

ROMTEC UTILITIES SCOPE OF SUPPLY AND DESIGN SUBMITTAL

FOR:

BAE SYSTEM PLANT GWT-043012-01 (KINGSPORT, TN)

DATE: GYdhYa VYf' &+, 2013

REVISION: ' – For the Record

CUSTOMER CONTACT INFORMATION:

Customer Name
Company Name
111 Company Address
555-555-5555
customername@company.com

ENGINEER CONTACT INFORMATION:

Customer Name
Company Name
111 Company Address
555-555-5555
customername@company.com



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



GYdhYa VYf`&+, 2013

To: Customer Name,
Company Name

From: Romtec Utilities Document Control

Re: Documentation for the proposed pump station project identified as

Project Name: BAE System Plant GWT-043012-01

Based on Design Criteria dated: 4/18/13

Revision #: '

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.

8-16. 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

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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"): BAE System Plant
GWT-043012-01

Location (herein referred to as "the site"): Kingsport, Tennessee

Document Date: - #&+/13

Revision #: '

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.

1.01**ABOUT THIS DOCUMENT****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.

1.01

ABOUT THIS DOCUMENT

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, suction lines 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, suction 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, and install 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, and 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 the 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 FORM & NOTICE TO PROCEED

I, _____, representing _____, have reviewed the Romtec Utilities' Scope of Supply and Design Submittal for the project named _____, dated _____, revision # _____, purchase order # _____.

1. INTRODUCTION

_____ I have read the introduction outlining how this submittal will be used, and I agree that these lists are complete and correct.

_____ I request the following changes: _____

2. SCOPE OF SUPPLY – PRODUCTS & SERVICES

_____ I have read the detailed lists of products and services to be supplied By Romtec Utilities, and I agree that these lists are complete and correct.

_____ I request the following changes: _____

3. PRODUCTS & SERVICES NOT SUPPLIED BY ROMTEC UTILITIES

_____ I have read the detailed lists of products and services to be not supplied By Romtec Utilities, and I agree that these lists are complete and correct.

_____ I request the following changes: _____

4. DESIGN CRITERIA

_____ I have confirmed that the data listed on the Lift Station Design Form are accurate.

5. PROJECT SITE

_____ If site drawings (by others) are included in this document; I have confirmed they are accurate.

6. WARRANTY & LIMITATIONS

_____ I have read the Romtec Utilities, Inc. Limited Warranty & Limitations. I agree with its terms conditions and limitations.

7. OPERATION & MAINTENANCE (O&M) MANUAL

_____ I have reviewed the operation & maintenance section. I approve the documents as submitted.

_____ I request the following changes: _____

8. PUMP SKID ASSEMBLY

_____ I have reviewed the pump skid assembly documents. I approve the documents as submitted.

_____ I request the following changes: _____

1.04 SUBMITTAL APPROVAL FORM & NOTICE TO PROCEED

9. PUMPS

_____ I have reviewed the documents for the pumps. I approve the documents as submitted.

_____ I request the following changes: _____

10. LIQUID LEVEL SENSORS

_____ I have reviewed the documents for the liquid level sensors. I approve the documents as submitted.

11. ELECTRICAL INTERCONNECTIONS

_____ If site electrical drawings (by others) are included in this document; I have confirmed they are accurate.

12. CONTROL PANEL/ELECTRICAL & COMMUNICATIONS

_____ I have reviewed the documents for the control panel/electrical and communications system. I approve the documents as submitted.

_____ I request the following changes: _____

13. PUMP ELECTRICAL CONNECTION ENCLOSURE/PANEL

_____ I have reviewed the documents for the pump electrical connection enclosure/panel. I approve the documents as submitted.

_____ I request the following changes: _____

14. INSTALLATION

_____ I have reviewed the document describing the pre-installation requirements. I approve the documents as submitted.

_____ I request the following changes: _____

15. FIELD START-UP REPORT

_____ I have reviewed the document describing the field start-up report requirements. I approve the documents as submitted.

_____ I request the following changes: _____

16. AUTODESK DESIGN REVIEW DOWNLOAD PROCEDURE

_____ I have reviewed the document describing the Autodesk Design Review download procedure. I approve the documents as submitted.

_____ I request the following changes: _____

1.04 SUBMITTAL APPROVAL FORM & NOTICE TO PROCEED

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

Date

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: Documentation Manager
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 Start-Up Preparation Checklist to be filled out by the owner/contractor prior to the scheduled start-up.

This section is structured as follows:

- 2.01 SCOPE OF SUPPLY PRODUCTS (TO BE SUPPLIED BY ROMTEC UTILITIES)
- 2.02 SCOPE OF SUPPLY SERVICES (TO BE SUPPLIED BY ROMTEC UTILITIES)
- 2.03 START-UP, TESTING & TRAINING OUTLINE
- 2.04 PRE-START-UP SCHEDULING INFORMATION
- 2.05 PRE-START-UP CHECKLIST

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
romtec3@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 SCOPE OF SUPPLY PRODUCTS
SUPPLIED BY ROMTEC UTILITIES**

COMPLETE PUMP STATION INCLUDES:

PUMP SKID ASSEMBLY

QTY ITEM

**2.01 SCOPE OF SUPPLY PRODUCTS
SUPPLIED BY ROMTEC UTILITIES**

CONTROL PANEL/ELECTRICAL & COMMUNICATION

QTY ITEM

2.02**SCOPE OF SUPPLY SERVICES (TO BE
SUPPLIED BY ROMTEC UTILITIES)****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.

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**SCOPE OF SUPPLY SERVICES (TO BE SUPPLIED BY ROMTEC UTILITIES)****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.

2.03**START-UP, TESTING & TRAINING OUTLINE****Start-up, testing & training outline**

1. Understanding the Complete System
 - a. Pumps (with assistance from pump manufacturer's representative)
 - b. Skid Assembly
 - c. Level devices

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

3. System Protection Methods/Devices
 - a. Phase Monitor
 - i. Surge Suppression

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

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

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

Pre Start-up Scheduling Information

SCHEDULING FOR START-UP AND TRAINING

1. LEAD TIME TO SCHEDULE START UP

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

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: Any additional time required of the suppliers must be directly ordered and contracted from the supplier by the customer.

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. Skid assembly installation complete
2. Review of electrical construction connecting to the skid assembly
3. Communication equipment
4. Water availability
5. Required photos
6. Personnel required for start-up

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.

1. PREVIOUSLY COMPLETED CONSTRUCTION REVIEW

The following components must be installed and approved.

	YES	NO
i. Discharge Pipes & Suction Lines		
1. Are connected to elbows?	<input type="checkbox"/>	<input type="checkbox"/>
2. Are plumb and connected to pump suction elbows?	<input type="checkbox"/>	<input type="checkbox"/>

2. REVIEW OF ELECTRICAL CONSTRUCTION CONNECTING TO THE RESERVOIR

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 level control wires been pulled between the pump control panel and the reservoir? | <input type="checkbox"/> | <input type="checkbox"/> |
| ii. Have the main feeder conductors been installed and ready to energize? | <input type="checkbox"/> | <input type="checkbox"/> |

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

- | | | |
|--|--------------------------|--------------------------|
| iii. 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. 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. | <input type="checkbox"/> | <input type="checkbox"/> |
| ii. Photo of the inside of the level sensing junction box. | <input type="checkbox"/> | <input type="checkbox"/> |

5. PERSONNEL REQUIRED FOR START-UP

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: _____

Site Electrician:

Name: _____
Company: _____
Phone: _____

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

**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. Installation of supplied pump station systems and components
 - d. Piping to and from pump station
 - e. Electrical conduit and wiring (except wires attached to supplied components)
 - f. Site lighting, signage, fencing, bollards

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 2.01 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: BAE System Plant GWT-043012-01

Design criteria supplied by: Lauren Engineers & Constructors

Design criteria date: 4/18/13

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 - #&+/13 dated Scope of Supply and Design Submittal based on the following information:

PART 1: PROJECT CONTACT INFORMATION

Today's Date: 4/18/2013

Information here in provided by:

Company Name

Company/Agency Type:

Engineer
 Engineer
 Developer
 Gov't. Agency
 Other

First Name:

John

Last Name:

Doe

Title:

Email Address:

name@company.com

Address:

111 Company Address

City:

State/Province:

_____ Zip Code: _____

Country:

USA

Telephone:

555-555-5555 Phone Ext: _____

Mobile/Other Phone:

_____ Fax: 555-555-5555

Project Name:

BAE SYSTEM PLANT - GWT-043012-01

Your Client for this project is:

Private Co.
 Public Agency
 Private Co.

Project Type:

Other
 Wastewater
 Stormwater
 Other

Project City:

KINGSPORT, TN Project Zip: _____

Project Engineer:

Company Name

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

Final Project Owner and/or Operator:

Governing Sewer or Water Authority:

Does Authority have a lift station standard?

N/A
 Yes
 No
 N/A

Who should Romtec contact about the lift station design standard?

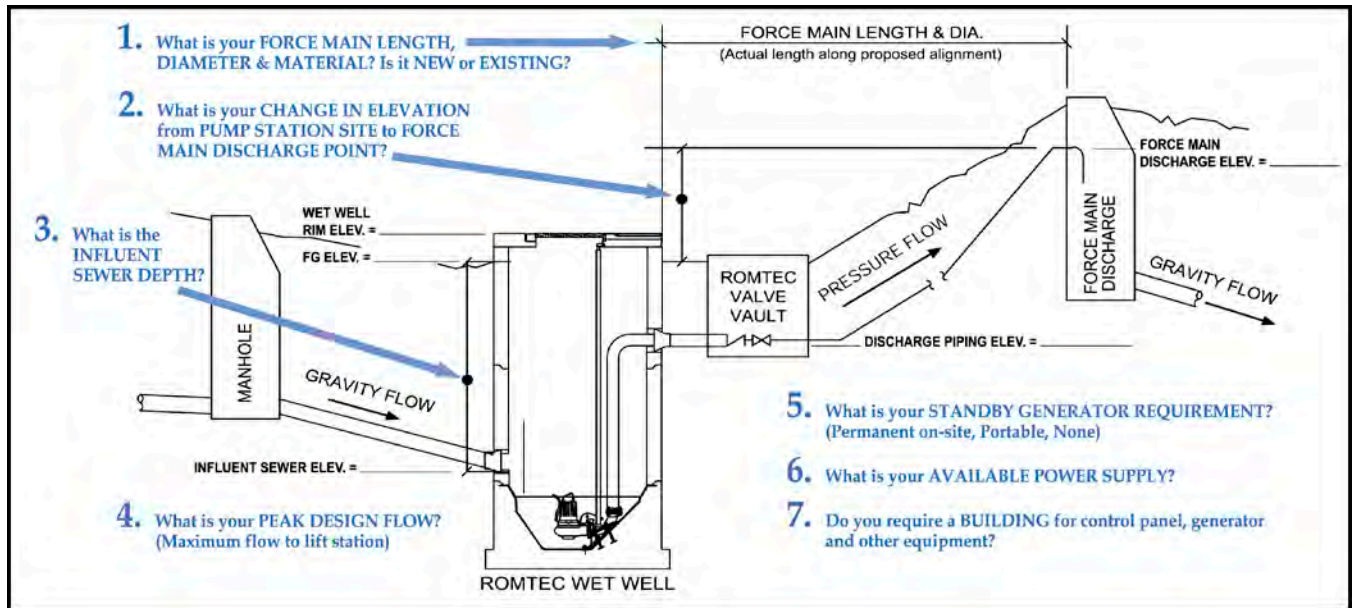
What is the Expected Project Bid Date?

_____ 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: _____ ft. (actual length along proposed alignment)

Force main diameter (inside): _____ in. inside dia.

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

Force Main is: New Existing

2. Elevation change from lift station site to force main discharge point: _____ ft.

Finish grade elevation at wet well: _____ ft.

Discharge piping elevation: _____ ft.

Force main discharge elevation: _____ ft.

3. Influent sewer elevation: _____ ft.

4. Peak design inflow (maximum flow to lift station): _____ 300 g.p.m. @ 30' TDH

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

Standby generator fuel: _____ 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

4.02 LIFT STATION DESIGN CRITERIA FORM

7. Electrical controls weather protection:

None

Enclosed
Building

Shelter
Structure

None

Weather protection structure is for:

SELECT ONE

Electrical Controls Only

Electrical Controls & Generator

Controls, Generator, Chemical Feed

**END
OF
SECTION**

5. SITE PLAN

The location of any project is critical in design. This section includes:

5.01 SITE SPECIFIC CONDUIT & WIRE LAYOUT LIMITATIONS

No site plan has been provided to Romtec Utilities in AutoCAD.

If and when we receive a site plan (in AutoCAD) showing the orientation of the influent lines, force main and lift station, Romtec Utilities will provide a proposed layout (to scale) of its equipment on the site.

Without a site plan, Romtec Utilities can only assume that its design is correct relative to site constraints and orientations.

If a site plan in AutoCAD is not provided to Romtec Utilities, any site layouts are by others.

If the Romtec Utilities Scope of Supply and Design Submittal or the Scope of Supply, Design and Installation Submittal does not have an approved site plan which includes the Romtec Utilities equipment layout on the site, then we will not be involved in any part of the utility layout.

It is okay if the site plan (in AutoCAD format) is not provide, but if it is not, Romtec Utilities will not design or advise on any part of the site utility plan. For example, Romtec Utilities will not recommend conduit sizing, wiring sizing, conduit layout, skid or control panel placement, etc.

If this site plan section is not complete, the responsibility for the physical layout of the Romtec Utilities lift station and all wet and dry utilities is by others.

Any difficulties that arise due to the lack of an approved site plan with an approved layout of the Romtec Utilities supplied equipment is the responsibility of the owner.

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.

5.01

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 11.01 – Typical Field Wiring Plan.

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

2. Section 12.05 – 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 pump skid assembly (or delivery of the pump skid assembly or the date that the pump skid assembly 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

Start-up that is performed without the presence of 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

6.01**ROMTEC UTILITIES LIMITED WARRANTY**

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.
- 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.
 - i. *Note: While there are many ways to vary and/or adjust "operational parameters" within the overall lift station, Romtec Utilities is only*

6.01

ROMTEC UTILITIES LIMITED WARRANTY

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. A Romtec Utilities advisor will be at the project site during installation of the pump station's components**
 - a. Any Romtec Utilities personnel at the project site during installation of the pump station's 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.

- 13. 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 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 onto the prepared surface.
 - b. Our goal is to save you (or your contractor) time and money. One way to do this is to deliver and install the Romtec Utilities system on the same day (from the Romtec Utilities' delivery truck to the prepared surface).

6.02

LIMITATIONS OF ROMTEC UTILITIES'
RESPONSIBILITIES

- c. Therefore, when Romtec Utilities schedules its construction advisor to be on-site we assume that the site has been prepared.
- 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.*

14. 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.*

6.02

**LIMITATIONS OF ROMTEC UTILITIES'
RESPONSIBILITIES**

- 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.
- 15. 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.
- 16. 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.
- 17. 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.*
- 18. 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.

6.02

LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES

- 19. 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.
- 20. 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 words

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.
- 21. Pump station owner and/or owner's designated station operator must receive training for warranty 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.

6.02

LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES

- 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.

22. 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. 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.

23. 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.*

6.02

LIMITATIONS OF ROMTEC UTILITIES' RESPONSIBILITIES

24. 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.

25. 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 scheduled 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.

**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.

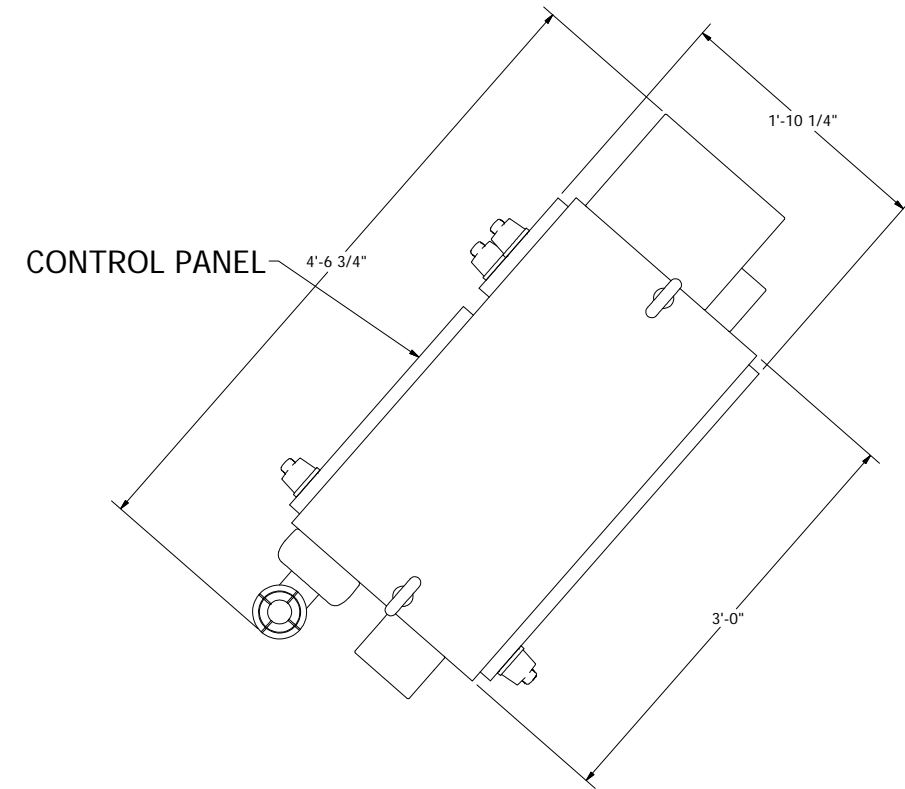
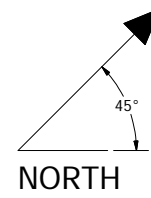
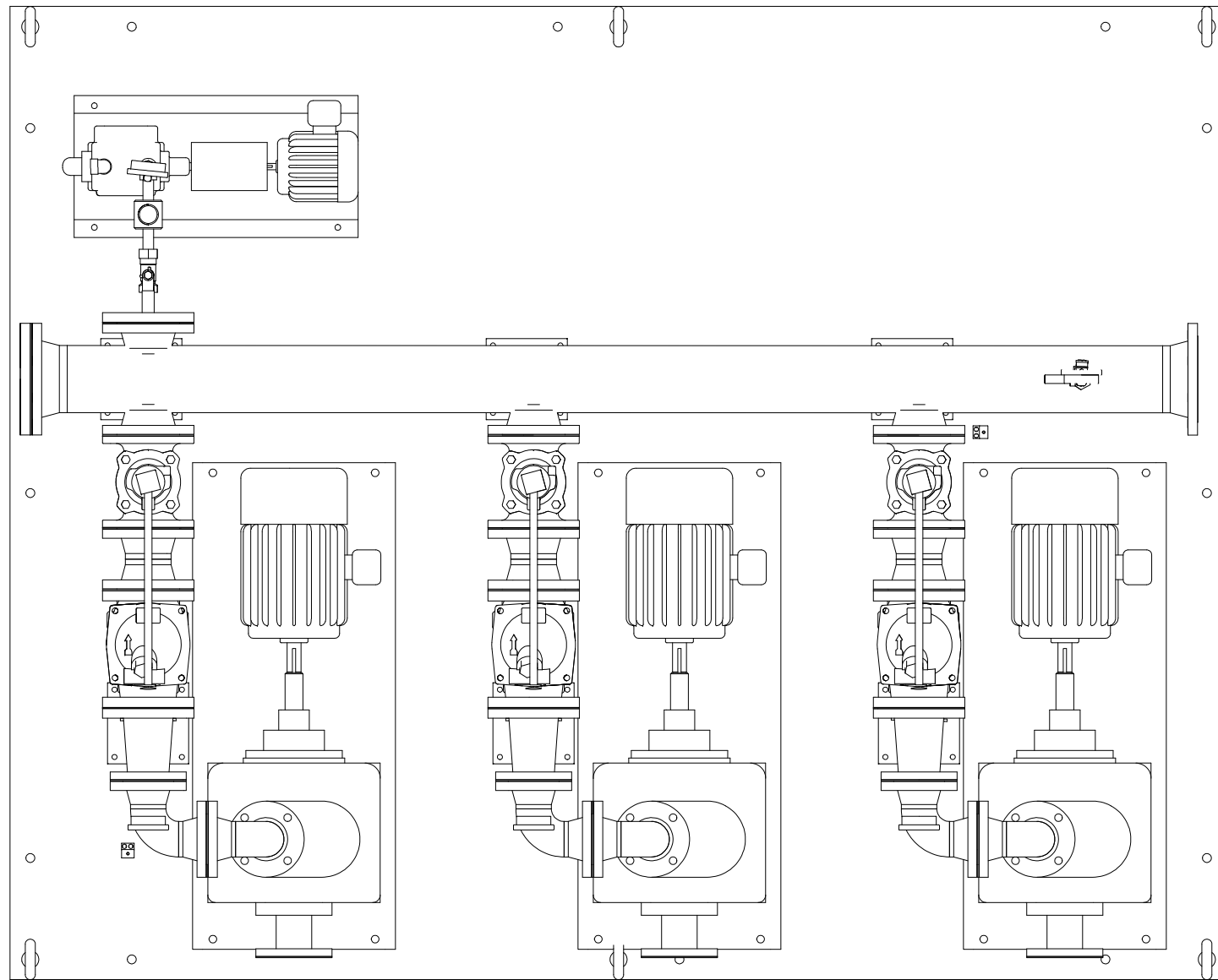
**END
OF
SECTION**

8. PUMP SKID ASSEMBLY

This section contains information pertaining to the pump skid assembly. There is both technical information and related drawings necessary for the construction.

This section is structured as follows:

- 8.01 COMPONENT DRAWING(S)
- 8.02 PUMP SKID ASSEMBLY RELATED DATA SHEETS
 - 8.02.1 BALL VALVE
 - 8.02.2 MANIFOLD ASSEMBLY
 - 8.02.3 PRESSURE GAUGE
 - 8.02.4 DIAPHRAGM SEAL
 - 8.02.5 GROUNDING LUG
 - 8.02.6 KF BALL VALVE
 - 8.02.7 PRESSURE SWITCH
 - 8.02.8 SWING CHECK VALVE VELAN
 - 8.02.9 SWING CHECK VALVE GRAINGER
 - 8.02.10 AMERCOAT & AMERSHIELD
 - 8.02.11 HEAT TRACE & INSULATION



WEIGHTS	
PARTS	WEIGHT
SKID ASSEMBLY PLATFORM	2270lbs
PIPING, PIPE SUPPORTS AND VALVES	1475lbs
SELF PRIMER PUMP ASSEMBLIES	3075lbs
OIL SKIMMER PUMP ASSEMBLY	260lbs
CONTROL PANEL	950lbs
TOTAL WEIGHT	8030lbs

NOTES:

CONTROL PANEL TO BE LOCATED OFF OF SKID. SHIP FOR FIELD MOUNTING PER DRAWING 7651-1360.2005.

DRAWING GEOMETRY IS ACCURATE AND CREATED AT 1:1 AND FIT TO THE SHEET. DO NOT SCALE THIS DRAWING.

REV	DESCRIPTION	DATE	APPROV
3	REVISION PER 5/16/13 COMMENTS	5-17-13	AD
2	REVISION PER 3/27/13 COMMENTS	4-9-13	AD
1	COMPONENT DRAWING	5-18-12	AD

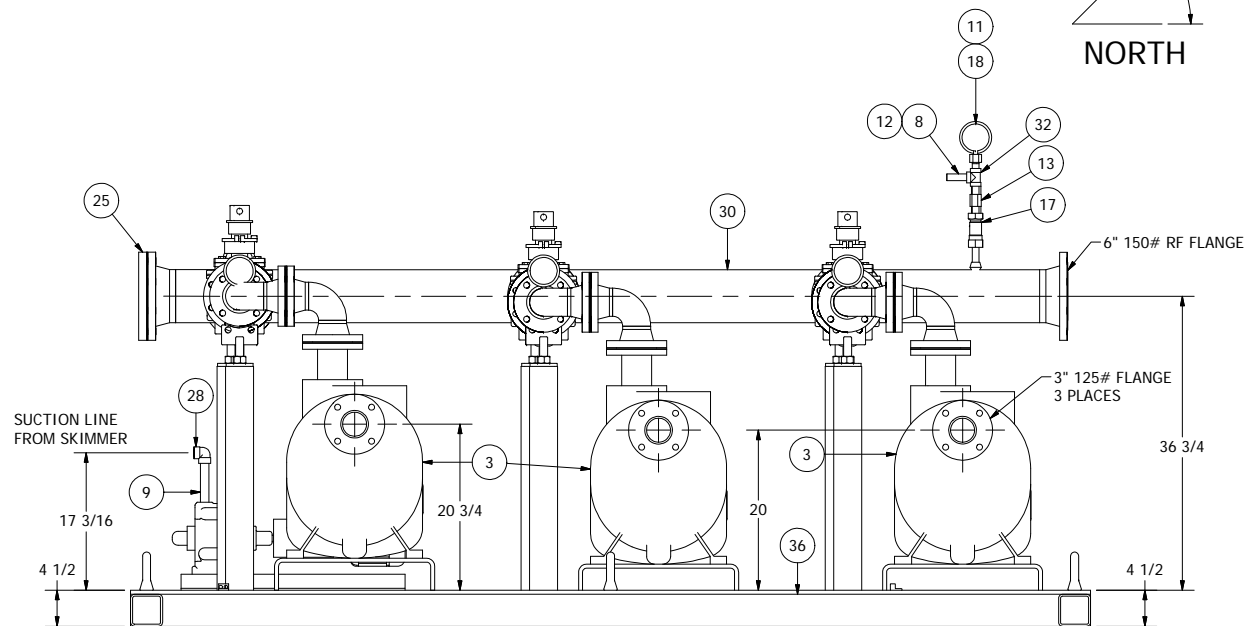
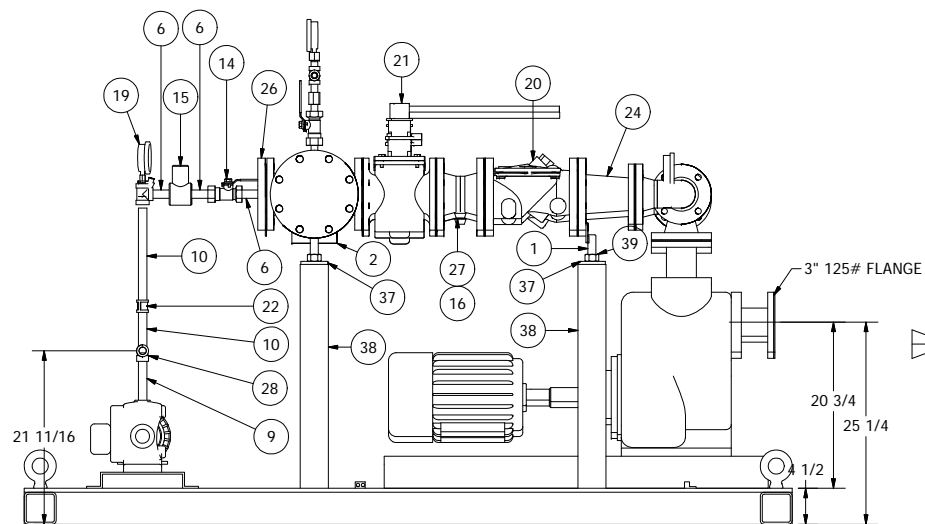
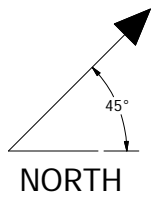
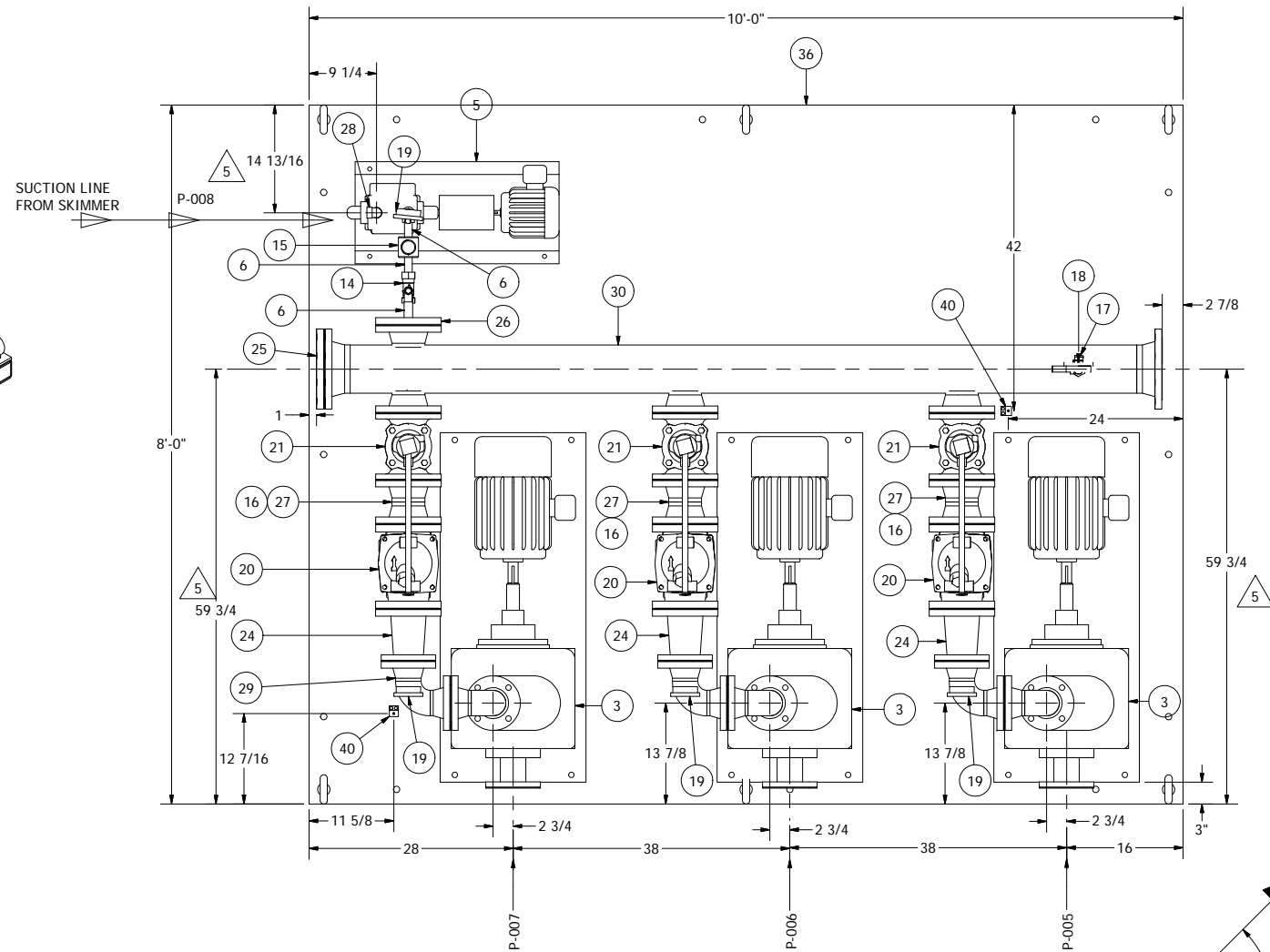
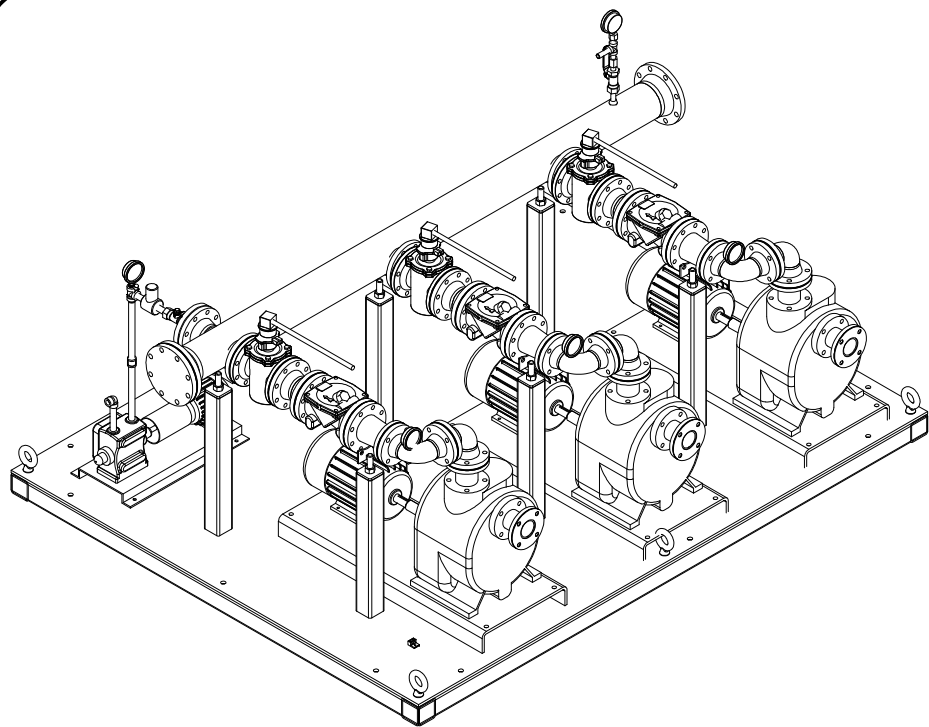
COMPONENT DRAWING

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

BAE -ACETIC ACID PLANT
 4" - 3 PUMP SKID LAYOUT

SHEET
 1 OF 4

JOB NUMBER
 RMTC
 0000



COATING NOTES:

ALL STAINLESS STEEL OR ALUMINUM PARTS DO NOT NEED ADDITIONAL COATING.

ALL PLAIN STEEL PARTS, SKID PLATFORM, AND PIPING STANDS IF NOT STAINLESS STEEL SHALL BE COATED (SHOP APPLIED) WITH:
 • PRIME COAT - AMERCOAT 240
 • FINISH COAT - AMERSHIELD (BLACK)

NOTES:

CONTROL PANEL TO BE LOCATED OFF OF SKID. SHIP FOR FIELD MOUNTING PER DRAWING 7651-1360.2005.

PIPE AND FITTINGS WILL HAVE HEAT TRACE AND INSULATION AS PER SPECIFICATIONS

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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.

