/16-22-1/4	LS10	35.60
MAL, MHL	2-3	1200			LH8	50.00	LM1	170.00	7-3/16-11-5/8	LS8	21.50	7-3/16-22-1/4	LS10	35.60
NAL, NCL, NEL, NXL	2-3	1200			LH8	50.00	LX7	170.00	8-1/4-12-3/4	LS8	21.50	8-1/4-23-3/8	LS10	35.60
PowerPact M and P▼	3	1200			LHP8	50.00	LW7	170.00	7-3/16-11-5/8	LS8	21.50	7-3/16-22-1/4	LS10	35.60

- ▲ Mounting depth measured from circuit breaker mounting surface (control panel) to outside of enclosure door in inches.
- Types LT1, LT4, LX1, and LX4 include an 8 in. handle rather than a 6 in. handle.
- ♦ Note: These operating mechanisms cannot be used with any LA/LH circuit breaker with an MB or MT suffix.
- ★ Type LW1 and LW4 include an 8 in. handle (9421LHP8) rather than a 6 in. handle.
- ▼ These circuit breakers must use the 9421LHP** or LCP** handles only.

Table 8.49: NEMA Type 4 and 4X Handle Assemblies ▲

Use With			Standard Handle Assemblies				Special 3 in. Version			
Circuit Breaker or Interrupter Type	No. of Poles	Frame Size (A)	NEMA Type 1, 3R, 4, 12 (Painted)		NEMA Type 1, 3R, 4, 4X, 12 (Chrome Plated)		NEMA Type 1, 3R, 4, 12 (Painted)		NEMA Type 1, 3R, 4, 4X, 12 (Chrome Plated)	
			Type	\$ Price	Type	\$ Price	Type	\$ Price	Type	\$ Price
GJL	3	75	LH46	90.00	LC46	149.00	LH43	165.00	LC43	233.00
FAL, FCL, FHL	2-3	100	LH46	90.00	LC46	149.00	LH43	165.00	LC43	233.00
KAL, KCL, KHL	2-3	250	LH46	90.00	LC46	149.00	LH43	165.00	LC43	233.00
NSF, PowerPact H and J	2-3	250	LH46	90.00	LC46	149.00	LH43	165.00	LC43	233.00
LAL, LHL, Q4L	2-3	400	LH46	90.00	LC46	149.00				
MEL, MXL	2-3	800	LH48	90.00	LC48	149.00				
MAL, MHL	2-3	1000	LH48	90.00	LC48	149.00				
NAL, NCL, NEL, NXL	2-3	1200	LH48	90.00	LC48	149.00				
PowerPact M and P	3	1200	LHP48	90.00	LCP48	149.00				

3 in. handles are not recommended for use with these circuit breakers.

- ▲ Due to gasketing, NEMA Type 3 & 4 handle assemblies are NOT trip indicating.

Table 8.50: IEC Style Operating Mechanisms

Circuit Breaker or Interrupter Type	Type 1, 4, 4X, 12			Operating Mechanism Includes Lockout		Extension Shafts			
	Color	Type	\$ Price	Type	\$ Price	Mounting Depth		Type	\$ Price
						Min.	Max.		
GJL	Red/Yellow	NW3	90.00	LG8	\$71.00	6-1/8	10-3/4	NS16	28.70
	Black	NW3B	90.00			6-1/8	17-7/8		

- ▲ Contains support bracket.

Table 8.51: Electrical Interlock Kits—Class 9999 ▲

Description	Class	Type	\$ Price
Single Pole Double Throw	9999	R47	131.00
Double Pole Double Throw	9999	R48	221.00

- ▲ Optional accessory for use with 9421L operating mechanisms.

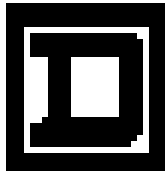
Note: Not used with GJL, NAL, NCL, NEL, NXL, NSF, NSJ, PowerPact® C, D, H, and J circuit breakers; use field-installed circuit breaker interlocks instead.



3 in. Handle Assembly



Standard Handle Assembly



SQUARE D
GRUPPE SCHNEIDER

60103

Multi 9 C60N UL 489 Listed 1 Pole Miniature Circuit Breaker

2 Amps, 120/240V AC

 Certified #179014

 Listed E215117



- Class 860 - Merlin Gerin
- Box Lug type terminals meeting UL486A
- UL 489 Listed and CSA 22.2 No.5.1 for branch circuit protection
- Magnetic Release: 7-10 x ampere rating
- 10 k AIR (1P @ 120 Vac)
- Suitable for reverse feeding
- Trip-free mechanism
- Positive indication of contact disconnect
- Thermal-magnetic Trip System
- Operating Temperature: -22°F to 158°F
- #18-#4 Awg; Torque 22 lb-in

UL/CSA Rating (kA RMS) (50/60 Hz)

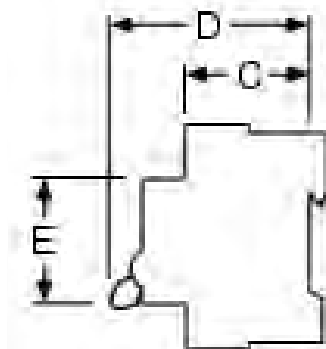
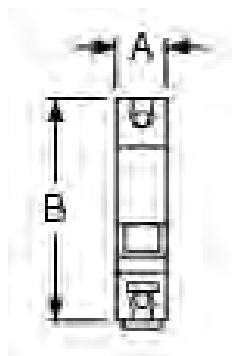
120 Vac: 10

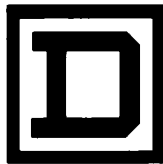
120/240 Vac: 5

240 Vac: 5

Dimensions (Inches):	A	B	C	D	E
	0.71	3.19	1.73	2.76	1.77

Dimensions





SQUARE D
GROUPE SCHNEIDER

60105

Multi 9 C60N UL 489 Listed 1 Pole Miniature Circuit Breaker

4 Amps, 120/240V AC

 Certified #179014

 Listed E215117



- Class 860 - Merlin Gerin
- Box Lug type terminals meeting UL486A
- UL 489 Listed and CSA 22.2 No.5.1 for branch circuit protection
- Magnetic Release: 7-10 x ampere rating
- 10 k AIR (1P @ 120 Vac)
- Suitable for reverse feeding
- Trip-free mechanism
- Positive indication of contact disconnect
- Thermal-magnetic Trip System
- Operating Temperature: -22°F to 158°F
- #18-#4 Awg; Torque 22 lb-in

UL/CSA Rating (kA RMS) (50/60 Hz)

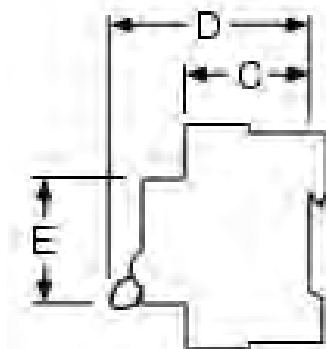
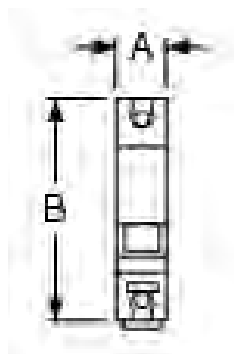
120 Vac: 10

120/240 Vac: 5

240 Vac: 5

Dimensions (Inches):	A	B	C	D	E
	0.71	3.19	1.73	2.76	1.77

Dimensions





by Schneider Electric

List Price \$125.00 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

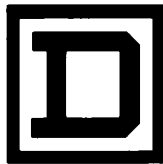
Technical Characteristics

For Use With	OEM Panels and Enclosures
Enclosure Rating	IP40
Approvals	UL489 Listed - CSA 22.2 #5.1 Certified - IEC Rated 60947-2
Circuit Breaker Type	Standard
Ampere Rating	5A
General Application	Short circuit and overcurrent protection
Marketing Trade Name	Multi 9
HACR Rated	Yes
Voltage Rating	120VAC - 60VDC
Mounting Type	Flush, Surface or DIN Rail (35mm)
Number of Poles	1-Pole
Weight	4.40 Ounces
Short Circuit Current Rating	5kA@240VAC - 10kA@120VAC
Terminal Type	Line: Box Lug - Load: Box Lug
Trip Curve	C Curve - Magnetic operates between 7 to 10 times
Type	C60N
Wire Size	#18 to #4 AWG
Width	0.71 Inches (18mm)
Height	4.21 Inches (107mm)
Depth	3.00 Inches (76mm)

Shipping and Ordering

Category	00915 -
Discount Schedule	DE2
GTIN	00785901208389
Package Quantity	1
Weight	0.29 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	FR

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



SQUARE D
GROUPE SCHNEIDER

60110

**Multi 9 C60N UL 489 Listed
1 Pole Miniature Circuit Breaker**

10 Amps, 120/240V AC

 **Certified** #179014

 **Listed** E215117



- Class 860 - Merlin Gerin
- Box Lug type terminals meeting UL486A
- UL 489 Listed and CSA 22.2 No.5.1 for branch circuit protection
- Magnetic Release: 7-10 x ampere rating
- 10 k AIR (1P @ 120 Vac)
- Suitable for reverse feeding
- Trip-free mechanism
- Positive indication of contact disconnect
- Thermal-magnetic Trip System
- Operating Temperature: -22°F to 158°F
- #18-#4 Awg; Torque 22 lb-in

UL/CSA Rating (kA RMS) (50/60 Hz)

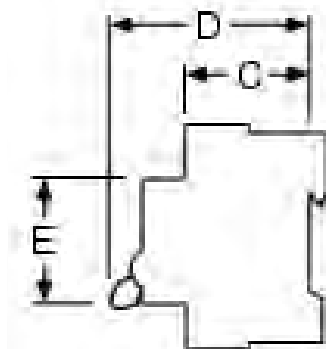
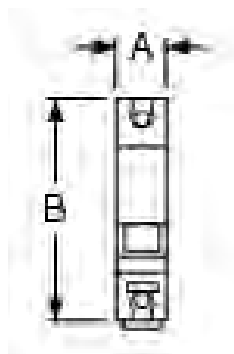
120 Vac: 10

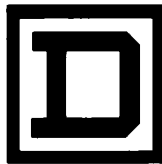
120/240 Vac: 5

240 Vac: 5

Dimensions (Inches):	A	B	C	D	E
	0.71	3.19	1.73	2.76	1.77

Dimensions





SQUARE D
GROUPE SCHNEIDER

60112

**Multi 9 C60N UL 489 Listed
1 Pole Miniature Circuit Breaker**

15 Amps, 120/240V AC

 **Certified** #179014

 **Listed** E215117



- Class 860 - Merlin Gerin
- Box Lug type terminals meeting UL486A
- UL 489 Listed and CSA 22.2 No.5.1 for branch circuit protection
- Magnetic Release: 7-10 x ampere rating
- 10 k AIR (1P @ 120 Vac)
- Suitable for reverse feeding
- Trip-free mechanism
- Positive indication of contact disconnect
- Thermal-magnetic Trip System
- Operating Temperature: -22°F to 158°F
- #18-#4 Awg; Torque 22 lb-in

UL/CSA Rating (kA RMS) (50/60 Hz)

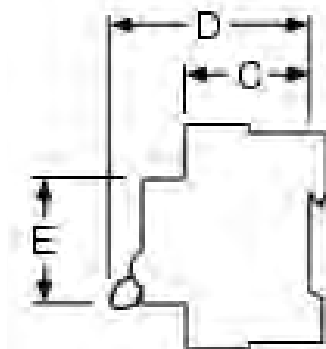
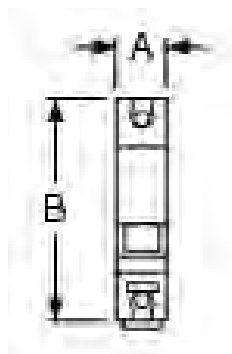
120 Vac: 10

120/240 Vac: 5










240 Vac: 5

Dimensions (Inches):	A	B	C	D	E
	0.71	3.19	1.73	2.76	1.77

Dimensions



Accessories — *Continued*

Connection Accessories		Catalog No.	List Price
	Ring Tongue Terminal Kit for UL 1077 C60		
	For one pole	17400	\$ 10.50
Plug-in Base for UL1077 C60 — Non UL Recognized — IEC Rated			
	One pole	MG26996	52.00
	Comb Busbar with integral end caps – 63 A – Recognized for use with UL 1077 C60 – See page 30 for IEC Rated type		
	12-Pole Long	1 Phase	MG10285 42.00
		2 Phase	MG10286 46.20
		3 Phase	MG10287 53.00
Tooth caps	20 pieces	60488	25.20
Interphase Barrier for UL1077 — Non UL Recognized			
	Bag of 10 pieces	MG27001	33.70
	Not available for C120.		
Terminal Screw Shield for UL1077 C60 — Non UL Recognized			
	Supplied as bag of two 4-Pole shields (May be divided into 1-, 2- or 3-Pole length)	MG26981	33.70
	Not available for C120.		
Terminal Cover for UL1077 C60 — Non UL Recognized			
	1-Pole (Set of two)	MG26975	16.90
	2-Pole (Set of two)	MG26976	33.70
	3-Pole (Requires one 1-Pole and one 2-Pole)	MG26975	16.90
		+MG26976	33.70
	4-Pole (Set of two)	MG26978	68.00
Not available for C120.			
Spacer — Non UL Recognized			
	9mm width	MG27062	6.20
	Padlock Attachment — Non UL Recognized		
	For all C60—bag of two—Accepts 0.315 in/8mm diameter padlock	MG26970	22.10
	For C120—bag of four—Accepts 0.315 in/8mm diameter padlock	MG27145	39.40
Heavy-duty Padlock Attachment — Non UL Recognized			
	For C60—set of two—Accepts 0.315 in/8mm diameter padlock	M9PAF	39.90



Application of Current transducer:

Current transducer measure power and monitor filling and pumping operations as well as monitoring changing process variables.

Feature of current transducer:

Three ranges per unit reduces inventory by select jumper or none.
No field adjustment necessary, factory calibrated
Average measurement is equivalent to True RMS for pure sine waves for the 0-5V,0-10V no need power supply,4-20mA series
True RMS measurement for sine waves or variable frequency drives for the 420T series
Input / Output isolation via current transformer
Solid-state reliability

Specifications:

FCS521/FCS2151

Power Supply 15-42 Vdc at sensor (loop powered) Operating Temperature -30C to +70°C(32 to 104 ° F)
Input Current Ranges Three field selectable ranges, 0-10/0-20/0-50 Amps
or 0-50/0-100/0-200 Amps
Operating Humidity 0 to 95% RH, non-condensing
Maximum Input Current

10/20/50 Amp ranges – 80/120/200 Amps continuous

50/100/200 Amp ranges – 175/300/400 Amps continuous

Protection Circuitry: Reverse voltage protected and output limited

Response Time: 250mS (0-90%)

Wiring Solid Core – Barrier strip

AC Conductor Hole: Split Core

Enclosure Material: UL 94 V-0 flammability rated ABS

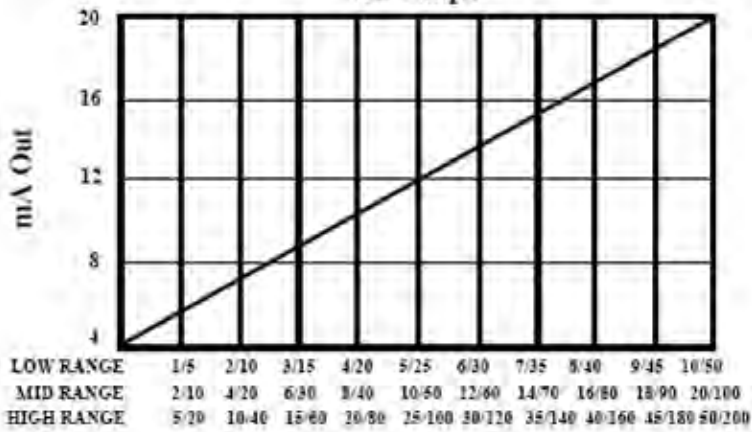
Enclosure Size: below dimension.

(H x W x D) 2.45" x 3.5" x 1"

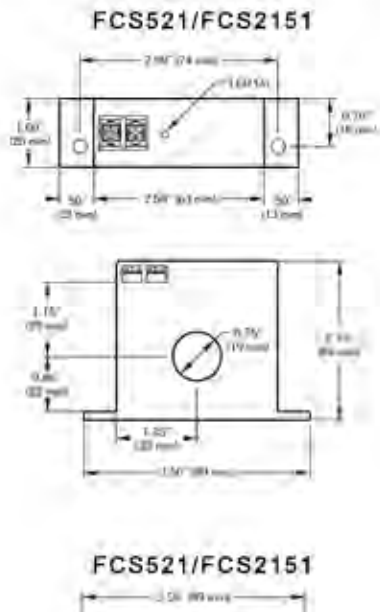
Output Signal & Accuracy: 4 to 20 mA represents 0 to 100% of current span. Better than $\pm 1\%$ FS on all three ranges

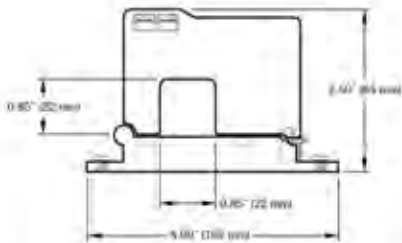
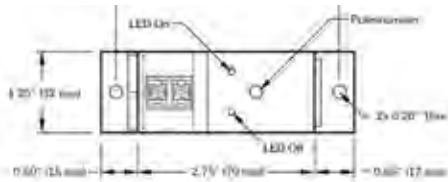
Model FCS521/FCS215

AC Amps



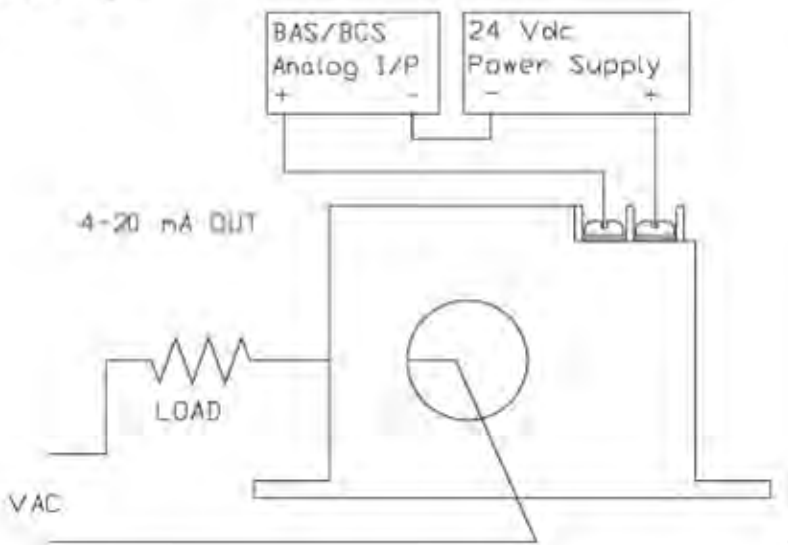
UL E320368, CE compliant, Rohs compliant





Installation:

Wiring



Attention: 0-5V, 0-10V output are do not need power supply.

Disconnect and lock-out all power sources during installation as severe injury or death can result from electrical shock due to contact with high voltage conductors. Ensure all installations are in compliance with applicable electrical codes and that the installation is completed by qualified installers familiar with the standards and proper safety procedures for high-voltage installation. Never rely on status indicating devices only to determine if power is present in a conductor. Insure the range selection jumper is installed in the correct position for the current being monitored. Excessive current can damage the sensor. See below for information on setting the jumpers.

Install the Split-Core over the conductor to be monitored and close the sensor until it latches, ensuring that the two halves are properly aligned. Operation of the sensor will be impaired if any dirt particles prevents good contact between the core pieces when the device is closed, keep the sensor clean when it is opened.

Mount the switch in a suitable location using the two mounting holes in the base of the unit.

The conductor may be looped more than once through the sensor to multiply the sensitivity but this also divides the maximum

currents. For example, on the 0-200 amp scale, if the conductor is looped through twice, the maximum current will now be 100 amps.

Connect the output circuit to the two screw terminals using ring or fork type terminals. Typical connections are shown in the wiring examples. Note polarity as indicated on the device label.

To allow field calibration, all devices have easily accessible calibration pots.

Availability **Stock Item: This item is normally stocked in our distribution facility.**

**Technical
Characteristics**

Shipping and Ordering

Category	21714 -
Discount Schedule	CP1
GTIN	00785901879145
Package Quantity	12
Weight	0.13 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	FR

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



**SMALL FUSE - BIG PROTECTION
FOR GENERAL CIRCUITS**

Amp-trap® ATMR fuses, in the Class CC family, are the smallest dimension 600VAC/DC fuses suitable for branch circuit protection. The ATMR is a popular choice for economical protection of control circuits and control circuit transformers where available short circuit currents exceed 10,000 amperes. ATMR's rejection dimensions prevent substitution by lesser rated fuses. These fast acting fuses give current limiting protection to general circuits.

B

Features/Benefits

- **Rejection style design** prevents replacement errors when used with recommended fuse blocks
- **Versatile design** for individual component and branch circuit protection

HIGHLIGHTS:

- Fast Acting
- Very Current-Limiting



APPLICATIONS:

- Control Circuits
- Lighting
- General Loads
- Branch Circuit Protection

Ratings

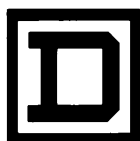
- **AC:** 1/10 to 30A
600VAC, 200kA I.R.
- **DC:** 1/10 to 30A
600VDC, 100kA I.R.

Approvals

- UL Listed to Standard 248-4 File E2137
- CSA Certified to Standard C22.2 No. 248.4
- DC Listed to ULStandard 248

**Standard Fuse Ampere Ratings,
Catalog Numbers**

AMPERE RATING	CATALOG NUMBER	AMPERE RATING	CATALOG NUMBER
1/10	ATMR1/10	3-1/2	ATMR3-1/2
1/8	ATMR1/8	4	ATMR4
2/10	ATMR2/10	5	ATMR5
1/4	ATMR1/4	6	ATMR6
3/10	ATMR3/10	7	ATMR7
1/2	ATMR1/2	8	ATMR8
3/4	ATMR3/4	9	ATMR9
1	ATMR1	10	ATMR10
1-1/4	ATMR1-1/4	12	ATMR12
1-1/2	ATMR-1-1/2	15	ATMR15
2	ATMR2	20	ATMR20
2-1/2	ATMR2-1/2	25	ATMR25
3	ATMR3	30	ATMR30



SQUARE D
GROUPE SCHNEIDER

9001SKS43B

Selector Switch

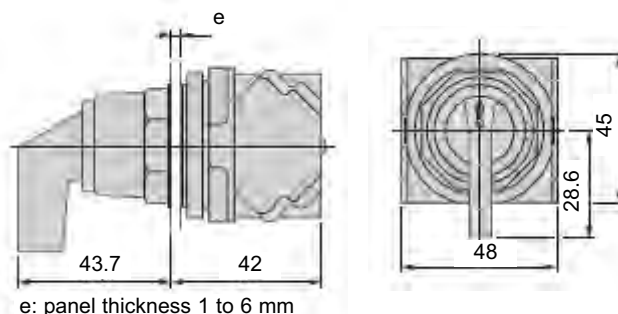
3-Position Maintained

30mm Black Lever Operator



Selector Switch Sequences (using contact block assemblies)

3 Position selector switch			
			Contact block guide
X	O	O	1 N.C. (left or right)
O	O	X	1 N.O. (left or right)
X	O	O	1 N.O. and (left or right)
O	O	X	1 N.C.



GENERAL CHARACTERISTICS

Environment:

Conformity to standards

Product certifications

Protective treatment

Ambient temperature

Resistance to vibration

Resistance to shock

Protection against electric shock

Degree of protection for chromium metal bezel

Degree of protection for plastic bezel range

Mechanical life

Mounting position

IEC 947-1, IEC 947-5-1, IEC 947-5-4, EN 60947-5-1, JIS C 4520 AND 852, UL 508, CSA C22-22 n° 14

UL508, NEMA A600-Q600

Standard version: "TC"

Operating: -25 °C to +70 °C (-13 °F to +158 °F) Storage: -40 °C to +70 °C (-40 °F to +158 °F)

Conforming to IEC 68-2-6. Frequency 2 to 500 Hz: 7gn Ford Standard EA-1

Conforming to IEC 68-2-27. Half sine wave: 50 gn

Conforming to IEC 536, Class II

Conforming to IEC 529 & NF C 20-010. IP 66;

Conforming to NEMA: Types 1,2,3,3R,4,6,12 and 13

Conforming to IEC 529 & NF C 20-010. IP 66;

Conforming to NEMA: Types 1,2,3,3R,4,4X,12 and 13

Pushbuttons, spring return, 5 million operations

Illuminated pushbuttons, 5 million operations

Selector switches and key switches, 0.5 million operations

All positions

PRODUCT CERTIFICATIONS



File LR 25490
Class 3211 03



File E 78403
CCN NKCR



File E 78403
CCN NKCR



Marked

For Declaration of
Conformity

9001KA1

30MM CONTACT BLOCK 1N/O 1N/C



List Price \$42.80 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Ampere Rating	10A
Approvals	UL File Number E42259 CCN NKCR - CSA File Number LR24590 Class 3211-03 - CE Marked
Contact Configuration	1 NO - 1 NC
Contact Type	Standard (Fingersafe)
Maximum Voltage Rating	600V
Size	30mm
Terminal Type	Screw Clamp
Type	K

Shipping and Ordering

Category	21434 - Blocks, Contact, Type KA
Discount Schedule	CS1
GTIN	00785901880004
Package Quantity	1
Weight	0.06 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	MX

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



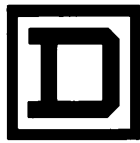
Technical Characteristics

Ampere Rating	10A
Approvals	UL File Number E42259 CCN NKCR - CSA File Number LR24590 Class 3211-03 - CE Marked
Bezel Material	Black Plastic
Button/Cap Color	Red
Button Type	Screw-On Plastic Mushroom (1.63 Inch/41mm)
Guard Type	No Guard
Contact Configuration	1 NO - 1 NC
Contact Block Code	H13
Contact Type	Standard (Fingersafe)
Enclosure Type	Water tight, Dust tight, Oil tight and Corrosion Resistant (Indoor/Outdoor)
Enclosure Rating	NEMA 1/2/3/3R/4/4X/6/12/13
Head Type	Round
Light Module Supply Voltage	110/120VAC@50/60Hz
Light Module Type	Transformer
Maximum Voltage Rating	600V
Markings	None
Mounting Type	Panel
Number of Operators	1
Number of Positions	2
Operator Action	Maintained (Push/Pull)
Operator Type	Illuminated
Size	30mm
Terminal Type	Screw Clamp
Type	K
Utilization Category	AC15 - DC13

Shipping and Ordering

Category	21429 - Push Buttons, Corrosion Resistant, Type SK & SKY
Discount Schedule	CS1
GTIN	00785901043102
Package Quantity	1
Weight	0.47 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	MX

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SQUARE D
GROUPE SCHNEIDER

9001SKR1B

**Type SK 30.5mm Black
Non-Illuminated Momentary
Push Button Operator
Without Contacts**



FULL GUARD

MAXIMUM CONTACT BLOCK USAGE:

3 blocks mounted in tandem (total of six blocks)

OPERATOR SERVICE TEMPERATURE RANGE:

-22° to +140° Fahrenheit at 50% relative humidity; -30° to +60° Celsius

ENVIRONMENTAL RATINGS:

The Type SK operators are UL approved for use in Types 1, 2, 3, 3R, 4, 4X, 6, 12 and 13 flat surface enclosures.

CONFORMING TO STANDARDS:

UL508, IEC 947-5-1, VDE 0106, CSA



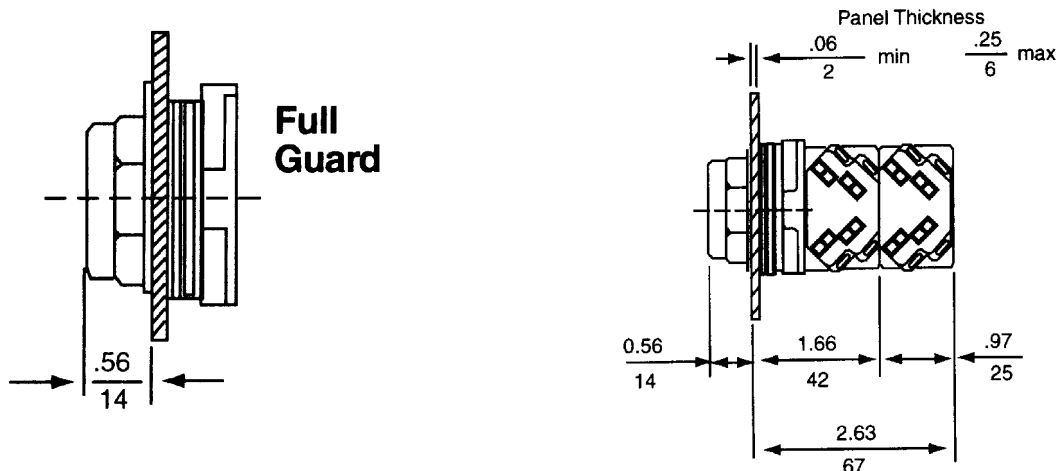
FILE E42259
CCN NKCR



FILE LR25490
CLASS 3211 03



APPROXIMATE DIMENSIONS



9001KA2

30MM CONTACT BLOCK 1N/O



List Price \$21.50 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

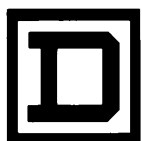
Technical Characteristics

Ampere Rating	10A
Approvals	UL File Number E42259 CCN NKCR - CSA File Number LR24590 Class 3211-03 - CE Marked
Contact Configuration	1 NO
Contact Type	Standard (Fingersafe)
Maximum Voltage Rating	600V
Size	30mm
Terminal Type	Screw Clamp
Type	K

Shipping and Ordering

Category	21434 - Blocks, Contact, Type KA
Discount Schedule	CS1
GTIN	00785901880011
Package Quantity	1
Weight	0.05 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	MX

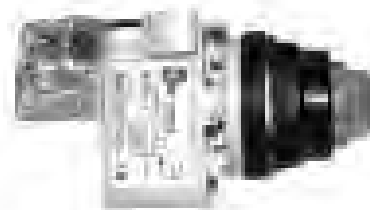
As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



SQUARE D
GROUPE SCHNEIDER

9001SKT1LR

**Pilot Light, 30 mm, LED, Transformer
Push to Test, Non-Metallic
120 VAC/DC, Full Voltage Type
For use with Red Colored Lens
(ordered separately)**



GENERAL CHARACTERISTICS

Environment:

Conformity to standards

IEC 947-1, IEC 947-5-1, IEC 947-5-4, EN 60947-5-1, JIS C 4520 AND 852, UL 508, CSA C22-22 n° 14

Product certifications

UL508, NEMA A600-Q600

Protective treatment

Standard version: "TC"

Ambient temperature

Operating: -25 °C to +70 °C (-13 °F to +158 °F) Storage: -40 °C to +70 °C (-40 °F to +158 °F)

Resistance to vibration

Conforming to IEC 68-2-6. Frequency 2 to 500 Hz: 7gn Ford Standard EA-1

Resistance to shock

Conforming to IEC 68-2-27. Half sine wave: 50 gn

Protection against electric shock

Conforming to IEC 536, Class II

Degree of protection for chromium metal bezel

Conforming to IEC 529 & NF C 20-010. IP 66;

Conforming to NEMA: Types 1,2,3,3R,4,6,12 and 13

Degree of protection for plastic bezel range

Conforming to IEC 529 & NF C 20-010. IP 66;

Conforming to NEMA: Types 1,2,3,3R,4,4X,12 and 13

Mechanical life

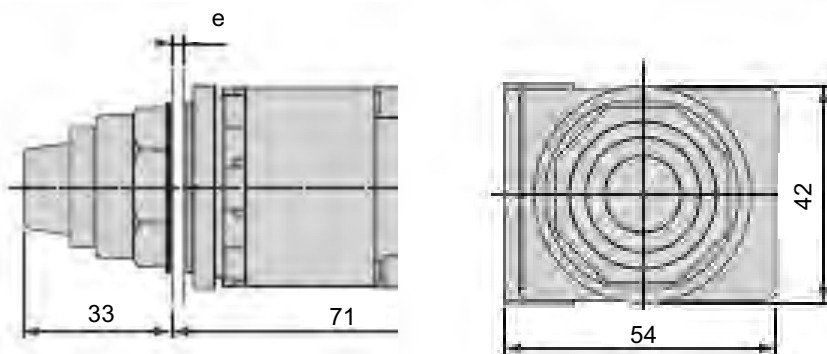
Pushbuttons, spring return, 5 million operations

Illuminated pushbuttons, 5 million operations

Selector switches and key switches, 0.5 million operations

Mounting position

All positions



e: panel thickness 1 to 6 mm

PRODUCT CERTIFICATIONS



File E 78403
CCN NKCR



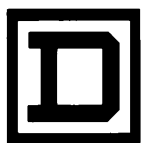
File LR 25490
Class 3211 03



File E 78403
CCN NKCR2



Marked



SQUARE D
GROUPE SCHNEIDER

9001_31

**Plastic Fresnel Pilot Light Lens
for SKP & SKT**

9001A31 - Amber

9001L31 - Blue

9001C31 - Clear

9001G31 - Green

9001R31 - Red

9001W31 - White

9001Y31 - Yellow



9001SKT35LGPilot Light , Push-To-Test, No Lens, No Lens,
Screw Clamp, LED (Green)

List Price \$185.00 USD

Availability **Non-Stock Item: This item is not normally stocked in our distribution facility.****Technical Characteristics**

Approvals	UL File Number E42259 CCN NKCR - CSA File Number LR24590 Class 3211-03 - CE Marked
Bezel Material	Black Plastic
Enclosure Type	Water tight, Dust tight, Oil tight and Corrosion Resistant (Indoor/Outdoor)
Enclosure Rating	NEMA 1/2/3/3R/4/4X/6/12/13
Head Type	Round
Lens Color	No Lens
Light Module Supply Voltage	24/28V
Lens Type	No Lens
Light Module Type	LED (Green)
Operator Type	Push-To-Test
Size	30mm
Type	K
Terminal Type	Screw Clamp

Shipping and Ordering

Category	21429 - Push Buttons, Corrosion Resistant, Type SK & SKY
Discount Schedule	CP1
GTIN	00785901413288
Package Quantity	1
Weight	0.5 lbs.
Availability Code	Non-Stock Item: This item is not normally stocked in our distribution facility.
Returnability	N
Country of Origin	MX

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



SR2P06

8 Pin Din Mount Screw Type Socket

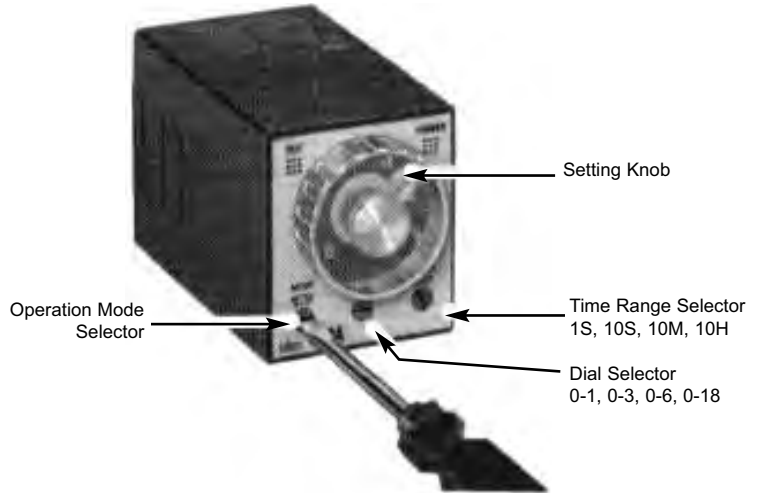


- High reliability and long service life
- SPDT, DPDT, or 3PDT pure silver contacts
- Available with octal (8-pin and 11-pin) or .187" blade plug-in terminals
- Worldwide approvals on octal (8-pin and 11-pin) models: UL, CSA, TUV, CE
- Options include check button for test operation and indicator light
- Mounting options include flange mounting, DIN socket, or panel mount socket





GT3A3AF20
Multi-Timer
(Multi-Mode Type)
8-Pin



TYPES:

- Operation Mode: A: ON Delay
 B: Interval ON
 C: Flicker
 D: Flicker ON

Rated Voltage Code: 100 to 240V AC (50/60Hz)

Time Range: 0.05 sec to 180 hours (See the time range table for details).

Output: 240V AC, 5A; 24V DC, 5A (resistive load)

Contact: Delayed DPDT

SWITCH SETTING:

1. The switches should be securely turned using a flat screwdriver, 4 mm wide maximum. Note that incomplete setting may cause malfunction. Type switches, which do not turn infinitely, should not be turned beyond the limits.
2. Since changing the setting during timer operation may cause malfunction, power should be turned off before changing the setting.

TIME RANGE DETERMINED BY TIME RANGE SELECTOR AND DIAL SELECTOR

Range \ Dial	0-1	0-3	0-6	0-18
1S	0.05 sec - 1 sec	0.05 sec - 3 sec	0.05 sec - 6 sec	0.05 sec - 18 sec
10S	0.1 sec - 10 sec	0.3 sec - 30 sec	0.6 sec - 60 sec	1.8 sec - 180 sec
10M	6 sec - 10 sec	18 sec - 30 sec	36 sec - 60 min	108 sec - 180 min
10H	6 min - 10 hours	18 min - 30 hours	36 min - 60 hours	108 min - 180 hours

Product data sheet

Characteristics

RXM4AB1F7

miniature plug-in relay - Zelio RXM - 4 C/O - 120 V AC - 6 A

Product availability: Stock - Normally stocked in distribution facility
Price*: 6.00 USD



Main

Commercial Status	Commercialised
Range of product	Zelio Relay
Series name	Miniature
Product or component type	Plug-in relay
Device short name	RXM
Contacts type and composition	4 C/O
Contacts operation	Standard
Control circuit voltage	120 V AC
[the] conventional enclosed thermal current	6 A at -40...131 °F (-40...55 °C)
Status LED	Without
Control type	Pushbutton
Coil interference suppression	Without
Utilisation coefficient	20 %
Sale per indivisible quantity	10

Complementary

Shape of pin	Flat
[Ui] rated insulation voltage	300 V conforming to UL 300 V conforming to CSA 250 V conforming to IEC
[Uimp] rated impulse withstand voltage	2.5 kV 1.2/50 µs IEC 61000-4-5
Contacts material	Silver alloy (Ag/Ni)
[Ie] rated operational current	8 A (AC-1/DC-1) conforming to UL 6 A (AC-1/DC-1) NO conforming to IEC 3 A (AC-1/DC-1) NC conforming to IEC
Minimum switching current	10 mA
Maximum switching voltage	250 V DC 250 V AC conforming to IEC
Minimum switching voltage	17 V
Load current	6 A at 28 V DC 6 A at 250 V AC
Maximum switching capacity	168 W, DC circuit 1500 VA, AC circuit
Minimum switching capacity	170 mW
Operating rate	<= 18000 cycles/hour no-load <= 1200 cycles/hour under load
Mechanical durability	10000000 cycles
Electrical durability	100000 cycles for resistive load
Average consumption in VA	1.2 AC 60 Hz
Drop-out voltage threshold	>= 0.15 U _c AC
Operating time	20 ms between coil energisation and making of the On-delay contact 20 ms between coil de-energisation and making of the Off-delay contact

Average resistance	4430 Ohm, AC circuit at 20 °C +/- 15 %
Rated operational voltage limits	96...132 V AC
Protection category	RT I
Operating position	Any position
CAD overall width	0.83 in (21 mm)
CAD overall height	1.06 in (27 mm)
CAD overall depth	2.17 in (55 mm)
Product weight	0.08 lb(US) (0.037 kg)

Environment

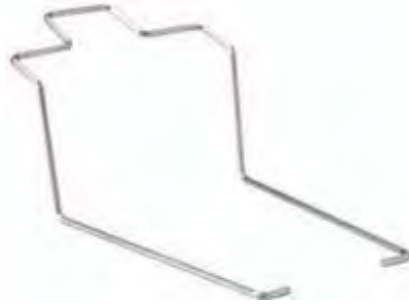
Dielectric strength	2000 V AC (between poles) 2000 V AC (between coil and contact) 1300 V AC (between contacts)
Product certifications	CSA GOST Lloyds UL
Standards	EN/IEC 61810-1 UL 508 CSA C22.2 No 14
Ambient air temperature for storage	-40...185 °F (-40...85 °C)
Ambient air temperature for operation	-40...131 °F (-40...55 °C)
Vibration resistance	5 gn (f = 10...150 Hz), amplitude +/- 1 mm (on 10 cycles not operating) conforming to EN/IEC 60068-2-27 3 gn (f = 10...150 Hz), amplitude +/- 1 mm (on 10 cycles in operation) conforming to EN/IEC 60068-2-27
IP degree of protection	IP40 conforming to EN/IEC 60529
Shock resistance	30 gn for 11 ms not operating conforming to EN/IEC 60068-2-27 10 gn for 11 ms in operation conforming to EN/IEC 60068-2-27

Ordering and shipping details

Category	21127 - ZELIO ICE CUBE RELAYS
Discount Schedule	CP2
GTIN	00785901646433
Nbr. of units in pkg.	10
Package weight(Lbs)	0.08
Product availability	Stock - Normally stocked in distribution facility
Returnability	Y
Country of origin	CN

Contractual warranty

Period	18 months
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List Price \$0.50 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Shipping and Ordering

Category	21128 -
Discount Schedule	CP2
GTIN	00785901646549
Package Quantity	10
Weight	0.01 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	CN

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

RXZE2M114M

RELAY SOCKET 300V 10A RUZ +OPTIONS



List Price \$5.00 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Shipping and Ordering

Category	21128 -
Discount Schedule	CP2
GTIN	00785901758051
Package Quantity	10
Weight	0.12 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	CN

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

Zelio[®] RSL Interface Relays

Save valuable panel space with slim-style relays and sockets.



Available 4Q 2009!

Schneider Electric's slim interface relays provide compact solutions for general-purpose relay requirements. At only 6mm wide, the Zelio RSL frees valuable panel space. The modular, space-saving design is ideal for panel builders, industrial automation, energy management, conveyors, and assembly machine applications.

Installation time is greatly reduced with pre-assembled relays and sockets. Relays can also be obtained individually to seamlessly replace worn-out, competitive products. Optional accessories include bus-jumpers and print tags to facilitate parallel wiring and provide quick identification.

The Zelio product line ranges from basic to full-featured relays designed for industrial and general purpose product designs.

Key Features:

- Space-saving 6mm width
- 6-amp load rating
- Single pole, double throw
- Coil voltage range: 12 to 230V
- Reinforced PCB pins (relay)
- Pre-assembled option
- Universal AC/DC socket with built-in surge protection and LED indicator
- DIN rail mounting
- Lever for easy locking and removal of the relay
- Screw terminal and spring clamp socket models
- Can be used in an ambient environment of -40°C to +55°C

Make the most of your energySM

Schneider
Electric

Zelio® RSL Interface Relays

Slim Interface Relays, Pre-assembled

Relays mounted on socket equipped with LED and protection circuit – sold in lots of 10

1 C/O contact – Thermal current (I _{th}) 6A		Socket Type	
Operating Voltage (VDC/VAC)	Control Circuit Voltage (VDC)	Screw Connector	Spring Terminal
		12	12
24	24	RSL 1PVBU	RSL 1PRBU
48	48	RSL 1PVFU	RSL 1PRFU
115	60	RSL 1PVFU	RSL 1PRFU
230	60	RSL 1PVFU	RSL 1PRFU

Slim Interface Relays for Customer Assembly: Relay + Socket

Relays with flat, reinforced pins (PCB type) – sold in lots of 10

1 C/O contact – Thermal current (I _{th}) 6A	
Control Circuit Voltage (VDC)	Standard
12	RSL 1AB4JD
24	RSL 1AB4BD
48	RSL 1AB4ED
60	RSL 1AB4ND

Sockets equipped with LED and protection circuit – sold in lots of 10

Operating Voltage VDC/VAC	For Use with Relays	Socket Type	
		Screw Connector	Spring Terminal
12 and 24	RSL 1•B4JD	RSL ZVA1	RSL ZRA1
	RSL 1•B4BD		
40 and 60	RSL 1•B4ED	RSL ZVA2	RSL ZRA2
	RSL 1•B4ND		
110	RSL 1•B4ND	RSL ZVA3	RSL ZRA3
230	RSL 1•B4ND	RSL ZVA4	RSL ZRA4

Accessories for sockets sold in lots of 10


Description	Compatibility	Catalog Number
ID tags (sheet of 64 tags)	With all sockets	RSL Z5
Bus jumper (20-pole jumper)		RSL Z2
Butterfly isolator		RSL Z3

> Put our expertise to work for you.

For more information on Schneider Electric interface relay solutions, visit us online at www.Schneider-Electric.us or talk to one of our experts at 1-888-778-2733.

Schneider Electric - North American Operating Division

1415 S. Roselle Road
Palatine, IL 60067
Tel: 847-397-2600
Fax: 847-925-7500

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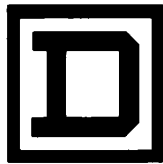
Availability **Stock Item: This item is normally stocked in our distribution facility.**

**Technical
Characteristics**

Shipping and Ordering

Category	21127 -
Discount Schedule	CP2
GTIN	00785901821878
Package Quantity	10
Weight	0.02 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	IT

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



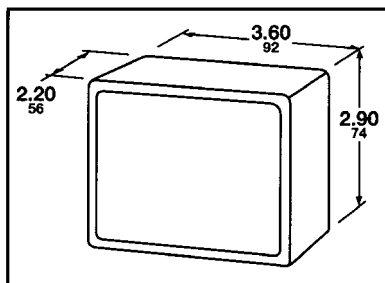
SQUARE D
GROUPE SCHNEIDER

SDSA3650 Secondary Surge Arrester

The SDSA3650 is a UL Listed and CSA Certified Secondary Surge Arrester designed for use on secondary services where maximum phase-to-ground system voltage does not exceed 650Vac. The device may also be used for surge protection of irrigation pumps, and motors operating below 650V.



- Meets ANSI/IEEE C62.11-1987



SDSA3650 secondary surge arrester will protect most secondary distribution wiring against surge-related damage but **may not protect solid state or electronic equipment from all lightning-induced or other large power surges**. Secondary surge arresters help transient voltage surge suppressors (TVSS) installed in Category A or B locations to protect sensitive electronic equipment. It may be necessary to install a plug-in surge suppressor at the point of use of electronic equipment for additional protection.

FEATURES:

Housing: The housing of the arrester is made of high temperature thermoplastic. The cover is permanently bonded to the housing by an ultrasonic welding process. Because the arrester is completely sealed, it may be used for both indoor and outdoor applications.

MOV Technology: Metal Oxide Varistors (MOV) provide voltage surges with a low resistance path line-to-line or line-to-neutral or line-to-ground while providing a high resistance to the 60Hz power. The MOV responds vaster and has a lower clamping voltage because it does not have a gap structure.

Fuse Link: A non-replaceable internal fuse link opens in the event of a damaging varistor overload.

APPLICATIONS:

This secondary surge arrester is suitable for use in Category C locations. The threat at these locations is characterized by ANSI/IEEE C62.41-1991 as a 20,000V potential and a 10,000A current. The device clamps the voltage during surges while diverting transient current. Electronic equipment may need to be additionally protected at the point of use with transient voltage surge suppressors.

ELECTRICAL CHARACTERISTICS

Voltage Rating: 650Vac Maximum phase-to-ground 50/60 Hz

Typical Clamping Voltages: For 8/20 microsecond combination wave surge current each phase to ground with specified lead length:

	1" lead	3" lead	6" lead	12" lead	18" lead
1,500A surge current	1525V	1750V	1775V	1800V	1825V
5,000A surge current	1700V	2100V	2125V	2325V	2425V
10,000A surge current	1925V	2375V	2400V	2700V	3000V

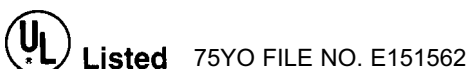
Minimum Life: 2,500 operations for 1.5kA 8/20 microsecond Wave each line-to-ground

Rated Peak Single Pulse Transient Current: 36,000A peak (8/20 microsecond wave)

Power Consumption per line: Less than 120 milliwatts. **Response Time:** Less than 1 ns.

Operating Temperature Range: -40° to 65°C (-40° to 140°F)

Surge Energy Capability Per Line: 2,100 Joules (8/20 microsecond wave)





DELTA SURGE CAPACITORS™

Delta Surge Capacitors™ Help Prevent Surge Damage to Electrical and Electronic Equipment. Surge Capacitors control surges which are too light or fast for a Lightning Arrestor, Surge Arrestor, or Surge Suppressor to function.

4F34 UL LISTED CA 302R



Leads:
18" #12
2 black
1 white

Weatherproof Enclosure
DIMENSIONS:
4-1/2" High 2-1/4" Diameter

Rated voltage - 250V single phase, three wire. Voltage to neutral - 125V. An internal automatic discharge circuit is provided.

This unit is designed for light duty service such as single phase commercial and residential service entrance panels.

Installation: Connect the black wires below the fuses or breaker. Connect the white wire to the ground and/or neutral bus.

4F34 UL LISTED CA 603R



Leads:
18" #12
3 black
1 white

Weatherproof Enclosure
DIMENSIONS:
4-1/2" High 2-1/4" Diameter

Rated voltage - 600V, three phase, four wire. An internal automatic discharge circuit is provided.

This unit is designed for regular duty service such as commercial three phase service entrance panels.

Installation: Connect the black wires below the fuses or breaker. Connect the white wire to the ground and/or neutral bus.

4F34 UL LISTED CA 603



Leads:
36" #12
3 black
1 white

Weatherproof Enclosure
DIMENSIONS:
5-3/4" High 3-1/2" Diameter

Rated voltage - 650V, three phase, four wire. An internal automatic discharge circuit is provided.

This unit is designed for heavy duty service such as motor installations.

Installation: Connect the black wires below the fuses or breaker. Connect the white wire to the ground and/or neutral bus.

Available with separate ground add part No. "G".

Surge capacitors function differently from surge arrestors. They begin to conduct at a voltage above normal line voltage after a specific time delay. Capacitors conduct current at normal line voltage continually, therefore there is no time delay or voltage change before capacitors begin to conduct. A surge arrestor or suppressor might act in as little as five nanoseconds. A surge capacitor reacts continually, therefore the response time is zero. An arrestor or suppressor might react to as little as a ten percent increase in voltage. A capacitor will react to **any** increase in voltage. Surge capacitors can handle fast low energy surges that can get by an MOV, a surge arrestor, or a surge suppressor. Delta surge arrestors/suppressors can handle high current surges that are too large for an MOV, a surge arrestor, or a surge suppressor. Use of both the Delta surge arrestor/suppressor and the Delta surge capacitor will provide more complete protection. While it is not possible to achieve 100% protection, Delta units will greatly reduce problems due to lightning, power surges, and voltage spikes.

DELTA LIGHTNING ARRESTORS™, INC.

P. O. BOX 750
BIG SPRING, TEXAS 79721

Data sheet

Industrial Ethernet IE-SW5-WAVE

Weidmüller Interface GmbH & Co. KG
 Klingenbergstraße 16
 D-32758 Detmold
 Germany
 Fon: +49 5231 14-0
 Fax: +49 5231 14-292083
 www.weidmueller.com

Technical data

Dimensions and weights

Length	108 mm	Width	22.5 mm
Height	127.8 mm	Net weight	340 g

Industrial Ethernet

AC input power	4 VA AC	DC input power	4 Watt DC
Standard	IEEE 802.3; 802.3u; 802.3x; Class I, Division 2	Segment length	Copper, 100 m; fibre multimode, 2 km; fibre singlemode 20 km
Type of mounting	TS 35	Storage temperature, min.	-40 °C
Storage temperature, max.	85 °C	Status indication	Data rate, Power, Connection/Activity
Number of ports	5x RJ45	Data rate	10 Base-T/100 Base-TX (copper) 100 Base-FX (fibre), 10 Base-T/100 Base-TX (copper) 100 Base-FX (fibre)@@@
Aging	300 s	Flow control	HD (backpressure) / FD (pause)
Input voltage AC, min.	12 V	Input voltage AC, max.	24 V
Input voltage DC, min.	10 V	Input voltage DC, max.	35 V
Input frequency	47 - 63 Hz	Version	Autonegotiation, Autocrossing (RJ45), Redundant power supply
Protection degree	IP 20		

Technical data

Version	Autonegotiation, Autocrossing (RJ45), Redundant power supply	Operating temperature, min.	0 °C
Operating temperature, max.	60 °C	Optical budget	8 dB for 62.5/125 µm multimode cable 4 dB for 50/125 µm multimode cable
Protection degree	IP 20		

Classifications

ETIM 3.0	EC000734	UNSPSC	43-17-27-01
eClass 5.1	19-03-01-17	eClass 6.2	19-17-01-06
eClass 7.1	19-17-01-06		

Approvals

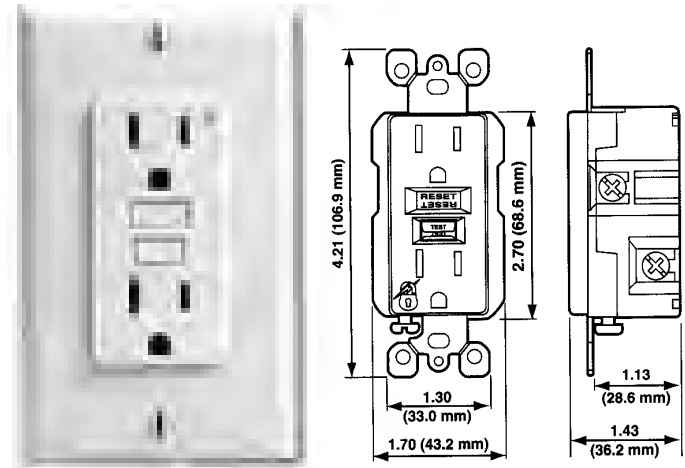
Approvals



ROHS Conform



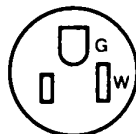
7599-I (Ivory)
Commercial Grade
Smart Lock™
GFCI Receptacle
with Lockout Action
15A 125V at Receptacle;
20A 125V Feed-Through



GROUND FAULT CIRCUIT INTERRUPTER

All Leviton GFCI receptacles have these features:

- Conforms to UL Standard 943 Class A (GFCI) and 498 (receptacles)
- #14-#12 AWG solid or stranded wire
- Tough impact-resistant construction
- Temperature tolerance range -30°F to 151°F
- Shallow 1-1/8 inch bodies for extra wall-box room
- Trip at 5Ma (± 1 Ma) threshold
- Feed-through ready
- Trip in 0.025 seconds for 240 mA fault
- Silver alloy contacts
- Dual slot terminal and installation crews accept both Phillips and standard driver heads
- Fully tested before shipping
- Supplied with Decora® wallplate
- TEST and RESET functions work together so that a tripped GFCI cannot be reset if GFCI circuit no longer provides ground fault protection
- RESET button is blocked if GFCI protection has been compromised, eliminating the possibility of end-users incorrectly assuming that a reset GFCI is providing ground fault protection when it actually is not
- Cannot be reset if neutral is not present. GFCI can still be tripped with TEST button under this condition
- Line-load diagnostic feature prevents GFCI from being reset and stops power from being fed through to downstream devices. This alerts installer to a line-load reversal.
- Advanced electronics design provides superior resistance to electrical surges and over-voltages
- LED indicator for line-load reversals
- Backed by a Limited Two-Year Warranty



NEMA 5-15R



Listed
File # 48380

MEETS 2003 UL REQUIREMENTS

FLZ 510 – FLZ 530

Thermostats



- The FLZ series are available with N.C. / N.O.¹ and changeover contacts. In combination with control cabinet heaters, they serve for temperature control inside the control cabinet.
- In combination with filterfans, they provide for additional savings on energy, materials and time. All in all, this results in greater reliability of the production process, reduced energy consumption due to need-based use and an improvement in the efficiency of the controlled heaters and filterfans.

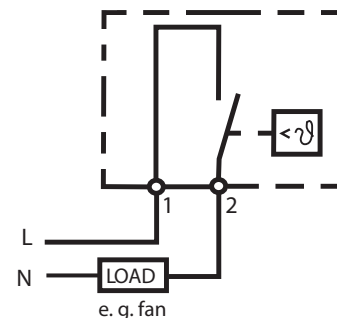
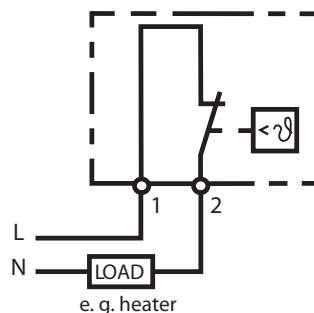
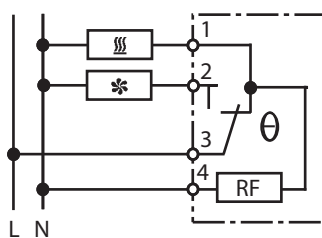
Data		FLZ 510	FLZ 520	FLZ 530	Unit
Part number	0° - 60 °C	17103000000	17111000000	17121000000	
	32 -140 °F	17103000010	17111000010	17121000010	
Type of contact		changeover with spring contact	N.C. with spring contact	N.O. with spring contact	
Switching temperature difference		1 ² /3		<7	K
Switching point tolerance		± 3		± 4	
Max. switching power - resistive value in brackets (!): inductive load at cos φ = 0.6	N.C.	100 - 250 V AC / 10 (2)		240 V AC / 10 (2)	W
	N.O.	100 - 250 V AC / 5 (2)		120 V AC / 15 (2)	
	DC			max. 30	
Operating temperature range			-4 ... +179 (-20 ... +80)		°F (°C)
Storage temperature range			-4 ... +179 (-20 ... +80)		
Probe type			bimetal		
System of protection			IP 20		
Weight		75	50		g
Connection		screw terminal for cable cross-section 0.5 to 2.5 mm ²			
Approvals		UL, cUL, CE	UL, cUL, CSA, CE		
Special feature		thermal return ²	-		
Suitable for the operation of		fan and heater	heater	fan	
Type of mounting		snap fastening for 35mm profile bars according to EN 60715			
Color		RAL 7035			

Accessories	Piece	Part number	Info on page
Hygrostat	1	17207000000	170
Internal enclosure fan	1	18103000002	59

¹ N.C. = normally closed / N.O. = normally open
² for 230 V AC operation only
 Approvals see page 168

Dimension	Dimensions		
	FLZ 510	FLZ 520	FLZ 530
	inches (mm)		
X	1.46 (37)	1.57 (40)	1.57 (40)
Y	2.52 (64)	2.83 (72)	2.83 (72)
Z	1.81 (46)	1.42 (36)	1.42 (36)

Schematics



Applications:

- Myers™ Scru-tite® and Ground hub are used in the termination of electrical circuits through wall of the enclosure
- Ideal for pharmaceutical, chemical and food processing, pulp/paper and nuclear industries.
- Resistant to a variety of chemicals, including acetic, citric and salt water.
- The O-ring is a special "Viton (75)" and has excellent chemical resistance.
- Hub is provided with a stainless steel ground nut.

Features:

- Vibration proof
- Grounding screw for added safety
- Captive o-ring gasket
- No welding
- Posi-Lok insulated throat (insuliner)
- Fit standard knockouts
- Easy installation
- Controlled thread lengths
- NPSL on male thread
- No sharp edges (along parting line)
- Male thread (NPT)



Certifications and Compliances:

- NEC/CEC:
 - Class I, Division 2
 - Class II, Division 1 & 2
 - Class III, Division 1 & 2
- UL Listed – UL Standard 514B
- CSA Certified – Certified by UL to CSA standard C22.2 No. 18
- NEMA Type 2, 3, 3R, 4, 4X, 12 (std hub)
- NEMA Type 2, 3, 3R, 4, 4X, 12 (ground hub)

Standard Materials:

- Nut: Zamek-2, Zamek-3, Aluminum (Al 360), Stainless (316)
- Body: Zamek-2, Zamek-3, Aluminum (Al 360), Stainless (316)
- Insuliner: Lexan
- O-Ring: Gasket Vi Ton
- Ground Screw: Steel

Standard Finishes:

- Aluminum: Natural
- Zinc: Natural

Optional Materials and Finishes:

- Stainless: Natural
- Zinc: Chrome-plate

Hub Basic Scru-Tite® – NEMA 2, 3, 3R, 4, 4X and 12

Zinc

UL File No. E-27258



Cat. #	Size	Unit Qty.	Wt. Lbs. Per 100
ST 03†	3/8"	25	12
ST 1†	1/2"	25	20
ST 2†	3/4"	25	32
ST 3†	1"	25	40
ST 4†	1 1/4"	10	60
ST 5†	1 1/2"	10	70
ST 6†	2"	10	90
ST 7†	2 1/2"	5	200
ST 8	3"	2	250
ST 9	3 1/2"	2	300
ST 10	4"	2	350
ST 11*	5"	1	600
ST 12*	6"	1	800

†Optional Nickel-Chrome Plate Finish. Add suffix -CP. See price list.

*Not supplied with insulator.

Hub Basic Scru-Tite® – NEMA 2, 3, 3R, 4, 4X and 12

Aluminum

UL File No. E-27258



Cat. #	Size	Unit Qty.	Wt. Lbs. Per 100
STA 1	1/2"	25	8
STA 2	3/4"	25	16
STA 3	1"	25	16
STA 4	1 1/4"	10	30
STA 5	1 1/2"	10	30
STA 6	2"	10	50
STA 7	2 1/2"	5	80
STA 8	3"	2	100
STA 9	3 1/2"	2	150
STA 10	4"	2	150
STA 11*	5"	1	300
STA 12*	6"	1	300

*Not supplied with insulator.

Stainless Steel Ground Hub – NEMA 2, 3, 3R, 4, 4X and 12

Stainless Steel – Type 316

UL File No. E-59509



Cat. #	Size	Unit Qty.	Wt. Lbs. Per 100
SSTG 1	1/2"	10	20
SSTG 2	3/4"	10	30
SSTG 3	1"	10	43
SSTG 4	1 1/4"	5	55
SSTG 5	1 1/2"	5	73
SSTG 6	2"	5	95
SSTG 7	2 1/2"	2	—
SSTG 8	3"	2	—
SSTG 9	3 1/2"	2	—
SSTG 10	4"	2	—

StreamLine® Low Profile Strobe Light



Models LP3P, LP3S, LP3T

PERFECT SIZE MEETS SUPERIOR PERFORMANCE

- Available in 12-48VDC, 120VAC and 240VAC
- Surface mount, T-mount, or integrated 1/2 - inch pipe mount
- Five dome colors
- Screw-on lens
- Low profile — Model LP3S is only 5" high
- Type 4X, IP66 enclosure
- PLC and triac compatible
- Optional dome guard
- UL and cUL Listed, CSA Certified and CE Approved*

* CE Approval for P, S models only.

Federal Signal introduces the Model LP3 low profile strobe light. This Type 4X strobe is available in five colors: amber, blue, clear, green and red. An optional dome wire guard is available for the LP3S and LP3T.

The LP3 is offered in three mounting configurations. LP3P features an integrated 1/2-inch NPT pipe mount. LP3S features a three-hole surface mount — ideal for control panels and other flat or flush surfaces. The “T-mount” LP3T has a popular 2-hole design for wall or flush mounting.

Both the LP3S and LP3T include a surface gasket to complete the Type 4X installation. An optional dome guard is available for use with the LP3S and LP3T. All LP3 units feature a threaded screw-on lens that provides tool-free wiring and strobe tube replacement. The strobe tube is rated for 7,000 hours.

The LP3 comes in three voltage variations: 12-48VDC, 120VAC and 240VAC. The state-of-the-art strobe mechanism produces 2.2 joules of energy, while drawing relatively low level amperage.