REV	DESCRIPTION	DATE	APPROV
7	COMPONENT DRAWING	5-18-12	AD
6	REVISION PER 3/27/13 COMMENTS	4-9-13	AD
5	REVISION PER 5/16/13 COMMENTS	5-31-13	AD
4	AS BUILT MANIFOLD DIMENSION CHANGE	6-14-13	AD
3	REVISED FOR PRODUCTION LAUNCH	5-31-13	AD
2	REVISION PER 5/16/13 COMMENTS	5-31-13	AD
1	COMPONENT DRAWING	5-18-12	AD

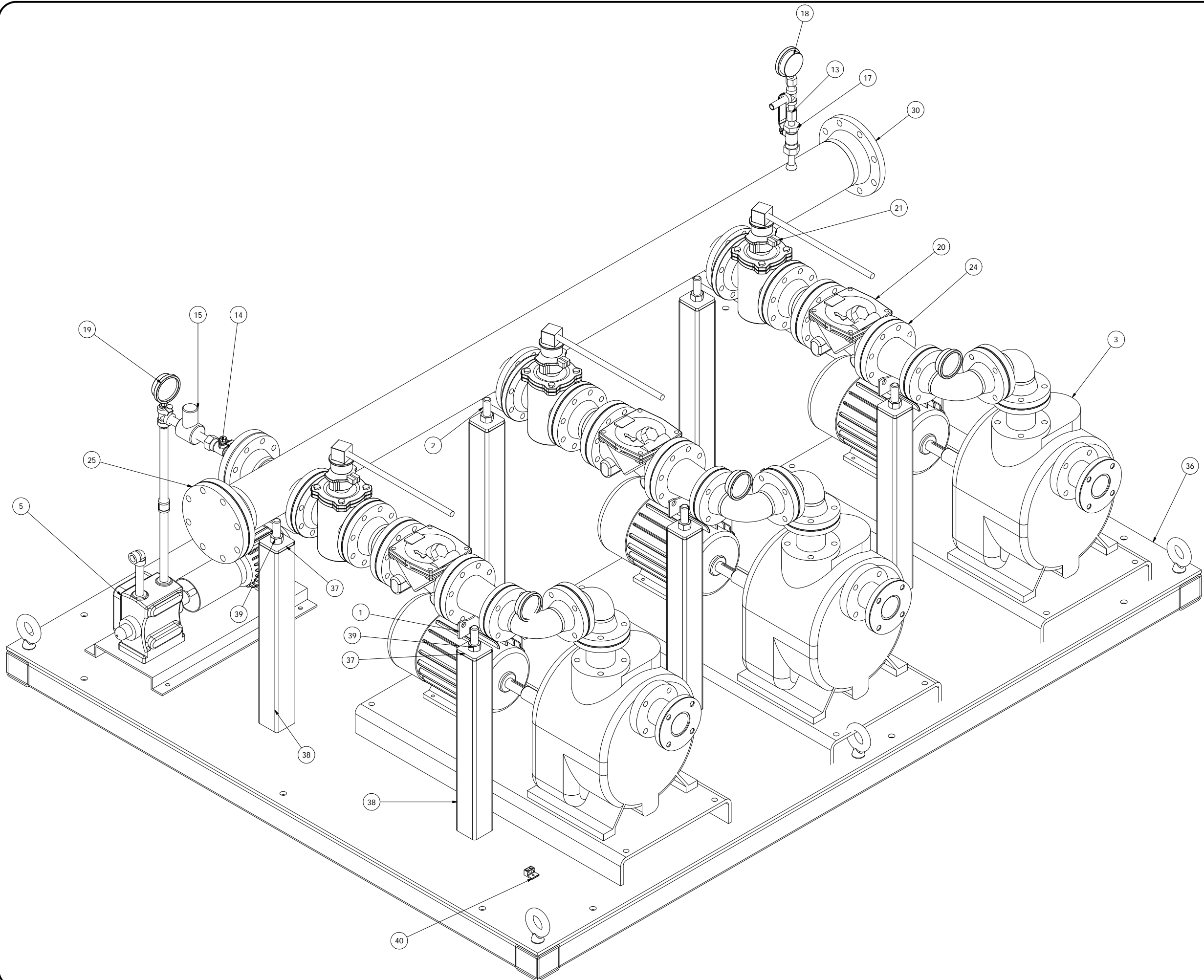
DRAWING GEOMETRY IS ACCURATE AND CREATED AT 1:1 AND FIT TO THE SHEET. DO NOT SCALE THIS DRAWING.

DSN - AD
 DRN - AD
 CKD - AD
 DATE - 11/28/11

COMPONENT DRAWING

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

**BAE - ACETIC ACID PLANT
 4" - 3 PUMP SKID ASSEMBLY**



DRAWING GEOMETRY IS ACCURATE AND CREATED AT 1:1 AND FIT TO THE SHEET. DO NOT SCALE THIS DRAWING.

DSN - AD
 DRN - AD
 CKD - AD
 DATE - 4-10-13

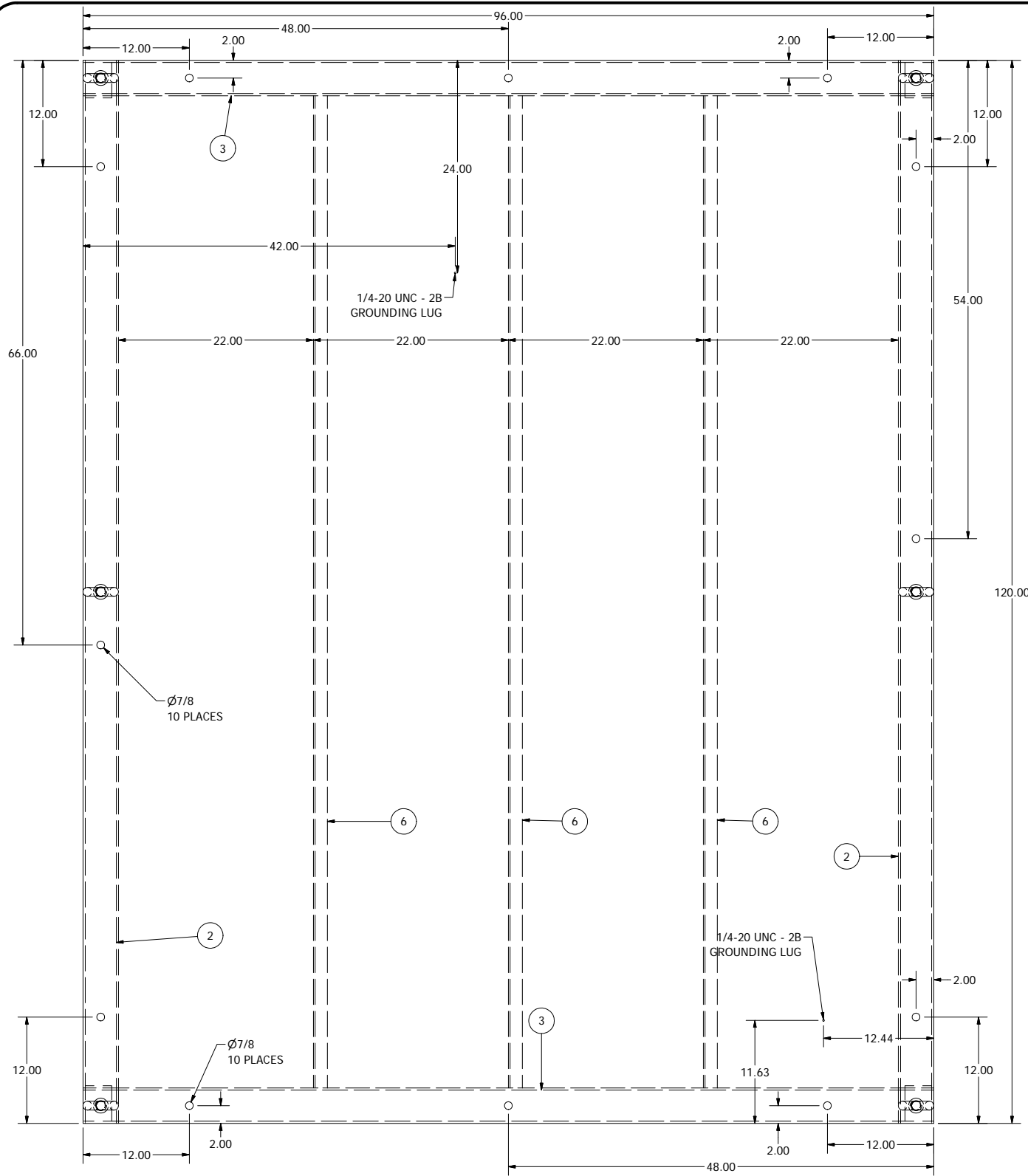
REV	DESCRIPTION	DATE	APPROV
7	PUMP PLATES	10-14-13	NINA
6	UPDATED PIPE STANDS	9-20-13	AD
5	AS BUILT MANIFOLD DIMENSION CHANGE	6-14-13	AD
4	REVISED FOR PRODUCTION LAUNCH	5-31-13	AD
3	REVISION PER 5/16/13 COMMENTS	5-17-13	AD
2	REVISION PER 3/27/13 COMMENTS	4-9-13	AD
1	COMPONENT DRAWING	5-18-12	AD

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

BAE - ACETIC ACID PLANT
3D VIEW

SHEET
3 OF 4

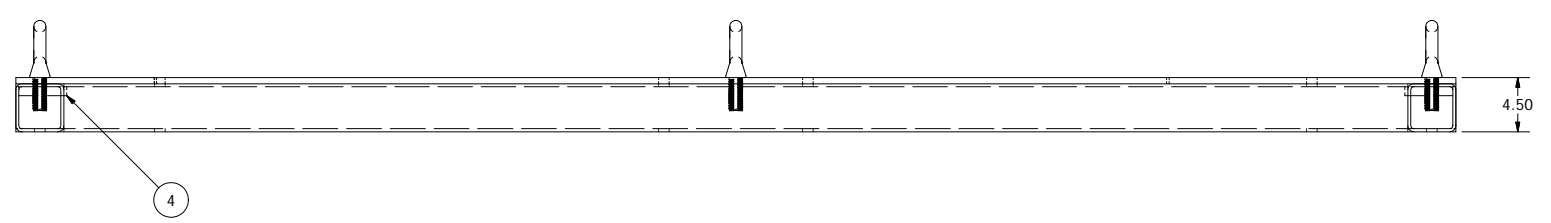
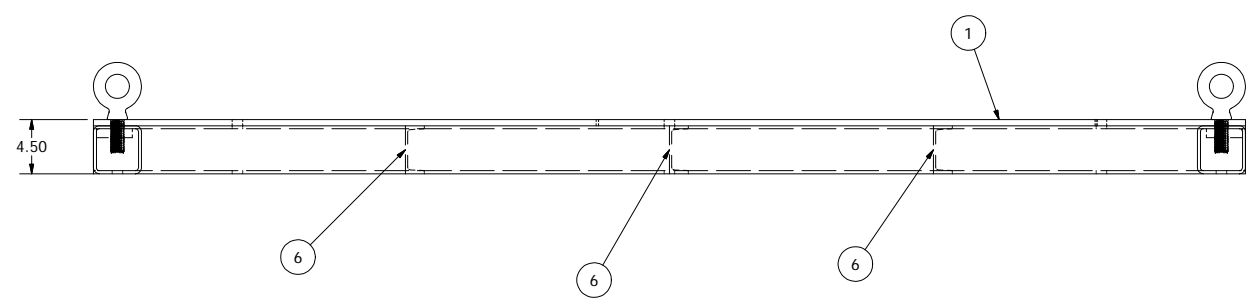
JOB NUMBER
**RMTC
 0000**



TOTAL SKID WEIGHT AS SHOWN APPROXIMATE 2270lbs

NOTES:
 ALL STRUCTURAL MATERIAL IS PLAIN STEEL.
 SEE COATING NOTE BELOW.
 HOLD DOWN ANCHOR BOLTS TO BE 3/4 IN 316 STAINLESS STEEL

COATING NOTES:
 ALL STAINLESS STEEL OR ALUMINUM PARTS DO NOT NEED ADDITIONAL COATING.
 ALL PLAIN STEEL PARTS, SKID PLATFORM, AND PIPING STANDS IF NOT STAINLESS STEEL SHALL BE COATED WITH:
 • PRIME COAT - AMERCOAT 240
 • FINISH COAT - AMERSHIELD (BLACK)



DRAWING GEOMETRY IS ACCURATE AND CREATED AT 1:1 AND FIT TO THE SHEET. DO NOT SCALE THIS DRAWING.

DSN - AD	REVIS PER PRODUCTION LAUNCH	5-31-13	AD
DRN - AD	DESCRIPTION	DATE	APPROV
CKD - AD	REV	1	
DATE - 4-10-13	REVISION HISTORY		

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

**BAE ACETIC ACID PLANT
 SKID FRAME DETAIL**

SHEET
4 OF 4

JOB NUMBER
**RMTC
 0000**

8.02

**PUMP SKID ASSEMBLY RELATED DATA
SHEETS**

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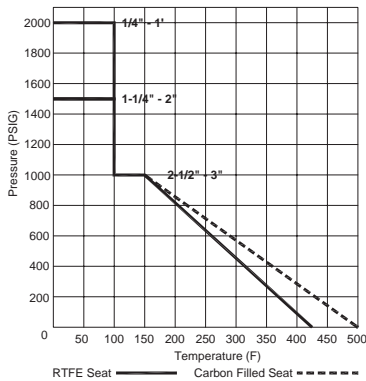
Figure 220 STAINLESS STEEL BALL VALVES



2 PC FULL PORT 2000 WOG

Features:

- 2000 WOG*
- 150 WSP (with Carbon Filled Seats)
- Full Port
- Blow-out Proof Stem
- Adjustable Packing
- Investment Cast Body & End Caps
- Threaded NPT Ends
- Stainless Steel Handle with Vinyl Grip
- Locking Device
- Actuator Mounting Pad
- Optional Carbon Filled Seats



*1/4" to 1" – 2000 WOG

1-1/4" to 2" – 1500 WOG

2-1/2" to 3" – 1000 WOG

Figure Number Matrix

FNW 2 2 0 SEAT X	
SEAT TYPE	SIZE CODES
BLANK = STANDARD RTFE	1/4 = B 1-1/4 = H
C = CARBON FILLED TFE	3/8 = C 1-1/2 = J
	1/2 = D 2 = K
	3/4 = F 2-1/2 = L
	1 = G 3 = M

For other valve materials or configurations, contact FNW Valve at (503) 287-8383 for sales assistance.

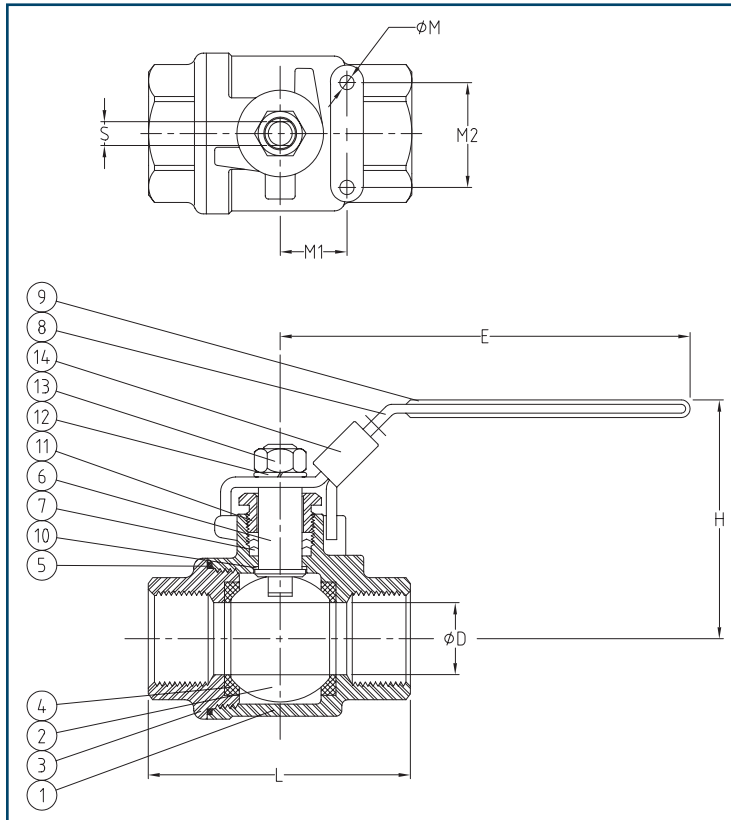
Cv & Weights

Size	Cv	Wt. (Lbs)
1/4	6	0.7
3/8	12	0.7
1/2	19	1.0
3/4	37	1.2
1	64	2.5
1-1/4	103	3.1
1-1/2	143	4.9
2	360	8.2
2-1/2	440	16.5
3	520	24.5

Torque

Size	Torque (in-lbs)
1/4	60
3/8	60
1/2	80
3/4	150
1	200
1-1/4	250
1-1/2	320
2	500
2-1/2	680
3	800

2 PC FULL PORT 2000 WOG



Standard Materials

Ref. No.	Description	Material		Qty
		220	220C	
1	Body	ASTM A351 Gr. CF8M		1
2	Ball	316SS		1
3	End Cap	ASTM A351 Gr. CF8M		1
4	Seat	RTFE	Carbon Filled TFE	2
5	Body Seal	PTFE	Carbon Filled TFE	1
6	Stem	316SS		1
7	Stem Packing	PTFE	Carbon Filled TFE	1 Set
8	Handle	304SS		1
9	Handle Cover	Vinyl		1
10	Thrust Washer	PTFE	Carbon Filled TFE	1
11	Gland Nut	304SS		1
12	Handle Washer	304SS		1
13	Handle Nut	304SS		1
14	Locking Pad	304SS		1

Dimensions (Inches)

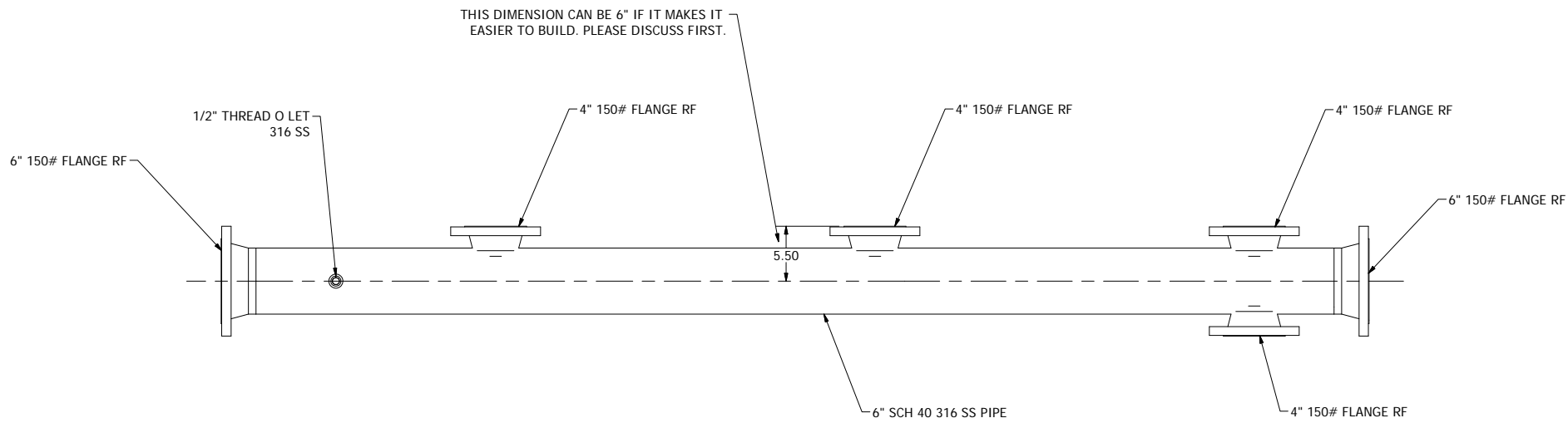
Size	ØD	E	L	H	S	M1	M2	M
1/4	0.39	3.74	2.17	2.52	0.196	0.50	1.12	10-24UNC
3/8	0.47	3.74	2.17	2.52	0.196	0.50	1.12	10-24UNC
1/2	0.62	4.92	2.55	2.52	0.255	0.50	1.12	10-24UNC
3/4	0.78	4.92	3.03	2.64	0.255	0.88	1.38	10-24UNC
1	0.98	5.51	3.46	3.27	0.314	0.88	1.38	10-24UNC
1-1/4	1.25	5.51	4.01	3.50	0.314	1.00	1.50	1/4 -20UNC
1-1/2	1.57	7.87	4.33	3.93	0.393	1.00	1.50	1/4 -20UNC
2	1.96	7.87	4.92	4.25	0.393	1.00	1.50	1/4 -20UNC
2-1/2	2.55	9.84	6.45	5.91	0.472	1.18	2.76	1/4 -20UNC
3	3.14	9.84	7.12	6.34	0.472	1.18	2.76	1/4 -20UNC

DOC: FNWBV22005 Ver. 7/05

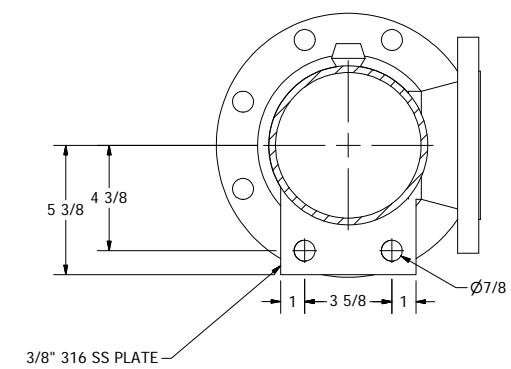
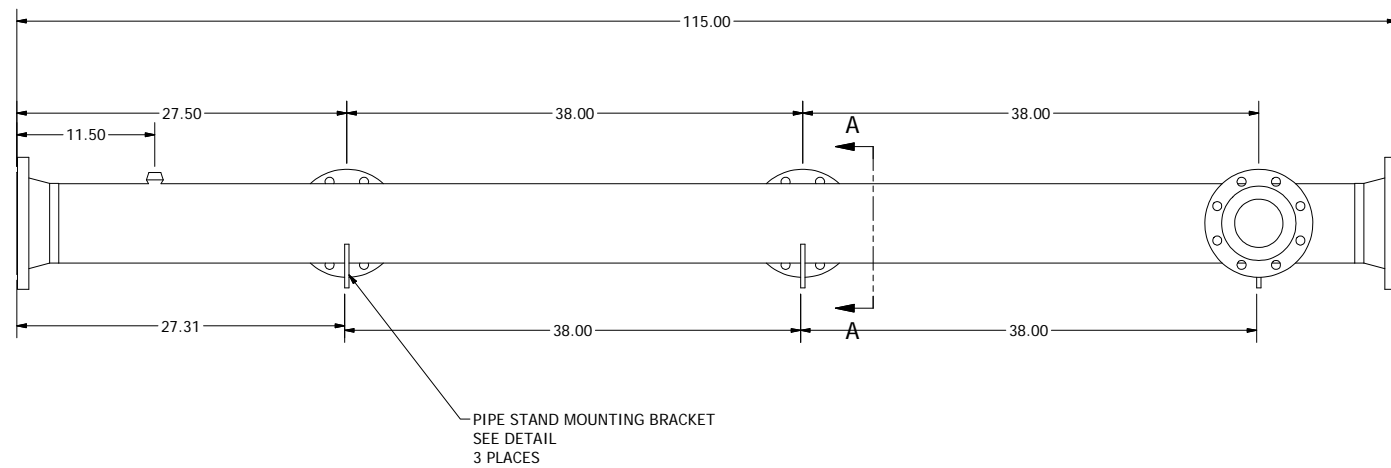
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MATERIAL: ALL 316 STAINLESS STEEL



SECTION A-A
SCALE 1/4
PIPE STAND
MOUNTING BRACKET

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 - 4-10-13

REV	DESCRIPTION	DATE	APPROV
1			

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

6in STAINLESS STEEL MANIFOLD
DETAIL

SHEET
1 OF 1

JOB NUMBER
RMTC
0000

DESIGNED FOR SAFETY AND LONGER LIFE

- 5-year limited warranty
- Patented PowerFlex™ movement isolates movement from shock and vibration for longer life
- All stainless, all-welded construction for long life
- ASME Grade 1A, 1% accuracy full scale
- True Zero™ pointer indication – no stop pin to mask false zero reading – ensures safety and process control

The following Table is *not* for conversion purposes.

STANDARD RANGES ⁽³⁾⁽⁴⁾⁽⁵⁾		
Pressure psi	kg/cm ² - bar	kPa
0/15	0/1	0/100
0/30	0/1.6	0/160
0/60	0/2.5	0/250
0/100		
0/160	0/4	0/400
0/200	0/6	0/600
0/300	0/10	0/1000
0/400	0/16	0/1600
0/600	0/25	0/2500
0/800	0/40	0/4000
0/1000	0/60	0/6000
0/1500	0/100	0/10,000
0/2000	0/160	0/16,000
0/3000	0/250	0/25,000
0/4000	0/400	0/40,000
0/5000	0/600	0/60,000
0/6000	0/1000	0/100,000
0/7500		
0/10,000		
0/15,000		
Vacuum		
30 in./0 in.Hg	-1/0	-100/0
Compound		
30 in.Hg/15 psi	-1/0/1.5	-100/0/150
30 in.Hg /30 psi	-1/0/3	-100/0/300
30 in.Hg /60 psi	-1/0/5	-100/0/500
30 in.Hg /100 psi	-1/0/9	-100/0/900
30 in.Hg /150 psi	-1/0/15	-100/0/1500
30 in.Hg /300 psi	-1/0/24	-100/0/2400

- New PLUS!™ Performance Option:
 - Liquid-filled performance in a dry gauge
 - Fights vibration and pulsations without liquid-fill headaches
 - See pages 6-7 for details
 - Order as option XLL

OTHER FEATURES:

Available in 2½" and 3½" dial sizes, Duralife® pressure gauges are liquid fillable and field convertible for panel mounting. Both zero and span adjustments are standard.

The gauge is available dry, liquid-filled weatherproof or hermetically sealed and now with PLUS!™ performance option. A five year limited warranty is standard with the Duralife® 1009.



BOURDON SYSTEM SELECTION ⁽¹⁾

Ordering Code	Bourdon Tube & Tip Material ⁽¹⁾	Socket Material	Tube Type	Range Selection Limits (psi)	NPT Conn. ⁽⁶⁾
AW	316 stainless steel	Bronze	C-Tube	Vac/600	¼
AW	316 stainless steel	Bronze	Helical	1000	¼
SW	316 stainless steel	316 stainless steel	C-Tube	Vac/600	¼ & ½ ⁽²⁾
SW	316 stainless steel	316 stainless steel	Helical	800/15,000	¼ & ½ ⁽²⁾

(1) For selection of the correct Bourdon system material, see the media application table on page 243.
 (2) ½ NPT available 3½" lower SW system only.
 (3) Type 1009 gauges may be ordered with metric single-scale dial: kPa, bar or kg/cm².

(4) Dual-scale dials will be supplied with standard metric inner scale and equivalent psi outer scale or with standard psi inner scale and equivalent metric outer scale—please specify.
 (5) Special logos and scales available upon request.
 (6) ¼" JIS, BSP or DIN threads available on SW systems.

TO ORDER THIS 1009 DURALIFE PRESSURE GAUGE:

Select:

1. Dial size—2½" 3½" 35

2. Case type—1009 1009

3. Tube and socket material SW

4. Liquid filled (glycerin), leave blank if dry (L)

5. Connection size—¼ (01), ½ (02) ½ (04) 04

6. Connection location—Lower (L), Back (B) XXX

7. Optional Features—see page 176 60PSI

8. Standard pressure range—1000 psi

Accessories: see pages 233-238

- All welded metal construction, prevents leakage of process media
- No gaskets or bolts
- For use on pressure gauges up to 3½" from vacuum to 1000 psi and 4½" gauges 100 psi to 1000 psi
- Top housing material 316L stainless steel standard
- Diaphragm materials in 316L stainless steel, hastelloy C and tantalum
- Bottom housing materials in 316L stainless steel and hastelloy C
- ¼ NPT or ½ NPT female, ¼-½ NPT male process connections
- ¼ NPT or ½ NPT instrument connections
- Type 312 furnished with ⅛ NPT flushing connection
- Not available in male process connections


SELECTION TABLES
Table A – Process Connection

Process Connection	Size	Code
Threaded – male NPT	¼	02
Threaded – male NPT	½	04
Threaded – male NPT	¾	06
Threaded – male NPT	1	08
Threaded – female NPT	¼	25
Threaded – female NPT	½	50

Table B – Type

Description	Code
All welded midi-seal	311
All welded midi-seal w/flushing connection	312

Table C – Diaphragm Materials

Materials	Code
316L stainless steel	S
tantalum	U
Hastelloy C-276	H

Table D – Bottom Housing Materials

Materials	Code
316L stainless steel	S
Hastelloy C-276	H

Table E – Instrument Connection

Instrument Connection	Size	Code
Threaded – female NPT	¼ NPT	02T
Threaded – female NPT	½ NPT	04T

Table F – Filling Fluid

Fill	Service	Connection to Instrument	Temperature Range °F	Code
Glycerin	Pressure	Direct Only	0/400	CG
Silicone	Pressure/Vacuum	Direct or Flexible Line	-40/600	CK
Halocarbon	Pressure/Vacuum in presence of strong oxidizing agent	Direct or Flexible Line	-70/300	CF
Syltherm	Pressure	Direct or Flexible Line	-40/750	HA

TO ORDER THIS TYPE 311/312 MIDI-SEAL ASSEMBLY:

1. From **Table A**...select PROCESS CONNECTION SIZE (e.g., 50 for ½" female NPT)
2. From **Table B**...select TYPE (e.g., 311 for all welded midi-seal)
3. From **Table C**...select DIAPHRAGM MATERIAL (e.g., U for Tantalum)
4. From **Table D**...select BOTTOM HOUSING MATERIAL (e.g., H for Hastelloy C)
5. From **Table E**...select INSTRUMENT CONNECTION SIZE (e.g., 02T for ¼" female NPT)
6. From **Table F**...select FILLING FLUID, if diaphragm seal will be attached to instrument (e.g., Glycerin – CG)

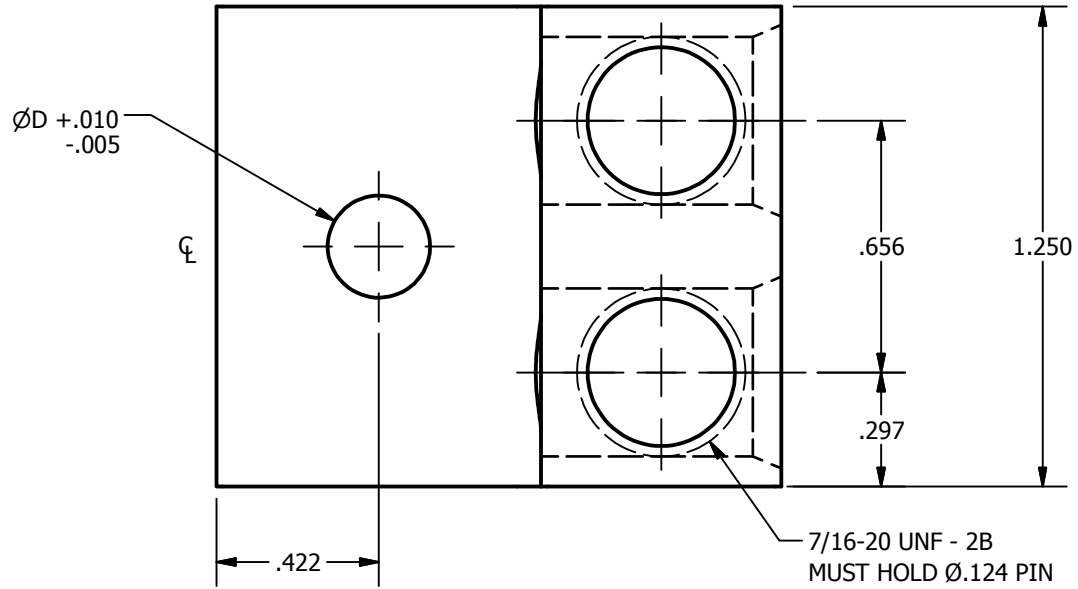
Coded order: 50-311-UH-02T-CG

50-312-SS-04T-CG

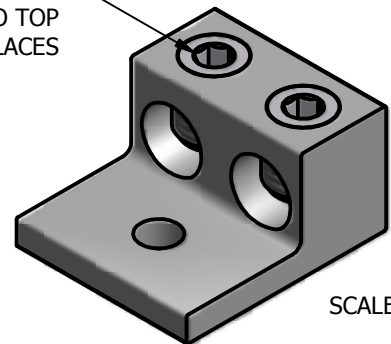
SCREW: E0950	MATERIAL:ALUMINUM, X0031	TOLERANCES-UNLESS OTHERWISE SPECIFIED 2 PL. DEC. ±.015 TRUE C.L. ±.015 3 PL. DEC. ±.015 ANGLES ±1		DWG. NO. D2057	
CAT. NO.:	PLATING: EL-TIN	DRAWN BY:CLH	SCALE: 2:1	SHEET 1 OF 1	
MASS:SEE CHART	MARKING: SEE CHART	DATE:1/16/2008	SIZE: A		
SURFACE AREA: SEE CHART ²		CELL:AMP			
STUFFER SHT: FORM 1					REV. DESCRIPTION

REV.	DESCRIPTION
E	

Cat #: AU-2/0
AU-2/0-B2



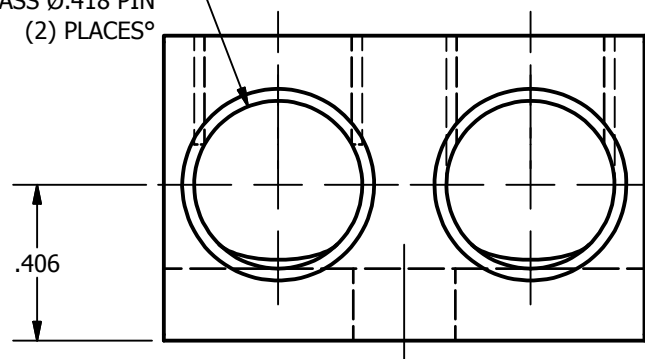
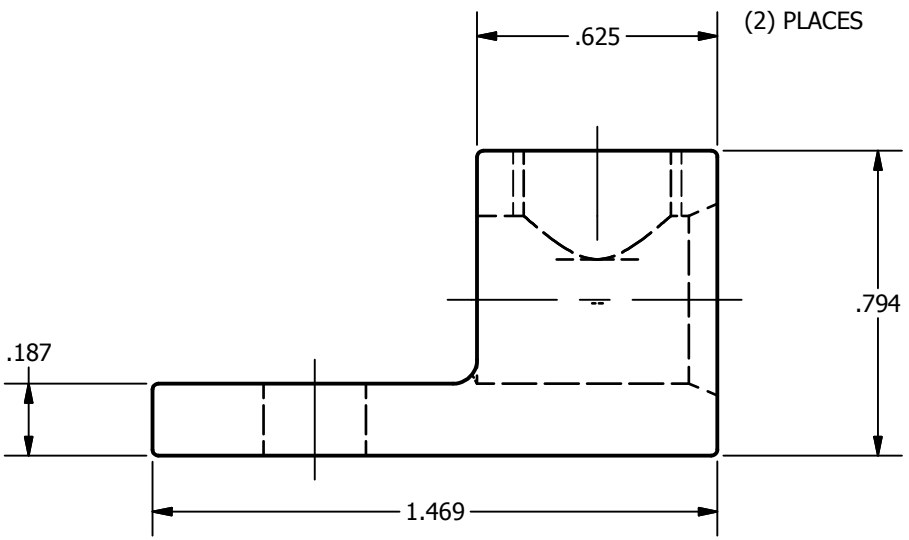
E0950 FLUSH TO TOP (2) PLACES




SCALE 1 : 1

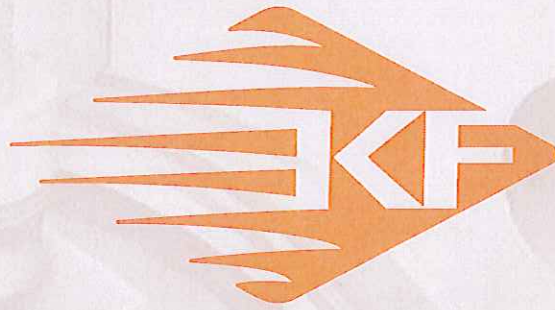
7/16-20 UNF - 2B
MUST HOLD Ø.124 PIN WITH NO LEAD GAGE (2) PLACES

✓ Ø.437±.005
✓ Ø.499±.040 X 45°
MUST PASS Ø.418 PIN (2) PLACES°

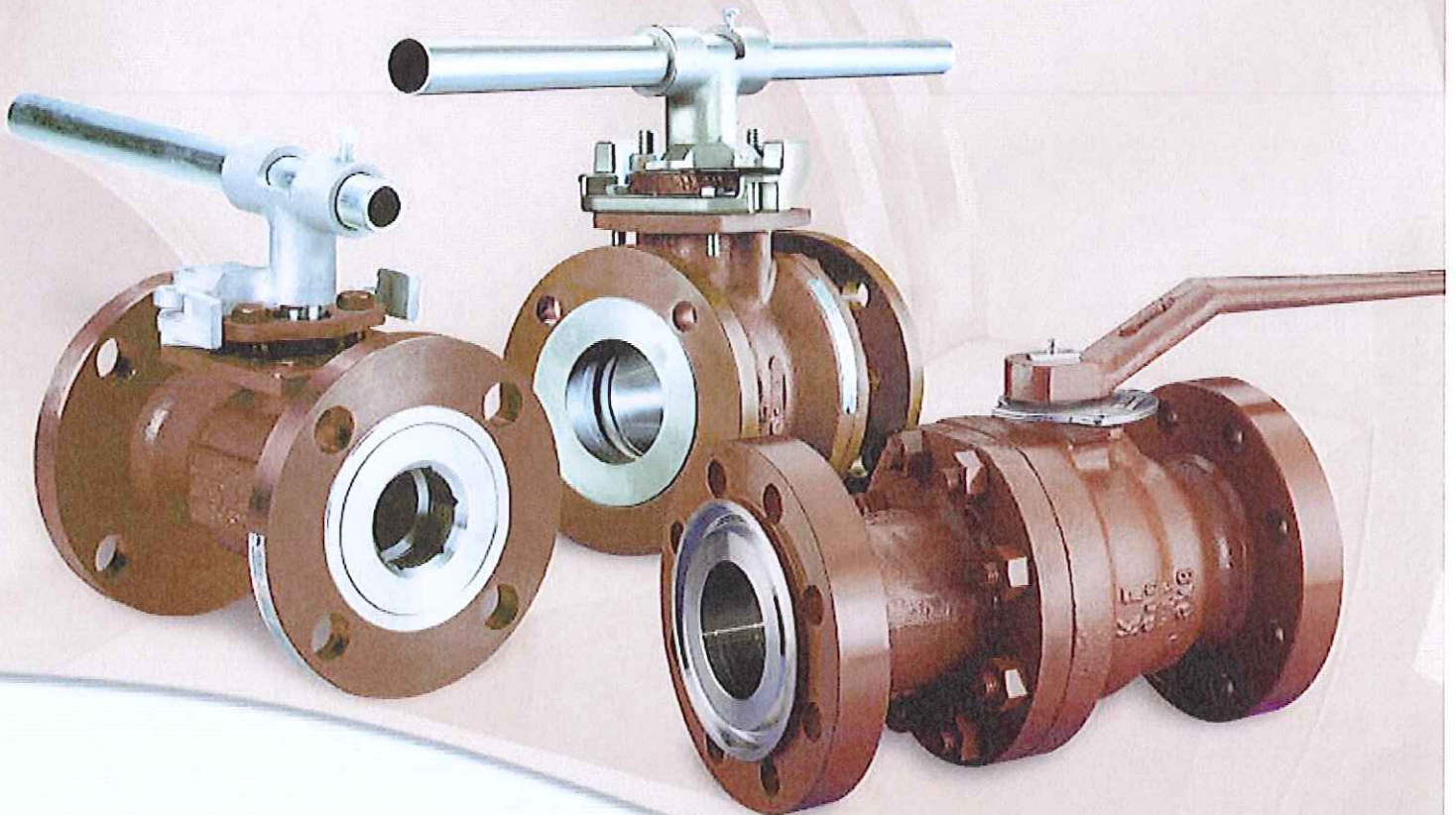


DEV	D	MASS LBS.	SURFACE AREA IN ²	MARKING
-22	.272	.0555	8.0048	ILSCO, D2057, AU-2/0, 2/0-14, AL9CU 

KF Series F Flanged Floating Ball Valves



KF Industries



Superior Fluid Control Products for the Petrochemical and Industrial Markets

A Brand of **CIRCOR** Energy Products, Inc.