StreamLine® strobes feature high-quality, long-life strobe lamps which are designed to reduce tungsten build-up for longer lamp maintenance cycles. Careful consideration is given to the relationship between lamp shape and lens design for maximum light output. StreamLine products make use of surface mount technology, which provides a more powerful light in a much smaller package. The dry-electrolyte capacitor used in StreamLine products runs cooler than those used in many competitive strobes, resulting in a more reliable product that won't fail due to overheating.

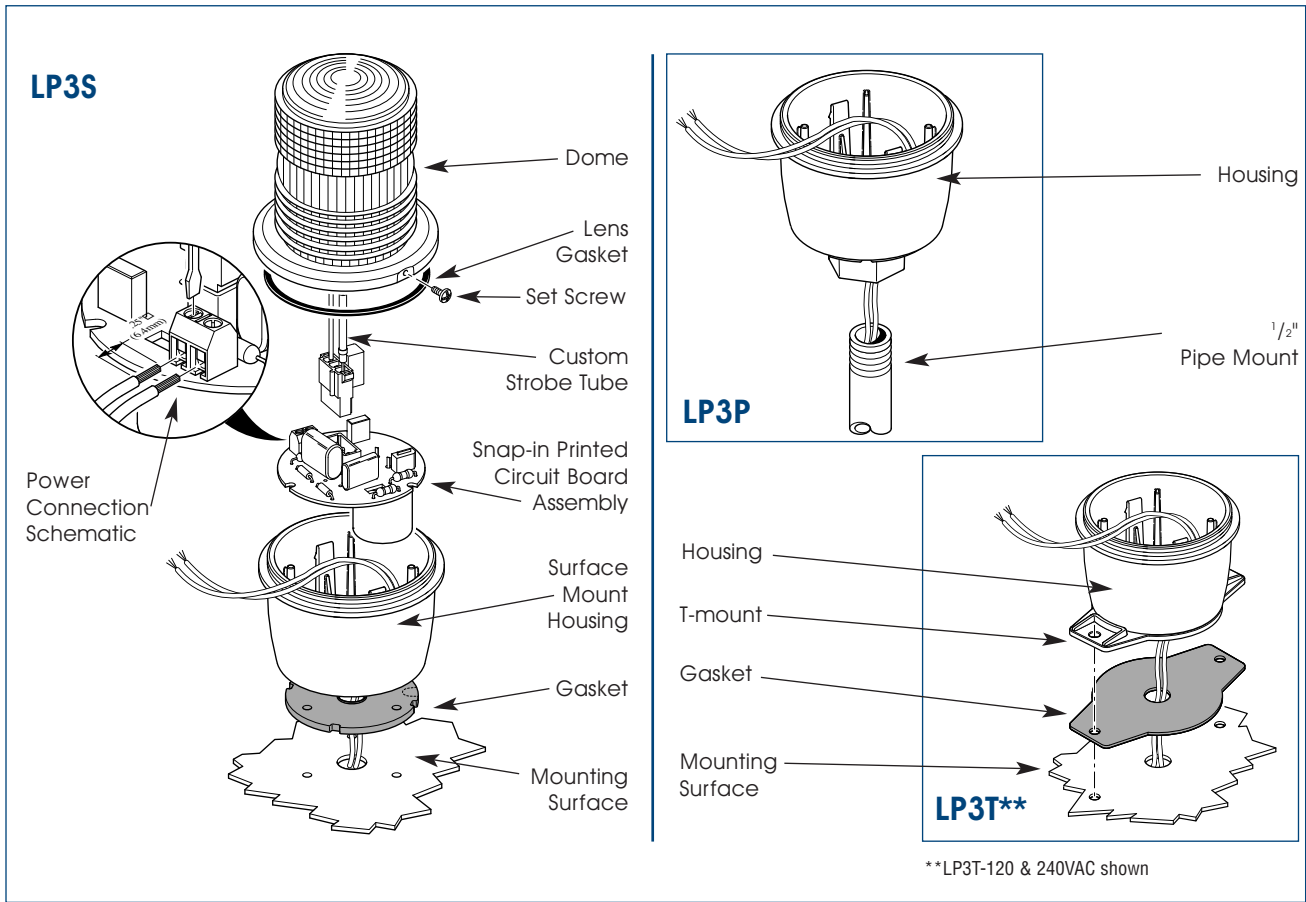
Model	Voltage	Operating Current	Flash Rate/Minute	Joule Output	Candela Peak ¹	ECP ²
LP3	12-48VDC	0.44-0.10 amps	65-95	2.2	175,000	51.5
LP3	120VAC	0.10 amps	65-95	2.2	175,000	51.5
LP3	240VAC	0.07 amps	65-95	2.2	175,000	51.5

¹ Peak candela is the maximum light intensity generated by a flashing light during its light pulse

² ECP (Effective Candela) is the intensity that would appear to an observer if the light were burning steadily



STREAMLINE® LOW PROFILE STROBE LIGHT (LP3S/LP3P/LP3T)



SPECIFICATIONS

Lamp Life:*	7,000 hours	7,000 hours
Lamp Style:	Strobe	Strobe
Operating Temperature:	-31°F to 150°F	-35°C to 66°C
Net Weight:	7.3 oz.	206.96 g
Shipping Weight:	8.5 oz.	240.98 g
Diameter:	3.125"	7.94 cm
Height (from bottom):		
LP3P	5.7"	14.48 cm
LP3S	5.0"	12.7 cm
LP3T	5.1"	12.95 cm

*Optimal hours under ideal conditions.

HOW TO ORDER

- Specify model, voltage and color
- Specify options
Wire/Dome guard for LP3S, LP3T (LP3G)
- Please refer to Model Number Index LP3 (P,S,T) beginning on page 374

REPLACEMENT PARTS

Description	Part Number	Description	Part Number
Dome, Amber	K8589063A	PC Assembly, 12-48VDC	K2001316B
Dome, Blue	K8589063A-01	PC Assembly, 120VAC	K2001317A
Dome, Clear	K8589063A-02	PC Assembly, 240VAC	K2001317A-01
Dome, Green	K8589063A-03	Gasket, Lens	K8589013A
Dome, Red	K8589063A-04	Gasket, LP3S	K8589011A
Strobe Tube	K149130A	Gasket, LP3T	K8589012A

9080GR6

TERMINAL BLOCK 600V 60AMP NEMA +OPTIONS



List Price \$2.40 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Ampere Rating	60A
Approvals	UL Listed File: E60616 CCN XCFR2 - CSA Certified File: LR62144 Class 6228 01 - CE Marked
Fingersafe	Yes
Block Material	Nylon
Color	Natural
Width	0.35 Inches
Standard Package Size	50
Lug Material	Copper
Maximum Voltage Rating	600VAC
Mounting Type	Track (9080GH/35mm DIN 3)
Recommended End Barrier	GM6B
Terminal Type	Box Lug
Block Type	Standard
Type	GR6
Wire Size	#22 to #8 AWG (Cu)
Density	34 Sections
Depth	1.72 Inches
Height	1.82 Inches

Shipping and Ordering

Category	21702 - Blocks, Terminal, NEMA, Channel Mount, Type G
Discount Schedule	CP5
GTIN	00785901000716
Package Quantity	50
Weight	0.03 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	MX

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



List Price \$0.78 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Type	GM6
Mounting Type	Track (9080GH/35mm DIN 3)
Color	Natural
Standard Package Size	10

Shipping and Ordering

Category	21702 - Blocks, Terminal, NEMA, Channel Mount, Type G
Discount Schedule	CP5
GTIN	00785901744023
Package Quantity	10
Weight	0.01 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	MX

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



List Price \$6.20 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Net Weight	0.88 oz
Color	Green/Yellow
Standard Package Size	100
Maximum Voltage Rating	600V
Mounting Type	Rail (35mm DIN 3)
Number of Points	2
Terminal Type	Screw Clamp
Block Type	Grounding
Type	AB1
Wire Size	#22 to #10 AWG (Cu)
Depth	1.91 Inches
Height	2.01 Inches
Approvals	UL Recognized File: E164359 CCN XCFR2 - CSA Certified File: 702070 Class 6228 01 - CE Marked
Width	0.24 Inches

Shipping and Ordering

Category	21715 - Blocks, Terminal, IEC, Channel Mount, Type AB1
Discount Schedule	CP5
GTIN	00785901369868
Package Quantity	100
Weight	0.06 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	DE

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



Main

Range of product	Terminal blocks
Product or component type	Terminal block
Technology type	Screw technology
Product specific application	For 3-wire proximity sensors
Fixing mode	Clip-on mounting on 35 mm asymmetrical rail Clip-on mounting on 35 mm notched symmetrical rail Clip-on mounting on 35 mm symmetrical DIN rail
Nominal cross section	2.5 mm ²
Local signalling	Without
Length	79.4 mm
Colour	Grey
Number of points	1
Sale per indivisible quantity	100

Complementary

Width	6 mm
Height	68.6 mm on 35 mm symmetrical DIN rail 73.1 mm on 35 mm asymmetrical rail 76.1 mm on 35 mm notched symmetrical rail
Cable cross section	0.5...1.5 mm ² , flexible with cable end 0.5...2.5 mm ² , flexible without cable end 0.5...4 mm ² , solid
Tightening torque	0.4...0.6 N.m, M2.5 conforming to EN 60999 0.4...0.6 N.m, M2.5 conforming to IEC 60974-1
[Ue] rated operational voltage	250 V AC conforming to VDE group C 300 V DC conforming to VDE group C 300 V, 22...12 AWG CSA 300 V, 22...12 AWG UL 400 V conforming to EN/IEC 60947-7-1
[Ie] rated operational current	25 A, 22...12 AWG CSA 25 A, 22...12 AWG UL 26 A conforming to VDE group C 3...24 A conforming to EN/IEC 60947-7-1
Product weight	11 g

Environment

Dielectric test voltage	6 kV conforming to EN/IEC 60947-7-1
Product certifications	ASEV CSA UL

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric Industries SAS nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein.

PANELITE™ ENCLOSURE LIGHTS OVERVIEW



INDUSTRY STANDARDS

PANELITE LED and Fluorescent Enclosure Lights

UL 508A Component Recognized; File No. E61997
 cUL Component Recognized per CSA C22.2 No 14; File No. E61997

CSA File No. 42186
 Maintains UL/CSA Type 4, 4X and 12 enclosure rating when properly installed in a Hoffman enclosure.

230 VAC Fluorescent Enclosure Light

UL 508A Component Recognized; File No. E234324
 cUL Component Recognized per CSA C22.2 No 14; File No. E61997

CE

LED Light

UL 508A Component Recognized; File No. E234324
 cUL Component Recognized per CSA C22.2 No 14; File No. E234324

CE

Ingress protection : IP 20

Maintains enclosure type rating up to 4X when installed per instructions

APPLICATION

Versatile, slim-profile LED and fluorescent lights provide mounting flexibility and are easy to install in any enclosure. Terminal blocks allow for easy wiring. Accessories include ganging cables, power cords and door switches, all provided with plug-and-play connectors for easy connection to the terminal blocks with an innovative terminal connection system. LED version provides superior lighting performance with minimal power consumption.

FEATURES

- Slim profile allows light to be tucked up out of the way for easy panel installation
- Versatile mounting allows the light to be positioned horizontally or vertically; two-way mounting provides for ideal orientation
- Includes mounting hardware for the following enclosure installations: PROLINE™ Frame, Enclosure Top, Panel Mount and Unistrut
- On/off switch incorporated in light; optional remote door switch accessory available to activate light when enclosure door is opened (230 VAC Fluorescent Enclosure Light has switch or door-activated sensor)

PANELITE Only:

- Mounting tabs provide easy access point for attachment hardware; light does not need to be disassembled for installation
- Up to five lights can be daisy-chained together
- Plug-and-play terminal connection system:
 - Pre-wired connection sockets on both ends of light allow use of Hoffman cable accessories
 - Optional terminal blocks snap into the connection sockets allowing customers to use own wiring methods; two terminal blocks provided with each light kit
 - Power supply can be wired manually with Hoffman PANELITE Power Cable with Leads or with Hoffman optional PANELITE Power Cord
 - Ganging cables are available in 2-, 4- and 6-ft. lengths to easily join up to five lights together using one power supply
 - Remote door switch for easy door activation eliminates need to mount light in the exact location required to activate the light

LED Light Only:

- Mechanical screw- or magnetic mount (non-slip rubberized)
- Protection Class II (double insulated)
- Operating temperature -22 F to 140 F (-30 C to 60 C)
- On / Off or motion-sensor activation
- LED lights with 900 LM illumination; 120° angle of illumination
- Low, 5-watt power requirement
- Light-weight, all-composite construction
- Input and output connectors included with light (16 AWG)

SPECIFICATIONS

PANELITE:

- Extruded aluminum center support
- Black composite end caps
- Black composite mounting tabs
- Each light fixture includes two mounting tabs, two pre-wired connection sockets, two optional terminal blocks that snap into the connection sockets and enclosure attachment hardware (bulb not included with fluorescent light)

230 VAC Fluorescent Enclosure Light:

- Light gray composite construction – UL 94V-0 material
- Hardware kit provides fasteners to mount to PROLINE, NEMA (4, 4X, 12, and 13), CONCEPT™, FUSION™ and other cabinets
- Easy-access terminal block that accommodates up to 16 AWG wires
- Fluorescent light bulb included (2G7 Base)

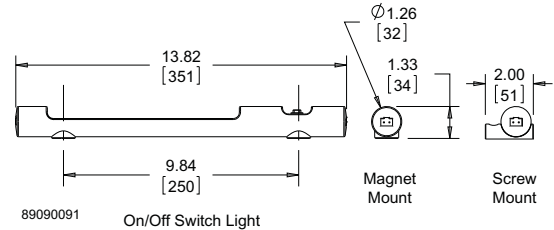
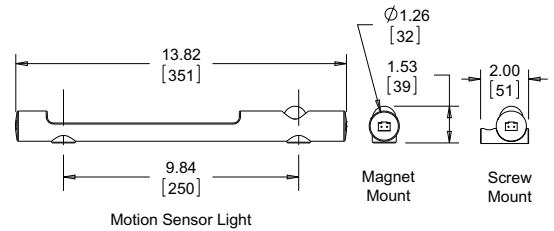
LED Light:

- LED (Light Emitting Diode) low-power light kit
- Screw mounting using included hardware kit (maintains enclosure rating up to UL Type 4X)
- No user-serviceable parts
- Life expectancy of 60,000 hours at 68 F (20 C) under specifications
- Operating temperature: -22 to +140 F (-30 to +60 C) under specifications
- 5-watt power consumption
- Transparent, composite construction

LED LIGHT KIT



LED light kits provide interior enclosure lighting. These light kits are ideal for remote and darkened enclosure applications. The light can be mechanically fastened with included hardware to maintain enclosure UL listing (up to Type 4X), or can be magnetically attached to flat steel surfaces. The lights have auto-sensing circuitry (AC voltage 90 VAC to 260 VAC and DC voltage 20 VDC to 60 VDC). LED lights are light-weight and in a small form factor while providing 900 LM of 6500K light. Power consumption for all models is 5 watts.



BULLETIN: A80LT

Catalog Number	AxBxC in./mm	Weight (oz)	Weight (gm)	Mounting Style	Power Source	Activation	Voltage
LEDA1M35	1.34 x 1.26 x 13.82 34 x 32 x 351	4.8	135	Magnetic	AC	On/off switch	90 VAC-260 VAC
LEDA2M35	1.54 x 1.26 x 13.82 39 x 32 x 351	5.0	140	Magnetic	AC	IR Motion Sensor	90 VAC-260 VAC
LEDA1S35	1.42 x 2.05 x 13.82 36 x 52 x 351	4.8	135	Screw	AC	On/off switch	90 VAC-260 VAC
LEDA2S35	1.63 x 2.05 x 13.82 41 x 52 x 351	5.0	140	Screw	AC	IR Motion Sensor	90 VAC-260 VAC
LEDD1M35	1.34 x 1.26 x 13.82 34 x 32 x 351	4.8	135	Magnetic	DC	On/off switch	20 VDC-60 VDC
LEDD2M35	1.54 x 1.26 x 13.82 39 x 32 x 351	5.0	140	Magnetic	DC	IR Motion Sensor	20 VDC-60 VDC
LEDD1S35	1.42 x 2.05 x 13.82 36 x 52 x 351	4.8	135	Screw	DC	On/off switch	20 VDC-60 VDC
LEDD2S35	1.63 x 2.05 x 13.82 41 x 52 x 351	5.0	140	Screw	DC	IR Motion Sensor	20 VDC-60 VDC

LED LIGHT INPUT CONNECTOR/CABLE ASSEMBLY



The input connector/cable assembly is used to provide supply power to the LED light. Pre-assembled connector/cable assembly with

78.7-in. (2000 mm) long cable whip. Cables are constructed of 16 AWG copper wire.

BULLETIN: A80LT

Catalog Number	A in./mm	Power Source	Use with
LEDA20C	78.74 2000	AC	AC LED Lights
LEDD20C	78.74 2000	DC	DC LED Lights

LED LIGHT EXTENSION CONNECTOR/CABLE ASSEMBLY



The extension connector/cable assembly is used to connect adjacent LED lights (daisy chain). Up to 10 LED lights can be ganged or connected in series. Pre-assembled connector/cable assembly with 39.4-in. (1000 mm) long cable between input and output connectors. Cables are constructed of 16 AWG copper wire.

BULLETIN: A80LT

Catalog Number	A in./mm	Power Source	Use with
LEDA10E	39.37 1000	AC	AC LED Lights
LEDD10E	39.37 1000	DC	DC LED Lights



Availability **Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Width	0.24 Inches
Approvals	UL Recognized File: E164359 CCN XCFR2 - CSA Certified File: 702070 Class 6228 01 - CE Marked
Net Weight	0.28 oz
Color	Gray
Standard Package Size	100
Maximum Voltage Rating	600V
Mounting Type	Rail (35mm DIN 3)
Number of Points	2
Recommended End Barrier	AB1AC24
Terminal Type	Screw Clamp
Block Type	Passthrough
Type	AB1
Wire Size	#22 to #10 AWG (Cu)
Ampere Rating	30A
Depth	1.91 Inches
Height	1.57 Inches

Shipping and Ordering

Category	21715 - Blocks, Terminal, IEC, Channel Mount, Type AB1
Discount Schedule	CP5
GTIN	00785901221494
Package Quantity	100
Weight	0.02 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	DE

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

Technical Characteristics

Color	Black Marking on White Background
For Use With	IEC Type Terminal Block
Type	AB1

Shipping and Ordering

Category	21715 - Blocks, Terminal, IEC, Channel Mount, Type AB1
Discount Schedule	CP5
GTIN	00785901581451
Package Quantity	25
Weight	0.01 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	DE

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



List Price \$0.62 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**




Technical Characteristics

Color	Grey
For Use With	IEC Type Terminal Block
Mounting Type	Rail
Type	AB1

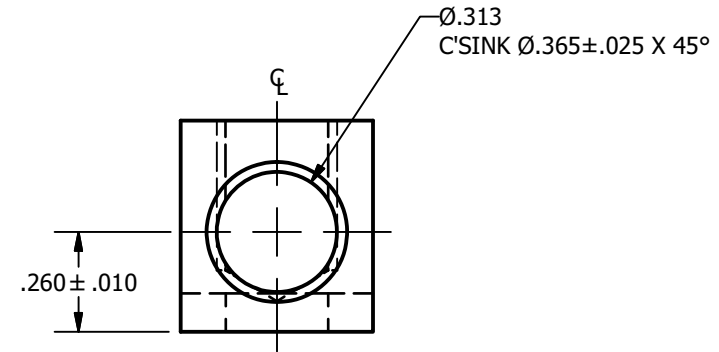
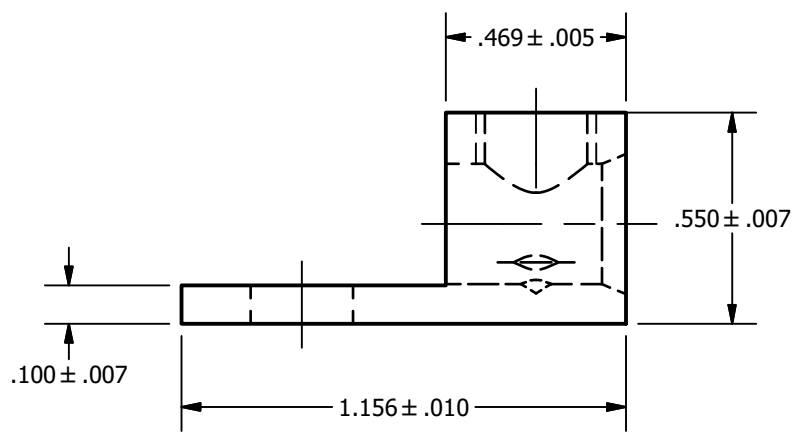
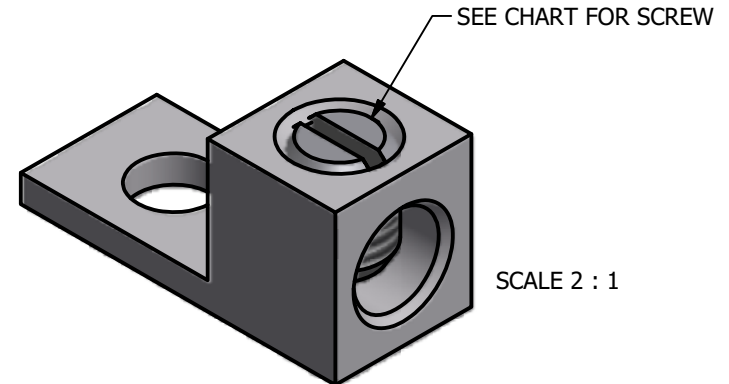
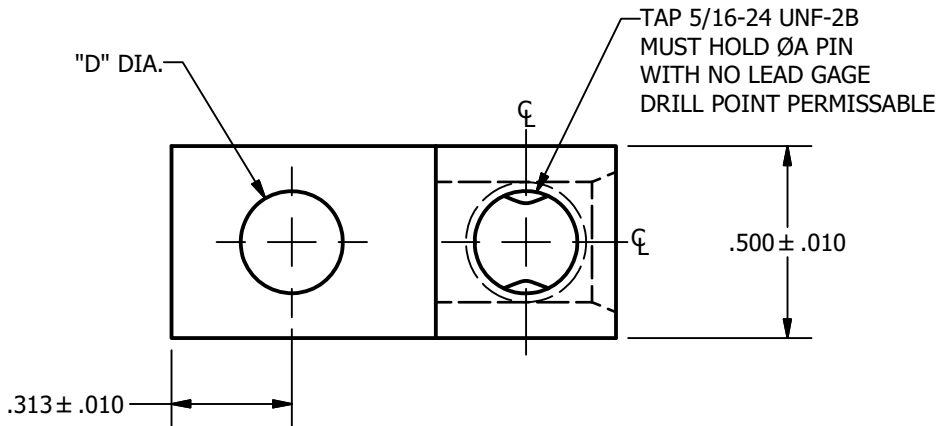
Shipping and Ordering

Category	21715 - Blocks, Terminal, IEC, Channel Mount, Type AB1
Discount Schedule	CP5
GTIN	00785901580157
Package Quantity	50
Weight	0.01 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	DE

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

SCREW: SEE CHART	MATERIAL:ALUMINUM, X0947	TOLERANCES-UNLESS OTHERWISE SPECIFIED 2 PL. DEC. ±.010 TRUE C.L. ±.015 3 PL. DEC. ±.005 ANGLES ±1		DWG. NO. D0980	
CAT. NO.:TA-2, TA-2-B2	PLATING: EL-TIN	DRAWN BY: NN	SCALE: 2:1	SHEET 1 OF 1	
MASS:.011 LBS	MARKING: ILSCO, TA-2, 2-14, AL9CU,  , 	DATE: 12/7/2007	SIZE: A		
SURFACE AREA: 2.645 IN ²		CELL:ABM			
STUFFER SHT: FORM 1			REV.	DESCRIPTION	

Cat #: TA-2
TA-2-B2



DEV.	"A"	ASSEMBLE	SCREW	"D"
-22	.120	FLUSH TO TOP	E0309C92Z	.266

ELECTRIC HEATERS



115/230 Volt
100/200 Watt



115/230 Volt
400/800 Watt



115/230 Volt
1300 Watt

INDUSTRY STANDARDS

UL 508A Component Recognized; File No. E61997

CSA Certified, CSA File No. LR42186
CE

APPLICATION

Protect mechanical, electrical and electronic equipment from low temperatures, condensation and corrosion with this thermostatically controlled, fan-driven heater that maintains a stable enclosure temperature. Fan draws cool air from the bottom of the enclosure and passes this air across the thermostat and heating element before being released into enclosure cavity. Heated air is discharged through the top of the heater unit.

SPECIFICATIONS

- Aluminum housing
- Thermostat range adjustable from 0 F to 100 F (-18 C to 38 C)
- Four 10-32 x self-tapping screws are included with each heater
- Ball bearing fan
- Terminal strip with clamp connector that accepts both solid and stranded wire

FINISH

- Brushed aluminum

CAUTION

These electric heaters are not designed for use in dusty, dirty, corrosive, or hazardous locations. Portions of the heater can get hot. Adequate protection must be taken to protect people from potential burns, and to protect other components from this heat. Pentair Technical Products recommends this heater only be installed in a totally-enclosed metal enclosure.

DO NOT INSTALL HEATERS ON WOOD PANELS.

Heat sensitive components should not be placed near the heater discharge area since this air can be quite warm. The clearance range defines the space that must be kept free of these components for proper and safe operation of the heater.

Performance Data **100 and 200 Watt Heaters**

CATALOG NUMBERS				
	DAH1001A	DAH1002A	DAH2001A	DAH2002A
ELECTRICAL DATA				
Rated Voltage	115	230	115	230
Frequency (Hz)	50/60	50/60	50/60	50/60
Power Consumption (Watts)	100	100	200	200
Nominal Current (Amps)	0.98	0.49	1.89	0.95
HEATING PERFORMANCE				
Watts	100	100	200	200
UNIT CONSTRUCTION				
Weight (lb./kg)	1.6/0.73	1.6/0.73	1.6/0.73	1.6/0.73
X (in./mm)	4.00/102	4.00/102	4.00/102	4.00/102

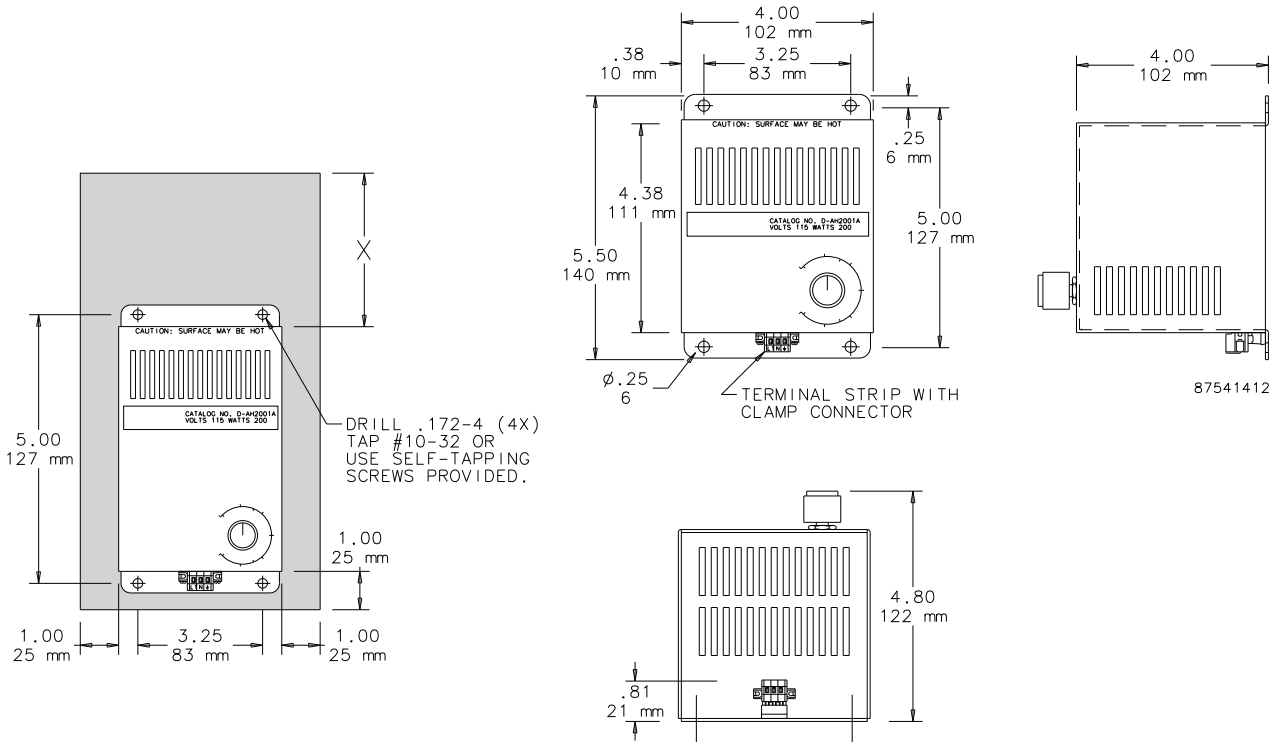
 Performance Data **400 and 800 Watt Heaters**

CATALOG NUMBERS				
	DAH4001B	DAH4002B	DAH8001B	DAH8002B
ELECTRICAL DATA				
Rated Voltage	115	230	115	230
Frequency (Hz)	50/60	50/60	50/60	50/60
Power Consumption (Watts)	400	400	800	800
Nominal Current (Amps)	3.72	1.86	7.37	3.69
HEATING PERFORMANCE				
Watts	400	400	800	800
UNIT CONSTRUCTION				
Weight (lb./kg)	2.2/1.00	2.2/1.00	2.2/1.00	2.2/1.00
X (in./mm)	6.00/152	6.00/152	8.00/203	8.00/203

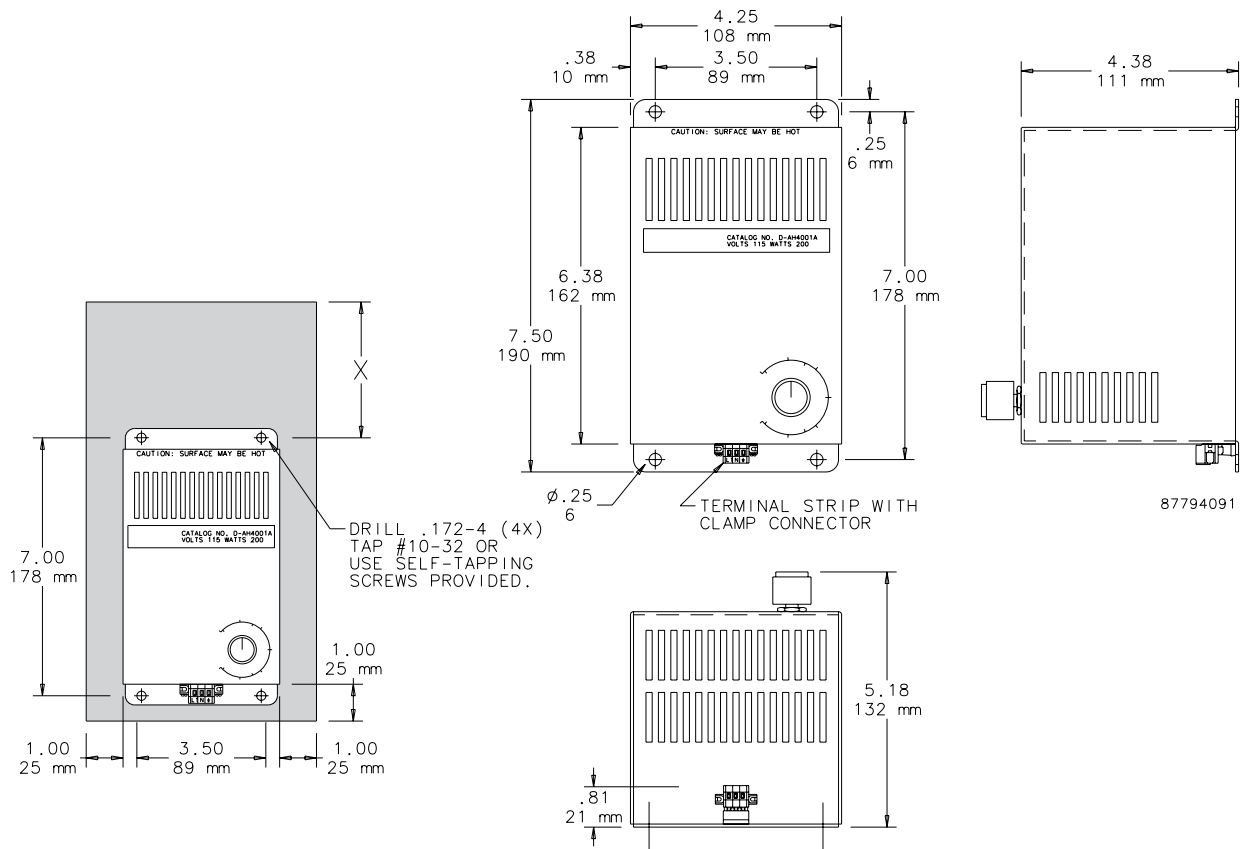
 Performance Data **1300 Watt Heaters**

CATALOG NUMBERS		
	DAH13001C	DAH13002C
ELECTRICAL DATA		
Rated Voltage	115	230
Frequency (Hz)	50/60	50/60
Power Consumption (Watts)	1300	1300
Nominal Current (Amps)	11.5	5.7
HEATING PERFORMANCE		
Watts	1300	1300
UNIT CONSTRUCTION		
Weight (lb./kg)	3.4/1.54	3.4/1.54
X (in./mm)	8.00/203	8.00/203

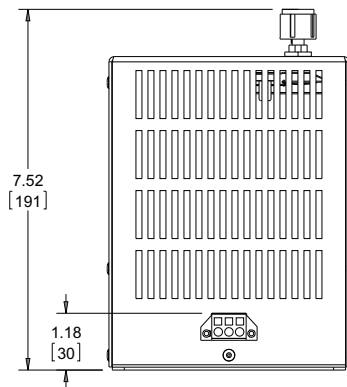
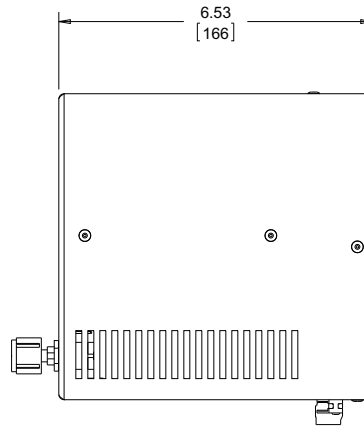
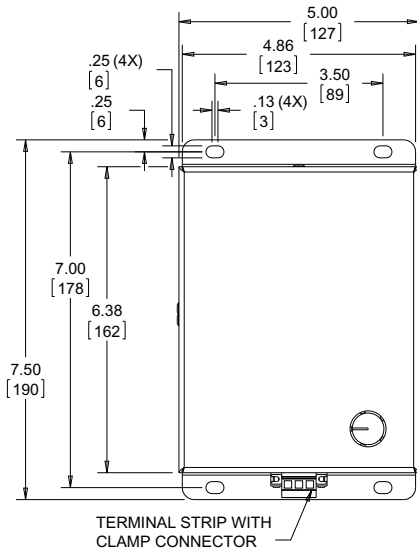
Dimensions and Clearance Range Drawing for DAH1001A, -2A and DAH2001A, -2A



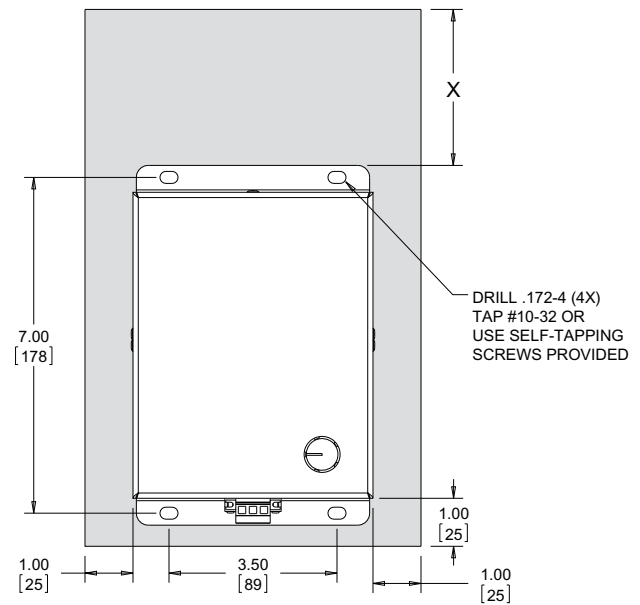
Dimensions and Clearance Range Drawing for DAH4001B, -2B and DAH8001B, -2B



Dimensions and Clearance Range Drawing for DAH13001C and DAH13002C



89091692



Altivar® 61

Variable speed AC drives
Power over the *elements!*



For 3-phase asynchronous motors from 1 to 900 HP.



Telemecanique



Altivar® 61 Drives

Manage and *monitor* your building

The Altivar® 61 drive defines **ease of use** for variable speed drives used in centrifugal pump and fan applications offering the **highest level of features, functions and flexibility**. Its evolutionary design will **reduce installation** and **start-up time** while offering **reliable operation, simple diagnostics** and **energy efficiency**.

The Altivar 61 drive enables you to:

- Reduce **energy costs** by reducing motor speed
- Reduce **installation costs** by eliminating throttling valves or inlet guide vanes typically used to control flow, offering internal connection to major building networks and with quick and simple installation
- Improve **up-time** by providing superior **voltage dip ride through**
- Reduce **life cycle costs** of the installation by eliminating mechanical shock to belts and motors
- Improve indoor **air quality** and **occupant comfort** through accurate flow control



Supply fans for heating and air conditioning:

- Adjustment of flow rates on the basis of actual need
- Enhance comfort by reducing noise pollution caused by the motor with unique random switching frequency modulation
- Detection of broken fan belt
- Automatic restart after most faults



Ventilation fans exhaust/smoke extraction

- Forced start function with fault inhibition and fireman's override
- For high inertia applications, braking possible using resistors
- Run permissive damper input
- Catch on the fly by speed search regardless of the direction of rotation to start wind milling fans



Cooling tower fans

- Suppression of mechanical resonance using skip/jump frequencies
- Loss of follower with alarm management
- External fault input
- Adjustments to eliminate gear box backlash and cogging



Multipump: water distribution

- With the multipump option card, the **Altivar 61 drive** provides **flexibility, user-friendliness and adaptability** for the management of multiple pump installations
- The multipump option card contains a variety of pre-programmed function and features to manage multipump installations, such as **monitor and fully control the installation** by switching and managing the wear and tear between pumps



Municipal water pumps

- **Safety and protection of pump:** Detection of current threshold
- Limitation of operating time at low speed
- PTC probe management
- Auto-restart function with configurable response
- Underload and overload detection



Hot water and chilled water pumps

- Underload and overload detection with alarm
- Low flow detection
- Sleep/wake function
- Power used, power on time, motor run time

The Altivar 61 drive offers the following values:

- For **OEMs**, it offers **customizable** capability that allows the OEM to add value and provide a **unique** solution.
- For **System Integrators**, it offers **flexibility, functionality** and wide product range to adapt to a wide variety of job requirements
- For **End User** installations, it offers **quick** installation, **simple** start-up, and on-board diagnostics for **uncomplicated** maintenance.

Altivar® 61 Drives

The *leading edge!*

This new generation of AC drives demonstrates the expertise and know-how of Schneider Electric with respect to AC drives. Exceptional flexibility, advanced functions and a high level of customization...while always keeping the emphasis on *simplicity*. Open to many communication networks, the Altivar 61 drive provides *ingenious solutions* for all your HVAC fan and pump requirements.

A *powerful* fleet

- 1 to 900 HP
3-phase 380 to 480V
- 1 to 125 HP
3-phase 200 to 240V
- Integrated EMC level A filters
- Worldwide offer:
UL, CSA, CE, C-Tick, GOST,
UL1995 Plenum rated, SEMI-F47

Remarkable performance for fan and pump applications

- Under voltage ride-thru qualified to SEMI-F47 standard
- Catch on the fly restart
- Up to **110% overcurrent**
- Energy economizer motor algorithm to maximize energy savings, or select two point or five point Volts/Hz profile
- Three skip frequency bands
- Bump-less transfer from automatic to hand control

Expandable capabilities

The drive is equipped with a wealth of features, application functions, inputs/outputs and communication capabilities. These can be further extended by:

- input/output extension cards
- communication cards
- a Controller Inside programmable card
- a Multipump application card



Simply Smart!

Leverage **ingenuity**
and intelligence
for **ease** of use



Protection at all levels

■ Of the Motor:

Thermal protection by PTC probe or integrated electronic thermal overload, voltage and current surge limitation

■ Of the Machine:

Power removal safety function (no unintended motor operation), alarm management, external fault management

■ Of the Drive:

Protection in the event of overheating, current limitation using hardware and software, protection against corrosive environments

■ Of the Installation:

The intelligent design of the Altivar 61 drive power system architecture optimizes the balance between inductance and capacitance to achieve effective harmonic mitigation with 3% equivalent impedance without requiring additional panel space. This unique design minimizes dc bus ripple, reduces input currents and lowers harmonic currents. This eliminates the need to oversize power wiring, disconnect means, and short circuit protection devices. This also improves the efficiency of the drive and allows operation at higher ambient temperature than other AC drives.

■ Of the Environment:

Developed in accordance with the Eco-Design principle. Materials used have been selected for their minimal impact on the environment and conform to the RoHS directive (Restriction of Hazardous Substances) that prohibits certain levels of materials. Also, 88% of the parts used for the Altivar 61 drive are recyclable, conforming to the directive WEEE (Waste Electrical & Electronic Equipment).



Easy to control...

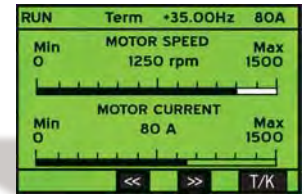
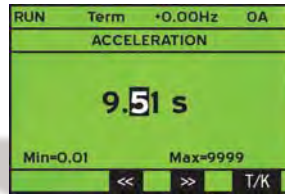
- Graphic screen with customizable display
- Plain text with six languages (English, Chinese, German, Spanish, French and Italian)
- Navigation wheel for easily “surfing” through the menus
- “Simply Start” menu for quick start-up and immediate benefit of the full performance of the Altivar 61 drive
- Function keys for short-cuts, on-line help or configurable for some applications
- Continuous display of the operating parameters of the motor
- Hand/auto function key provides one button bumpless transfer between terminal strip control and control with the keypad, or between communication network control and control with the keypad



Altivar® 61 Drives

Message received: *all clear...*

The Altivar 61 drive is a professional at communication: its messages are clear, precise, illustrated and intuitive to use.



Flexibility

with its remote mounting alternatives:

- on the door of an enclosure, with an IP54 or IP65 degree of protection
- for multipoint connection to several drives

Stores four configurations for transfer to other drives.

Protection

Multi level password protected, for allowing access to parameters or configurations with complete security.

Refine

select filtering and scaling values to analog inputs and analog outputs

Ergonomic

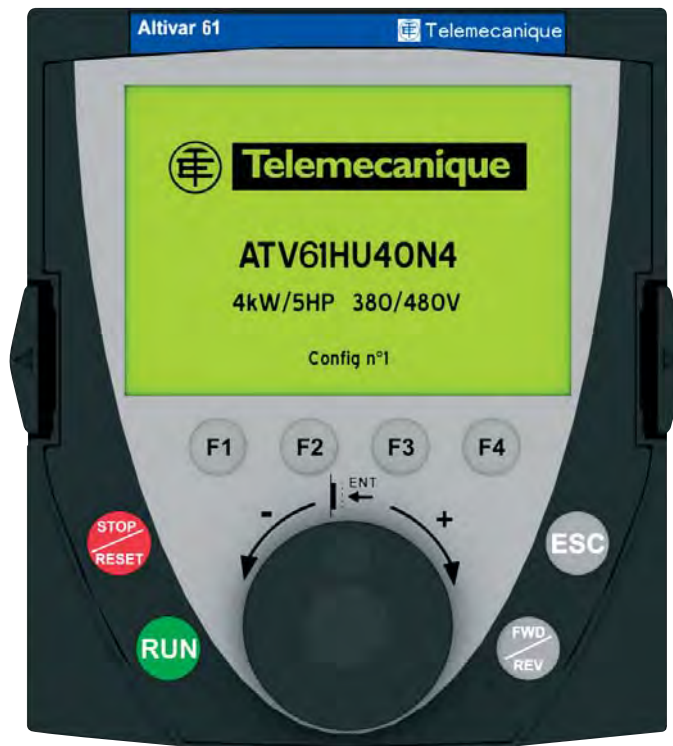
with its navigation button. With just one finger, freely and quickly "surf" the drop-down menu.

Clarity

of the display comprising eight lines of text and graphics. Legibility from 16 ft. Six languages available: English, Chinese, German, French, Spanish and Italian.

Simplicity

using function keys for short-cuts, direct access and on-line help, display of the minimum and maximum values of the parameters.



Customization

of parameters, display screens, on-line monitoring, creation of "user" menu.

Adaptability

add timing delays to logic inputs, logic outputs and relay output.

Modify

configure the active state on the relay and logic outputs.

Configure for your application

- Integrated **macro-configurations** are designed for a wide variety of applications and uses: pump and fan, connection to communication networks and PID regulation. They can easily be customized
- The architecture of the menus, hierarchical parameter system and short-cut functions enable **simple and quick programming**, even for the most sophisticated functions

RUN	Term	+60.00Hz	5.4A
1.1-SIMPLY START			
2/3 wire control	:	2 wire	
Macro-configuration	:	Pumps, Fans	
Standard mot. freq.	:	60Hz NEMA	
Rated motor power	:	10HP	
Rated motor volt.	:	460V	
Code	<<	>>	406V

The "Simply Start" menu provides easy access to the most common parameters to reduce start-up time of the Altivar 61 drive.

RDY	Term	+0.00Hz	0.0A
1. DRIVE MENU			
1.1 SIMPLY START			
1.2. MONITORING			
1.3. SETTINGS			
1.4. MOTOR CONTROL			
1.5. INPUTS / OUTPUTS CFG			
Code	<<	>>	T/K

RDY	Term	+0.00Hz	0.0A
QUICK NAVIGATION			
RETURN TO MAIN MENU			
DIRECT ACCESS TO...			
TO LAST MODIFICATIONS			
Code	<<	>>	

More on-board diagnostics

Ample diagnostics available via the graphic terminal **simplify setting-up** and **maintaining** your equipment.

The state of the drive is recorded at moment of a fault to assist with diagnostics

- Elapsed time
- Line voltage
- Motor current
- and more...



With PowerSuite™ software workshop you **stay in control, even from a distance!**

For configuring, adjusting and monitoring your Altivar drive...keep an eye on your installations via Bluetooth®...

Oscilloscope function incorporated in the Altivar 61 drive: display multiple channels using PowerSuite.

RUN	Mod.	+50.00Hz	5.4A
COMMUNICATION MAP			
Cmd channel	:	Modbus	
Cmd value	:	ABCD Hex	
Active ref. ch	:	RUN	
Frequency re	:	Term +50.00Hz 5.4A	
ETA status w	:	LOGIC INPUT MAP	
Code			
	PR	LI1	LI2
	LI3	LI4	LI5
	LI6	LI7	LI8
	LI9	LI10	
	MOT LI: 010101010101B		
	<<	>>	T/K

Display of inputs/outputs, communication, etc.

RDY	Term	+0.00Hz	0.0A
TEST IGBT			
IGBT 1	OK		
IGBT 2	Open		
IGBT 3	OK		
	<<	>>	T/K

Test functions for drive, motor, components, inputs/outputs, etc.

RUN	Term	+50.00Hz	5.4A
SERVICE MESSAGE			
For technical support, dial 123-45			
	<<	>>	T/K

Service messages of all types of information on the display: a telephone number, a specific instruction... stored in the drive.

RUN	Term	+50.00Hz	5.4A
1.11 IDENTIFICATION			
ATV61HU22N4			
2.2kW/ 3HP			
380 / 480 V			
Appl. Software V1.0 IE 01			
MC Software V1.0 IE 01			
	<<	>>	T/K

Identity incorporated in the drive simplifies **installed base management.**

Altivar® 61 Drives

Evolutionary design

Unrivalled basic equipment

With the many functions already integrated in the Altivar 61 drive, you **reduce the cost of solutions** for your installation. The most economical solution is offered without compromise!

Interface with the typical HVAC and Pump I/O requirements such as:

- run command: Input to VFD by remote dry contact from the BAS
- speed command: Input to VFD from the BAS
- run status: Output contact from VFD to the BAS
- speed feedback: Analog output from VFD to the BAS
- fault output: Form-C contact from VFD to the BAS
- fire/safety interlock: 24Vdc supplied by VFD, Use N.C. contacts

Fans optimized for long life and serviceability

The cooling fans on the Altivar 61 drive are designed to be easily removed for cleaning and servicing. These fans can be removed without removing the drive from the wall or its enclosure and are intelligently cycled on only when required to cool the drive, maximizing the life of the fan.

With more than 100 fan and pump functions available, you benefit from:

- increased flexibility
- high level of customization
- high level of integration

Integrated Modbus® and CANopen Port

With these two standard networks, you achieve:

- simplified installation
- savings in panel space
- direct connection to building network systems

Dialogue

The graphic terminal can be multipoint connected to several drives. The Altivar 61 drive is also available with a 7-segment display for ratings up to and including 20 HP @230Vac and 100 HP @460Vac for the most economical solution.

EMC mastered

Incorporating level A conducted and radiated EMC filters, the Altivar 61 drive simplifies installation and establishes conformity of the machine for CE marking, without additional costs.



“Power Removal” function

Conforming to the machine standard EN 954-1 category 3 and the standard for electrical installations IEC/EN 61508-1 SIL2, and certified by a competent body (INERIS), it enables:

- easier machine certification
- elimination of electromechanical relays
- reduced wiring and installation times
- space savings in enclosures

For any *Mounting* requirement:

On a wall

- Simple compact installation use the Type 1 conduit kit

Reduce enclosure size

- side by side mounting reduces panel space
- industry leading 50° C rating
- externally mounting the heat sink with kit

In severe environments

- resistance to corrosive environments conforming to class 3C2 of IEC 60721-3-3
- Exposed copper is tinned, circuit boards are conformal coated in critical areas, and plastics are treated to better withstand the corrosive nature of certain oils. (This protection is standard on products 75 HP and higher @ 230 VAC and on 125 HP and higher @ 460 VAC. Add S337 to the end of the catalog number to receive this protection on smaller horsepower products)

Modular configuration

When you require additional inputs or outputs, a communication network connection or desire decentralized equipment control, you can select up to two option cards that snap in without requiring additional panel space

■ *Input/output extension* cards:

Logic inputs, open collector outputs, relay, PTC probe input, analog inputs, analog outputs, pulse input

■ *Communication* cards:

for connection to the main communication networks available on the market

For building networks:

Lonworks, BACnet, Metasys N2, Apogee FLN P1

For industrial networks:

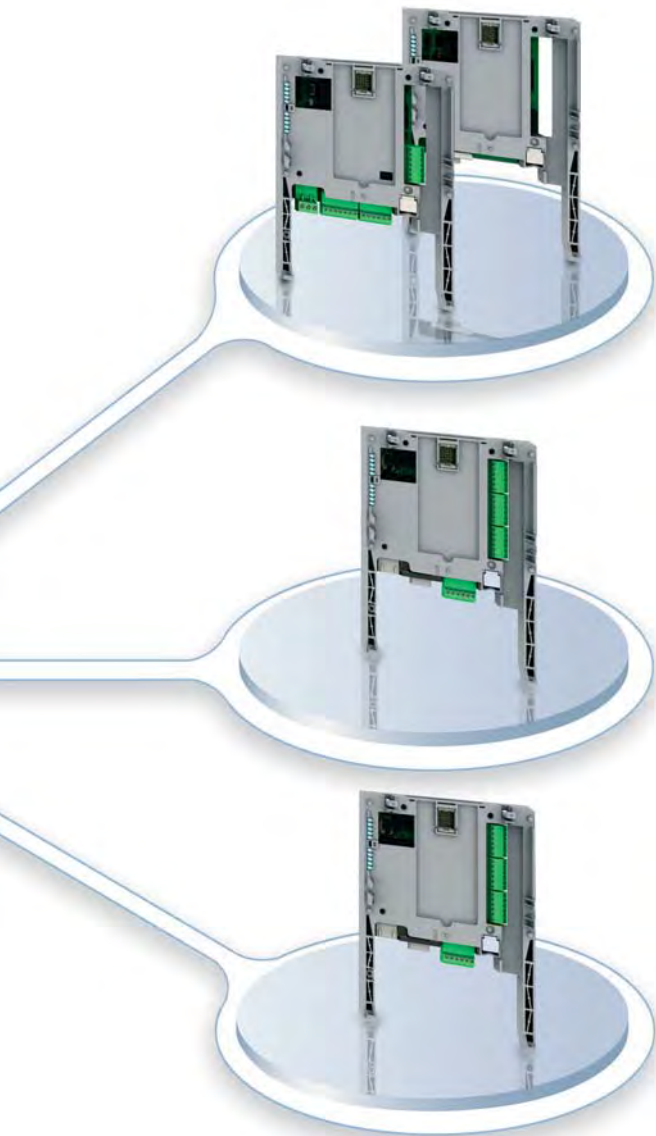
Fipio, Ethernet, Modbus Plus, Profibus DP, DeviceNet, Uni-Telway, InterBus

■ *Controller Inside* programmable card:

Allows integration of simple programs in the drive for an OEM or integrator to provide a unique solutions

■ *The pump application* option card incorporates application functions for managing pumps

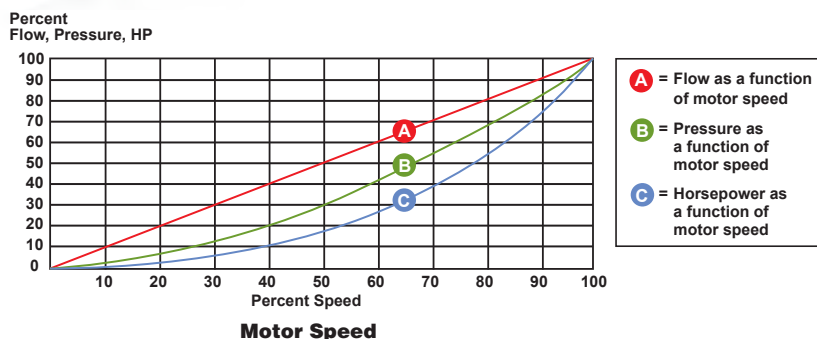
- Single pump or multiple pump management with up to four pump motors with variable speed and fixed speed motors
- Management of relative operating time
- Set-up screens minimize start-up
- Activate only the functions your system requires
- Instrumentation scaling
- Real time clock
- System status and fault messaging



Go *green* with the Altivar® 61 Drive!

Let the Altivar 61 drive operate your buildings with greater efficiency. Using the Altivar 61 drive on fans and pumps can significantly reduce your energy costs. In many instances, the payback period for using an adjustable frequency drive in place of other flow control methods is less than 18 months.

Most HVAC systems are designed to keep the building cool on the hottest days and warm on the coldest days. Therefore, the HVAC system only needs to work at full capacity on the 10 or so hottest days and the 10 or so coldest days of the year. On the other 345 days, the HVAC system may operate at a reduced capacity. This is where a variable air volume system with variable frequency drives (VFDs) can be used to match air flow to actual heating and cooling demands. The VFD can reduce the motor speed when full flow is not required, thereby reducing the power required and the electrical energy used.



An Example of an Energy Saving Calculation*

A fan with a 20 horsepower motor supplies air 10 hours a day for 260 days a year and the energy cost is \$0.10 cents per kilowatt-hour. Cost of running full speed:

$$20 \text{ hp} \times 0.746 \text{ kW/hp} \times 2600 \text{ hours} \times \$0.10/\text{kWhr} = \mathbf{\$3879.20}$$

Assuming the fan does not need to run at full speed all of the time, let's use an example of:

- Running full speed (100%) for 25% of the time
- 80% speed for 50% of the time
- 60% speed for the remaining 25% of the time

Cost of running with an AC drive controlling the motor:

$$20 \text{ hp} \times (1) \times 0.746 \text{ kW/hp} \times 650 \text{ hours} \times \$0.10/\text{kWhr} = \$969.80$$

$$20 \text{ hp} \times (0.8)^3 \times 0.746 \text{ kW/hp} \times 1300 \text{ hours} \times \$0.10/\text{kWhr} = \$993.08$$

$$20 \text{ hp} \times (0.6)^3 \times 0.746 \text{ kW/hp} \times 650 \text{ hours} \times \$0.10/\text{kWhr} = \$209.48$$

$$\mathbf{Total = \$2172.36}$$

$$\mathbf{Annual savings: \$3879.20 - \$2172.36 = \$1706.84}$$

Actual results may vary for closed loop pumping and variable air volume systems.

Conserving Earth's *Energy*

A variable air/water/refrigerant volume HVAC system controlled by VFDs can go a long way in helping a new or existing building achieve greater energy efficiency. Not only will HVAC systems run by VFDs save money, but they also will increase the comfort of the building and reduce equipment maintenance costs and downtime. Plus, meeting the requirements of the Energy Policy Act of 2005 and achieving a more "green" system through LEED certification can offer more money-saving opportunities if the building is eligible for state and local government incentives. Ultimately, more efficient HVAC systems create more energy efficient buildings, which in turn conserves energy resources across the U.S. and the world.

Altivar® 61 Drives *Eco-Design:* thinking of the future

Within its sustainable development policy, Schneider Electric is committed to environmental friendliness:

“Our products safeguard life, make goods safer and optimize the consumption of energy and natural resources. We are actively involved in design, production, distribution and recycling processes that are environmentally friendly. Protection of the environment forms an integral part of our strategic decision making.”

ISO 14 001 certified sites for their manufacturing operations:

- Pacy-sur-Eure/France
 - Houston TX/USA
 - Mie/Japan
- and certified for their Eco-Design cycles

The new generation of **Altivar 61 drives** benefits from an **Eco-Design** approach. The same importance has been given to the “environment” criterion as that for other criteria, such as: performance, quality, ergonomics...and this applies to each stage of the **life cycle of the product*** (manufacture, distribution, usage and end of life).

Exemplary end of life recovery ...

88% of the parts used for the Altivar 61 drive are recyclable. They enable the recuperation of energy (incineration with energy recuperation) or of material (recycling, composting) conforming to the European directive WEEE (Waste Electrical & Electronic Equipment).

With Eco-Design



Without Eco-Design



70 %

Recovery rate imposed by the European directive WEEE.

... due to a strict selection and ideal combination of materials

Materials used for the **Altivar 61 drive** have been selected for their minimal impact on the environment. Conformity to the European directive ROHS (Restriction Of Hazardous Substances) that prohibits the use of materials such as lead, cadmium, mercury and hexavalent chromium.

*For the complete “Product Environmental Profile” document relating to the entire range, please contact Schneider Electric.

Analysis carried out using EIME (Environmental Information and Management Explorer) software and based on international averages.

The *green building* movement is on!

The Altivar 61 drive can help create green buildings. The U.S. Green Building Council® (USGBC) developed and administered the LEED® (Leadership in Energy and Environmental Design) Green Building Rating System™, to define green buildings. One of the prerequisites of the LEED-NC Energy and Atmosphere component is meeting both the mandatory provisions and prescriptive/performance requirements of ASHRAE 90.1-2004. This standard sets minimum requirements to promote the principles of effective, energy-conserving

design for buildings and building systems. More specifically, the ASHRAE prescriptive strongly recommends that HVAC systems with total fan power greater than 5 hp have variable air volume fan control and that individual variable air volume fans with motors greater than or equal to 15 hp have variable speed drives.

For government buildings, government regulations such as the Energy Policy Act of 2005 (EPAAct) mandate energy monitoring and energy efficiency improvements. LEED certification alone has its benefits. In addition to saving energy costs, it also allows the building owner to take advantage of state and local government incentives and makes the building project more marketable to tenants who are seeking more energy-efficient/sustainable facilities.

The Altivar 61 drive can help create green buildings by providing gains in energy efficiency, easier commissioning and monitoring of the building, and by its Eco-Design.