KF Series F

KF Series F Flanged Floating Ball Valves are a prime example of KF's reliability, performance, manufacturing and superior engineering techniques at work. Featuring a unibody or two-piece bolted design.

General Design Features

- NACE MR0175 - (ISO 15156)
(Stainless Steel ball/stem configuration)
- Blowout proof stem
- Weather Seal (Class 600 and higher)
- Actuator mounting pad (4 bolt machined)
- API 6D
- API 607 4th Edition* (O-Ring & Graphite)
- Secondary Metal-to-Metal Sealing
- Full rated bi-directional dead end service
- Antistatic Device
- Lockable handle
- O-Ring design (standard)
- Graphite or Teflon® packing (optional)

*Not applicable to Teflon® packed.

Applicable Standards

API-American Petroleum Institute

- Spec. 6D Specification for pipeline valves.
- Spec. RP6F Recommended practice for fire testing valves.
- Std. 598 Valve inspection and test.**
- Std. 607 Fire test for soft seated quarter-turn valves.

ASME/ANSI-American National Standard

- B16.5 Steel pipe flanges and flanged fittings.
- B16.10 Face-to-face and end-to-end dimensions of ferrous valves.
- B16.34 Steel valves- Flanged and butt welding ends.

EC-European Community

CE Marked (P.E.D. 97/23/EC, Cat. 3)**

ISO-International Org. for Standardization

- ISO 9001: Quality systems-Model for quality assurance
2000 in design/development, production, installation and servicing.
- ISO 15156 Materials for use in H2S containing environments in oil and gas production.

MSS-Manufacturers Standardization Society

- SP 6 Std. finishes for contact faces of pipe flanges and connecting- end flanges of valves and fittings.
- SP 25 Standard marking system for valves, fittings, flanges and unions.
- SP 44 Steel pipeline flanges.
- SP 55 Quality standard for steel castings visual method.

NACE-National Assoc. of Corrosion Engineers

MR0175 Sulfide stress cracking resistant metallic materials for oilfield equipment. (Superseded by ISO 15156)

**P.O.A. consult factory.

Size Range and Design Availability

Size (in.)	Class/Configuration				
	150	300	600	900	1500
1 FP	▲	▲	▲	▲	▲
1 1/2 FP	▲	▲	▲	—	—
2 RP	■	■	▲	▲	—
2 FP	▲	▲	▲	▲	—
2 1/2 RP	▲	▲	▲	—	—
3 RP	■	■	▲	—	—
3 FP	▲	▲	▲	—	—
4 RP	■	■	▲	—	—
4 FP	▲	▲	▲	—	—
6 RP	■	■	▲	—	—
6 FP	▲	▲	▲	—	—
8 RP	▲	▲	▲	—	—
8 FP	▲	▲	—	—	—
10 RP	▲	▲	—	—	—
10 FP	▲	—	—	—	—
12 RP	▲	—	—	—	—

■ Unibody

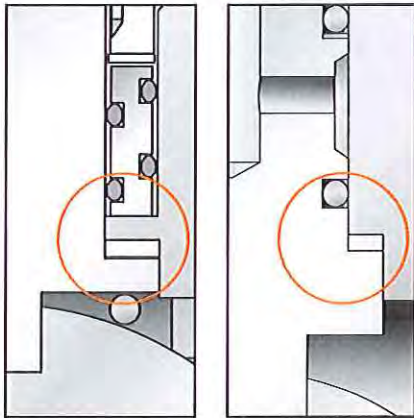
▲ Split Body

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KF Series F Design Features

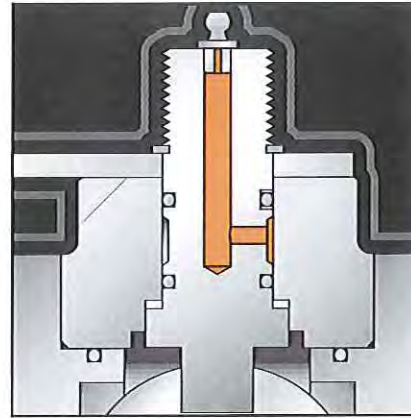


Class 150 & 300

Class 600 & higher

Blowout Proof Stem

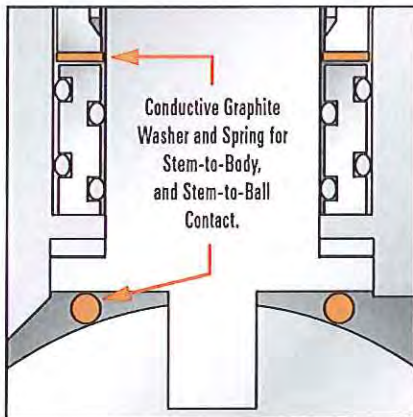
Internally inserted, "backseated" stem assures fire safety and blow-out prevention by retaining stem in the valve at all pressures.



Class 600 & higher

Stem Journal Lubrication

All valves incorporate external stem lubrication. A vented weather seal allows safe pressure relief in event of excessive grease gun pressure.

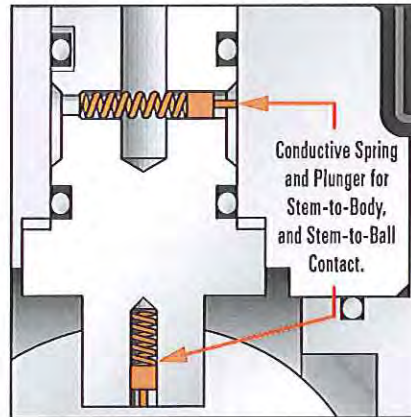


Class 150 & 300

(O-Ring shown, packing also available.)

Antistatic Device

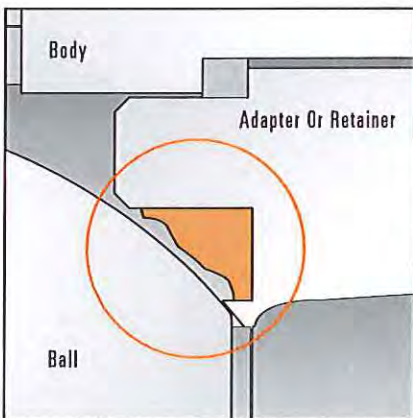
A conductive spring and a graphite washer provide antistatic continuity throughout the valve.



Class 600 & higher

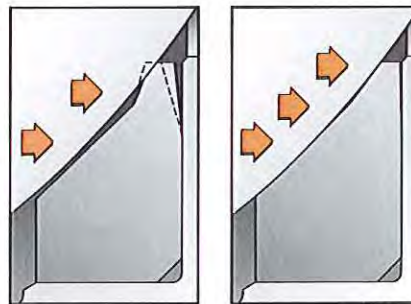
Antistatic Device

1" bore - 4" bore, cl. 600, 900 & 1500 use spring-loaded pins between the ball, stem, and body to provide antistatic continuity throughout the valve.



Firesafe Seat Sealing

In event of fire and seat destruction, ball floats downstream to effectively provide metal-to-metal seat sealing.



Low Pressure Sealing

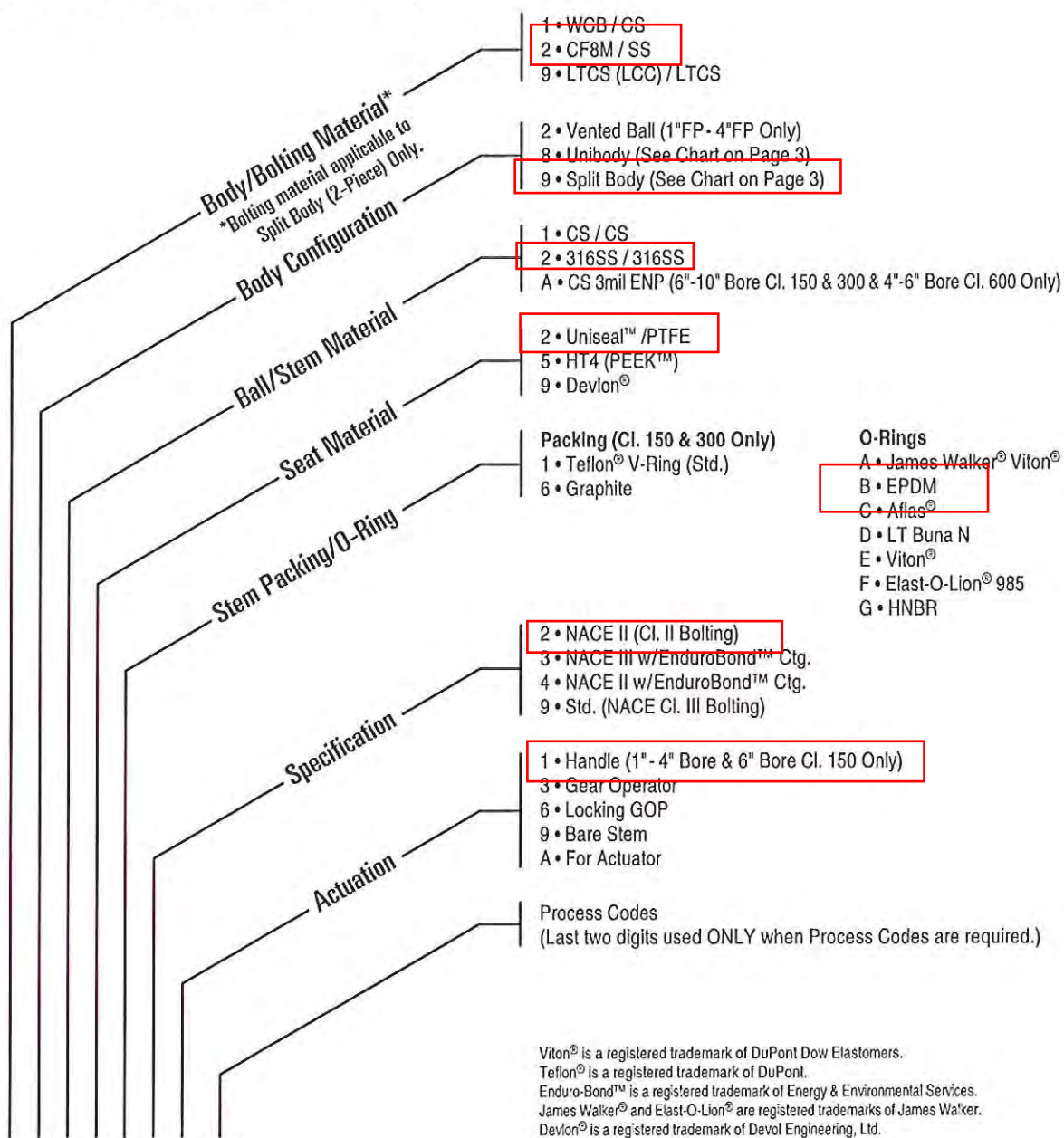
High Pressure Sealing

Positive Low & High Pressure Sealing For Devlon® and HT4 Seats

A special *integral seat lip* provides positive low pressure "bubble-tight" sealing between the ball and seat with minimal operating torque. The KF *seat lip* defects slightly at higher pressures to ensure full seat contact with the ball. The seat's "memory-action" provides "bubble-tight" sealing at both low and high pressures. This "self compensation for swell" feature results in low torque and long life operation.



KF Series F Part Number Codes



Assembly Base No.

GXXXX-X X X X X X X XX

Viton® is a registered trademark of DuPont Dow Elastomers.
Teflon® is a registered trademark of DuPont.
Enduro-Bond™ is a registered trademark of Energy & Environmental Services.
James Walker® and Elast-O-Lion® are registered trademarks of James Walker.
Devlon® is a registered trademark of Devol Engineering, Ltd.
PEEK™ is a trademark of Victrex Plc.
Atlas® is a registered trademark of Asahi Glass.

Assembly Base Numbers — 1"FP - 12"RP

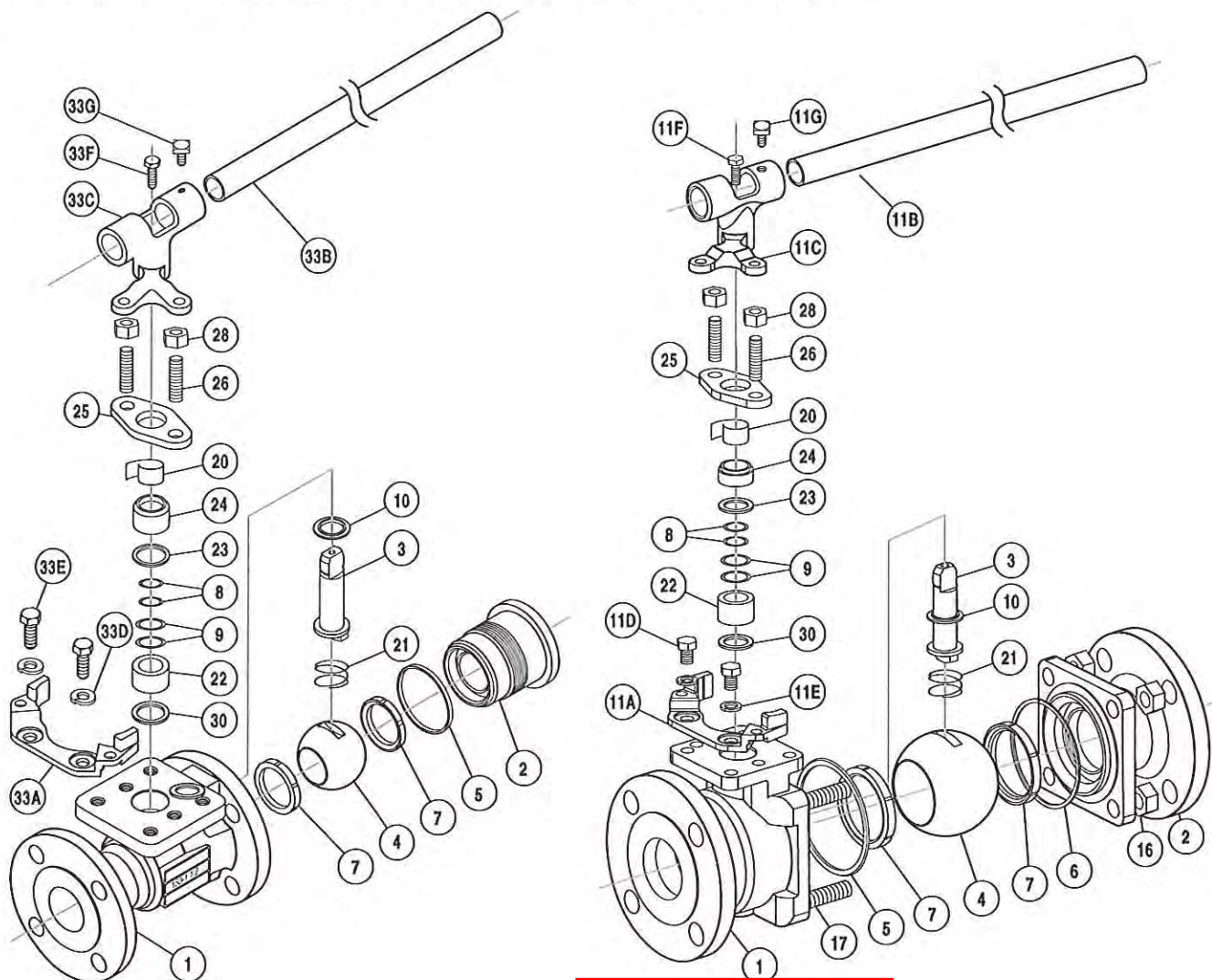
G2156-2 9 2 2 B 2 1

Size (in.)	Class/End Connection							
	150RF	300RF	600RF	600RTJ	900RF	900RTJ	1500RF	1500RTJ
1FP	G2147	G2297	G2597	G2607	G3348	G3349	G3348	G3349
1½FP	G2149	G2299	G2599	G2609	—	—	—	—
2RP	G2150	G2300	G2600	G2610	G2900	G2910	—	—
2½RP	G2152	G2302	G2602	G2612	—	—	—	—
2FP	G2151	G2301	G2601	G2611	G2901	G2911	—	—
3RP	G2153	G2303	G2603	G2613	—	—	—	—
3FP	G2154	G2304	G2604	G2614	—	—	—	—
4RP	G2155	G2305	G2605	G2615	—	—	—	—

Size (in.)	Class/End Connection							
	150RF	300RF	600RF	600RTJ	900RF	900RTJ	1500RF	1500RTJ
4FP	G2156	G2306	G2606	G2616	—	—	—	—
6RP	G2157	G2307	G2618	G2617	—	—	—	—
6FP	G1720	G1724	G1728	G1730	—	—	—	—
8RP	G1721	G1725	G1729	G1731	—	—	—	—
8FP	G1722	G1726	—	—	—	—	—	—
10RP	G1723	G1727	—	—	—	—	—	—
10FP	G1752	—	—	—	—	—	—	—
12RP	G1753	—	—	—	—	—	—	—



KF Series F Component Parts, Class 150 & 300



Parts List, Unibody

Part No.	Description
1	Body
2	Seat Retainer
3	Stem
4	Ball
5	Body Seal
7	Seat
8	Inner Stem O-Rings***
9	Outer Stem O-Rings***
10	Thrust Washer
20	Liner
21	Ground Spring
22	Stem Seal: Gland or Packing
23	Ground Washer*

*Not required with Graphoil® packing in Firesafe valves.

**Required in 2" and larger packed valves only.

***Not used in packed stem valves.

Parts List, Split Body

Part No.	Description
1	Body
2	Adapter
3	Stem
4	Ball
5	Body Gasket
6	Body O-Ring***
7	Seat
8	Inner Stem O-Rings***
9	Outer Stem O-Rings***
10	Thrust Bearing
11A	Lock Plate
11B	T-Handle Tube
11C	T-Handle Hub
11D	Lock Plate Screw

*Not required with Graphoil® packing in Firesafe valves.

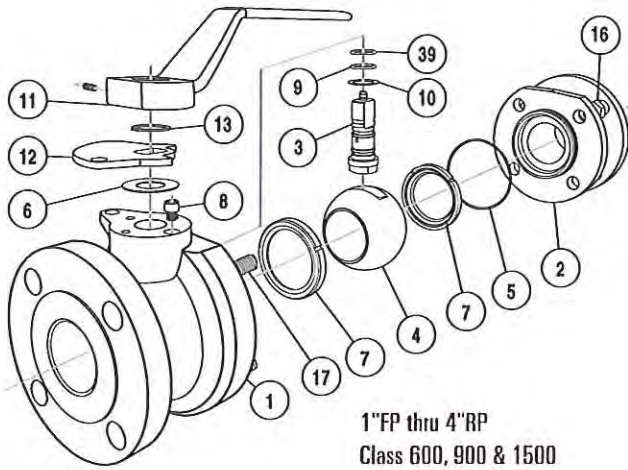
**Required in 2" and larger packed valves only.

***Not used in packed stem valves.

Part No.	Description
11E	Lock Plate Lock Washer
11F	Handle Hub Screw
11G	Tube Lock Screw
16	Hex Nut
17	Stud
20	Follower Liner
21	Ground Spring
22	Stem Seal: Gland or Packing
23	Ground Washer*
24	Packing Follower
25	Packing Retainer
26	Packing Stud
28	Packing Nut
30	Stem Washer**



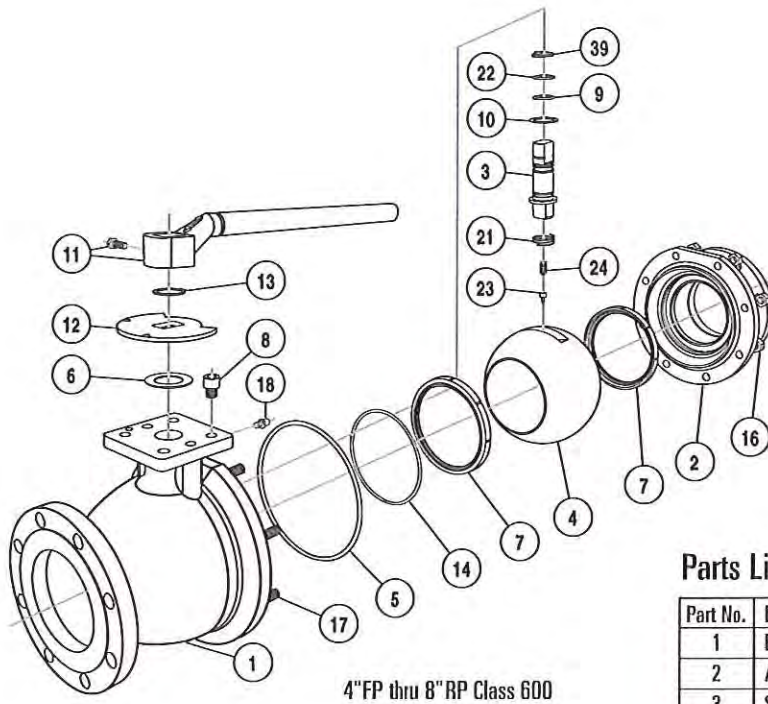
KF Series F Component Parts, Class 600, 900 & 1500



Parts List

Part No.	Description
1	Body
2	Adapter
3	Stem
4	Ball
5	Body Seal
6	Stem Bearing
7	Seat
8	Stop Screw

Part No.	Description
9	Stem Seal
10	Thrust Bearing
11	Handle Assembly
12	Stop Plate
13	Retainer
16	Hex Nut
17	Stud
39	Weather Seal



Parts List

Part No.	Description
1	Body
2	Adapter
3	Stem
4	Ball
5	Body Seal
6	Stem Bearing*
7	Seat
8	Stop Screw*
9	Stem Seal
10	Thrust Bearing
11	Handle Assembly*

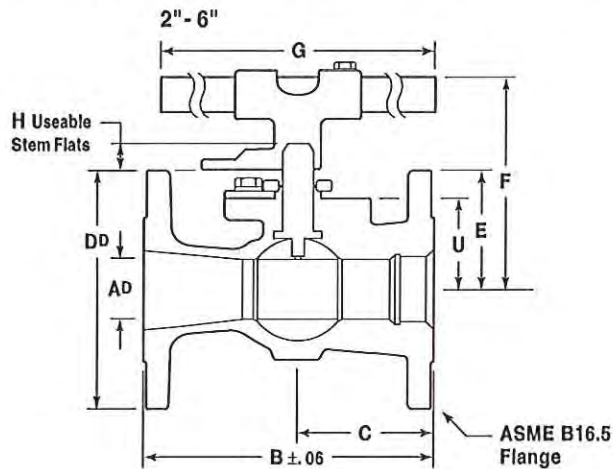
Part No.	Description
12	Stop Plate*
13	Retainer*
14	Adapter Pilot Seal
16	Hex Nut
17	Stud
18	Luba Fitting
21	Ground Spring**
22	Firesafe Stem Packing
23	Ground Plunger*
24	Ground Spring*
39	Weather Seal

*4" Bore Only

**6" Bore Only



KF Series F Unibody, Dimensional Data (in.), Class 150 & 300



Dimensional Data (in.), 2"-6", Class 150, Reduced Port

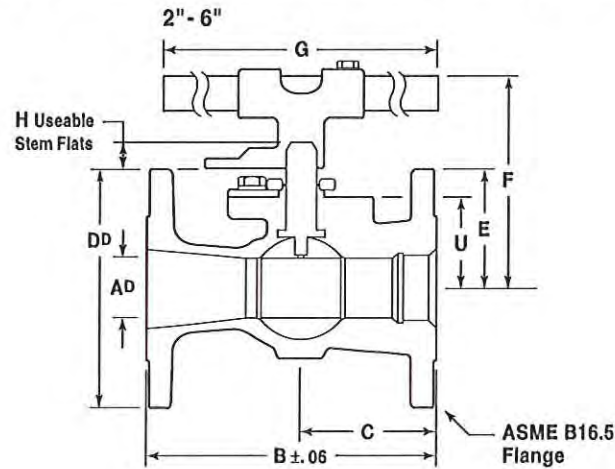
Size (in.)	Dimension (in.)									Wt. (lbs.)
	A	B	C	D	E	F	G	H	U	
2	1.50	7.00	3.27	6.00	3.69	5.36	17.00	.70	2.31	17.6
3	2.42	8.00	3.46	7.50	4.38	6.05	17.00	.70	3.06	31.5
4	3.00	9.00	4.10	9.00	6.75	8.83	22.00	1.38	4.43	54.2
6	4.50	10.50	5.25	11.00	8.56	10.55	22.00	1.44	6.02	137.0

Dimensional Data (in.), 2"-6", Class 300, Reduced Port

Size (in.)	Dimension (in.)									Wt. (lbs.)
	A	B	C	D	E	F	G	H	U	
2	1.50	8.50	3.27	6.50	3.69	5.36	17.00	.70	2.31	26.0
3	2.42	11.12	3.96	8.25	4.38	6.05	17.00	.70	3.06	46.0
4	3.00	12.00	4.10	10.00	6.75	8.83	22.00	1.38	4.43	70.0
6	4.50	15.88	5.25	12.50	8.56	10.55	22.00	1.44	6.02	157.0



KF Series F Unibody, Dimensional Data (mm), Class 150 & 300



Dimensional Data (mm), 2"-6", Class 150, Reduced Port

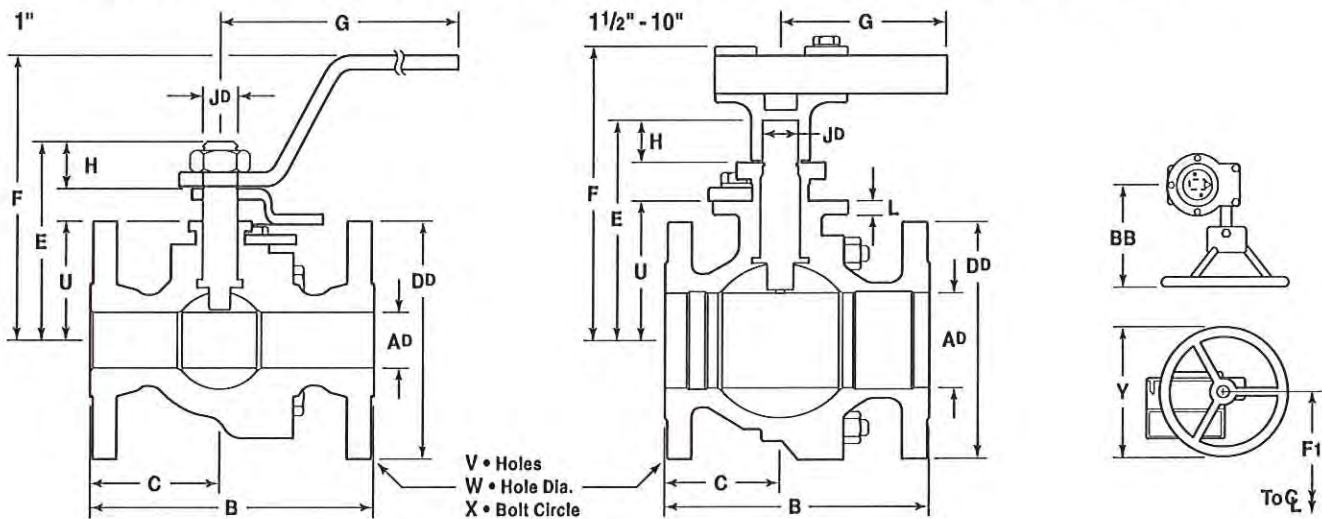
Size (in.)	Dimension (mm)									Wt. (kg)
	A	B	C	D	E	F	G	H	U	
2	38.1	177.8	83.1	152.4	93.7	136.1	431.8	17.8	58.7	7.98
3	61.5	203.2	87.9	190.5	111.3	153.7	431.8	17.8	77.7	14.29
4	76.2	228.6	104.1	228.6	171.5	224.3	558.8	35.1	112.5	24.58
6	114.3	266.7	133.4	279.4	217.4	268.0	558.8	36.6	152.9	62.14

Dimensional Data (mm), 2"-6", Class 300, Reduced Port

Size (in.)	Dimension (mm)									Wt. (kg)
	A	B	C	D	E	F	G	H	U	
2	38.1	215.9	83.1	165.1	93.7	136.1	431.8	17.8	58.7	11.79
3	61.5	282.4	100.6	209.6	111.3	153.7	431.8	17.8	77.7	20.87
4	76.2	304.8	104.1	254	171.5	224.3	558.8	35.1	112.5	31.75
6	114.3	403.4	133.4	317.5	217.4	268.0	558.8	36.6	152.9	71.21



KF Series F Split Body, Dimensional Data (in.), Class 150 & 300



Dimensional Data (in.), 1" - 12", Class 150

Size (in.)	Dimension (in.)																	Wt. (lbs.)
	A	B	C	D	E	F	F1	G	H	J	L	U	V	W	X	Y	BB	
1 x 1	1.00	5.00	2.31	4.25	3.50	5.44	—	6.31	1.32	.586	—	1.69	4	.63	3.13	—	—	17.0
1 1/2 x 1 1/2	1.50	6.50	2.96	5.00	3.69	5.75	7.37	15.50	.640	.705	.38	2.31	4	.63	3.88	6.00	6.50	12.8
2 x 2	2.00	7.00	3.02	6.00	4.51	6.56	8.20	15.50	.640	.705	.44	3.14	4	.75	4.75	6.00	6.50	17.6
2 1/2 x 2*	2.00	7.50	2.94	7.00	4.38	6.06	—	8.50	1.00	.873/.871	—	3.06	4	.75	5.50	—	—	37.5
3 x 3	3.00	8.00	3.50	7.50	6.81	10.25	11.63	20.00	1.28	1.067/1.062	.44	4.43	4	.75	6.00	6.00	6.50	31.5
4 x 4	4.00	9.00	4.00	9.00	8.40	11.00	13.08	20.00	1.28	1.321/1.316	.62	5.88	8	.75	7.50	8.00	9.00	54.2
6 x 6	6.00	15.50	7.75	11.00	10.81	11.12	15.63	20.00	1.45	1.515/1.510	.75	8.00	8	.88	9.50	8.00	9.50	137
8 x 6	6.00	11.50	5.13	13.50	10.81	11.12	15.63	20.00	1.45	1.515/1.510	.75	8.00	8	.88	9.50	8.00	9.50	210
8 x 8	8.00	18.00	9.00	13.50	14.25	—	18.26	—	2.27	1.997/1.994	.62	9.64	8	.88	9.50	12.00	9.50	477
10 x 8	8.00	13.00	6.50	16.00	14.25	—	18.26	—	2.27	1.997/1.994	.62	9.64	12	1.00	14.25	12.00	9.50	557
10 x 10	10.00	21.00	10.50	16.00	17.41	—	22.53	—	3.06	2.497/2.493	.62	11.91	12	1.00	14.25	16.00	11.50	685
12 x 10	10.00	14.00	7.00	19.00	17.41	—	22.53	—	3.06	2.497/2.493	.62	11.91	12	1.00	17.00	16.00	11.50	806

*For design artwork, refer to page 12.