Altivar® 61 Drives Electrical Specifications

Input Voltage	200 -15% to 240 +10%, 380 -15% to 480 +10%
Displacement Power Factor	98% through speed range
Input Frequency	50 Hz -5% to 60 Hz +5%
Drive Input Section	Six pulse bridge rectifier
Drive Output Section	Three Phase, IGBT Inverter with Pulse Width Modulated (PWM) output Maximum voltage equal to input voltage
Galvanic Isolation	Galvanic isolation between power and control (inputs, outputs and power supplies)
Frequency Range of Power Converter	0.5 to 500 Hz
Torque/overtorque	110% of nominal motor torque for 60 s, minimum
Current (transient)	110% of controller rated current for 60 s, minimum
Switching Frequency	Selectable from 1 to 16 kHz, 12 kHz nominal rating for 1-60 hp @ 200/240 V, 1-100 hp @ 380/480 V. Selectable: 2.5 to 8 kHz, 2.5 kHz nominal rating for 75-125 hp @ 200/240 V 125-900 hp @ 380/480 V.
Speed Reference Inputs	AI: 0 to +10 V, Impedance = 30 kOhms Used for Speed potentiometer, 1-10 kOhms AI2: Factory setting = 4 to 20mA, software configurable for current, (0-20mA, X-Y) or voltage
Analog Reference Resolution	0.1 for 100 Hz (11 bits)
I/O Sampling Time	2 ms +/- 0.5 ms on analog inputs & outputs, & logic inputs, 7 ms +/- 0.5 ms on relay outputs
Power Removal/Run Permissive Input	24Vdc input, for use to prohibit unintended equipment operation
Efficiency	98% at full load typical
Acceleration and Deceleration Ramps	0.1 to 999.9 seconds (definition in 0.1 s increments)
Skip Frequencies	Three configurable skip frequency/jump frequency bands
Motor Control Profiles	Energy economizer (flux optimization) motor algorithm to maximize energy savings. (Automatically optimizes voltage based on load.) or select from 2 point or 5 point volts/hertz profile or SLFV (sensorless flux vector)
Speed Range	1 to 100, open loop
Motor Protection	Class 10 electronic overload protection or PTC probe
Graphic Display Terminal	Simply Start menu, PID set-up menu, network set-up menu, Logic I/O & Analog I/O mapping and status, Monitoring and self diagnostics with fault messages and status such as; Power on time, elapsed time, motor run time, line voltage, motor current, ready to run, running, motor speed
Compliance	RoHS and WEEE (Waste Electrical & Electronic Equipment compliant)
Codes and Standards	UL, CSA, NOM 117, DNV, CE, C-Tick, GOST, UL 1995 Plenum rated, SEMI-F47 certified for voltage dip ride-through

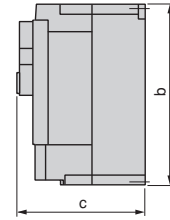
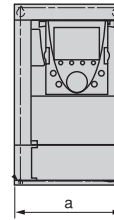
Altivar® 61 Drives Environmental Specifications

Temperature	Operation:+14 to + 122° F (-10 to +50° C) Storage:-13 to +158° F (-25 to +70° C)
Humidity	95% with no condensation or dripping water, conforming to IEC 600068-2-3.
Altitude	3,300 ft. (1,000 m) without derating; 3,300- 9850 ft (1,000-3,000 m) derate output current by 1% for each additional 330 ft. (100 m). 6560 ft (2000m) maximum for corner grounded distribution system.
Enclosure Rating	<i>1-60 hp @ 200/240 V, 1-100 hp @ 380/480 V:</i> IP 41 on top IP21 on all other surfaces, Type 1 with optional conduit kit. <i>75-125 hp @ 200/240 V, 125-500 hp @ 380/480 V:</i> IP 41 on top, IP30 sides & front IP00 on bottom, Type 1 w/ optional conduit kit. 600 -900 hp @ 380/480 V. IP 41 on top, IP30 sides and front, IP00 on bottom
Pollution Degree	<i>1-20 hp @ 200/240 V, 1-25 hp @ 380/480 V:</i> Pollution degree 2 per IEC/EN 61800-5-1, Option S337 provides protection per IEC 60721-3-3 Class 3C2 <i>25-60 hp @ 200/240 V, 30-100 hp @ 380/480V:</i> Pollution degree 3 per IEC/EN 61800-5-1, Option S337 provides protection per IEC 60721-3-3 Class 3C2 <i>60-125hp @ 200/240 V, 125-900 hp @ 380/480V:</i> Pollution degree 3 per IEC/EN 61800-5-1 and protection per IEC 60721-3-3 Class 3C2
Vibration Resistance	1-60hp @ 200/240V 1-100 hp @ 380/480 V Conforming to IEC/EN 60068-2-6 1.5mm peak to peak from 3 to 13 Hz, 1gn from 13 to 200 Hz. 75-125 hp @ 200/240V, 125-900 hp @ 380/480V: Conforming to IEC/EN 60068-2-6 1.5mm peak to peak from 3 to 10 Hz, 0.6gn from 10 to 200 Hz.
Shock Resistance	1-60 hp @ 200/240 V, 1-100 hp @ 380/480 V: 15gn for 11ms conforming to IEC/EN 600068-2-27 75-125 hp @ 200/240 V, 125-500 hp @ 380/480 V: 7gn for 11ms conforming to IEC/EN 600068-2-27 600-900 hp @ 380/480 V. 4gn for 11ms conforming to IEC/EN 600068-2-27

Altivar® 61 Drives Dimensions and Weights

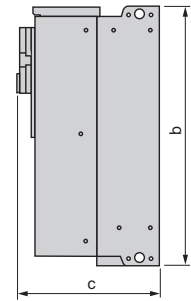
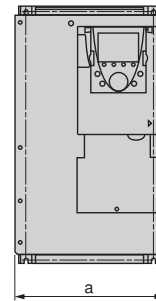
With LCD Graphic Display Terminal

Frame Size	a Width		b Height		c Depth		Weight		b Height with Type 1 Kit	
	mm	In.	mm	In.	mm	In.	kg.	lbs.	mm	In.
1	130	5.12	230	9.06	175	6.89	3	6.61	357	14.05
2	155	6.10	260	10.24	187	7.36	4	8.82	387	15.23
3	175	6.89	295	11.61	187	7.36	5.5	12.13	422	16.61
4	210	8.27	295	11.61	213	8.39	7	15.43	396	15.61
5	230	9.06	400	15.75	213	8.39	9	19.84	502	19.75



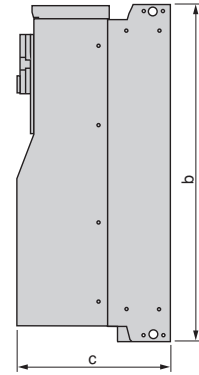
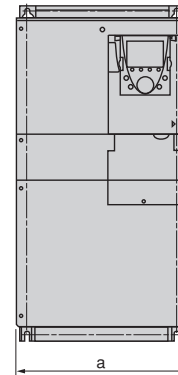
For a drive without a graphic display terminal, the depth is reduced by 26mm (1.02 in)
 For a drive with one option card installed, the depth is increases 23mm (0.91 in)
 For a drive with two option cards installed, the depth is increases 46mm (1.81 in)

Frame Size	a Width		b Height		c Depth		Weight		b Height with Type 1 Kit	
	mm	In.	mm	In.	mm	In.	kg.	lbs.	mm	In.
6	240	9.45	420	16.54	236	9.29	30	66.14	547	21.54
7	240	9.45	550	21.65	266	10.47	37	81.57	677	26.65
8	320	12.60	550	21.65	266	10.47	37	81.87	753	29.65
9	320	12.60	630	24.80	290	11.42	45	99.21	833	32.80



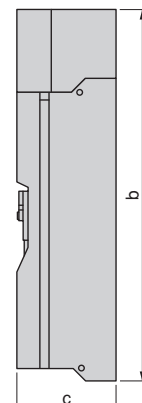
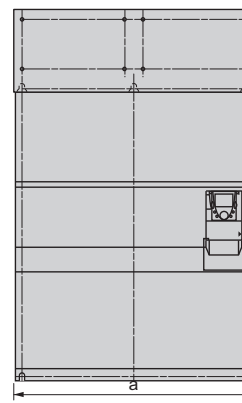
For a drive without a graphic display terminal, the depth is reduced by 26mm (1.02 in)
 For a drive with one option card installed, the depth is increases 23mm (0.91 in)
 For a drive with two option cards installed, the depth is increases 46mm (1.81 in)

Frame Size	a Width		b Height		c Depth		Weight		b Height with Type 1 Kit	
	mm	In.	mm	In.	mm	In.	kg.	lbs.	mm	In.
10	320	12.60	920	36.22	377	14.84	74	163	985	38.77
11	360	14.17	1022	40.24	377	14.84	80	176	1188	46.79
12	340	13.39	1190	46.85	377	14.84	110	242	1471	57.90
13	440	17.32	1190	46.85	377	14.84	140	309	1407	55.40
14	595	23.43	1190	46.85	377	14.84	215	474	1458	57.40



For a drive with one option card installed, the depth remains the same
 For a drive with two option cards installed, the depth is increases 15mm (0.59 in)

Frame Size	a Width		b Height		c Depth		Weight	
	mm	In.	mm	In.	mm	In.	kg.	lbs.
15	890	35.04	1390	54.72	377	14.84	225	496
16	1120	44.09	1390	54.72	377	14.84	300	661



For a drive with one option card installed, the depth remains the same
 For a drive with two option cards installed, the depth is increases 15mm (0.59 in)

Altivar® 61 Drives Selection guide

Supply voltage: 3-phase 200...240V

Motor		Drive		Frame size
kW	HP	Amps	References (LCD keypad included)	
0.75	1	4.8	ATV61H075M3 ⁽¹⁾	1
1.5	2	8	ATV61HU15M3 ⁽¹⁾	1
2.2	3	11	ATV61HU22M3 ⁽¹⁾	2
3	–	13.7	ATV61HU30M3 ⁽¹⁾	2
4	5	17.5	ATV61HU40M3 ⁽²⁾	2
5.5	7.5	27.5	ATV61HU55M3 ⁽²⁾	3
7.5	10	33	ATV61HU75M3 ⁽²⁾	4
11	15	54	ATV61HD11M3X ⁽³⁾	5
15	20	66	ATV61HD15M3X ⁽³⁾	5
18.5	25	75	ATV61HD18M3X ⁽³⁾	6
22	30	88	ATV61HD22M3X ⁽³⁾	6
30	40	120	ATV61HD30M3X ⁽³⁾	8
37	50	144	ATV61HD37M3X ⁽³⁾	8
45	60	176	ATV61HD45M3X ⁽³⁾	8
55	75	221	ATV61HD55M3X ⁽³⁾⁽⁴⁾	10
75	100	285	ATV61HD75M3X ⁽³⁾⁽⁴⁾	10
90	125	359	ATV61HD90M3X ⁽³⁾⁽⁴⁾	11

For 20 HP and smaller, add the letter "Z" to the end of the reference for an Altivar 61 to receive the drive with an LED keypad in place of the LCD keypad.

- (1) For single-phase 0.75 to 7.5 kW range, select the next rating up (example: 2.2 kW - reference = ATV61HU30M3).
- (2) For single-phase operation, select the next rating up and add a line choke.
- (3) Without EMC filter.
- (4) With integrated DC bus inductance.

Supply voltage: 3-phase 380...480V

Motor		Drive		Frame size
kW	HP	Amps	References (LCD keypad included)	
0.75	1	2.3	ATV61H075N4 ⁽⁴⁾	1
1.5	2	4.1	ATV61HU15N4 ⁽⁴⁾	1
2.2	3	5.8	ATV61HU22N4 ⁽⁴⁾	1
3	–	7.8	ATV61HU30N4 ⁽⁴⁾	2
4	5	10.5	ATV61HU40N4 ⁽⁴⁾	2
5.5	7.5	14.3	ATV61HU55N4 ⁽⁴⁾	3
7.5	10	17.6	ATV61HU75N4 ⁽⁴⁾	3
11	15	27.7	ATV61HD11N4 ⁽⁴⁾	4
15	20	33	ATV61HD15N4 ⁽⁴⁾	5
18.5	25	41	ATV61HD18N4	5
22	30	48	ATV61HD22N4	6
30	40	66	ATV61HD30N4	7
37	50	79	ATV61HD37N4	7
45	60	94	ATV61HD45N4	9
55	75	116	ATV61HD55N4	9
75	100	160	ATV61HD75N4	9
90	125	179	ATV61HD90N4 ⁽⁵⁾	10
110	150	215	ATV61HC11N4 ⁽⁵⁾	10
132	200	259	ATV61HC13N4 ⁽⁵⁾	11
160	250	314	ATV61HC16N4 ⁽⁵⁾	12
220	350	427	ATV61HC22N4 ⁽⁵⁾	13
250	400	481	ATV61HC25N4 ⁽⁵⁾	14
315	500	616	ATV61HC31N4 ⁽⁵⁾	14
400	600	759	ATV61HC40N4 ⁽⁵⁾	15
500	700	941	ATV61HC50N4 ⁽⁵⁾	15
630	900	1188	ATV61HC63N4 ⁽⁵⁾	16

- (4) For 100 HP and smaller, add the letter "Z" to the end of the reference for an Altivar 61 to receive the drive with an LED keypad in place of the LCD keypad.
- (5) With integrated DC bus inductance.

Inputs/outputs on board

- Analog input #1: +/- 10Vdc bipolar input, 1 bits + 1 sign resolution, 2ms +/- .5ms sample time
- Analog input #2: software selectable for 1-10Vdc or x-y mA
x-y selectable from 0-20mA, 11 bits resolution, 2ms +/- .5ms sample time
- Analog output #1: software selectable for 1-10Vdc or x-y mA
x-y selectable from 0-20mA, 10 bits resolution, 2ms +/- .5ms sample time
- Relay output #1: one NO (normally open) one NC (normally closed)
- Relay output #2: one NO (normally open)
- 6 logic inputs 24Vdc, 2ms +/- .5ms sample time
Multiple function assignment possible
Positive logic (source) or Negative logic (sink) choice LI6 offers PTC probe assignment
- Power Removal input: 1 input for interlocking function (run permissive)
- RJ45 port Modbus or CANopen (selectable)

PowerSuite software workshop

- PowerSuite CD-ROM for PC _____ VW3 A 8104
- Connection kit for PC _____ VW3 A 8106
- Adaptor for wireless link Modbus-Bluetooth® _____ VW3 A 8114

Input/output cards

- Logic inputs/outputs
1 voltage output, 24V
1 voltage output, -10V
1 logic output, relay
4 programmable logic inputs
2 assignable logic outputs with open collector
1 input for 6 PTC probes max. _____ VW3 A 3201
- Extended inputs/outputs
Same as logic inputs/outputs card +
2 analog inputs
2 analog outputs
1 pulse input _____ VW3 A 3202

Communication cards

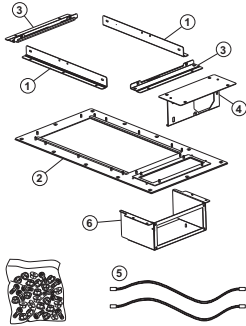
- Modbus Plus _____ VW3 A 3302
- Uni-Telway _____ VW3 A 3303
- InterBus _____ VW3 A 3304
- Profibus DP _____ VW3 A 3307
- DeviceNet _____ VW3 A 3309
- Ethernet _____ VW3 A 3310
- Fipio _____ VW3 A 3311
- LonWorks _____ VW3 A 3312
- METASYS N2 _____ VW3 A 3313
- APOGEE FLN _____ VW3 A 3314
- BACnet _____ VW3 A 3315

Controller Inside programmable card

- _____ VW3 A 3501

- Pump application card _____ VW3 A 3503

Altivar® 61 Drives Accessories Selection guide



Heatsink Mounting Kit VW3A9506

Control Fan Kit

Installation of kit enables the drive to operate in higher ambient temperature. Fan mounts on top of drive and is powered from the drive.

For Drives	Catalog Number
ATV 61H037M3...HU55M3	VW3 A9 401
ATV 61H075N4...HU75N4	
ATV 61HU75M3...HD15M3	VW3 A9 402
ATV 61HD11N4...HD18N4	
ATV 61HD18M3X...HD22M3X	VW3 A9 404
ATV 61HD22N4	
ATV 61HD30N4...HD37N4	VW3 A9 405
ATV 61HD30M3X...HD45M3X	VW3 A9 406
ATV 61HD45N4...HD75N4	VW3 A9 407

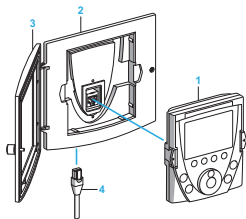
Type 1 Conduit Kit

Kit includes: a metal box, with conduit knockouts. Kit provides conduit landing when wall mounting the drive.

For Drives	Catalog Number
ATV 61H037M3...HU15M3	VW3 A9 201
ATV 61H075N4...HU22N4	
ATV 61HU22M3...HU40M3	VW3 A9 202
ATV 61HU30N4, HU40N4	
ATV 61HU55M3	VW3 A9 203
ATV 61HU55N4, HU75N4	
ATV 61HU75M3	VW3 A9 204
ATV 61HD11N4	
ATV 61HD11M3X, HD15M3X	VW3 A9 205
ATV 61HD15N4, HD18N4	
ATV 61HD18M3X, HD22M3X	VW3 A9 206
ATV 61HD22N4	
ATV 61HD30N4, HD37N4	VW3 A9 207
ATV 61HD30M3X...HD45M3X	VW3 A9 217
ATV 61HD45N4...HD75N4	VW3 A9 208
ATV 61HD55M3X, HD75M3X	VW3 A9 209
ATV 61HD90N4, HC11N4	
ATV 61HD90M3X	VW3 A9 210
ATV 61HC13N4	
ATV 61HC16N4	VW3 A9 211
ATV 61HC22N4	VW3 A9 212
ATV 61HC25N4...HC31N4	VW3 A9 213
Without braking unit	
With braking unit VW347101	VW3 A9 214



ATV61HU40N4 with VW3A9202 Conduit Kit



LCD Keypad Mounting Kit

Kit for Mounting Heatsink thru Back of Enclosure

Kit used to mount the heatsink of the drive outside of an enclosure. Kit includes: a metal frame, seals, mounting hardware, bracket to mount fan kit so fan can be accessed from the front of the drive.

For Drives	Catalog Number
ATV 61H037M3...HU15M3	VW3 A9 501
ATV 61H075N4...HU22N4	
ATV 61HU22M3...HU40M3	VW3 A9 502
ATV 61HU30N4, HU40N4	
ATV 61HU55M3	VW3 A9 503
ATV 61HU55N4, HU75N4	
ATV 61HU75M3	VW3 A9 504
ATV 61HD11N4	
ATV 61HD11M3X, HD15M3X	VW3 A9 505
ATV 61HD15N4, HD18N4	
ATV 61HD18M3X, HD22M3X	VW3 A9 506
ATV 61HD22N4	
ATV 61HD30N4, HD37N4	VW3 A9 507
ATV 61HD30M3X...HD45M3X	VW3 A9 508
ATV 61HD45N4...HD75N4	VW3 A9 509
ATV 61HD55M3X, HD75M3X	VW3 A9 510
ATV 61HD90N4, HC11N4	
ATV 61HD75M3X	VW3 A9 511
ATV 61HC11N4	
ATV 61HC16N4	VW3 A9 512
ATV 61HC16N4	VW3 A9 513
ATV 61HC25N4...HC31N4	VW3 A9 514
Without braking unit	
With braking unit VW3A7101	VW3 A9 515

LCD Keypad Mounting Kit

Use the remote mounting kit to mount the LCD keypad in an enclosure door.

Add the clear plastic door to improve to an IP65 rating and view the LCD screen.

Refer to diagram for item number	Catalog Number
1 LCD graphic keypad: IP54 rating	VW3A 1101
2 Remote mounting kit: includes bezel and mounting hardware	VW3A 1102
3 Door for use with remote mount kit for IP65 rating	VW3A 1103
4 Cable for remote mounting LCD graphic keypad RJ45 connector on each end	
	1 meter VW3A1104 R10
	3 meters VW3A1104 R30
	5 meters VW3A1104 R50
	10 meters VW3A1104 R100
RJ 45 female female adaptor to connect LCD keypad and cable. Not required if using VW3A1102	VW3A1105

The efficiency of Telemecanique® branded *solutions*

Used in combination, Telemecanique products provide quality solutions, meeting all your **Automation** and **Control** applications requirements.



Simple machines

Altistart 01: 0.25 to 75 HP

Altivar 11: 0.25 to 3 HP

Altivar 31: 0.25 to 20 HP



Complex, high power machines

Altivar 71: 0.5 to 700 HP



Pumping and ventilation machines

Altistart 48: 3 to 1200 HP

Altivar 21: 1 to 100 HP

Altivar 61: 1 to 900 HP



A worldwide presence

Schneider Electric is a global supplier of electrical distribution, automation and control equipment products under the brand names of Square D®, Telemecanique® and Merlin Gerin®. For over 100 years, Schneider Electric has been an innovator in manufacturing products that are tailored to the demanding specifications of our customers. Backed by a global organization of 80,000 employees in 130 countries, Schneider Electric is a global electrical industry leader. With one of the strongest distribution networks in the US and around the world, you can count on Schneider Electric to keep your business running smoothly and efficiently.

Schneider Electric has been providing adjustable frequency drive solutions for HVAC and pumping applications for over 30 years. Schneider Electric has made a significant investment in research and development to design in a new generation of products to serve the HVAC and pumping marketplace.

Schneider Electric - North American Operating Division

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TeSys™ D Contactors

Table 14: TeSys D Contactors

Catalog Number	Standard Motor Ratings @ 50/60 Hz (hp)						Max. Inductive AC3 Current (A)	Max. Resistive AC1 Current (A)	Max. Component SCCR (kA) ¹	
	1 Ø		3 Ø						Circuit Breakers @ 480 V ²	Fuses @ 600 V ³
	120 V	240 V	208 V	240 V	480 V	600 V				
LC1D09	0.5	1	2	2	5	7.5	9	20	85	100
LC1D12	1	2	3	3	7.5	10	12	25	85	100
LC1D18	1	3	5	5	10	15	18	32	85	100
LC1D25	2	3	7.5	7.5	15	20	25	40	85	100
LC1D32	2	5	10	10	20	30	32	50	85	100
LC1D40A	3	5	10	10	30	30	40	60	100	100
LC1D50A	3	7.5	15	15	40	40	50	80	100	100
LC1D65A	5	10	20	20	40	50	65	80	100	100
LC1D80	7.5	15	25	30	60	60	80	125	100	100
LC1D115	—	—	30	40	75	100	115	200	100	100
LC1D150	—	—	40	50	100	125	150	200	100	100

¹ Ratings apply to circuits with voltages no greater than those listed.

² When protected by any circuit breaker, including thermal-magnetic and magnetic-only, meeting the size limits in Table 15.

³ When protected by any Class J or CC time-delay fuse meeting the size limits in Table 15.

NOTE: This table lists the maximum SCCR of the component when protected by any circuit breaker or fuse. If the maximum component SCCR is 100 kA and a 25 kA rated circuit breaker is used, then the system will be 25 kA as the circuit breaker becomes the weakest link.



TeSys D Contactor
LC1D12

Table 15: TeSys D Contactor Maximum Component SCCR ¹

Catalog Number	Circuit Breakers @ 480 V ²		Fuses @ 600 V ³	
	Max. Breaker Size (A)	Max. SCCR (kA)	Max. Fuse Size (A)	Max. SCCR (kA)
LC1D09	35	85	25	100
LC1D12	35	85	30	100
LC1D18	60	85	40	100
LC1D25	60	85	60	100
LC1D32	60	85	80	100
LC1D40A	110	100	90	100
LC1D50A	110	100	110	100
LC1D65A	110	100	125	100
LC1D80	150	100	175	100
LC1D115	250	100	250	100
LC1D150	250	100	300	100

¹ Ratings apply to circuits with voltages no greater than those listed.

² When protected by any circuit breaker, including thermal-magnetic and magnetic-only.

³ When protected by any Class J or CC time-delay fuse (Class CC applicable up to 30A only).

NOTE: This table lists the maximum SCCR of the component when protected by any circuit breaker or fuse. If the maximum component SCCR is 100 kA and a 25 kA rated circuit breaker is used, then the system will be 25 kA as the circuit breaker becomes the weakest link.

TeSys™ D Overload Relays



TeSys D Overload Relay

Table 31: TeSys D Overload Relays

Current Setting Range (A)	For Direct Mounting to LC1...	Class 10 with Single Phase Sensitivity	Class 10 without Single Phase Sensitivity	Class 20 with Single Phase Sensitivity	Class 20 without Single Phase Sensitivity	Max. Component SCCR ¹				
						Circuit Breakers @ 480 V ²		Fuses @ 600 V ³		
						Max. Breaker Size (A)	Max. SCCR (kA)	Max. Fuse Size (A)	Max. SCCR (kA)	
0.10–0.16	D09–D32	LRD01	LR3D01	—	—	15	65	10	100	
0.16–0.25		LRD02	LR3D02	—	—	15	65	10	100	
0.25–0.40		LRD03	LR3D03	—	—	15	65	10	100	
0.40–0.63		LRD04	LR3D04	—	—	15	65	10	100	
0.63–1		LRD05	LR3D05	—	—	15	65	10	100	
1–1.6		LRD06	LR3D06	—	—	15	65	10	100	
1.6–2.5		LRD07	LR3D07	—	—	15	65	10	100	
2.5–4		LRD08	LR3D08	LRD1508	LR3D1508A1	15	65	15	100	
4–6		LRD10	LR3D10	LRD1510	LR3D1510A1	15	65	20	100	
5.5–8		LRD12	LR3D12	LRD1512	LR3D1512A1	15	65	30	100	
7–10		LRD14	LR3D14	LRD1514	LR3D1514A1	20	65	40	100	
9–13		D12–D32	LRD16	LR3D16	LRD1516	LR3D1516A1	25	65	50	100
12–18		D18–D32	LRD21	LR3D21	LRD1521	LR3D1521A1	35	65	60	100
16–24		D25–D32	LRD22	LR3D22	—	—	45	65	60	100
17–25	—		—	LRD1522	LR3D1522A1	45	65	100	100	
23–32	LRD32		LR3D32	—	—	60	65	80	100	
23–28	—		—	LRD1530	LR3D1530A1	60	65	100	100	
25–32	—		—	LRD1532	LR3D1532A1	60	65	100	100	
30–38	D32		LRD35	LR3D35	—	—	70	65	100	100
9–13	D40A–D65A ⁴	LRD313	LR3D313	LRD313L	—	25	100	30	100	
12–18		LRD318	LR3D318	LRD318L	—	35	100	45	100	
16–25		LRD325	LR3D325	LRD325L	—	45	100	60	100	
23–32		LRD332	LR3D332	LRD332L	—	60	100	80	100	
30–40		LRD340	LR3D340	LRD340L	—	70	100	100	100	
37–50		LRD350	LR3D350	LRD350L	—	90	100	125	100	
48–65	D50A–D65A ⁴	LRD365	LR3D365	LRD365L	—	125	100	200	100	
17–25	D40–D80 ⁵	LRD3322	LR3D3322	LR2D3522	LR3D3522	45	100	60	100	
23–32		LRD3353	LR3D3353	LR2D3553	LR3D3553	60	100	80	100	
30–40		LRD3355	LR3D3355	LR2D3555	LR3D3555	70	100	90	100	
37–50	D50–D80 ⁵	LRD3357	LR3D3357	LR2D3557	LR3D3557	90	100	125	100	
48–65		LRD3359	LR3D3359	LR2D3559	LR3D3559	125	100	150	100	
55–70	D65–D80 ⁵	LRD3361	LR3D3361	LR2D3561	LR3D3561	125	100	175	100	
63–80		LRD3363	LR3D3363	LR2D3563	LR3D3563	150	100	200	100	
80–104	D80	LRD3365	—	—	—	200	100	250	100	
80–104	D115–D150	LRD4365	—	—	—	200	100	250	100	
95–120		LRD4367	—	—	—	—	250	100	400	100

¹ Ratings apply to circuits with voltages no greater than those listed.

² When protected by any circuit breaker, including thermal-magnetic and magnetic-only.

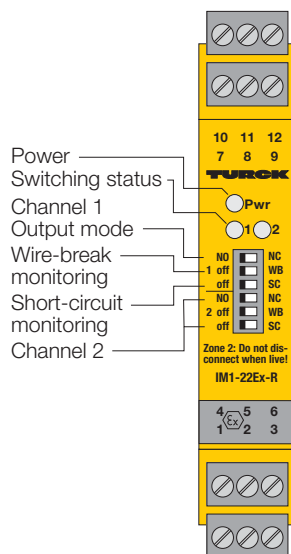
³ When protected by any Class J or CC time-delay fuse (Class CC applicable up to 30A only).

⁴ Overload relays with Everlink termination - direct mount to D40A to D65A only.

⁵ Direct mount to old D2 style D40 to D65 (no Everlink terminations) and to D80 only.

NOTE: This table lists the maximum SCCR of the component when protected by any circuit breaker or fuse. If the maximum component SCCR is 100 kA and a 25 kA rated circuit breaker is used, then the system will be 25 kA as the circuit breaker becomes the weakest link.

Isolating Switching Amplifier IM1-22Ex-R 2-channel



- **2-channel isolating switching amplifier with removable terminal blocks**
- **Intrinsically safe input circuits EEx ia**
- **Area of application according to ATEX: II (1) GD, II 3 G**
- **Approved for installation in zone 2, however the device must be installed in a housing which complies with the requirements of EN 60079-15 with a minimum protection degree of IP54**
- **Functional safety up to SIL 2 (acc. to EN 61508)**
- **Galvanic isolation between input circuits, output circuits and supply voltage**
- **Input circuit monitoring for wire-break and short-circuit (can be disabled)**
- **2 relay outputs, each with one NO contact**
- **Selectable NO/NC output function**
- **Universal supply voltage (20...250 VAC/20...125 VDC)**

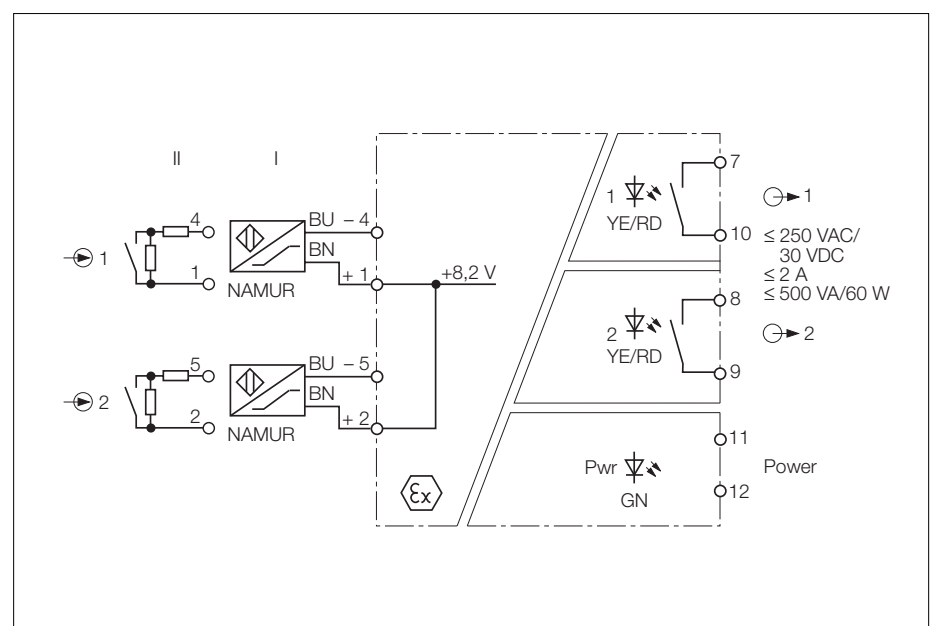
The isolating switching amplifier type IM1-22Ex-R is a dual channel device featuring intrinsically safe input circuits. It can be connected to sensors according to EN 60947-5-6 (NAMUR), variable resistors or potential-free contacts.

The output circuits feature one relay with one NO contact each.

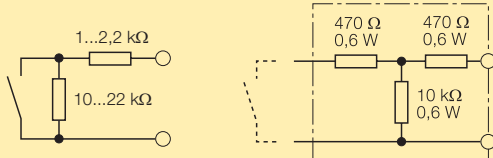
Six front panel programming switches select the output function of each channel (normally open mode = NO/or normally closed mode = NC) and enable separate activation and de-activation of wire-break (WB) and short-circuit (SC) monitoring of each channel.

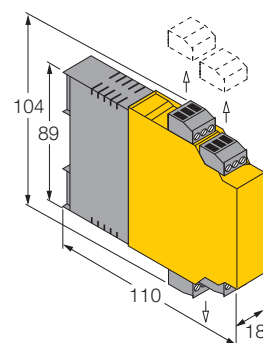
When using mechanical contacts as the input device, wire-break and short-circuit monitoring must be disabled or shunt resistors must be connected to the contacts (II). (See next page for contact configuration).

The green LED on the front cover indicates that the device is powered. The two dual colour LEDs indicate the switching status (yellow) as well as fault conditions (red). When the input circuit monitoring feature is activated, red illuminates to indicate a fault in the input circuit and the respective output relay is de-energised.



Isolating switching amplifier IM1-22Ex-R

Type	IM1-22Ex-R
Ident-no.	7541231
Supply voltage U_B	20...250 VAC/20...125 VDC
Line frequency (AC)	40...70 Hz
Power/current consumption	≤ 3 W
Galvanic isolation	between input circuit, output circuits and supply voltage for 250 V _{rms} test voltage 2.5 kV _{rms}
Input circuits	according to EN 60947-5-6 (NAMUR), intrinsically safe according to EN 50020
Operating characteristics	
– Voltage	8,2 V
– Current	8,2 mA
Switching threshold	1.55 mA
Hysteresis	typ. 0.2 mA
Wire-break threshold	≤ 0.1 mA
Short-circuit threshold	≥ 6 mA
Contact configuration	
Of mechanical switches with active input circuit monitoring function	 <p>resistor module WM1, ident-no. 0912101</p>
Output circuits	2 relay outputs with 1 NO contact each
Switching voltage	≤ 250 VAC/120 VDC
Switching current per output	≤ 2 A
Switching capacity per output	≤ 500 VA/60 W
Switching frequency	≤ 10 Hz
Contact material	silver-alloy + 3 μm Au
Ex-Approval acc. to certificate of conformity	TÜV 04 ATEX 2553 / TÜV 06 ATEX 552968 X
Maximum nominal values	
– No load voltage U_0	≤ 9.6 V
– Short-circuit current I_0	≤ 11 mA
– Power P_0	≤ 26 mW
Maximum external inductances/capacitances	
– [EEx ia] IIC	1 mH/1.1 μF / 5 mH/0.83 μF / 10 mH/0.74 μF
– [EEx ia] IIB	2 mH/5.2 μF / 10 mH/3.8 μF / 20 mH/3.4 μF
– Ex nL IIC	1 mH/1.9 μF / 5 mH/1.4 μF / 10 mH/1.2 μF
– Ex nL IIB	1 mH/11 μF / 5 mH/7.5 μF / 10 mH/6.6 μF
Marking of devices	Ⓔ II (1) GD [EEx ia] IIC II 3 G Ex nA nC [nL] IIC/IIB T4
LED indications	
– Power	green
– Switching status/Fault indication	2 x yellow/red (dual colour LED)
Terminal housing	12-pole, 18 mm wide, Polycarbonate/ABS, flammability class V-0 per UL 94
Mounting	snap-on clamps for top-hat rail (DIN 50022) or screw terminals for panel mounting
Connection	removeable terminal blocks, reverse-polarity protected, screw connection, self-lifting
Connection profile	≤ 1 x 2.5 mm ² , 2 x 1.5 mm ² or 2 x 1.0 mm ² with wire sleeves
Degree of protection (IEC 60529/EN 60529)	IP20
Operating temperature	-25...+70 °C



Features

The 460's universal range from 190-480VAC, 50/60 Hz provides the versatility needed to handle global applications.

Four adjustment pots provide versatility for a variety of applications.

Diagnostic LEDs indicate trip status and provide simple troubleshooting.

Microcontroller-based circuitry provides better accuracy and higher reliability than analog designs.

Single-phase conditions are detected regardless of regenerated voltages.

Transient protection meets IEEE and IEC standards and permits operation under tough conditions.



MotorSaver
THREE-PHASE ELECTRIC
MOTOR PROTECTOR

Model 460

**Three-Phase
Voltage Monitor**

**Engineered
Protection**

**Microcontroller
Based**

Protects 3-Phase Motors from:

- Loss of any phase
- Low voltage
- High voltage
- Voltage unbalance
- Phase reversal
- Rapid cycling

Additional Features:

- Compact design
- UL and cUL listed
- CE compliant
- Finger-safe terminals
- 5-year warranty
- Made in USA
- Standard surface or DIN rail mountable
- Standard 1-500 sec. variable restart delay
- Standard 2-8% variable voltage unbalance
- Standard 1-30 sec. variable trip delay
- One 10 amp general purpose Form C relay
- Optional manual reset

The **Model 460** is designed to protect 3-phase motors from damaging power conditions. The 460's wide operating range combined with UL and CE compliance enables quick access to domestic and global markets.

A unique microcontroller-based voltage and phase-sensing circuit constantly monitors the 3-phase voltages to detect harmful power line conditions. When a harmful condition is detected, the MotorSaver's 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 delay prevents nuisance tripping due to rapidly fluctuating power line conditions.

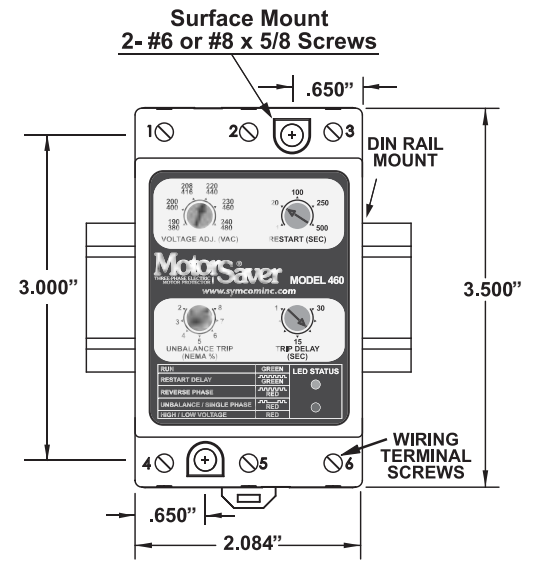
The Model 460 automatically senses whether it is connected to a 190-240V, 60Hz system, a 440-480V, 60Hz system, or a 380-416V, 50Hz system. An adjustment is provided to set the nominal line voltage from 190-240 or 380-480VAC. Other adjustments include a 1-30 second trip delay, 1-500 second restart delay, and 2-8% voltage unbalance trip point.

Model 460 Three-Phase Voltage Monitor

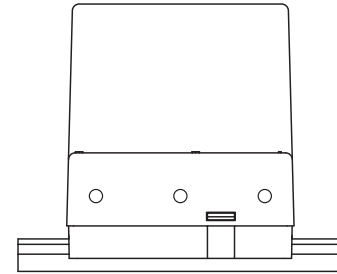
Specifications	
3-Phase Line Voltage	190-480VAC (475-600VAC optional) (95-120VAC optional)
Frequency50*/60Hz
Low Voltage (% of setpoint)	
• Trip90% ±1%
• Reset93% ±1%
High Voltage (% of setpoint)	
• Trip	110% ±1%
• Reset	107% ±1%
Voltage Unbalance (NEMA)	
• Trip	2-8% adjustable
• Reset	Trip setting minus 1% (5 - 8%) Trip setting minus .5% (2 - 4%)
Trip Delay Time	
• Low, High and Unbalanced Voltage	1-30 seconds adjustable
• Single-Phasing Faults	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	
• 1-Form C	10A General Purpose @ 240VAC Pilot Duty 480VA @ 240VAC, B300
Power Consumption	6 Watts (max.)
Weight	14 oz.
Enclosure	Polycarbonate
Terminal Torque6 in.-lbs.
Wire Type	Stranded or solid 12-20 AWG, one per terminal
Safety Marks	
• UL	UL508
• CE	IEC 60947-6-2
Standards Passed	
• Electrostatic Discharge (ESD)	IEC 1000-4-2, Level 3, 6kV contact, 8kV air
• Radio Frequency Immunity, Radiated	150 MHz, 10V/m
• Fast Transient Burst	IEC 1000-4-4, Level 3, 3.5kV input power & controls
Surge	
• IEC	IEC 1000-4-5, Level 3, 4kV line-to-line; Level 4, 4kV line-to-ground
• ANSI/IEEE	C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line
• Hi-potential Test	Meets UL508 (2 x rated V +1000V for 1 minute)
Environmental	
Temperature Range	Ambient Operating: -20° to 70° C (-4° to 158°F) Ambient Storage: -40° to 80° C (-40° to 176°F)
Class of Protection	IP20, NEMA 1 (FINGER SAFE)
Relative Humidity	10-95%, non-condensing per IEC 68-2-3
Special Options	
Manual Reset	External momentary pushbutton required.

*Note: 50 Hz will increase all delay timers by 20%

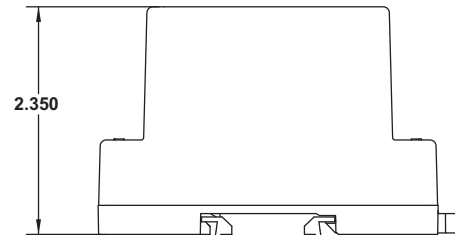
SymCom warrants its microcontroller based products against defects in material or workmanship for a period of five (5) years from the date of manufacture. All other products manufactured by SymCom shall be warranted against defects in material and workmanship for a period of two (2) years from the date of manufacture. For complete information on warranty, liability, terms, returns, and cancellations, please refer to the SymCom Terms and Conditions of Sale document.



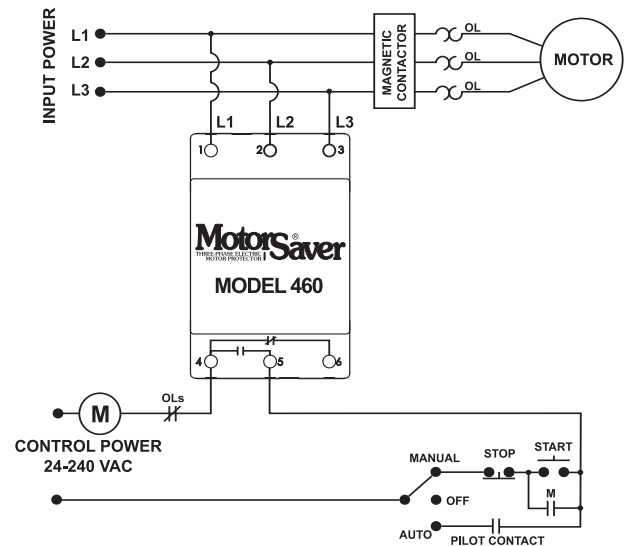
FRONT VIEW



BOTTOM VIEW



SIDE VIEW



TYPICAL WIRING DIAGRAM



Product availability: Stock - Normally stocked in distribution facility



Main

Commercial Status	Commercialised
Product or component type	Contactor
Range of product	Type S
Contactor application	Reversing
NEMA size	3
Rated power in HP	50 HP 575 V AC 50 HP 460 V AC 30 HP 230 V AC 25 HP 200 V AC
NEMA degree of protection	Not rated (open device)
Control type	No control units
Control circuit	Separate control circuit
Control type	No control units
Provided equipment	Fuse not supplied
Control circuit voltage	120 V AC 60 Hz 110 V AC 50 Hz
Local signalling	No indicator
Auxiliary contact composition	Without
Poles description	3P
Network number of phases	3 phases
[In] rated current	90 A
Product certifications	CSA UL listed
[Ue] rated operational voltage	600 V AC
Electrical connection	Screw clamp terminals

Ordering and shipping details

Category	21273 - 8702,36 SE,SF(NOT S*R,T,W)
Discount Schedule	CP1
GTIN	00785901808916
Nbr. of units in pkg.	1
Package weight(Lbs)	17.00
Product availability	Stock - Normally stocked in distribution facility
Returnability	Y
Country of origin	MX

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric Industries SAS nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. *Prices are indicative

Offer Sustainability

Sustainable offer status	Not Green Premium product
RoHS	Will not be Compliant
REACH	Reference not containing SVHC above the threshold

Contractual warranty

Period	18 months
--------	-----------

**END
OF
SECTION**

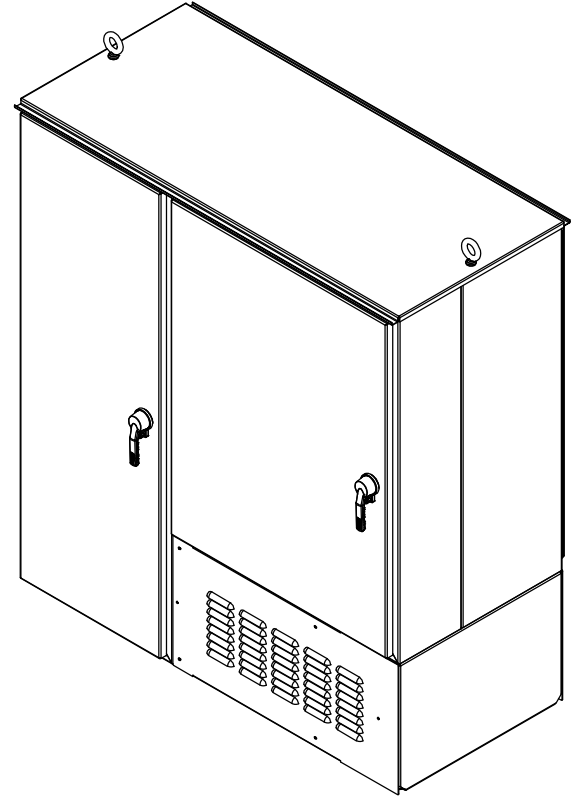
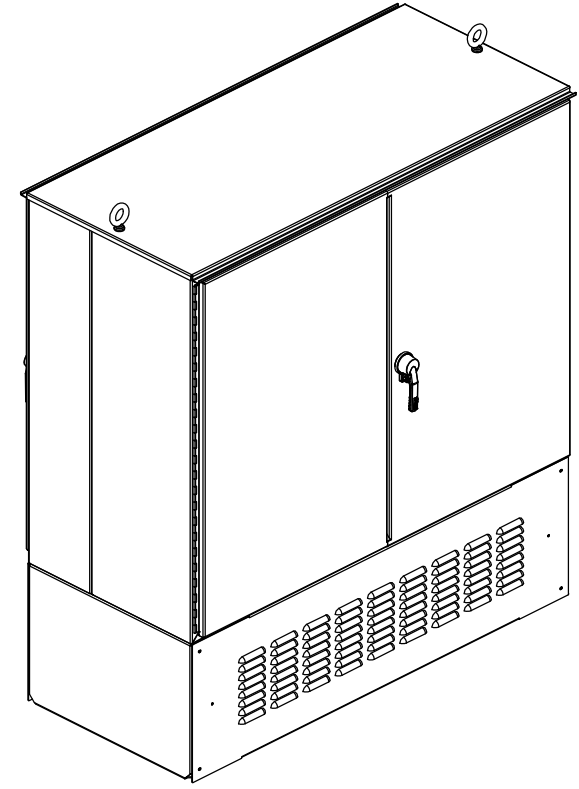
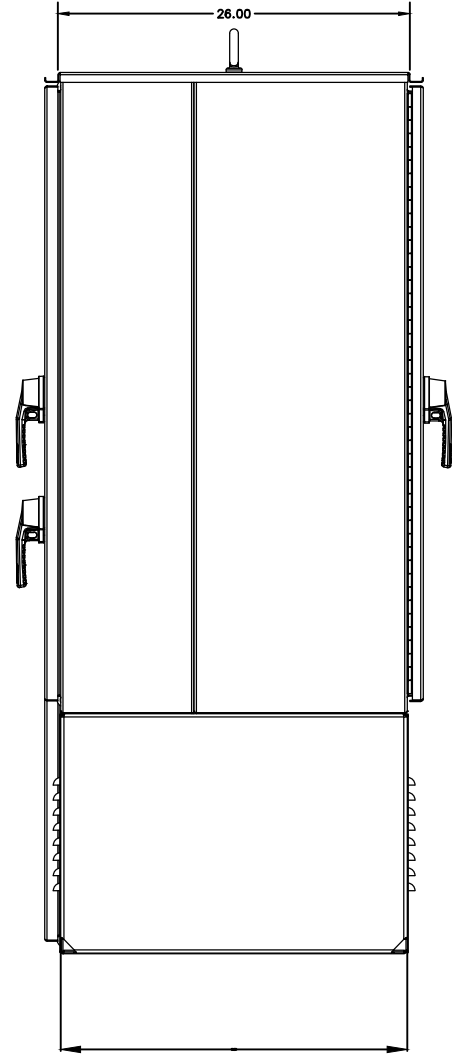
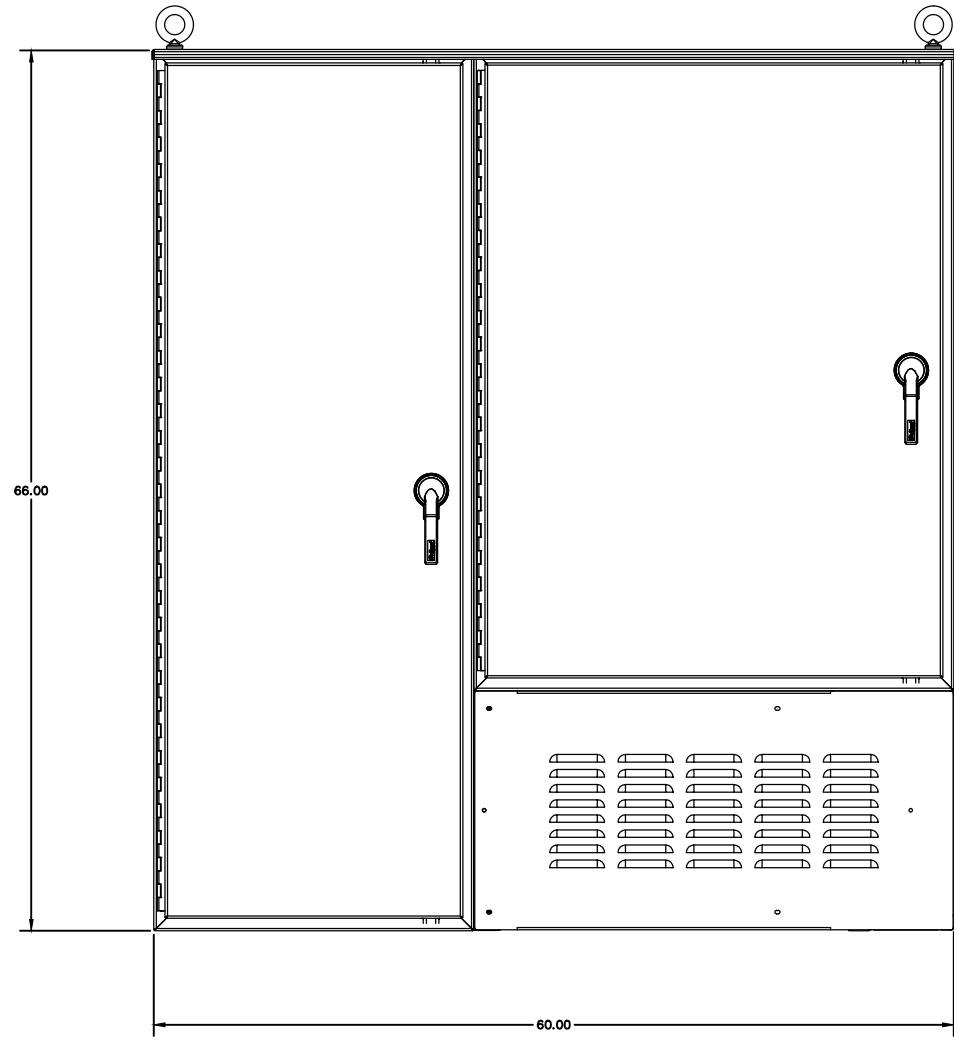
15. PUMP ELECTRICAL ENCLOSURE

This section includes design and data pertinent to the pump electrical enclosure/panel.

This section is structured as follows:

15.01 PUMP ELECTRICAL ENCLOSURE DRAWINGS

15.02 JUNCTION BOX



BAY MEADOWS

CONTROL PANEL
LAYOUT DRAWING

SHEET
3 OF 4
JOB NUMBER

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DWG. -

DSN.

DIRN.

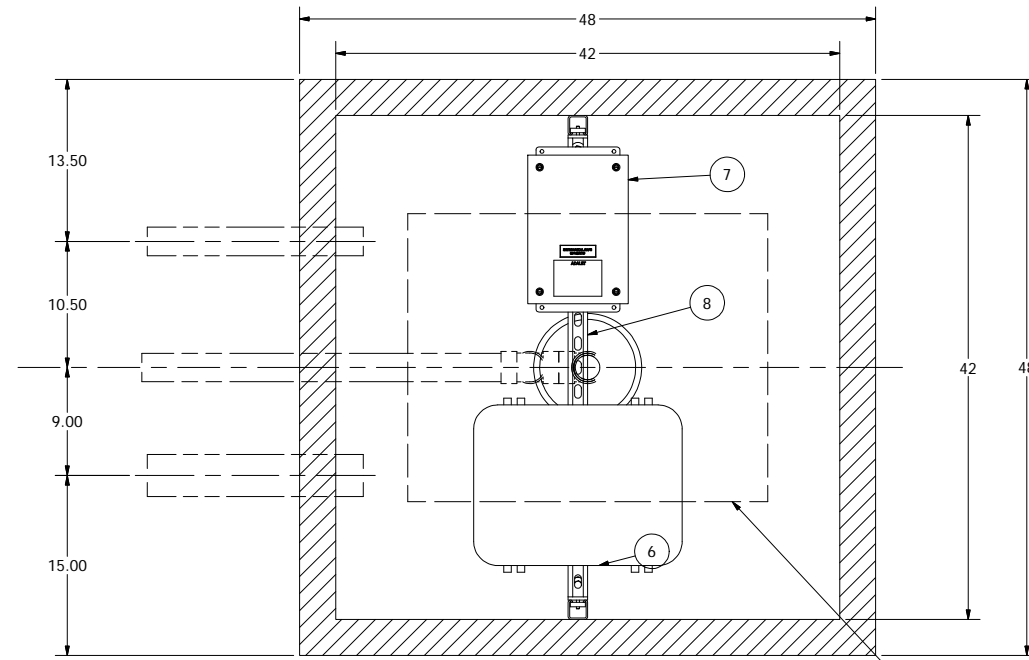
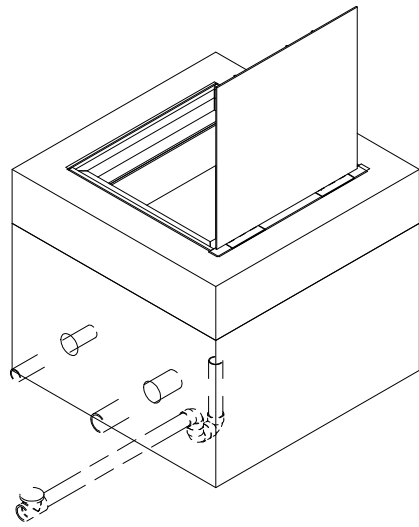
CKD. 3/6/13

REV | DATE

DESCRIPTION

REVISIONS

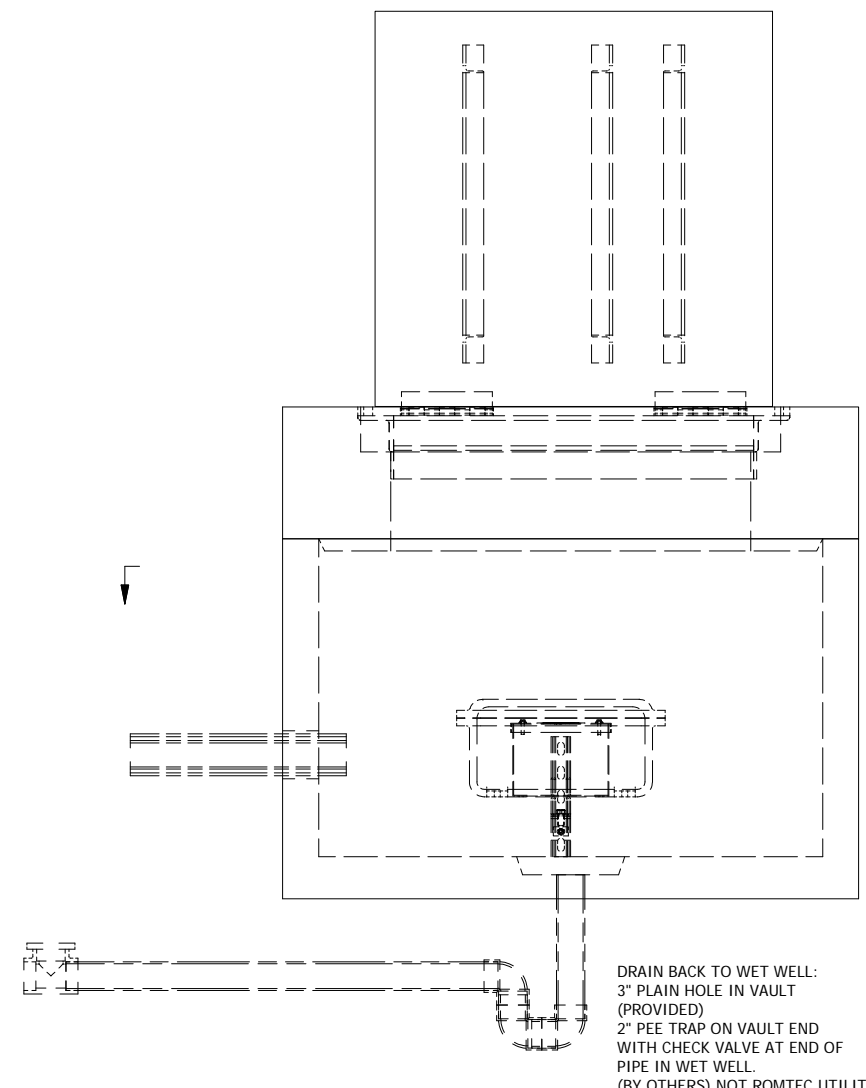
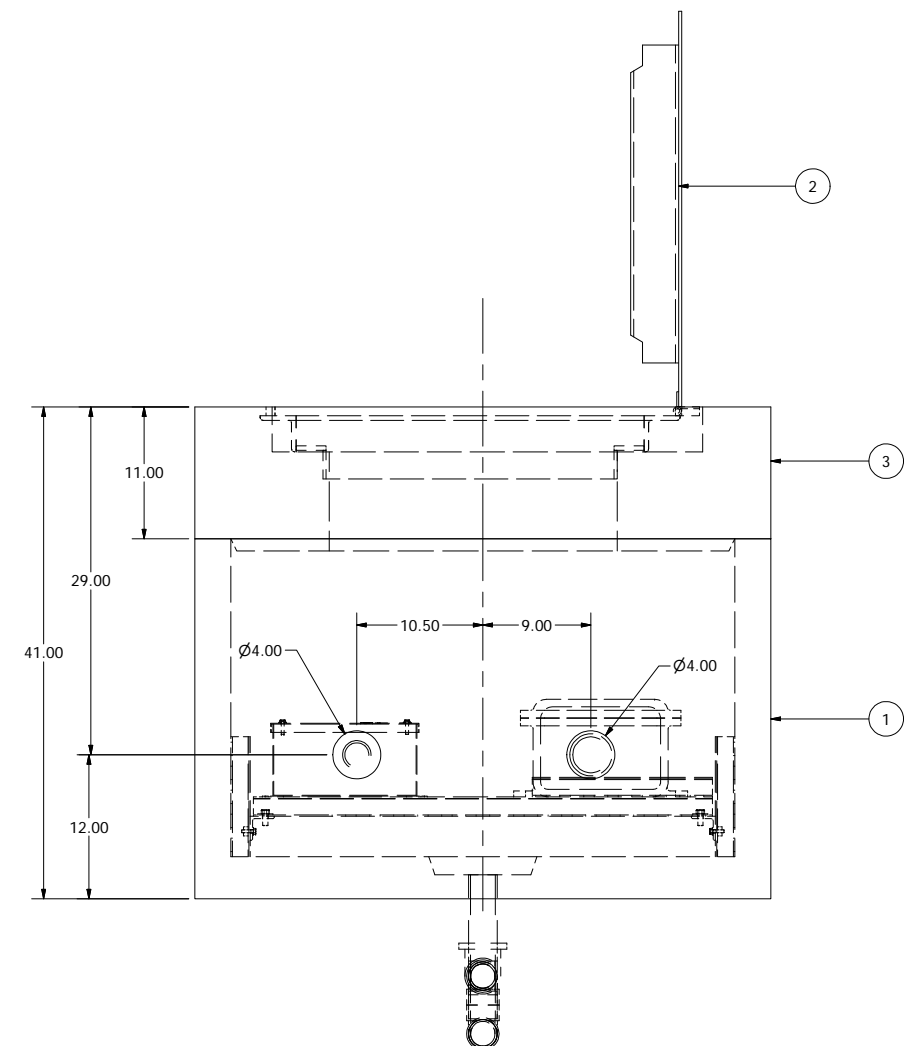
BY



HATCH CLEAR OPENING
24" X 30"

NOTE: JUNCTION BOX HATCH AND TOP SLAB ARE H20 OCCASIONAL TRAFFIC RATED

Parts List			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
1	1	20-4875	BASE - VV - 444B X 30in TALL
2	1	23-4713	HATCH - FLOODTIGHT - H20 - 24X30
3	1	24-4716	TOP SLAB - VV - 444 - H20
4	21	51-5510	SEALANT - .75in X .75in X 21ft CS-202
5	17	51-5949	TAPECOAT - 6in X .65mils X LFT
6	1	61-4851	ADLET ENCLOSURE - EXPLOSION PROOF
7	1	61-4852	ADALET ENCLOSURE - LEVEL SENSING
8	1	62-XXXX	JUNCTION BOX SUPPORT BRACKET
9	3	62-XXXX	CONDUIT UNIONS
10	3	62-XXXX	CMP CABLE CONNECTOR - 1.16in - 1.5in
11	3	62-5528	SEAL OFFS - 40% FILL - 1in NPT
12	4	62-XXXX	CORD GRIP - PLASTIC - 1_2in - .125-.275
13	3	62-XXXX	NIPPLE - GALV - 1in X CLOSE
14	2	62-XXXX	SEAL OFFS - 40% FILL - .75inNPT
15	2	62-XXXX	NIPPLE - GALV - .75in X CLOSE



DRAIN BACK TO WET WELL:
3" PLAIN HOLE IN VAULT
(PROVIDED)
2" PEE TRAP ON VAULT END
WITH CHECK VALVE AT END OF
PIPE IN WET WELL.
(BY OTHERS) NOT ROMTEC UTILITIES

VERIFY SCALE
BAR IS ONE INCH ON
ORIGINAL DRAWING
1"
0
IF NOT ONE INCH ON
THIS SHEET ADJUST
SCALE APPROPRIATELY
DSN - AD
DRN - AD
CKD - AD
DATE - 11-15-13

REV	DESCRIPTION	DATE	APPROV
1			

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BAY MEADOWS
JUNCTION BOX ASSEMBLY

SHEET
1 OF 1
JOB NUMBER
RMTC
0000

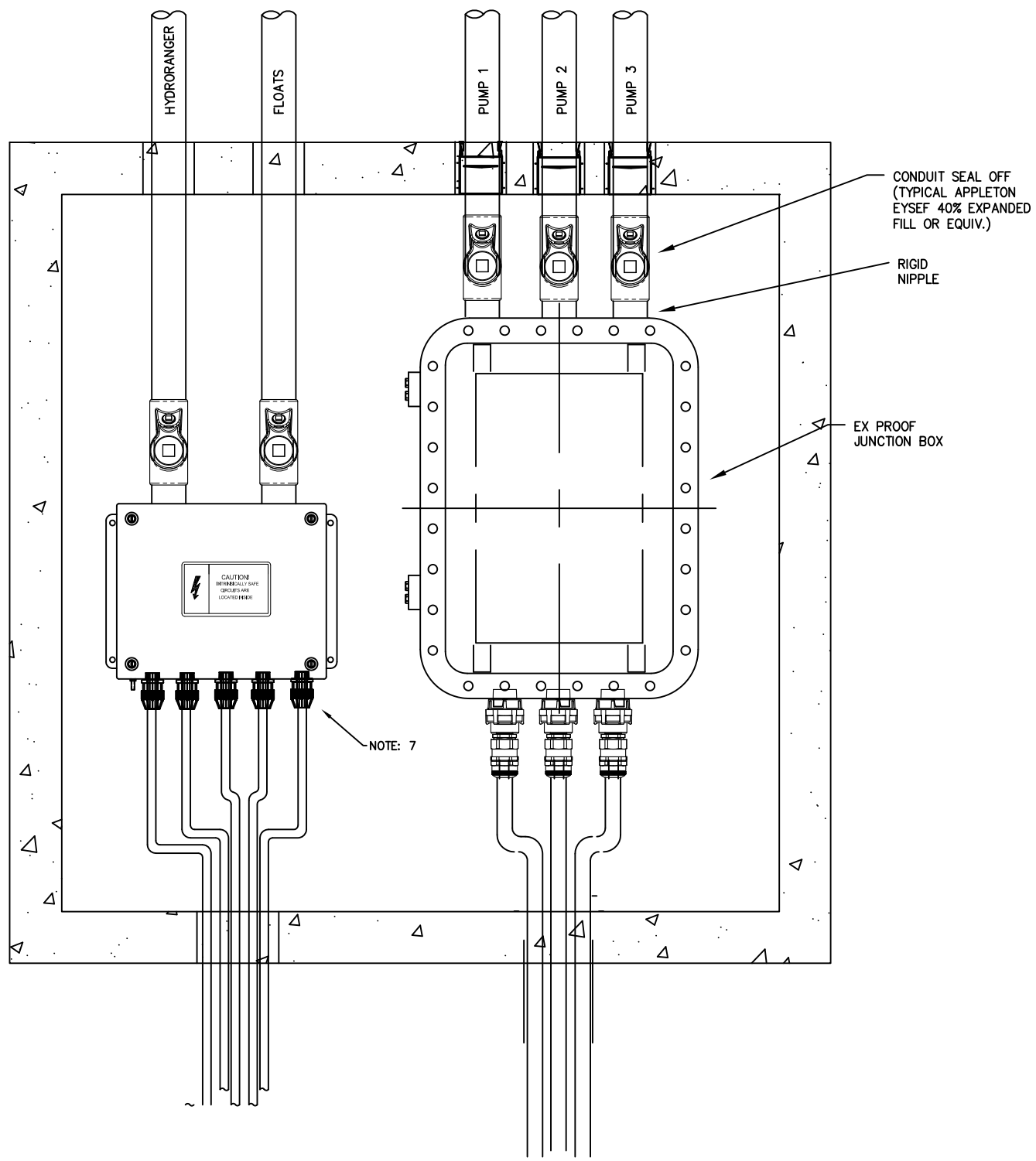
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IN GROUND JUNCTION BOX
TRIPLEX PUMP APPLICATION
IN GROUND JUNCTION BOX
TYPICAL INSTALLATION
ELECTRICAL REQUIREMENTS

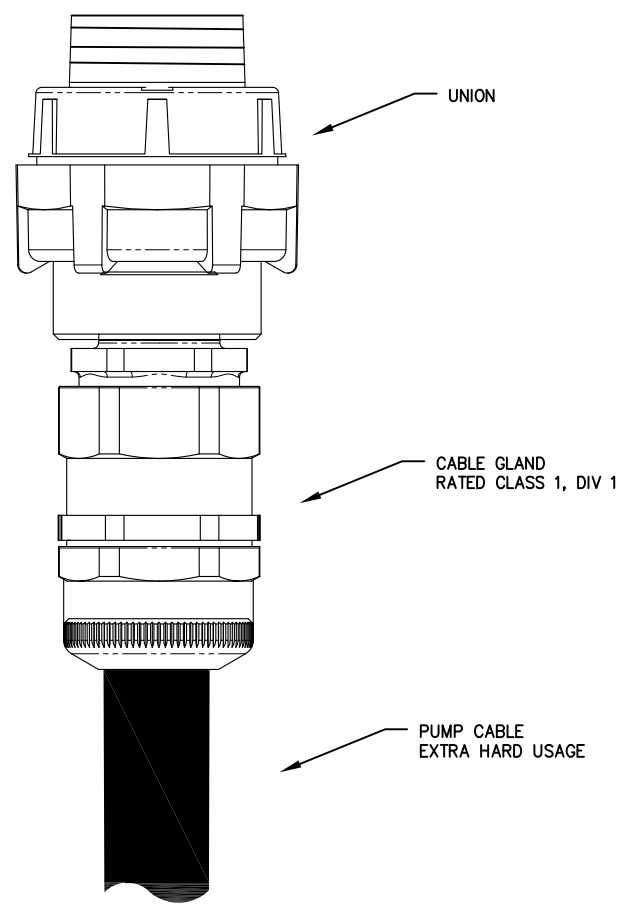
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1 4' X 4' CONCRETE INGROUND JUNCTION BOX DETAIL
SCALE: NOT TO SCALE



2 CABLE TERMINATION DETAIL
SCALE: NOT TO SCALE

NOTES: 1. NEC 501.10(A)(2) FLEXIBLE CONNECTIONS. WHERE NECESSARY TO EMPLOY FLEXIBLE CONNECTIONS, AS AT MOTOR TERMINALS, FLEXIBLE FITTINGS LISTED FOR THE LOCATION, OR FLEXIBLE CORD IN ACCORDANCE WITH THE PROVISIONS OF 501.140 TERMINATED WITH CORD CONNECTORS LISTED FOR THE LOCATION, SHALL BE PERMITTED.

2. NEC 501.140(A)(3) FOR ELECTRIC SUBMERSIBLE PUMPS WITH THE MEANS FOR REMOVAL WITHOUT ENTERING THE WET PIT. THE EXTENSION OF THE FLEXIBLE CORD WITHIN A SUITABLE RACEWAY BETWEEN THE WET PIT AND THE POWER SOURCE SHALL BE PERMITTED.

3. NEC 501.140(B) WHERE FLEXIBLE CORDS ARE USED, THE CORDS SHALL COMPLY WITH ALL OF THE FOLLOWING:

- (1) BE OF A TYPE LISTED FOR EXTRA-HARD USAGE
- (2) CONTAIN, IN ADDITION TO THE CONDUCTORS OF THE CIRCUIT, AN EQUIPMENT GROUNDING CONDUCTOR COMPLYING WITH 400.23
- (3) BE SUPPORTED BY CLAMPS OR BY OTHER SUITABLE MEANS IN SUCH A MANNER THAT THERE IS NO TENSION ON THE TERMINAL CONNECTIONS.
- (4) IN DIVISION 1 LOCATIONS OR IN DIVISION 2 LOCATIONS WHERE THE BOXES, FITTINGS, OR ENCLOSURES ARE REQUIRED TO BE EXPLOSION PROOF, THE CORD SHALL BE TERMINATED WITH A CORD CONNECTOR OR ATTACHMENT PLUG LISTED FOR THE LOCATION OR A CORD CONNECTOR INSTALLED WITH A SEAL LISTED FOR THE LOCATION. IN DIVISION 2 LOCATIONS WHERE EXPLOSION PROOF EQUIPMENT IS NOT REQUIRED, THE CORD SHALL BE TERMINATED WITH A LISTED CORD CONNECTOR OR ATTACHMENT PLUG.

4. NEC 504.10(B) LOCATION. INTRINSICALLY SAFE APPARATUS SHALL BE PERMITTED TO BE INSTALLED IN ANY HAZARDOUS (CLASSIFIED) LOCATION FOR WHICH IT HAS BEEN IDENTIFIED. GENERAL PURPOSE ENCLOSURES SHALL BE PERMITTED FOR INTRINSICALLY SAFE APPARATUS.

5. NEC 504.20 WIRING METHODS. ANY OF THE WIRING METHODS SUITABLE FOR UNCLASSIFIED LOCATIONS, INCLUDING THOSE COVERED BY CHAPTER 7 AND CHAPTER 8, SHALL BE PERMITTED FOR INSTALLING INTRINSICALLY SAFE APPARATUS. SEALING SHALL BE AS PROVIDED IN 504.70.

6. NEC 504.70 SEALING. CONDUITS AND CABLES THAT ARE REQUIRED TO BE SEALED BY 501.15, 502.15 SHALL BE SEALED TO MINIMIZE THE PASSAGE OF GASES, VAPORS, OR DUST. SUCH SEALS SHALL NOT BE REQUIRED TO BE EXPLOSION PROOF OR FLAME PROOF BUT SHALL BE IDENTIFIED FOR THE PURPOSE OF MINIMIZING PASSAGE OF GASES, VAPORS, OR DUST UNDER NORMAL OPERATING CONDITIONS AND SHALL BE ACCESSIBLE.

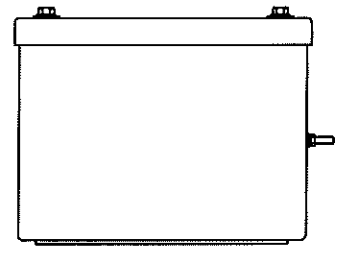
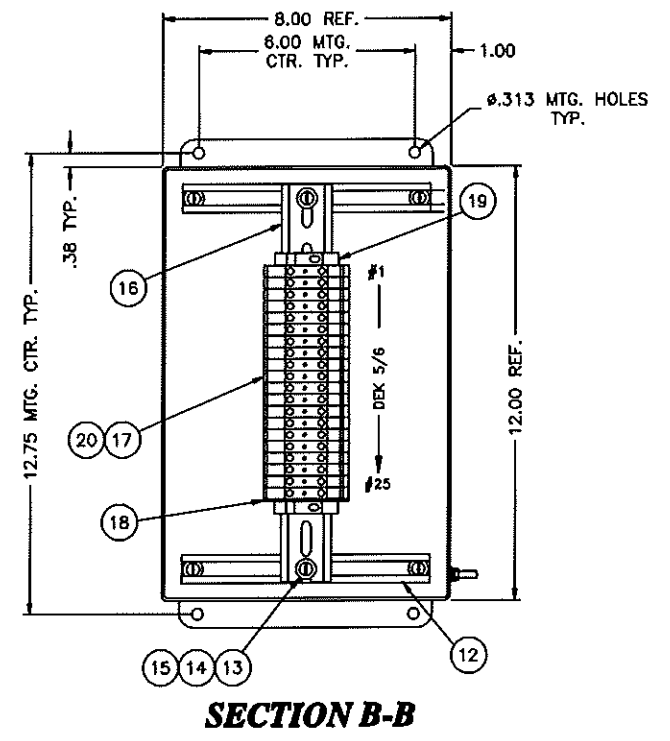
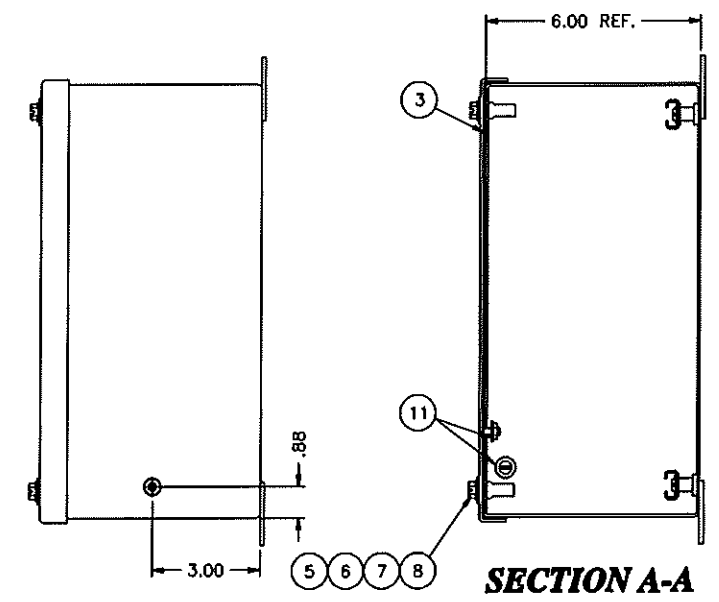
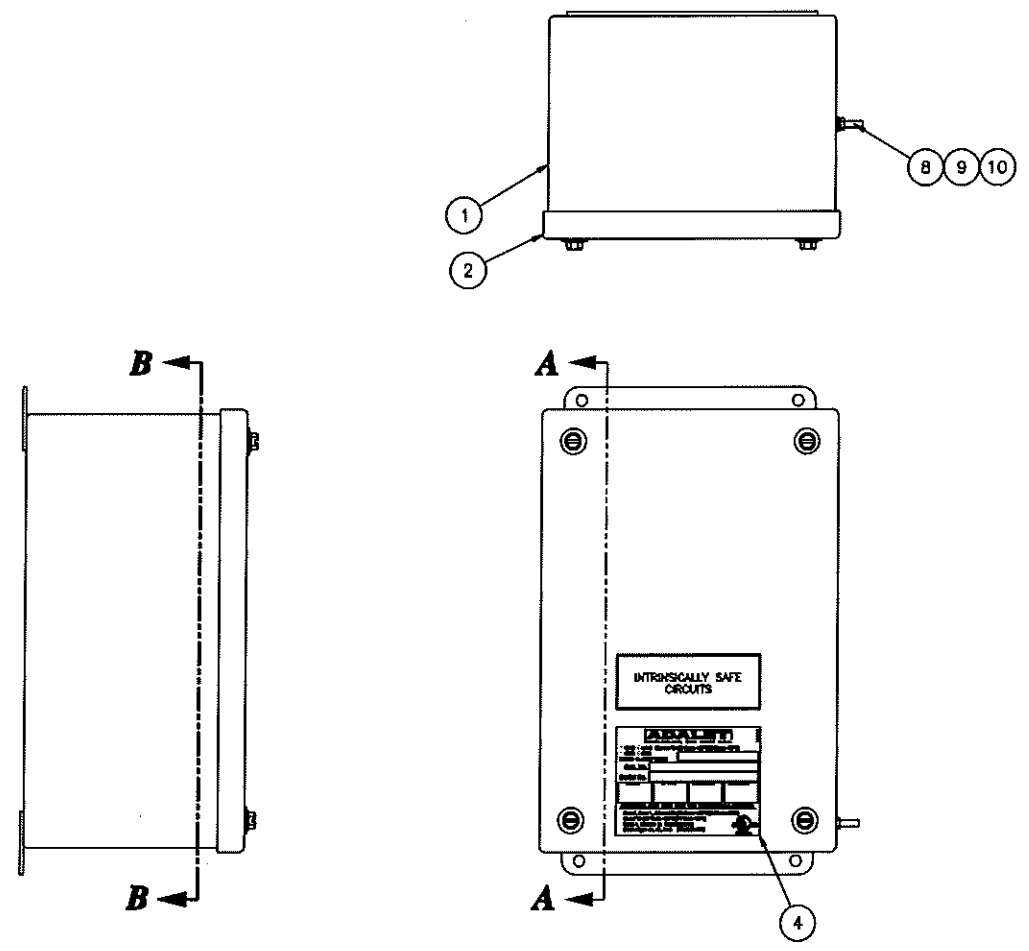
EXCEPTION: SEALS SHALL NOT BE REQUIRED FOR ENCLOSURES THAT CONTAIN ONLY INTRINSICALLY SAFE APPARATUS, EXCEPT AS REQUIRED BY 501.17

7. T&B #2690 OR EQUIVALENT CORD CONNECTOR

8. BASED ON THE 2011 NATIONAL ELECTRICAL CODE

SAMPLE DRAWING

R2213



BILL OF MATERIAL				
ITEM #	QTY.	PART #	DESCRIPTION	
1	1	R2213-1	TSC4X6-120806 BOX	
2	1	M3037	TSC4X6-1208 COVER	
3	1	M2502-8	TSC-1212 COVER GASKET PORON	
4	1	M3326	TSC NAMEPLATE W/TERMINALS ATEX	
5	4	M2-41	RVNUT FLAT HEAD 1/4-20 CLOSED END	
6	4	M1-34	RETAINING RING 1/4 NON-METALLIC	
7	4	M2-42	CAPTIVE SCREW HEX WASHER HEAD 1/4-20 X 3/4	
8	5	2-13	1/4 FLAT WASHER SS	
9	1	2-526	WSHR EXTOLW 1/4 SS	
10	1	5860-1	NUT HXREG/FIN 1/4-20 SS	
11	1	M14033	JN HARDWARE KIT FOR GROUND & MTG PAN	
12	2	M3266-3	MOUNTING RAIL FOR 8" W/L TSC BOXES	
13	2	M3334	#10-32 CLAMPING NUT WITH SPRING SS	
14	2	2-283	SCRW SLPH #10-32 x 3/8" LG. SS	
15	2	2-274	WSHR FLAT #10 SS	
16	2	M3165-1	TS35 RAIL 11.00" LG	
17	25	M3205-85	WEIDMULLER TB ATEX WDU 4/E BLUE #102018	
18	1	M3206-2	WEIDMULLER EP WAP 2.5...10 #105000	
19	2	M3210-3	WEIDMULLER ES EW35 #38356	
20	2	R1953-4	WEIDMULLER DEK5/6 (#1-24)V #160982	
21	1	M3370	LAMICOID NAMEPLATE "INTRINSICALLY SAFE"	
22	.5	7057	TAPE DBLE SIDED .5 X .06 THK.	
23	1	DS633-10	TERMINAL POP CHART TSC 120806 (NOT SHOWN)	
24	1	M3261	LABEL 1 X 3 MINIMUM CONDUCTOR RATING (NOT SHOWN)	
25	1	DS635	TSC EC DECLARATION OF CONFORMITY (NOT SHOWN)	
26	1	DS647	INSTALLATION SHEET TSC SERIES (NOT SHOWN)	

GASKET INSTALLATION:
 1. CLEAN ALL SURFACES PRIOR TO INSTALLING.
 2. REMOVE PAPER BACKING AND FIRMLY PRESS INTO PLACE.

ATEX INSPECTION NOTES:
 ▲ 1. INSPECT CONTINUITY OF ALL WELDED SEAMS.
 ▲ 2. INSPECT ALL GASKETS FOR COMPLETE ADHESION.

NOTES:

1. UNLESS OTHERWISE NOTED, REFERENCE DWG. #DS577 FOR STANDARD FORMING, WELDS, PARTS AND LOCATIONS.

ADALET
 CLEVELAND, OHIO 44135 U.S.A.
 CE 0030 E 2 G EEx e II T8 (T8 Tamb +50°C)(T4 Tamb +70°C)
 CE 0030 E 2 ED
 DEMAND 01 ATEX 130948

Cat. No. TSC4X6-120806 R2213

Serial No. SEE ENGINEERING FOR SERIAL NUMBER

600	10A	65	4mm2
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Junction and Pull Box for Hazardous Locations
 Class I, Zone 1, AEx e II T8 (T8 Tamb +50°C)(T4 Tamb +70°C)
 Ex e II T8 (T8 Tamb +50°C)(T4 Tamb +70°C)
 Class I, Division 2; Class II, Division 2
 NEMA4 Type 1X, 12, & 13 IEC9500: IP66

NAMEPLATE MARKING

APPROVAL

APPROVED AS SENT BY ADALET
 ON / / (NO CHANGES)

APPROVED AS NOTED
 (CHANGES CLEARLY IDENTIFIED)

NOT APPROVED

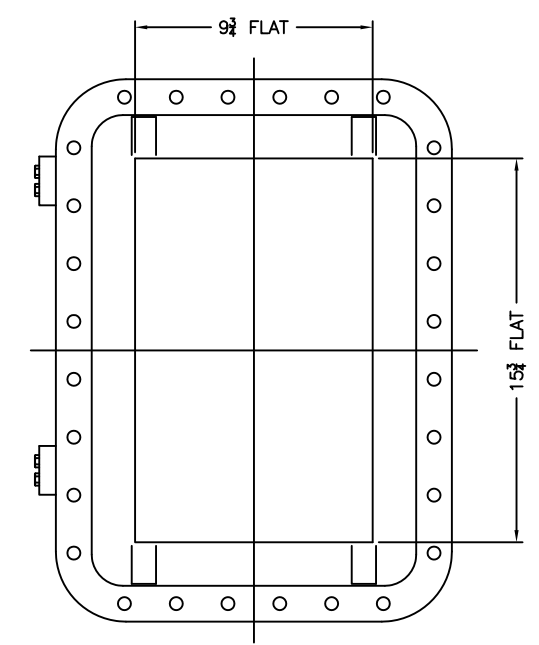
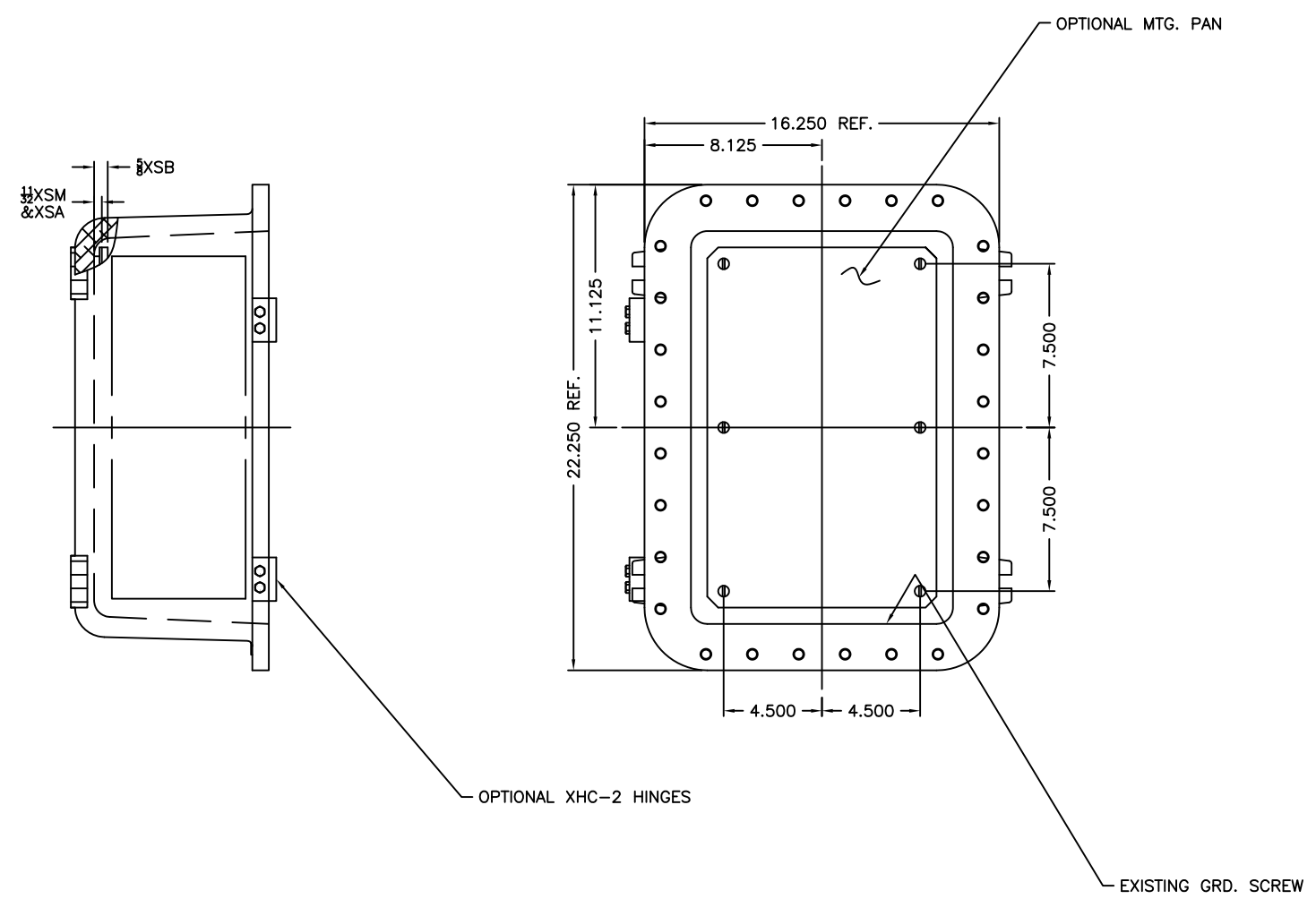
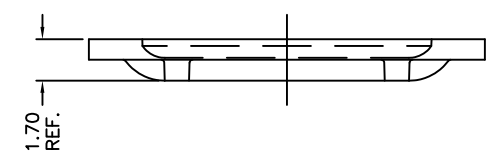
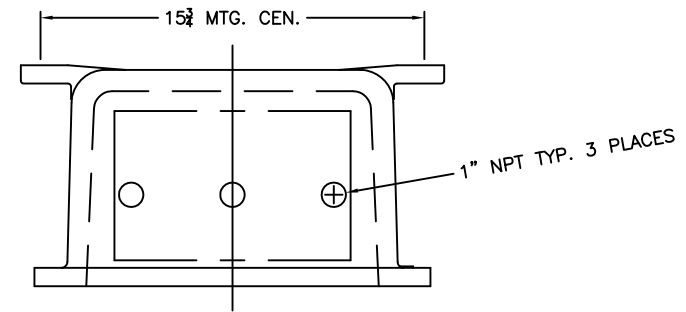
DATE: / /

NAME (PRINT):

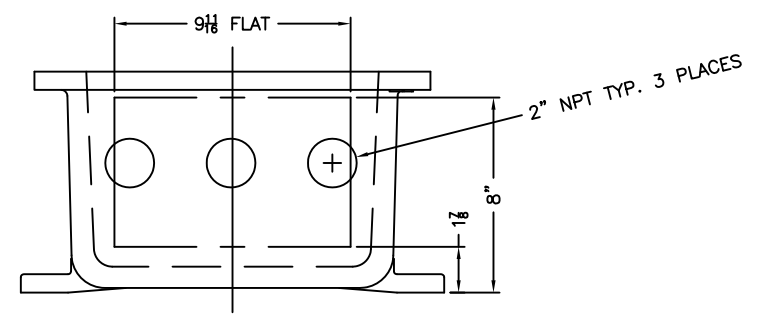
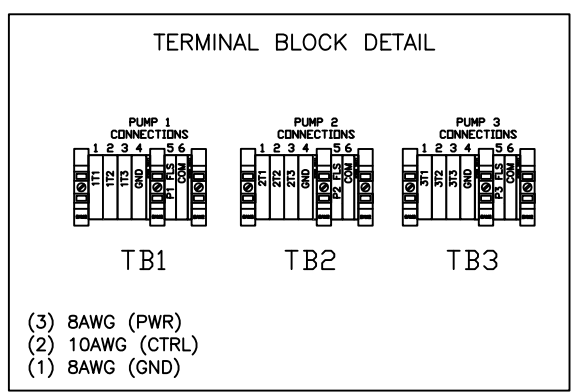
SIGNATURE:

ADALET MAY BE ADVISED OF ANY CHANGES TO THE INVENTOR

<p>DO NOT SCALE DRAWING</p> <p>DRAWING OPERATIONS COMPLETE</p> <p>EXCESSIVE DIMENSIONS ARE TO BE REMOVED</p> <p>SHEET METAL TOLERANCES</p> <p>NOT OTHERWISE SPECIFIED:</p> <p>FINISH 4/1/16"</p> <p>JOX ± .03"</p> <p>JOX ± .010"</p> <p>ANGLES ± 0°-30'</p> <p>ROUND CORNERS = 0.040" ROUN</p> <p>SWIRLAGE = 1/16" PER FOOT</p> <p>ALL WELD SIZES ARE MIN.</p>	<p>ADALET A SCOTT FETZER COMPANY Enclosure Systems • Cable Accessories 4445555</p> <p>TSC4X6-120806 ENCLOSURE FOR ROMTEC UTILITIES</p> <p>DESIGNED BY TT</p> <p>DATE 11/28/07</p> <p>APPROVED BY</p> <p>SCALE 1=2.5</p> <p>DATE</p> <p>REV D</p> <p>REV NO</p> <p>REV DATE</p> <p>TSC4X6-120806</p>	<p>R2213</p> <p>10F1</p> <p>2</p>
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XCE 1218 COVER



NOTES:

- COVER DRILLING ALLOWABLE IN XCE ONLY
1. MINIMUM SPACING FROM CENTER OF OPERATOR TO NEAREST FLAT IS 1 1/8.
 2. MINIMUM SPACING BETWEEN 3/4-14 NPSM OPERATOR CENTERS IS 3" FOR THIS ENCLOSURE.
 3. MAXIMUM NUMBER OF OPERATORS IS 15.
 4. DIMENSION FROM CENTER LINES OF COVER FOR OPERATORS.
 5. DIMENSION FROM CENTER LINE AND BACK OF MTG. LUG FOR CONDUIT.
 6. FOR MTG. ENCLOSURE USE 1/2 BOLT.

DO NOT SCALE DRAWING UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. CART TOLERANCES ON DIMENSIONS NOT OTHERWISE SPECIFIED: 1/8" STOCK DRAFT 1/16" FILLET OR CORNER RADI 1/8" FRAC 1/16" ANGLES ± 1°		ADALET A SCOTT FETZER COMPANY Enclosure Systems - Cable Accessories		TITLE MODIFIED XCE/XJF 121808 ENCLOSURE FOR	
NOTICE TO PERSONS RECEIVING THIS DRAWING: ADALET-PLM CLAIMS PROPRIETARY RIGHTS IN THE MATERIAL INCLOSED HEREIN. THIS DRAWING IS ISSUED IN CONFIDENCE FOR ENGINEERING INFORMATION ONLY AND MAY NOT BE REPRODUCED OR USED TO MANUFACTURE ANYTHING SHOW HEREIN WITHOUT DIRECT WRITTEN PERMISSION FROM ADALET-PLM TO THE USER.		DRAWN BY DDH DATE 11-12-01		PLOT SCALE 1=4	
MACHINING TOLERANCES ON DIMEN- SIONS NOT OTHERWISE SPECIFIED: 1/2 ± .02" .00X ± .010" FILLET RADI .03" EDGE BREAK .005"-.015" R. or 45° ANGLES ± 0-30°		MATERIAL TUMBLAST		DWG APPROVAL DWG SIZE D	
GAGING FOR THREADED HOLES NOT OTHERWISE SPECIFIED: NPT E-21-2.8 NPSM E-24-1.0		FINISH XCE/XJF 121808		DWG NO 10F1	

**END
OF
SECTION**

16. GENERATOR

This section includes drawings and specifications for an onsite generator.

This section is structured as follows:

16.01 GENERATOR SUBMITTAL

Submittal

Bay Meadows

The Power of One™

Cummins Northwest, LLC
Washington, Oregon, Alaska & Montana

Powerful Solutions. Dependable Support. Every Time

Table of Contents

Material Summary
 Pre-Start-Up Check List
 Genset Warranty
 ATS Warranty

Generator

Specification Sheet
 Generator Data Sheet
 Power Command Digital Generator Set Control
 Certificate of Compliance
 Exhaust Emission Data Sheet
 Exhaust Compliance Data Sheet
 Sound Data Sheet
 Prototype Test Report.....
 Alternator Data Sheet
 Generator Outline Drawings.....
 Circuit Breaker Outline Drawing

Automatic Transfer Switch

Switch Specifications
 Control Box Outline Drawing
 Wiring Diagram

Accessories

Battery Specifications
 Fuel Tank Accessories

Quotation

Cummins Northwest, LLC
 4711 N Basin Ave
 Portland OR 97217 United States
 June 27, 2013

Project Name: Romtec-Bay Meadows

Quotation: 2220000000122133

Thank you for your inquiry. We are pleased to quote as follows:

		USD
Item	Description	Qty
	Diesel Genset: 60Hz-100kW	
US-Stat	U.S. EPA, Stationary Emergency Application	1
100DSGAA	Genset-Diesel,60Hz,100kW	1
A331-2	Duty Rating-Standby Power	1
L090-2	Listing-UL 2200	1
L169-2	Emission Cert, EPA, Tier 3,NSPS CI Stationary Emergency	1
F173-2	Enclosure-Steel, Sound Attenuated ,Level 2,w/Exhaust System	1
R002-2	Voltage-277/480,3 Phase,Wye,4 Wire	1
B267-2	Alternator-60Hz,12 Ld, Broad Range, Full 1Ph Outp,125C	1
H700-2	GENSET CONTROL-POWERCOMMAND 1.1	1
B184-2	Exciter/Regulator-Pmg, 3 Phase Sensor	1
A366-2	Engine Governor-Electronic, Isochronous Only	1
H609-2	Control Mounting-Left Facing	1
K796-2	Stop Switch-Emergency	1
KU93-2	CB or EB or TB-Left Only	1
KT75-2	CircuitBreaker-200A,Left,3P,600/525V,TM,80%,UL/IEC	1
L163-2	Listing, ULC-S601-07	1
C259-2	Fuel Tank-Dual Wall Subset, 24 Hour Capacity	1
C127-2	Separator-Fuel/Water	1
H574-2	Warning-Fuel in Rupture Basin	1
H645-2	Warning-Low Fuel Level	1
A422-2	Engine Starter - 12 VDC Motor	1
A333-2	Battery Charging Alternator-Normal Output	1
E125-2	Engine Cooling-High Ambient Air Temperature	1
H389-2	Shutdown-Low Coolant Level	1
E089-2	Extension-Engine Coolant Drain	1
H669-2	Engine Coolant-50% Antifreeze, 50% Water Mixture	1

H036-2	Coolant Heater-120 Volt Ac, Single Phase	1
D036-2	Engine Air Cleaner-Heavy Duty	1
L188-2	ST 3YR 900HR Parts, Labor, and Travel	1
F065-2	Rack-Battery	1
SPEC-K	Product Revision - K	1
0541-1464	Over Fill Prevention Valve (OFPV) Kit	1
0541-1466	5 Gallon Round Spill Box Kit	1
0541-1467	Normal Vent Extension Kit	1
	Transfer Switch-Electronic Control: 225A	
OPEC225	Transfer Switch-Electronic Control,225Amp	1
A028-7	Poles-3	1
A046-7	Listing-UL 1008/CSA Certification	1
A044-7	Frequency-60 Hertz	1
A042-7	System-3 Phase,3 Wire Or 4 Wire	1
R026-7	Voltage-480 Vac	1
B002-7	Cabinet-Type 3R	1
KB59-7	Battery Charger-15 Ampere, 12 Volt, 50/60 Hertz	1
M033-7	Genset Starting Battery-12VDC	1
G006-7	Transfer Switch Warranty - 5 Yr Basic	1
SPEC-A	Product Revision - A	1
SUT10	Start Up and Testing	1
GRP4D	Starting Battery	1
OFRT	Freight-FOB Factory Fresno, CA, Off-Loading By Others	1

NOTES:

1. THIS QUOTATION IS SUBJECT TO CUMMINS NORTHWEST, LLC STANDARD TERMS & CONDITIONS - SEE ATTACHMENT
2. THIS UNIT MEETS NATIONAL EPA AND CARB REQUIREMENTS. CONTRACTOR TO VERIFY IF ANY LOCAL EMISSIONS REQUIREMENTS ARE NECESSARY.
3. REGARDING SELECTIVE COORDINATION FOR NEC ARTICLE 700 AND 701 LOADS. CUMMINS GENERATORS ARE EQUIPPED WITH THE MANUFACTURERS RECOMMENDED THERMAL MAGNETIC CIRCUIT BREAKER. INFORMATION REGARDING THIS DEVICE CAN BE SUPPLIED UPON REQUEST. THIS QUOTATION IS NOT VALID IF ANY CHANGES TO THIS CIRCUIT BREAKER(S) IS REQUIRED TO COORDINATE WITH OTHER DEVICES IN THE ELECTRICAL DISTRIBUTION SYSTEM. IF CHANGES ARE REQUIRED, THE CUSTOMER MUST PROVIDE A COPY OF THE COORDINATION STUDY LISTING THE MANUFACTURERS PART NUMBER OF THE DISCONNECT DEVICE TO BE SUPPLIED WITH THE GENERATOR AND A REVISED QUOTATION WILL BE ISSUED.

Submitted by



Matt Chapman , Oregon Power Generation Sales
matt.chapman@Cummins.com
Direct: 503-972-6615

Attachment to Quotation -Exclusions-

Exhaust System:	All off-engine piping, hangers, flanges, gaskets, bolts, insulation, and other materials associated with exhaust system installation unless specifically listed in the preceding quotation.
Fuel System:	All off-engine fuel piping for supply, return, venting, valves, coolers, filters, pumps, fittings, fuel storage tank & senders, all fuel for testing and initial fill of fuel.
Cooling System:	Intake louvers, exhaust louvers, air dampers, sheet metal ducting, flex adapters, sound attenuators/baffles. All off engine piping, flexible connections, secondary loop coolant, labor to install coolant for remote cooling systems unless specifically listed in the preceding quotation.
Electrical:	All off-engine wiring, field terminations of wiring, and lugs other than those detailed in our submittal.
Mounting:	Generator mounting bolts and anchors. Vibration isolators (if included) for the generator will be shipped loose for installation at the jobsite by others.
Testing:	All electrical testing, including but not limited to NETA, infrared scanning, harmonic content or other independent agency testing of switchgear, switchboards, protective relays or any other electrical component unless specifically listed in the preceding quotation. All environmental testing, including but not limited to EPA, local air quality district or other unless specifically listed in the preceding quotation. Calculations and Engineering Services - all electrical coordination studies, arc flash studies, seismic engineering calculations and seismic anchorage calculations unless specifically included in the preceding quotation. Programming - all protective relay settings, breaker settings, PLC programming or other user configurable device programming unless specifically included in the preceding quotation
Documentation:	Unless stated otherwise, electronic submittals and O&M manuals will be provided. Printed copies are available upon request, additional charges may apply.
Taxes and Permits:	Any applicable sales tax, permits, licenses.
Bonds	Any bid bond, payment or performance bond, or other type of bond unless specifically listed in the proposal. Cost for any required bond will be reimbursed to CNW by the buyer.

All items listed are excluded and will only be supplied by Cummins Northwest, LLC if agreed upon, in writing, by a sales representative for Cummins Northwest, LLC.

Current factory lead-time is 8-10 weeks after drawing approvals.

-Terms and Conditions-

- This offer and quotation incorporates and is contingent upon acceptance of the terms and conditions in the standard Sales Order of Cummins Northwest, LLC. Purchase Orders or other documents with terms and conditions that are inconsistent with the CNW standard Sales Order will not be accepted unless agreed to in writing by an officer of Cummins Northwest, LLC.
- **Prices are valid for 30 days**
- If included in the quotation, all on-site startup, testing and training assumes weekdays, during standard CNW business hours. **Additional charges may be added for work requested to be done on overtime, weekends, and holidays.**
- **F.O.B. factory, freight allowed to first destination, off-loading is not included**
- Factory direct shipments require credit approval prior to shipment
- Terms are C.O.D., or 30 days **upon approval of credit**
- Equipment held for longer than 30 days may be charged a monthly storage fee
- Cancellation charges are 25% **minimum** after release of order

Commercial Standby Extended Warranty Statements

Performance you rely on.™



Commercial Standby Extended Warranty Statements

Limited Standby 3 Year or 900 Hour Parts + Labor + Travel Extended Warranty – L188

Commercial Generating Set

When purchased, this limited extended warranty applies to all Cummins Power Generation® branded commercial generating sets and associated accessories (hereinafter referred to as "Product").

This warranty covers any failures of the Product, under normal use and service, which result from a defect in material or factory workmanship.

Warranty Period:

The warranty start date is the date of initial start up, first rental, demonstration or 18 months after factory ship date, whichever is sooner. The coverage duration is 3 years from warranty start date or 900 hours, whichever occurs first.

Emergency Standby Power (ESP) is defined as the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage. The permissible average power output over 24 hours of operation shall not exceed 70% of the ESP.

Cummins Power Generation® Responsibilities:

In the event of a failure of the Product during the extended warranty period due to defects in material or workmanship, Cummins Power Generation® will only be responsible for the following costs:

- All parts and labor required to repair the Product.
- Reasonable travel expenses to and from the Product site location.
- Maintenance items that are contaminated or damaged by a warrantable failure.

Owner Responsibilities:

The owner will be responsible for the following:

- Notifying Cummins Power Generation® distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins Power Generation®'s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.

In addition, the owner will be responsible for:

- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of generating sets used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

Limitations:

This limited extended warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Failures due to normal wear, corrosion, varnished fuel system parts, lack of reasonable and necessary maintenance, unauthorized modifications and/or repair, and use of add-on or modified parts.
- Improper and/or unauthorized installation.
- Owner's or operator's negligence, accidents or misuse.
- Noncompliance with any Cummins Power Generation® published guideline or policy.
- Use of improper or contaminated fuels, coolants or lubricants.
- Improper storage before and after commissioning.

Limitations Continued:

- Owner's delay in making Product available after notification of potential Product problem.
- Replacement parts and accessories not authorized by Cummins Power Generation®.
- Use of Battle Short Mode
- Owner or operator abuse or neglect such as: operation without adequate coolant or lubricants; overfueling; overspeeding; lack of maintenance to lubricating, cooling or air intake systems; late servicing and maintenance; improper storage, starting, warm-up, run-in or shutdown practices, or for progressive damage resulting from a defective shutdown or warning device.
- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the generating set.

This limited extended warranty does not cover costs resulting from:

- Difficulty in gaining access to the Product.
- Damage to customer property.
- Repair of cosmetic damage to enclosures.

Items not covered by this limited extended warranty:

- Batteries
- Enclosures
- Coolant heaters
- Exhaust systems and aftertreatment components
- Maintenance items

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CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:

Failed components claimed under warranty remain the property of Cummins Power Generation®. Cummins Power Generation® has the right to reclaim any failed component that has been replaced under warranty.

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS POWER GENERATION ® IN REGARD TO THE PRODUCT. CUMMINS POWER GENERATION® MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT IS CUMMINS POWER GENERATION® LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

This limited extended warranty shall be enforced to the maximum extent permitted by applicable law. This limited extended warranty gives the owner specific rights that may vary from state to state or from jurisdiction to jurisdiction.

Product Model Number: _____

Product Serial Number: _____

Date in Service: _____

Power Electronics Extended Warranty Statements

Our energy working for you.™



Power Electronics Extended Warranty Statements

Feature Codes

G004

—▶ G006

G007

G008

G013

Limited 5 Year Basic Extended Warranty – G006

Transfer Switch and Paralleling Systems

When purchased, this limited extended warranty applies to all Cummins Power Generation® branded Transfer Switches, Paralleling Systems and associated accessories (hereinafter referred to as "Product").

This limited extended warranty covers any failures of the Product, under normal use and service, which result from a defect in material or factory workmanship.

Warranty Period:

The limited extended warranty start date is the date of commissioning[†], demonstration or 18 months after factory ship date, whichever is sooner. The coverage duration is 5 years from warranty start date.

[†] Date of commissioning not to exceed date of Generator Set initial start-up.

Cummins Power Generation® Responsibilities:

In the event of a failure of the Product during the limited extended warranty period due to defects in material or workmanship, Cummins Power Generation® will only be responsible for the following costs:

- All parts required to repair the Product

Owner Responsibilities:

The owner will be responsible for the following:

- Notifying Cummins Power Generation® distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins Power Generation®'s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.

In addition, the owner will be responsible for:

- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of power generating equipment used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- Labor and travel after the base warranty period expires.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

Limitations:

This limited extended warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Non-conformance to applicable industry standards for installation
- Normal wear and tear.
- Improper and/or unauthorized installation.
- Owner's or operator's negligence, accidents or misuse.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins Power Generation® published guideline or policy.
- Improper storage before and after commissioning.

- Owner's delay in making Product available after notification of potential Product problem.
- Use of steel enclosures within 60 miles of the coast of salt water when aluminum or an alternate non-corrosive material enclosure option is available.
- Replacement parts and accessories not authorized by Cummins Power Generation®.
- Owner or operator abuse or neglect such as: late servicing and maintenance and improper storage.
- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the transfer switch or paralleling system.

This limited extended warranty does not cover costs resulting from:

- Difficulty in gaining access to the Product.
- Repair of cosmetic damage to enclosures.

CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:

Failed components claimed under warranty remain the property of Cummins Power Generation®. Cummins Power Generation® has the right to reclaim any failed component that has been replaced under warranty.

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THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS POWER GENERATION® IN REGARD TO THE PRODUCT. CUMMINS POWER GENERATION® MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT IS CUMMINS POWER GENERATION® LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

This limited extended warranty shall be enforced to the maximum extent permitted by applicable law. This limited warranty gives the owner specific rights that may vary from state to state or from jurisdiction to jurisdiction.

Product Model Number: _____

Product Serial Number: _____

Date in Service: _____



Diesel Generator set QSB7 series engine

100-200 kW 60 Hz



Description

Cummins Power Generation commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary standby and prime power applications.

Features

Cummins® heavy-duty engine - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

Alternator - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

Control system - The PowerCommand® 1.1 electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance. The optional PowerCommand 2.2 control is UL 508 Listed and provides AmpSentry™ protection.

Cooling system - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

Enclosures - Optional weather protective and sound attenuated enclosures are available.

NFPA - The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

Model	Standby rating		Prime rating		Continuous rating		Data sheets	
	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz	50 Hz
→ DSGAA	100 (125)		90 (113)				D-3349	
DSGAB	125 (156)		113 (141)				D-3350	
DSGAC	150 (188)		135 (169)				D-3351	
DSGAD	175 (219)		160 (200)				D-3516	
DSGAE	200 (250)		180 (225)				D-3517	

Generator set specifications

Governor regulation class	ISO 8528 Part 1 Class G3
Voltage regulation, no load to full load	± 1%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Radio frequency emissions compliance	Meets requirements of most industrial and commercial applications

Engine specifications

Bore	107 mm (4.21 in)
Stroke	124.0 mm (4.88 in)
Displacement	6.69 L (408 in ³)
Configuration	Cast iron, in-line, 6 cylinder
Battery capacity	1100 amps minimum at ambient temperature of -18 °C to 0 °C (0 °F to 32 °F)
Battery charging alternator	100 amps
Starting voltage	12 volt, negative ground
Fuel system	Direct injection: number 2 diesel fuel, fuel filter, automatic electric fuel shutoff
Fuel filter	Single element, 10 micron filtration, spin-on fuel filter with water separator
Air cleaner type	Dry replaceable element
Lube oil filter type(s)	Spin-on, full flow
Standard cooling system	High ambient radiator

Alternator specifications

Design	Brushless, 4 pole, drip proof, revolving field
Stator	2/3 pitch
Rotor	Single bearing, flexible discs
Insulation system	Class H
Standard temperature rise	150 °C standby at 40 °C ambient
Exciter type	Torque match (shunt) standard, PMG optional
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower fan
AC waveform total harmonic distortion	< 5% no load to full linear load, < 3% for any single harmonic
Telephone influence factor (TIF)	< 50 per NEMA MG1-22.43
Telephone harmonic factor (THF)	< 3

Available voltages

60 Hz Three phase line-neutral/line-line	60 Hz Single phase line-neutral/line-line
<ul style="list-style-type: none"> • 110/190 • 110/220 • 115/200 • 115/230 Delta • 120/208 • 120/240 Delta • 127/220 • 139/240 • 220/380 • 230/400 • 240/416 • 255/440 • 277/480 • 347/600 	<ul style="list-style-type: none"> • 110/220 • 115/230 • 120/240 <p>(not available with DSGAD or DSGAE)</p>

Note: Consult factory for other voltages.

Generator set options and accessories

<p>Engine</p> <ul style="list-style-type: none"> <input type="checkbox"/> 120 V 150 W lube oil heater <input checked="" type="checkbox"/> 120/240 V 1500 W coolant heater <p>Fuel System</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> 24 hour sub-base tank (dual wall) 	<p>Alternator</p> <ul style="list-style-type: none"> <input type="checkbox"/> 105 °C rise <input type="checkbox"/> 125 °C rise <input type="checkbox"/> 120 V 100 W anti-condensation heater <input checked="" type="checkbox"/> PMG excitation <input type="checkbox"/> Single phase 	<p>Exhaust system</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Heavy duty exhaust elbow <input type="checkbox"/> Slip on exhaust connection <p>Generator set</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Battery <input type="checkbox"/> Battery charger <input checked="" type="checkbox"/> Enclosure: aluminum, steel, weather protective or sound attenuated <input checked="" type="checkbox"/> Main line circuit breaker 	<ul style="list-style-type: none"> <input type="checkbox"/> Remote annunciator panel <input type="checkbox"/> Spring isolators <input type="checkbox"/> 2 year prime power warranty <input type="checkbox"/> 2 year standby power warranty <input type="checkbox"/> 5 year basic power warranty
--	---	---	--

Note: Some options may not be available on all models - consult factory for availability.

Control system PowerCommand 1.1



PowerCommand control is an integrated generator set control system providing voltage regulation, engine protection, operator interface and isochronous governing (optional). Major features include:

- Battery monitoring and testing features and smart starting control system.
- Standard PCCNet interface to devices such as remote annunciator for NFPA 110 applications.
- Control boards potted for environmental protection.
- Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics.

Operator/display panel

- Manual off switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols)
- LED lamps indicating genset running, not in auto, common warning, common shutdown, manual run mode and remote start
- Suitable for operation in ambient temperatures from -20 °C to +70 °C
- Bargraph display (optional)

AC protection

- Over current warning and shutdown
- Over and under voltage shutdown
- Over and under frequency shutdown
- Over excitation (loss of sensing) fault
- Field overload

Engine protection

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- High, low and weak battery voltage warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown

Alternator data

- Line-to-line and line-to-neutral AC volts
- 3-phase AC current
- Frequency
- Total kVA

Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature
- Engine speed

Other data

- Genset model data
- Start attempts, starts, running hours
- Fault history
- RS485 Modbus® interface
- Data logging and fault simulation (requires InPower service tool)

Digital governing (optional)

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

Digital voltage regulation

- Integrated digital electronic voltage regulator
- 2-phase line-to-line sensing
- Configurable torque matching

Control functions

- Time delay start and cooldown
- Cycle cranking
- PCCNet interface
- (2) Configurable inputs
- (2) Configurable outputs
- Remote emergency stop
- Glow plug control (some models)

Options

- Auxiliary output relays (2)
- 120/240 V, 100 W anti-condensation heater
- Remote annunciator with (3) configurable inputs and (4) configurable outputs
- PMG alternator excitation
- PowerCommand iWatch web server for remote monitoring and alarm notification (loose)
- Auxiliary, configurable signal inputs (8) and configurable relay outputs (8)
- Digital governing
- AC output analog meters (bargraph)
 - Color-coded graphical display of:
 - 3-phase AC voltage
 - 3-phase current
 - Frequency
 - kVa
- Remote operator panel
- PowerCommand 2.2 control with AmpSentry protection

For further detail see document S-1531.

Ratings definitions

Emergency standby power (ESP):

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Limited-time running power (LTP):

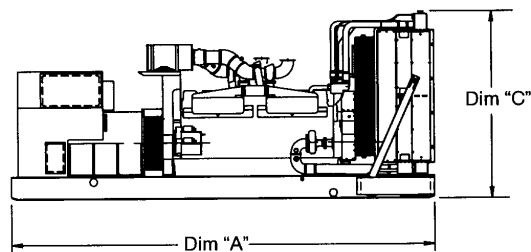
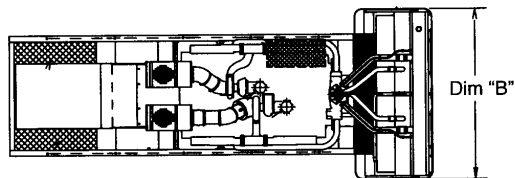
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

Prime power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Base load (continuous) power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.





Do not use for installation design

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set Weight* dry kg (lbs)	Set Weight* wet kg (lbs)
→ DSGAA	2656 (104.6)	1100 (43.3)	1549 (61)		1180 (2602)
DSGAB	2656 (104.6)	1100 (43.3)	1549 (61)		1225 (2700)
DSGAC	2656 (104.6)	1100 (43.3)	1549 (61)		1263 (2784)
DSGAD	2656 (104.6)	1100 (43.3)	1549 (61)		1361 (3000)
DSGAE	2656 (104.6)	1100 (43.3)	1549 (61)		1361 (3000)

* Note: Weights represent a set with standard features. See outline drawings for weights of other configurations.

Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.		The generator set is available Listed to UL 2200, Stationary Engine Generator Assemblies for all 60 Hz low voltage models.
	The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins Power Generation products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.	U.S. EPA	Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 3 exhaust emission levels. U.S. applications must be applied per this EPA regulation.
	All low voltage models are CSA certified to product class 4215-01.	International Building Code	The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003 IBC2006, IBC2009 and IBC2012.

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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S-1544m (3/13)



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Model: DSGAA
Frequency: 60
Fuel type: Diesel
KW rating: 100 standby
90 prime
Emissions level: EPA NSPS Stationary Emergency Tier 3

➤ **Generator set data sheet**



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Exhaust emission data sheet:	EDS-1083
Exhaust emission compliance sheet:	EPA-1117
Sound performance data sheet:	MSP-1055
Cooling performance data sheet:	MCP-170
Prototype test summary data sheet:	PTS-285
Standard set-mounted radiator cooling outline:	A035C611
Optional set-mounted radiator cooling outline:	
Optional heat exchanger cooling outline:	
Optional remote radiator cooling outline:	

Fuel consumption	Standby				Prime				Continuous
	kW (kVA)				kW (kVA)				kW (kVA)
Ratings	100 (125)				90 (113)				
Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full	Full
US gph	3.47	5.00	7.17	8.87	3.37	4.59	6.43	8.26	
L/hr	13.1	18.9	27.0	33.6	12.7	17.4	24.3	31.3	

Engine	Standby rating	Prime rating	Continuous rating
Engine manufacturer	Cummins		
Engine model	QSB7-G5 NR3		
Configuration	Cast iron, in-line, 6 cylinder		
Aspiration	Turbocharged and air-to-air aftercooled		
Gross engine power output, kWm (bhp)	242 (324)	208 (279)	
BMEP at set rated load, kPa (psi)	1204 (175)	1090 (158)	
Bore, mm (in)	107 (4.21)		
Stroke, mm (in)	124 (4.88)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	7.4 (1464)		
Compression ratio	17.2:1		
Lube oil capacity, L (qt)	17.5 (18.5)		
Overspeed limit, rpm	2100		
Regenerative power, kW	19		

Fuel flow		
Maximum fuel flow, L/hr (US gph)	106 (28)	
Maximum fuel flow with C174, L/hr (US gph)		
Maximum fuel inlet restriction with clean filter, mm Hg (in Hg)	127 (5)	
Maximum return restriction, mm Hg (in Hg)	152 (6)	

Air	Standby rating	Prime rating	Continuous rating
Combustion air, m ³ /min (scfm)	13.7 (486)	12.9 (456)	
Maximum air cleaner restriction with clean filter, kPa (in H ₂ O)	3.7 (15)		
Alternator cooling air, m ³ /min (cfm)	37.0 (1308)		

Exhaust

Exhaust flow at set rated load, m ³ /min (cfm)	31.3 (1105)	28.9 (1021.5)	
Exhaust temperature, °C (°F)	430 (807)	420 (788)	
Maximum back pressure, kPa (in H ₂ O)	10 (40)		

Standard set-mounted radiator cooling

Ambient design, °C (°F)	55 (131)		
Fan load, kW _m (HP)	9.7 (13.0)		
Coolant capacity (with radiator), L (US Gal)	23 (6.1)		
Cooling system air flow, m ³ /min (scfm)	351 (12400)		
Total heat rejection, MJ/min (Btu/min)	6.77 (6408)	6.14 (5813)	
Maximum cooling air flow static restriction, kPa (in H ₂ O)	0.12 (0.5)		

Optional set-mounted radiator cooling

Ambient design, °C (°F)			
Fan load, kW _m (HP)			
Coolant capacity (with radiator), L (US Gal.)			
Cooling system air flow, m ³ /min (scfm)			
Total heat rejection, MJ/min (Btu/min)			
Maximum cooling air flow static restriction, kPa (in. H ₂ O)			

Optional heat exchanger cooling

Set coolant capacity, L (US Gal.)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum raw water pressure, jacket water circuit, kPa (psi)			
Maximum raw water pressure, aftercooler circuit, kPa (psi)			
Maximum raw water pressure, fuel circuit, kPa (psi)			
Maximum raw water flow, jacket water circuit, L/min (US Gal/min)			
Maximum raw water flow, aftercooler circuit, L/min (US Gal/min)			
Maximum raw water flow, fuel circuit, L/min (US Gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US Gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US Gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US Gal/min)			
Raw water delta P at min flow, jacket water circuit, kPa (psi)			
Raw water delta P at min flow, aftercooler circuit, kPa (psi)			
Raw water delta P at min flow, fuel circuit, kPa (psi)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			

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Optional remote radiator cooling¹

	Standby rating	Prime rating	Continuous rating
Set coolant capacity, L (US gal)			
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)			
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum friction head, jacket water circuit, kPa (psi)			
Maximum friction head, aftercooler circuit, kPa (psi)			
Maximum static head, jacket water circuit, m (ft)			
Maximum static head, aftercooler circuit, m (ft)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum fuel flow, L/hr (US gph)			
Maximum fuel return line restriction, kPa (in Hg)			

Weights²

Unit dry weight kgs (lbs.)	
Unit wet weight kgs (lbs.)	1180 (2602)

Notes:

¹ For non-standard remote installations contact your local Cummins Power Generation representative.

² Weights represent a set with standard features. See outline drawing for weights of other configurations.

Derating factors

Standby	Engine power available up to 3048 m (10,000 ft) at ambient temperature up to 50° C (122° F). Consult your Cummins Power Generation distributor for temperature and ambient requirements outside these parameters.
Prime	Engine power available up to 3048 m (10,000 ft) at ambient temperature up to 40° C (104° F) and 2226 m (7300 ft) at 50° C (122° F). Consult your Cummins Power Generation distributor for temperature and ambient requirements outside these parameters.
Continuous	

Ratings definitions

Emergency standby power (ESP):	Limited-time running power (LTP):	Prime power (PRP):	Base load (continuous) power (COP):
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.	Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.

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Alternator data



Three Phase Table ¹		105° C	105° C	105° C	105° C	125° C	125° C	125° C	125° C	125° C	150° C	150° C	150° C
Feature Code		B418	B415	B268	B304	B417	B414	B267	B246	B303	B416	B413	B419
Alternator Data Sheet Number		208	208	210	207	207	207	209	206	207	206	207	206
Voltage Ranges		110/190 Thru 120/208 220/380 Thru 240/416	120/208 Thru 139/240 240/416 Thru 277/480	120/208 Thru 139/240 240/416 Thru 277/480	347/600	110/190 Thru 120/208 220/380 Thru 240/416	120/208 Thru 139/240 240/416 Thru 277/480	120/208 Thru 139/240 240/416 Thru 277/480	139/240 Thru 277/480	347/600	110/190 Thru 120/208 220/380 Thru 240/416	120/208 Thru 139/240 240/416 Thru 277/480	347/600
Surge kW		155	155	157	154	152	152	156	151	154	151	152	153
Motor Starting kVA (at 90% sustained voltage)	Shunt	422	422	563	360	360	360	516	313	360	313	360	313
	PMG	497	497	663	423	423	423	607	368	423	368	423	368
Full Load Current - Amps at Standby Rating		120/208 347	127/220 328	139/240 301	220/380 190	240/416 174	254/440 164	277/480 151	347/600 120				

Single Phase Table		105° C	105° C	105° C	125° C	125° C	125° C	150° C					
Feature Code		B418	B415	B268	B417	B414	B267	B413					
Alternator Data Sheet Number		208	208	210	207	207	209	207					
Voltage Ranges		120/240 ²	120/240 ²	120/240 ³	120/240 ²	120/240 ²	120/240 ³	120/240 ²					
Surge kW		149	152	153	149	149	152	149					
Motor Starting kVA (at 90% sustained voltage)	Shunt	250	250	330	215	215	305	215					
	PMG	290	290	385	250	250	360	250					
Full Load Current - Amps at Standby Rating		120/240 ² 278	120/240 ³ 417										

- ¹ Single phase power can be taken from a three phase generator set at up to 2/3 set rated 3-phase kW at 1.0 power factor. Also see Note 3 below.
- ² The broad range alternators can supply single phase output up to 2/3 set rated 3-phase kW at 1.0 power factor.
- ³ The extended stack (full single phase output) and 4 lead alternators can supply single phase output up to full set rated 3-phase kW at 1.0 power factor.

Formulas for calculating full load currents:

Three phase output

$$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$$

Single phase output

$$\frac{\text{kW} \times \text{Single Phase Factor} \times 1000}{\text{Voltage}}$$

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Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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PowerCommand® 1.1 control system



> [Specification sheet](#)

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**Power
Generation**

Control system description

The PowerCommand® control system is a microprocessor-based generator set monitoring, metering and control system designed to meet the demands of today's engine driven generator sets. The integration of all control functions into a single control system provides enhanced reliability and performance compared to conventional generator set control systems. These control systems have been designed and tested to meet the harsh environment in which gensets are typically applied.

Features

- 128 x 64 pixels graphic LED backlight LCD.
- Digital voltage regulation. Single phase full wave SCR type regulator compatible with either shunt or PMG systems.
- Digital engine speed governing (where applicable).
- Generator set monitoring and protection.
- Advanced overcurrent protection.
- Modbus® interface for interconnecting to customer equipment.
- 12 and 24 VDC battery operation.
- Warranty and service. Backed by a comprehensive warranty and worldwide distributor service network.
- Certification. Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC Mil Std., CE and CSA standards.

PowerCommand digital generator set control PCC 1302



Description

The PowerCommand generator set control is suitable for use on a wide range of generator sets in non-paralleling applications. The PowerCommand control is compatible with shunt or PMG excitation style. It is suitable for use with reconnectable or non-reconnectable generators, and it can be configured for any frequency, voltage and power connection from 120-600 VAC line-to-line.

Power for this control system is derived from the generator set starting batteries. The control functions over a voltage range from 8 VDC to 30 VDC.

Features

- 12 and 24 VDC battery operation.
- Digital voltage regulation - Single phase full wave SCR type regulator compatible with either shunt or PMG systems. Sensing is single phase.
- Digital engine speed governing (where applicable) - Provides isochronous frequency regulation.
- Full authority engine communications (where applicable) - Provides communication and control with the Engine Control Module (ECM).
- Common harnessing - with higher feature Cummins Power Generation controls allows for easy field upgrades.
- Generator set monitoring - Monitors status of all critical engine and alternator functions.
- Digital genset metering (AC and DC).
- Genset battery monitoring system - to sense and warn against a weak battery condition.
- Engine starting - Includes relay drivers for starter, fuel shut off (FSO), glow plug/spark ignition power and switch B+ applications.
- Generator set protection - Protects engine and alternator.
- Advanced serviceability - using InPower™, a PC-based software service tool.
- Environmental protection - The control system is

designed for reliable operation in harsh environments. The main control board is a fully encapsulated module that is protected from the elements.

- Modbus interface - for interconnecting to customer equipment.
- Configurable inputs and outputs - Four discrete inputs and two dry contact relay outputs.
- Warranty and service - Backed by a comprehensive warranty and worldwide distributor service network.
- Certifications - Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.

Base control functions

HMI capability

Operator adjustments - The HMI includes provisions for many set up and adjustment functions.

Generator set hardware data - Access to the control and software part number, generator set rating in KVA and generator set model number is provided from the HMI or InPower.

Data logs - Includes engine run time, controller on time, number of start attempts.

Fault history - Provides a record of the most recent fault conditions with control hours time stamp. Up to 10 events are stored in the control non-volatile memory.

Alternator data

- Voltage (single or three phase line-to-line and line-to-neutral)
- Current (single or three phase)
- KVA (three phase and total)
- Frequency

Engine data

- Starting battery voltage
- Engine speed
- Engine temperature
- Engine oil pressure
- Partial Full Authority Engine (FAE) data (where applicable)

Service adjustments - The HMI includes provisions for adjustment and calibration of generator set control functions. Adjustments are protected by a password. Functions include:

- Engine speed governor adjustments
- Voltage regulation adjustments
- Cycle cranking
- Configurable fault set up
- Configurable output set up
- Meter calibration
- Units of measurement

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Engine control

SAE-J1939 CAN interface to full authority ECMs (where applicable) - Provides data swapping between genset and engine controller for control, metering and diagnostics.

12 VDC/24 VDC battery operations - PowerCommand will operate either on 12 VDC or 24 VDC batteries.

Isochronous governing (where applicable) - Capable of controlling engine speed within +/-0.25% for any steady state load from no load to full load. Frequency drift will not exceed +/-0.5% for a 33 °C (60 °F) change in ambient temperature over an 8 hour period.

Temperature dependent governing dynamics (with electronic governing) - Modifies the engine governing control parameters as a function of engine temperature. This allows the engine to be more responsive when warm and more stable when operating at lower temperature levels.

Remote start mode - Accepts a ground signal from remote devices to automatically start the generator set and immediately accelerate to rated speed and voltage. The remote start signal will also wake up the control from sleep mode. The control can incorporate a time delay start and stop.

Remote and local emergency stop - The control accepts a ground signal from a local (genset mounted) or remote (facility mounted) emergency stop switch to cause the generator set to immediately shut down. The generator set is prevented from running or cranking with the switch engaged. If in sleep mode, activation of either emergency stop switch will wake up the control.

Sleep mode - The control includes a configurable low current draw state to minimize starting battery current draw when the genset is not operating. The control can also be configured to go into a low current state while in auto for prime applications or applications without a battery charger.

Engine starting - The control system supports automatic engine starting. Primary and backup start disconnects are achieved by one of three methods: magnetic pickup, battery charging alternator feedback or main alternator output frequency. The control also supports configurable glow plug control when applicable.

Cycle cranking - Configurable for the number of starting cycles (1 to 7) and duration of crank and rest periods. Control includes starter protection algorithms to prevent the operator from specifying a starting sequence that might be damaging.

Time delay start and stop (cooldown) - Configurable for time delay of 0-300 seconds prior to starting after receiving a remote start signal and for time delay of 0-600 seconds prior to shut down after signal to stop in normal operation modes. Default for both time delay periods is 0 seconds.

Alternator control

The control includes an integrated line-to-line sensing voltage regulation system that is compatible with shunt or PMG excitation systems. The voltage regulation system is full wave rectified and has an SCR output for good motor starting capability. Major system features include:

Digital output voltage regulation - Capable of regulating output voltage to within +/-1.0% for any loads between no load and full load. Voltage drift will not exceed +/-1.5% for a 40 °C (104 °F) change in temperature in an eight hour period. On engine starting or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level.

The automatic voltage regulator feature can be disabled to allow the use of an external voltage regulator.

Torque-matched V/Hz overload control - The voltage roll-off set point and rate of decay (i.e. the slope of the V/Hz curve) is adjustable in the control.

Protective functions

On operation of a protective function the control will indicate a fault by illuminating the appropriate status LED on the HMI, as well as display the fault code and fault description on the LCD. The nature of the fault and time of occurrence are logged in the control. The service manual and InPower service tool provide service keys and procedures based on the service codes provided. Protective functions include:

Battle short mode

When enabled and the *battle short* switch is active, the control will allow some shutdown faults to be bypassed. If a bypassed shutdown fault occurs, the fault code and description will still be annunciated, but the genset will not shutdown. This will be followed by a *fail to shutdown fault*. Emergency stop shutdowns and others that are critical for proper operation are not bypassed. Please refer to the Control Application Guide or Manual for list of these faults.