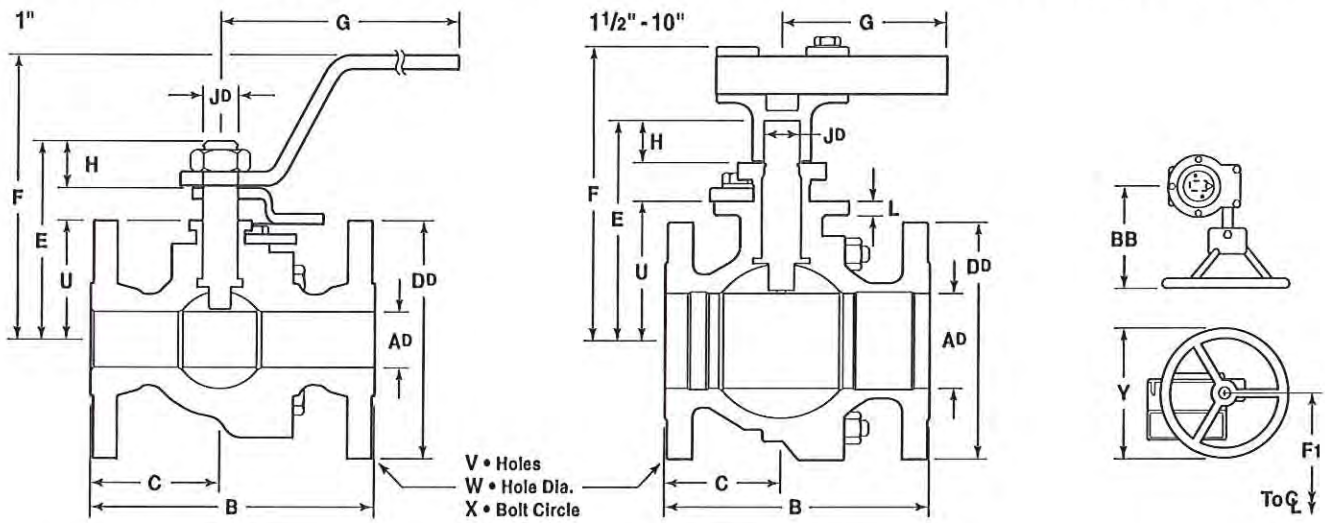
Dimensional Data (in.), 1" - 10", Class 300

Size (in.)	Dimension (in.)																	Wt. (lbs.)
	A	B	C	D	E	F	F1	G	H	J	L	U	V	W	X	Y	BB	
1 x 1	1	6.50	3.50	4.88	3.50	5.44	—	6.31	1.32	.586	—	1.69	4	.75	3.50	—	—	22.0
1 1/2 x 1 1/2	1.50	7.50	3.53	6.13	3.69	5.75	7.37	15.50	.640	.705	.38	2.31	4	.88	4.50	6.00	6.50	20.0
2 x 2	2.00	8.50	4.25	6.50	4.51	6.56	8.20	15.50	.640	.705	.44	3.14	8	.75	5.00	6.00	6.50	26.0
2 1/2 x 2*	2.00	9.50	4.69	7.50	4.38	6.06	—	8.50	1.00	.873/.871	—	3.06	8	.88	5.88	—	—	43.7
3 x 3	3.00	11.13	5.82	8.25	6.81	10.25	11.63	20.00	1.28	1.067/1.062	.44	4.43	8	.88	6.63	6.00	6.50	46.0
4 x 4	4.00	12.00	6.00	10.00	8.40	11.00	13.08	20.00	1.28	1.321/1.316	.62	5.88	8	.88	7.88	8.00	9.00	70.0
6 x 6	6.00	15.88	7.94	12.50	12.75	—	15.63	—	2.27	1.950/1.945	.62	8.12	12	.88	10.63	12.00	9.50	157.0
8 x 6	6.00	16.50	6.63	15.00	12.75	—	15.63	—	2.27	1.950/1.945	.62	8.12	12	1.00	13.00	12.00	9.50	275
8 x 8	8.00	19.75	9.88	15.00	16.00	—	21.14	—	3.06	2.497/2.492	.62	10.52	12	1.00	13.00	16.00	11.50	624
10 x 8	8.00	18.00	6.25	17.50	16.00	—	21.14	—	3.06	2.497/2.492	.62	10.52	16	1.13	15.25	16.00	11.50	724

*For design artwork, refer to page 12.



KF Series F Split Body, Dimensional Data (mm), Class 150 & 300



Dimensional Data (mm), 1" - 12", Class 150

Size (in.)	Dimension (mm)																	Wt. (kg)
	A	B	C	D	E	F	F ₁	G	H	J	L	U	V	W	X	Y	BB	
1 x 1	25.4	127	58.7	108.0	88.9	138.2	—	160.3	33.5	14.9	—	42.9	4	16.0	79.5	—	—	7.7
1 1/2 x 1 1/2	38.1	165.1	75.2	127	93.7	146.1	187.2	393.7	16.3	17.9	9.7	58.7	4	16.0	98.6	152.4	165.1	5.8
2 x 2	50.8	177.8	76.7	152.4	115.0	166.6	208.3	393.7	16.3	17.9	11.2	79.8	4	19.1	120.7	152.4	165.1	8.0
2 1/2 x 2*	50.8	190.5	74.7	177.8	111.3	153.9	—	215.9	25.4	22.17/22.12	—	77.7	4	19.1	139.7	—	—	17.0
3 x 3	76.2	203.2	88.9	190.5	173.0	260.4	295.4	508	32.5	27.10/26.97	11.2	112.5	4	19.1	152.4	152.4	165.1	14.3
4 x 4	101.6	228.6	101.6	203.2	213.4	279.4	332.2	508	32.5	33.55/33.43	15.7	149.4	8	19.1	190.5	203.2	228.6	24.6
6 x 6	152.4	393.7	196.9	279.4	274.6	282.4	397.0	508	36.8	38.48/38.35	19.1	203.2	8	22.4	241.3	203.2	241.3	62.1
8 x 6	152.4	292.1	130.3	279.4	274.6	282.4	397.0	508	36.8	38.48/38.35	19.1	203.2	8	22.4	241.3	203.2	241.3	95.3
8 x 8	203.2	457.2	228.6	342.9	362.0	—	463.8	—	57.7	50.72/50.65	15.7	244.9	8	22.4	241.3	304.8	241.3	216.4
10 x 8	203.2	330.2	165.1	406.4	362.0	—	463.8	—	57.7	50.72/50.65	15.7	244.9	12	25.4	362.0	304.8	241.3	252.7
10 x 10	254	533.4	266.7	406.4	442.2	—	572.3	—	77.7	63.42/63.32	15.7	302.5	12	25.4	362.0	406.4	292.1	310.7
12 x 10	254	355.6	177.8	482.6	442.2	—	572.3	—	77.7	63.42/63.32	15.7	302.5	12	25.4	431.8	406.4	292.1	365.6

*For design artwork, refer to page 12.

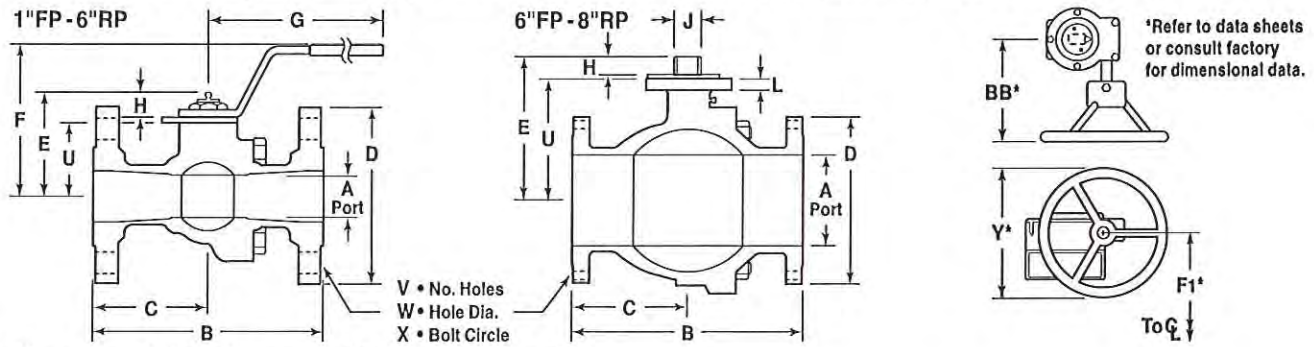
Dimensional Data (mm), 1" - 10", Class 300

Size (in.)	Dimension (mm)																	Wt. (kg)
	A	B	C	D	E	F	F ₁	G	H	J	L	U	V	W	X	Y	BB	
1 x 1	25.4	165.1	88.9	124.0	88.9	138.2	—	160.3	33.5	14.9	—	42.9	4	19.1	88.9	—	—	10.0
1 1/2 x 1 1/2	38.1	190.5	89.7	155.7	93.7	146.1	187.2	393.7	16.3	17.9	9.7	58.7	4	22.4	114.3	152.4	165.1	9.1
2 x 2	50.8	215.9	108.0	165.1	115.0	166.6	208.3	393.7	16.3	17.9	11.2	79.8	8	19.1	127	152.4	165.1	11.8
2 1/2 x 2*	50.8	241.3	119.1	190.5	111.3	153.9	—	215.9	25.4	22.17/22.12	—	77.7	8	22.4	149.4	—	—	19.8
3 x 3	76.2	282.7	147.8	210.0	173.0	260.4	295.4	508	32.5	27.10/26.97	11.2	112.5	8	22.4	168.4	152.4	165.1	20.9
4 x 4	101.6	304.8	152.4	254	213.4	279.4	332.2	508	32.5	33.55/33.43	15.7	149.4	8	22.4	200.2	203.2	228.6	31.8
6 x 6	152.4	403.4	201.7	317.5	323.9	—	397.0	—	57.7	49.53/49.40	15.7	206.2	12	22.4	270.0	304.8	241.3	71.2
8 x 6	152.4	419.1	168.4	381	323.9	—	397.0	—	57.7	49.53/49.40	15.7	206.2	12	25.4	330.2	304.8	241.3	124.7
8 x 8	203.2	501.7	251.0	381	406.4	—	537.0	—	77.7	63.42/63.30	15.7	267.2	12	25.4	330.2	406.4	292.1	283.0
10 x 8	203.2	457.2	158.8	444.5	406.4	—	537.0	—	77.7	63.42/63.30	15.7	267.2	6	28.7	387.4	406.4	292.1	328.4

*For design artwork, refer to page 12.



KF Series F Split Body, Dimensional Data (in., mm), Class 600, 900 & 1500



Dimensional Data (in., mm), 1"FP-8"RP, Class 600

Size (in.)	Dimension (in.)																	Wt. (lbs.)	Ring Groove
	A	B/RF	B/RTJ	C/RF	C/RTJ	D	E	F	G	H	J	L	U	V	W	X			
1FP	1	8 1/2	8 1/2	3 3/4	3 3/4	4 7/8	3	4 3/16	5 7/8	1 3/16	.623/.621	—	1 11/16	4	3/4	3 1/2	25	R-16	
1 1/2FP	1 1/2	9 1/2	9 1/2	3 7/8	3 7/8	6 1/8	3 15/16	5 5/8	8 1/2	1	.873/.871	—	2 5/8	4	7/8	4 1/2	30.4	R-20	
2RP	1 1/2	11 1/2	11 5/8	4 7/16	4 1/2	6 1/2	3 15/16	5 5/8	8 1/2	1	.873/.871	—	2 5/8	8	3/4	5	35	R-23	
2FP	2	11 1/2	11 5/8	4 7/16	4 1/2	6 1/2	4 3/8	6 1/16	8 1/2	1	.873/.871	—	3 1/16	8	3/4	5	41.5	R-23	
2 1/2RP	2	13	13 1/8	4 15/16	5	7 1/2	4 3/8	6 1/16	8 1/2	1	.873/.871	—	3 1/16	8	7/8	5 7/8	52.9	R-26	
3RP	2	14	14 1/8	6	6 1/16	8 1/4	4 3/8	6 1/16	8 1/2	1	.873/.871	—	3 1/16	8	7/8	6 5/8	61.6	R-31	
3FP	3	14	14 1/8	5 3/4	5 13/16	8 1/4	5 21/32	7 1/4	15	1 1/4	1.248/1.246	—	4	8	7/8	6 5/8	89.1	R-31	
4RP	3	17	17 1/8	7 3/4	7 13/16	10 3/4	5 21/32	7 1/4	15	1 1/4	1.248/1.246	—	4	8	1	8 1/2	133.8	R-37	
4FP	4	17	17 1/8	8 1/2	8 9/16	10 3/4	8 19/32	9 1/2	48	1 11/16	1.791/1.773	1/2	6.5	8	1	8 1/2	167	R-37	
6RP	4	22	22 1/8	11	11 1/16	14	8 19/32	9 1/2	48	1 11/16	1.791/1.773	1/2	6.5	12	1 1/8	11 1/2	345	R-45	
6FP	6	22	22 1/8	11	11 1/16	14	11 3/4	—	—	2 7/8	2.499/2.492	5/8	8 25/32	12	1 1/8	11 1/2	427	R-45	
8RP	6	26	26 1/8	13	13 1/16	16 1/2	11 3/4	—	—	2 7/8	2.499/2.492	5/8	8 25/32	12	1 1/4	13 3/4	672	R-49	

Size (in.)	Dimension (mm)																	Wt. (kg)	Ring Groove
	A	B/RF	B/RTJ	C/RF	C/RTJ	D	E	F	G	H	J	L	U	V	W	X			
1FP	25.4	215.9	215.9	95.3	95.3	123.8	76.2	106.4	149.2	20.6	15.82/15.77	—	42.9	4	19.1	88.9	11.3	R-16	
1 1/2FP	38.1	241.3	241.3	98.4	98.4	155.6	100.0	142.9	215.9	25.4	22.17/22.12	—	66.7	4	22.2	114.3	13.8	R-20	
2RP	38.1	292.1	295.3	112.7	114.3	165.1	100.0	142.9	215.9	25.4	22.17/22.12	—	66.7	8	19.1	127.0	15.9	R-23	
2FP	50.8	292.1	295.3	112.7	114.3	165.1	111.1	154.0	215.9	25.4	22.17/22.12	—	77.8	8	19.1	127.0	18.8	R-23	
2 1/2RP	50.8	330.2	333.4	125.4	127	190.5	111.1	154.0	215.9	25.4	22.17/22.12	—	77.8	8	22.2	149.2	24.0	R-26	
3RP	50.8	355.6	358.8	152.4	154.0	209.6	111.1	154.0	215.9	25.4	22.17/22.12	—	77.8	8	22.2	168.3	27.9	R-31	
3FP	76.2	355.6	358.8	146.1	147.6	209.6	143.7	184.2	381.0	31.8	31.70/31.65	—	101.6	8	22.2	168.3	40.4	R-31	
4RP	76.2	431.8	435.0	196.9	198.4	273.1	143.7	184.2	381.0	31.8	31.70/31.65	—	101.6	8	25.4	215.9	60.7	R-37	
4FP	101.6	431.8	435.0	215.9	217.5	273.1	218.3	241.3	1219.2	42.9	45.49/45.03	12.7	165.1	8	25.4	215.9	75.7	R-37	
6RP	101.6	558.8	562.0	279.4	281.0	355.6	218.3	241.3	1219.2	42.9	45.49/45.03	12.7	165.1	12	28.6	292.1	156	R-45	
6FP	152.4	558.8	562.0	279.4	281.0	355.6	298.5	—	—	73.0	63.47/63.30	15.9	223.0	12	28.6	292.1	194	R-45	
8RP	152.4	660.4	663.6	330.2	331.8	419.1	298.5	—	—	73.0	63.47/63.30	15.9	223.0	12	31.8	349.3	305	R-49	

Note: Sizes 1"FP-6"RP is weight w/handle.
 Sizes 6"FP-8"RP is weight w/gear operator.

Dimensional Data (in., mm), 1"FP-2"FP, Class 900 & 1"FP, Class 1500

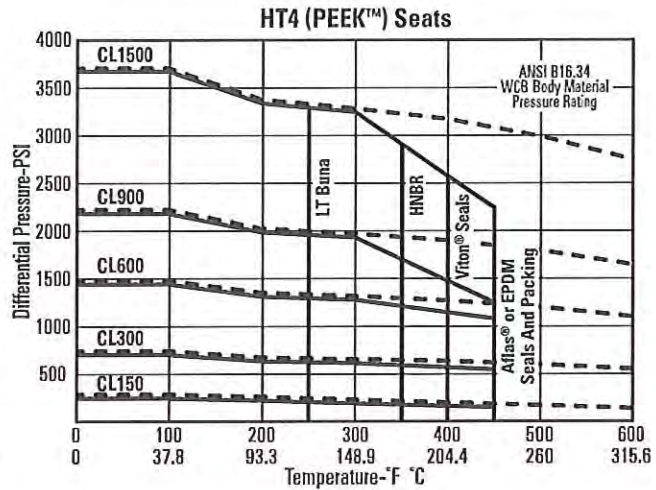
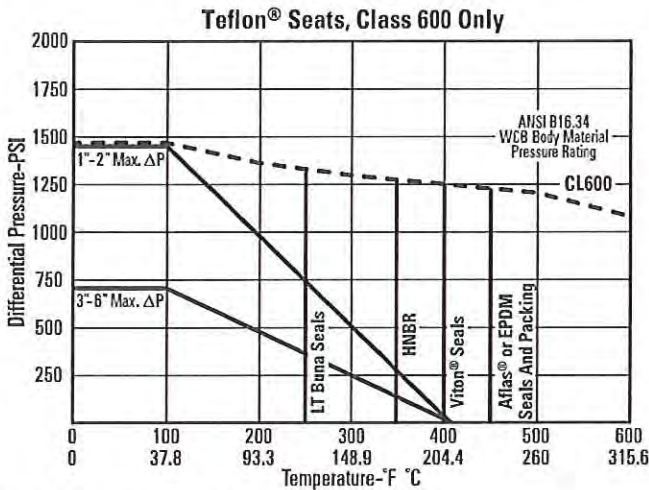
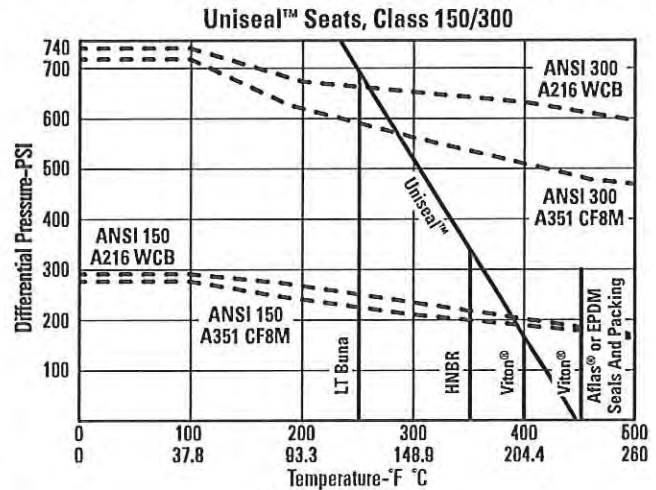
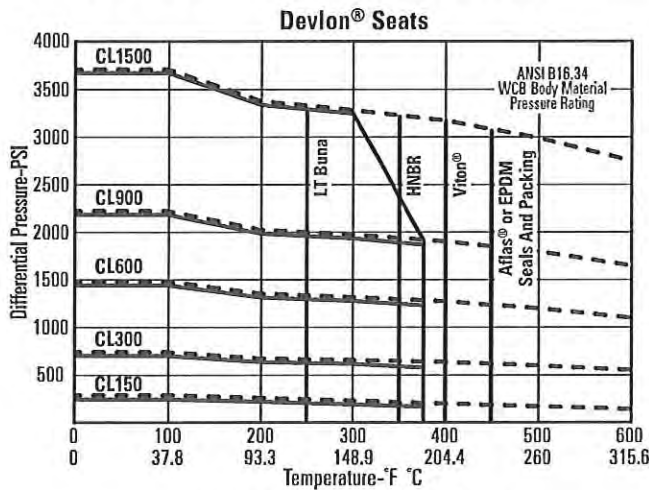
Size (in.)	Dimension (in.)																	Wt. (lbs.)	Ring Groove
	A	B/RF	B/RTJ	C/RF	C/RTJ	D	E	F	G	H	J	L	U	V	W	X			
1FP	1	10	10	4 3/4	4 3/4	5 7/8	3 1/16	4 1/2	5 7/8	1 1/8	.623/.621	—	2	4	1	4	28	R-16	
2RP	1 1/2*	14 1/2*	14 5/8*	7 1/4*	7 5/16*	8 1/2*	3 15/16*	5 5/8*	8 1/2*	1 1/16*	.873/.871*	—	2 5/8*	8*	1*	6 1/2*	42.9*	R-24*	
2FP	2*	14 1/2*	14 5/8*	7 1/4*	7 5/16*	8 1/2*	4 3/8*	6 1/16*	8 1/2*	1 1/16*	.873/.871*	—	3 1/16*	8*	1*	6 1/2*	51.2*	R-24*	

Size (in.)	Dimension (mm)																	Wt. (kg)	Ring Groove
	A	B/RF	B/RTJ	C/RF	C/RTJ	D	E	F	G	H	J	L	U	V	W	X			
1FP	25.4	254.0	254.0	120.7	120.7	149.2	77.8	114.3	149.2	28.6	15.82/15.77	—	50.8	4	25.4	101.6	12.7	R-16	
2RP	38.1*	368.3*	371.5*	184.2*	185.7*	215.9*	100.0*	142.9*	215.9*	27.0*	22.17/22.12*	—	66.7*	8*	25.4*	165.1*	19.5*	R-24*	
2FP	50.8*	368.3*	371.5*	184.2*	85.7*	1215.9*	111.1*	154.0*	215.9*	27.0*	22.17/22.12*	—	77.8*	8*	25.4*	165.1*	23.2*	R-24*	

Note: Weight is w/handle.
 *Class 900 Only.



KF Series F Engineering Data • Pressure Temperature (sizes listed on Teflon® chart indicate bore size)



Low Temperature Limits

Body Material	°F	°C
WCC	-20°	-28.9
LCC	-50°	-45.6
WCB	-20°	-28.9
CF8M	-50°	-45.6

Seat Material	°F	°C
Devlon® V	-50°	-45.6
Teflon®	-50°	-45.6
HT4 (PEEK™)	-50°	-45.6

Seal Material	°F	°C
TFE/GRF Packing	-50°	-45.6
Low Temp Buna N	-50°	-45.6
Viton®	-20°	-28.9
Elast-O-Lion 985	-50°	-45.6

Seal Material	°F	°C
J. Walker® Viton®	+10°	-12.2
HNBR	-40°	-40
Aflas®	+32°	0
EPDM	-50°	-45.6

Flow Coefficient (C_v)

Class	Valve Size (In.)															
	1FP	1 1/2FP	2RP	2FP	2 1/2RP	3RP	3FP	4RP	4FP	6RP	6FP	8RP	8FP	10RP	10FP	12RP
150	98	265	125	470	220	430	1240	600	2470	1010	5249	2500	10,750	5000	17,775	8400
300	98	265	125	420	220	430	1050	600	2000	1010	5100	2400	10,300	4825	—	—
600	93	308	140	365	220	185	1000	570	1800	900	4600	2235	—	—	—	—
900/1500	90	—	135*	350*	—	—	—	—	—	—	—	—	—	—	—	—

*Class 900 only.

Method of Calculating Flow

The Flow Coefficient "C_v" of a valve is the flow rate of water (gallons/minute) through a fully opened valve, with a pressure drop of 1 psi across the valve. To find the flow of liquid through valve from the C_v, use the following formulas:

Liquid Flow

QL = flow rate of liquid (gal./min.)
 ΔP = differential pressure across the valve (psi)
 G = specific gravity of liquid (for water, G=1)

$$QL = C_v \sqrt{\frac{\Delta P}{G}}$$

Gas Flow

Qg = flow rate of gas (CFH at STP)
 P2 = outlet pressure (psia)
 g = Specific gravity of gas (for air, g=1.000)

$$Q_g = 61 C_v \sqrt{\frac{P_2 \Delta P}{g}}$$

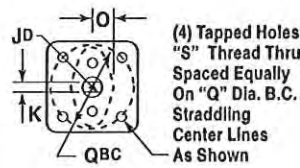
For non-critical flow
 $\left\{ \frac{\Delta P}{P_2} < 1.0 \right\}$



KF Series F • Topworks (in.) & Stem Torque (in.-lbs)

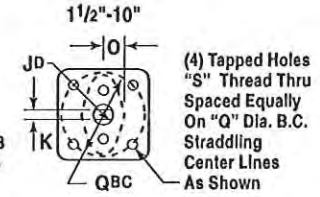
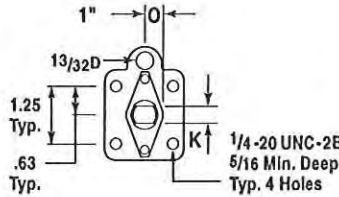
KF Unibody Ball Valves, Class 150 & 300

Size (in.)	Class	Dimension (in.)				
		J	K	O	Q	S
2	150/300	.705	.376/.373	.81	3.25	3/8-16 UNC
3	150/300	.705	.376/.373	.81	3.25	3/8-16 UNC
4	150/300	1.06	.674/.670	1.36	4.13	3/8-16 UNC
6	150/300	1.32	.865/.861	1.36	4.41	1/2-13 UNC



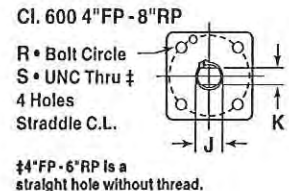
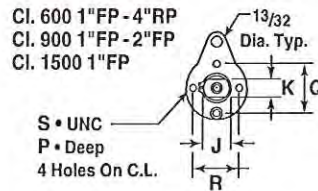
KF Split Body Ball Valves, Class 150 & 300

Size (in.)	Class	Dimension (in.)				
		J	K	O	Q	S
1 x 1	150/300	.586	.371/.369	.56	—	1/4-20 UNC
1 1/2 x 1 1/2	150/300	.705	.376/.373	.76	3.25	3/8-16 UNC
2 x 2	150/300	.705	.376/.373	.76	3.25	3/8-16 UNC
2 1/2 x 2	150/300	.873/.871	.560/.556	—	1.75	1/4-20 UNC
3 x 3	150/300	1.097/1.062	.674/.670	1.36	4.13	3/8-16 UNC
4 x 4	150/300	1.321/1.316	.865/.861	1.36	4.41	1/2-13 UNC
6 x 6	150	1.515/1.510	1.065/1.061	1.36	5.13	5/8-11 UNC
6 x 6	300	1.950/1.945	1.249/1.245	1.58	5.13	5/8-11 UNC
8 x 6	150	1.575/1.570	1.065/1.061	1.36	5.13	5/8-11 UNC
8 x 6	300	1.950/1.945	1.249/1.245	1.58	5.13	5/8-11 UNC
8 x 8	150	1.997/1.992	1.247/1.243	1.58	5.13	5/8-11 UNC
8 x 8	300	2.497/2.492	1.747/1.743	2.10	6.75	3/4-10 UNC
10 x 8	150	1.997/1.992	1.247/1.243	1.58	5.13	5/8-11 UNC
10 x 8	300	2.497/2.492	1.747/1.743	2.10	6.75	3/4-10 UNC
10 x 10	150	2.497/2.492	1.747/1.743	2.10	6.75	3/4-10 UNC
12 x 10	150	2.497/2.492	1.747/1.743	2.10	6.75	3/4-10 UNC



KF Series F Ball Valves, Class 600, 900 & 1500

Size (in.)	Class	Dimension (in.)					
		J	K	P	Q	R	S
1FP	600	.623/.621	.372/.370	5/16	1 1/4	1 1/4	1/4-20 UNC
1FP	900	.623/.621	.372/.370	5/16	1 1/4	1 1/4	1/4-20 UNC
1FP	1500	.623/.621	.372/.370	5/16	1 1/4	1 1/4	1/4-20 UNC
1 1/2 FP	600	.873/.871	.560/.556	3/8	1 3/4	1 3/4	1/4-20 UNC
2 RP	600/900	.873/.871	.560/.556	3/8	1 3/4	1 3/4	1/4-20 UNC
2 1/2 RP	600	.873/.871	.560/.556	3/8	1 3/4	1 3/4	1/4-20 UNC
2 FP	600/900	.873/.871	.560/.556	3/8	1 3/4	1 3/4	1/4-20 UNC
3 RP	600	.873/.871	.560/.556	3/8	1 3/4	1 3/4	1/4-20 UNC
3 FP	600	1.248/1.245	.622/.618	5/8	3 1/8	2 1/4	5/16-18 UNC
4 RP	600	1.248/1.245	.622/.618	5/8	3 1/8	2 1/4	5/16-18 UNC
4 FP	600	1.791/1.773	1.247/1.243	thru	—	4 1/4	7/16
6 RP	600	1.791/1.773	1.247/1.243	thru	—	4 1/4	7/16
6 FP	600	2.499/2.492	1.749/1.745	thru	—	6 3/4	3/4-10 UNC
8 RP	600	2.499/2.492	1.749/1.745	thru	—	6 3/4	3/4-10 UNC



Design Torques for Actuator Sizing (in.-lbs.)*

Class/Work. Press. (psi)	Valve Size (In.)															
	1FP	1 1/2 FP	2 RP	2 FP	2 1/2 RP	3 RP	3 FP	4 RP	4 FP	6 RP	6 FP	8 RP	8 FP	10 RP	10 FP	12 RP
150/285	180	280	240	440	600	520	600	600	1440	1440	5500	5500	12,000	12,000	23,000	23,000
300/740	180	280	240	500	960	590	1000	1000	2500	2500	12,000	12,000	27,000	27,000	—	—
600/1480	600	900	900	1200	1200	1200	2700	2700	5280	5280	27,000	27,000	—	—	—	—
900/2220	780	—	1320	1800	—	—	—	—	—	—	—	—	—	—	—	—
1500/3705	1200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

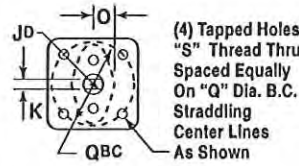
*There is no safety factor in the above torques. KF recommends at least a 25% safety factor be added.



KF Series F • Topworks (mm) & Stem Torque (Nm)

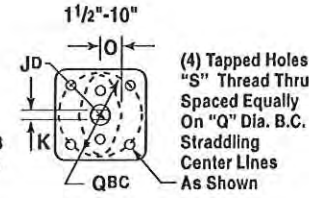
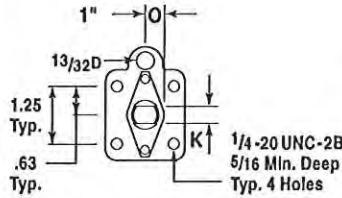
KF Unibody Ball Valves, Class 150 & 300

Size (in.)	Class	Dimension (mm)				
		J	K	O	Q	S
2	150/300	17.9	9.55/9.47	20.6	82.6	3/8-16 UNC
3	150/300	17.9	9.55/9.47	20.6	82.6	3/8-16 UNC
4	150/300	26.9	17.12/17.02	34.5	104.9	3/8-16 UNC
6	150/300	33.5	21.97/21.87	34.5	112.0	1/2-13 UNC



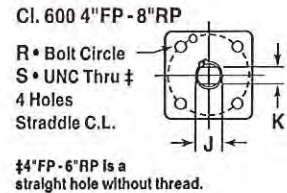
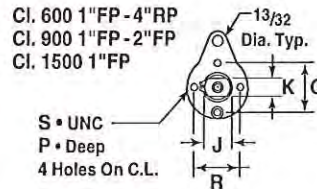
KF Split Body Ball Valves, Class 150 & 300

Size (in.)	Class	Dimension (mm)				
		J	K	O	Q	S
1 x 1	150/300	14.9	9.42/9.37	14.2	—	1/4-20 UNC
1 1/2 x 1 1/2	150/300	17.9	9.55/9.47	19.3	82.6	3/8-16 UNC
2 x 2	150/300	17.9	9.55/9.47	19.3	82.6	3/8-16 UNC
2 1/2 x 2	150/300	22.17/22.12	14.22/14.12	—	44.5	1/4-20 UNC
3 x 3	150/300	27.10/26.97	17.12/17.02	34.5	104.9	3/8-16 UNC
4 x 4	150/300	33.55/33.43	21.97/21.87	34.5	112.0	1/2-13 UNC
6 x 6	150	38.48/38.35	27.05/26.95	34.5	130.3	5/8-11 UNC
6 x 6	300	49.53/49.40	31.72/31.62	40.13	130.3	5/8-11 UNC
8 x 6	150	40.01/39.88	21.97/21.87	34.5	130.3	5/8-11 UNC
8 x 6	300	49.53/49.40	31.72/31.62	40.13	130.3	5/8-11 UNC
8 x 8	150	50.72/50.60	31.67/31.57	40.13	130.3	5/8-11 UNC
8 x 8	300	63.42/63.30	44.37/44.27	53.3	171.5	3/4-10 UNC
10 x 8	150	50.72/50.60	31.67/31.57	40.13	130.3	5/8-11 UNC
10 x 8	300	63.42/63.30	44.37/44.27	53.3	171.5	3/4-10 UNC
10 x 10	150	63.42/63.30	44.37/44.27	53.3	171.5	3/4-10 UNC
12 x 10	150	63.42/63.30	44.37/44.27	53.3	171.5	3/4-10 UNC



KF Series F Ball Valves, Class 600, 900 & 1500

Size (in.)	Class	Dimension (mm)					
		J	K	P	Q	R	S
1 FP	600	15.82/15.77	9.45/9.40	7.9	31.8	31.8	1/4-20 UNC
1 FP	900	15.82/15.77	9.45/9.40	7.9	31.8	31.8	1/4-20 UNC
1 FP	1500	15.82/15.77	9.45/9.40	7.9	31.8	31.8	1/4-20 UNC
1 1/2 FP	600	22.17/22.12	14.22/14.12	9.5	44.5	44.5	1/4-20 UNC
2 RP	600/900	22.17/22.12	14.22/14.12	9.5	44.5	44.5	1/4-20 UNC
2 1/2 RP	600	22.17/22.12	14.22/14.12	9.5	44.5	44.5	1/4-20 UNC
2 FP	600/900	22.17/22.12	14.22/14.12	9.5	44.5	44.5	1/4-20 UNC
3 RP	600	22.17/22.12	14.22/14.12	9.5	44.5	44.5	1/4-20 UNC
3 FP	600	31.70/31.65	15.80/15.70	15.9	79.4	57.2	5/16-18 UNC
4 RP	600	31.70/31.65	15.80/15.70	15.9	79.4	57.2	5/16-18 UNC
4 FP	600	45.49/45.03	31.67/31.57	thru	—	108.0	11.1
6 RP	600	45.49/45.03	31.67/31.57	thru	—	108.0	11.1
6 FP	600	63.47/63.30	44.42/44.32	thru	—	171.5	3/4-10 UNC
8 RP	600	63.47/63.30	44.42/44.32	thru	—	171.5	3/4-10 UNC



Design Torques for Actuator Sizing (Nm)*

Class/Work. Press. (psi)	Valve Size (in.)															
	1 FP	1 1/2 FP	2 RP	2 FP	2 1/2 RP	3 RP	3 FP	4 RP	4 FP	6 RP	6 FP	8 RP	8 FP	10 RP	10 FP	12 RP
150/285	20.3	31.6	27.1	49.7	67.8	58.8	67.8	67.8	162.7	162.7	621.4	621.4	1355.8	1355.8	2598.7	2598.7
300/740	20.3	31.6	27.1	56.5	108.5	66.7	113.0	113.0	282.5	282.5	1355.8	1355.8	3050.6	3050.6	—	—
600/1480	67.8	101.7	101.7	135.6	135.6	135.6	305.1	305.1	596.6	596.6	3050.6	3050.6	—	—	—	—
900/2220	88.1	—	149.1	203.4	—	—	—	—	—	—	—	—	—	—	—	—
1500/3705	135.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

*There is no safety factor in the above torques, KF recommends at least a 25% safety factor be added.