Configurable alarm and status inputs

The control accepts up to four alarm or status inputs (configurable contact closed to ground or open) to indicate a configurable (customer-specified) condition. The control is programmable for warning, shutdown or status indication and for labeling the input.

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Emergency stop

Annunciated whenever either emergency stop signal is received from external switch.

Hydro mechanical fuel system engine protection

Overspeed shutdown - Default setting is 115% of nominal.

Low lube oil pressure warning/shutdown - Level is preset (configurable with InPower) to match the capabilities of the engine used. Control includes time delays to prevent nuisance shutdown signals.

High lube oil temperature warning/shutdown - Level is preset (configurable with InPower) to match the capabilities of the engine used. Control includes time delays to prevent nuisance shutdown signals.

High engine temperature warning/shutdown - Level is preset (configurable with InPower) to match the capabilities of the engine used. Control includes time delays to prevent nuisance shutdown signals.

Low coolant temperature warning - Indicates that engine temperature may not be high enough for a 10 second start or proper load acceptance.

Sensor failure indication - Logic is provided on the base control to detect analog sensor or interconnecting wiring failures.

Full authority electronic engine protection

Engine fault detection is handled inside the engine ECM. Fault information is communicated via the SAE-J1939 data link for annunciation in the HMI.

General engine protection

Low and high battery voltage warning - Indicates status of battery charging system (failure) by continuously monitoring battery voltage.

Weak battery warning - The control system will test the battery each time the generator set is signaled to start and indicate a warning if the battery indicates impending failure.

Fail to start (overcrank) shutdown - The control system will indicate a fault if the generator set fails to start by the completion of the engine crank sequence.

Fail to crank shutdown - Control has signaled starter to crank engine but engine does not rotate.

Cranking lockout - The control will not allow the starter to attempt to engage or to crank the engine when the engine is rotating.

Alternator protection

High AC voltage shutdown (59) - Output voltage on any phase exceeds preset values. Time to trip is inversely proportional to amount above threshold. Values

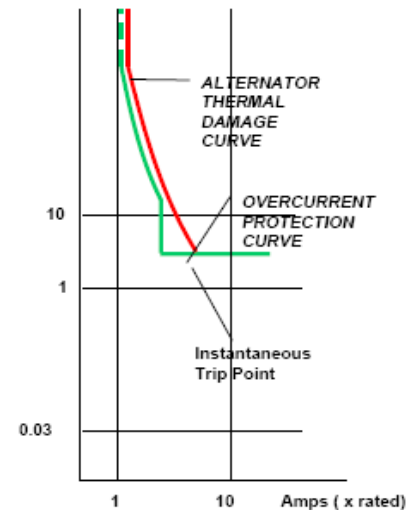
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adjustable from 105-130% of nominal voltage, with time delay adjustable from 0.1-10 seconds. Default value is 110% for 10 seconds.

Low AC voltage shutdown (27) - Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of reference voltage, time delay 2-20 seconds. Default value is 85% for 10 seconds.

Overcurrent warning/shutdown - Implementation of the thermal damage curve with instantaneous trip level calculated based on current transformer ratio and application power rating.



Under frequency shutdown (81 u) - Generator set output frequency cannot be maintained. Settings are adjustable from 2-10 Hz below nominal governor set point, for a 5-20 second time delay. Default: 6 Hz, 10 seconds.

Over frequency shutdown/warning (81o) - Generator set is operating at a potentially damaging frequency level. Settings are adjustable from 2-10 Hz above nominal governor set point for a 1-20 second time delay. Default: 6 Hz, 10 seconds, enabled.

Loss of sensing voltage shutdown - Shutdown of generator set will occur on loss of voltage sensing inputs to the control.

Field overload shutdown - Uses field voltage to shutdown generator set when a field overload condition occurs.

Field control interface

Input signals to the base control include:

- Remote start
- Local and emergency stop
- Configurable inputs: Control includes (4) input signals from customer discrete devices that are configurable for warning, shutdown or status indication, as well as message displayed

Output signals from the PowerCommand control include:

- Configurable relay outputs: Control includes (2) relay output contacts rated at 2 A. These outputs can be configured to activate on any control warning or shutdown fault as well as ready to load, not in auto, common alarm, common warning and common shutdown.
- Ready to load (generator set running) signal: Operates when the generator set has reached 90% of rated speed and voltage and latches until generator set is switched to off or idle mode.

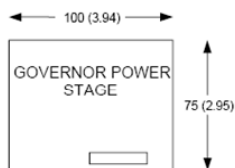
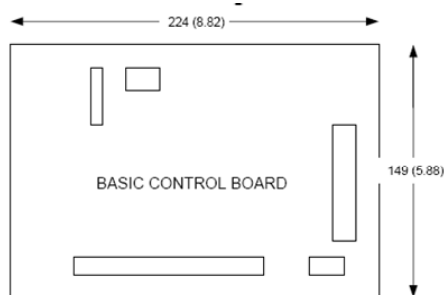
Communications connections include:

- PC tool interface: This RS-485 communication port allows the control to communicate with a personal computer running InPower or PowerCommand for Windows® software.
- Modbus RS-485 port: Allows the control to communicate with external devices such as PLCs using Modbus protocol.

Note - An RS-232 or USB to RS-485 converter is required for communication between PC and control.

- Networking: This RS-485 communication port allows connection from the control to the other Cummins Power Generation products.

Mechanical drawings



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S-1566b (4/08) Page 5 of 6

PowerCommand human machine interface HMI211



Description

This control system includes an intuitive operator interface panel that allows for complete genset control as well as system metering, fault annunciation, configuration and diagnostics. The interface includes five generator set status LED lamps with both internationally accepted symbols and English text to comply with customer needs. The interface also includes an LED backlit LCD display with tactile feel soft-switches for easy operation and screen navigation. It is configurable for units of measurement and has adjustable screen contrast and brightness.

The *run/off/auto* switch function is integrated into the interface panel.

All data on the control can be viewed by scrolling through screens with the navigation keys. The control displays the current active fault and a time-ordered history of the five previous faults.

Features

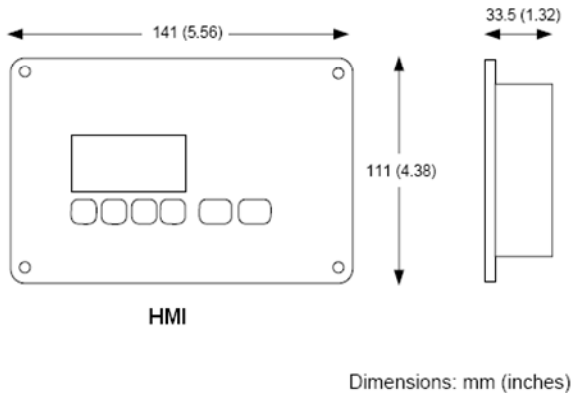
- LED indicating lamps:
 - remote start
 - not in auto
 - shutdown
 - warning
 - auto
 - run
- 128 x 64 pixels graphic LED backlight LCD.
- Four tactile feel membrane switches for LCD defined operation. The functions of these switches are defined dynamically on the LCD.
- Two tactile feel membrane switches dedicated for *off* and *back*.
- Allows for complete genset control setup.
- Certifications: Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.



Communications connections

- PC tool interface - This RS-485 communication port allows the HMI to communicate with a personal computer running InPower.
- This RS-485 communication port allows the HMI to communicate with the main control board.

Mechanical drawing



Software

InPower (beyond 6.0 version) is a PC-based software service tool that is designed to directly communicate to PowerCommand generator sets and transfer switches, to facilitate service and monitoring of these products.

Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 °C (104 °F) to +70 °C (158 °F), and for storage from -55 °C (131 °F) to +80 °C (176 °F). Control will operate with humidity up to 95%, non-condensing.

The HMI is designed for proper operation in ambient temperatures from -20 °C (-4 °F) to +70 °C (158 °F), and for storage from -30 °C (-22 °F) to +80 °C (176 °F).



See your distributor for more information

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Fax 44 1843 255902

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TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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The control board is fully encapsulated to provide superior resistance to dust and moisture. Display panel has a single membrane surface, which is impervious to effects of dust, moisture, oil and exhaust fumes. This panel uses a sealed membrane to provide long reliable service life in harsh environments.

The control system is specifically designed and tested for resistance to RFI/EMI and to resist effects of vibration to provide a long reliable life when mounted on a generator set. The control includes transient voltage surge suppression to provide compliance to referenced standards.

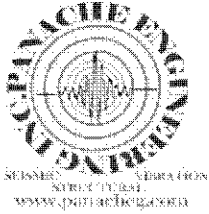
Certifications

PowerCommand meets or exceeds the requirements of the following codes and standards:

- NFPA 110 for level 1 and 2 systems.
- ISO 8528-4: 1993 compliance, controls and switchgear.
- CE marking: The control system is suitable for use on generator sets to be CE-marked.
- EN 50081-1,2 residential/light industrial emissions or industrial emissions.
- EN 50082-1,2 residential/light industrial or industrial susceptibility.
- ISO 7637-2, level 2; DC supply surge voltage test.
- Mil Std 202C, Method 101 and ASTM B117: Salt fog test.
- PowerCommand control systems and generator sets are designed and manufactured in ISO 9001 certified facilities.
- UL 508 recognized or Listed and suitable for use on UL 2200 Listed generator sets.
- CSA C282-M1999 compliance.
- CSA 22.2 No. 14 M91 industrial controls.

Warranty

All components and subsystems are covered by an express limited one year warranty. Other optional and extended factory warranties and local distributor maintenance agreements are available.



**SEISMIC CERTIFICATION
OF
NON-STRUCTURAL
COMPONENTS AND SYSTEMS**



CERTIFICATE OF COMPLIANCE

Cummins Power Generation has qualified the engine generator systems in the mounting configurations and subassemblies listed in Table-1as Certified¹ for seismic performance under the seismic parameters listed in Table-2.

Table-1 Certified Products

Gen Models/ Gen Components	Dimensions				Mounting Configurations				Engine	Alternator	Controller	Radiator
	Max Length (in)	Max Width (in)	Max Height (in)	Max Weight (lbs)	Fuel Tank Options	External Isolators	Internal Isolators	Enclosure Options	Manufacturer	Manufacturer	Manufacturer	Manufacturer
DSGA <u>A</u> ,B,C,D,E	105	41	60	3,209	None	None	Yes	None	Cummins	Cummins	Cummins	Denso Marston
DSGA <u>A</u> ,B,C,D,E	138	41	81	4,903	UL142/UL2085	None	Yes	None	Cummins	Cummins	Cummins	Denso Marston
DSGA <u>A</u> ,B,C,D,E	158	44	100	5,100	UL142/UL2085	None	Yes	Yes	Cummins	Cummins	Cummins	Denso Marston
DSGA <u>A</u> ,B,C,D,E	158	44	78	8,942	None	None	Yes	Yes	Cummins	Cummins	Cummins	Denso Marston

The basis of qualification is by shake table testing and component product line extrapolation/interpolation for active and energized components in accordance with the following International Building Code and Standards:

**International Building Code Releases: IBC 2000, IBC 2003, IBC 2006, IBC 2009, IBC 2012
ASCE Standards: ASCE 7-05, ASCE 7-10 and ICC Standard: ICC-AC-156**

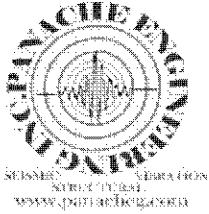
Models description and options listed in table 1 are included in this certification. A complete list of design documents for certified models and components are detailed in certification report number PAN-CUM-TIG-001-1 as issued by PANACHE ENGINEERING INC. Any change in the components, subassemblies, their materials or configurations without review by PANACHE ENGINEERING INC will invalidate this certificate. Review of the certified components, subassemblies, their materials or configurations is required to issue renewal of this certificate when expired at the expiration date noted below.

This certification includes the engine generator systems, their subassemblies and configurations as limited by the Table-1. The certified systems must be installed and attached to the building structure per the manufacturer supplied seismic installation instructions². This certification is exclusive only to Cummins engine generator systems as listed. Any other component not listed in Table-1 or not manufactured by Cummins is beyond the scope of this certification.

The above referenced equipments are approved for seismic application when properly installed³ and used per the manufacturer directions.

Table-2 Maximum Seismic Performance Data

Gen Models	Sds (G)	z/h
DSGA <u>A</u> ,B,C,D,E	2.48	0
	2.00	1



SEISMIC CERTIFICATION
OF
NON-STRUCTURAL
COMPONENTS AND SYSTEMS



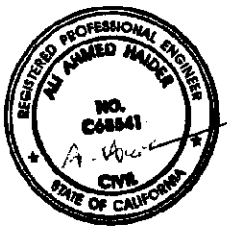
CERTIFICATE OF COMPLIANCE

Notes and Comments:

1. This certification includes the engine generator systems and subassemblies for the model numbers and configurations as limited by the Table-1 and manufacturer equipment drawings listed in the certification report. The seismic certifications are valid for seismic conditions where seismic parameters cannot exceed the maximum listed values in Table-2.
2. This certificate is valid when the certified engine generator units and their sub-components are properly attached to the primary building structure. The structural engineer or design engineer of record is responsible for detailing and/or reviewing the anchorage and/or attachment of the equipment to the supporting structure to meet project seismic and anchorage specifications and applicable building codes. The installer and manufacturers of the anchorage system are responsible for assuring that the mounting requirements and inspections are met per the applicable building codes. Any supporting structures and/ or housekeeping pads must also be seismically designed and approved by the Structure Engineer of Record to withstand the design seismic loads imposed by the equipment per the current IBC.
3. The above referenced equipment is approved for seismic application when properly installed and used as intended. Installation seismic parameters should not exceed the maximum seismic parameters listed in table-2
4. The basis of this certification is Shake table test for the similar equipment and component product line extrapolation and interpolations requirements by the ICC-AC 156 section 4.5. Panache Engineering Inc seismic shake table tested Cummins engine generator systems in accordance with ICC-ES AC-156.

Certification Issues By: The Panache Engineering Inc.
Document Control Number: PAN-CUM-FG10-001

Issue Date: 05/01/2013
Expiration Date: 05/01/2014



Ahmed Haider, Ph.D., P.E.
Engineering Manager
Panache Engineering Inc

Steven Englund
Codes and Standards
Cummins Power Generation



Exhaust Emission Data Sheet

100DSGAA

60 Hz Diesel Generator Set

EPA Emission: Tier 3

Engine Information:

Model:	Cummins Inc. QSB7-G5 NR3	Bore:	4.21 in. (107 mm)
Type:	4 Cycle, In-line, 6 Cylinder Diesel	Stroke:	4.88 in. (124 mm)
Aspiration:	Turbocharged and CAC	Displacement:	408 cu. In. (6.7 liters)
Compression Ratio:	17.2:1		
Emission Control Device:	Turbocharged and CAC		

	1/4	1/2	3/4	Full	Full
PERFORMANCE DATA	Standby	Standby	Standby	Standby	Prime
BHP @ 1800 RPM (60 Hz)	51	87	124	162	147
Fuel Consumption (gal/Hr)	3.4	4.9	7.0	8.7	8.1
Exhaust Gas Flow (CFM)	457	662	888	1106	1022
Exhaust Gas Temperature (°F)	544	689	752	807	788
EXHAUST EMISSION DATA					
HC (Total Unburned Hydrocarbons)	0.71	0.29	0.20	0.12	0.15
NOx (Oxides of Nitrogen as NO2)	2.28	1.85	1.89	1.94	1.92
CO (carbon Monoxide)	2.93	1.80	1.32	0.83	1.03
PM (Particular Matter)	0.16	0.16	0.13	0.10	0.11
SO2 (g/Hp-hr)	0.18	0.17	0.17	0.16	0.17
Smoke (Bosch)	0.41	0.73	0.69	0.65	0.67

All values are Grams per HP-Hour

TEST CONDITIONS

Data is representative of steady-state engine speed (± 25 RPM) at designated genset loads. Pressures, temperatures, and emission rates were stabilized.

Fuel Specification: ASTM D975 No. 2-D diesel fuel with 0.03-0.05% sulfur content (by weight), and 40-48 cetane number.

Fuel Temperature: 99 ± 9 °F (at fuel pump inlet)

Intake Air Temperature: 77 ± 9 °F

Barometric Pressure: 29.6 ± 1 in. Hg

Humidity: NOx measurement corrected to 75 grains H2O/lb dry air

Reference Standard: ISO 8178

The NOx, HC, CO and PM emission data tabulated here are representative of test data taken from a single engine under the test conditions shown above. Data for the other components are estimated. These data are subjected to instrumentation and engine-to-engine variability. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures and instrumentation. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits or with improper maintenance, may result in elevated emission levels.



2013 EPA Tier 3 Exhaust Emission Compliance Statement 100DSGAA Stationary Emergency 60 Hz Diesel Generator Set

Compliance Information:

The engine used in this generator set complies with Tier 3 emissions limit of U.S. EPA New Source Performance Standards for stationary emergency engines under the provisions of 40 CFR 60 Subpart IIII when tested per ISO8178 D2.

Engine Manufacturer:	Cummins Inc
EPA Certificate Number:	DCEXL0409AAD-008
Effective Date:	05/01/2012
Date Issued:	05/01/2012
EPA Engine Family (Cummins Emissions Family):	DCEXL0409AAD (D313)

Engine Information:

Model:	QSB6.7 / QSB7 / QSB7-G5 NR3	Bore:	4.21 in. (107 mm)
Engine Nameplate HP:	324	Stroke:	4.88 in. (124 mm)
Type:	4 Cycle, In-line, 6 Cylinder Diesel	Displacement:	408 cu. in. (6.7 liters)
Aspiration:	Turbocharged and CAC	Compression Ratio:	17.2:1
Emission Control Device:		Exhaust Stack Diameter:	4 in.

Diesel Fuel Emission Limits

D2 Cycle Exhaust Emissions

	Grams per BHP-hr			Grams per kWm-hr		
	<u>NOx + NMHC</u>	<u>CO</u>	<u>PM</u>	<u>NOx + NMHC</u>	<u>CO</u>	<u>PM</u>
Test Results - Diesel Fuel (300-4000 ppm Sulfur)	3.0	0.7	0.08	4.0	1.0	0.11
EPA Emissions Limit	3.0	2.6	0.15	4.0	3.5	0.20
Test Results - CARB Diesel Fuel (<15 ppm Sulfur)	2.7	0.7	0.07	3.7	1.0	0.10
CARB Emissions Limit	3.0	2.6	0.15	4.0	3.5	0.20

The CARB emission values are based on CARB approved calculations for converting EPA (500 ppm) fuel to CARB (15 ppm) fuel.

Test Methods: EPA/CARB Nonroad emissions recorded per 40CFR89 (ref. ISO8178-1) and weighted at load points prescribed in Subpart E, Appendix A for Constant Speed Engines (ref. ISO8178-4, D2)

Diesel Fuel Specifications: Cetane Number: 40-48. Reference: ASTM D975 No. 2-D.

Reference Conditions: Air Inlet Temperature: 25°C (77°F), Fuel Inlet Temperature: 40°C (104°F). Barometric Pressure: 100 kPa (29.53 in Hg), Humidity: 10.7 g/kg (75 grains H2O/lb) of dry air; required for NOx correction, Restrictions: Intake Restriction set to a maximum allowable limit for clean filter; Exhaust Back Pressure set to a maximum allowable limit.

Tests conducted using alternate test methods, instrumentation, fuel or reference conditions can yield different results.

Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.



Sound Pressure Level @ 7 meters, dB(A)

See Notes 1-8 listed below

Configuration		Measurement Location Number								Average
		1	2	3	4	5	6	7	8	
Standard-Unhoused (Note 3)	Infinite Exhaust	80.7	84.6	84.6	88.9	87.4	88.5	85.4	85.7	86.3
F182 - Enclosure-Steel, Weather Protective,with ExhSys	Mounted Muffler	82.0	87.6	87.9	89.2	86.4	88.4	86.2	85.6	87.1
F216- Enclosure-Aluminum,Weather Protective,w/Exh System	Mounted Muffler	82.0	87.6	87.9	89.2	86.4	88.4	86.2	85.6	87.1
F173 - Enclosure-Steel,Sound Att,Level 2,w/Exhaust System	Mounted Muffler	71.0	73.6	70.9	71.8	71.4	72.7	70.4	72.2	71.9
F217- Enclosure-Aluminum,Sound Att,Level 2,w/ExhSystem	Mounted Muffler	74.1	75.2	72.4	72.8	70.0	75.4	71.4	73.5	73.2
F232- Enclosure-Steel,Sound Att,Level 3,w/Exhaust System	Mounted Muffler	67.7	68.3	67.8	70.4	68.2	70.3	67.9	69.7	68.9
F233- Enclosure-Aluminum, Sound Att,Level 3,w/ExhSystem	Mounted Muffler	70.9	69.9	69.3	71.4	66.7	73.0	68.9	71.0	70.2

Sound Power Level, dB(A)

See Notes 2-6, 9, 10 listed below

Configuration		Octave Band Center Frequency (Hz)								Overall Sound Power Level
		63	125	250	500	1000	2000	4000	8000	
Standard-Unhoused (Note 3)	Infinite Exhaust	76.8	96.1	107.8	105.7	109.6	108.2	103.3	99.6	114.6
F182 - Enclosure-Steel, Weather Protective,with ExhSys	Mounted Muffler	88.4	99.6	106.7	106.5	111.0	109.0	105.0	102.6	116.0
F216- Enclosure-Aluminum,Weather Protective,w/Exh System	Mounted Muffler	88.4	99.6	106.7	106.5	111.0	109.0	105.0	102.6	116.0
F173 - Enclosure-Steel,Sound Att,Level 2,w/Exhaust System	Mounted Muffler	80.6	91.7	95.2	93.9	95.3	94.9	92.8	89.1	102.2
F217- Enclosure-Aluminum,Sound Att,Level 2,w/ExhSystem	Mounted Muffler	77.2	93.5	97.9	94.4	97.0	96.6	94.4	93.1	104.0
F232- Enclosure-Steel,Sound Att,Level 3,w/Exhaust System	Mounted Muffler	79.0	90.5	92.6	91.0	92.3	91.0	89.6	85.4	99.3
F233- Enclosure-Aluminum, Sound Att,Level 3,w/ExhSystem	Mounted Muffler	75.6	92.3	95.3	91.5	94.0	92.7	91.2	89.4	101.1

Exhaust Sound Pressure Level @ 1 meter, dB(A)

Open Exhaust (No Muffler Rated Load)	Octave Band Center Frequency (Hz)								Sound Pressure Level
	63	125	250	500	1000	2000	4000	8000	
	89.2	98.9	107.0	108.8	113.0	117.5	117.4	116.0	123.0

Note:

- Position 1 faces the engine front. The positions proceed around the generator set in a counter-clockwise direction in 45° increments. All positions are at 7m (23 ft) from the surface of the generator set and 1.2m (48") from floor level.
- Sound levels are subject to instrumentation, measurement, installation and manufacturing variability.
- Sound data with remote-cooled generator sets are based on rated loads without cooling fan noise.
- Sound levels for aluminum enclosures are approximately 2 dB(A)s higher than listed sound levels for steel enclosures.
- Sound data for generator set with infinite exhaust do not include exhaust noise.
- Data is based on full rated load with standard radiator-cooling fan package
- Sound Pressure Levels are measured per ANSI S1.13 and ANSI S12.18, as applicable.
- Reference sound pressure is 20 µPa.
- Sound Power Levels per ISO 3744 and ISO 8528-10, as applicable.
- Reference power = 1 pw (10⁻¹² W)
- Exhaust Sound Pressure Levels are per ISO 6798, as applicable.



PROTOTYPE TEST SUPPORT (PTS) 60 HZ TEST SUMMARY

GENERATOR SET MODELS		REPRESENTATIVE PROTOTYPE	
100 DSGAA	125 DSGAB	Model:	200 DSGAE
150 DSGAC	175 DSGAD	Alternator:	UCDI274J
200 DSGAE		Engine:	QSB7-G5 NR3



The following summarizes prototype testing conducted on the designated representative prototype of the specified models. This testing is conducted to verify the complete generator set electrical and mechanical design integrity. Prototype testing is conducted only on generator sets not sold as new equipment.

Maximum Surge Power: 213 kW

The generator set was evaluated to determine the stated maximum surge power.

Torsional Analysis and Testing:

The generator set was tested to verify that the design is not subjected to harmful torsional stresses. A spectrum analysis of the transducer output was conducted over the speed range of 1350 to 1950 RPM.

Cooling System: 50 °C Ambient
0.50 in. H2O restriction

The cooling system was tested to determine ambient temperature and static restriction capabilities. The test was performed at full rated load in elevated ambient temperature under stated static restriction conditions.

Durability:

The generator set was subjected to a minimum 250 hour endurance test operating at variable load up to the standby rating based upon MIL-STD-705 to verify structural soundness and durability of the design.

Electrical and Mechanical Strength:

The generator set was tested to several single phase and three phase faults to verify that the generator can safely withstand the forces associated with short circuit conditions. The generator set was capable of producing full rated output at the conclusion of the testing.

Steady State Performance:

The generator set was tested to verify steady state operating performance was within the specified maximum limits.

Voltage Regulation:	±0.5%
Random Voltage Variation:	±0.5%
Frequency Regulation:	Isochronous
Random Frequency Variation:	±0.25%

Transient Performance:

The generator set was tested with the alternator listed to verify single step loading capability as required by NFPA 110. Voltage and frequency response on load addition or rejection were evaluated. The following results were recorded:

Full Load Acceptance:

Voltage Dip:	26.1	%
Recovery Time:	2.9	Second
Frequency Dip:	19.5	%
Recovery Time:	3.9	Second

Full Load Rejection:

Voltage Rise:	22.5	%
Recovery Time:	1.5	Second
Frequency Rise:	9.1	%
Recovery Time:	1.9	Second

Harmonic Analysis:

(per MIL-STD-705B, Method 601.4)

<u>Harmonic</u>	<u>Line to Line</u>		<u>Line to Neutral</u>	
	<u>No Load</u>	<u>Full Load</u>	<u>No Load</u>	<u>Full Load</u>
3	0.0	0.2	0.0	0.2
5	1.0	0.8	1.0	0.8
7	0.6	1.9	0.6	1.8
9	0.1	0.0	0.1	0.0
11	0.3	0.6	0.3	0.6
13	0.2	0.5	0.2	0.5
15	0.0	0.0	0.0	0.0



ALTERNATOR DATA SHEET

Frame Size: **UC3F**

CHARACTERISTICS

WEIGHTS:	Wound Stator Assembly	337 lb	153 kg
	Rotor Assembly	419 lb	190 kg
	Complete Alternator	1175 lb	533 kg

EXCITATION CURRENT: Full Load 2 Amps No Load 0.5 Amps

INSULATION SYSTEM: Class H Throughout **MAXIMUM SPEED:** 2250 rpm

1 Ø RATINGS (1.0 power factor) <small>(Based on specified temperature rise at 40°C ambient temperature)</small>	60 Hz			50 Hz			
	Double Delta	4 Lead		Double Delta			
125°C Rise Ratings kW/kVA	120/240 109 / 109	120/240 125 / 125		110-120 220-240 96 / 96			
105°C Rise Ratings kW/kVA	98 / 98	113 / 113		87 / 87			
3 Ø RATINGS (0.8 power factor) <small>(Based on specified temperature rise at 40°C ambient temperature)</small>	Upper Broad Range	LBR*	347/600	Broad Range			
150°C Rise Ratings kW	120/208 240/416	139/240 277/480	190-208 380-416	347/600	110/190 220/380	120/208 240/415	127/220 254/440
150°C Rise Ratings kVA	150 188	170 213	148 185	170 213	136 170	136 170	128 160
125°C Rise Ratings kW	145	165	144	165	128	128	120
125°C Rise Ratings kVA	181	206	180	206	160	160	150
105°C Rise Ratings kW	130	150	128	150	116	116	108
105°C Rise Ratings kVA	163	188	160	188	145	145	135
80°C Rise Ratings kW	112	128	110	128	101	101	94
80°C Rise Ratings kVA	140	160	138	160	126	126	118
3 Ø REACTANCES (per unit, ±10%) <small>(Based on full load at 105°C Rise Rating)</small>							
Synchronous	2.21	1.92	1.68	1.97	2.04	1.71	1.42
Transient	0.18	0.15	0.14	0.16	0.17	0.15	0.12
Subtransient	0.13	0.11	0.09	0.10	0.12	0.10	0.09
Negative Sequence	0.14	0.12	0.10	0.11	0.13	0.11	0.09
Zero Sequence	0.08	0.07	0.07	0.07	0.08	0.07	0.06
3 Ø MOTOR STARTING							
Maximum kVA (Shunt)	516	516	516		367		
(90% Sustained Voltage) (PMG)	607	607	607		458		
TIME CONSTANTS (Sec)							
Transient	0.035	0.035	0.035		0.035		
Subtransient	0.011	0.011	0.011		0.011		
Open circuit	0.900	0.900	0.900		0.900		
DC	0.009	0.009	0.009		0.009		
WINDINGS (@ 20°C)							
Stator Resistance (Line to Line, Ohms)	0.0480	0.0400	0.0700		0.0480		
Rotor Resistance (Ohms)	0.0480	0.0400	0.0700		0.0480		
Number of Leads	12	12	6		12		

* Lower broad range 110/190 thru 120/208, 220/380 thru 240/416.

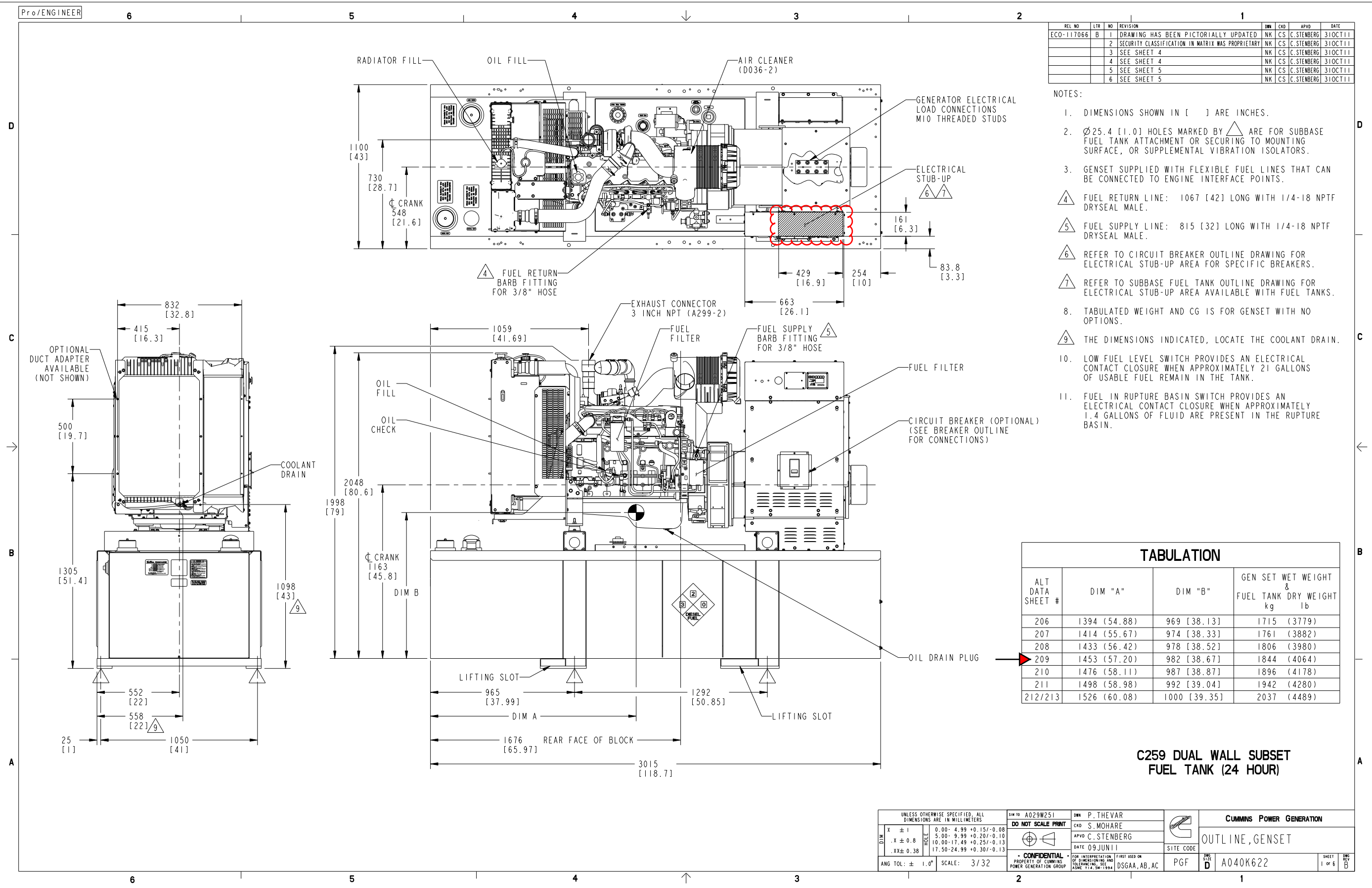
REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-117066	B	1	DRAWING HAS BEEN PICTORIALLY UPDATED	NK	CS	C.STENBERG	31OCT11
		2	SECURITY CLASSIFICATION IN MATRIX WAS PROPRIETARY	NK	CS	C.STENBERG	31OCT11
		3	SEE SHEET 4	NK	CS	C.STENBERG	31OCT11
		4	SEE SHEET 4	NK	CS	C.STENBERG	31OCT11
		5	SEE SHEET 5	NK	CS	C.STENBERG	31OCT11
		6	SEE SHEET 5	NK	CS	C.STENBERG	31OCT11

NOTES:

- DIMENSIONS SHOWN IN [] ARE INCHES.
- Ø25.4 [1.0] HOLES MARKED BY \triangle ARE FOR SUBBASE FUEL TANK ATTACHMENT OR SECURING TO MOUNTING SURFACE, OR SUPPLEMENTAL VIBRATION ISOLATORS.
- GENSET SUPPLIED WITH FLEXIBLE FUEL LINES THAT CAN BE CONNECTED TO ENGINE INTERFACE POINTS.
- \triangle FUEL RETURN LINE: 1067 [42] LONG WITH 1/4-18 NPT DRYSEAL MALE.
- \triangle FUEL SUPPLY LINE: 815 [32] LONG WITH 1/4-18 NPT DRYSEAL MALE.
- \triangle REFER TO CIRCUIT BREAKER OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA FOR SPECIFIC BREAKERS.
- \triangle REFER TO SUBBASE FUEL TANK OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA AVAILABLE WITH FUEL TANKS.
- TABULATED WEIGHT AND CG IS FOR GENSET WITH NO OPTIONS.
- \triangle THE DIMENSIONS INDICATED, LOCATE THE COOLANT DRAIN.
- LOW FUEL LEVEL SWITCH PROVIDES AN ELECTRICAL CONTACT CLOSURE WHEN APPROXIMATELY 21 GALLONS OF USABLE FUEL REMAIN IN THE TANK.
- FUEL IN RUPTURE BASIN SWITCH PROVIDES AN ELECTRICAL CONTACT CLOSURE WHEN APPROXIMATELY 1.4 GALLONS OF FLUID ARE PRESENT IN THE RUPTURE BASIN.

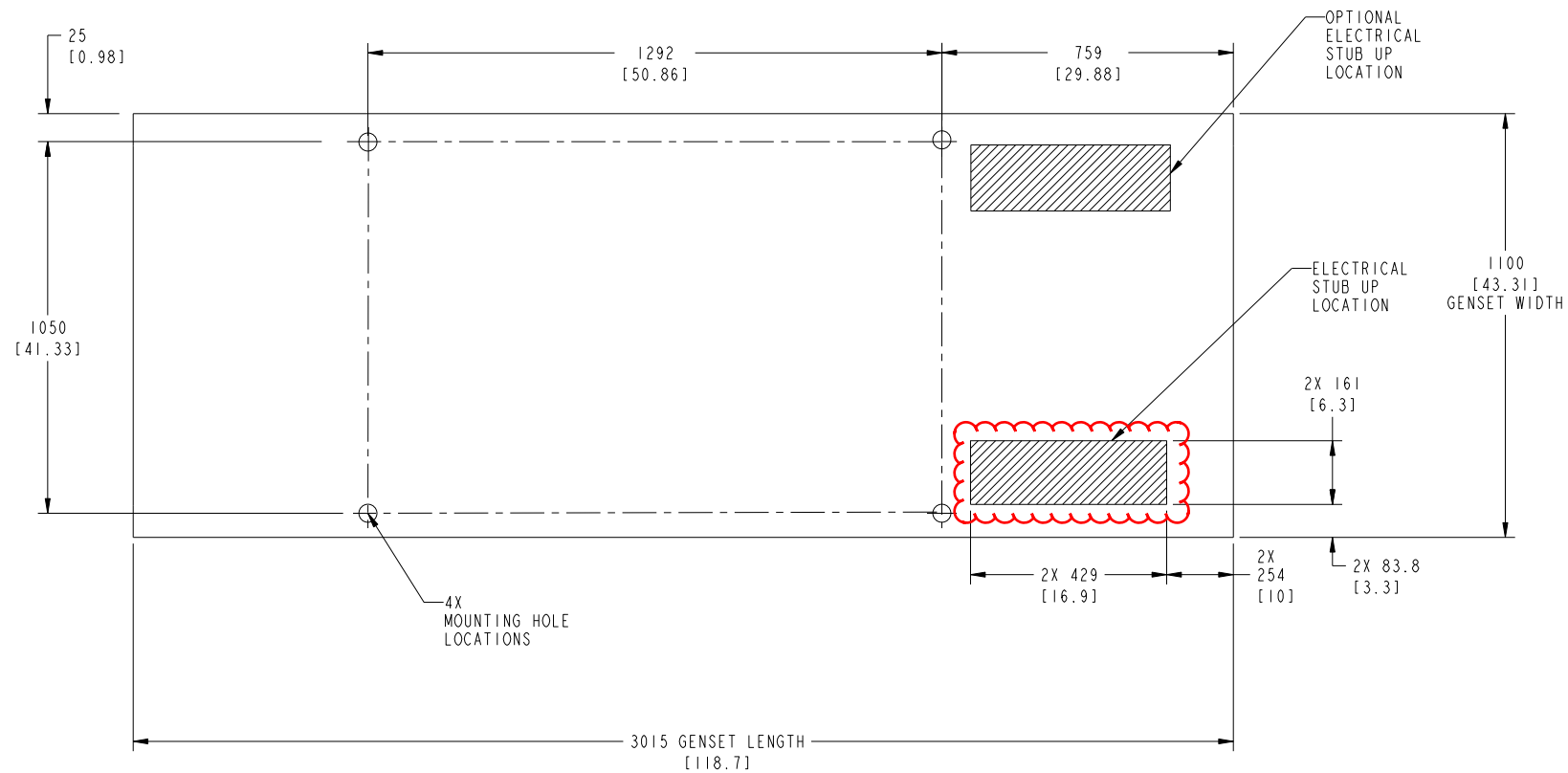
ALT DATA SHEET #	DIM "A"	DIM "B"	GEN SET WET WEIGHT & FUEL TANK DRY WEIGHT	
			kg	lb
206	1394 (54.88)	969 [38.13]	1715	(3779)
207	1414 (55.67)	974 [38.33]	1761	(3882)
208	1433 (56.42)	978 [38.52]	1806	(3980)
209	1453 (57.20)	982 [38.67]	1844	(4064)
210	1476 (58.11)	987 [38.87]	1896	(4178)
211	1498 (58.98)	992 [39.04]	1942	(4280)
212/213	1526 (60.08)	1000 [39.35]	2037	(4489)

C259 DUAL WALL SUBSET FUEL TANK (24 HOUR)



UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM 10 A029W251	OWN P. THEVAR		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT			CND S. MOHARE		OUTLINE, GENSET	
X ± 1 .X ± 0.8 .XX ± 0.38	0.00- 4.99 +0.15/-0.08 5.00- 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13		APVD C. STENBERG		SITE CODE	SHEET 1 OF 6
ANG TOL: ± 1.0°	SCALE: 3/32		DATE 09JUN11			
- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994		DSGAA, AB, AC	A040K622	REV B

REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-117066	B	-	---	NK	CS	C.STENBERG	31OCT11

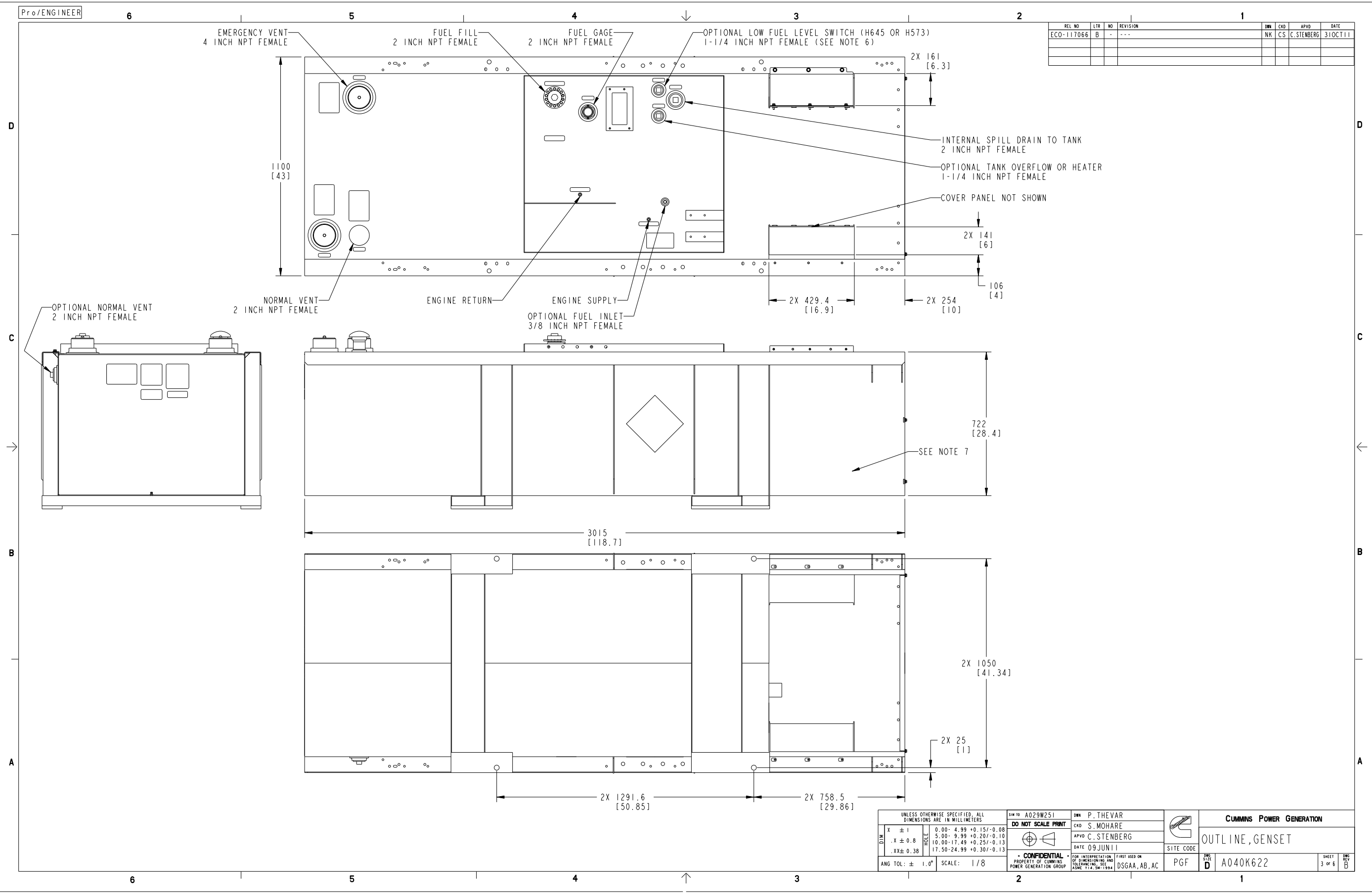


**MOUNTING PAD LAYOUT
C259 DUAL WALL SUBSET
FUEL TANK (24 HOUR)**

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM 10 A029W251	OWN P. THEVAR		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT			CND S. MOHARE		OUTLINE, GENSET	
CH	X ± 1	0.00- 4.99 +0.15/-0.08	APVD C. STENBERG		SITE CODE	SHEET 2 OF 6 REV B
	.X ± 0.8	5.00- 9.99 +0.20/-0.10	DATE 09JUN11			
	.XX ± 0.38	10.00-17.49 +0.25/-0.13				
		17.50-24.99 +0.30/-0.13				
ANG TOL: ± 1.0°		SCALE: 1/8	- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	FIRST USED ON DSGAA, AB, AC PGF D A040K622

Pro/ENGINEER

REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-117066	B	-	---	NK	CS	C.STENBERG	31OCT11



UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM 10 A029W251	OWN P. THEVAR		CUMMINS POWER GENERATION																																			
DO NOT SCALE PRINT		CND S. MOHARE	APVD C. STENBERG		OUTLINE, GENSET																																			
<table border="1"> <tr> <th>CH</th> <th>TOL</th> <th>SCALE</th> </tr> <tr> <td>X ± 1</td> <td>0.00- 4.99 +0.15/-0.08</td> <td rowspan="3">1/8</td> </tr> <tr> <td>.X ± 0.8</td> <td>5.00- 9.99 +0.20/-0.10</td> </tr> <tr> <td>.XX ± 0.38</td> <td>10.00-17.49 +0.25/-0.13</td> </tr> <tr> <td></td> <td>17.50-24.99 +0.30/-0.13</td> <td></td> </tr> </table>	CH	TOL	SCALE	X ± 1	0.00- 4.99 +0.15/-0.08	1/8	.X ± 0.8	5.00- 9.99 +0.20/-0.10	.XX ± 0.38	10.00-17.49 +0.25/-0.13		17.50-24.99 +0.30/-0.13		DATE 09JUN11	SITE CODE	PGF	<table border="1"> <tr> <td>ANG TOL: ± 1.0°</td> <td>SCALE: 1/8</td> </tr> </table>	ANG TOL: ± 1.0°	SCALE: 1/8	<table border="1"> <tr> <td>CONFIDENTIAL</td> <td>FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994</td> <td>FIRST USED ON DSGAA, AB, AC</td> </tr> </table>	CONFIDENTIAL	FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	FIRST USED ON DSGAA, AB, AC	<table border="1"> <tr> <td>DATE 09JUN11</td> <td>SITE CODE</td> </tr> </table>	DATE 09JUN11	SITE CODE	<table border="1"> <tr> <td>PGF</td> <td> <table border="1"> <tr> <td>DATE 09JUN11</td> <td>SITE CODE</td> </tr> </table> </td> </tr> </table>	PGF	<table border="1"> <tr> <td>DATE 09JUN11</td> <td>SITE CODE</td> </tr> </table>	DATE 09JUN11	SITE CODE	<table border="1"> <tr> <td>DATE 09JUN11</td> <td>SITE CODE</td> </tr> </table>	DATE 09JUN11	SITE CODE	<table border="1"> <tr> <td>DATE 09JUN11</td> <td>SITE CODE</td> </tr> </table>	DATE 09JUN11	SITE CODE	<table border="1"> <tr> <td>DATE 09JUN11</td> <td>SITE CODE</td> </tr> </table>	DATE 09JUN11	SITE CODE
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Pro/ENGINEER

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5

4

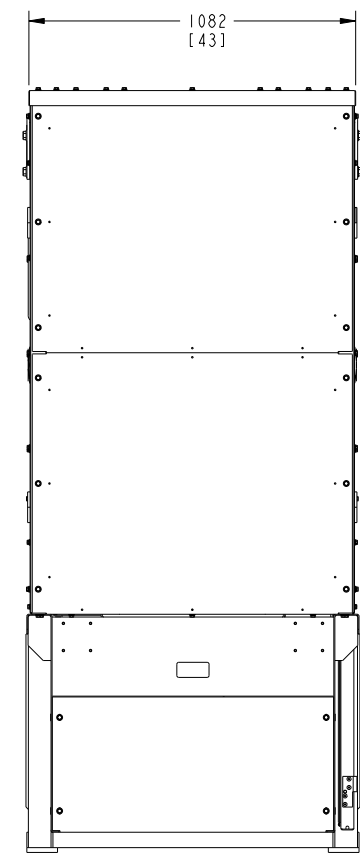
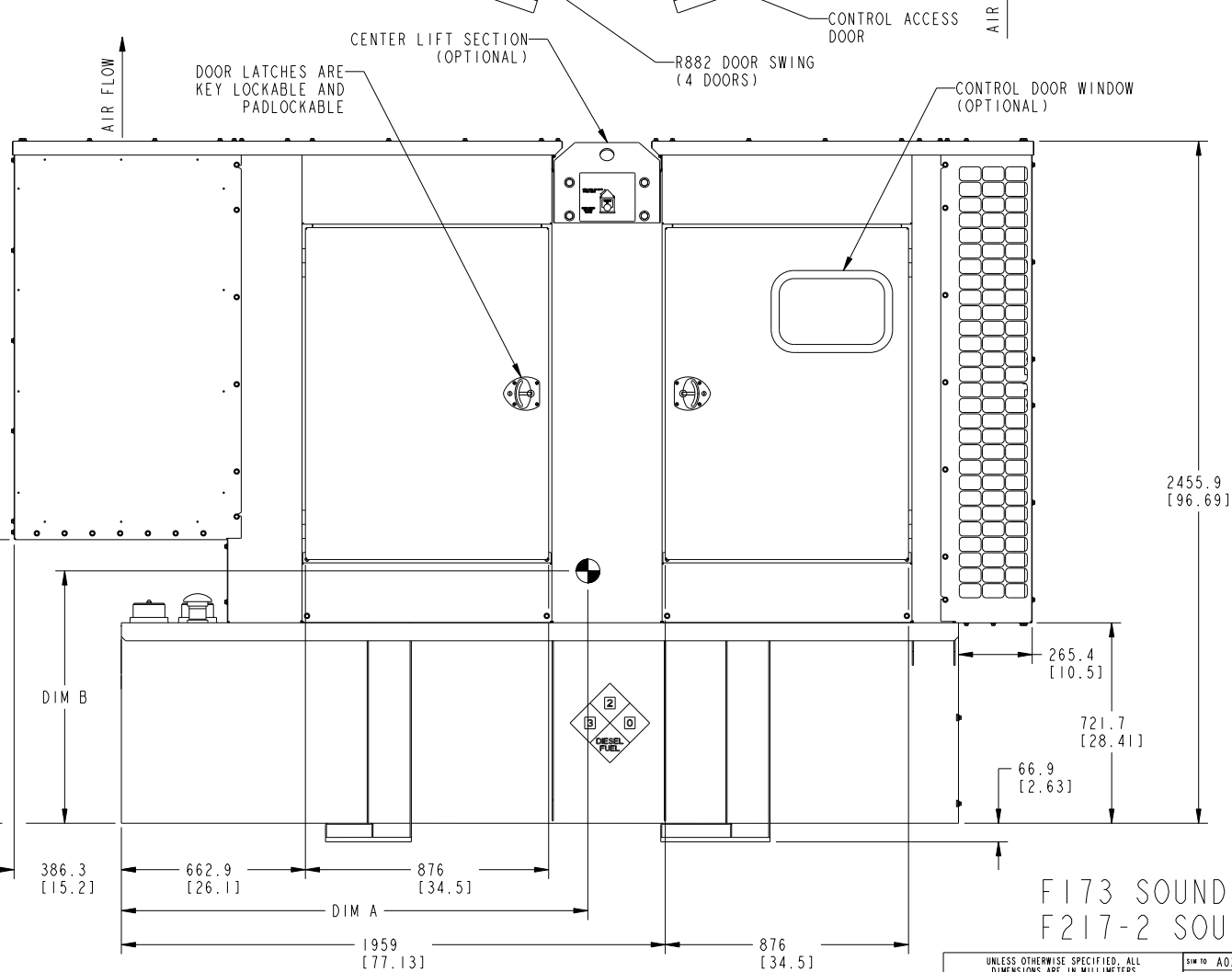
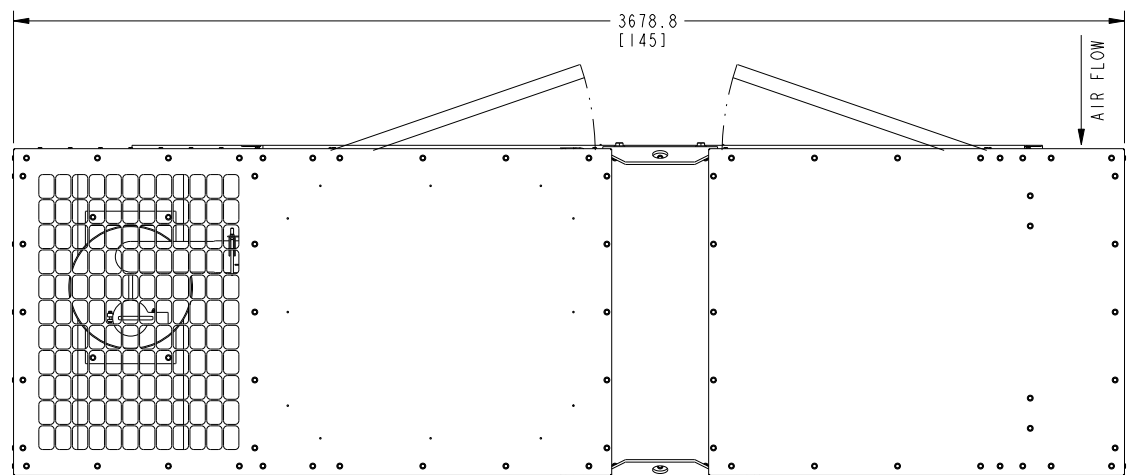
3

2

1

REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-117066	B	1	DRAWING HAS BEEN PICTORIALY UPDATED	NK	CS	C.STENBERG	31OCT11
		5	ZONE ØA5: ADD DIM 386.3 (15.2)	NK	CS	C.STENBERG	31OCT11
		6	ZONE ØA2: ADD DIM 265.4 (10.5)	NK	CS	C.STENBERG	31OCT11

TABULATION				
ALT DATA SHEET#	DIM "A"	DIM "B"	GENSET WET WEIGHT & FUEL TANK DRY WEIGHT & SOUND ENCLOSURE (STEEL) kg lb	GENSET WET WEIGHT & FUEL TANK DRY WEIGHT & SOUND ENCLOSURE (ALUMINUM) kg lb
206	1429 [56.26]	969 [38.13]	2470 [5453]	1984 [4381]
207	1447 [56.97]	974 [38.33]	2516 [5556]	2031 [4484]
208	1467 [57.76]	978 [38.52]	2561 [5654]	2075 [4582]
209	1487 [58.54]	982 [38.67]	2599 [5738]	2113 [4666]
210	1510 [59.45]	987 [38.87]	2651 [5852]	2165 [4780]
211	1530 [60.24]	992 [39.04]	2697 [5954]	2211 [4882]
212/213	1558 [61.34]	1000 [39.35]	2791 [6163]	2306 [5091]



F173 SOUND HOUSING (STEEL) W/MUFFLER
 F217-2 SOUND HOUSING (ALUMINUM) W/MUFFLER

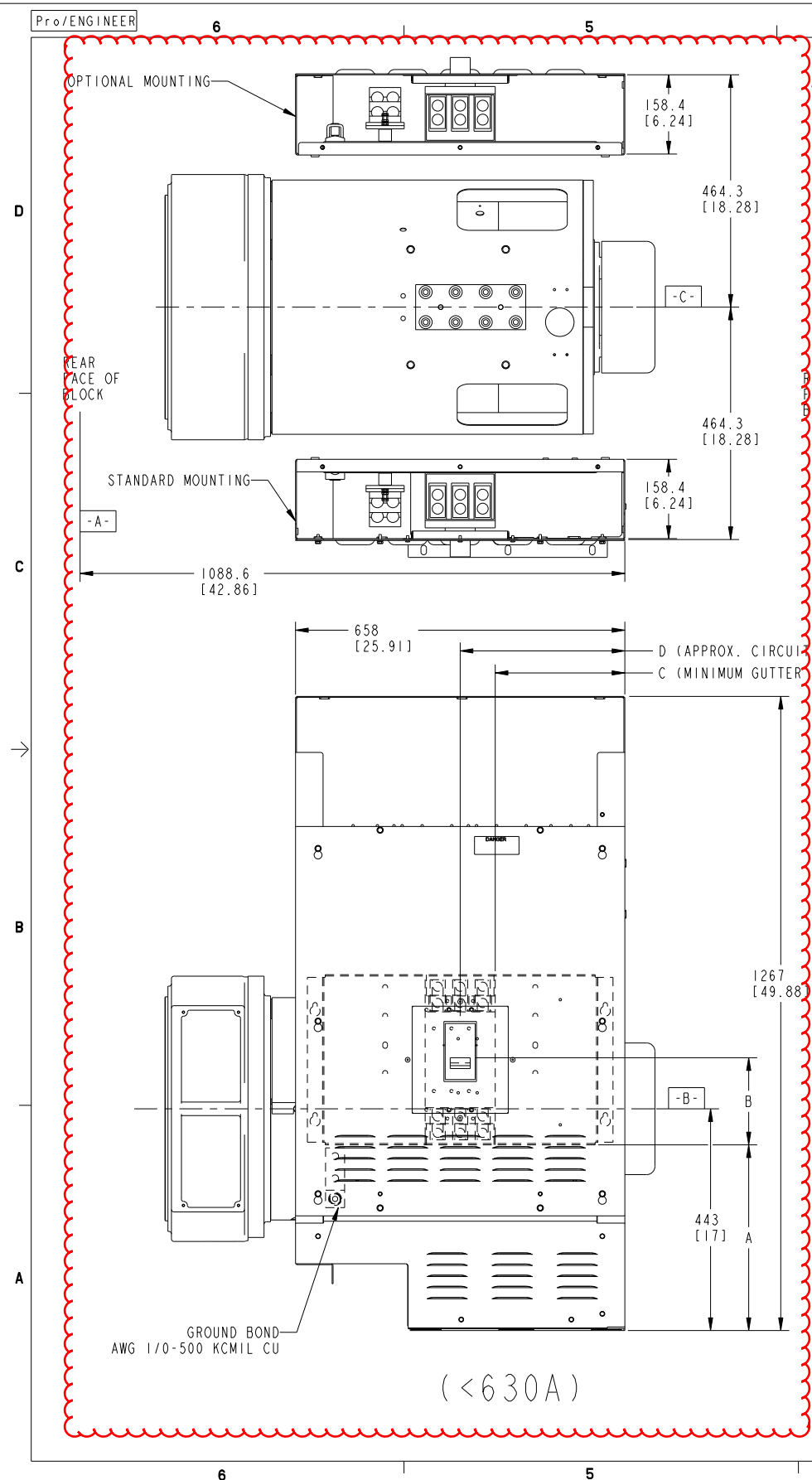
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM 10 A029W251	OWN P.THEVAR		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT		CAD S.MOHARE	APVD C.STENBERG		OUTLINE, GENSET	
CH	XX ± 0.38	0.00- 4.99 +0.15/-0.08	DATE 09JUN11	SITE CODE	PGF	SHEET 5 OF 6
	.X ± 0.8	5.00- 9.99 +0.20/-0.10	FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	DSGAA, AB, AC	D	REV B
	.X ± 0.8	10.00-17.49 +0.25/-0.13	CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP			
	.XX ± 0.38	17.50-24.99 +0.30/-0.13	FIRST USED ON			
ANG TOL: ± 1.0°	SCALE: 1/8					

Pro/ENGINEER

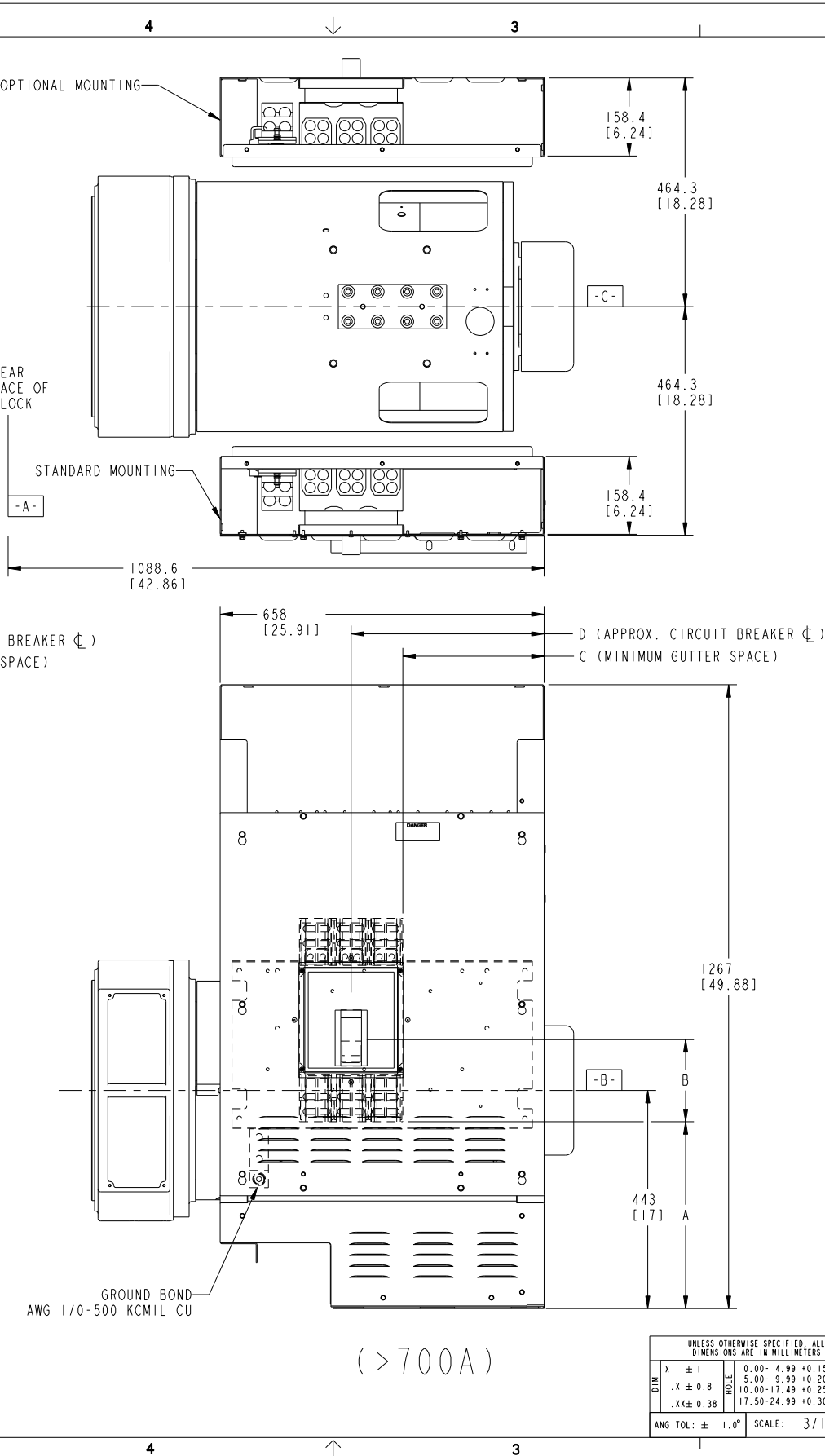
REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-117272	A	1	PRODUCTION RELEASE	PT	SM	C. STENBERG	13 JUN 11

NOTES:

1. DIMENSIONS SHOWN IN [] ARE IN INCHES.
2. "NS" SHUNT TRIP HAS NO INTERNAL CONTACTS. IT MUST BE USED IN CONJUNCTION WITH AUXILIARY CONTACTS TO ACCEPT CONTINUOUS APPLIED VOLTAGE. IT CAN OPERATE AT 75% OF NOMINAL VOLTAGE.
3. THE SHUNT TRIP CAN OPERATE AT 70% TO 100% OF NORMAL VOLTAGE AND WILL ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE.
4. 800 AMP BREAKER:
A LUG ACCEPTING (2) 3/0-600 kcmil CONDUCTORS IS AVAILABLE THRU ACCESSORIES. PGA PART NUMBER 0332-4278.
5. 1200 AMP BREAKER:
A LUG ACCEPTING (3) 3/0-600 kcmil CONDUCTORS IS AVAILABLE THRU ACCESSORIES. PGA PART NUMBER 0332-4279.



(<630A)

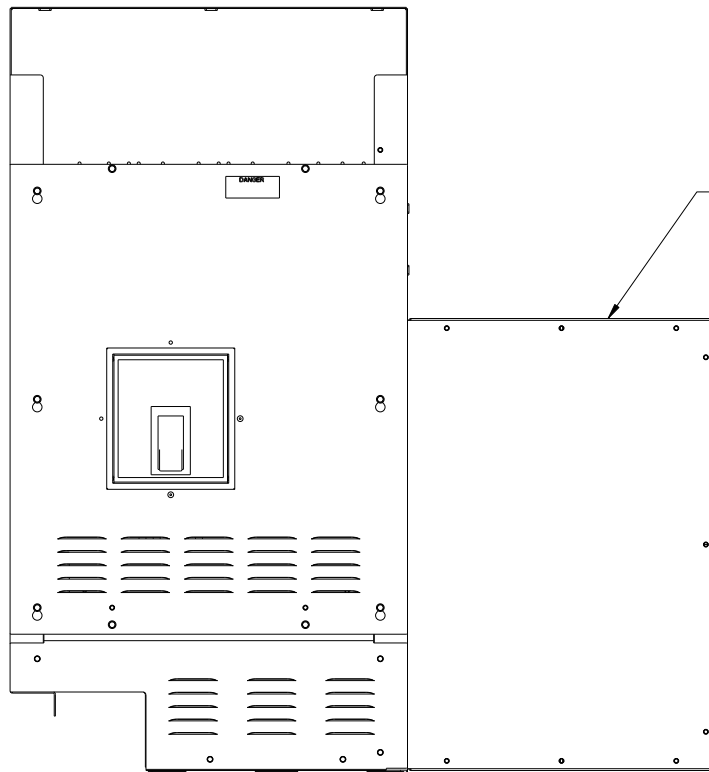
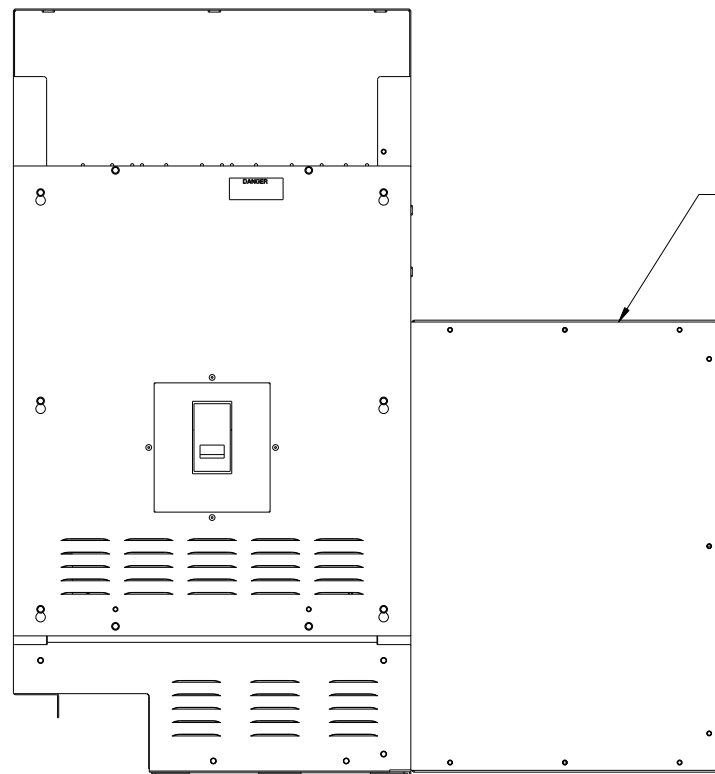
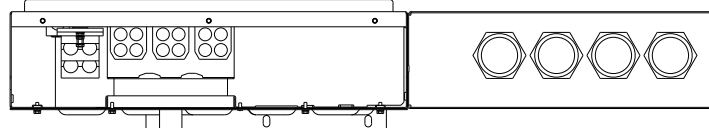
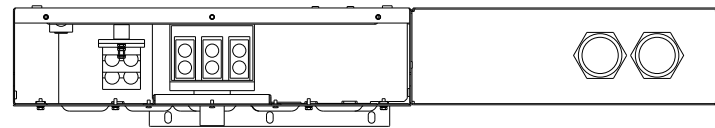


(>700A)

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM NO 0500_4668	OWN P. THEVAR		CUMMINS POWER GENERATION								
DO NOT SCALE PRINT		CND S. MOHARE	APVD C. STENBERG		OUTLINE, CIRCUIT BREAKER								
<table border="1"> <tr> <td>X ± 1</td> <td>0.00- 4.99 +0.15/-0.08</td> </tr> <tr> <td>.X ± 0.8</td> <td>5.00- 9.99 +0.20/-0.10</td> </tr> <tr> <td>.XX ± 0.38</td> <td>10.00-17.49 +0.25/-0.13</td> </tr> <tr> <td></td> <td>17.50-24.99 +0.30/-0.13</td> </tr> </table>		X ± 1	0.00- 4.99 +0.15/-0.08	.X ± 0.8	5.00- 9.99 +0.20/-0.10	.XX ± 0.38	10.00-17.49 +0.25/-0.13		17.50-24.99 +0.30/-0.13	DATE 13 JUN 11	SITE CODE		
X ± 1	0.00- 4.99 +0.15/-0.08												
.X ± 0.8	5.00- 9.99 +0.20/-0.10												
.XX ± 0.38	10.00-17.49 +0.25/-0.13												
	17.50-24.99 +0.30/-0.13												
ANG TOL: ± 1.0°		SCALE: 3/16		PGF		A040K670 SHEET 1 OF 3 REV A							

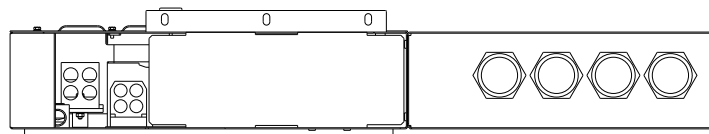
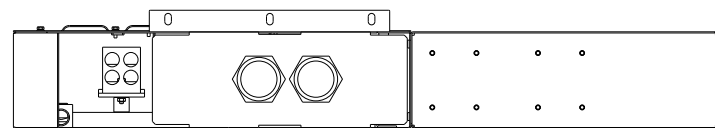
Pro/ENGINEER

REL NO	LTR	NO	REVISION	OWN	CAD	APVD	DATE
ECO-117272	A	1	PRODUCTION RELEASE	PT	SM	C. STENBERG	13 JUN 11



(<630A)

(>700A)



TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC TABLE 310.16 AT 40C

BREAKER TRIP SETTING	WIRE (COPPER)		CONDUIT	
	QTY	SIZE	QTY	SIZE
600 A	2	350 KCMIL	2	2.5"
400 A	2	3/0	2	2.0"
250 A	1	250 KCMIL	1	2.5"
100 A	1	2	1	1.25"

TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC TABLE 310.16 AT 40C

BREAKER TRIP SETTING	WIRE (COPPER)		CONDUIT	
	QTY	SIZE	QTY	SIZE
1200 A	4	350 KCMIL	4	2.5"
1000 A	3	400 KCMIL	3	3.0"
800 A	3	300 KCMIL	3	2.5"

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM NO 0500_4668	OWN P. THEVAR		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT			CND S. MOHARE		OUTLINE, CIRCUIT BREAKER	
CH X ± 1 .X ± 0.8 .XX ± 0.38 ANG TOL: ± 1.0°	0.00- 4.99 +0.15/-0.08		APVD C. STENBERG		SITE CODE	PGF
	5.00- 9.99 +0.20/-0.10		DATE 13 JUN 11			
	10.00-17.49 +0.25/-0.13					
	17.50-24.99 +0.30/-0.13					
- CONFIDENTIAL -		SCALE: 3/16	FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	DSGAA, AB, AC, AD	SIZE D	A040K670
PROPERTY OF CUMMINS POWER GENERATION GROUP						SHEET 2 OF 3

REL NO	LTR	NO	REVISION	DWN	CAD	APVD	DATE
ECO-117272	A	1	PRODUCTION RELEASE	PT	SM	C. STENBERG	13 JUN 11

UL/IEC LUGS								ACCESSORY SPECIFICATIONS			
LUG	FRAME	MAX AMPS	WIRE RANGE COPPER	DIM A	DIM B	DIM C	DIM D	ACCESSORY DESCRIPTION	CONTACT RATING	INRUSH CURRENT	CONNECTION TYPE
	NSJ 600/690V	400A 3 OR 4 POLE	#2-600 KCMIL	381 [15]	176 [6.9]	257 [10.1]	327 [12.9]	12 VDC SHUNT TRIP	-	10A Δ 2	COMPRESSION TERMINALS #20-16 AWG OR SMALLER TORQUE: 10 LB-IN
		600A 3-POLE 630A 4-POLE	2/0-350 KCMIL					1 EA. FORM C 1 AUX CONTACT + 1 TRIP ALARM	6A AT 690 VAC 2.5A AT 48 VDC, 0.3A AT 250 VDC	-	
	QDL 240V	250A 2-POLE	#4-300 KCMIL	466 [18.3]	72 [2.8]	295 [11.6]	314 [12.4]	NONE AVAILABLE			
		250A 3-POLE	#4-300 KCMIL	466 [18.3]	72 [2.8]	255 [10]	312 [12.3]	NONE AVAILABLE			
	Q4 240V	400A	#1-600 KCMIL	401 [15.8]	123 [4.8]	251 [9.9]	327 [12.9]	NONE AVAILABLE			
	P	800A 3-POLE	3/0-500 KCMIL	398 [15.7]	127 [5]	285 [11.2]	392 [15.4]	12 VDC SHUNT TRIP	-	200VA Δ 3	COMPRESSION TERMINALS FOR 1 OR 2 #1-18-16 AWG. TORQUE: 10 LB-IN
								1 EA. FORM C 4 AUX CONTACTS + 1 TRIP ALARM	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125 VDC, 0.3A AT 250 VDC	-	
	P	1200A 3-POLE	3/0-500 KCMIL	389 [15.3]	170 [6.7]	285 [11.2]	392 [15.4]	12 VDC SHUNT TRIP	-	200VA Δ 3	COMPRESSION TERMINALS FOR 1 OR 2 #1-18-16 AWG. TORQUE: 10 LB-IN
								1 EA. FORM C 4 AUX CONTACTS + 1 TRIP ALARM	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125 VDC, 0.3A AT 250 VDC	-	
	H	15-150	(1) #14-3/0 AWG	464 [18.3]	93.8 [3.69]	275 [10.8]	327 [12.9]	12 VDC SHUNT TRIP	COIL BURDEN < 5W	10A	COMPRESSION TERMINALS #14-#10 AWG, 50 LB-IN #8-3/0, 120 LB-IN
		175	(1) 1/0-4/0 AWG	454 [17.9]	108 [4.25]	275 [10.8]	327 [12.9]	1 EA FORM C 1 AUX CONTACT + 1 TRIP ALARM	MIN LOAD = 10 ma WITH 24V DC AC	-	COMPRESSION TERMINALS 3/0-350 KCMIL 225 LB-IN
	J	200-250	(1) 3/0-350 KCMIL								

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIM 10 0500_4668	DWN P. THEVAR		CUMMINS POWER GENERATION	
DO NOT SCALE PRINT			CND S. MOHARE		OUTLINE, CIRCUIT BREAKER	
DIM TOL	X ± 1	0.00- 4.99 +0.15/-0.08	APVD C. STENBERG	SITE CODE	PGF	SHEET 3 OF 3
	.X ± 0.8	5.00- 9.99 +0.20/-0.10	DATE 13 JUN 11			
	.XX ± 0.38	10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13				
ANG TOL: ± 1.0°		SCALE: 3/16	- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	FIRST USED ON DSCGAA, AB, AC, AD
					DWG SIZE D	PART NO A040K670

Transfer switch OTEC open transition



> Specification sheet

40 - 1200 Amp

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Description

OTEC transfer switches are designed for operation and switching of electrical loads between primary power and standby generator sets. They are suitable for use in emergency, legally required, and optional standby applications. The switches monitor both power sources, signal generator set startup, automatically transfer power, and return the load to the primary power source once a stable utility is available.

The fully integrated controller is designed for practical functionality, with LED indicators and digital pushbuttons for ease of operator use.



All switches are UL 1008 Listed with UL Type Rated cabinets and UL Listed CU-AL terminals.



All switches are certified to CSA 282 Emergency Electrical Power Supply for Buildings, up to 600 VAC.

NEC

Equipment shall be suitable for use in systems compliant to 700, 701 and 702.



All switches comply with NFPA 70, 99 and 110.



All switches comply with NEMA ICS 10.



All switches comply with IEEE 446 Recommended Practice for Emergency and Standby Power Systems.



This transfer switch is designed and manufactured in facilities certified to ISO9001.

Features

Microprocessor control - Easy-to-use, standard control. LEDs display transfer switch status; pushbuttons allow operator to activate control test, exercise timing and transfer mode.

Programmed transition - Open transition timing can be adjusted to completely disconnect the load from both sources for a programmed time period, as recommended by NEMA MG-1 for transfer of inductive loads.

Advanced transfer switch mechanism - Unique bi-directional linear actuator provides virtually friction-free, constant force, straight-line transfer switch action during automatic operation.

Manual operation - Manual operating handles, shielded termination, and over-center contact mechanisms allow effective manual operation under de-energized conditions.

Positive interlocking - Mechanical and electrical interlocking prevent source-to-source connection through the power or control wiring.

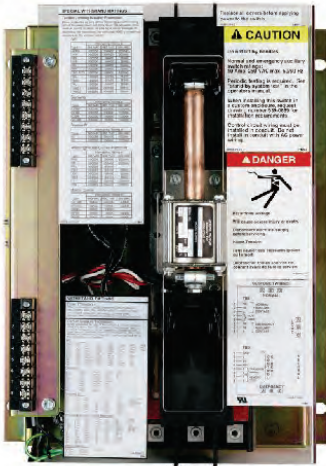
Main contacts - Heavy-duty silver alloy contacts with multi-leaf arc chutes are rated for 100% load interruption. They require no routine contact maintenance and provide 100% continuous current ratings.

Easy service/access - Single-plug harness connection and compatible terminal markings simplify servicing. Access space is ample. Door-mounted controls are field-programmable; no tool is required.

Complete product line - Cummins Power Generation offers a wide range of equipment, accessories and services to suit virtually any backup power application.

Warranty and service - Products are backed by a comprehensive warranty and a worldwide network of distributors with factory-trained service technicians.

Transfer switch mechanism



- Transfer switch mechanism is electrically operated and mechanically held in the Source 1 and Source 2 positions. The transfer switch incorporates electrical and mechanical interlocks to prevent inadvertent interconnection of the sources.
- Independent break-before-make action is used for both 3-pole and 4-pole/switched neutral switches. This design allows use of sync check operation when required, or control of the operating speed of the transfer switch for proper transfer of motor and rectifier-based loads (programmed transition feature).
- True 4-pole switching allows for proper ground (earth) fault sensing and consistent, reliable operation for the life of the transfer switch. The neutral poles of the transfer switch have the same ratings as the phase poles and are operated by a common crossbar mechanism, eliminating the possibility of incorrect neutral operation at any point in the operating cycle, or due to failure of a neutral operator.
- Electrical interlocks prevent simultaneous closing signals to normal and emergency contacts and interconnection of normal and emergency sources through the control wiring.
- High pressure silver alloy contacts resist burning and pitting. Separate arcing surfaces further protect the main contacts. Contact wear is reduced by multiple leaf arc chutes that cool and quench the arcs. Barriers separate the phases to prevent interphase flashover. A transparent protective cover allows visual inspection while inhibiting inadvertent contact with energized components.
- Switch mechanism, including contact assemblies, is third-party certified to verify suitability for applications requiring high endurance switching capability for the life of the transfer switch. Withstand and closing ratings are validated using the same set of contacts, further demonstrating the robust nature of the design.

Specifications

Voltage rating	Transfer switches rated from 40 A through 1200 A are rated up to 600 VAC, 50 or 60 Hz.
Arc interruption	Multiple leaf arc chutes cool and quench the arcs. Barriers prevent interphase flashover.
Neutral bar	A full current-rated neutral bar with lugs is standard on enclosed 3-pole transfer switches.
Auxiliary contacts	Two contacts (one for each source) are provided for customer use. Wired to terminal block for easy access. Rated at 10A continuous and 250 VAC maximum.
Operating temperature	-22 °F (-30 °C) to 140 °F (60 °C)
Storage temperature	-40 °F (-40 °C) to 140 °F (60 °C)
Humidity	Up to 95% relative, non-condensing
Altitude	Up to 10,000 ft (3,000 m) without derating
Total transfer time (source-to-source)	Will not exceed 6 cycles at 60 Hz with normal voltage applied to the actuator and without delayed transition enabled.
Manual operation handles	Transfer switches are equipped with permanently attached operating handles and quick-break, quick-make contact mechanisms suitable for manual operation under de-energized conditions.

Open transition/programmed – Controls the time required for the device to switch from source to source, so that the load-generated voltages decay to a safe level before connecting to an energized source. Recommended by NEMA MG-1 to prevent nuisance tripping breakers and load damage. Adjustable 0-60 seconds, default 0 seconds.

Open transition/in-phase – Initiates open transition transfer when in-phase monitor senses both sources are in phase. Operates in a break-before-make sequence. Includes ability to enable programmed transition as a backup. If sources are not in phase within 120 seconds, the system will transfer using programmed transition.

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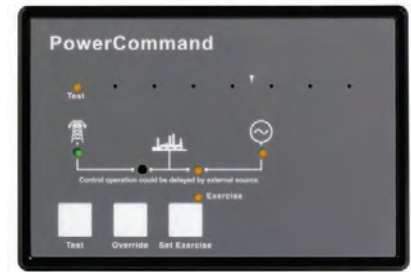
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S-1464o (5/12)



Microprocessor control

- Simple, easy-to-use control provides transfer switch information and operator controls
- LED lamps for source availability and source connected indication, exercise mode, and test mode. LED status lamps also provided for control set-up and configuration.
- Pushbutton controls for initiating test, overriding time delays and setting exercise time.
- Field-configurable for in-phase open or programmed open transition.
- Integral exerciser clock
- Control is prototype-tested to withstand voltage surges per EN 60947-6-1.
- Gold-flashed generator start contacts



Control functions

Voltage sensing: All phases on the normal source and single phase on generator source. Normal Source Pickup: adjustable 90-95%, Dropout: adjustable 70-90% of nominal voltage; Generator Source Pickup: 90%, dropout: 75% of nominal voltage.

Frequency sensing: Generator Source Pickup: 90% of nominal frequency; Dropout: 75% of nominal frequency.

Exerciser clock: Switch is furnished with an integral engine exerciser configurable for operation on a 7, 14, 21, or 28-day cycle with a fixed exercise period duration of 20 minutes. A 12-hr exerciser time offset allows for the convenient setting of exercise time without the need to activate the timer at the exact time that you need to schedule the generator exercise for. Software selectable capability allows for the exercising of the generator with or without load.

Time-delay functions

Engine start: Prevents nuisance genset starts due to momentary power system variation or loss. Adjustable: 0-10 seconds; default: 3 seconds.

Transfer normal to emergency: Allows genset to stabilize before application of load. Prevents power interruption if normal source variation or loss is momentary. Allows staggered transfer of loads in multiple transfer switch systems. Adjustable 0-300 seconds, default 5 seconds.

Retransfer emergency to normal: Allows the utility to stabilize before retransfer of load. Prevents needless power interruption if return of normal source is momentary. Allows staggered transfer of loads in multiple transfer switch systems. Adjustable 0-30 minutes, default 10 minutes.

Genset stop: Maintains availability of the genset for immediate reconnection in the event that the normal source fails shortly after transfer. Allows gradual genset cool down by running unloaded. Adjustable 0-30 minutes, default 10 minutes.

Delayed (programmed) transition: Controls the speed of operation of the transfer switch power contacts to allow load generated voltages from inductive devices to decay prior to connecting a live source. Adjustable 0-10 seconds, default 0 seconds.

Elevator signal: Provides a relay output contact for the elevator signal relay (load disconnect). The signal can also be configured to provide a post transfer delay of the same duration. Adjustable: 0-300 seconds (requires optional elevator signal relay for use).

Options

Elevator signal relay: Provides a relay output contact for the signal relay function

Programmable exerciser clock: Provides a fully-programmable 7-day clock to provide greater flexibility in scheduling exercise periods than standard integral exerciser. Time-of-day setting feature operates generator during periods of high utility rates.

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UL withstand and closing ratings

The transfer switches listed below must be protected by circuit breakers or fuses. Referenced drawings include detailed listings of specific breakers or fuse types that must be used with the respective transfer switches. Consult with your distributor/dealer to obtain the necessary drawings. Withstand and Closing Ratings (WCR) are stated in symmetrical RMS amperes.

Transfer switch ampere	MCCB protection			Special circuit breaker protection		
	WCR at volts max with specific manufacturers MCCBs	Max MCCB rating	Drawing reference	With specific current limiting breakers (CLB)	Max CLB rating	Drawing reference
40, 70, 125 3-pole	14,000 at 600	225 A	098-6885	200,000 @ 600	225 A	098-6918
40, 70, 125 4-pole	30,000 at 600	225 A	098-6885	200,000 @ 600	225 A	098-6918
150, 225, 260	30,000 at 600	400 A	098-6886	200,000 @ 600	400 A	098-6919
300, 400, 600	65,000 at 600	1200 A	098-6887	200,000 @ 600	1200 A	098-6920
800, 1000	65,000 at 480	1400 A	098-6888	200,000 @ 600	1400 A	098-6921
	50,000 at 600					
1200	85,000 at 480	1600 A	A030U183	200,000 @ 600	1600 A	A030U185
	65,000 at 600					

Fuse protection

Transfer switch ampere	WCR at volts max. with current limiting fuses	Max fuse, size and type	Drawing reference
40, 70, 125 3- and 4-pole	200,000 at 600	200 A Class, J, RK1, RK5, T	098-6885
150, 225, 260	200,000 at 600	1200 A Class L or T, or 600 A class J, RK1, RK5	098-6886
300, 400, 600	200,000 at 600	1200 A Class L or T, or 600 A Class, J, RK1, RK5	098-6887
800, 1000	200,000 at 600	2000 A Class L or 1200 A class T or 600 A class J, RK1, RK5	098-6888
1200	200,000 at 600	2000 A Class L or 1200 A class T or 600 A class J, RK1, RK5	A030U183

3-cycle ratings

Transfer switch ampere	WCR at volts max 3-cycle rating	Max MCCB rating	Drawing reference
1200	42,000 at 600	1600 A	A030U183
	50,000 at 480		

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Enclosures

The transfer switch and control are wall-mounted in a key-locking enclosure. Wire bend space complies with 2008 NEC.

Dimensions - transfer switch in UL type 1 enclosure

Amp rating	Height		Width		Depth				Weight		Outline drawing
	in	mm	in	mm	Door closed		Door open		lb	kg	
					in	mm	in	mm			
40, 70, 125 3-pole	27.0	686	20.5	521	12.0	305	31.5	800	82	37	0310-0544
40, 70, 125 4-pole	35.5	902	26.0	660	16.0	406	41.0	1042	165	75	0500-4896
150, 225	35.5	902	26.0	660	16.0	406	41.0	1042	165	75	0310-0414
260	43.5	1105	28.5	724	16.0	406	43.0	1093	170	77	0310-0540
300, 400, 600	54.0	1372	25.5	648	18.0	457	42.0	1067	225	102	0310-1307
800, 1000	68.0	1727	30.0	762	19.5	495	48.5	1232	360	163	0310-0417
1200	90.0	2286	39.0	991	27.0	698	63.0	1600	730	331	A030L411

Dimensions - transfer switch in UL type 3R, 4, 4X, or 12 enclosure

Amp rating	Height		Width		Depth				Weight		Cabinet type	Outline drawing
	in	mm	in	mm	Door closed		Door open		lb	kg		
					in	mm	in	mm				
40, 70, 125 3-pole	34.0	864	26.5	673	12.5	318	36.5	927	125	57	3R, 12	0310-0453
	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4	0310-0445
40, 70, 125 4-pole	42.5	1080	30.5	775	16.0	406	44.0	1118	215	97	3R, 12	0500-4896
	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4	0500-4896
125, 225	42.5	1080	30.5	775	16.0	406	44.0	1118	215	97	3R, 12	0310-0454
	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4	0310-0446
260	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	3R, 12	0310-0455
											4	0310-0447
											4X	0500-4184
300, 400, 600	59.0	1499	27.5	699	16.5	419	41.5	1054	275	125	3R, 12	0310-1315
											4	0310-1316
											4X	0500-4185
800, 1000	73.5	1867	32.5	826	19.5	495	49.5	1257	410	186	3R, 12	0310-0457
											4	0310-0449
											4X	0500-4185
1200	90.0	2286	39.0	991	27.0	698	63.0	1600	730	331	3R, 12	A030L411
											4, 4X	A041N370

Transfer switch lug capacities

All lugs accept copper or aluminum wire unless indicated otherwise.

Transfer switch ampere	Cables per phase	Size
40, 70, 125 3-pole	1	#12 AWG-2/0
40 4-pole	1	#12 AWG-2/0
70, 125 4-pole	1	#6 AWG - 300 MCM
125, 225	1	#6 AWG - 300 MCM
260	1	#6 AWG - 400 MCM
300, 400	1	3/0 - 600 MCM
300, 400	2	3/0 - 250 MCM
600	2	250 - 500 MCM
800	4	250 - 500 MCM
1000, 1200	4	#2 AWG-750 MCM

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Submittal detail

Amperage ratings

- 40
- 70
- 125
- 150
- 225
- 260
- 300
- 400
- 600
- 800
- 1000
- 1200

Voltage ratings

- R020 120
- R038 190
- R021 208
- R022 220
- R023 240
- R024 380
- R025 416
- R035 440
- R026 480
- R027 600

Pole configuration

- A028 Poles - 3 (solid neutral)
- A029 Poles - 4 (switched neutral)

Frequency

- A044 60 Hertz
- A045 50 Hertz

Application

- A035 Utility to genset

System options

- A041 Single phase, 2-wire or 3-wire
- A042 Three phase, 3-wire or 4-wire

Enclosure

- B002 Type 3R: intended for outdoor use, provides some protection from dirt, rain and snow (similar to IEC Type IP34)
- B003 Type 4: indoor or outdoor use, provides some protection from wind-blown dust and water spary (similar to IEC Type IP65)
- B010 Type 12: indoor use, some protection from dust (similar to IEC Type IP61)
- B025 Type 4X: stainless steel, indoor or outdoor use, provides some protection from corrosion (similar to IEC Type IP65)

Standards

- A046 UL 1008/CSA certification
- A080 Seismic certification

Control voltage

- M033 12V, Genset starting voltage
- M034 24V, Genset starting voltage

Control options

- J030 External exercise clock
- M032 Elevator signal relay

Battery chargers

- K001 2 amps, 12/24 volts
- KB59 15 amps, 12 volts
- KB60 12 amps, 24 volts

Auxiliary relays

Relays are UL Listed and factory installed. All relays provide (2) normally closed isolated contacts rated 10 A @ 600 VAC. Relay terminals accept (1) 18 gauge to (2) 12 gauge wires per terminal.

- L101 24 VDC coil - installed, not wired (for customer use).
- L102 24 VDC coil - emergency position - relay energized when switch is in source 2 (emergency) position.
- L103 24 VDC coil - normal position - relay energized when switch is in source 1 (normal) position
- L201 12 VDC coil installed, not wired (for customer use)
- L202 12 VDC coil - emergency position - relay energized when switch is in source 2 (emergency) position
- L203 12 VDC coil - normal position - relay energized when switch is in source 1 (normal) position

Miscellaneous options

- C027 Cover - guard
- M003 Terminal block - 30 points (not wired)

Optional lug kits

- N032 Lug adapters, compression, ½ stab
- N045 Cable lugs, mechanical, 600 MCM, 4 per pole
- N066 Cable lugs, mechanical, 750 MCM, 4 per pole

Warranty

- G009 1 year comprehensive
- G004 2 year comprehensive
- G006 5 year basic
- G007 5 year comprehensive
- G008 10 year major components

Shipping

- A051 Packing - export box (800-1000 A)

Accessories

- AC-170 Accessories specifications sheet

Cummins Power Generation

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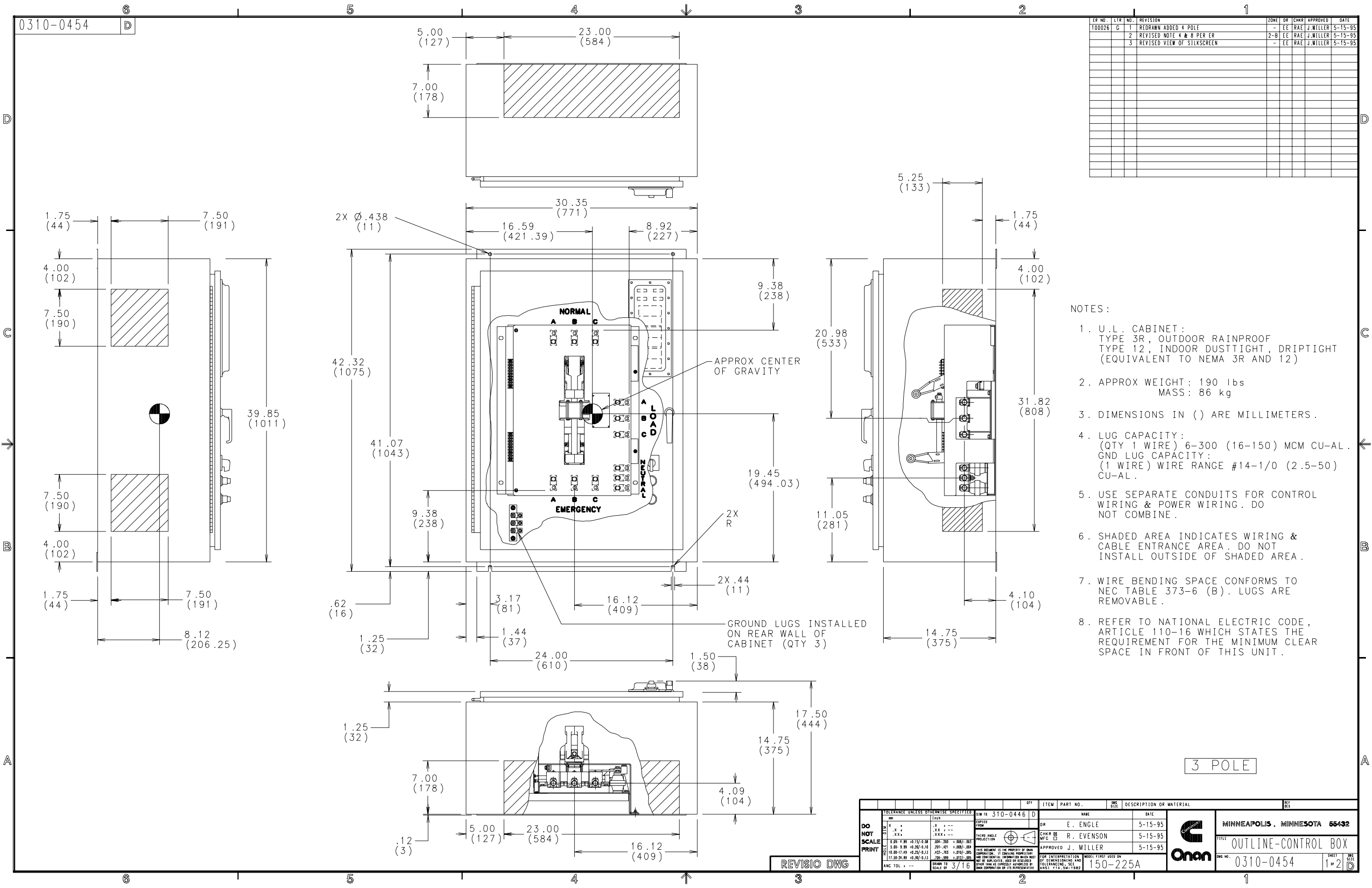
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0310-0454

REV NO.	DATE	REVISION	ZONE	DR	CHKD	APPROVED	DATE
100026	G	1	-	EE	RAE	J. MILLER	5-15-95
		2	-	2-B	EE	RAE	J. MILLER
		3	-	EE	RAE	J. MILLER	5-15-95



NOTES:

- U.L. CABINET: TYPE 3R, OUTDOOR RAINPROOF; TYPE 12, INDOOR DUSTTIGHT, DRIPTIGHT (EQUIVALENT TO NEMA 3R AND 12)
- APPROX WEIGHT: 190 lbs; MASS: 86 kg
- DIMENSIONS IN () ARE MILLIMETERS.
- LUG CAPACITY: (QTY 1 WIRE) 6-300 (16-150) MCM CU-AL. GND LUG CAPACITY: (1 WIRE) WIRE RANGE #14-1/0 (2.5-50) CU-AL.
- USE SEPARATE CONDUITS FOR CONTROL WIRING & POWER WIRING. DO NOT COMBINE.
- SHADED AREA INDICATES WIRING & CABLE ENTRANCE AREA. DO NOT INSTALL OUTSIDE OF SHADED AREA.
- WIRE BENDING SPACE CONFORMS TO NEC TABLE 373-6 (B). LUGS ARE REMOVABLE.
- REFER TO NATIONAL ELECTRIC CODE, ARTICLE 110-16 WHICH STATES THE REQUIREMENT FOR THE MINIMUM CLEAR SPACE IN FRONT OF THIS UNIT.

3 POLE

REVISIO DWG

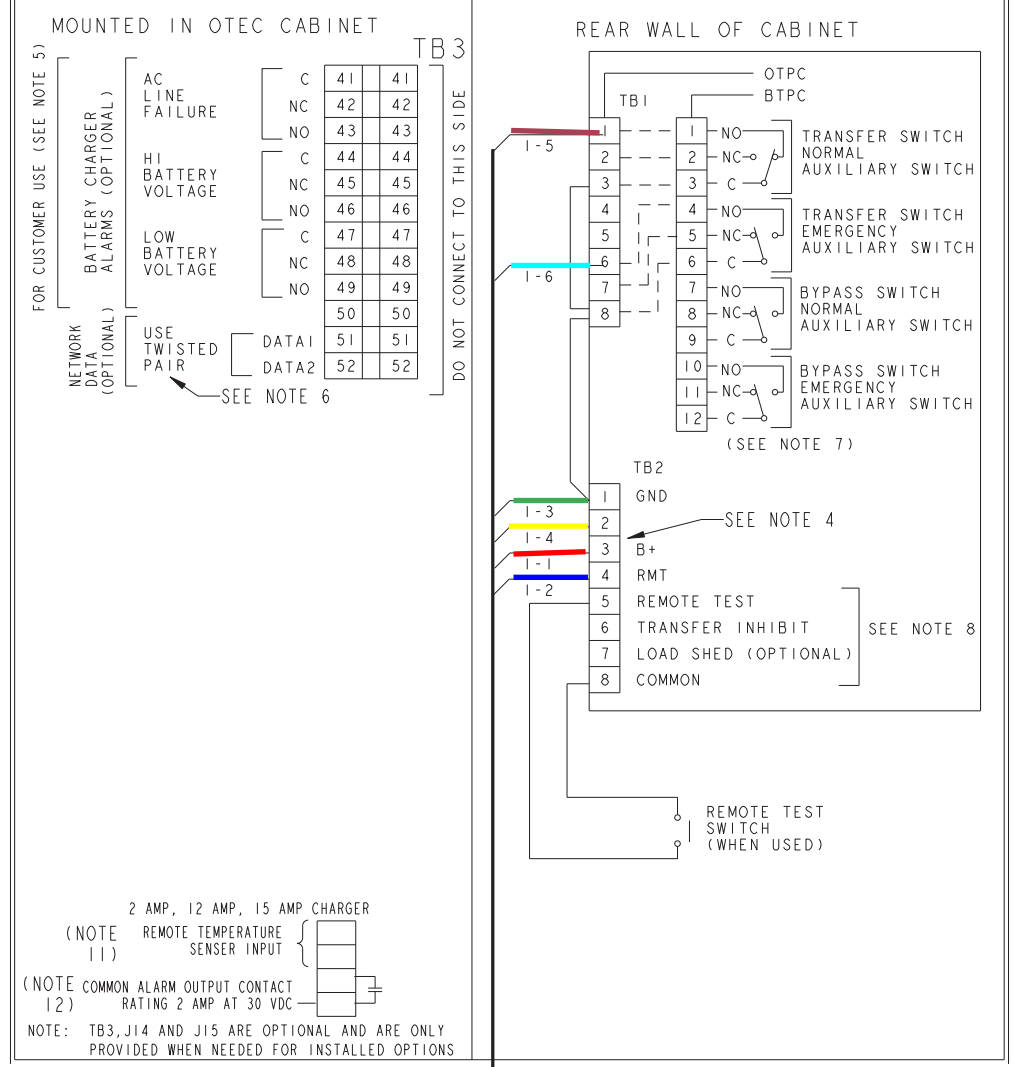
TOLERANCE UNLESS OTHERWISE SPECIFIED		DIM TO 310-0446 D		ITEM PART NO.		DESCRIPTION OR MATERIAL		REF DES	
INCH	FRACTION	MM	DECIMAL	QTY	NAME	QTY	DATE		
.125	1/8	3.175	0.125		DR E. ENGLE		5-15-95		
.005	0.005	0.127	0.005		CHR DR R. EVENSON		5-15-95		
.001	0.001	0.025	0.001		MFG APPROVED J. MILLER		5-15-95		
DO NOT SCALE PRINT		SCALE OF 3/16		MODEL FIRST USED ON 150-225A					

MINNEAPOLIS, MINNESOTA 55432
Onan
 TITLE: OUTLINE-CONTROL BOX
 DWG NO.: 0310-0454
 SHEET 1 OF 2

OTEC UTILITY TO GENSET

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
ECO-103227	F	2	ADDED THIS SHEET	-	JFM	RS	SCROGGINS	14 JAN 09

ONAN/CUMMINS GENERATOR SET WITH PCC1.X, PCC2.X, PCC3.X CONTROL

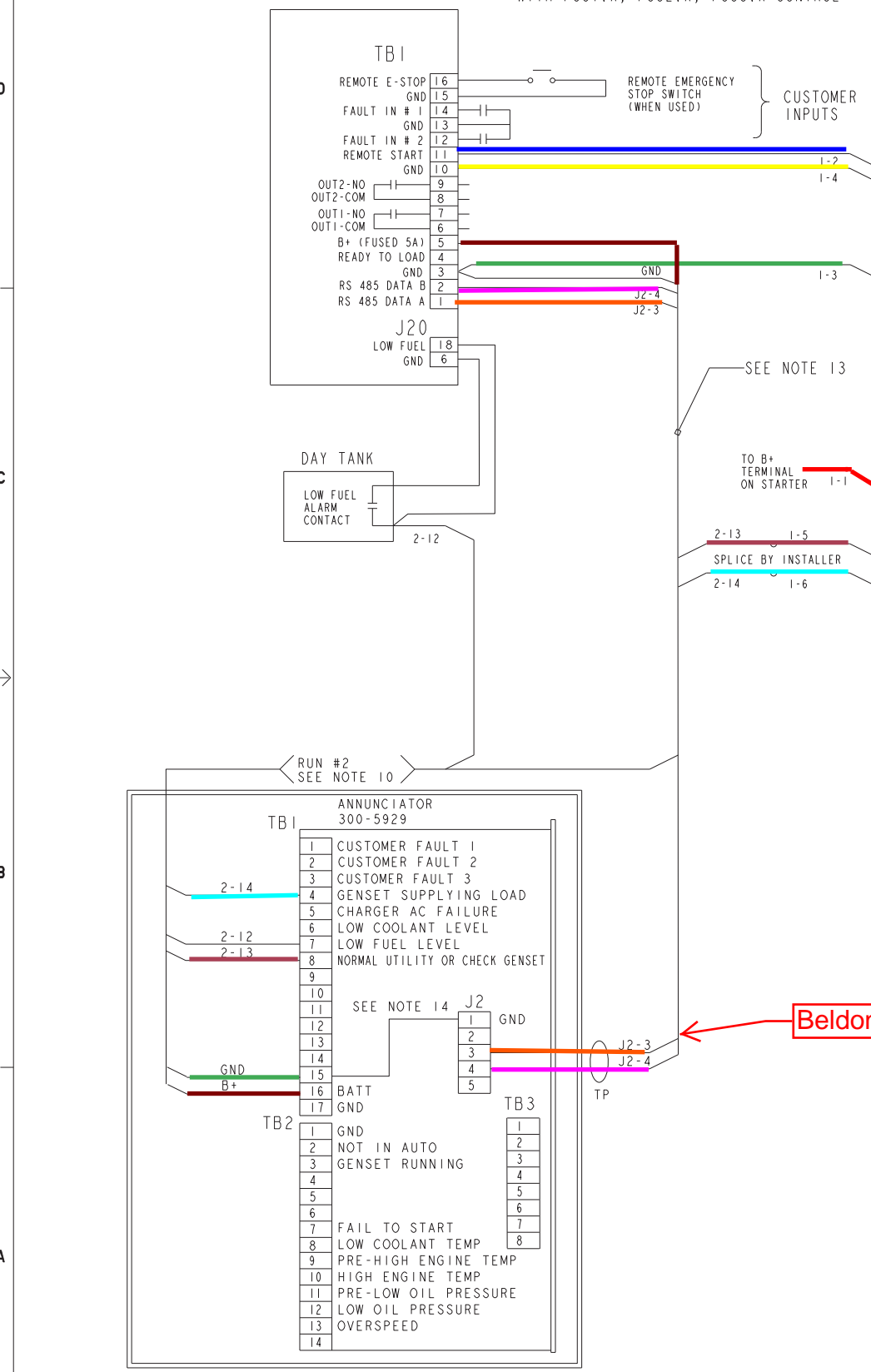


- NOTES:
- WIRE SIZES MUST BE AS FOLLOWS:
 RUN #1-GENSET TO TRANSFER SWITCH-LEAD SIZE MUST BE INCREASED IF A BATTERY CHARGER IS INSTALLED IN THE SWITCH.
 WITH NO BATT CHARGER-LEADS 1-1, -2, -3, -4, -5 USE COL A.
 WITH 2 AMP CHARGER, MAXIMUM VOLTAGE DROP OF 1.5 VOLTS, LEADS 1-1, & 1-3 USE COL B.
 WITH 12/15 AMP CHARGER MAXIMUM VOLTAGE DROP OF 1.5 VOLTS, LEADS 1-1 & 1-3 USE COL. C.
 WITH 2 AMP CHARGER, MAXIMUM VOLTAGE DROP OF 0.75 VOLTS, LEADS 1-1, & 1-3 USE COL D.
 WITH 12/15 AMP CHARGER, MAXIMUM VOLTAGE DROP OF 0.75 VOLTS, LEADS 1-1, & 1-3 USE COL E. TO MEET THE NFPA110 REQUIREMENT TO RETURN A FULLY DISCHARGED BATTERY TO 100% OF IT'S AMPERE-HOUR RATING WITHIN 24 HOURS USE COL. E.
 - RUN #2-GENSET TO ANNUNCIATOR-ALL LEADS, USE COL. A
 - FOR MULTIPLE TRANSFER SWITCHES, DUPLICATE RUN #1 FOR EACH SWITCH. DAISY CHAIN CONNECTION IS ACCEPTABLE PROVIDED WIRE SIZE & DISTANCE TO THE LAST SWITCH MEET THE SPECS IN NOTE 1.
 - DO NOT INSTALL JUMPER BETWEEN TB2-2 & TB2-3 AND TB2-1 & TB2-2.
 - CONTACTS RATED: 4 AMPS AT 30 VDC OR 120V MAX.
 - USE STRANDED TWISTED PAIR WIRES WHEN CONNECTING DATA1 AND DATA2 TO THE NETWORK.
 - TRANSFER SWITCH SHOWN CLOSED TO NORMAL. BYPASS SWITCH SHOWN IN NEUTRAL POSITION.
 - CONNECT AN OPEN DRY CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). FOR REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED. CLOSE TO ACTIVATE.
 - CONTACTS RATED: 2 AMPS AT 30 VDC OR 0.60 AMPS AT 120 VAC.
 - REFER TO 0900-0301 FOR INSTALLATION OF 0300-5929.
 - USE THE INVENTER REMOTE TEMPERATURE PROBE (0193-0530).
 - THE FOLLOWING FAILS WILL CAUSE A BATTERY CHARGER ALARM OUTPUT:
 LOW BATTERY VOLTAGE, HIGH BATTERY VOLTAGE, LOW AC INPUT VOLTAGE, HIGH AC INPUT VOLTAGE, OVERCURRENT, HIGH CHARGER TEMPERATURE, BATTERY FAILURE, HIGH BATTERY TEMPERATURE (NOT AVAILABLE ON 2 AMP CHARGER).
 - NETWORK CONNECTIONS: USE BELDEN 9729 24 GAUGE TWISTED, STRANDED, SHIELDED CABLE. SHIELD SHOULD BE GROUNDED AT ONE END. TOTAL NETWORK LENGTH NOT TO EXCEED 4000 FEET. UP TO 20 NODES CAN BE CONNECTED TO THE NETWORK. (NOTE ANY COMMUNICATIONS WIRE CONNECTED TO THE GENSET SHOULD BE STRANDED CABLE.)
 - J2-1 CAN BE INTERCONNECTED TO PROVIDE A COMMON LOGIC REFERENCE WHEN APPLICABLE. J2-1 CAN BE USED TO INTERCONNECT TWO CONTROLS WHERE ONE OF THE CONTROLS USES A FLOATING DC POWER SUPPLY NOT CONNECTED TO EARTH GROUND AND THE OTHER IS CONNECTED TO EARTH GROUND. OTHERWISE, USING J2-1 CAN INDUCE A GROUND LOOP.

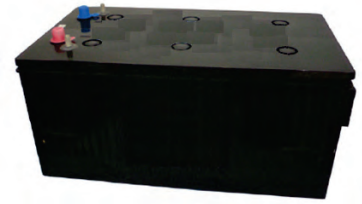
WIRE SIZE (AWG)	DISTANCE IN FEET, ONE WAY (MULTIPLY BY 0.3 FOR METERS)				
	A	B	C	D	E
16	1000	90	-	50	-
14	1600	150	20	80	5
12	2400	225	30	125	10
10	4000	350	50	200	15
8	-	600	80	300	25
6	-	1000	125	500	40

Belden 9729 Cable

DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED	SIM TO 0630_1974	QTY	ITEM	PART NO	DATE	DESCRIPTION OR MATERIAL	REF DES
ANG TOL ± 1.0°	INCHES X ± 0.1 .X ± 0.8 .XX ± 0.38	INCHES X ± .XX ± .XXX ±						
SCALE OF 1/1	MILLIMETERS 0.09-4.99 +0.15/-0.08 5.00-9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13	MILLIMETERS 004-200 1.006/-0.03 201-421 1.008/-0.04 422-703 1.010/-0.05 704-999 1.012/-0.05						
				APPROVED J MILLER		02-13-04		
				OTEC			WD- INTERCONNECTION	
					PGA	0630_2810		



Batteries and accessories



> **Specification sheet**

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**Power
Generation**

Battery Specifications

Part number	Battery	Cold cranking amps	Voltage	Reserve capacity	Length	Width	Height	Group size	Ship weight lbs	Qts electrolyte
0416-0439	Dry	1400	12	430	20.75	11.00	9.63	8D	110	16.0
0416-0579	Dry	525	12	90	10.25	6.63	8.75	24C-675	20	6.0
0416-0579-01	Wet	525	12	90	10.25	6.63	8.75	24C-675	36	6.0
0416-0796	Wet	725	12	150	13.00	6.88	9.63	31-4	62	4.2
0416-0823	Dry	725	12	150	13.00	6.88	9.63	31-4	42	4.2
→ 0416-0848	Dry	1080	12	270	20.75	8.63	9.63	4D	85	13.0
0416-0980	Wet	1000	12	200	13.00	6.88	9.63	31-5	65	4.2
0416-1040	Dry	800	12	160	13.00	6.88	9.44	31	65	4.2
0416-1051	Wet	530	12	80	8.13	6.63	7.50	26-775	31	3.7
0416-1105	Wet	1400	12	430	20.75	11.00	9.63	8D	125	16.0
0416-1138	Sealed	NA	12	NA	5.88	3.88	3.75	NP12-12	9	4.0
0416-1264	Dry	730	12	420	20.67	10.83	9.45	8D	110	16.0
0416-1291	Sealed	800	12	110	10.00	6.88	7.81	34	38	4.0
0416-1330	Wet	810	12	146	10.25	6.63	8.88	24XL	43	5.9
0416-1332	Dry	420	12	60	9.13	5.25	8.88	22NF	19	4.0

Application

Listed below, by set model, is the specific battery designed to fit the skid mounted battery rack. (Larger batteries, if required, may not fit the standard skid mounted rack.)

Model	Begin spec	Current spec	Battery P/N	Quantity
DFAA	F	H	0416-0439	2
DFAB	G	N	0416-0439	2
DFAC	F	N	0416-0439	2
DFBF	M	Z	0416-0439	2
DFCB	M	Z	0416-0439	2
DFCC	M	Z	0416-0439	2
DFCE	B	J	0416-0439	2
DFEB	M	T	0416-0439	2
DFEC	E	L	0416-0439	2
DFED	B	H	0416-0439	2
DFEG	A	K	0416-0439	2
DFEH	A	K	0416-0439	2
DFEJ	A	K	0416-0439	2
DFEK	A	K	0416-0439	2
DFGA	F	H	0416-0439	4
DFGB	F	L	0416-0439	4
DFGE	A	D	0416-0439	4
DFHA	A	J	0416-0439	2
DFHB	A	J	0416-0439	2
DFHC	A	H	0416-0439	2
DFHD	A	H	0416-0439	2
DFJA	E	M	0416-0439	4
DFJB	E	M	0416-0439	4
DFJC	N	R	0416-0439	4
DFJD	F	H	0416-0439	4
DFLB	M	T	0416-0439	4
DFLC	N	W	0416-0439	4
DFLD	E	N	0416-0439	4
DFLE	A	F	0416-0439	4
DFMB	E	T	0416-0439	4
DGBB	E	M	0416-0848	1
DGBB	E	M	0416-0980	1
DGBC	D	L	0416-0848	1
DGBC	D	L	0416-0980	1
DGCA	M	V	0416-0848	1
DGCA	M	V	0416-0980	1
DGCB	M	V	0416-0848	1
DGCB	M	V	0416-0980	1
DGCG	A	C	0416-0848	1
DGCG	A	C	0416-0980	1
DGDA	A	C	0416-0848	1
DGDA	A	C	0416-0980	1
DGDB	L	S	0416-0848	1
DGDB	L	S	0416-0980	1
DGDK	L	S	0416-0848	1
DGEA	L	S	0416-0980	1
DGFA	A	S	0416-0848	1
DGFB	K	S	0416-0848	1
DGFC	K	S	0416-0848	1
DGFS	K	S	0416-0848	1

Model	Begin spec	Current spec	Battery P/N	Quantity
DGGD	A	E	0416-0980	1
DGHCA	A	A	0416-0980	1
DGHCB	A	A	0416-0980	1
DGHCC	A	A	0416-0980	1
DGHDA	A	A	0416-0980	1
DGHDB	A	A	0416-0980	1
DGHD	A	E	0416-0980	1
DGHE	A	E	0416-0980	1
DKAC	A	C	0416-0579	1
DKAE	A	D	0416-0796	1
DKAF	A	E	0416-0796	1
DNAA	A	B	0416-1040	1
DNAB	A	B	0416-1040	1
DNAF	A	E	0416-1040	1
DQAA	A	F	0416-0439	4
DQAB	A	F	0416-0439	4
DQAD	A	E	0416-0439	2
DQAE	A	E	0416-0439	2
DQAF	A	E	0416-0439	2
DQBA	B	G	0416-0439	2
DQBB	B	G	0416-0439	2
DQCA	A	C	0416-0439	2
DQCB	A	C	0416-0439	2
DQCC	A	C	0416-0439	2
DQDAA	B	F	0416-0848	2
DQDAB	B	F	0416-0848	2
DQDAC	B	E	0416-0848	2
DQFAA	A	E	0416-0439	2
DQFAB	A	E	0416-0439	2
DQFAC	A	E	0416-0439	2
DQFAD	A	E	0416-0439	2
DQGAA	A	C	0416-0439	4
DQGAB	A	C	0416-0439	4
DQGAC	A	B	0416-0439	4
DQGAE	A	A	0416-0439	4
DQGAF	A	A	0416-0439	4
DQHAA	A	E	0416-0439	2
DQHAB	A	E	0416-0439	2
DQKAA	A	D	0416-0439	4
DQKAB	A	D	0416-0439	4
DQKAD	A	A	0416-0439	4
DQKAE	A	A	0416-0439	4
DQKAF	A	A	0416-0439	4
DQKB	A	G	0416-0439	4
DQKC	A	G	0416-0439	4
DQKD	A	A	0416-0439	4
DQKH	A	E	0416-0439	4
DQLA	A	A	0416-0439	6
DQLB	A	A	0416-0439	6
DQLC	A	B	0416-0439	6

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Battery Accessories

Battery racks (Not recommended for mounting on skids.)

Part number	Description
0416-0527	20.5" x 11" (includes hold down brackets)
0416-0475	14.5" x 9.25" (loose rack, not intended for anchoring)
0541-0798	13.725" x 9.725" (includes hold down brackets)

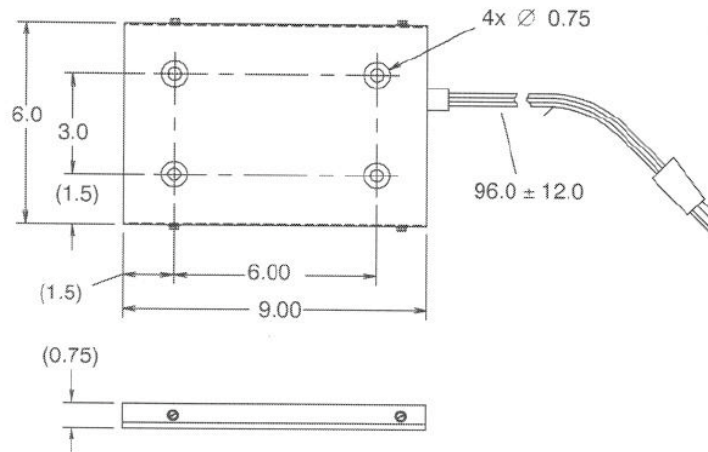
Battery heater Increases battery starting capability in lower than optimum ambient temperatures.

Heater Kit	Temperature Range	Voltage AC	Watts	Inst Sheet	Critical Component
0333-0469	Preset to maintain 80° F	120	200	NA	0333-0469-01
0333-0770	65° F on; 80° F off	120	50	G744	NA – as purchased
0541-0555	40° F / 70° F Setting	120	120	C587	0333-0636

Battery box

Part number	Description
0416-1263	Battery box has approximate inside dimensions of 21.125" long X 11.75" wide X 10.5" high. Box is constructed of black plastic with 4 mounting feet and a cover held on by 2 thumb screws. The box also has 2 slots on each side to accommodate battery cables. (see drawing on page 3). Note: Box material will become soft and pliable around 240 °F.

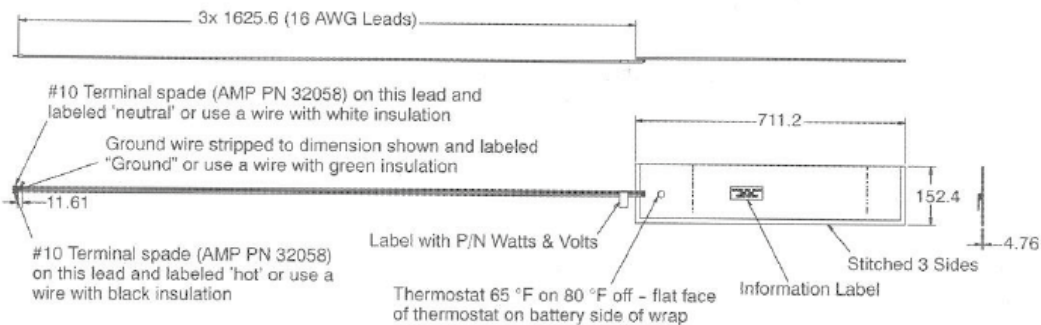
Image 1: 0333-0469



Specifications

200 Watts / 120 Volts
Preset to maintain 80° F

Image 2: 0333-0770



Specifications

50 Watts / 120 Volts
288 Total OHMS; 274 Min OHMS; 317 Max OHMS

Notes

1. All seams folded over onto Battery side are stitched.
2. This area is unheated.
3. Two wire ties attach to the battery

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Image 3: 0541-0555



Specifications

120 Watts / 120 Volts
 Thermostatically Controlled
 40° F / 70° F Setting
 24", 22 gauge Teflon leads
 6.5" x 7.9" silicone rubber

Components

Item #	Part #	Quantity	Description
1	0333-0636	1	Battery Heater
2	0898-1195-01	2.5	Insulation Sleeving
3	0332-2630	2	Spade Terminal (AMP 52929-3)
4	0418-0079	1	Box
5	000C-0587	1	Instruction Sheet
6	0098-7591-14	1	Label

Americas
 1400 73rd Avenue N.E.
 Minneapolis, MN 55432 USA
 Phone: 763 574 5000
 Fax: 763 574 5298

Europe, CIS, Middle East and Africa
 Manston Park Columbus Ave.
 Manston Ramsgate
 Kent CT 12 5BF United Kingdom
 Phone 44 1843 255000
 Fax 44 1843 255902

Asia Pacific
 10 Toh Guan Road #07-01
 TT International Tradepark
 Singapore 608838
 Phone 65 6417 2388
 Fax 65 6417 2399

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect generator sets to any building electrical system except through an approved device or after building main switch is open.

Warning: For professional use only. Must be installed by a qualified service technician. Improper installation presents hazards of electrical shock and improper operation, resulting in severe personal injury and/or property damage.