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P-Series Differential Pressure, Pressure & Temperature Switches



FEATURES

- **Explosion Proof and Watertight Enclosure – N7 Models**
- **Easy-to-read scale for approximate setpoint indication ($\pm 5\%$ accuracy)**
- **Stainless steel internal parts**
- **Easy setpoint adjustment(s) capability**
- **Diaphragm-sealed piston actuator for long life is standard for most ranges**

Ashcroft® switches and controls are highly reliable for your industrial and process applications. We begin with rock-solid designs, matching the most appropriate technology with the safety and reliability requirements of the applications. The materials of construction are specified to exacting standards, and product is built to last in the toughest applications. Our modern, responsive manufacturing facility is supported by an extensive network of stocking distributors and factory sales offices located in virtually every part of the world. Special application assistance is always just a telephone call away. The Ashcroft P-Series switch line is designed for uncompromising end user reliability and safety.

Die cast aluminum enclosure is available in NEMA 7/9 (explosion-proof enclosure Class I, Div. 1 & 2, Groups B, C, & D and Class II, Div. 1 & 2, Groups E, F and G). Dual chamber design allows setpoint changes to be made safely even with power connected. Materials of construction have been selected for long life. A wide variety of precision switch elements are available to meet every application requirement, including hermetically sealed contacts for added reliability and safety. The actuators we use have been proven in more than twenty years of service in plants and mills throughout the world. Multiple features such as dual setpoints and adjustable deadbands are offered. Special designs are available for fire safety, limit control and other more stringent requirements. Ease of use is stressed to improve the reliability of the installation.

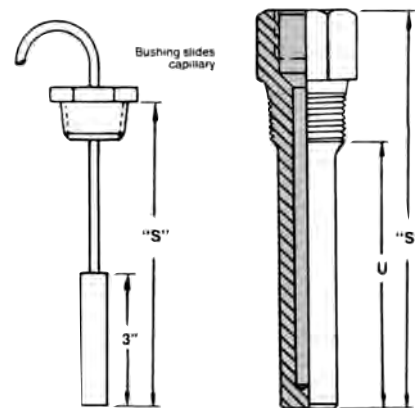
P-Series switches are currently being successfully used in refineries, chemical and petrochemical plants, water and sewage treatment plants, steel mills and other tough applications. Typical applications are on blowers, compressors, boilers, burners, turbines and reverse osmosis systems.

Thermowells

Thermowells must be used on any application where the stem of the temperature switch may be exposed to pressure, corrosive fluids or high velocity. Additionally, the use of a thermowell permits instrument interchange or calibration check without disturbing or closing down the process.

Ashcroft temperature switches have bulb diameters to match $\frac{3}{8}$ " nominal bore thermowells. The bulbs have a sensitive portion length of 2" which can be used with $2\frac{1}{2}$ " "U" dimensioned thermowells or longer. For maximum accuracy, a thermowell's "U" dimension should be selected to permit complete immersion of the sensitive portion plus 1" when measuring the temperature of liquids; an extra 3" should be allowed when measuring the temperature of gases.

Thermowell bushings should be used with remote mount temperature switches. We recommend the standard 3" bulb and code 69 Series bushings for use with any thermowell "U" dimension. A split rubber grommet allows easy installation and "S" dimension adjustment.



P-Series Differential Pressure, Pressure & Temperature Switches

Temperature Switches

P-Series temperature switches feature a SAMA Class II vapor pressure thermal system. This system provides quick, accurate response to process temperature changes with negligible ambient temperature effects. This is inherent in the design due to the precise relationship that exists between temperature

and pressure according to the vapor pressure laws. A wide selection of sensing bulb and armored capillary lengths are available. The vapor pressure system design features small bulb sizes, making installation easy and cost-effective.

All models feature $\pm 1\%$ percent of span set point repeatability with very

high overtemperature ratings.

These standard designs perform well in applications where shock and vibration could be a problem and should be used with Ashcroft thermowells for bulb protection and ease of installation and maintenance.

STANDARD TEMPERATURE RANGE SELECTION

APPROXIMATE DEADBAND

NOMINAL RANGE		MAX. TEMP. °F	SWITCH ELEMENT								
			PTA ⁽⁴⁾		PTS ⁽⁴⁾			PTD ⁽⁴⁾			
°F	°C		J,H	G	J,H	K,F	P	GG	JJ,HH	KK,FF	PP
-40 to 60	-40 to 16	400	18-90	2-10	9-18	1-2	1-5	2-10	9-18	1-2	1-5
0 to 100	-20 to 40	400	30-90	2-15	10-30	1-3	1.5-7	2-15	10-30	1.5-3	1.5-7
75 to 205	20 to 95	400	34-120	2-17	10-34	1.5-3.5	1.5-8	2-17	10-34	1.5-3.5	1.5-8
150 to 260	65 to 125	400	25-100	2.5-12	9-25	1-2.5	1-7	2.5-12	9-25	1-2.5	1-7
235 to 375	110 to 190	500	35-130	2-18	10-35	1-3.5	1.5-8	2-18	10-35	1-3.5	1.5-8
350 to 525 ⁽⁶⁾	175 to 275	700	40-165	3-25	15-40	2-4.5	2.5-11	3-25	15-40	2-4.5	2.5-11
500 to 750 ⁽⁵⁾	260 to 400	900	50-200	20-36	36-60	5-10	6-21	20-36	36-60	5-10	6-21

- NOTES:**
- 1 All deadbands are in °F.
 - 2 Switches can be set at increase or decrease throughout the nominal range.
 - 3 Deadbands for PTA models are adjustable between the values shown.
 - 4 Deadbands for PTS and PTD models are fixed within the range of values shown. Manufacturing and parts variances result in variation from one unit to another as shown.
 - 5 Available with remote mount thermal systems only.
 - 6 Not available with 2 3/4" stem.

P-Series Differential Pressure, Pressure & Temperature Switches

Pressure & Differential Pressure Switches

P-Series pressure, differential pressure and vacuum switches use two different actuators depending on setpoint requirements. For setpoints between 2 and 3000 psi, the simple, rugged diaphragm-sealed piston actuator is used. This design features high reliability and a choice of actuator seal materials for virtually every application. An optional welded design is also available for setpoints up to 1000 psi

for maximum reliability. This design is available in 316 SS or Monel. Differential pressure models use a unique dual-diaphragm-sealed piston design that features very high static operating pressures and small size.

For setpoints between 4.5 and 150 inches of H₂O, a large diaphragm is used for increased sensitivity in both pressure and differential pressure designs with good choice

of materials of construction.

All standard models feature ± 1 percent of range setpoint repeatability and a minimum of 400 percent of range proof pressures.

These standard designs perform well in applications where shock and vibration could be a problem and may be used with Ashcroft® diaphragm seals in extreme services such as slurries or abrasive process fluids.

PRESSURE/VACUUM SWITCHES

APPROXIMATE DEADBAND⁽²⁾ (BUNA-N DIAPHRAGM)

NOMINAL RANGE ⁽¹⁾			Overpressure Ratings		PPA ⁽³⁾		PPS ⁽⁴⁾					PPD ⁽⁴⁾		
			Proof psi	Burst psi	SWITCH ELEMENT									
					J,H	G	J,H	K,F	P	GG	JJ,HH	KK,FF	PP	
VACUUM -30" Hg	-760mm Hg	-100 Kpa	250	400	7-26	3-5	3-6.5	1-2	1-2.5	3-5	3-6.5	1-2	1-2.5	
COMPOUND 30" Hg/ 15 psi	760mm Hg/ 1.0 Kg/cm ²	-100 Kpa 100 Kpa	250	400	10-25	3-5	2.5-3.5	1-2	1-2.5	3-5	2.5-4.5	1-2	1-2.5	
					4-13	1-2	1-3	0.5-1	0.5-1.2	2-4	1-3	0.5-1	0.5-1.2	
PRESSURE	30" H ₂ O	7.5 Kpa	20	35	4-27	1.5-3.5	2-5	0.5-1	0.5-2	1.5-3.5	2-5	0.5-1	0.5-2	
	60" H ₂ O	1500mm H ₂ O	15 Kpa	20	35	5-54	1.5-3.5	2.5-5	0.5-1.3	1-2	1.5-3.5	2.5-5	0.5-1.3	
	100" H ₂ O	2500mm H ₂ O	25 Kpa	20	35	8.5-90	4-6	4-8.5	1-2	1-3	4-7	4-8.5	1-2	
	150" H ₂ O	3750mm H ₂ O	37 Kpa	20	35	18-135	5-11	10-18	1.5-3	2-6	8-14	10-18	1.5-3	
	15 psi	1.0 kg/cm ²	100 Kpa	500	1000	2.5-13	1-2	1-3	0.5-1	0.5-1.2	1-2	1-3	0.5-1	
	30 psi	2.0 kg/cm ²	200 Kpa	500	1500	3-26	1-2.5	2-4.5	0.5-1.5	0.5-1.5	1-2.5	2-4.5	0.5-1.5	
	60 psi	4.0 kg/cm ²	400 Kpa	500	1500	5-54	2-4	4-7	1-2	1-2.5	2-4	4-7	1-2	
	100 psi	7.0 kg/cm ²	700 Kpa	1000	3000	10-90	5-7	5-10	1-2.5	2-4	5-7	5-10	1-2.5	
	200 psi	14 kg/cm ²	1400 Kpa	1000	3000	20-180	10-15	10-18	1-4	5-8	10-20	15-35	3-6	
	400 psi	28 kg/cm ²	2800 Kpa	2400	3000	45-360	16-30	16-45	4-8	5-15	16-30	16-45	4-8	
	600 psi	42 kg/cm ²	4200 Kpa	2400	3000	75-540	16-50	20-75	5-15	6-25	16-50	20-75	5-15	
1000 psi ⁽⁵⁾	70 kg/cm ²	7000 Kpa	12000	14000	160-900	75-130	50-160	7-30	10-85	75-130	50-160	7-30		
2000 psi	140 kg/cm ²	14000 Kpa	12000	14000	350-1800	150-200	150-350	20-50	25-110	150-200	150-350	20-50		
3000 psi	210 kg/cm ²	21000 Kpa	12000	14000	400-2600	180-250	180-400	30-70	50-250	180-250	180-400	30-70		

DIFFERENTIAL PRESSURE SWITCHES

APPROXIMATE DEADBAND⁽²⁾ (BUNA-N DIAPHRAGM)

NOMINAL RANGE ⁽¹⁾			Overpressure Ratings		PDA ⁽³⁾		PDS ⁽⁴⁾					PDD ⁽⁴⁾		
			Static Working Pressure	Proof psi	SWITCH ELEMENT									
					J,H	G	J,H	K,F	P	GG	JJ,HH	KK,FF	PP	
30" H ₂ O Diff.	750mm H ₂ O	5.4	21.6	5.5-27	3-5	4-6.5	0.5-1	0.5-2	3-5	4-6.5	0.5-1	0.5-2		
60" H ₂ O Diff.	1500mm H ₂ O	5.4	21.6	5.5-54	3-5	4.5-6.5	0.5-1.3	1-2	3-5	4-6.5	0.5-1.3	1-2		
100" H ₂ O Diff.	2500mm H ₂ O	5.4	21.6	8.5-90	4-6	4.5-8.5	1-2	1-3	4-7	4-8.5	1-2	1-3		
150" H ₂ O Diff.	3750mm H ₂ O	5.4	21.6	18-135	5-11	10-18	1.5-3	2-6	8-12	10-18	1.5-3	2-6		
15 psid	1.0 kg/cm ²	500	2000	2.5-13	1-2	1-3	0.5-1	0.5-1.2	1-2	1-3	0.5-1	0.5-1.2		
30 psid	2.0 kg/cm ²	500	2000	3.5-27	1-2.5	2-4.5	1-1.5	1-1.5	1-2.5	2-4.5	0.5-1.5	0.5-1.5		
60 psid	4.0 kg/cm ²	500	2000	6.5-54	2-4	4-7	1-2	1-2.5	2-4	4-7	1-2	1-2.5		
100 psid	7.0 kg/cm ²	1000	4000	10-90	5-7	5-10	1-2.5	2-4	5-7	5-10	1-2.5	2-4		
200 psid	14 kg/cm ²	1000	4000	20-180	10-15	10-18	1-4	5-8	10-20	10-18	3-6	5-8		
400 psid	28 kg/cm ²	1000	8000	45-360	16-30	16-45	4-8	5-15	16-30	16-45	4-8	5-15		

Values shown are for 0 static working pressure

NOTES:

- Switches may generally be set between 15% and 100% of nominal range on in-creasing pressure. Consult factory for applications where set points must be lower.
- All deadbands are given in English units as shown in the nominal range column.

Deadbands shown are for switches with Buna N diaphragm.

Approximate deadbands for optional diaphragms:

- Viton: Multiply Buna N value by 1.4
- Teflon: Multiply Buna N value by 1.2
- Stainless Steel: Multiply Buna N value by 1.7
- Monel: Multiply Buna N value by 1.7

3 Deadbands for PPA and PDA models are adjustable between

the values shown.

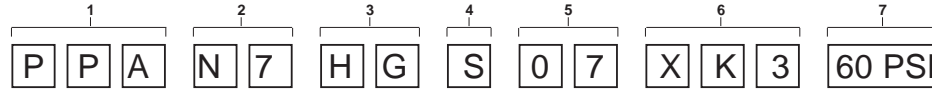
- Deadbands for PPS, PPD, PDS and PDD models are fixed within the range of values shown. Manufacturing and parts variances result in variation from one unit to another as shown.

5 Proof pressure is 4000 psi with SS and Monel welded diaphragms.

P-Series Differential Pressure, Pressure & Temperature Switches

P-SERIES PRESSURE AND DIFFERENTIAL PRESSURE SWITCH MODEL NUMBER:

To specify the exact switch desired select entries from appropriate tables as shown in example below.



1 – FUNCTION	
PPA	Pressure control, single setpoint, adjustable deadband
PPD	Pressure control, two independently adjustable setpoints, fixed deadband
PPS	Pressure control, single setpoint, fixed deadband
PDA	Differential pressure control, single setpoint, adjustable deadband
PDD	Differential pressure control, two independently adjustable setpoints, fixed deadband
PDS	Differential Pressure control, single setpoint, fixed deadband

2 – ENCLOSURE	
	N7-NEMA 7&9, IP66 (explosion proof Div. 1 & 2)

3 – SWITCH ELEMENTS FOR PPA & PDA CONTROLS			
CODE		S.P.D.T. Switch Elements UL/CSA Listed	
H	General Purpose	10A, 125/250 Vac 1/2A, 125 Vdc 1/4A, 250 Vdc	
J	Hermetically Sealed Switch, General Purpose	11A, 125/250 Vac 5A, 30 Vdc	
SWITCH ELEMENTS FOR PPD, PPS, PDD AND PDS CONTROLS			
CODE		Switch Elements UL/CSA Listed	
Single (PS)	Dual (PD)		
C	CC	Heavy Duty – AC	22A, 125/250 Vac
E	EE	Manual Reset, Actuates on Decreasing Pressure	15A, 125/250 Vac 5A, 30 Vdc
F⁽⁴⁾	FF	Sealed Environment Proof	15A, 125/250 Vac
G⁽⁵⁾	GG	General Purpose	15A, 125/250/480 Vac 1/2A, 125 Vdc 1/4A, 250 Vdc
H	HH	General Purpose – AC-DC	10A, 125/250 Vac 10A, Vdc
J	JJ	Hermetically Sealed Switch, General Purpose	11A, 125/250 Vac 5A, 30 Vdc
K⁽⁴⁾	KK	Narrow Deadband	15A, 125/250 Vac
L	LL	Hermetically Sealed, Gold Contacts	1A, 125 Vac
M	MM	Low Level Gold Contacts	1A, 125 Vac
P(3)	PP	Hermetically Sealed – AC	5A, 125/250 Vac
U	UU	Manual Reset, Actuates on Increasing Pressure	15A, 125/250 Vac 6A, 130 Vdc
W	WW	Ammonia Service	5A, 125/250 Vac 6A, 30 Vdc
Y	YY	High Temperature 300°F Ambient	15A, 125/250 Vac
S	SS	Heavy Duty – DC	10A, 125 Vac or Vdc 1/8 HP, 125 Vac or Vdc

NOTES:

- 1 These items are wetted by process fluid.
- 2 Ambient operating temperature limits –20 to 150°F, all styles. Set point shift of range per 50°F temperature change is normal.
- 3 Estimated dc rating, 2.5A, 28 Vdc (not UL listed).
- 4 Estimated dc rating, .4A, 120 Vdc (not UL listed).
- 5 Not UL listed at 480 Vac.
- 6 Supply static pressure for D/P switches.
- 7 St. diaphragm only.
- 8 Not available with Buna-N diaphragm.
- 9 Available on psi only.
- 10 Not available on NEMA 7.
- 11 Available with Teflon diaphragm only, to 600 psi only.

4 – ACTUATOR SEAL™					
Code and Material	Process Temp. Limits °F ⁽²⁾	Range			
		VAC ~ H ₂ O	0-600 psi	1000 psi	2000-3000 psi
B – Buna-N	0 to 150	•	•	•	•
V – Viton	20 to 300	•	•	•	•
T – Teflon	0 to 150	•	•	•	•
S – SS⁽⁹⁾	0 to 300	•	•	•	•
P – Monel ⁽⁹⁾	0 to 300	•	•	•	•

5 – PRESSURE PORT	
Code	
25	¼" NPT Female (Std. up to 1000#)
06	¼" NPT Female and ½" NPT Male Combination
07	½" NPT Female

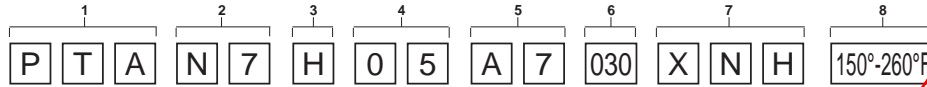
6 – P-SERIES OPTIONS					
CODE	DESCRIPTION	Pressure		Differential Pressure	
		psi	~ H ₂ O	psi	~ H ₂ O
XCH	Chained Cover	•	•	•	•
XC8⁽¹⁰⁾	CSA Approval, N7	•	•	•	•
XD2	Dual Seal Rating	•	N/A	N/A	•
XFP	Fungus Proofing	•	•	•	•
XFS⁽⁶⁾	Factory Adjusted Setpoints	•	•	•	•
XG9⁽⁷⁾	Fire Safe Actuator	•	N/A	N/A	N/A
HHX	40 psi Static Press. (D/P Only)				
	160 psi Proof Press. (D/P Only)	N/A	•	N/A	•
	100 psi Proof Press. (Press. Only)				
XJL	¾" to ½" Reducing Bushing	•	•	•	•
XK3	Terminal Blocks	•	•	•	•
XL9⁽¹¹⁾	Low Hardness SS Pressure Conn.	•	N/A	N/A	N/A
XNH	Tagging Stainless Steel	•	•	•	•
XPK⁽¹⁰⁾	Pilot Light(s)	•	•	•	•
XPM	¾" Sealed Conduit Conn. with 16" Lead Wires	•	•	•	•
XTA	316 SS Press. Conn. for ~H ₂ O Ranges	N/A	•	N/A	•
XUD	316 SS Press. Conn. for psid Ranges	N/A	N/A	•	N/A
X6B⁽⁶⁾	Cleaned for Oxygen Service	•	N/A	•	N/A

7 – RANGE	
Select from Table on Page 2	

P-Series Differential Pressure, Pressure & Temperature Switches

P-SERIES TEMPERATURE SWITCH MODEL NUMBER:

To specify the exact switch desired select entries from appropriate tables as shown in example below.



1 – FUNCTION	
PTA	Temperature control, single setpoint, adjustable deadband
PTD	Temperature control, two independently adjustable setpoints, fixed deadband
PTS	Temperature control, single setpoint, fixed deadband

2 – ENCLOSURE	
N7-NEMA 7, 9, IP66 (explosion proof Div.1 & 2)	

4 – LINE LENGTH ⁽²⁾		
Direct Mount		
ORDER CODE	Line Length	Style
00	Not Applicable	Rigid
Remote Mount		
05	5'	Capillary with Armor (Std.)
10	10'	
15	15'	
20	20'	
25	25'	

5 – THERMAL SYSTEM SELECTION ⁽¹⁾	
LINE MATERIAL	
Direct Mount	
ORDER CODE	DESCRIPTION
	No Entry Required for Direct Mount
Remote Mount	
A7	SS Armor (Std.)

6 – BULB LENGTH SELECTION ⁽³⁾		
Direct Mount		
ORDER CODE	"S" DIM.	MIN. ⁽⁸⁾ THERMOWELL "U" DIM.
027⁽¹⁰⁾	2¾"	–
040	4"	2½"
060	6"	4½"
090	9"	7½"
120	12"	10½"
Remote Mount		
030	3"	2½"

3 – SWITCH ELEMENTS FOR PTA CONTROLS			
CODE	S.P.D.T. Switch Elements UL/CSA Listed		
H	General Purpose	10A, 125/250 Vac 1/2A, 125 Vdc 1/4A, 250 Vdc	
J	Hermetically Sealed Switch, General Purpose	11A, 125/250 Vac 5A, 30 Vdc	
SWITCH ELEMENTS FOR PTD AND PTS CONTROLS			
CODE		Switch Elements UL/CSA Listed	
Single (PS)	Dual (PD)		
C	CC	Heavy Duty – AC	22A, 125/250 Vac
E	EE	Manual Reset, Actuates on Decreasing Pressure	15A, 125/250 Vac 5A, 30 Vdc
F⁽⁴⁾	FF	Sealed Environment Proof	15A, 125/250 Vac
G⁽⁵⁾	GG	General Purpose	15A, 125/250/480 Vac 1/2A, 125 Vdc 1/4A, 250 Vdc
H	HH	General Purpose – AC-DC	10A, 125/250 Vac 10A, Vdc
J	JJ	Hermetically Sealed Switch, General Purpose	11A, 125/250 Vac 5A, 30 Vdc
K⁽⁴⁾	KK	Narrow Deadband	15A, 125/250 Vac
L	LL	Hermetically Sealed, Gold Contacts	1A, 125 Vac
M	MM	Low Level Gold Contacts	1A, 125 Vac
P⁽³⁾	PP	Hermetically Sealed – AC	5A, 125/250 Vac
U	UU	Manual Reset, Actuates on Increasing Pressure	15A, 125/250 Vac 6A, 130 Vdc
W	WW	Ammonia Service	5A, 125/250 Vac 6A, 30 Vdc
Y	YY	High Temperature 300°F Ambient	15A, 125/250 Vac
S	SS	Heavy Duty – DC	10A, 125 Vac or Vdc 1/8 HP, 125 Vac or Vdc

7 – P-SERIES OPTIONS	
CODE	DESCRIPTION
XCH	Chained Cover
XC8⁽⁹⁾	CSA Approval, N7
XFP	Fungus Proof
XFS	Factory Adjusted Setpoints
XJL	¾" to ½" Reducing Bushing
XK3	Terminal Blocks
XNH	Tagging Stainless Steel
XPk	Pilot Light(s)
XPM	¾" Sealed Conduit Connection with 16" Lead Wires
XBx	69 Series Bushing for Thermowell System. ½ Male NPT

8 – STANDARD TEMPERATURE RANGE SELECTION ⁽⁴⁾	
Select from Table on Page 2	

NOTES:

- 1 All thermal systems are 316 St. St.
- 2 Additional line lengths available, consult factory.
- 3 Additional bulb lengths available, consult factory.
- 4 Additional ranges available, consult factory.
- 5 Estimated dc rating, 2.5A, 28Vdc (not UL listed).
- 6 Estimated dc rating, .4A, 120 Vdc (not UL listed).
- 7 Not UL listed at 480 Vac.
- 8 See page 5 for thermowell application information.
- 9 Standard on N4 enclosure.
- 10 Not available in 350/5250F range.

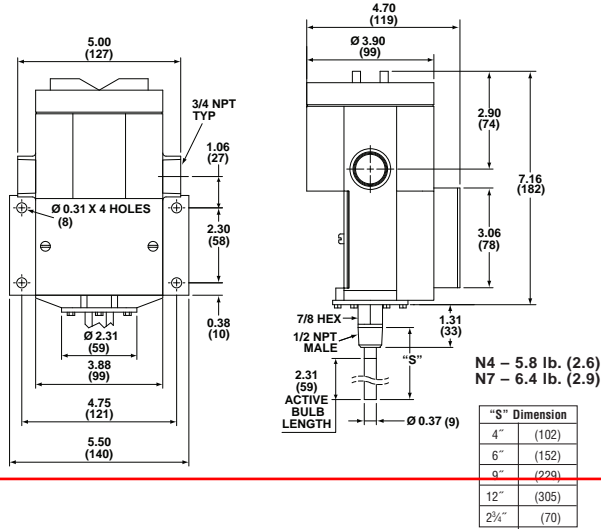
All specifications are subject to change without notice.
All sales subject to standard terms and conditions.
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Ashcroft Inc., 250 East Main Street, Stratford, CT 06614 USA
Tel: 203-378-8281 • Fax: 203-385-0408
email: info@ashcroft.com • www.ashcroft.com

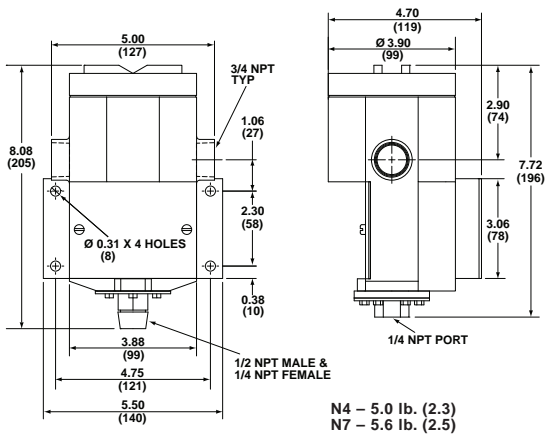
P-Series Differential Pressure, Pressure & Temperature Switches

Dimensions – P-Series

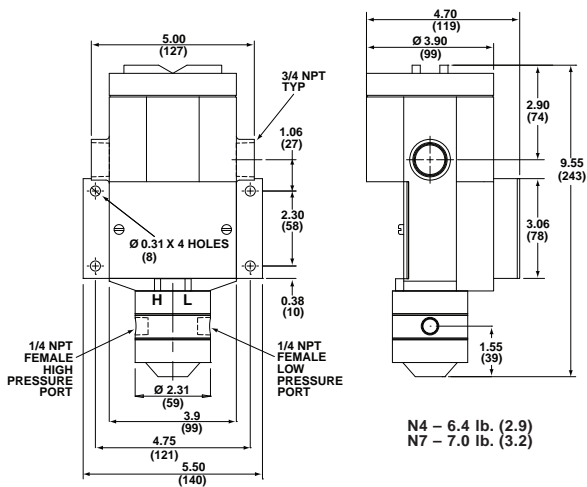
Temperature Switch – Direct Mount



Pressure Switch – psi Ranges



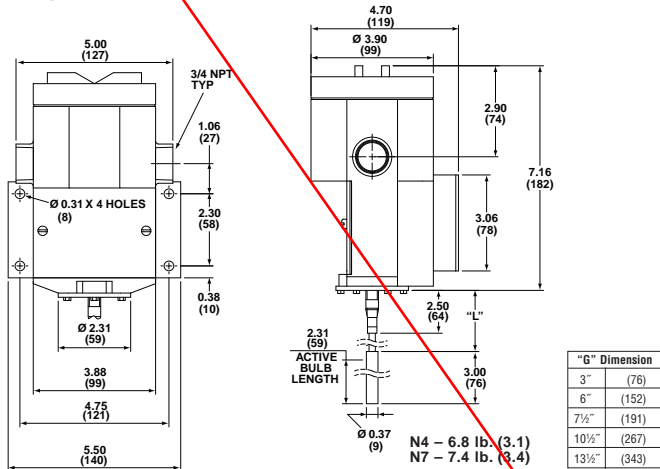
Differential Pressure Switch – psid Ranges



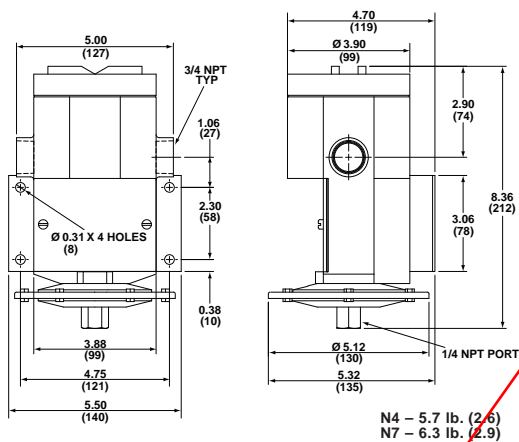
P-Series Differential Pressure, Pressure & Temperature Switches

Dimensions – P-Series

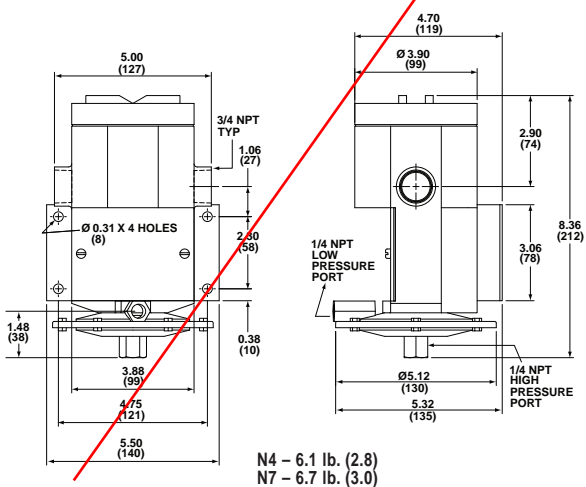
Temperature Switch – Remote Mount



Pressure Switch – in. H₂O Ranges



Differential Pressure Switch – Diff. in. H₂O Ranges



VELAN

CAST STEEL Gate, Globe and Check Valves



API 600 & 603 • ASME Class 150-1500 • 2-60" (50-1500 mm)

VELAN COMPANY PROFILE

Velan is one of the world's leading manufacturers of industrial valves, supplying forged and cast steel gate, globe, check, ball, butterfly and knife gate valves for critical applications in the chemical, petrochemical, oil and gas, fossil and nuclear power, cogeneration, pulp and paper and cryogenic industries.

Founded in 1950, Velan earned a reputation for excellence as a major supplier of forged valves for nuclear power plants and the U.S. Navy. Velan Inc., pioneered many designs which became industry standards, including bellows seal valves, all stainless steel knife gate valves and forged valves up to 24".

Velan valves are manufactured in 12 specialized manufacturing plants, including five in Canada, two in Korea, and one each in the U.S., France, U.K., Portugal and Taiwan. We have a total of 1,126 employees in North America and 374 overseas.

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The **Velan Corporate Philosophy** is to bring to the market new and innovative valve designs with special emphasis on quality, safety, ease of operation, simple in-line maintenance and most of all, long service life. All this combined with the use of high quality materials, advanced manufacturing technology and automation in all stages of manufacturing ensures the highest possible quality at a competitive price. Velan is strongly committed to defending its market position and aggressively competing in all countries around the world.

HEAD OFFICE & PLANT 5



MONTREAL, CANADA 115,000 sq. ft. (10,683 m²)
3-24" (80-600 mm) butterfly, 3/8-4" (10-100 mm) metal & resilient seated ball valves

MANUFACTURING LOCATIONS

CANADA

VELAN INC.
HEAD OFFICE & PLANT 5
7007 Côte de Liesse
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PLANT 2/7
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Montreal, QC H4T 1X8
Tel: (514) 748-7743
Fax: (514) 341-3032

PLANT 4/6
1010 Cowie Street
Granby, QC J2J 1E7
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Fax: (450) 378-6865

PROQUIP
835 Fourth Line
Oakville, ON L6L 5B8
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U.S.A.

VELAN VALVE CORPORATION
PLANT 3
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Fax: 44-116-275-0224

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Velan has sales offices and distributors located worldwide.

GENERAL INFORMATION

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Visit the Velan website at www.velan.com for an updated contact list.

NOTE: The material in this catalog is for general information. For specific performance data and proper material selection, consult your Velan representative. Although every attempt has been made to ensure that the information contained in this catalog is correct, Velan reserves the right to change designs, materials or specifications without notice.

MANUFACTURING PLANTS AROUND THE WORLD



PLANT 1
MONTREAL, CANADA 109,000 sq. ft. (10,126 m²) ¼-4" (8-100 mm) forged gate, globe & check valves, ASME 'N' stamp, ISO 9001



PLANT 2 & 7
MONTREAL, CANADA 170,000 sq. ft. (15,800 m²) 2-60" (50-1500 mm) forged and cast steel gate, globe, check, ball, knife and butterfly valves 3-36" (80-700 mm) ASME 'N' stamp, ISO 9001



PLANT 4 & 6
GRANBY, CANADA 186,500 sq. ft. (17,325 m²) 2-12" (50-300 mm) cast steel gate and check valves, ¼-12" (8-300 mm) ball valves, ISO 9001



TORONTO, CANADA *Velan-Proquip* 41,000 sq. ft. (3,800 m²) 2-48" (50-1200 mm) wafer check valves ½-24" (15-600 mm) clamp joint connectors, ISO 9001



WILLICH, GERMANY 12,000 sq. ft. (1,115 m²) ISO 9002



LEICESTER, ENGLAND 14,000 sq. ft. (1,300 m²), ISO 9002



PLANT 3
WILLISTON, VERMONT, U.S.A. 155,000 sq. ft. (14,400 m²) 2-24" (50-600 mm) forged and cast steel gate, globe and check valves, ASME 'N' stamp, ISO 9001



LYON, FRANCE 160,000 sq. ft. (14,900 m²) ¼-40" (8-1,000 mm) forged and cast steel gate, globe and butterfly valves, ISO 9001



LISBON, PORTUGAL 60,000 sq. ft. (5,600 m²) ISO 9002 2-12" (50-300 mm) cast steel gate, globe and check valves



ANSAN CITY, SOUTH KOREA *Plant 1* 30,000 sq. ft. (2,800 m²) components and 2-4" (50-100 mm) cast steel valves, ISO 9002



ANSAN CITY, SOUTH KOREA *Plant 2* 65,000 sq. ft. (5,800 m²) 2-12" (50-300 mm) cast steel gate, globe, check, ball and knife gate valves



TAICHUNG, TAIWAN *Velan-Valvac* 20,000 sq. ft. (1,840 m²) ¼-2" (8-50 mm) ball valves, ISO 9002

VELAN API 600 & 603 CAST STEEL VALVES

**FOR THE OIL, GAS, PETROCHEMICAL,
CHEMICAL AND PULP & PAPER INDUSTRIES**

LOW FUGITIVE EMISSIONS

Velan's comprehensive line of cast steel gate globe and check valves features leading edge design, engineering and manufacturing technology. Our valves meet the most stringent national and international standards for fugitive emissions.

Our gate globe and check valves are widely used in many industries including:

- **Process Industries** – Oil, Chemical, Petrochemical, Refining, Pulp & Paper, Pharmaceutical and Food Processing.
- **Power Industries** – Nuclear, Fossil Fuel, Combined Cycle, Cogeneration and District Heating.

In addition, our valves are used for Ship-building, LNG Tanker Carriers, Offshore Platforms, Water Treatment, Mining and more.



Carbon steel gate valve (ASME Class 600), used for boiler feed water installation at a Hydrogen Plant in Texas.



Cast steel valve installation at an oil refinery.



A geothermal power plant valve installation for sour gas service.



API 600 gate valves in service for a boiler feed installation.

CAST STEEL VALVES MANUFACTURING PROGRAM

API 600 CAST STEEL GATE, GLOBE & CHECK VALVES

VALVE TYPE & CLASS	SIZE (in, mm)																					
	2 50	2½ 65	3 80	4 100	6 150	8 200	10 250	12 300	14 350	16 400	18 450	20 500	24 600	28 700	30 750	32 800	36 900	40 1000	42 1100	48 1200	54 1350	60 1500
GATE	150	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
	600	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
	900	✓	✓	✓	✓	✓	✓	✓														
	1500	✓	✓	✓	✓	✓	✓	✓														
GLOBE	150	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓											
	300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓											
	600	✓	✓	✓	✓	✓	✓	✓														
	900	✓		✓	✓																	
	1500	✓		✓	✓																	
CHECK	150	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓					
	300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
	600	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									
	900	✓	✓	✓	✓	✓	✓															
	1500	✓	✓	✓	✓	✓	✓															

API 603 CAST STAINLESS STEEL GATE, GLOBE & CHECK VALVES

VALVE TYPE & CLASS	SIZE (in, mm)																
	½ 15 ⁽¹⁾	¾ 20 ⁽¹⁾	1 25 ⁽¹⁾	1½ 40 ⁽¹⁾	2 50	2½ 65	3 80	4 100	6 150	8 200	10 250	12 300	14 350	16 400	18 450	20 500	24 600
GATE	150	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
GLOBE	150	✓	✓	✓	✓	✓	✓	✓	✓								
	300	✓	✓	✓	✓	✓	✓	✓	✓								
CHECK	150	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
	300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					

(1) Refer to API 603 catalog.

API 600 BONNET GASKET MATERIALS

VALVE TYPE	MATERIAL
GATE	Class 150: corrugated steel/graphite (except 2–2½" (50–65 mm) spiral wound)
	Class 300–1500: spiral wound stainless steel and graphite
GLOBE	Spiral wound stainless steel and graphite
CHECK	Spiral wound stainless steel and graphite

OPTIONAL BODY MATERIALS

ASTM SPEC. GRADE	NOMINAL DESIGNATION	MIN. TEMP		MAX. TEMP.		VELAN CODE
		°F	°C	°F	°C	
A216-WCB	Carbon steel	-20	-29	800	427	02
A217-WC6	1½ CR–½ Mo	-20	-29	1100*	593	05
A217-WC9	2½ CR–1 Mo	-20	-29	1100*	593	06
A217-C5	5 CR–½ Mo	-20	-29	1200*	649	04
A217-C12	9 CR–1 Mo	-20	-29	1200*	649	09
A352-LCB	Carbon steel	-50	-46	650	343	25
A352-LCC	Carbon steel	-50	-46	700	371	31
A352-LC2	2½ Ni	-100	-73	650	343	26
A351-CF8M	18 CR-9 Ni-2 Mo	-425	-254	1500*	816*	13
A351-CF3M	18 CR-9 Ni-2 Mo	-425	-254	850	454	14

Note: *Flanged end ratings terminate at 1000°F (538°C) for Class 150.

API 603 BONNET GASKET MATERIALS

VALVE TYPE	MATERIAL	
GATE, GLOBE and CHECK	Trim SX or SY	Trim GX, GY or GS
	PTFE with stainless wire mesh	graphite with stainless steel foil

VELAN

Mission Statement

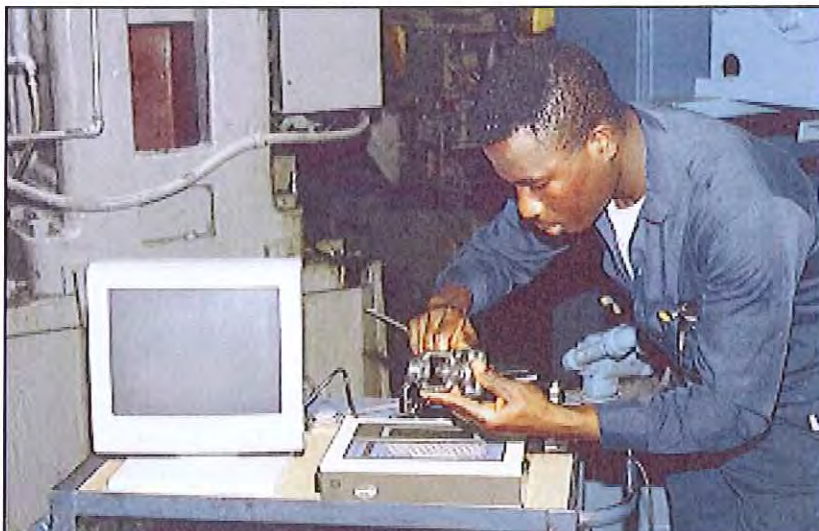
Our aim is to offer products and services which not only meet, but clearly exceed, the expectations of our customers.

Through training, teamwork and performance, our employees strive to achieve continuous improvement of all processes.

*Our goals are:
Total Quality and On-time Delivery.
Our method is Total Commitment.*



**A.K. Velan,
President and C.E.O.**



ON-LINE NETWORKED SPC

Velan has installed on-line networked SPC computers operated by machinists themselves.

Each unit can handle four gageports and provide instant feedback on tool wear and lubrication to a control manager station.

6 SYSTEMS ENSURE THE FINAL QUALITY GOALS

1. DESIGN

All valves are designed to comply with the requirements of ASME B16.34, the ASME code and special customer requirements, as applicable.

2. QUALITY ASSURANCE

Every step from procurement through production, welding, assembly, testing and packaging is in accordance with written quality programs and procedures. (An ASME Section III manual for code valve production and an ISO 9001 QA manual for all other production.) Velan's six North American plants are certified to ISO 9001 and Plants 1 and 2 have ASME "N" type Certificates of Authorization, Plant 3 has a Certificate of Accreditation. Furthermore, Velan has been fully approved to supply CE marked valves in accordance with the PED (European Pressure Equipment Directive). Orders are reviewed by Engineering and QA Departments and all special customer requirements are incorporated into QCI (Quality Control Instructions) issued for each project. The QA Department also maintains calibration and gauge control systems, and trains and qualifies skilled welders and NDT inspectors.

3. QUALITY CONTROL

The QC Department is responsible for all aspects of quality, from receiving of material to control of machining processes, welding, nondestructive examination, assembly, pressure testing, cleaning, painting and packaging. When required, a permanent record of all completed quality goals is prepared and sent to customers in the form of a "Valve Data Package".

4. PRESSURE TESTING

Each valve is pressure tested in accordance with ASME B16.34, the ASME Code, or special customer requirements as applicable. In all plants test status is integrated into production control/inventory management software.



TQM innovations at Plant 2 include "snag lists" of any problems encountered in daily engineering and manufacturing processes. The lists are compiled on a weekly basis and automatically become the first items on the agenda for TQM team meetings.

5. IMPROVEMENT TEAMS

Continuous Improvement Teams at point of manufacturing ensure quality at source, process control, higher quality workmanship and operator ownership.

6. QUALIFICATION TESTING

A key to reliability is the performance of functional qualification tests. These tests are performed on all valves to determine reliability and service life. 1000 cold and 1000 thermal cycles with 1000°F superheated steam and five blowdowns with "0" leakage.

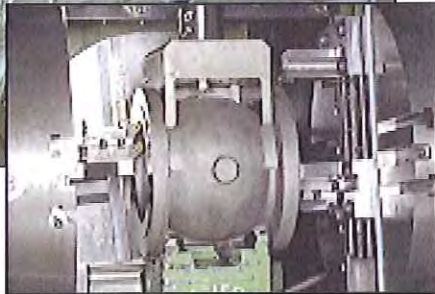


Operator on CNC horizontal boring mill monitors his own quality.

WORLD'S LARGEST MASS PRODUCTION OF API 600 CAST STEEL VALVES



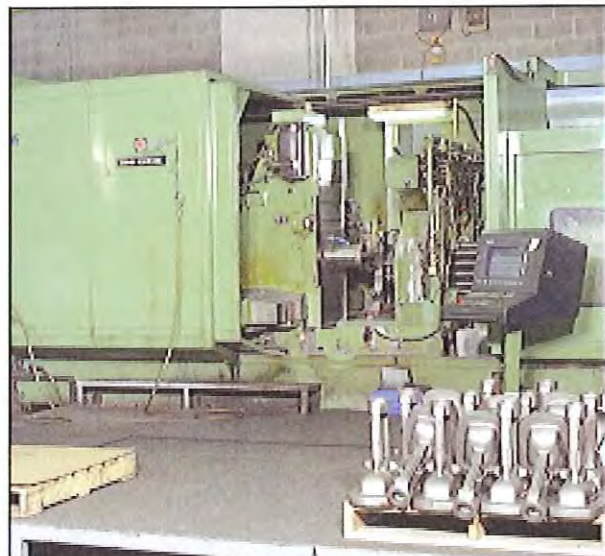
Automatic 3-way facing machine.



For smaller runs, complete automatic machining and drilling in one set-up.



Automatic multiple drilling machine.

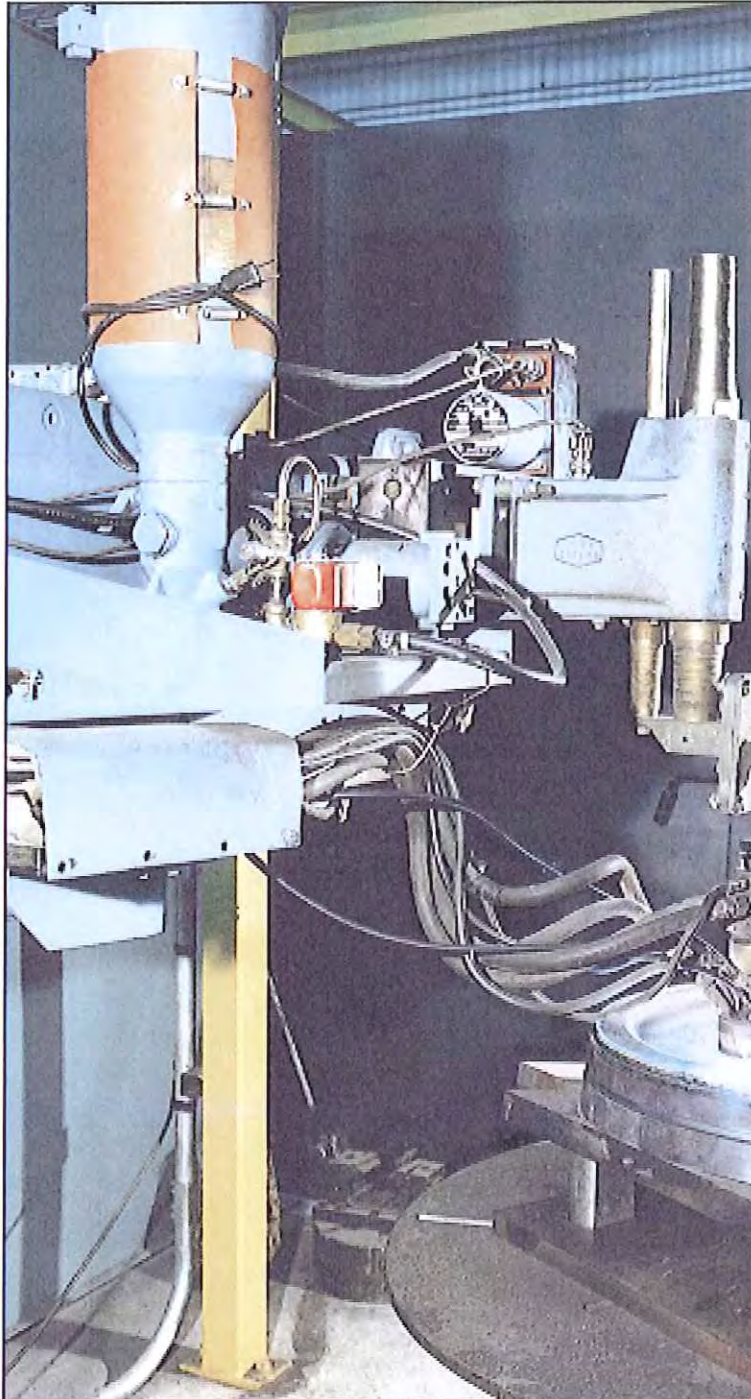


Automatic bonnet machine.



AUTOMATIC PLASMA ARC HARDFACING FOR SEATS AND DISCS

High quality deposits of Stellite 6 and other hardfacing alloys are assured by the use of the following state of the art technology: controlled preheating, automatic Plasma Arc hardfacing equipment and a controlled cooling process. Shown below is the hardfacing of a gate valve wedge and to the right a cast steel seat.



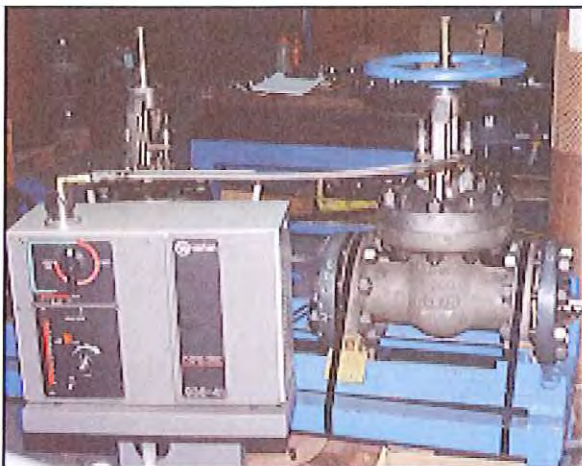
RELIABILITY THROUGH TESTING



Top:
Semi-automatic
stations for
testing 2-12"
(50-300 mm)
valves to API 598.

Bottom Right:
Operational test for
electric actuators.

Bottom Left:
TA-LUFT
qualification test
on a 4" Class 600
gate valve with
live-loading.
The test medium
is helium at
1500 psi (100 bar).



All valves are tested during production for reliability with pressurized air and hydrotested for bubble-free tightness in accordance with API 598 specifications.



CONTINUOUS CASTING QUALITY IMPROVEMENT AND COMPUTERIZED CASTING PROCESS SIMULATION

VELAN'S VEL-QCI-955 PROGRAM (API 600/ISO 10434)

The Velan VEL-QCI-955 Program was implemented to set the quality control standards for pressure boundary castings, and to ensure a consistent supply of quality castings to Velan.

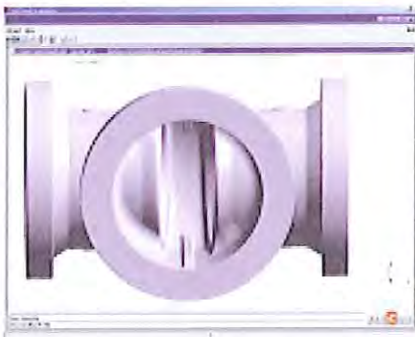
1. X-Ray Sample (pattern) Approval Process;
2. X-Ray Monitoring Program;
3. Casting Monitoring Program.

SAMPLE CASTINGS

Before castings are released for production, the Velan NDE Inspector Level III, evaluates and approves the submitted x-ray films (100% coverage) as per B16.34 acceptance standard.

X-RAY MONITORING:

Random x-ray monitoring requires that castings taken every six months from each vendor, randomly by size and quantity sets and x-rayed per B16.34 requirement.

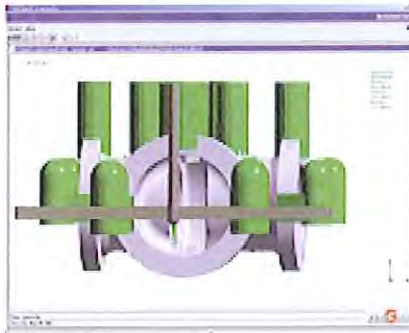


Pro-Engineering model imported into Magmasoft® casting simulation program.

If casting fails to meet the x-ray requirements of B16.34, Velan's Senior Metallurgist will issue a corrective action request to the vendor, including recommendations for detailed methoding change and re-x-ray.

CASTING MONITORING:

Rejected castings due to defects such as hydro-test leakage, porosity, inclusions, shrinkage indication discovered by x-ray or machining, are entered into the computer, as part of the statistical control of each vendor.

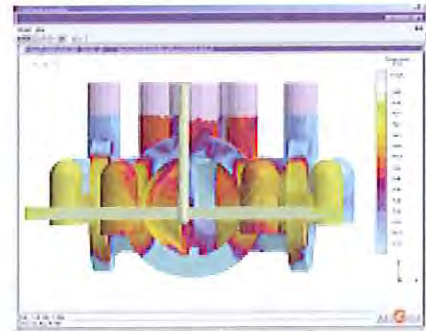


Riser and gating simulation on a 30" Class 600 gate body.

3-D SOLIDIFICATION SIMULATION:

Velan is one of the first valve manufacturers in the world to have the MAGMASOFT® computer casting simulation program at its design facilities.

Working together with foundry engineers and our designers, we continue improving the internal integrity of castings, to X-Ray Level II or better as a general standard.



90% filling simulation on a 30" Class 600 gate body.

One example of the successful cooperation of Engineering, our Metallurgist and the foundry, using the MAGMASOFT® simulation, is shown for 30" Class 600 Gate body on this page.



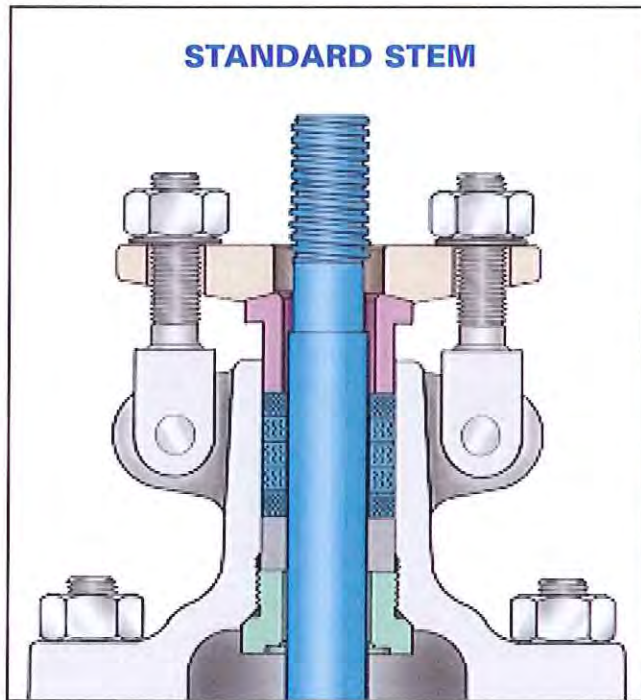
No shrinkage on a 30" Class 600 gate body simulation.

Benefits to Velan's customers and to the foundries:

- Shorter delivery time,
- Higher quality of commercial castings,
- Optimum methoding system,
- Elimination of trial at sample approval,
- Improves the internal integrity of castings (RT level 2 or better) at pattern approval,
- Optimizes the metal flow and solidification pattern,
- Predicts internal defects,
- Reduces scrap,
- Optimizes the design of the castings,
- Solves problems such as shrinkage and porosity, without test castings,
- Reduces NDE (x-ray) upgrading.

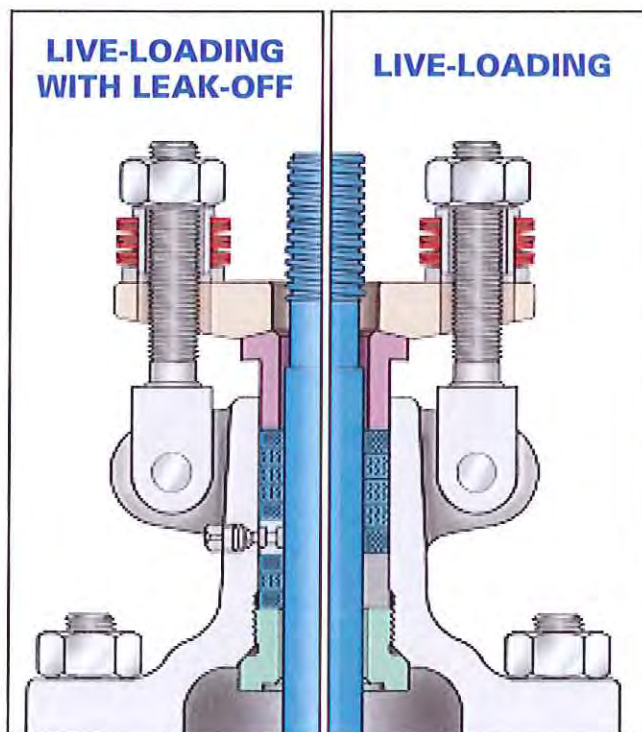
DESIGN OF STEM SEALS

Velan now offers standard cast steel bolted bonnet gate and globe valves qualification tested for compliance with EPA fugitive emissions regulations



The Velan stem seal evolved from these test findings:

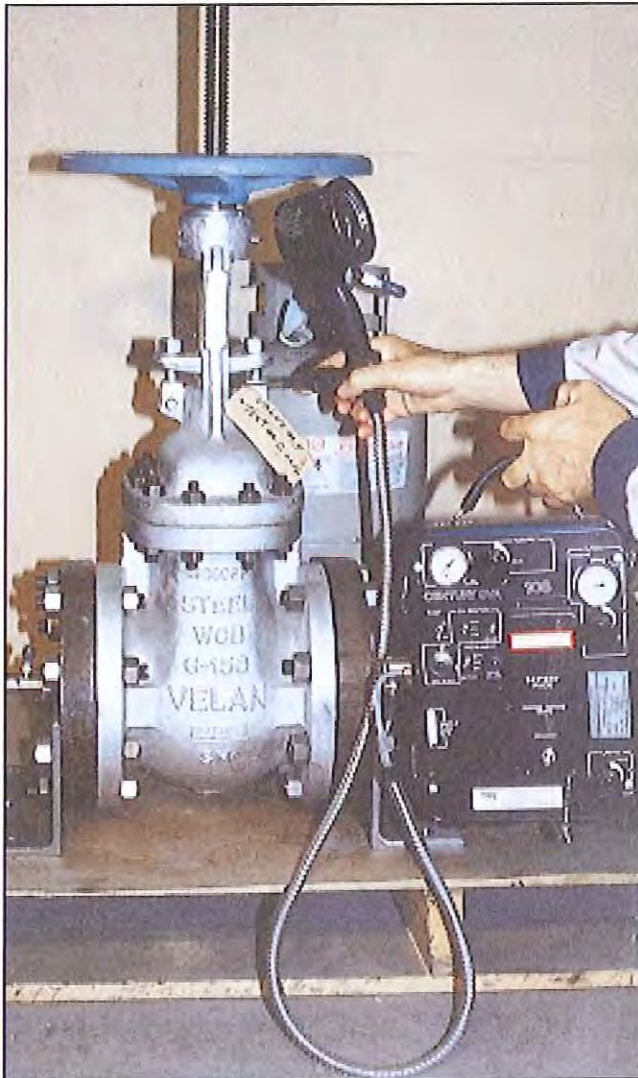
- **Ensures leakage of less than 100 ppm** as demonstrated through extensive laboratory testing.
- **Large loads.** Sealing is achieved when compression load is high and packing forms a mass of low porosity and permeability (4,000 psi for graphite).
- **Small clearances between vital parts.**
- **Precision stem and packing chambers.** Straightness, roundness and fine finish of stem and packing chamber wall are essential.
- **Short and narrow packing chambers improve sealing.** Maximum six rings in a single set chamber and wherever possible, only $\frac{1}{4}$ " wide.
- **Stem and packing chamber walls.** Close roundness, straightness and superior surface finish of 6 RMS or better for the stem and 63 RMS for the packing chamber.



LIVE-LOADING OPTIONS

- **Live-loading.** Two sets of Belleville springs maintain a permanent packing stress of 3500–4000 psi. Live-loading extends low emission service life especially in service with large pressure/temperature transients or frequent cycling.
- **Leak-off.** For critical service a lantern ring and double packing can be provided with a leak-off connection. The leak-off is provided to allow collection of leakage from the lower packing set.
- **Rings individually compressed in packing chamber** to 3500–4000 psi for graphite and 2,000 psi PTFE to ensure equal stress distribution and effectiveness of all rings.
- **Velan has extensive experience in valve live-loading.** The original live-loading concept was developed by Velan in 1972 in a research project for AECL to eliminate leakage in Nuclear service. Velan has been supplying live loaded valves for Nuclear and non-Nuclear service for more than 30 years.

API 600 CAST STEEL VALVES TYPICAL TEST REPORT



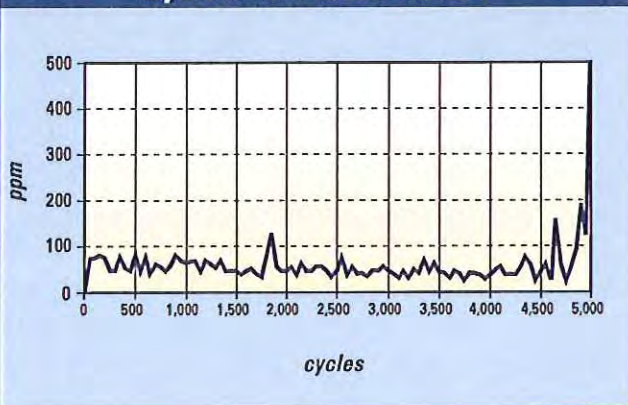
TEST CONDITIONS

- Test Medium:** Propane at 115 psi, ambient temperature
- Instrument:** Organic vapor analyzer OVA-108, range 1–10,000 ppm
- Valve Type:** Gate, Class 150, API 600
- Sizes:** 3", 6", 12" (80, 150, 300 mm)
- Packing:** Graphite
- Gasket:** Corrugated steel with graphite filler
- Trim:** Wedge: 13 CR
Seat: Stellite
- Quantity:** 3" (80 mm) – one valve
6" (150 mm) – four valves
12" (300 mm) – one valve

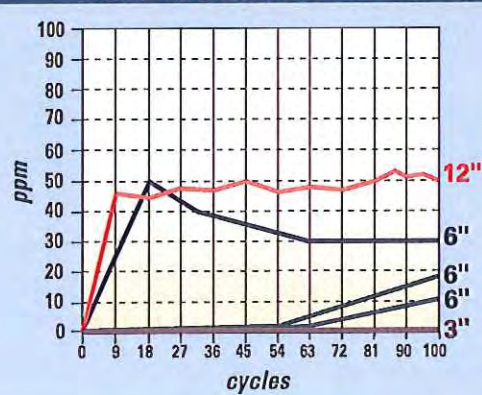
TEST COMPARISON TO API 598 TEST

- API 598 test standard requires no visible external leakage (gasket, packing chamber and casting). The organic vapor analyzer measures leakage in parts per million (ppm). "Visible leakage" in API 598 is one drop of liquid per minute which we estimate is equivalent to about 2,400 ppm of gas. The API 598 test does not invoke cycling while we have cycled valves between 100 and 5000 cycles in our research testing.
- Critical factors in low emission service life include severity of pressure-temperature transients, number of cycles and cleanliness. During extensive cycling tests it was found that after leak paths developed, leakage could be reduced or eliminated by retightening gland bolts. For example a 150 ppm leak that developed after 350 cycles could be reduced to zero after retightening gland bolts.

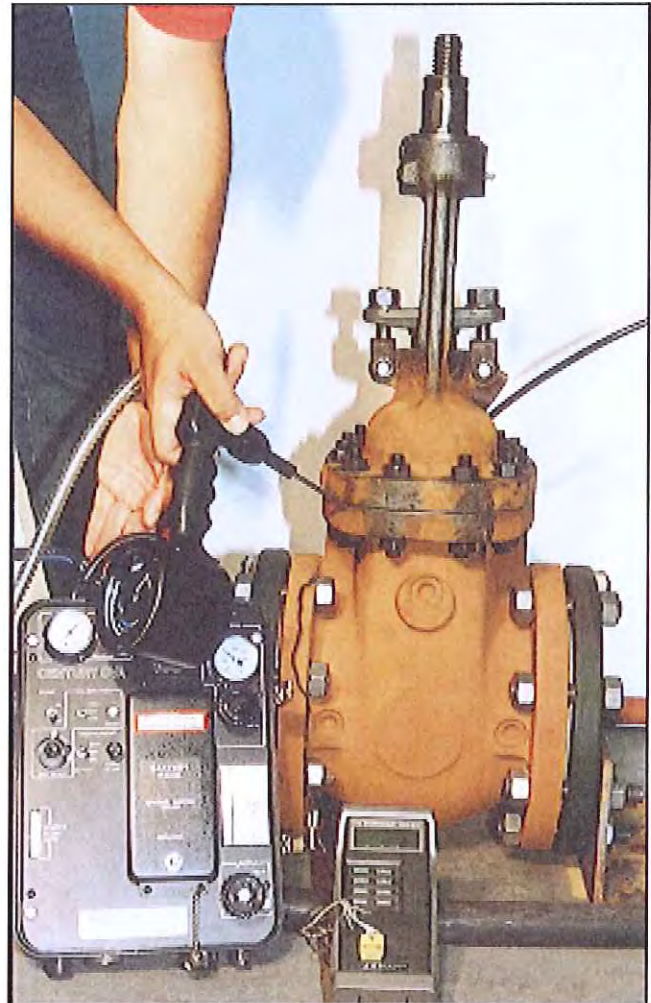
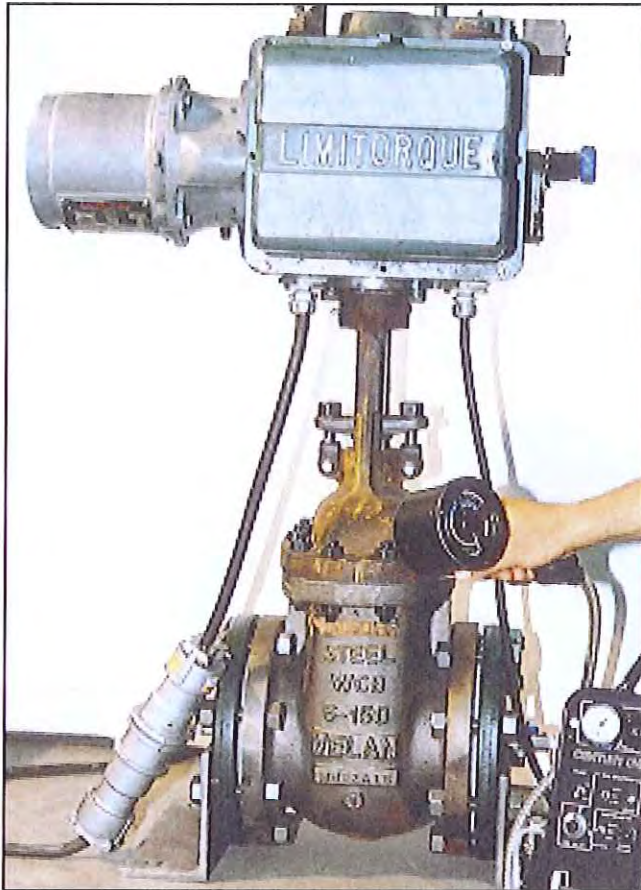
**6" GATE VALVE
5,000 CYCLE TEST**



**3", 6" & 12" GATE VALVES
100 CYCLE TEST**

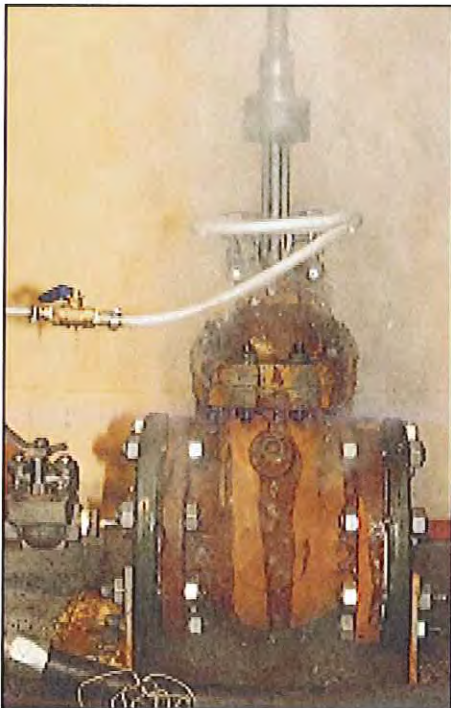


TESTING GASKET PERFORMANCE



Upper left:
3000 cycles
with propane
at 125 psi
Leakage:
zero ppm.

Upper right: 50 cycles with steam at 400°F (204°C)
Leakage: zero ppm.



Left:
Thermal shock
with water at
60°F (15°C)
Leakage:
zero ppm.

Valve type:	Class 150 gate valve
Size:	6" (150 mm)
Gasket:	Corrugated steel with graphite filler
Instrument:	OVA-108 vapor analyzer Range: 1–10,000 ppm

BODY-BONNET GASKET DESIGN GATE VALVES WITH OVAL FLANGES



Standard corrugated steel gaskets without graphite as specified in API 600 were found to be an unacceptable choice for low emission service, even under ideal laboratory test conditions, and regardless of flange finish and gasket load. After testing several alternative gaskets, we selected the best performing gasket in our tests - a corrugated steel gasket with graphite filled channels.

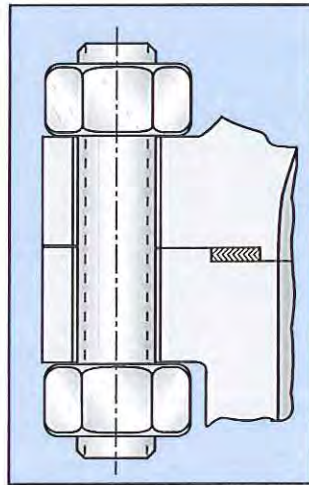
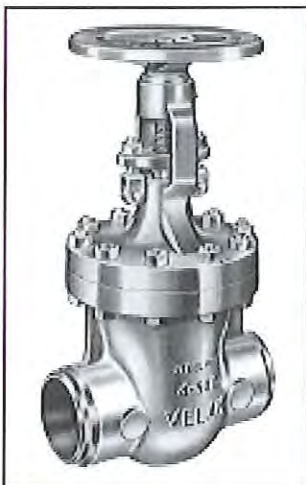
TYPICAL TEST RESULT:

3700 cycles with zero ppm for 6" Class 150.