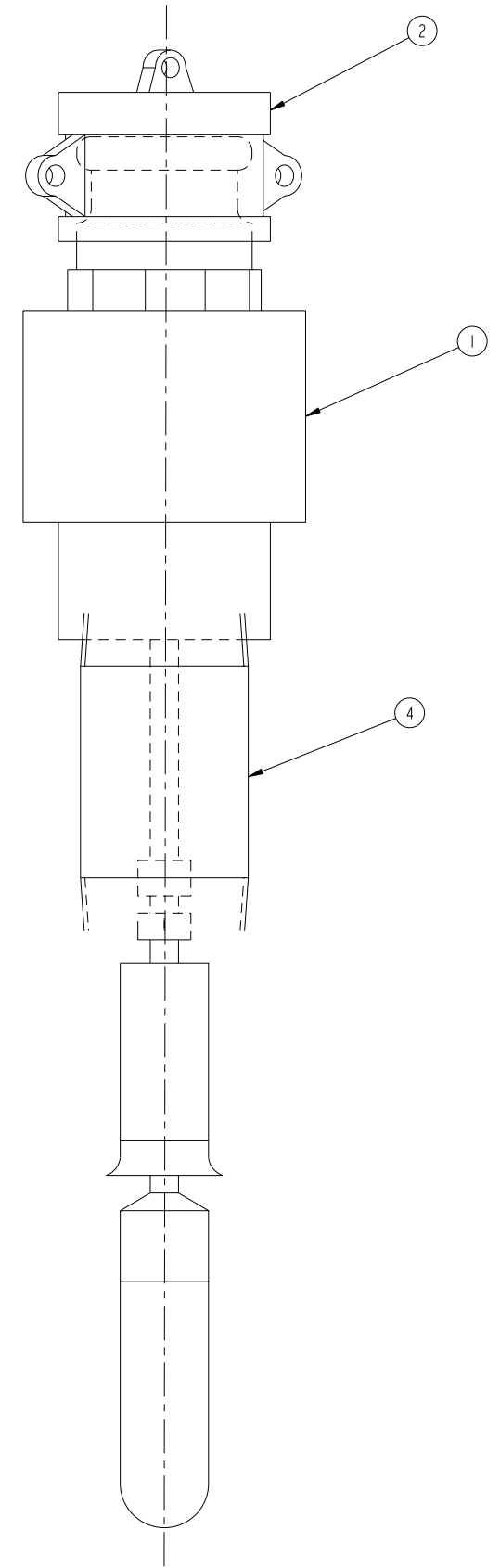
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REL NO	LTR	NO	REVISION	ZONE	OWN	CRD	APVD	DATE
ECO-101939	B	1	ADD PICTORIAL REPRESENTATION ON THE DRAWING	-	PY	VO	HAWKINS	13NOV08
		2	ADD TABULATION HEADING / CHG ITEM 5 QTY 2 WAS 1	-	PY	VO	HAWKINS	13NOV08

NOTES:
 1. THIS PART IS MANUFACTURER SOURCE CONTROLLED.
 2. APPLICABLE FOR USE ON FUEL TANKS: 0159-1720-01
 0159-1720-02

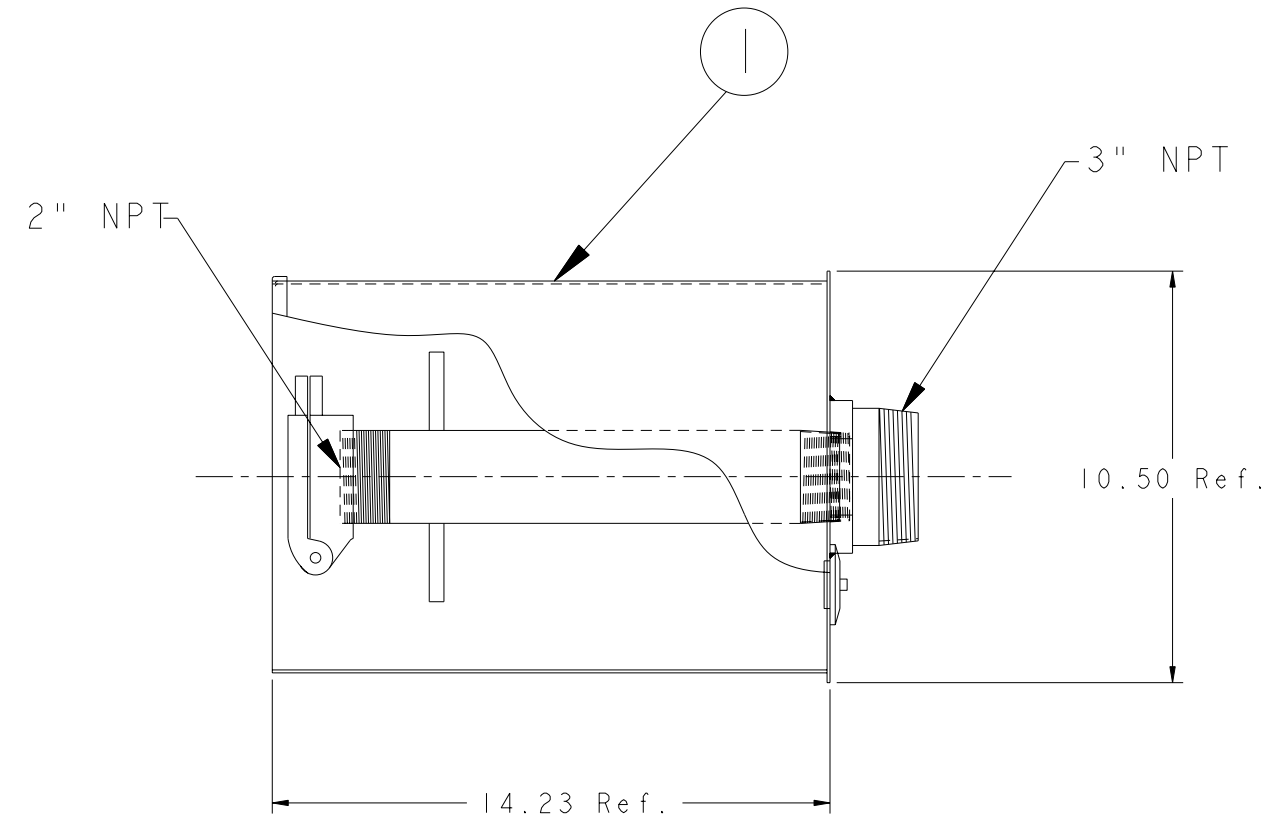


SUPPLIER TABULATION FOR REFERENCE ONLY				
ITEM NO.	QTY	UAI PART NO.	DESCRIPTION	UAI VENDOR PART NO. (REF)
1	1	OFPV 002F	VALVE, OVER FILL PREVENTION 2"	MORRISON 9095S-0500 AV
2	1	QD 800DC	CAP, FUEL INLET 2" AL	MORRISON 800DC
3	1	LA 00028	LABEL, (REV C)	
4	1	NP 20045PT	NIPPLE, 2" NPT X 4.5" LG PAINTED	
5	2	-	LABEL, SHIPPING	
6	1	-	BOX, SHIPPING	
7	1	BOX 212R	BOX, SHIPPING	
8	1	CPG-G737	INSTRUCTION SHEET	

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		ITEM	PART NO	DESCRIPTION OR MATERIAL	CUMMINS POWER GENERATION 1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432 FUEL SYSTEM KIT OFPV
DIM X ± 1 .X ± 0.8 .XX ± 0.38		SIM TO DO NOT SCALE PRINT		DWN L. ARNOLD CRD D. GILLETT APVD D. GILLETT DATE 02-13-07	
TOLERANCE 0.00- 4.99 +0.15/-0.08 5.00- 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13		ANG TOL: ± 1.0° SCALE: 1/1		SITE CODE PGF	SHEET 1 OF 1 DWG REC B
- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994		FIRST USED ON DSGAA, AB, AC	0541-1464

REL NO	LTR	NO	REVISION	ZONE	OWN	CRD	APVD	DATE
ECO-101939	B	1	ADD PICTORIAL REPRESENTATION ON THE DRAWING	-	PY	VO	HAWKINS	13NOV08
		2	ADD TABULATION HEADING	-	PY	VO	HAWKINS	13NOV08

NOTES:
 1. THIS PART IS MANUFACTURER SOURCE CONTROLLED.
 2. APPLICABLE FOR USE ON FUEL TANKS: 0159-1720-01
 0159-1720-02

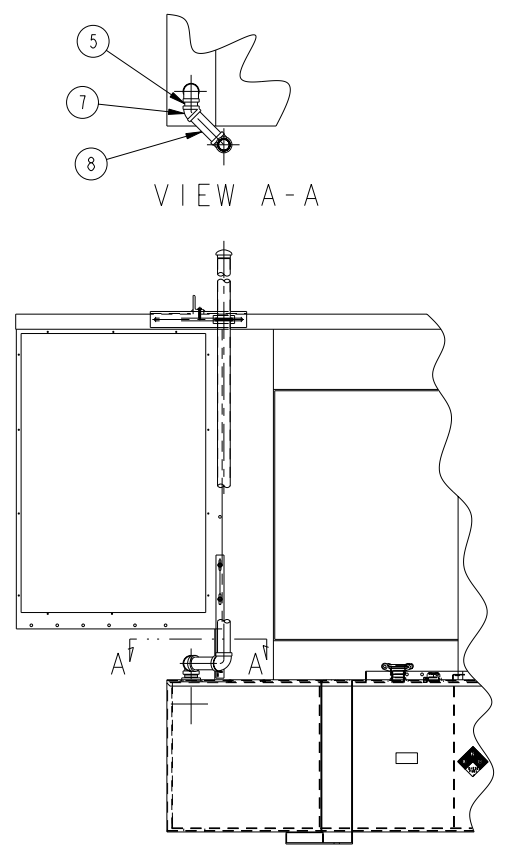
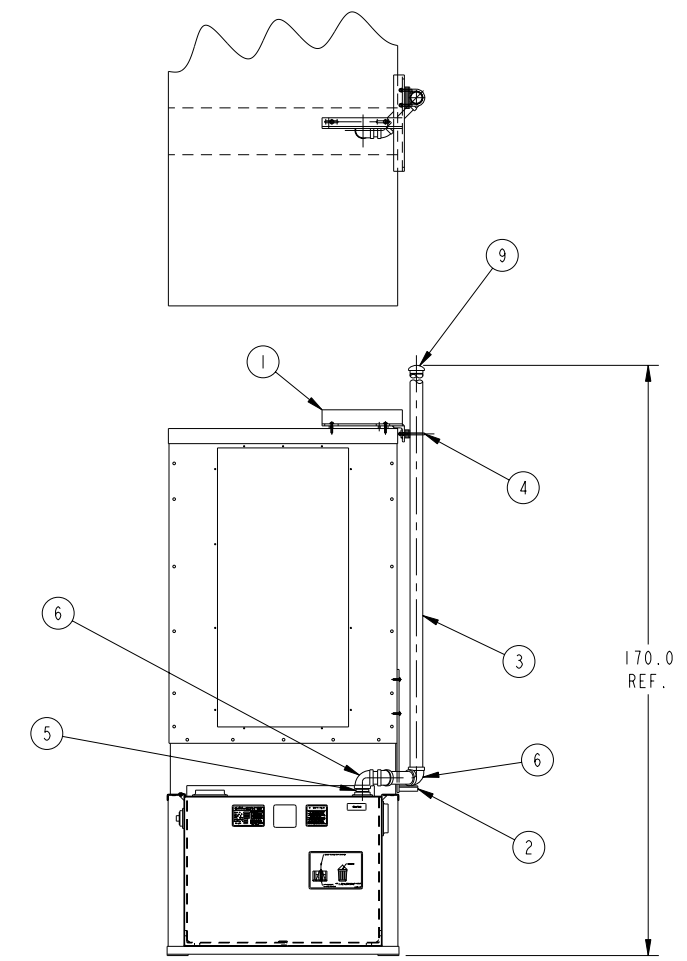


SUPPLIER TABULATION FOR REFERENCE ONLY			
ITEM NO.	QTY	UAI PART NO.	DESCRIPTION
1	1	SB 5GALINT-00	5 GALLON (ROUND) SPILL BOX
2	2	-	LABEL, SHIPPING
3	1	S-4166 16X16X16	BOX, SHIPPING
4	1	CPG-G738	INSTRUCTION SHEET

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		ITEM	PART NO	DESCRIPTION OR MATERIAL
DIM	X ± 1	DO NOT SCALE PRINT	OWN	L. ARNOLD
	.X ± 0.8		CRD	D. GILLETT
	.XX ± 0.38		APVD	D. GILLETT
ANG TOL: ± 1.0°	SCALE: 1/1	DATE	02-13-07	SITE CODE
PROPERTY OF CUMMINS POWER GENERATION GROUP		- CONFIDENTIAL -		CUMMINS POWER GENERATION 1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432
FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994		FIRST USED ON DSGAA, AB, AC		FUEL SYSTEM KIT SPILL BOX 5 GAL
		PGF	SIZE D	0541-1466
				SHEET 1 OF 1 DWG REC B

REL NO	LTR	NO	REVISION	ZONE	DWN	CRD	APVD	DATE
ECO-101939	B	1	ADD PICTORIAL REPRESENTATION ON THE DRAWING	-	PY	VO	HAWKINS	13NOV08
		2	UPDATE THE TABULATION-SEE ECO	-	PY	VO	HAWKINS	13NOV08

- NOTES:
- THIS PART IS MANUFACTURER SOURCE CONTROLLED.
 - APPLICABLE FOR USE ON FUEL TANKS: 0159-1720-01
0159-1720-02



SUPPLIER TABULATION FOR REFERENCE ONLY			
ITEM NO.	QTY	UAI PART NO.	DESCRIPTION
1	1	BU 4020	BRACKET, STABILIZER - UPPER
2	1	BL 200	BRACKET, SUPPORT - PRIMARY
3	1	MVA 20132PT	NIPPLE, 2" NPT X 132" LG PAINTED
4	1	CU 200PT	U-BOLT 2" PIPE PAINTED
5	2	NP 2 CLOSE	NIPPLE 2" NPT X CLOSE (2" LG)
6	2	EL 290PT	ELBOW 2" NPT 90 DEG PAINTED
7	1	EL 2046PT	ELBOW 2" NPT 45 DEG PAINTED
8	1	NP 2006PT	NIPPLE, 2" NPT X 4" LG PAINTED
9	1	MV 0200 PT	VENT, MUSHROOM 2" NPT PAINTED
10	1	LA 00011	LABEL, VENT
11	1	BOX 201614	BOX, 20 X 16 X 14"
12	1	PL0005	PALLET, SHIPPING
13	2	LA-8433	LABEL, SHIPPING
14	2	CT-01	TAG, CABLE TIE 7" LG
15	2	S-2028	TAG, 3.125 X 6.25 WEATHER RESISTANT
16	1	CPG-6739	INSTRUCTION SHEET

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		ITEM PART NO DESCRIPTION OR MATERIAL		CUMMINS POWER GENERATION 1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432		
DIM TOLERANCE X ± 1 .X ± 0.8 .XX ± 0.38	TOLERANCE 0.00- 4.99 +0.15/-0.08 5.00- 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13	DO NOT SCALE PRINT	DWN L. ARNOLD	INSTALLATION KIT VENT-EXT SITE CODE PGF 0541-1467		
			CRD D. GILLETT			APVD D. GILLETT DATE 02-13-07
		ANG TOL: ± 1.0° SCALE: 1/1	PROPERTY OF CUMMINS POWER GENERATION GROUP FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994			FIRST USED ON DSGAA, AB, AC SHEET 1 OF 1 DPG B

**END
OF
SECTION**

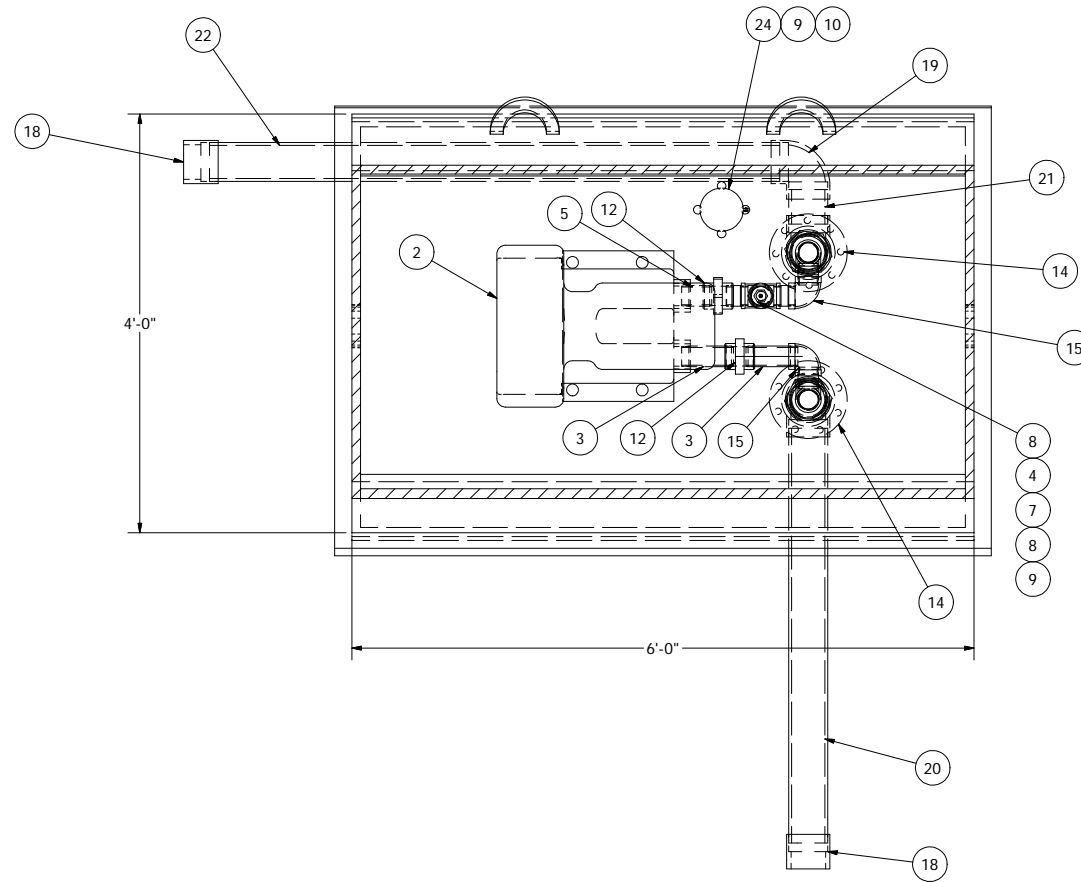
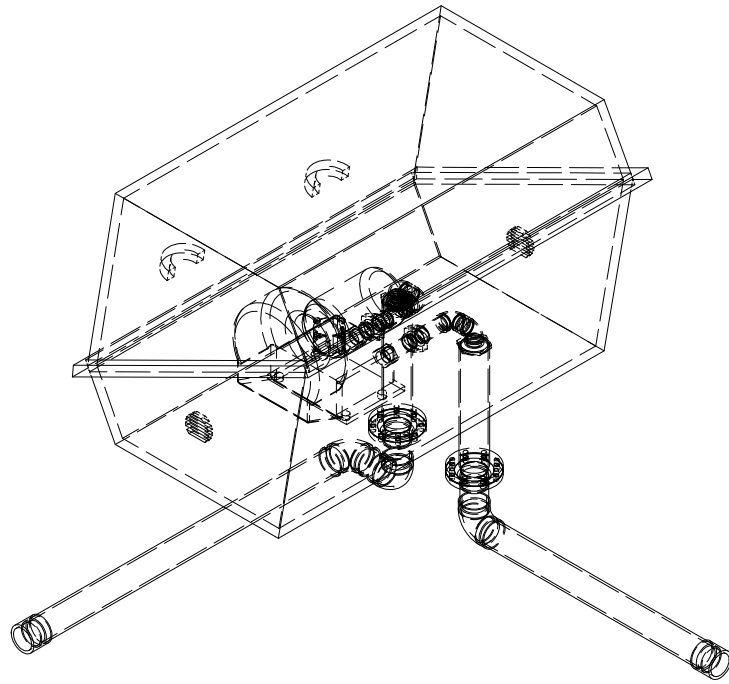
17. ODOR CONTROL

This section includes drawings and specifications for the Odor Control system.

This section is structured as follows:

17.01 ODOR CONTROL COMPONENT DRAWINGS

17.02 EXPLOSION PROOF BLOWER



Parts List			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
1	1	10-XXXX	ENCLOSURE - INSULATED FIBERGLASS
2	1	30-5500	BLOWER - EXPLOSION PROOF REGENERATIVE TYPE
3	2	40-XXXX	NIPPLE - 316SS - 2in X 6in
4	2	40-4111	NIPPLE - 316SS - 2in SCH40 X CLOSE
5	1	40-6458	NIPPLE - 316SS - 2in SCH40 X 3.5in
6	2	40-XXXX	NIPPLE - 316SS - 2in X CLOSE
7	1	40-XXXX	BUSHING - 316SS - 2in FEMALE X 1in MALE THD
8	1	40-XXXX	BUSHING - 316SS - 1in MALE THD X 1-8in FEMALE THD
9	2	40-XXXX	HOSE FITTING - PUSH X MALE THD - 1-8in
10	1	40-XXXX	HOSE - NYLONE - 1-8in - 2ft
11	2	42-4928	BUSHING - SS - 4inX2in
12	2	42-XXXX	UNION - 316SS - 2in
13	2	44-XXXX	FLANGE - PVC - 4in SCH40 - 150# - SOC
14	2	45-XXXX	SPOOL - FLG X PE - 4in X 24in - 316SS - 4in FTHD X 4in FLG
15	4	46-XXXX	ELBOW - 316SS - 2in - 90 DEG - - THREADED
16	1	46-XXXX	TEE - 316SS - 2in - THREADED
17	2	47-6546	GASKET - FLANGE - 4in X 1/8in
18	2	48-XXXX	COUPLING - 4in SCH40 - SLP X SLIP
19	3	48-5460	ELL: 4" PVC 90, SLIP X SLIP -SCH40
20	4	48-XXXX	PIPE - 4in PVC - SCH40 - 1 @ 48in
21	1	48-XXXX	PIPE - 4in PVC - SCH40 - 1 @ 12in
22	6	48-XXXX	PIPE - 4in PVC - SCH40 - 1 @ 72in
23	1	48-XXXX	PIPE - 4in PVC - SCH40 - 2 @ 6in
24	1	62-XXXX	PRESSURE SWITCH

VERIFY SCALE
BAR IS ONE INCH ON
ORIGINAL DRAWING
1"
IF NOT ONE INCH ON
THIS SHEET, ADJUST
SCALE APPROPRIATELY

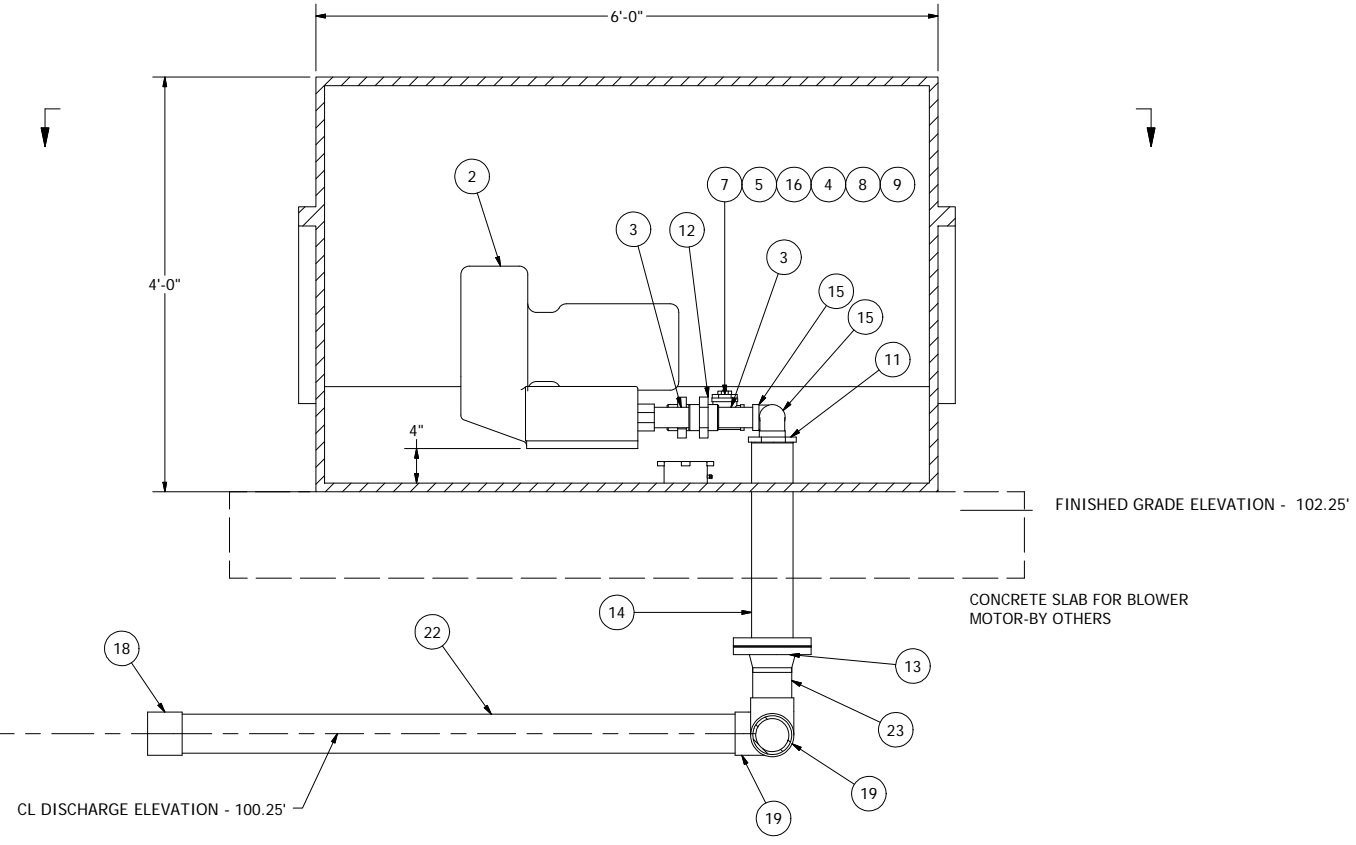
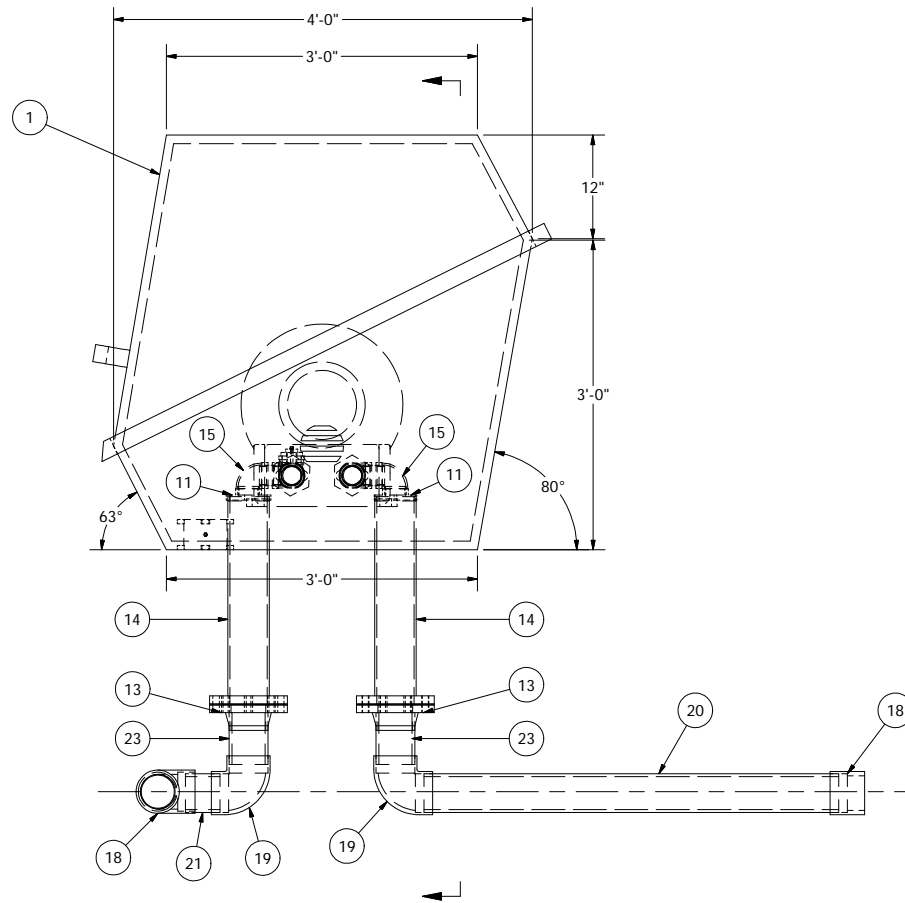
DSN - NG
DRN - NG
CKD - AD
DATE - 7-12-13

**BLOWER ASSEMBLY
FOR ODOR CONTROL
2" SS TO 4" PVC PIPING**

**COMPONENT
DRAWING**

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

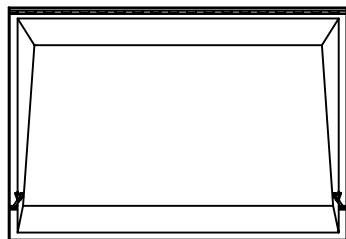
NOTE: ALL DIMENSIONS AND ELEVATIONS SHOWN ARE NOMINAL DIMENSIONS. IT IS THE RESPONSIBILITY OF THE ON-SITE CONTRACTOR OR ROMTEC UTILITIES CUSTOMER (NOT ROMTEC UTILITIES) TO VERIFY THE ACCURACY OF ANY CRITICAL DIMENSIONS OR ELEVATIONS PRIOR TO SETTING OR INSTALLING ANY EQUIPMENT.



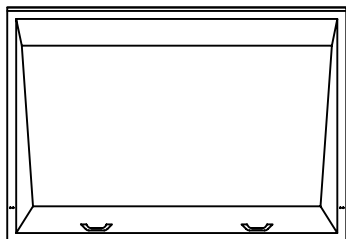
**BAY MEADOWS
O.C. BLOWER ASSEMBLY**

REV	DESCRIPTION	DATE	APPROV
1	ADDED PRESSURE SWITCH/ACCESSORIES	11-21-13	NNA

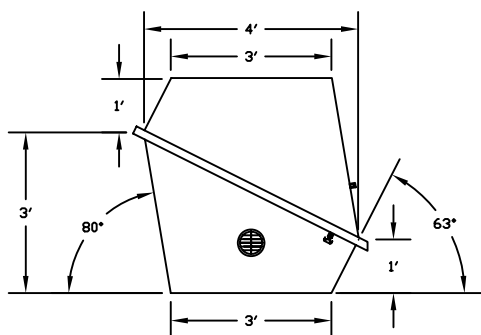
REVISION HISTORY



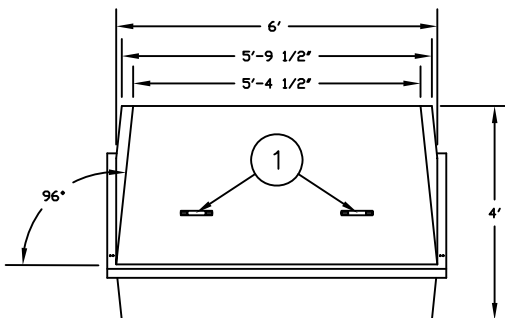
BOTTOM VIEW



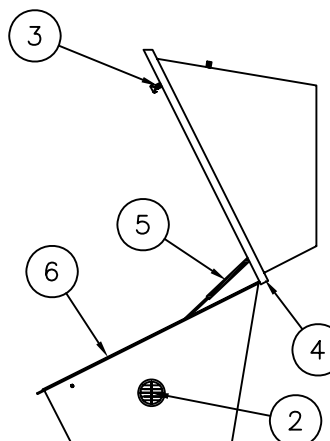
TOP VIEW



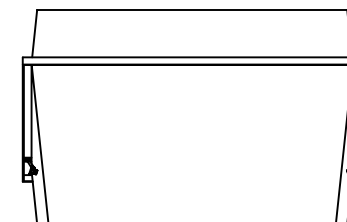
LEFT VIEW
CLOSED



FRONT VIEW
CLOSED



RIGHT VIEW
OPENED



BACK VIEW
CLOSED

INTERIOR COLOR:		WHITE		EXTERIOR COLOR:		???	
OPTIONAL ITEMS LIST							
ITEM #	QTY.	PART #	DESCRIPTION			NOTES	
1	2	AEI 30357	PLASTIC GRAB HANDLE			MOLDED POLYPROPYLENE	
2	2	2B1140	5" ROUND VENT			304 STAINLESS STEEL	
3	2	12065A63	RUBBER DRAW DOWN LATCH			W/ NYLON STRIKE	
4	1	H716AL	CONTINUOUS ALUMINUM HINGE			HARD ALLOY, FULL HARD PIN	
5	2	AC 10150	GAS SPRING			LIFT ASSISTANCE	
6	-	X119	GASKET			SPONGE RUBBER	



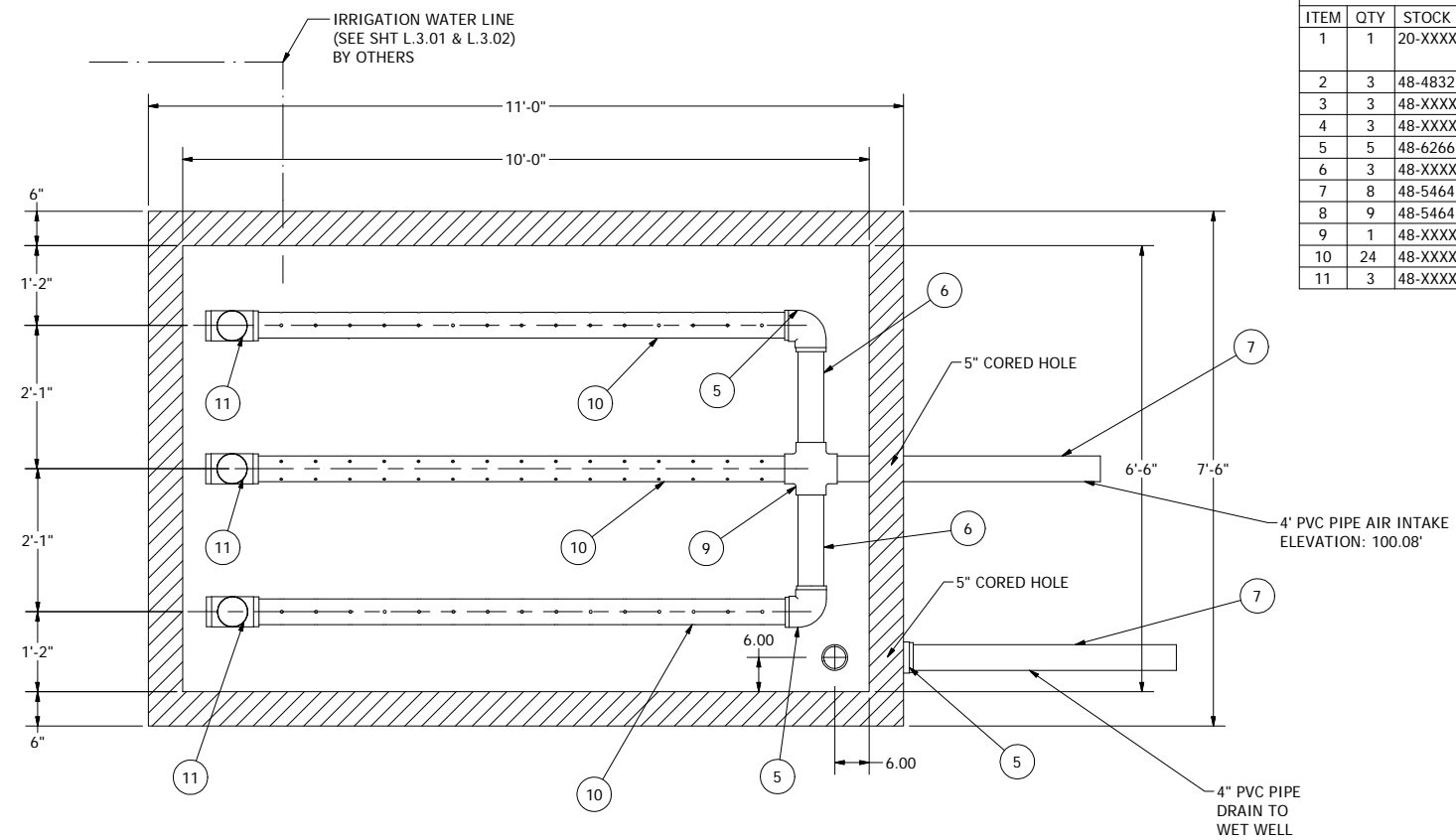
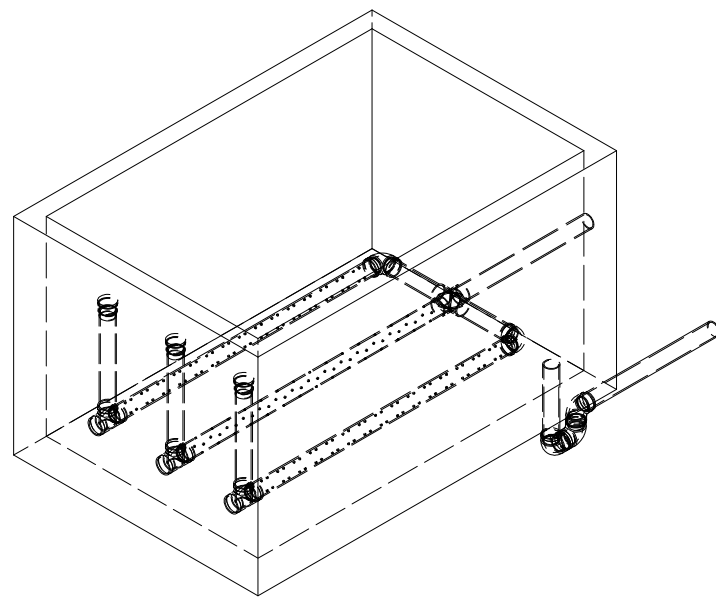
SHELTER WORKS™
 2616 South Third Street, St. Louis, MO 63118
 Phone: (800) 794-8037 Fax: (314) 664-9301
 www.shelterworks.com

REV	DESCRIPTION	BY	DATE

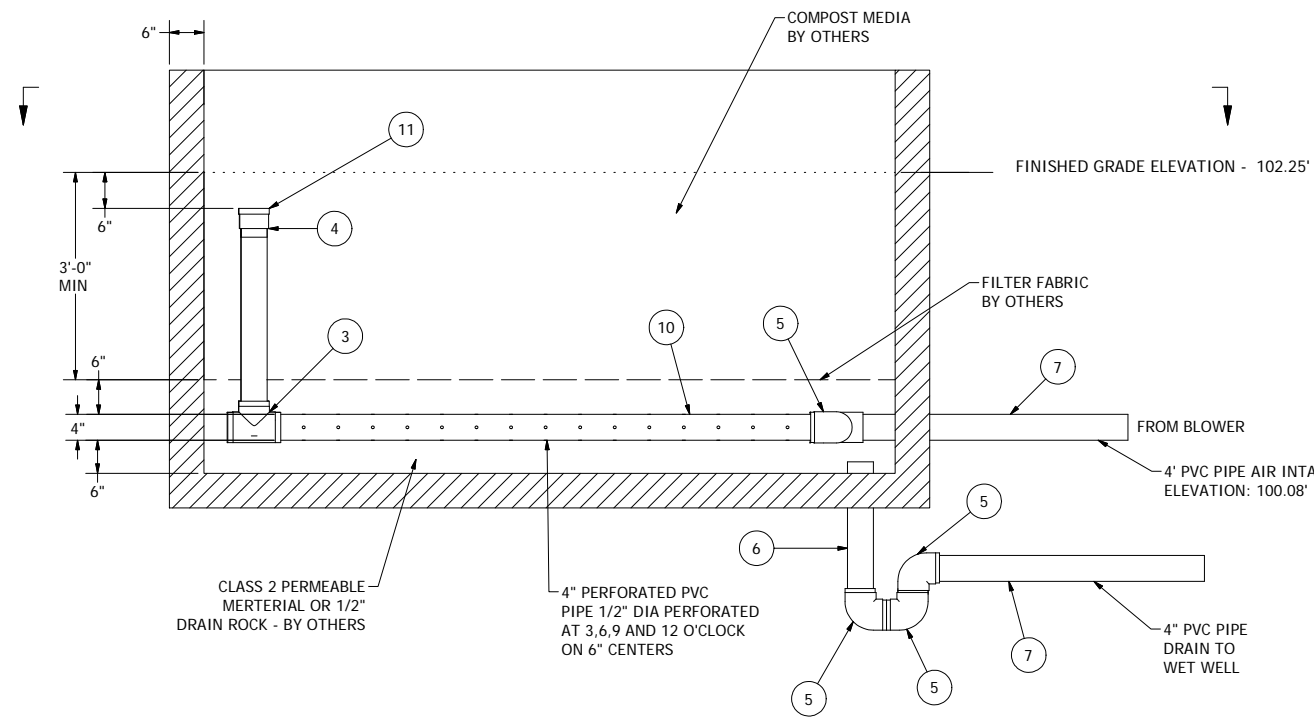
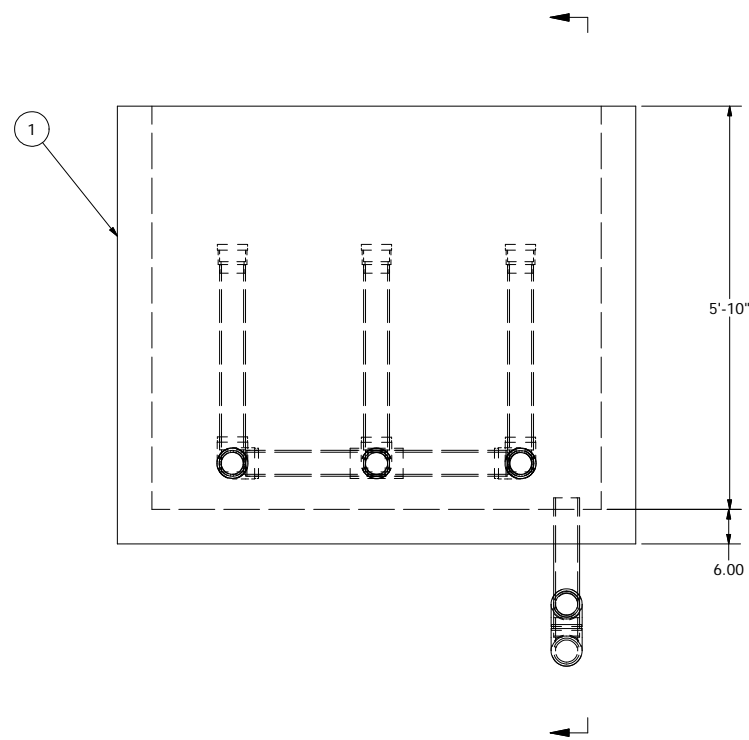
EXTERIOR VIEWS		PROPRIETARY TO SHELTER WORKS™	
FILE:	BM-487248-HLA-GEN .DWG	This document is confidential and proprietary to Shelter Works™ and cannot be used, disclosed, copied, or duplicated in any manner without the prior written consent of Shelter Works™	
PLOT SCALE:	1/64	BY:	J.G.
		DATE:	02/14/08

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CUSTOMER:	GENERIC	ORDER #:	-
PROJECT:	-	SIZE:	B
TITLE:	BIG MOUTH CABINET - HINGED W/ LIFT ASSISTANCE	SHEET	1 OF 1
SCALE:	1/16"	DWG #:	BM-487248-HLA-GEN



Parts List			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
1	1	20-XXXX	BASE - VAULT - PRECAST - 6ft6in X 10ft X 5ft10in - NO TOP SLAB
2	3	48-4832	CAP - PVC - 4in SCH40
3	3	48-XXXX	TEE - PVC - 4in SCH40 - SLIP
4	3	48-XXXX	COUPLING - PVC - 4in SCH40 - 150# - SOC
5	5	48-6266	ELBOW - PVC - 4in SCH40 - 90 DEG - SLIP X SLIP
6	3	48-XXXX	4in PVC - SCH 40 X 24in
7	8	48-5464	PIPE - 4in PVC - SCH80 X 2 @ 48in
8	9	48-5464	PIPE - 4in PVC - SCH80 X 3 @ 36in
9	1	48-XXXX	CROSS - PVC - 4in - SCH40
10	24	48-XXXX	PIPE - 4in PVC - SCH40 X 3 @ 96in - PERFORATED
11	3	48-XXXX	CAP - THREADED - PVC - 4in - SCH40



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

DSN - NG
DRN - NG
CKD - AD
DATE - 7-9-13

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

BAY MEADOWS
ODOR CONTROL VAULT

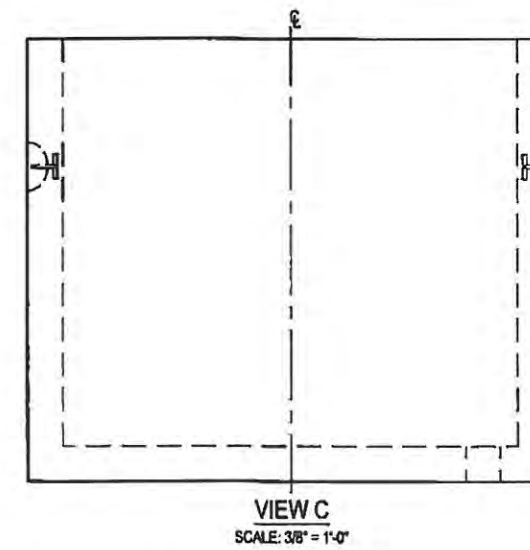
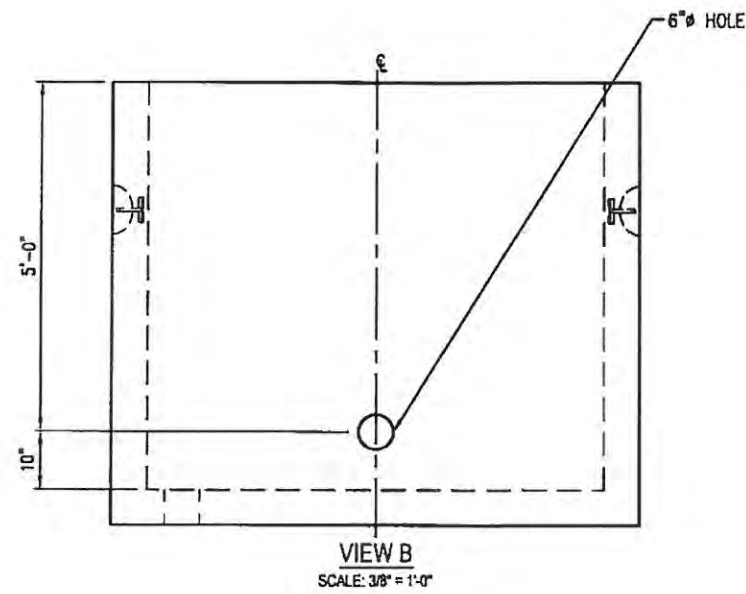
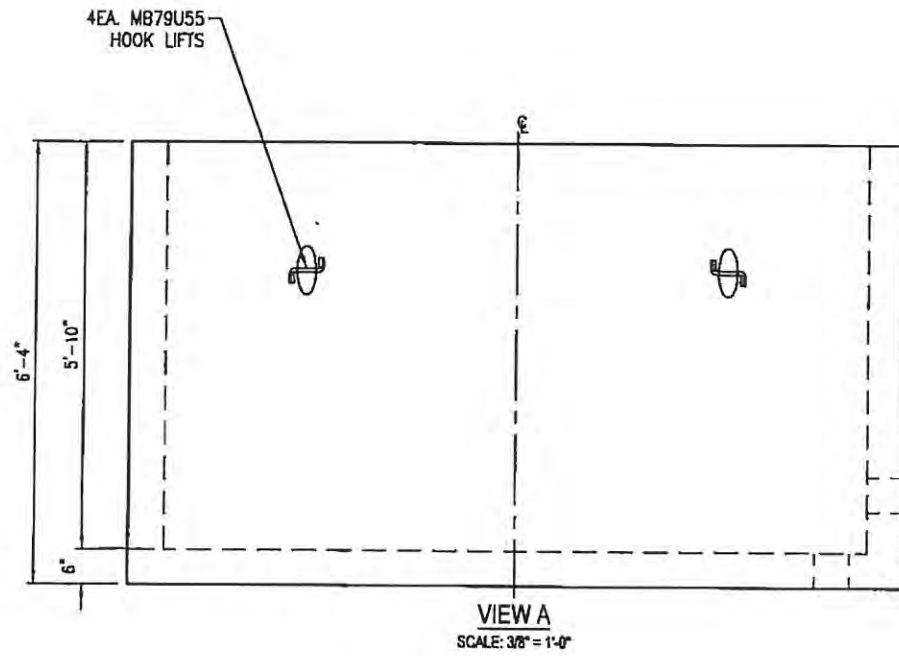
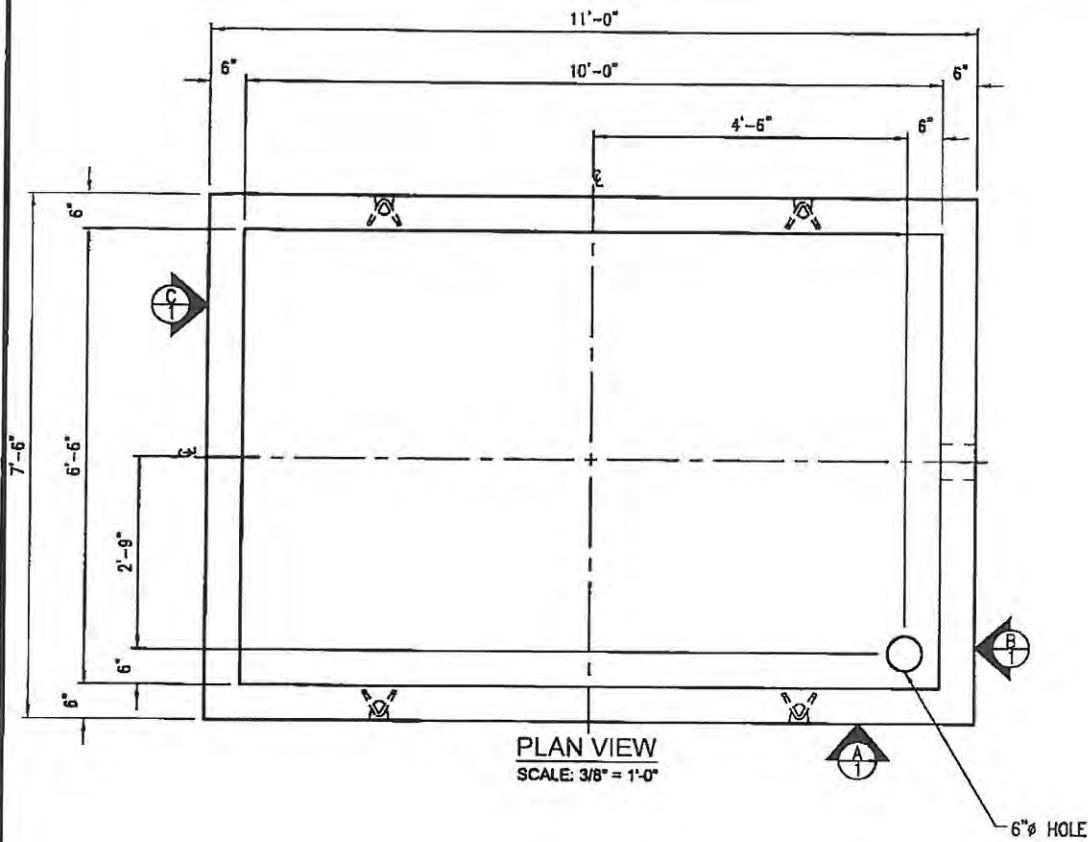
SHEET
3 OF 4

JOB NUMBER
RMTC
0000

REV	DESCRIPTION	DATE	APPROV
1			

REV	DESCRIPTION	DATE	APPROV
1			

Preliminary



**SIGN HERE TO
OK PRODUCTION**

STRUCTURAL NOTES:

- LOADS:**
- H2O TRAFFIC
 - MAXIMUM SOIL COVER: 0 FT
 - 150 PCF CONCRETE DENSITY; 120 PCF SOIL DENSITY
 - H2O SURCHARGE: 128 PSF TO 8 FT BELOW GRADE
 - DRY SOIL LATERAL LOAD - 40 PCF
 - WET SOIL LATERAL LOAD - 80 PCF
 - WATER TABLE - BELOW VAULT

- DESIGN SPECIFICATIONS**
- AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"
 - ACI-318-05 BUILDING CODE
 - ASTM C 857 MINIMUM STRUCTURAL DESIGN LOADING FOR UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES.

- MATERIALS:**
- CONCRETE - 28 DAY COMPRESSIVE STRENGTH $f_c = 6000$ PSI
 - REBAR - ASTM A 706 GRADE 60
 - CEMENT - ASTM C150
 - FLYASH - ASTM C618

- GENERAL NOTES:**
- 1) CONTRACTOR TO: VERIFY ALL DIMENSIONS AND OPENING LOCATIONS
 - 2) REBAR MAY BE TACK WELDED OR TIED
 - 3) TOLERANCES PER ASTM C-858 STANDARD SPECIFICATION FOR UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES

WEIGHTS / CONCRETE YD ³	
SECTION	WEIGHT
TOP SECTION	22,950 LBS / 5.555 CYD
TOTAL LBS	22,950 LBS
TOTAL CYD	5.555 CYD

Oldcastle Precast
P.O. BOX 727 PLEASANTON, CA 94588
PHONE: 925-248-1113 FAX: 925-248-4004

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6'-6"X10'-0"X5'-10" (I.D.) PRECAST VAULT

BAY MEADOWS ORDER CONTROL VAULT
PLEASANTON, CA

CUSTOMER ROMTEC UTILITIES					
DATE	SALES	DRAWN	ENGINEER	CHECKED	SALES ORDER
7/18/13	JG	VK	JM	JM	S166318
DRAWING NUMBER 030-S166318-001				REVISION REV DATE	SHEET 1 OF 3

AMETEK[®]
TECHNICAL & INDUSTRIAL PRODUCTS

T3M Equipment
541-447-5660
541-950-6035 Cell
541-447-6101 Fax
t3m@crestviewcable.com

CP808
Romtec



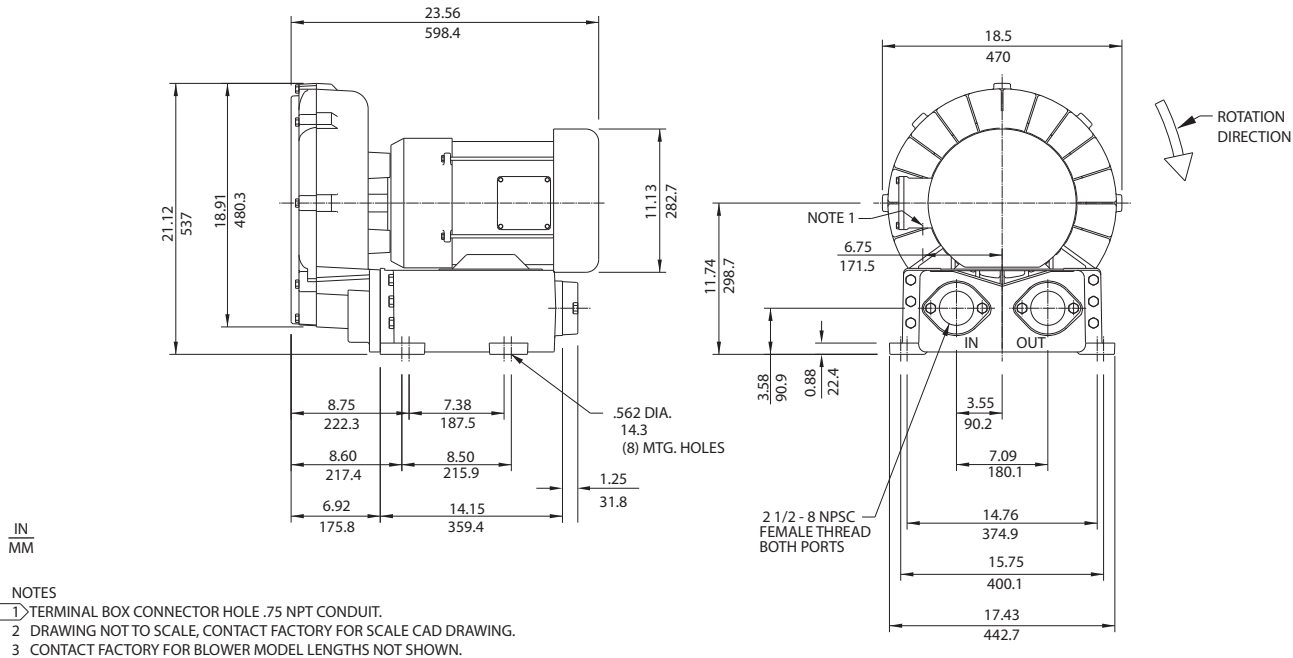
WELCOME TO SOLUTION CITY[®]

Environmental / Chemical Processing Blowers

EN 808 & CP 808 Three-Phase

ROTRON®

Sealed Regenerative Blower w/Explosion-proof Motor



Specification	Units	Part/ Model Number		
		EN808BA72MXL 081229	EN808BA86MXL 081230	CP808FY72MXLR 081234
Motor Enclosure - Shaft Mtl.	-	Explosion-proof-CS	Explosion-proof-CS	Chem XP-SS
Horsepower	-	7.5	7.5	7.5
Phase - Frequency	-	Three-60 hz	Three-60 hz	Three-60 hz
Voltage	AC	230/460	575	230/460
Motor Nameplate Amps	Amps (A)	18.6/9.3	7.4	18.6/9.3
Max. Blower Amps	Amps (A)	22.0/11.0	8.1	22.0/11.0
Inrush Amps	Amps (A)	126/63	56	126/63
Service Factor	-	1.0	1.0	1.0
Starter Size	-	1/1	1	1/1
Thermal Protection	-	Class B - Pilot Duty	Class B - Pilot Duty	Class B - Pilot Duty
XP Motor Class - Group	-	I-D, II-F&G	I-D, II-F&G	I-D, II-F&G
Shipping Weight	Lbs	287	287	287
	Kg	130.2	130.2	130.2

Voltage - ROTRON motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

Operating Temperatures - Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

Maximum Blower Amps - Corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

XP Motor Class - Group - See Explosive Atmosphere Classification Chart in Section I

This document is for informational purposes only and should not be considered as a binding description of the products or their performance in all applications. The performance data on this page depicts typical performance under controlled laboratory conditions. AMETEK is not responsible for blowers driven beyond factory specified speed, temperature, pressure, flow or without proper alignment. Actual performance will vary depending on the operating environment and application. AMETEK products are not designed for and should not be used in medical life support applications. AMETEK reserves the right to revise its products without notification. The above characteristics represent standard products. For product designed to meet specific applications, contact AMETEK Technical & Industrial Products Sales department.

Sealed Regenerative Blower w/Explosion-proof Motor

FEATURES

- Manufactured in the USA - ISO 9001 and NAFTA compliant
- Maximum flow: 360 SCFM
- Maximum pressure: 85 IWG
- Maximum vacuum: 90 IWG
- Standard motor: 7.5 HP, explosion-proof
- Cast aluminum blower housing, impeller, cover & manifold; cast iron flanges (threaded); teflon® lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards

MOTOR OPTIONS

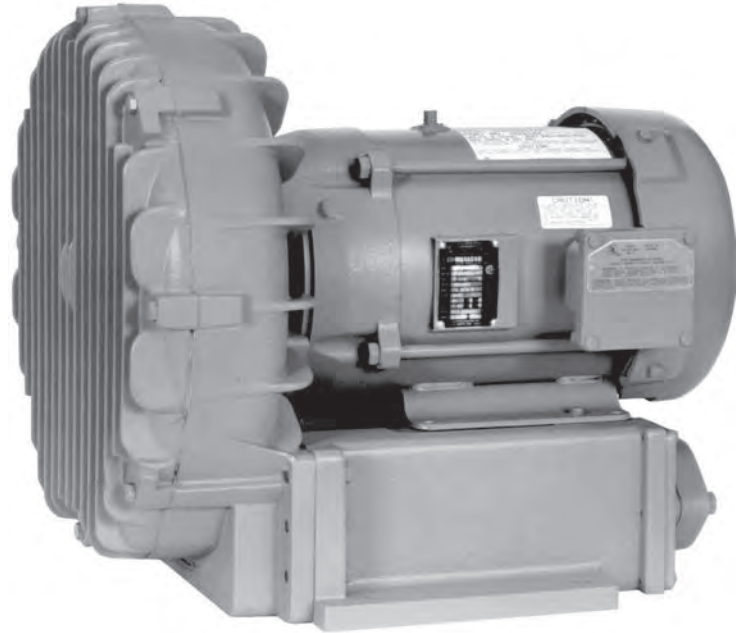
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepower for application-specific needs

BLOWER OPTIONS

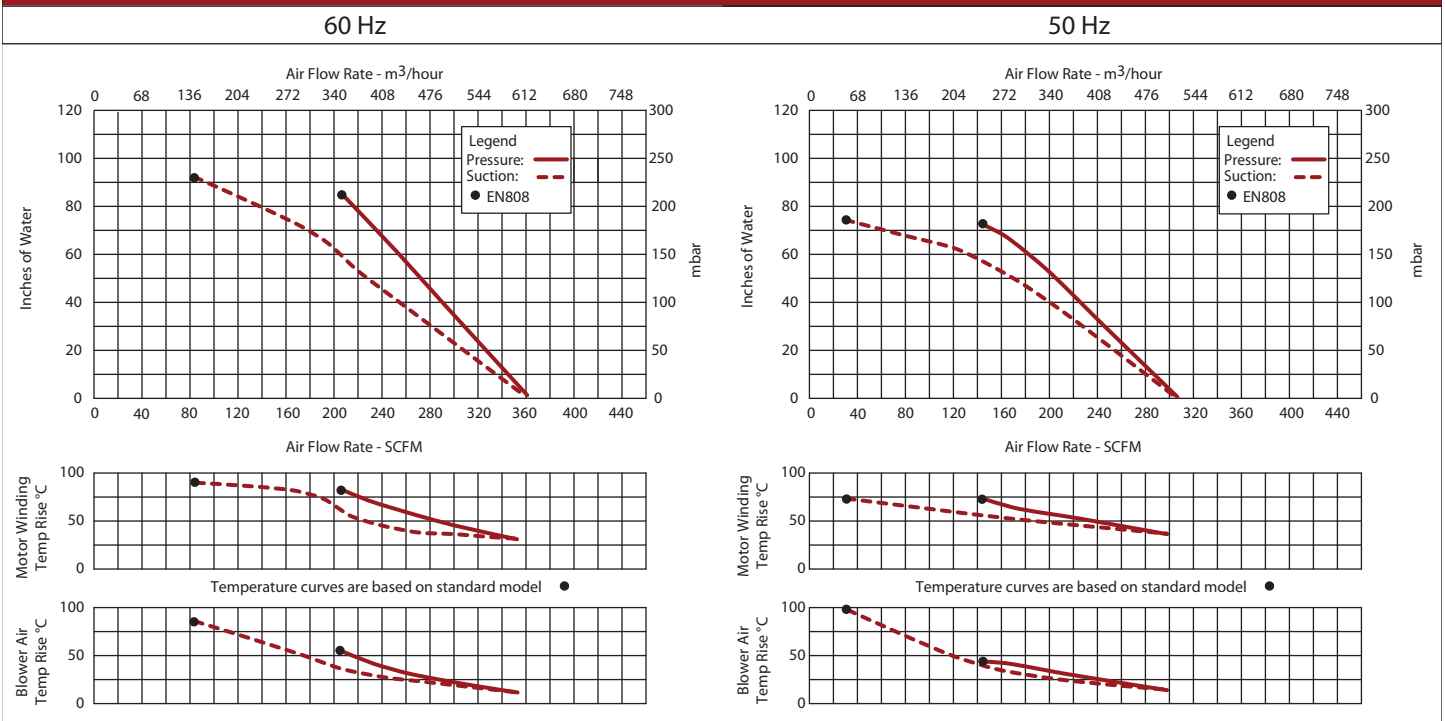
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES

- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges, & relief valves
- Switches - air flow, pressure, vacuum, or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package



Blower Performance at Standard Conditions



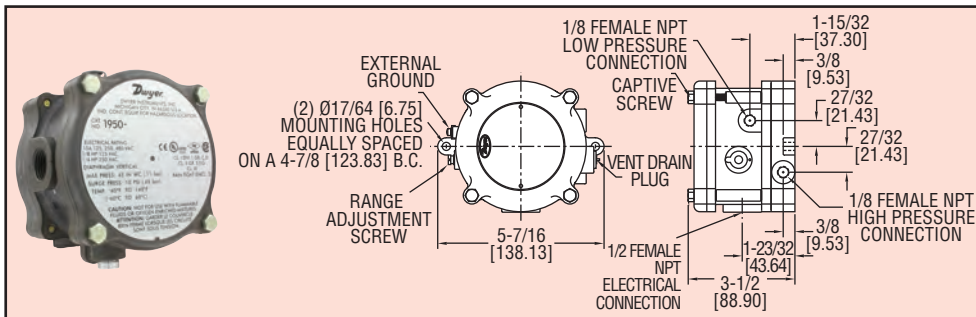
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Series
1950

Explosion-proof Differential Pressure Switches

Compact, Low Cost, Explosion-proof and Weatherproof



SPECIFICATIONS

Service: Air and non-combustible, compatible gases.

Wetted Materials: Consult factory.

Temperature Limits: -40 to 140°F (-40 to 60°C); 0 to 140°F (-17.8 to 60°C) for 1950P-8, 15, 25, and 50. -30 to 130°F (-34.4 to 54.4°C) for 1950-02.

Pressure Limits: Continuous: 1950's - 45 in w.c. (0.11 bar); 1950P's - 35 psi (2.41 bar); 1950P-50 only - 70 psi (4.83 bar). Surge: 1950's - 10 psi (0.69 bar), 1950P's - 50 psi (3.45 bar), 1950P-50 only - 90 psi (6.21 bar).

Enclosure Rating: NEMA 3 (IP54), NEMA 7 & 9.

Switch Type: Single-pole double-throw (SPDT).

Electrical Rating: 15 A @ 125, 250, 480 VAC, 60 Hz. Resistive 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC, 60 Hz.

Electrical Connections: 3 screw type, common, normally open and normally closed.

Process Connections: 1/8" female NPT.

Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.

Set Point Adjustment: Screw type on top of housing.

Weight: 3.25 lb (1.5 kg); 1950-02 model, 4.4 lb (2 kg).

Agency Approvals: CE, CSA, FM, UL.

Model 1950 Explosion-Proof Differential Pressure Switch combines the best features of the popular Dwyer® Series 1900 Pressure Switch with an integral explosion-proof and weatherproof housing, making it an exceptional value for either application. It is CE, UL and CSA listed, FM approved for use in Class I, Div 1, Groups C and D, Class II Groups E, F, and G and Class III hazardous atmospheres (NEMA 7 & 9), Raintight NEMA 3 (IP54). Weatherproof features include a drain plug and O-ring seal in cover. Electrical connections are easily made by removing front cover. For convenience the set point adjustment screw is located on the outside of the housing. Twelve models offer set points from .03 to 20 in w.c. (7.5 to 5 kPa) and from .5 to 50 psi (0.035 to 3.5 bar). The unit is very light and compact – about half the weight and bulk of other explosion-proof or weather-proof switches with separate enclosures.

Series 1950 Switches - Operating Ranges and Dead Bands

Model	Range, in w.c.	Approximate Dead Band at	
		Min. Set Point	Max. Set Point
1950-02-2S	.03 to .10	.025	.05
1950-00-2F	.07 to .15	.04	.05
1950-0-2F	.15 to .50	.10	.15
1950-1-2F	.4 to 1.6	.15	.20
1950-5-2F	1.4 to 5.5	.30	.40
1950-10-2F	3 to 11	.40	.50
1950-20-2F	4 to 20	.40	.60

Model*	Range, psid	Approximate Dead Band at	
		Min. Set Point	Max. Set Point
1950P-2-2F	0.5 to 2	.3	.3
1950P-8-2F	1.5 to 8	1.0	1.0
1950P-15-2F	3 to 15	.9	.9
1950P-25-2F	4 to 25	.7	.7
1950P-50-2F	15 to 50	1.0	1.5

CAUTION: For use only with air or compatible gases. Applications with hazardous atmospheres and a single positive pressure may require special venting. *P=PSID range models

**END
OF
SECTION**

18. PRE-INSTALLATION

This section includes pre-installation information and an example of the checklist that Romtec Utilities requires the owner/contractor to fill out prior to installation of the system. Also included are installation data sheets that will help when installing the system.