DESIGN FEATURES:

- Ensures leakage of no more than 20 ppm as demonstrated through extensive laboratory testing.
- Requires no retorquing after long cycling.
- Effective under wide fluctuations of temperature and pressure.
- Insensitive to flange finish.
- Steel walls of graphite channels provide additional protection from oxidation, corrosion and blow-out.
- Seal offers the advantage of flexible graphite (0-14pH, -328°F to +2000°F).
- Lower bolt torques.
- Modern torquing methods.

API 600 CAST STEEL VALVES WITH ROUND BODY-BONNET FLANGES



FULLY-ENCASED SPIRAL WOUND 316 or 347 SS/GRAPHITE BODY-BONNET GASKET

Gate	Class 150: 2-2½" (50-65 mm) Class 300-1500: 2-36" (50-900 mm)
Globe	Class 150-600: 2-16" (50-400 mm)
Check	Class 150-1500: 2-36" (50-900 mm)

DESIGN FEATURES:

- Full enclosure to allow gasket to retain positive radial support during loading.
- Ensures leakage of no more than 20 ppm as demonstrated through extensive laboratory testing.
- Accurate control of compression through close tolerance of gasket groove and allowance for radial expansion.
- No radial machine marks.
- Minimum of three inner wraps to prevent buckling.
- Minimum of three tack welds.
- Minimum of three filler wraps.
- Close tolerance ($\pm 0.005"$ or 0.13 mm) for gasket thickness.
- Regular testing of gasket resiliency and inspection at Receiving due to sensitivity to inconsistent quality.
- Modern torquing methods.

TYPICAL TEST RESULT:

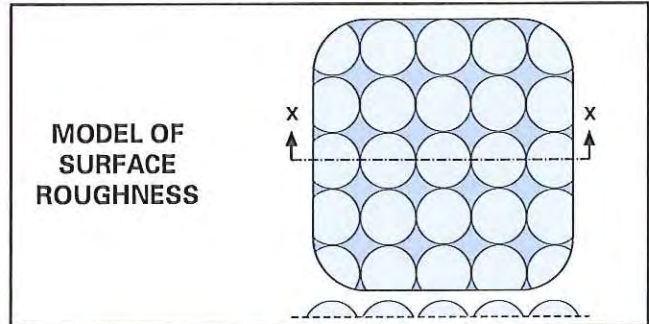
3100 cycles with zero ppm for 10" Class 300.

TECHNOLOGY OF SEAT-DISC TIGHTNESS

The initial seat tightness of valves which can be proven by hydro-testing has little effect on extended long-term tightness.

SEAT-DISC CONTACT MECHANICS

- When magnified, even a ground, lapped surface appears irregular and rough.
- The rate of leakage is a function of the smoothness and finish of the surfaces.
- The seat-disc (wedge) contacts are between the peaks.
- For absolutely leak-tight joints, the peaks must be deformed with torque until a large portion of mating surfaces is in microscopic contact.
- The compression stress is approximately 3 times the yield (for 70,000 psi–210,000 psi).
- Sufficient contact pressure generated by the torque is essential. A small increase in contact pressure produces a rapid decrease in leakage.
- The valve seat should be either very narrow or very wide, depending on the valve type.



Globe Valves	Conical seat-line contact
Gate Valves and Swing Check Valves	Large, flat-faced seats

VELAN API 600 GATE VALVE SEAT TIGHTNESS

GATE VALVE SEAT TIGHTNESS

- Welded-in Stellite 6 faced seats and a flexible wedge in 13 CR, SS 316, Monel or hardfaced with Stellite 6.
- Seating faces ground and lapped to 2 RMS.

Factory Acceptance Standard for Gate Valve Seat Leakage

Size in	Velan Standard (VEL-NDT-571)	Seat Leakage Rate ⁽¹⁾ (API 598 – October 1996)	
		Low Pressure Test	High Pressure Test
2	0	0	0
2½–6	0	24	12
8–12	0	40	20
14+	28	56	28

(1) Leakage rates are in bubbles per minute for low pressure test and drops per minute for high pressure test

EIGHT IMPORTANT STEPS IN ASSEMBLY & TESTING

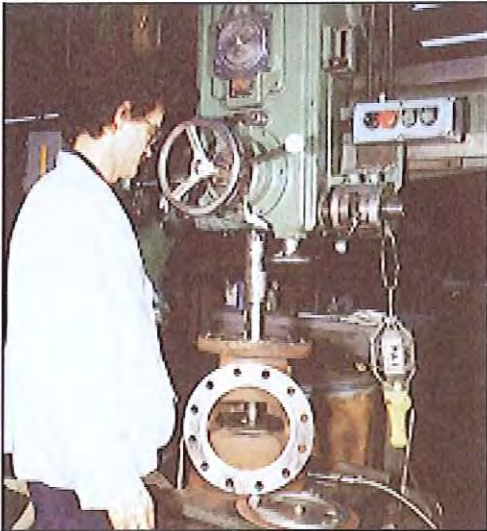
Make the Difference in Seat Tightness and Performance



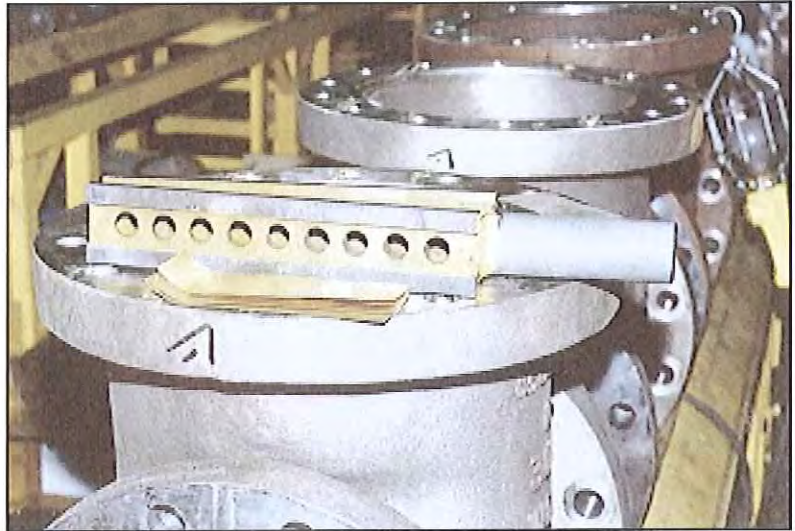
1 Automatic seal welding of Stellite 6 hardfaced seats.



2 Air-under-water test of the seat's welds.



3 Relapping of seating faces after seal welding.



4 Determination of final seat/seat angle with gauge and shims to determine ideal wedge angle (6-60").



5 Precision grinding of individually fit wedge seating surfaces.



6 Lapping of wedge seating surfaces.

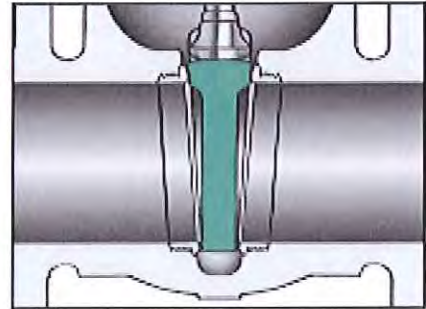


7 Assigning the ideally fitted wedge, ground and lapped, to proper valve body.



8 After assembly, pressure testing of shell, seats, packing and backseat to API 598.

VELAN API 600 GATE VALVES FLEXIBLE WEDGE VERSUS SOLID WEDGE



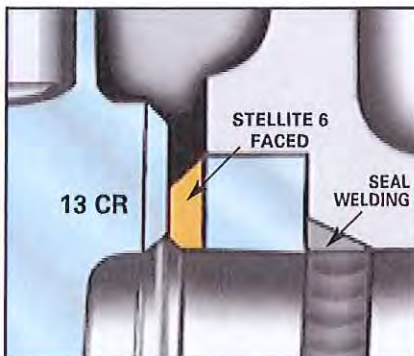
FLEXIBLE ROUND WEDGE PIONEERED BY VELAN

- Universal use for temperatures up to 1000°F (538°C).
- Flexibility compensates for seat face distortion.
- Compensates for deformation of body due to pipe stresses.
- Long cycle life.
- Ideal for processes with large temperature fluctuations.
- Assures valve tightness on both seats over wide range of pressures.
- Stem to wedge connection is inside the seating faces supporting the wedge ears during opening.
- More robust with less mass.

CLASSICAL SOLID WEDGE ON COMPETITIVE DESIGNS

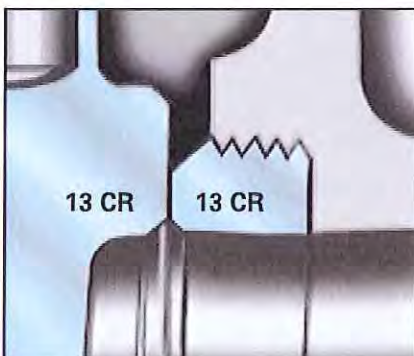
- Wedge may cause severe jamming at temperatures over 200°F (93°C).
- Suitable for small valves (½–2", 15–50 mm).
- Wedge will stick when valve is closed hot and allowed to cool.
- No compensation for deformation of body due to pressure-temperature or pipe stresses.
- Difficult to make valve tight on both seats due to seat face distortion.

SEAL WELDED SEATS VS SCREWED-IN SEATS



VELAN STANDARD GROUND AND LAPPED SEAL WELDED SEAT RINGS FACED WITH STELLITE 6

- Pioneered by Velan and considered state-of-the-art technology.
- Welded-in leakproof.
- Weld quality 100% tested.
- Stellite 6 seating faces for long service life.
- Ground and lapped to 2 RMS finish after weld-in.
- Standardized use for steam up to 1000°F (538°C), oil and gas.
- Stellite face will wear less than the 13 CR wedge, which can easily be repaired or replaced.

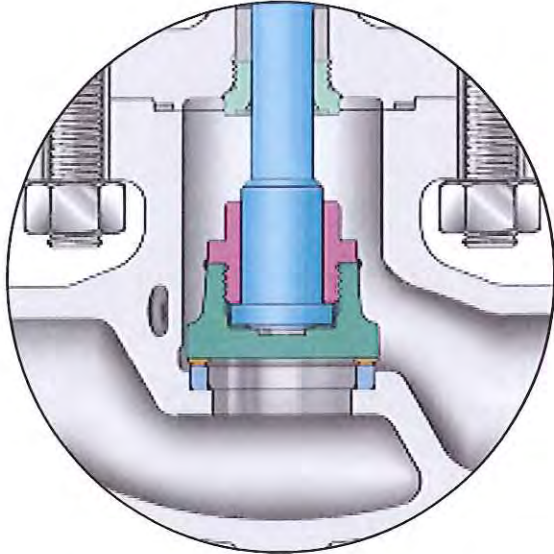


COMPETING SCREWED-IN SEATS IN 13 CR

- Can loosen up due to corrosion and cause substantial leakage.
- Replacement is difficult if not impossible.
- Threads can corrode and cause leakage.
- Seat is unsecured from unscrewing.
- Seat can become loose due to temperature fluctuations, corrosion or vibration, and can leak.
- Not suitable for steam service. Steam and other fluids will wire draw body threads of loose seats beyond repair.
- 13 CR seat suitable only for certain fluids.

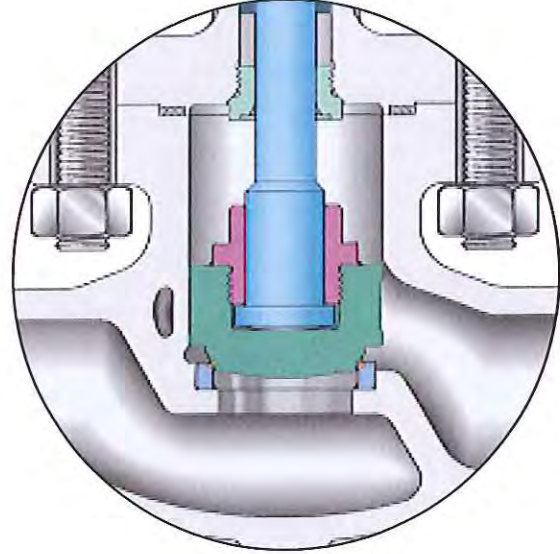
VELAN API 600 GLOBE VALVES FLAT AND CONICAL SEATS

FLAT SEAT



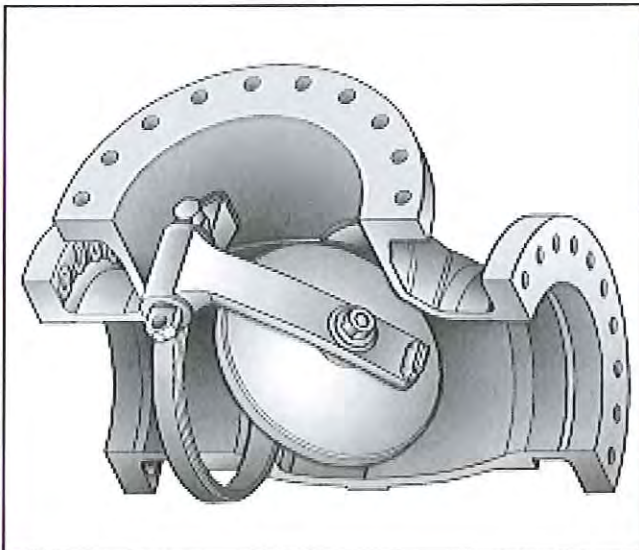
- Machining, lapping to close tolerances is easy.
- Flatness tolerance easy to control.
- Area contact wide seat.
- Disc is guided by the mating surface of the seat.
- Hard thrust pad prevents galling.
- Faster maintenance in-line. Flat seating faces can be lapped and checked for flatness easier.

CONICAL SEAT



- Line contact seal.
- Contact pressure increase by 1.5–5 with same stems and yokes.
- Seat has greater elasticity.
- Lower closing torques.
- Recommended for high pressure-temperature.

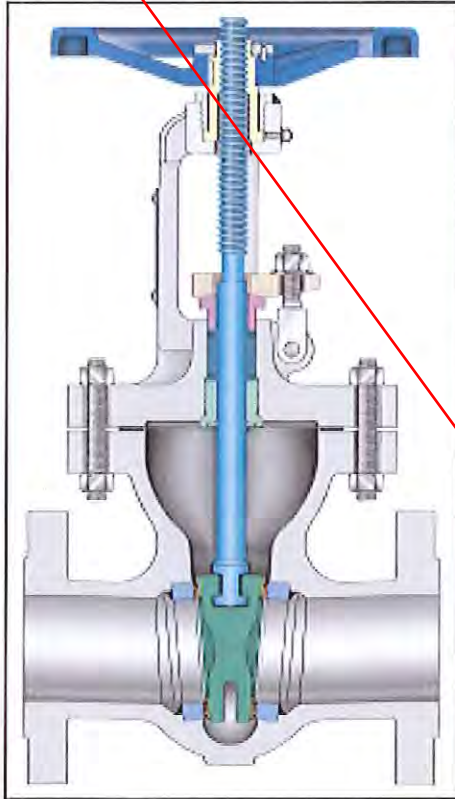
VELAN API 600 SWING CHECK VALVES



- Cage unit design with no penetration of body prevents:
 - a) Possibility of leakage with gasketed or packed hinge pin.
 - b) Possibility of pin ejection.
- All parts are accessible from the top for easy servicing.
- Welded-in seat is Stellite 6 faced.
- Disc is free to rotate to prevent localized wear.
- Ground and lapped seating surfaces.



CAST CARBON, STAINLESS OR ALLOY STEEL API 600 BOLTED BONNET GATE VALVES, 2–60" (50–1500 mm) ASME CLASSES 150, 300, 600, 900 AND 1500



CLASS	FIGURE NUMBER
150	0064C
300	1064C
600	2064C
900	7064C
1500	3064C

DESIGN FEATURES:

- **Universal Trim.** 13 CR stem, wedge in CA 15 or 13 CR faced, and Stellite seat API Trim 8 suitable for applications up to 850°F (454°C).
- **Seat face** Stellite, ground and lapped to a mirror finish.
- **Flexible Wedge** with low center stem-wedge contact, in solid CA15 (13 CR) or hardfaced with 13 CR, SS 316, Monel or Stellite. Wedge is ground and lapped to a mirror finish and tightly guided to prevent dragging and seat damage. A Stellite 6 hardfaced CF8M wedge is also available.
- **Non-rotating stem** with precision Acme threads and burnished finish. Double Acme for faster operation.
- **Body and bonnet joint** accurately machined. Gasket materials on page 3, details on page 13.

STANDARD MATERIALS

PART	MATERIALS			
	WCB	WC6	WC9	CF8M
Body ⁽¹⁾	WCB	WC6	WC9	CF8M
Bonnet ⁽¹⁾	WCB	WC6	WC9	CF8M
Stem ⁽¹⁾⁽³⁾	SS 410			SS 630, 600 or SS 316
Wedge ⁽¹⁾	CA 15 or 13 CR faced WCB	CA 15 or 13 CR faced WC6	CA 15 or 13 CR faced WC9	CF8M
Seat ⁽¹⁾⁽²⁾	Stellite 6 faced carbon steel	Stellite 6 faced F11	Stellite 6 faced F22	Stellite 6 faced F316
Packing flange	Carbon steel			Stainless steel
Gland bushing	Carbon steel			Stainless steel
Packing ring ⁽¹⁾	Graphite			Graphite
Gland stud	Gr. B or B7 ⁽⁴⁾			F316, B8M or 630 ⁽⁵⁾
Gland nut	Gr. 2H			Gr. 8M
Body/bonnet nut	Gr. 2H	Gr. 4		Gr. 8M
Body/bonnet stud	B7	B16		B8M or 630
Back seat ⁽¹⁾⁽³⁾	SS 410			SS 316
Gasket ⁽¹⁾	Class 150: corrugated steel/graphite Class 300-1500: spiral wound stainless steel/graphite			
Key	Carbon steel			
Yoke bushing	Carbon steel			Stainless steel
Bearing	Steel			
Handwheel nut	Malleable iron or steel			
Handwheel ⁽¹⁾	Malleable iron or steel			
Grease fitting	Steel			
Groove pin	Carbon steel			Stainless steel
Bushing	Carbon steel			Stainless steel
Washer	Carbon steel			Stainless steel
Name plate	Stainless steel			
Identification tag	Stainless steel			
Rivet	Stainless steel			
Stem nut	A 439 Austenitic ductile iron Gr. D-2C			

- (1) Other materials available. (2) Stellite. (3) Hardened.
 (4) For eye bolts Gr. B, for studs B7 is used.
 (5) For eye bolts F316, for studs B8M or 630 is used.

DESIGN SPECIFICATIONS

ITEM	APPLICABLE SPECIFICATION
Wall thickness and general valve design	API 600, BS1414
Pressure-temperature rating	ASME B16.34
Face to face dimensions for butt weld and flanged valves	ASME B16.10
Flange design	ASME B16.5
Butt welding design	ASME B16.25
Materials	ASTM

- **Body and bonnet** castings are precision machined. One-piece bonnet up to 12" (300 mm) for better alignment and fewer parts.
- **Gland** has two-piece construction for easy alignment.
- **Flanges:**
 Classes 150–300: 1/8" raised face,
 Class 600–1500: 1/4" raised face.
 Finish 125–250 AARH for all valves.
- **Rotating stem nut** is Austenitic ductile iron Gr. D-2C renewable in line (as shown). Thrust bearings are supplied as follows:
 150–300: 10–12" (250–300 mm), 1 bearing (top),
 16" (400 mm), and up, two bearings
 600: 6" (150 mm) and up
 900–1500: 6" (150 mm) and up.

For information on BELLOWS SEAL VALVES see VEL-BS catalog.

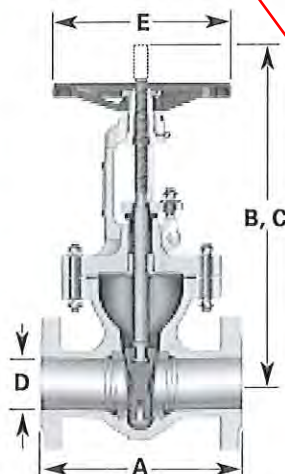
GATE VALVE DIMENSIONS (CLASSES 150-600)

SIZE in mm	ASME 150 (PN 20)						ASME 300 (PN 50)					ASME 600 (PN 100)				
	A		B ⁽¹⁾	C ⁽¹⁾	D	E	A ⁽³⁾	B ⁽¹⁾	C ⁽¹⁾	D	E	A ⁽³⁾	B ⁽¹⁾	C ⁽¹⁾	D	E
	BW	FL														
2	8.50	7.00	15.63	20.38	2.00	8	8.50	15.63	20.38	2.00	8	11.50	15.66	20.51	2.00	8
50	216	178	397	518	51	203	216	397	518	51	203	292	398	521	51	203
2½	9.50	7.50	16.88	22.14	2.50	8	9.50	16.94	22.20	2.50	8	13.00	18.59	24.19	2.50	10
65	241	191	429	562	64	203	241	430	564	64	203	330	472	614	64	254
3	11.12	8.00	18.56	24.26	3.00	10	11.12	20.22	26.38	3.00	10	14.00	21.63	27.78	3.00	10
80	282	203	471	616	76	254	283	514	670	76	254	356	549	709	76	254
4	12.00	9.00	22.25	28.32	4.00	10	12.00	23.90	30.95	4.00	10	17.00	25.75	32.76	4.00	14
100	305	229	565	719	102	254	305	607	786	102	254	432	654	832	102	356
6	15.88	10.50	31.19	38.00	6.00	14	15.87	32.31	40.38	6.00	14	22.00	36.28	44.18	6.00	20
150	403	267	792	965	152	356	403	821	1026	152	356	559	922	1122	152	508
8	16.50	11.50	38.19	46.13	8.00	18	16.50	40.94	50.16	8.00	18	26.00	43.72	53.25	7.88	24
200	419	292	970	1172	203	457	419	1040	1274	203	457	660	1110	1353	200	610
10	18.00	13.00	47.16	56.28	10.00	20	18.00	49.19	59.87	10.00	20	31.00	49.06	59.87	9.75	30
250	457	330	1198	1430	254	508	457	1249	1521	254	508	787	1246	1521	248	762
12	19.75	14.00	55.91	66.75	12.00	20	19.75	59.00	70.61	12.00	20	33.00	61.13	72.74	11.75	30
300	502	356	1420	1695	305	508	502	1499	1763	305	508	838	1553	1848	298	762
14	22.50	15.00	61.50	75.50	13.25	24	30.00	61.38	77.75	13.25	24	35.00	72.50	83.50	12.88	(2)
350	572	381	1562	1918	337	610	762	1559	1975	337	610	889	1842	2121	327	(2)
16	24.00	16.00	68.75	85.00	15.25	24	33.00	68.75	85.50	15.25	30	39.00	82.25	91.00	14.75	(2)
400	610	406	1746	2159	387	610	838	1746	2172	387	762	991	2089	2311	375	(2)
18	26.00	17.00	73.25	90.00	17.25	24	36.00	77.88	94.00	17.00	(2)	43.00	87.06	116.00	16.50	(2)
450	660	432	1861	2286	438	610	914	1978	2388	432	(2)	1092	2211	2946	419	(2)
20	28.00	18.00	83.00	100.00	19.25	30	39.00	86.50	100.00	19.00	(2)	47.00	103.00	123.00	18.25	(2)
500	711	457	2108	2540	489	762	991	2197	2540	483	(2)	1194	2616	3124	464	(2)
24	32.00	20.00	97.00	115.00	23.25	30	45.00	101.25	125.00	23.00	(2)	55.00	115.00	132.00	22.00	(2)
600	813	508	2464	2921	591	762	1143	2572	3175	584	(2)	1397	2921	3353	559	(2)
26	34.00	22.00	114.50	125.00	25.00	(2)	49.00	114.50	125.00	25.00	(2)	-	-	-	-	-
650	864	559	2908	3175	635	(2)	1245	2908	3175	635	(2)	-	-	-	-	-
28	36.00	24.00	118.63	130.00	27.00	(2)	53.00	118.63	130.00	27.00	(2)	-	-	-	-	-
700	914	610	3013	3302	686	(2)	1346	3013	3302	686	(2)	-	-	-	-	-
30	36.00	24.00	124.12	140.00	29.25	(2)	55.00	124.13	145.00	29.25	(2)	65.00	122.50	150.00	24.75	(2)
750	914	610	3153	3556	743	(2)	1397	3153	3683	743	(2)	1651	3112	3810	629	(2)
32	38.00	26.00	129.63	150.00	30.75	(2)	60.00	129.63	150.00	30.75	(2)	-	-	-	-	-
750	965	660	3293	3810	781	(2)	1524	3293	3810	781	(2)	-	-	-	-	-
36	40.00	28.00	146.68	170.00	35.25	(2)	68.00	147.88	185.00	35.25	(2)	68.00	145.13	170.00	29.00	(2)
900	1016	711	3726	4318	895	(2)	1727	3754	4699	895	(2)	1727	3686	4318	737	(2)
40	42.00	30.00	158.66	188.00	38.50	(2)	-	-	-	-	-	-	-	-	-	-
1000	1067	762	4030	4775	978	(2)	-	-	-	-	-	-	-	-	-	-
42	44.00	31.00	166.50	195.00	40.25	(2)	-	-	-	-	-	-	-	-	-	-
1050	1118	787	4229	4953	1022	(2)	-	-	-	-	-	-	-	-	-	-
48	-	36.00	189.81	225.00	46.00	(2)	-	-	-	-	-	-	-	-	-	-
1200	-	914	4821	5715	1168	(2)	-	-	-	-	-	-	-	-	-	-
54	52.00	40.00	216.56	248.00	51.50	(2)	-	-	-	-	-	-	-	-	-	-
1350	1321	1016	5501	6299	1308	(2)	-	-	-	-	-	-	-	-	-	-
60	-	42.00	238.80	275.00	57.50	(2)	-	-	-	-	-	-	-	-	-	-
1500	-	1067	6066	6985	1461	(2)	-	-	-	-	-	-	-	-	-	-

CLASSES 900-1500

SIZE in mm	ASME 900 (PN 150)					ASME 1500 (PN 250)				
	A ⁽³⁾	B ⁽¹⁾	C ⁽¹⁾	D	E	A ⁽³⁾	B ⁽¹⁾	C ⁽¹⁾	D	E
2	14.50	21.25	29.00	1.88	10	14.50	21.25	29.00	1.88	10
50	368	540	737	48	254	368	540	737	48	254
3	15.00	25.75	34.50	2.88	14	15.00	25.75	34.50	2.75	14
80	381	654	876	73	356	470	654	876	70	356
4	18.00	28.75	37.50	3.88	18	21.50	28.75	37.50	3.63	18
100	457	730	953	99	457	546	730	953	92	457
6	24.00	39.00	49.00	5.75	20	27.75	39.00	49.00	5.38	(2)
150	610	991	1245	146	508	705	991	1245	137	(2)
8	29.00	51.75	62.75	7.50	(2)	32.75	45.25	60.00	7.00	(2)
200	737	1315	1594	191	(2)	832	1149	1524	178	(2)
10	33.00	57.75	67.25	9.38	(2)	39.00	57.75	71.00	8.75	(2)
250	838	1467	1708	238	(2)	991	1467	1803	222	(2)
12	38.00	66.57	83.00	11.12	(2)	-	-	-	-	-
300	965	1691	2108	283	(2)	-	-	-	-	-
14	40.50	73.88	90.00	12.25	(2)	-	-	-	-	-
350	1029	1877	2286	311	(2)	-	-	-	-	-
16	44.50	80.44	100.00	14.00	(2)	-	-	-	-	-
400	1130	2043	2540	356	(2)	-	-	-	-	-

(1) Height does not include actuator. (2) Gear actuator. (3) Butt weld & flanged valves have the same end-to-end dimensions for Class 300 and up.



BW = Butt weld
FL = Flanged

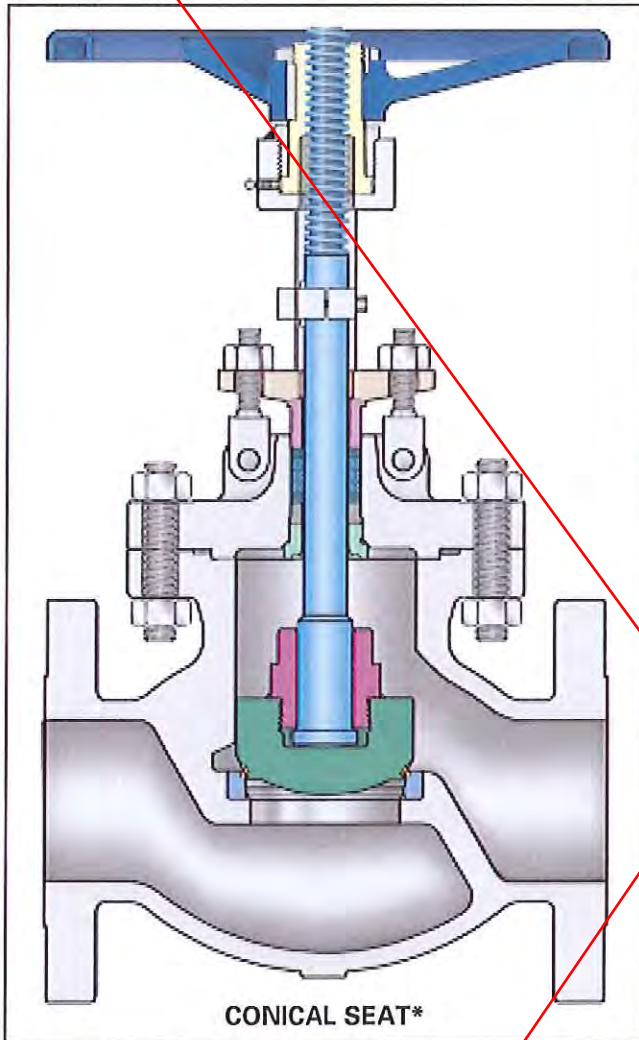
B = Center-to-Top, Open
C = Dismantling Height

Classes 900-2500
forged gate valves
also available.
See page 32 & 33 for valve
weights and CVs.

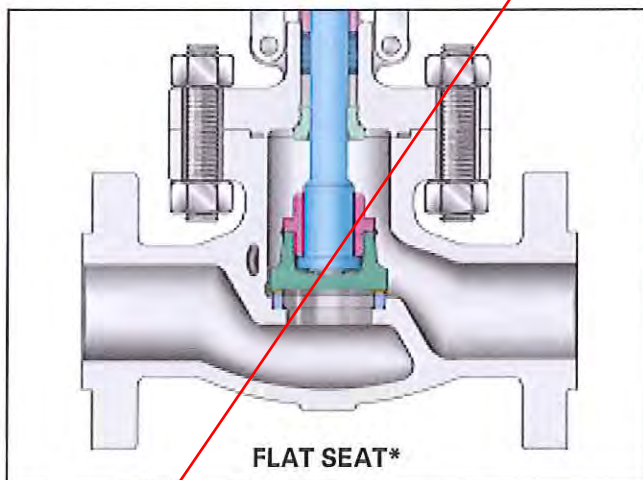
VELAN

CAST CARBON, STAINLESS OR ALLOY STEEL API 600
BOLTED BONNET GLOBE AND STOP CHECK VALVES,
2-16" (50-400 mm) ASME CLASSES 150, 300 AND 600

NOW THE ONLY API 600 GLOBE VALVE WITH NON-ROTATING STEM



CONICAL SEAT*



FLAT SEAT*

DESIGN FEATURES:

- **Non-rotating Stem** with precision Acme threads and burnished finish. Valve suitable for horizontal installation.
- **Universal Trim.** 13 CR stem, 13 CR faced disc and Stellite 6 faced seats API Trim 8 suitable for service up to 850°F.
- **Seat face** Stellite, ground and lapped to a mirror finish. Conical seat machined to 8 RMS.
- **Flat disc.** Floating stem-disc engagement, hardfaced with 13 CR, Stellite 6, SS 316 or Monel, ground and lapped with seat. Disc in SS 316 hardfaced with Stellite 6 also available.
- **Tapered disc.** Disc is guided by the mating surface of the seat, hardfaced with 13 CR, Stellite 6, SS 316 or Monel, ground and lapped with seat. Disc in SS 316 hardfaced with Stellite 6 also available. 2-6" (50-150 mm) valves may have solid CA15 (13 CR) discs.
- **Body and bonnet.** Castings are precision machined. One-piece bonnet for better alignment, fewer parts.
- **Stuffing box** finish to 63 RMS or better.
- **Body and bonnet joint** accurately machined. Fully enclosed gasket. Gasket materials on page 3. Details on page 13.
- **Gland** has two-piece construction for easy alignment.
- **Rotating Stem nut.** Austenitic ductile iron Gr. D-2C, renewable in-line.
- **Torque arm.** To reduce wear on packing rings, to enable better sealing and to reduce torque.
- **Impactor handwheels.** Globe and stop check valves require higher closing torques than gate valves with the same seat diameter and pressure class. The most economical mechanism for tight shutoff is the impactor handwheel. Two lugs cast under the wheel strike simultaneous blows and give 3-10 times the closing force of standard handwheels. Impactor handwheels are supplied at manufacturer's option unless specified by customer (see page 21).
- **Flanges.** Class 150-300: 1/16" raised face. Class 600: 1/4" raised face. Finish 125-250 AARH for all valves.

***NOTE:** Most sizes and pressure classes have conical seats. Choice of flat or conical seat is manufacturer's option unless specified by customer.