18.01 PRE-INSTALLATION INFORMATION

18.02 PRE-INSTALLATION CHECKLIST

18.03 INSTALLATION DATA SHEETS

Send the completed Start-Up Preparation Checklist to:

Romtec Utilities Document Control

18240 North Bank Rd., Roseburg, OR 97470

Phone: 541-496-9678; Fax: 541-496-0804

Romtec8@romtecutilities.com

Pre-Installation Information

1. SCHEDULING INSTALLATION

A. LEAD TIME:

Romtec Utilities and all associated technical personnel require two (2) weeks advance notice to schedule an installation date.

B. DURATION:

Installation begins at 8 am and will take one full day (as stated in the approved Romtec Utilities Scope of Supply and Design Submittal dated _____).

ATTENTION

- 1. Do not lower the pumps into the wet well. A Romtec Utilities start-up advisor will do this at start-up in accordance with Romtec Utilities' warranty or warranty is voidable.**
- 2. The contractor must provide all equipment and a qualified operator to lower the pumps into the wet well on the start-up date.**

2. ITEMS DELIVERED FOR INSTALLATION

PLEASE REVIEW

A. **Pre-cast Base Slab**

- i. Ready to set
 1. NOTE: *The specification and the process for creating a stable compacted "footing" or "base" for the Romtec Utilities wet well foundation is by others. Creating a compacted base that will not allow the Romtec Utilities wet well to "settle" and/or "tilt" during or after installation is not the responsibility of Romtec Utilities*
- ii. Pump discharge elbows attached
- iii. Lifting methodology included:

1. **WARNING! WEIGHTS OF CONCRETE VARY!** See approved scope of supply and design submittal section_____, dated _____for concrete weights.
2. The contractor must provide a crane capable of lifting the base.
3. **LIFTING STRAP RECOMMENDATIONS**
 - a. 4' Base, barrels and vault: Four (4) 16' straps.
 - b. 5' Base, barrels and vault: Four (4) 16' straps.
 - c. 6' Base, barrels and vault: Four (4) 16' straps.
 - d. 8' Base, barrels and vault: Four (4) 16' straps.
 - e. 10' Base, barrels and vault: Four (4) 16' straps.
4. **PAY ATTENTION!** Check the alignment marks on all concrete pieces. Check that all pieces are numbered, in order, bottom to top.
5. **IMPORTANT IF YOU ARE USING SHORING!** The base and first barrel are one solid piece. The base slab is square, rectangular or round! The shoring must be wide enough to allow rotation of the base 360 degrees to be able to align the gravity sewer and force main. See approved scope of supply and design submittal section_____, dated_____for concrete dimensions.

B. Pre-cast Barrels

- i. All discharge and inlet holes pre-cored plus Kor-n-Seals installed.
- ii. Romtec Utilities does not provide cored holes into the wet well for electrical conduit ports or conduit runs unless specified in the Scope of Supply and Design Submittal. The electrical related cored holes in the wet well are the responsibility of the contractor and electrician. Wet well electrical related cored holes final size, orientation, height and number are best determined after installation of the wet well and other electrical components.
- iii. If the wet well includes Ameron T-Lock lining, all joints, cored holes and all penetrated concrete must be welded by a "Certified" Ameron welder. All piping going through the wet well must be installed prior to the welding.

- C. **Pre-cast/Pre-Fabricated Top Slab**
 - i. This is the last concrete piece.

- D. **Accessory Pallet**
 - i. Wet well gaskets and sealers
 - ii. Discharge pipe (pre-fabricated)
 - 1. **WARNING! TRIM TO FIT.**
 - 2. Discharge pipe intentionally too long, the contractor must measure and trim to fit.
 - 3. Contractor must plumb discharge pipe and secure to wet well using the pre-installed bracket.
 - iii. Level sensing devices (store for installation at start-up)
 - iv. **In the accessory pallet there are going to be items that you will NEED to complete Start up of your pump station. Please keep track of these items for start up. Your pump station will not be able to be completed without them.**

- E. **Guiderails**
 - i. **WARNING!** Trim to fit. Guiderails are produced too long intentionally; the contractor must measure and trim to fit.

- F. **Upper Guiderail Brackets**
 - i. **PLEASE!** Install in provided nut rail already built into top slab hatch.
 - ii. Mounting hardware included.
 - iii. Contractor must plumb guide rails before tightening the supplied bolts.

- G. **Inside drop system (Optional)**
 - i. **LOOK!** Inside drop system goes in wet well on pre-installed concrete anchors and provided pipe brackets.
 - ii. Look for, and install PVC drop pipe between inside drop bowl (pre-installed) and wet well base.
 - iii. EXPLANATION: The inside drop system is intended to direct the influent water and guide the flow.

- H. **Pump Disconnect Panel and Stand (optional)**
 - i. Electrician to install the conduits between the disconnect panel and the control panel per the site engineer's direction. This includes one to three power conduits and one separate conduit for level sensing.

- I. **Electrical Junction Box (optional)**
 - i. **WARNING!** Electrician to install.
 - ii. Electrician to install the conduits between the electrical junction box and the control panel per the site engineer's direction. This includes one to three power conduits and one separate conduit for level sensing.

- J. **Control Panel (if included in this shipment)**
 - i. **WARNING!** Electrician to install per site engineer's direction.

- K. **Pumps (if included in this shipment)**
 - i. Installed by Romtec Utilities after system construction.
 - ii. You do not need to bring pumps to the site until start-up.
 - iii. **PLEASE!** Leave the pumps and chains at the contractor's office until start-up.

3. THE FOLLOWING ARE STRONGLY RECOMMENDED ON SITE:

- A. Two (2) six-foot ladders.
- B. One (1) six-foot level.
- C. Shoring for safe working space in the hole and shoring of adequate size for room around the base slab.
- D. Crane to off load and set all concrete components.
- E. Forklift to offload accessory pallet and control panel (may be shipped separately at a later date).
- F. Secure site for accessory pallet (and control panel with pumps, when they arrive). These items may need to be hauled to a secure site. Please provide a truck to transfer these items to a separate site if necessary.
- G. Review the site and **LOOK** for overhead obstructions before delivery.
- H. A person on-site whose sole purpose is to be in charge of safety.



Pre-Installation Checklist

Please fill out this form accurately. If the equipment and excavated site is not ready for installation of the wet well and associated parts, the installer will be responsible for all costs associated with the initial site visit.

Note: The Romtec Utilities Installation Advisor is on-site as an advisor only. The Romtec Utilities Advisor will not be performing any of the installation tasks.

Please have this form completed and returned a minimum of two weeks prior to the arrival of the Install Advisor to ensure time for this document to be reviewed. Send this completed Pre-Installation Checklist to:

Romtec Utilities Post Sales Coordinator
18240 North Bank Rd.
Roseburg, OR 97470
Phone: 541-496-9678; Fax: 541-496-0804
romtec8@romtecutilities.com

Jobsite information:

Street Address: _____
State: _____ Zip Code: _____

Name of Main Site Contact:

Name: _____
Company: _____
Phone: _____
E-mail: _____

Safety Coordinator on Site:

Name: _____
Company: _____
Phone: _____
E-mail: _____

Requested Delivery Date of Wet well assembly: _____

Note: All equipment necessary to off load the wet well and associated parts must be on site and ready for the truck on the above requested delivery date .

**PLEASE COMPLETE THE FOLLOWING TO CONFIRM YOU ARE READY FOR
 INSTALLATION**

	YES	NO
1. Will the site be prepared by the delivery date established?	<input type="checkbox"/>	<input type="checkbox"/>
2. IF APPLICABLE, Please advise when you will be ready for the Ameron welding: _____.	<input type="checkbox"/>	<input type="checkbox"/>
3. Is the contractor ready to begin construction?	<input type="checkbox"/>	<input type="checkbox"/>
4. Is the hole excavated and prepared per site engineer specifications? If not, when will it be ready? _____	<input type="checkbox"/>	<input type="checkbox"/>
5. Will the crane be on-site on the delivery day to unload the Romtec Utilities supplied items from the delivery trucks?	<input type="checkbox"/>	<input type="checkbox"/>
6. Has the contractor confirmed that the crane has appropriately stable ground from which to work?	<input type="checkbox"/>	<input type="checkbox"/>
7. Will the contractor be ready to stack the wet well and possibly install the valve vault & related piping on the delivery date?	<input type="checkbox"/>	<input type="checkbox"/>
8. Will the hole be shored? Is the shoring wide enough to be able to rotate the base 360 degrees? Base dimensions: _____	<input type="checkbox"/>	<input type="checkbox"/>
9. Will the contractor have adequate dewatering on-site?	<input type="checkbox"/>	<input type="checkbox"/>
10. Will the bottom of the hole have the base rock installed and compacted and level as per site engineer's requirements, prior to 8:00 AM on the above requested installation date?	<input type="checkbox"/>	<input type="checkbox"/>

Note: Construction should not occur on the same day the hole is being excavated.



- | | YES | NO |
|---|--------------------------|--------------------------|
| 11. Will someone from the contractor's company review and verify the Romtec Utilities packing list and the supply of all equipment? | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Note: If there is not a Romtec Utilities Installation Advisor on site, please scan and e-mail or fax to Romtec Utilities after this has been completed.</i> | | |
| 12. Who will review and verify? _____ | | |
| 13. Will the contractor provide at least one laborer exclusively for unloading the truck and prepping concrete parts per Romtec Utilities direction? | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. Does the contractor recognize that the elevations in section 16 are the elevations in the Romtec Utilities system drawing, and these are the governing elevations? | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Note: Please list the elevations you have in the table below, and mark any elevations that do not match.</i> | | |
| 15. Has a safety plan for installation been developed and implemented in conformance with OSHA requirements? | <input type="checkbox"/> | <input type="checkbox"/> |
| 16. Does the safety plan include components for confined spaces, climbing, high voltage (underground and overhead) and shoring? | <input type="checkbox"/> | <input type="checkbox"/> |
| 17. Have contractor's employees been instructed with respect to the safety plan? | <input type="checkbox"/> | <input type="checkbox"/> |

18. Does the contractor agree that these are the correct elevations?

Note: These elevations are based on our approved Scope of Supply and Design Submittal. Please call our office immediately if your elevations do not match ours.

	RU ELEVATION	YOUR ELEVATION	DO THEY MATCH
WET WELL RIM	102.25'		<input type="checkbox"/> YES <input type="checkbox"/> NO
WET WELL FLOOR	82.25'		<input type="checkbox"/> YES <input type="checkbox"/> NO
WET WELL BASE	81.25'		<input type="checkbox"/> YES <input type="checkbox"/> NO
WET WELL DISCHARGE CENTERLINE	95.32'		<input type="checkbox"/> YES <input type="checkbox"/> NO
WET WELL INFLUENT INVERT	89.10'		<input type="checkbox"/> YES <input type="checkbox"/> NO
VALVE VAULT RIM	102.25'		<input type="checkbox"/> YES <input type="checkbox"/> NO
VALVE VAULT BASE	93.00'		<input type="checkbox"/> YES <input type="checkbox"/> NO

COMMENTS:

 AUTHORIZED SIGNATURE

 PRINT NAME

 DATE

SAFETY DISCLOSURE & ACKNOWLEDGMENT

Installation Safety Threats

Installation of the equipment to be supplied may implicate five (5) specific potential safety threats, among others:

1. Work in confined spaces, particularly within the wet wells, valve vaults and meter vault.
2. Inadequate shoring of dirt walls in the installation well.
3. Work at heights, relative to the base of the lift station in the bottom of the excavated hole.
4. Misuse of machinery, such as cranes, used in installation.
5. High voltage.

Acknowledgment of Responsibility

Your signature below signifies your acceptance of the following:

1. You (including, but not limited to, you, your employees, or your Contractor), and not Romtec Utilities, assume full responsibility for installation of the equipment.
2. You are not an agent of Romtec Utilities in any capacity.
3. Romtec Utilities will provide fundamental instruction regarding installation by a Romtec Utilities advisor, but any such advisor will have no authority or obligation to supervise or direct your personnel in the course of installation.
4. **You are solely responsible for ensuring safety in all facets of installation.**

By signing this form you are agreeing to each of the above. Please contact our office with any questions or concerns you may have.

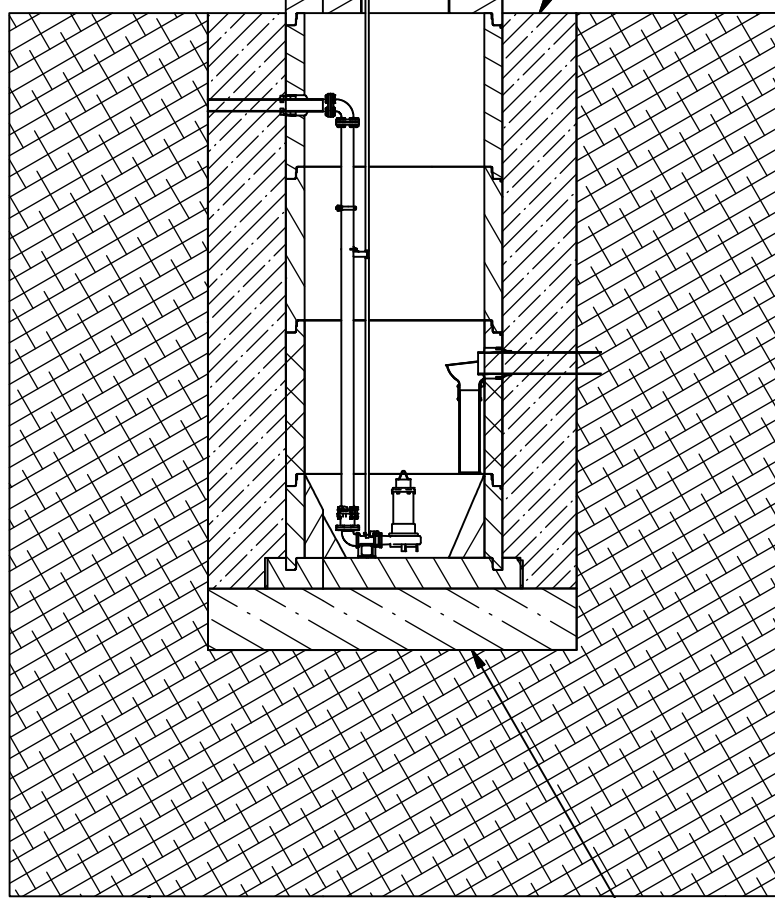
SIGNATURE

DATE

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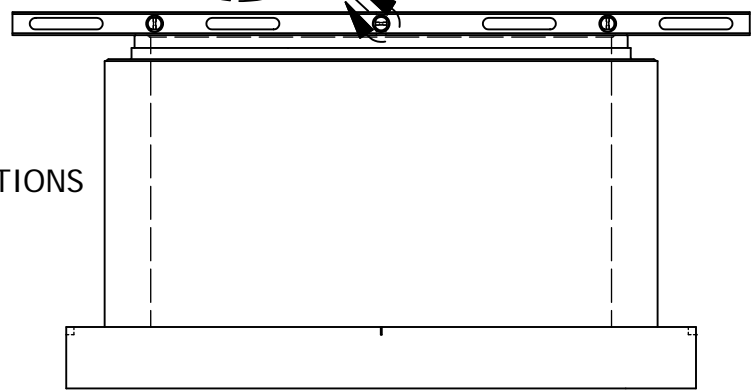
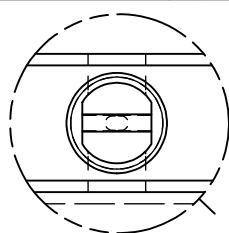
ROMTEC
WET WELL ASSEMBLY

COMPACTED BACK FILL
AS SPECIFIED BY THE
ENGINEER




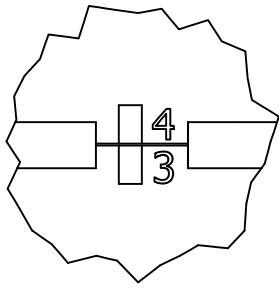
UNDISTURBED SOIL

COMPACTED BASE ROCK
AS REQUIRED & SPECIFIED
BY THE ENGINEER

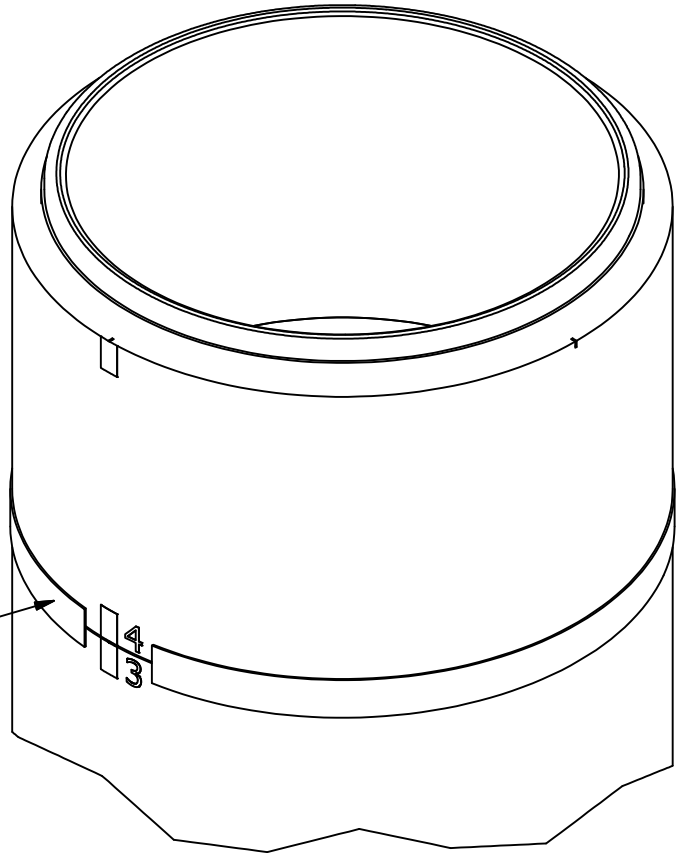


NOTE: BASE MUST BE
LEVELED IN ALL DIRECTIONS
PRIOR TO STACKING
BARRELS.

DRN BY	AM	DATE	04/10/13		18240 NORTH BANK ROAD ROSEBURG, OREGON 97470 541-496-3541
CHK BY		DATE			
APR BY		DATE		DESCRIPTION	
				WET WELL BASE LEVELING	
				DWG NO	REV



ALIGNMENT MARKS AND
NUMBERS FOR MATCHING
THE BARRELS



TAPE COAT INSTALLED AT
EACH BARREL JOINT
SUPPLIED BY ROMTEC
UTILITIES INSTALLED
BY CONTRACTOR

BARREL

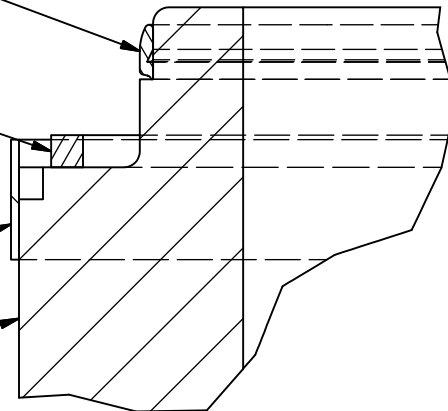
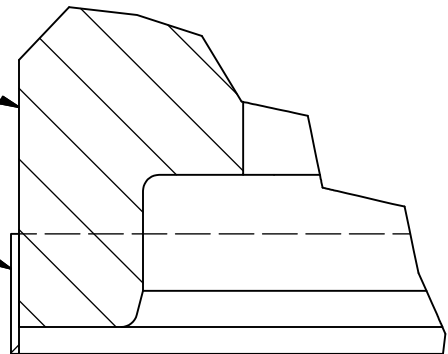
TAPECOAT


TYLOX SUPER SEAL GASKET
(MAKE SURE GASKET IS
AGAINST SHOULDER)

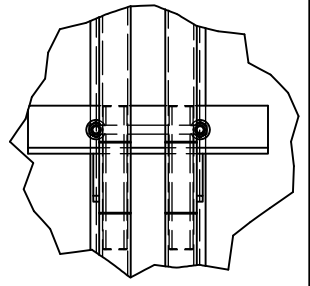
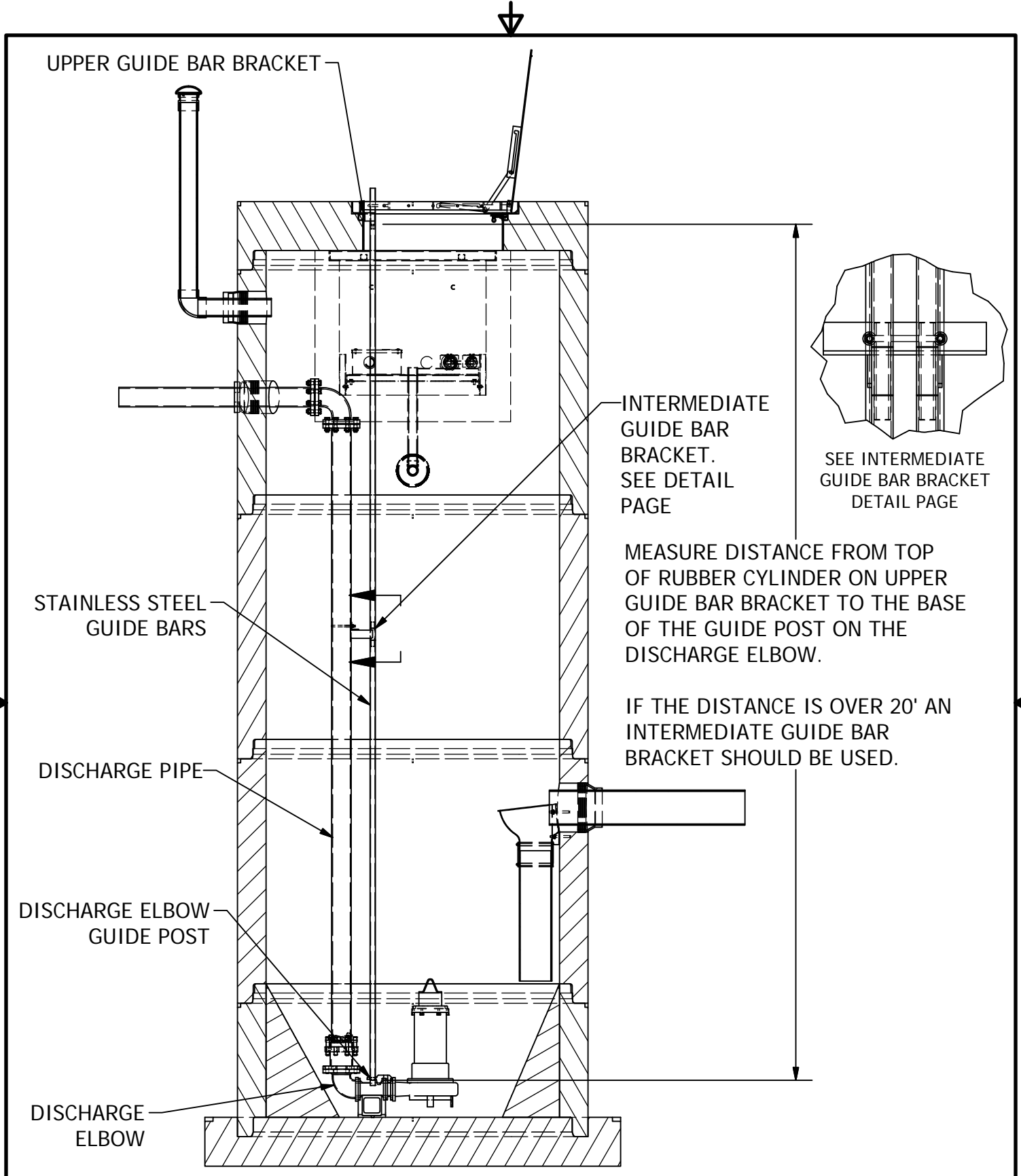
1" X 1" CONSEAL FOR 6', 8' & 10'
3/4" X 3/4" CONSEAL FOR 4' & 5'

TAPECOAT

BARREL



DRN BY	AM	DATE	09/23/08		18240 NORTH BANK ROAD	
CHK BY		DATE			ROSEBURG, OREGON 97470	
APR BY		DATE		DESCRIPTION	541-496-3541	
				BARREL JOINT SEALS		
				DWG NO		REV




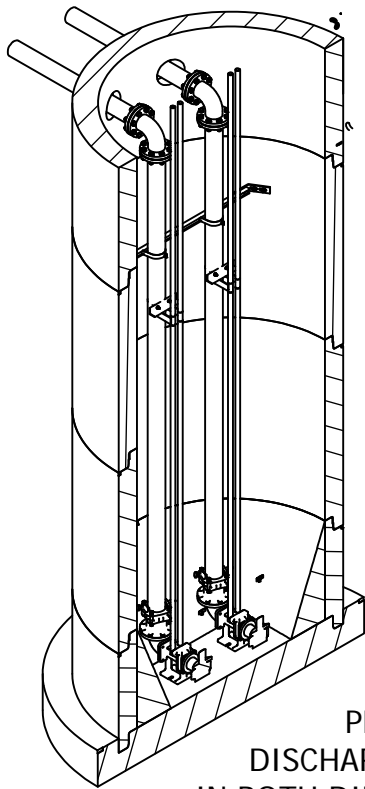
SEE INTERMEDIATE
GUIDE BAR BRACKET
DETAIL PAGE

INTERMEDIATE
GUIDE BAR
BRACKET.
SEE DETAIL
PAGE

MEASURE DISTANCE FROM TOP
OF RUBBER CYLINDER ON UPPER
GUIDE BAR BRACKET TO THE BASE
OF THE GUIDE POST ON THE
DISCHARGE ELBOW.

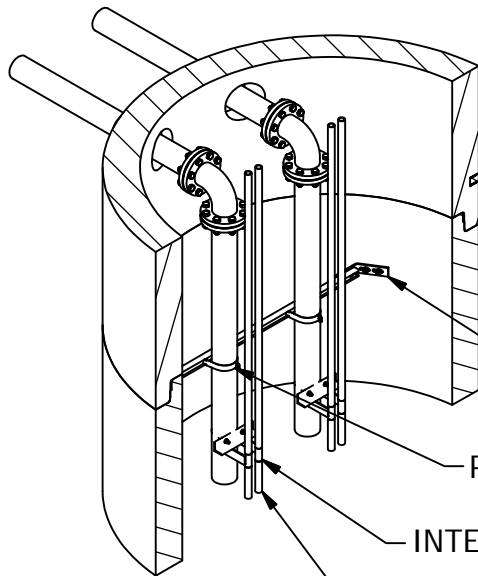
IF THE DISTANCE IS OVER 20'
AN INTERMEDIATE GUIDE BAR
BRACKET SHOULD BE USED.

DRN BY	AM	DATE	04/11/13		18240 NORTH BANK ROAD ROSEBURG, OREGON 97470 541-496-3541	
CHK BY		DATE				
APR BY		DATE				
				DESCRIPTION	GUIDE BAR MEASUREMENT	
				DWG NO		REV



MEASURE FROM
THE INSIDE SHOULDER
OF THE DISCHARGE
ELBOW TO THE BOTTOM
OF THE INSIDE DIAMETER
OF THE KOR-N-SEAL

PLUMB THE
DISCHARGE PIPES
IN BOTH DIRECTIONS
BEFORE TIGHTENING
DISCHARGE ELBOW

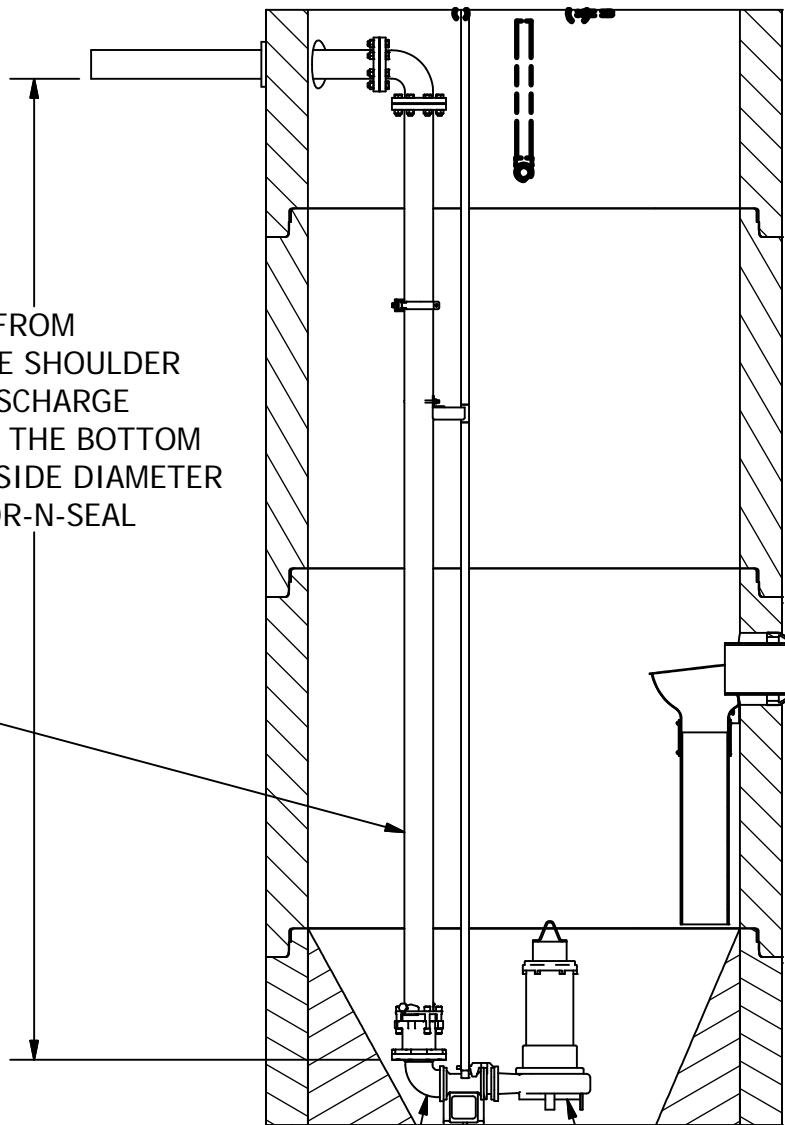


DISCHARGE PIPE SUPPORT ASSEMBLY

PIPE CLAMPS

INTERMEDIATE GUIDE BAR BRACKETS (IF REQD)

STAINLESS STEEL GUIDE BARS



DISCHARGE ELBOW

PUMPS

DRN BY	AM	DATE	04/11/13
CHK BY		DATE	
APR BY		DATE	



18240 NORTH BANK ROAD
ROSEBURG, OREGON 97470
541-496-3541

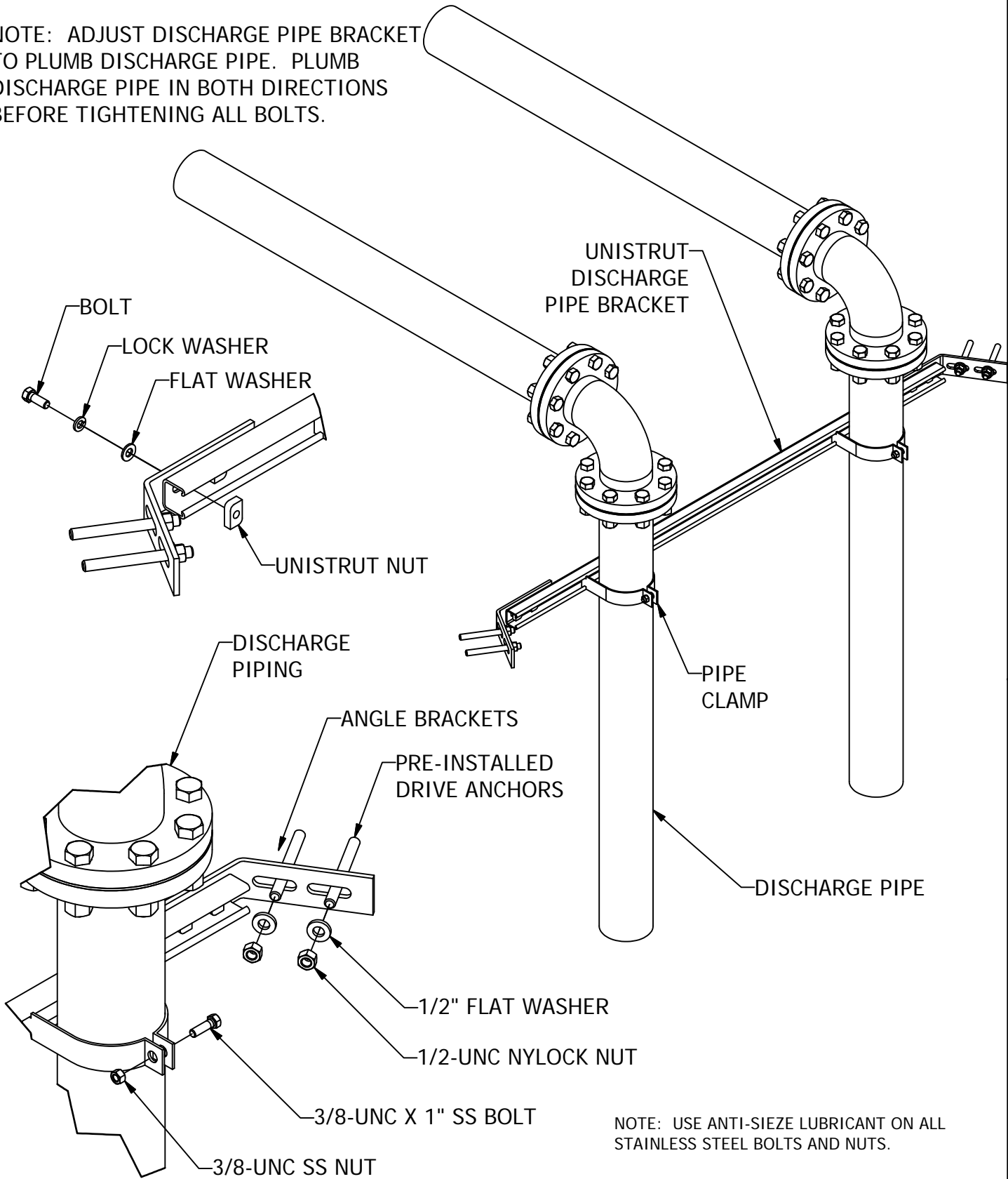
DESCRIPTION

DISCHARGE PIPE ASSEMBLY


DWG NO

REV

NOTE: ADJUST DISCHARGE PIPE BRACKET TO PLUMB DISCHARGE PIPE. PLUMB DISCHARGE PIPE IN BOTH DIRECTIONS BEFORE TIGHTENING ALL BOLTS.



NOTE: USE ANTI-SIEZE LUBRICANT ON ALL STAINLESS STEEL BOLTS AND NUTS.

DRN BY	AM	DATE	09/11/08		18240 NORTH BANK ROAD ROSEBURG, OREGON 97470 541-496-3541	
CHK BY		DATE				
APR BY		DATE		DESCRIPTION		
				DISCHARGE PIPE BRACKETS		
				DWG NO		REV



STAINLESS STEEL HARDWARE
EVERY OTHER SLOT LOCATION.

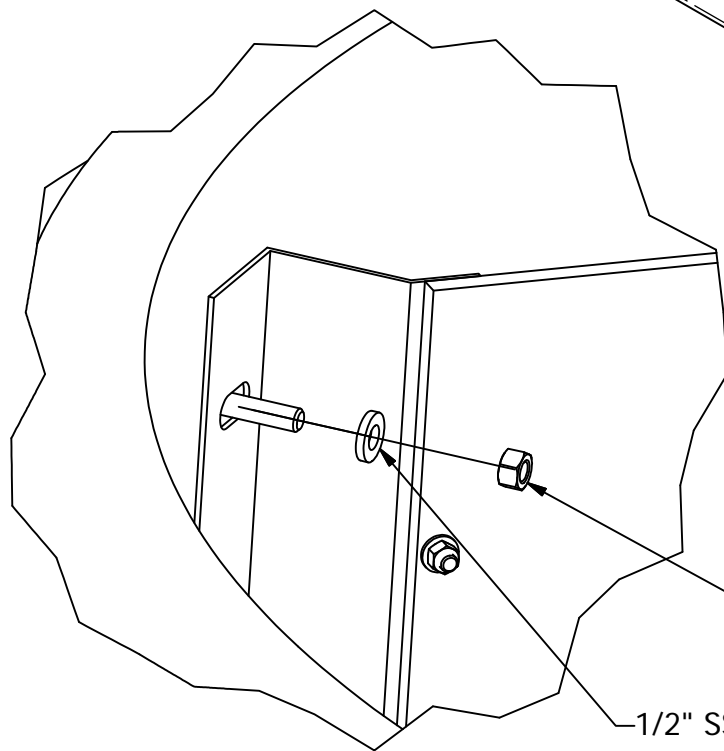
DEFLECTOR PANEL
(HDPE)

GUILLOTINE HANGER
BRACKET & CABLE ASSY

STAINLESS
STEEL DEFLECTOR
PANEL BRACKET

GUILLOTINE FOR
CLEANOUT HOLE
ACCESS (HDPE)

CLEANOUT HOLE
IN DEFLECTOR PANEL



NOTE: IF DEFLECTOR PANEL IS LIMITED
TO ONE BARREL THE ASSEMBLY WILL BE
PRE-INSTALLED AT THE FACTORY.

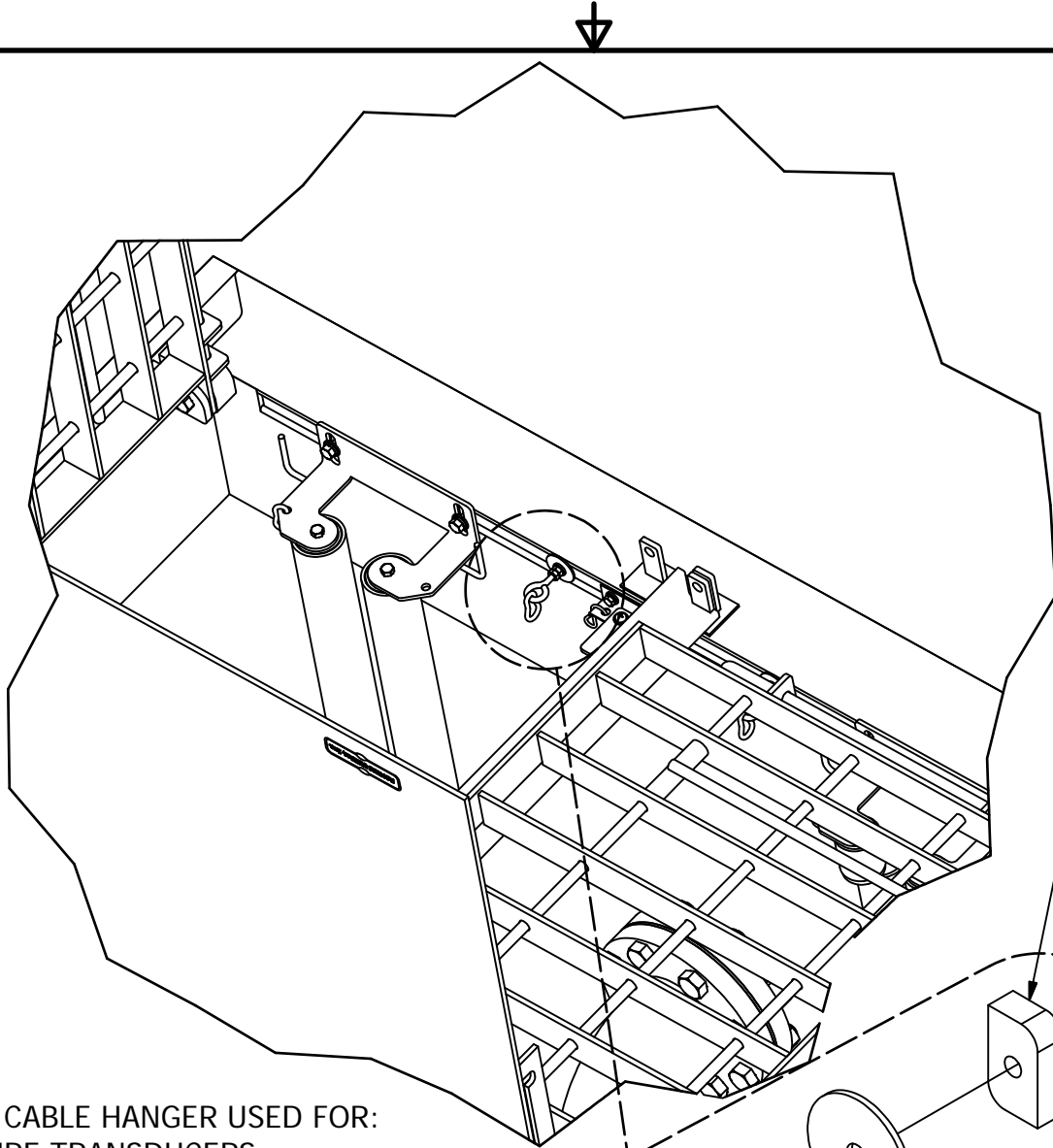
1/2-UNC SS NYLOCK NUT

1/2" SS FLAT WASHER

NOTE: USE ANTI-SIEZE LUBRICANT ON ALL
STAINLESS STEEL BOLTS AND NUTS.

DRN BY	AM	DATE	4/12/13		18240 NORTH BANK ROAD ROSEBURG, OREGON 97470 541-496-3541
CHK BY		DATE			
APR BY		DATE		DESCRIPTION	
				DEFLECTOR PANEL DETAIL	
				DWG NO	REV





NOTE: CABLE HANGER USED FOR:
 PRESSURE TRANSDUCERS
 ULTRA SONIC SENSORS
 MECHANICAL FLOAT SWITCHES

SPRING CLIP

UNISTRUT
 NUT


1/4" X 1 1/2"
 SS FENDER WASHER

1/4" SS FLAT WASHER

1/4-UNC SS HEX NUT

1/4" SS EYE BOLT

NOTE: USE ANTI-SIEZE LUBRICANT ON ALL
 STAINLESS STEEL BOLTS AND NUTS.

DRN BY	AM	DATE	09/12/08		18240 NORTH BANK ROAD ROSEBURG, OREGON 97470 541-496-3541
CHK BY		DATE			
APR BY		DATE		DESCRIPTION	
				CABLE HANGER ASSEMBLY	
				DWG NO	REV

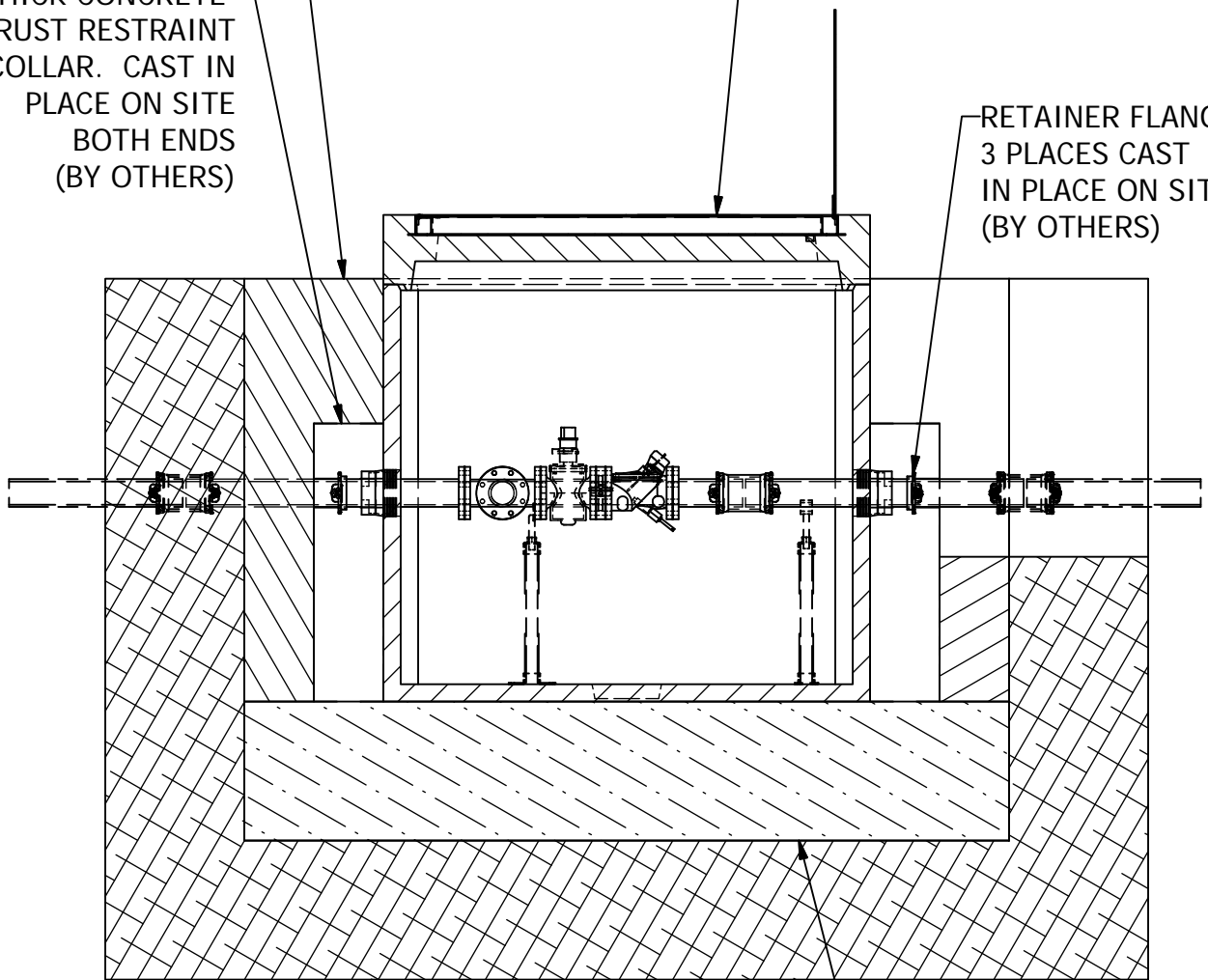


COMPACTED BACK FILL
AS SPECIFIED BY
ENGINEER

12" THICK CONCRETE
THRUST RESTRAINT
COLLAR. CAST IN
PLACE ON SITE
BOTH ENDS
(BY OTHERS)

ROMTEC VALVE VAULT ASSEMBLY


RETAINER FLANGE
3 PLACES CAST
IN PLACE ON SITE
(BY OTHERS)



UNDISTURBED SOIL

COMPACTED BASE ROCK
AS REQUIRED AS
SPECIFIED BY ENGINEER

NOTE: VAULT MUST BE
LEVELED IN ALL DIRECTIONS
PRIOR TO POURING RESTRAINT
COLLARS AND BACKFILLING.

DRN BY	AM	DATE	4/12/13		18240 NORTH BANK ROAD ROSEBURG, OREGON 97470 541-496-3541
CHK BY		DATE			
APR BY		DATE		DESCRIPTION	
				VALVE VAULT BASE LEVELING	
				DWG NO	REV

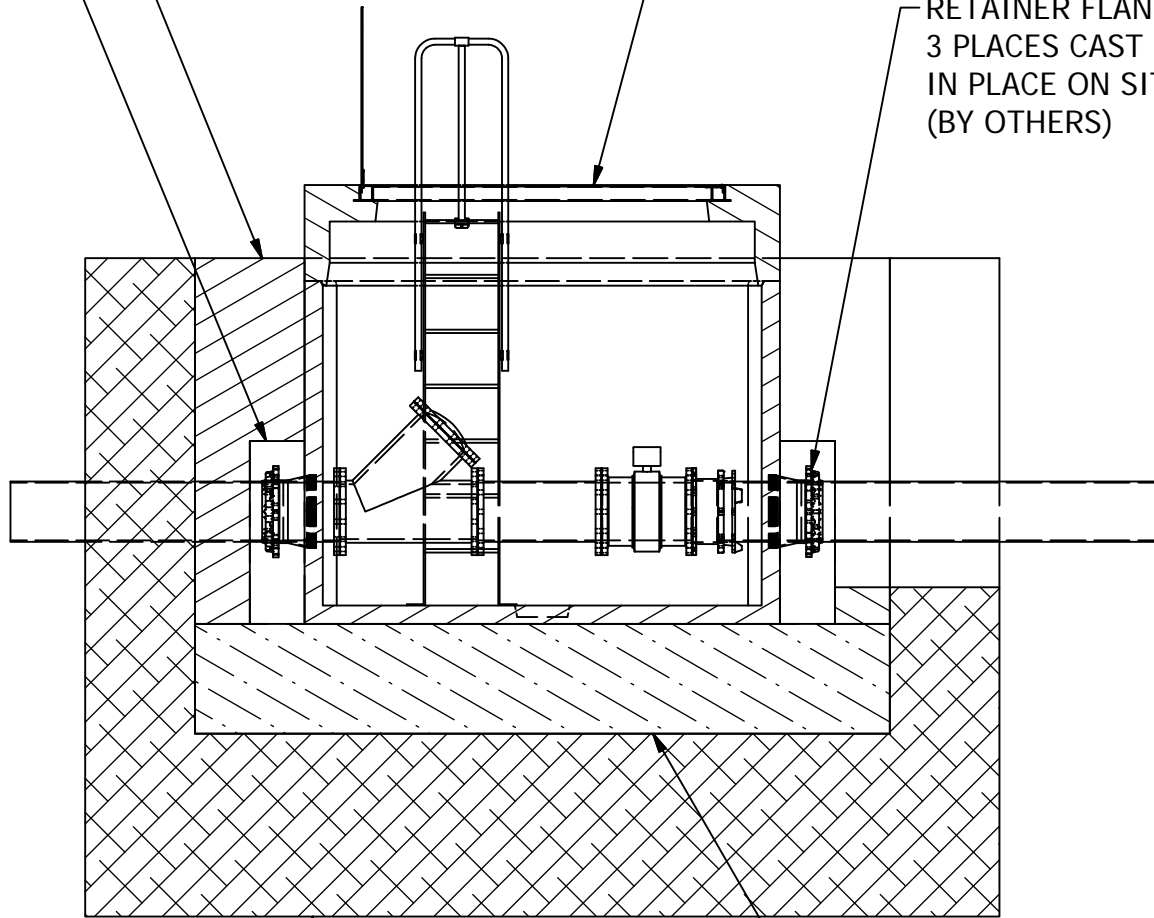


12" THICK CONCRETE THRUST RESTRAINT COLLAR. CAST IN PLACE ON SITE BOTH ENDS (BY OTHERS)

COMPACTED BACK FILL AS SPECIFIED BY ENGINEER

ROMTEC METERING VAULT ASSEMBLY


RETAINER FLANGE 3 PLACES CAST IN PLACE ON SITE (BY OTHERS)



UNDISTURBED SOIL

COMPACTED BASE ROCK AS REQUIRED AS SPECIFIED BY ENGINEER

NOTE: VAULT MUST BE LEVELED IN ALL DIRECTIONS PRIOR TO POURING RESTRAINT COLLARS AND BACKFILLING.

DRN BY	AM	DATE	4/12/13		18240 NORTH BANK ROAD ROSEBURG, OREGON 97470 541-496-3541
CHK BY		DATE			
APR BY		DATE		DESCRIPTION	
				METERING VAULT BASE LEVELING	
				DWG NO	REV

**END
OF
SECTION**

19. FIELD START-UP REPORT

This section includes the Field Start-Up Report to be filled out by Romtec Utilities onsite advisor at the scheduled start-up of the system.

This section is structured as follows:

19.01 FIELD START-UP REPORT

FIELD START-UP REPORT

TO BE COMPLETED BY ROMTEC UTILITIES START-UP TECHNICIAN

DATE: ____/____/____

(SITE OVERVIEW)

1. STRUCTURAL / MECHANICAL CONSTRUCTION

A. Are all the components for the wet well and valve vault installed and approved?

Yes No

2. OPERATION & MAINTENANCE MANUAL

A. Please fill in the contact information for the person that the O&M Manual should be mailed to.

Contact: _____

Address: _____

Phone: _____

Email: _____

3. ELECTRICAL CONSTRUCTION

A. Have the conduits been installed between the wet well and the main control panel minimum (one (1) for each pump, one (1) for level control)?

Yes No Installed by _____

B. Have the "pump power" wires been pulled between the main control panel and the wet well?

Yes No Installed by _____

C. Have the level control signal wires been pulled between the pump control panel and the wet well?

Yes No Installed by _____

D. Have the level control wires been landed on the appropriate terminals inside the control panel?

Yes No Installed by _____

- E. Have the panel power wires been installed between the main disconnect, automatic transfer switch (if present) and the pump control panel?
 Yes No
- F. Have the "meter base" and main disconnect been installed and inspected?
 Yes No
- G. Has the power company energized the meter?
 Yes No

4. COMMUNICATION EQUIPMENT

- A. Has all required communication equipment (radio, phone, cellular) been installed and tested and operational?
 Yes No NA

5. WATER AVAILABILITY

- A. Is there enough water available for a minimum of ½ hour of pumping?
 Yes No

(TESTING AND START-UP)

1. PUMP DATA

Pump: P-1 Model: _____ Serial No.: _____ Imp.: _____ HP: _____ FLA: _____
Pump: P-2 Model: _____ Serial No.: _____ Imp.: _____ HP: _____ FLA: _____
Pump: P-3 Model: _____ Serial No.: _____ Imp.: _____ HP: _____ FLA: _____

- A. Do the above meet the approved scope of supply?
 Yes No (Explain in Comments)

2. PUMP CONTROL DATA

Primary Level Control Type/Mfg./Model: _____
Secondary Level Control Type/Mfg./Model: _____

- A. Do the above meet the approved scope of supply?

Yes No (Explain in Comments)

3. PHYSICAL INSPECTION

A. Have all of the terminals and lugs been checked for tightness?

Yes No NA

B. Inspected pumps and cable for damage?

P-1: Yes No NA

P-2: Yes No NA

P-3: Yes No NA

C. Check oil in seal chamber for condition and quantity?

P-1: Yes No NA

P-2: Yes No NA

P-3: Yes No NA

D. Does impeller spin freely when rotated by hand?

P-1: Yes No NA Verified by _____

P-2: Yes No NA

P-3: Yes No NA

E. Discharge connection level and tight (verify with contractor)?

P-1: Yes No NA

P-2: Yes No NA

P-3: Yes No NA

F. Guide bars vertical and tight (verify with contractor)?

P-1: Yes No NA

P-2: Yes No NA

P-3: Yes No NA

G. Lifting cable free of damage and connected securely?

P-1: Yes No NA

P-2: Yes No NA

P-3: Yes No NA

H. Electrical connections tight and connected correctly?

P-1: Yes No NA

P-2: Yes No NA
 P-3: Yes No NA

- I. Pump station free of debris?
 Yes No NA (Explain in Comments)
- J. Junction boxes, conduits, seals installed correctly?
 Yes No NA
- K. Is the system properly grounded and bonded?
 Yes No NA
- L. Are cord grips properly installed?
 Yes No NA
- M. Are the working clearance requirements maintained as per code?
 Yes No NA
- N. Are all level sensing devices installed as designed & properly documented?
 Yes No NA
- O. Are the schematics on the door accurate?
 Yes No NA

4. PRE-START-UP PUMP ELECTRICAL CHECKS

Resistance of Motor & Cable:

Pump: <u>P-1</u>	R(2)~W(3)_____Ω	W(3)~B(1)_____Ω	B(1)~R(2)_____Ω
Pump: <u>P-2</u>	R(2)~W(3)_____Ω	W(3)~B(1)_____Ω	B(1)~R(2)_____Ω
Pump: <u>P-3</u>	R(2)~W(3)_____Ω	W(3)~B(1)_____Ω	B(1)~R(2)_____Ω

Sensor Loop Resistance:

Pump: <u>P-1</u>	Thermal_____Ω	Seal Test_____Ω
Pump: <u>P-2</u>	Thermal_____Ω	Seal Test_____Ω
Pump: <u>P-3</u>	Thermal_____Ω	Seal Test_____Ω

Insulation Resistance to ground (YEL/GRN-FLYGT PUMPS ONLY):

Pump: <u>P-1</u>	R(2)~GRD_____MΩ	W(3)~GRD_____MΩ	B(1)~GRD_____MΩ
Pump: <u>P-2</u>	R(2)~GRD_____MΩ	W(3)~GRD_____MΩ	B(1)~GRD_____MΩ
Pump: <u>P-3</u>	R(2)~GRD_____MΩ	W(3)~GRD_____MΩ	B(1)~GRD_____MΩ

Note: This value should exceed 10 MΩ.

5. OPERATIONAL CHECKS

1. Supply Voltage, Pumps Off:

L1 ~ L2: _____V L2 ~ L3: _____V L1 ~ L3: _____V

a. Do the above meet the approved scope of supply?

Yes **No (Explain in Comments)**

2. Phase monitor settings: Voltage: _____, Delay: _____, % Imbalance: _____

3. Starter Type/Mfg./Model: _____

4. O.L. Type/Setting: _____ Amp _____

5. Impeller Rotation (CW/CCW) viewed from _____:

P-1: _____, P-2: _____, P-3: _____,

6. Volts, Pump Operating in System: Pump: 1 T1~T2 _____V T2~T3 _____V T3~T1 _____V

Pump: 2 T1~T2 _____V T2~T3 _____V T3~T1 _____V

Pump: 3 T1~T2 _____V T2~T3 _____V T3~T1 _____V

7. Amps, Pump Operating in System: Pump: 1 T-1 _____A T-2 _____A T-3 _____A

Pump: 2 T-1 _____A T-2 _____A T-3 _____A

Pump: 3 T-1 _____A T-2 _____A T-3 _____A

8. Abnormal noise/vibration?

P-1: **Yes** **No** **NA**

P-2: **Yes** **No** **NA**

P-3: **Yes** **No** **NA**

9. Does pump shut down and lockout when sensor lead(s) are disconnected?

P-1: **Yes** **No** **NA**

P-2: **Yes** **No** **NA**

P-3: **Yes** **No** **NA**

10. Have VFD's been programmed and do they work correctly (if applicable)?

P-1: **Yes** **No** **NA**

P-2: **Yes** **No** **NA**

P-3: **Yes** **No** **NA**

11. List of VFD parameters has been provided (if applicable) to: _____

12. Has controller been programmed and is it working correctly (if applicable)?

Yes **No** **NA**

13. List of controller parameters provided to: _____

14. Does the primary level control system work correctly? Pump On/Off Points _____
 Yes No (Explain in Comments)

15. Does the hi level warning work correctly?
 Yes No

16. Does the redundant level control system work correctly (if applicable)?
 Yes No NA

17. Does flow meter work correctly (if applicable)?
 Yes No NA

18. Has the auto dialer been powered up and does it work correctly (if applicable)?
 Yes No NA

19. Has disconnect panel been installed and does it work correctly (if applicable)?
 Yes No NA

20. Has all I/O been checked out and verified?
 Yes No

21. Have all communication issues been tested & signed off by owner/contractor?
 Yes No NA

6. DRAW DOWN TEST:

- Gallons per foot: 4' diameter = 94 gallons
- 5' diameter = 146.88 gallons
- 6' diameter = 211.51 gallons
- 8' diameter = 376.01 gallons
- 10' diameter = 587.52 gallons

Draw down: P-1: _____ FT
 P-2: _____ FT
 P-3: _____ FT

Pump flow: P-1: _____ GPM
 P-2: _____ GPM
 P-3: _____ GPM

*** DOES THE ABOVE MEET THE APPROVED SCOPE OF SUPPLY?**

YES ___ NO ___ EXPLAIN IN COMMENTS

7. PRESSURE READINGS (IF AVAILABLE):

Pump 1 - Pump off _____ psi. Pumping _____ psi. Pump on with valve closed _____ psi.
 Pump 2 - Pump off _____ psi. Pumping _____ psi. Pump on with valve closed _____ psi.
 Pump 3 - Pump off _____ psi. Pumping _____ psi. Pump on with valve closed _____ psi.

8. WET WELL PRIMARY LEVEL SETTINGS:

High/high level alarm: Elevation _____ ft.
 Distance measured from floor _____ ft.
 High level alarm: Elevation _____ ft.
 Distance measured from floor _____ ft.
 Lag/third pump start: Elevation _____ ft.
 Distance measured from floor _____ ft.
 Lag/second pump start: Elevation _____ ft.
 Distance measured from floor _____ ft.
 Lead pump start: Elevation _____ ft.
 Distance measured from floor _____ ft.
 Lag/third pump stop: Elevation _____ ft.
 Distance measured from floor _____ ft.
 Lag/second pump stop: Elevation _____ ft.
 Distance measured from floor _____ ft.
 Lead pump stop: Elevation _____ ft.
 Distance measured from floor _____ ft.
 Low level alarm: Elevation _____ ft.
 Distance measured from floor _____ ft.

*** DOES THE ABOVE MEET THE APPROVED SCOPE OF SUPPLY?**

YES ___ NO ___ EXPLAIN IN COMMENTS

COMMENTS

LIST ANY CORRECTIVE ACTION REQUIRED AND LIST RESPONSIBLE PARTY

10. **The Romtec Utilities technician PERFORMED ALL OF THE FOLLOWING start-up activities**

1. Verify electrical supply voltage.
2. Field check control panel.
3. Perform start-up procedure for pumps.
4. Set level controls per approved scope of supply.
5. Testing of pumping rate to the expected performance curve.
6. Field check and set back up power (generators) by Romtec Utilities (IF APPLICABLE).

All parties agree that Romtec Utilities has fulfilled all requirements (1-6) for this lift station, and the station is fully approved and commissioned.

Startup Technician:

Print Name: _____

Sign: _____

Cell Phone Number: _____

Date: _____

Contractor's Representative:

Print Name: _____

Sign: _____

Cell Phone Number: _____

Date: _____

Electrical Contractor Representative:

Print Name: _____

Sign: _____

Cell Phone Number: _____

Date: _____

Site Engineer Representative:

Print Name: _____

Sign: _____

Cell Phone Number: _____

Date: _____

Owner/Sewer Agency Representative:

Print Name: _____

Sign: _____

Cell Phone Number: _____

Date: _____

Lead Maintenance/Service Personnel:

Print Name: _____

Sign: _____

Cell Phone Number: _____

Date: _____

Startup witnessed by:

Print Name: _____

Sign: _____

Cell Phone Number: _____

Date: _____

Startup witnessed by:

Print Name: _____

Sign: _____

Cell Phone Number: _____

Date: _____

Startup witnessed by:

Print Name: _____

Sign: _____

Cell Phone Number: _____

Date: _____

11. Who is the main contact to be in charge of operation and maintenance of the lift station through the duration of the warranty period:

Name: _____
Company: _____
Phone: _____

Note: *This person is responsible for troubleshooting with the help of Romtec Utilities over the phone in the event of a warranty issue throughout the one year warranty period beginning the day Start up Training is completed.*

Special Note: *All other personnel relevant to the maintenance and operation of the lift station are required to be present for the duration of startup training.*

**END
OF
SECTION**

20. AUTODESK DESIGN REVIEW

This section explains how to use the file extension DWF that should be attached to this submittal.

20.01 AUTODESK DESIGN REVIEW DOWNLOAD PROCEDURE

20.01

AUTODESK DESIGN REVIEW DOWNLOAD PROCEDURE

Included with your ROMTEC Utilities, Inc. Submittal is a file with the extension DWF.

The DWF file is a viewable 3D model of your actual system. To view the file, download the free software following the procedure below.

Autodesk Design Review Download Procedure:

1. Go to: www.autodesk.com
2. Click on: Autodesk Design Review Free tab located on the right of the page
3. Select the correct language and click Download Now
4. Select Save File
5. Go to the folder you downloaded the program to and double click the file AutodeskDesignRevSetup.exe
6. Click on Run
7. Follow the Installation Tips on the screen

To view and manipulate your .DWF file double click on the .DWF file



**END
OF
SECTION**