For information on BELLOWS SEAL VALVES see VEL-BS catalog

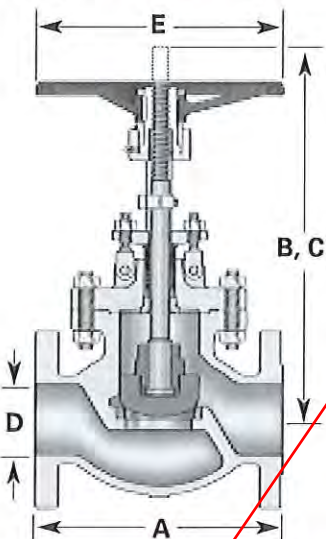
GLOBE VALVE DIMENSIONS (CLASSES 150-600)

SIZE	ASME 150 (PN 20)					ASME 300 (PN 50)					ASME 600 (PN 100)				
	A	B ⁽¹⁾	C ⁽¹⁾	D	E	A	B ⁽¹⁾	C ⁽¹⁾	D	E	A	B ⁽¹⁾	C ⁽¹⁾	D	E
2	8.00	16.85	20.88	2.00	8	10.50	16.85	20.88	2.00	8	11.50	17.10	21.13	2.00	10
50	203	428	530	51	203.2	267	428	530	51	203	292	434	537	51	254
2½	8.50	17.10	21.25	2.50	10	11.50	17.10	21.25	2.50	10	13.00	18.67	22.88	2.50	10
65	216	434	540	64	254	292	434	540	64	254	330	474	581	64	254
3	9.50	18.42	22.75	3.00	10	12.50	18.42	22.75	3.00	10	14.00	20.19	24.13	3.00	14
80	241	468	578	76	254	318	468	578	76	254	356	513	613	76	356
4	11.50	20.88	26.18	4.00	14	14.00	20.88	26.18	4.00	14	17.00	23.88	29.25	4.00	24 ⁽²⁾⁽³⁾
100	292	530	665	102	356	356	530	665	102	356	432	607	743	102	610
6	16.00	25.75	32.00	6.00	24	17.50	26.38	32.88	6.00	24 ⁽²⁾⁽³⁾	22.00	31.22	37.88	6.00	24 ⁽²⁾⁽³⁾
150	406	654	813	152	610	445	670	835	152	610	559	793	962	152	610
8	19.50	30.73	38.38	8.00	24	22.00	32.00	38.88	8.00	24 ⁽²⁾⁽³⁾⁽⁴⁾	26.00	41.75	57.88	7.88	(4)
200	495	780	975	203	610	559	813	988	203	610	660	1060	1470	200	(4)
10	24.50	39.25	46.75	10.00	24 ⁽²⁾⁽³⁾	24.50	42.34	52.18	10.00	24 ⁽²⁾⁽³⁾⁽⁴⁾	31.00	47.16	59.00	9.75	(4)
250	622	997	1187	254	610	622	1075	1325	254	610	787	1198	1499	248	(4)
12	27.50	42.52	53.00	12.00	24 ⁽²⁾⁽³⁾⁽⁴⁾	28.00	46.19	62.75	12.00	(4)	-	-	-	-	-
300	699	1080	1346	305	610	711	1173	1594	305	(4)	-	-	-	-	-
14	31.00	54.21	65.44	13.25	(4)	33.00	54.21	72.00	13.25	(4)	-	-	-	-	-
350	787	1377	1662	337	(4)	838	1377	1829	337	(4)	-	-	-	-	-
16	36.00	59.94	72.63	15.25	(4)	34.00	59.94	76.00	15.25	(4)	Inclined cast classes 900-2500 globe valves also available				
400	914	1522	1845	387	(4)	863	1522	1930	387	(4)					
18	38.50	59.62	75.00	17.50	(4)	38.50	59.62	75.00	17.50	(4)					
450	978	1514	1905	444	(4)	978	1514	1905	444	(4)					

CLASSES 900-1500

SIZE	ASME 900 (PN 150)					ASME 1500 (PN 250)				
	A	B ⁽¹⁾	C ⁽¹⁾	D	E	A	B ⁽¹⁾	C ⁽¹⁾	D	E
2	14.50	19.75	25.00	1.88	18	14.50	19.75	25.00	1.88	18
50	368	502	635	48	457	368	502	635	48	457
3	15.00	24.09	30.50	2.88	14 ⁽²⁾⁽³⁾	18.50	24.09	30.50	2.75	14 ⁽²⁾⁽³⁾
80	381	612	775	73	356	470	612	775	70	356
4	18.00	27.50	35.38	3.88	18 ⁽²⁾⁽³⁾	21.50	27.50	35.38	3.63	18 ⁽²⁾⁽³⁾
100	457	699	899	99	457	546	699	899	92	457

(1) Height does not include actuators. (2) Impactor handwheel. (3) Gear actuator is optional. (4) Gear actuator.



Forged globe valves classes 900-2500 also available.

See page 32 & 33 for valve weights and CVs.

B = Center-to-Top, Open
C = Dismantling Height

CLASS	FIGURE NUMBERS		
	GLOBE	STOP CHECK	NEEDLE
150	0074C	0084C	0094C
300	1074C	1084C	1094C
600	2074C	2084C	2094C
900	7074C	7084C	7094C
1500	3074C	3084C	3094C

STANDARD MATERIALS

PART	MATERIALS			
	WCB	WC6	WC9	CF8M
Body ⁽¹⁾	WCB	WC6	WC9	CF8M
Bonnet ⁽¹⁾	WCB	WC6	WC9	CF8M
Seat ⁽¹⁾⁽²⁾	Stellite 6 faced Carbon steel	Stellite 6 faced F11	Stellite 6 faced F22	Stellite 6 F316
Disc	CA 15 or 13 CR faced A105	CA 15 or 13 CR faced F11	CA 15 or 13 CR faced F22	CF8M or F316
Disc nut	Carbon steel			SS 304 or 316
Stem ⁽¹⁾⁽³⁾	SS 410			SS 316 or 630
Backseat ⁽¹⁾⁽³⁾	SS 410			SS 316
Packing ring ⁽¹⁾	Graphite			
Gland stud	Gr. B or B7 ⁽⁴⁾			F316, B8M or 630 ⁽⁵⁾
Gland nut	Gr. 2H			Gr. 8M
Packing flange	Carbon steel			SS
Gland bushing	Carbon steel			SS
Bonnet stud	B7	B16		B8M or 630
Bonnet nut	Gr. 2H	Gr. 4		Gr. 8M
Hinge pin	Steel			SS
Gasket ⁽¹⁾	Spiral wound stainless steel/graphite			
Torque arm	Carbon steel			
Yoke bushing	Carbon steel			Stainless steel
Stem nut	A 439 Austenitic ductile iron Gr. D-2C			
Handwheel nut	Malleable iron or steel			
Handwheel ⁽¹⁾	Malleable iron or steel			

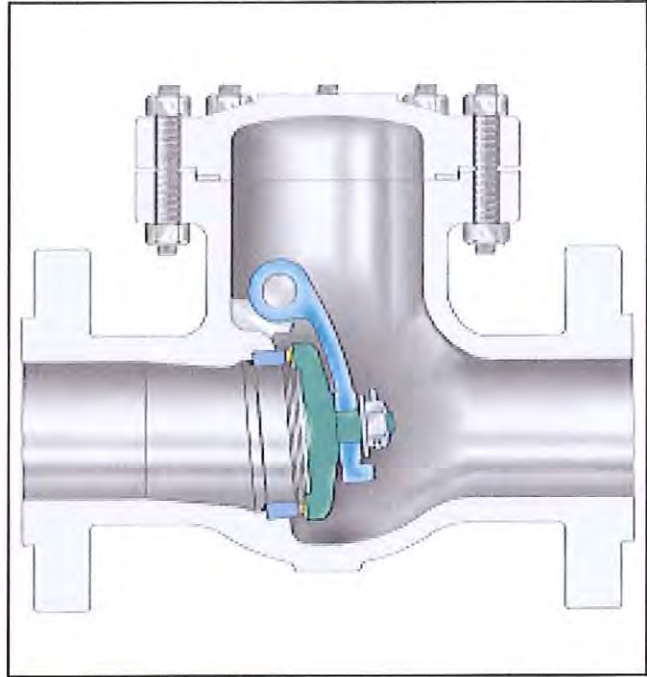
(1) Other materials available. (2) Stellite. (3) Hardened. (4) For eye bolts Gr.B, for studs B7 is used. (5) For eye bolts F316, for studs B8M or 630 is used.

DESIGN SPECIFICATIONS

ITEM	APPLICABLE SPECIFICATION
Wall thickness and general valve design	API 600, BS 1873
Pressure-temperature rating	ASME B16.34
Face-to-face dimensions for butt weld and flanged valves	ASME B16.10
Flange design	ASME B16.5
Butt welding design	ASME B16.25
Materials	ASTM



**CAST CARBON, STAINLESS OR ALLOY STEEL API 600
SWING CHECK VALVES, 2–36" (50–900 mm)**
ASME CLASSES 150, 300, 600, 900 AND 1500



CLASS	FIGURE NUMBER	CLASS	FIGURE NUMBER
150	0114C	900	7114C
300	1114C	1500	3114C
600	2114C		

DESIGN FEATURES:

- **Body and cover.** Precision machined castings. **Exclusive:** Disc shaft does not penetrate body.
- **Body and cover joint.** Accurately machined, fully-enclosed gasket (gasket materials on page 3).
- **Disc.** Robust one-piece construction to withstand the severe shock of check valve service. Hardfaced with 13 CR, Stellite 6, SS 316, or Monel, ground and lapped to mirror finish. Sizes 2–6" (50–150 mm) may have solid CA15 (13 CR) disc. SS 316 disc with Stellite 6 facing also available.
- **Disc assembly.** Disc is fastened securely to disc hanger with a lock nut and cotter pin. Disc is free to rotate to avoid localized wear. Disc hanger is supported on a sturdy disc carrier hinge pin of excellent bearing qualities. All parts are accessible from top for easy servicing.
- **Flanges.**
Class 150/300: 1/8" raised face.
Class 600: 1/4" raised face.
Finish: 125–250 AARH for all valves.

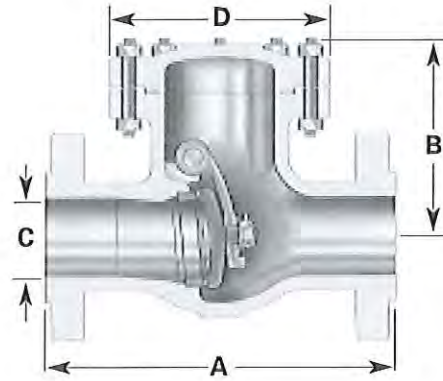
STANDARD MATERIALS

PART	MATERIALS			
	WCB	WC6	WC9	CF8M
Body ⁽¹⁾	WCB	WC6	WC9	CF8M
Seat ⁽¹⁾⁽²⁾	Stellite 6 faced CS	Stellite 6 faced F11	Stellite 6 faced F22	Stellite 6 faced F316
Hinge pin ⁽¹⁾⁽³⁾	SS 410			SS 630 or 660
Gasket ⁽¹⁾	Spiral wound stainless steel/graphite			
Cover stud	Gr. B7	B16		B8M or 630
Cover nut	Gr. 2H	Gr. 4		Gr. 8M
Cover ⁽¹⁾	WCB	WC6	WC9	CF8M
Washer	Commercial			
Disc ⁽¹⁾	CA 15 or 13 CR faced WCB	CA 15 or 13 CR faced WC6	CA 15 or 13 CR faced WC9	CF8M
Disc hanger	WCB	WC6	WC9	CF8M
Disc nut	Gr. 2H	Gr. 4		Gr. 8M

(1) Other materials available. (2) Stellite. (3) Hardened.

DESIGN SPECIFICATIONS

ITEM	APPLICABLE SPECIFICATION
Wall thickness and general valve design	API 600, BS1868
Pressure-temperature rating	ASME B16.34
Face-to-face dimensions for butt weld and flanged valves	ASME B16.10
Flange design	ASME B16.5
Butt welding design	ASME B16.25
Materials	ASTM



See page 32 & 33 for valve weights and CVs.

CHECK VALVE DIMENSIONS

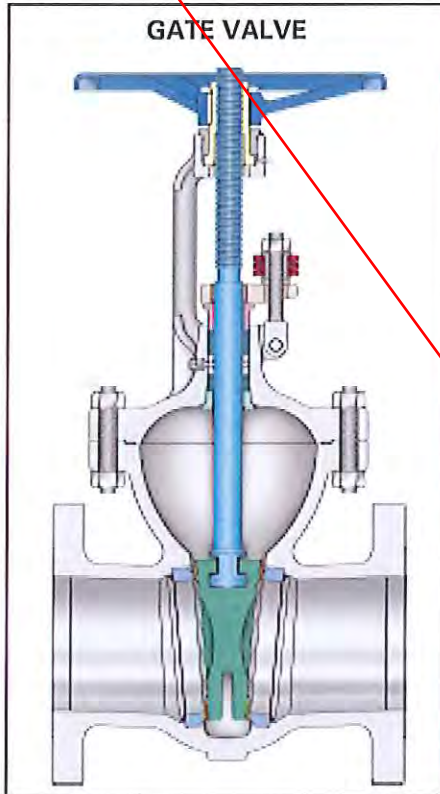
SIZE in mm	ASME 150 (PN 20)				ASME 300 (PN 50)				ASME 600 (PN 100)				ASME 900 (PN 150)				ASME 1500 (PN 250)			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
2 50	8.00 203	5.75 146	2.00 51	6.75 171	10.50 267	6.00 152	2.00 51	6.75 171	11.50 292	6.25 159	2.00 51	6.75 171	14.50 368	9.50 241	1.88 48	8.63 219	14.50 368	9.50 241	1.88 48	8.63 219
2½ 65	8.50 216	6.25 159	2.50 64	6.75 171	11.50 292	6.25 159	2.50 64	6.75 171	13.00 330	6.50 165	2.50 64	7.50 191	16.50 419	10.00 254	2.25 57	9.25 235	16.50 419	10.00 254	2.25 57	9.25 235
3 80	9.50 241	7.75 197	3.00 76	8.50 216	12.50 318	7.75 197	3.00 76	8.50 216	14.00 356	8.75 222	3.00 76	9.75 248	15.00 381	10.50 267	2.88 73	10.50 267	18.50 470	11.50 292	2.75 70	10.50 267
4 100	11.50 292	8.75 222	4.00 102	10.25 260	14.00 356	8.75 222	4.00 102	10.25 260	17.00 432	9.25 235	4.00 102	12.00 305	18.00 457	11.75 299	3.88 99	12.25 311	21.50 546	12.00 305	3.63 92	12.25 311
6 150	14.00 356	10.75 273	6.00 152	12.50 318	17.50 445	10.75 273	6.00 152	12.50 318	22.00 559	11.50 292	6.00 152	15.75 400	24.00 610	15.00 381	5.75 146	15.25 387	27.75 705	16.50 419	5.38 137	16.00 406
8 200	19.50 495	12.75 324	8.00 203	15.75 400	21.00 533	12.75 324	8.00 203	15.75 400	26.00 660	13.50 343	7.88 200	15.75 400	29.00 737	19.25 489	7.50 191	18.38 467	32.75 832	21.00 533	7.00 178	20.75 527
10 250	24.50 622	15.50 394	10.00 254	18.50 470	24.50 622	16.25 413	10.00 254	18.50 470	31.00 787	16.75 425	9.75 248	19.50 495	-	-	-	-	-	-	-	-
12 300	27.50 699	17.00 432	12.00 305	20.50 521	28.00 711	17.00 432	12.00 305	20.50 521	33.00 838	18.50 470	11.75 298	22.50 572	-	-	-	-	-	-	-	-
14 350	31.00 787	19.63 499	13.25 337	23.00 584	33.00 838	19.63 499	13.25 337	23.00 584	35.00 889	20.93 532	12.88 327	26.25 667	-	-	-	-	-	-	-	-
16 400	34.00 864	22.00 559	15.25 387	26.50 673	34.00 864	22.50 572	15.25 387	26.50 673	39.00 991	23.38 594	14.75 375	28.25 718	-	-	-	-	-	-	-	-
18 450	38.50 978	25.00 635	17.13 435	28.50 724	38.50 978	25.00 635	17.13 435	28.50 724	43.00 1092	28.67 728	16.50 419	31.50 800	-	-	-	-	-	-	-	-
20 500	38.50 978	26.50 673	19.00 483	31.50 800	40.00 1016	26.50 673	19.00 483	31.50 800	47.00 1194	27.12 689	18.25 464	35.25 895	-	-	-	-	Other sizes on application.			
24 600	51.00 1295	31.25 794	23.25 591	37.00 940	53.00 1346	31.25 794	23.25 591	37.00 940	55.00 1397	35.69 907	22.00 559	40.25 1022	-	-	-	-				
26 650	51.00 1295	32.63 829	25.00 635	37.25 946	53.00 1346	32.63 829	25.00 635	37.25 946	-	-	-	-	-	-	-	-	-	-	-	-
28 700	57.00 1448	36.55 928	27.00 686	42.00 1067	59.00 1499	36.55 928	27.00 686	42.00 1067	-	-	-	-	-	-	-	-	-	-	-	-
30 750	60.00 1524	36.89 937	29.25 743	44.50 1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36 900	77.00 1956	41.78 1061	35.25 895	53.00 1346	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See catalog VEL-PS for Classes 900 and 1500
FORGED STEEL CHECK VALVES.

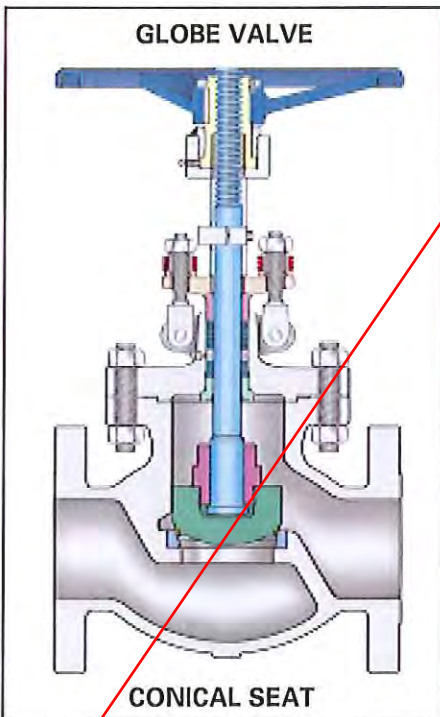
VELAN

CAST STEEL API 600 GATE, 2– 60" (50– 1500 mm) & GLOBE VALVES, 2–16" (50– 400 mm)

ASME CLASSES 150, 300, 600, 900 AND 1500
WITH SINGLE OR DOUBLE PACKING, LEAK-OFF AND LIVE-LOADING
LIVE-LOADED VALVES



GATE VALVE



GLOBE VALVE

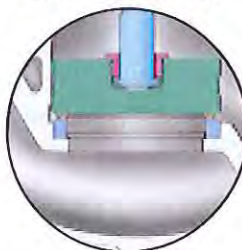
CONICAL SEAT

DESIGN FEATURES:

- Safer and tighter stem seal.
- Short and narrow packing chamber improves sealing effectiveness.
- Long-life leakproof packing chamber with double packing and leak-off or single set packing.
Double packing: two sets of graphite packing rings compressed to 4000 psi. A lantern ring and leak-off provide option for removal of leakage, if any, from lower packing set.
Single set packing: three or four graphite rings between braided rings, 80-90 lbs./cu. ft. density.
- Live-loading. Two sets of Belleville springs keep stem tight for long periods of time without maintenance.
- Two-piece stem drive is renewable in-line.
- Stronger leakproof body-bonnet joint.
Class 150: Corrugated graphite-filled steel gasket.
Class 300-600: Fully-encased spiral wound graphite-filled stainless steel gasket.
- Classes 300, 600, 900 and 1500 have round bonnet and encased gasket
- Welded-in seats hardfaced with Stellite 6.
- Flexible one-piece wedge, hardfaced with Stellite 6 or 13 CR (solid 13 CR up to 8").
- 13 CR hardened stem with mirror-like, burnished finish for longer packing life.

For dimensions on Gate valves see page 19.
For dimensions on Globe valves see page 21.
For other Globe valve design features see page 20.

Most sizes and pressure classes have conical seats.



FLAT SEAT

Choice of flat or conical seat is manufacturer's option unless specified by customer.

For BELLOWS SEAL GATE & GLOBE VALVES ½-12" (15-300 mm) see VEL-BS catalog.



HF ACID GATE, GLOBE AND CHECK VALVES CARBON STEEL AND MONEL 2–36" (50–900 mm)

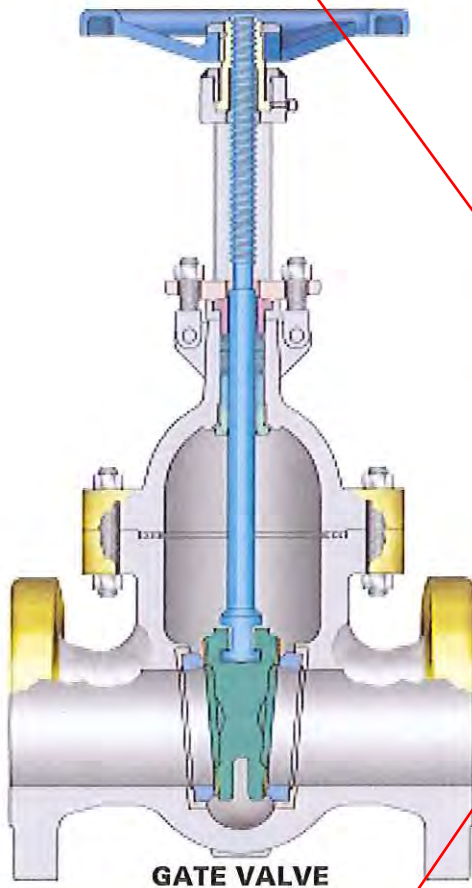
PRESSURE CLASSES 150–300

HYDROFLUORIC ACID PROCESSING VALVES



Hydrofluoric Acid is one of the strongest and most corrosive acids. Industries using HF acid in their manufacturing process have placed an increasing emphasis on safety in using this product.

Fugitive emissions are a critical factor in the performance of any HF Acid valve and at Velan, we have been committed to reducing emissions beyond the industry standards, and providing the highest quality products to our customers for over 50 years. Velan offers a comprehensive line of Phillips approved and UOP listed API 600 gate, globe and check HF acid valves with several benefits.

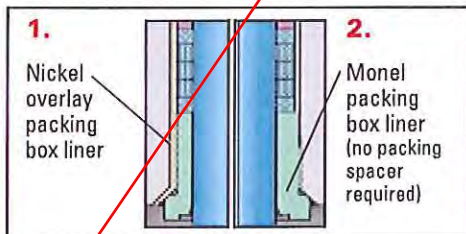


DESIGN FEATURES:

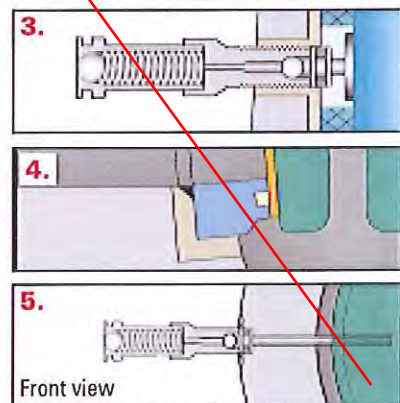
- **Nickel plated overlay on backseat in stem hole** to combat severe alkylation conditions.
- **HF acid detecting paint** to ensure valve integrity.
- **Stem** - made from solid age hardened K-Monel 500 for increased strength and corrosion resistance.
- **Casting design**
X-ray "RT" quality castings as per B16.34 acceptance standards. Velan is one of the first valve manufacturers to have the MAGMASOFT® computer casting simulation program to ensure high quality levels.
- **Bonnet Joint** - accurately machined for better service life.
- **Seal Welded Seats in Monel**
Monel seats are welded-in for ensuring zero leakage behind and around the seat and then ground and lapped after welding using state of the art technology to prevent in-service corrosion.
- **Body/Bonnet wall thickness** to API 600.
- **Velan's low-fugitive emissions guarantee**
Based on extensive laboratory testing and field experience.

OPTIONAL DESIGN FEATURES

- 1. Nickel overlay packing box liner**
- 2. Packing box in Monel**
– to combat severe alkylation conditions in this critical area.



- 3. Grease injector & lantern ring**
– where grease injection is a requirement (UOP only).
- 4. PTFE seat insert** – resists abrasion and corrosion
- 5. PTFE seat seal grease injection**
– when required (UOP only)

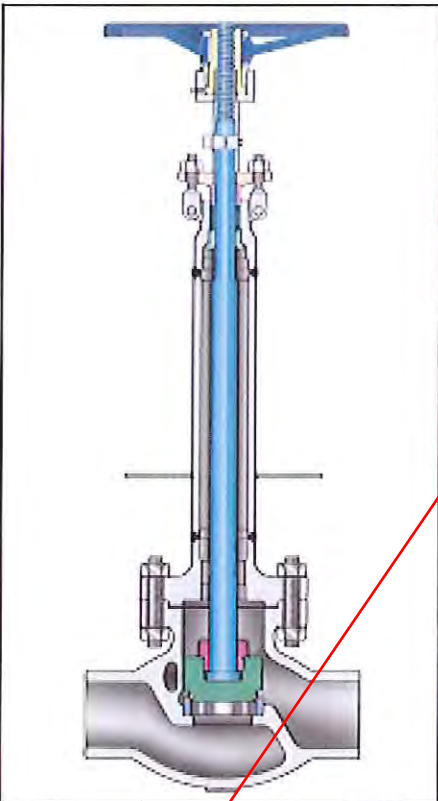
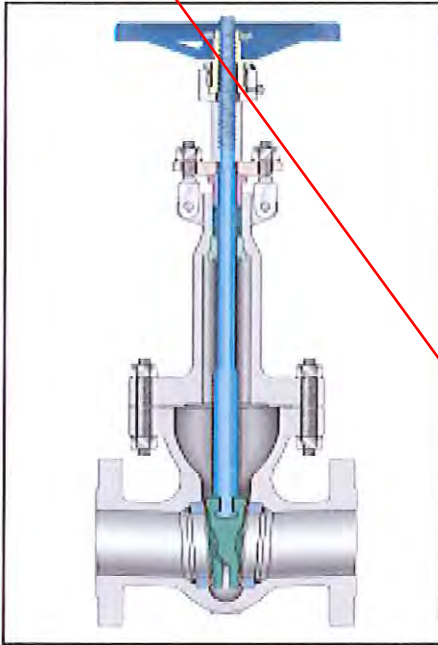


For more information on
VELAN HF ACID GATE, GLOBE
& CHECK VALVES
see VEL-HFA catalog.



CAST CRYOGENIC GATE, GLOBE AND CHECK VALVES
AUSTENITIC STAINLESS STEEL 2–30" (50–750 mm)
 PRESSURE CLASSES 150–1500

CAST STEEL CRYOGENIC VALVES



The production, transport and storage of liquefied gases such as oxygen, nitrogen, argon, natural gas, hydrogen or helium (down to -425°F), presents several technical problems. Velan specially-adapted extended bonnet cast valves offer safe and efficient service.

MATERIALS:

- **Body and bonnet:** Austenitic stainless steel castings used for bodies and bonnets offer excellent impact strength, minimal heat loss and protection against corrosion.
- **Stem:** Austenitic stainless steel. To reduce galling, stems are also offered in A479 grade XM-19 with high tensile strength even at extreme low temperatures, excellent low friction and galling-free movement at points of stem contact.
- **Wetted parts:** All Austenitic stainless steel and Stellite 6.
- **Stem nut/yoke bushing:** Austenitic ductile iron Gr. D-2C.
- **Packing:** PTFE or graphite packing protected from freezing by a column of insulating gas.
- **Seating faces:** Stellite 6 is used to prevent seizing and galling. When extremely tight shutoff is required, globe and check valves are supplied with Neoflon, PTFE or other soft inserts.
- **Bolting:** Strain-hardened Austenitic stainless steel.
- **Lubrication of stem nut:** Exxon Nebula Lubriplate No. 930-AA or Shell Darina EPI or equivalent.

DESIGN FEATURES:

- **Extended bonnets** with sufficient gas column length, usually specified by customer, are supplied for all valves to keep stem packing at sufficient distance away from the cold fluid to remain functional.
- **Flexible wedges** with Stellite seating faces for cryogenic service.
- **Neoflon inserts** are available for globe, piston, and swing check discs.
- **Cleaning:** All cryogenic valves are thoroughly degreased and cleaned and pipe ends are sealed to prevent contamination.

TABLE OF LIQUEFIED GASES

Type	Boiling Point		Liquid Density lb/ft. ³	Type	Boiling Point		Liquid Density lb/ft. ³
	°C	°F			°C	°F	
Natural gas (LNG)	-168	-270	26	Air	-194.4	-318	57.87
Methane (CH ₄)	-161.5	-258	26.20	Nitrogen (N ₂)	-195.8	-320	50.45
Oxygen (O ₂)	-182.9	-296	71.20	Hydrogen (H ₂)	-252.7	-423	4.43
Argon (Ar)	-185.9	-303	87.40	Helium (He)	-268.9	-452	7.82
Carbon Dioxide (CO ₂)	-78.5	-109	50.60	Absolute zero	-273.16	-460	-

For more details on Cryogenic Gate, Globe & Check Valves see VEL-CRYO catalog.

VELAN

BLOCK & BLEED GATE VALVES FOR CHEMICAL AND PETROCHEMICAL INDUSTRIES



Valve shown has a special "Pipeline" bonnet.

Standard bonnets with regular yoke also available.

DESIGN FEATURES:

- **Positive shutoff** with visual or remote proof of seat tightness.
- **No product contamination** absolute tightness.
- **Dual seating.** Elastomer-to-metal seat plus metal-to-metal secondary seal.
- **Fire Safe.** The metal-to-metal seat ensures tightness if the secondary elastomer seat is damaged during the fire.
- **PTFE seat insert** resists corrosive media, has high abrasion resistance and operates up to +400°F (204°C).
- **Seat hardfaced with SS 410** and seal welded.

AVAILABLE RANGE

Velan block and bleed gate valves are available in the following sizes:

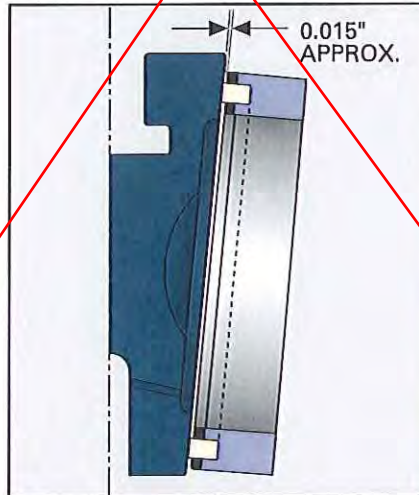
Class 150: carbon steel, flanged or butt weld, 2–60" (50–1500 mm).

Class 300: carbon steel, flanged or butt weld, 2–36" (50–900 mm).

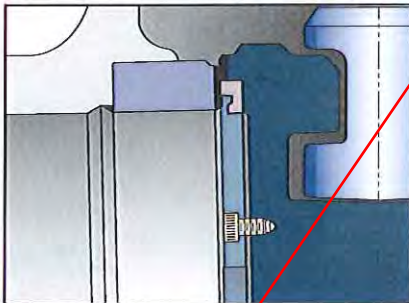
EASY IN-LINE VALVE RESEATING

Seats are hardfaced with SS 410 and welded-in for lifetime service. A worn soft seat insert can easily be replaced after removal of wedge from the body. Shut off flow and relieve pressure before replacing the seat insert.

STYLE A 2–12" SEAT - WEDGE DESIGN



STYLE B 14–60" SEAT - WEDGE DESIGN*



TEST PLUG

*14–24" (350–600 mm) may be STYLE A or B at manufacturer's option

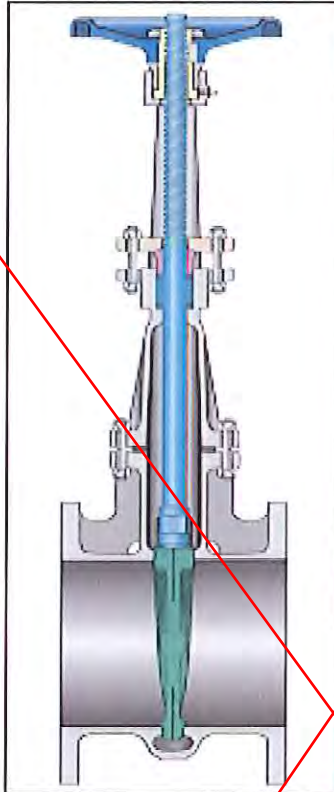
SPECIFICATIONS FOR SEAT INSERT MATERIALS

TYPE	MAXIMUM OPERATING TEMPERATURE	NOT RECOMMENDED
PTFE	-100°F to +400°F -73°C to +204°C	Fluorinated hydrocarbons
Buna-N	-20°F to +200°F -29°C to +93°C	Halogenated hydrocarbons, Nitrobenzene, Aniline, Hydraulic fluids, Skydrol, Cellulube, Pydrazil, Acetone
Viton	-20°F to +400°F -29°C to +240°C	Acetone, Anines, Anhydrous ammonia, Hot Hydrofluoric acid, Ester, Ethers



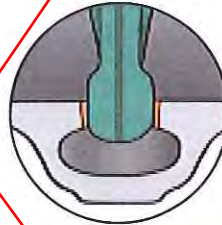
CAST STAINLESS STEEL GATE VALVES API 603 INTEGRAL SEAT, 2–24", (50–600 mm)

FLANGED, ASME CLASSES 150, 300, WALL THICKNESS TO B16.34
WITH FLEXIBLE WEDGE



STANDARD MATERIALS

PART	MATERIAL
Body	A 351 Gr. CF8M
Bonnet	A 351 Gr. CF8M
Wedge	A 351 Gr. CF8M
Stem	Gr. 316
Gland	Gr. 316
Gland flange	A 351 Gr. CF8M
Yoke bushing	Gr. 316
Handwheel	Malleable iron (painted)
Handwheel nut	Carbon steel
Body/bonnet stud	Gr. B8M
Body/Bonnet nut	Gr. 8M
Gland stud	Gr. 304
Gland nut	Gr. 8M
Spring pin	Stainless steel
Gland packing	SX or SY PTFE GS, GX or GY Graphite
Gasket	SX or SY PTFE with stainless wire mesh GS, GX or GY Graphite with stainless steel foil
Name plate	Stainless steel
Stem nut	A 439 Austenitic ductile iron Gr. D-2C

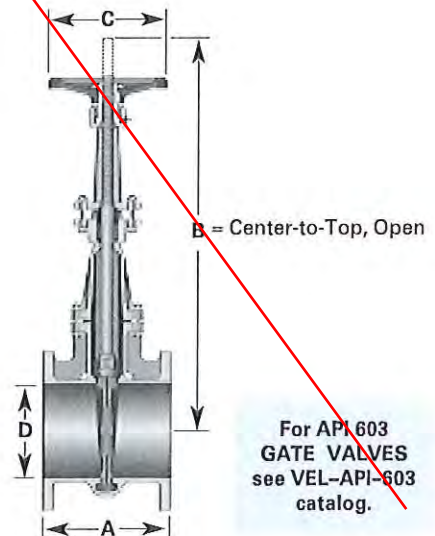


**Optional integral
Stellited seat face
available for longer
service life.**

DIMENSIONS AND WEIGHTS

SIZE in mm	FLANGED, ASME 150 (PN 20)					FLANGED, ASME 300 (PN 50)				
	A	B	C	D	WEIGHT lb (kg)	A	B	C	D	WEIGHT lb (kg)
2 50	7.00 178	13.00 330	8.00 203	2.00 51	30 13.6	8.50 216	14.00 356	8.00 203	2.00 51	44 20.0
2½ 65	7.50 191	15.75 400	8.00 203	2.50 64	46 20.9	9.50 241	16.75 425	8.00 203	2.50 64	60 27.2
3 80	8.00 203	17.75 451	8.00 203	3.00 76	52 23.6	11.13 283	18.50 470	8.00 203	3.00 76	86 39.0
4 100	9.00 229	21.50 546	10.00 254	4.00 102	80 36.4	12.00 305	22.63 575	10.00 254	4.00 102	134 60.8
6 150	10.50 267	28.25 718	10.00 254	6.00 152	135 61.2	15.88 403	29.75 756	10.00 254	6.00 152	247 112.07
8 200	11.50 292	36.50 927	14.00 356	8.00 203	222 100.9	16.50 419	39.19 995	14.00 356	8.00 203	390 177.3
10 250	13.00 330	45.00 1143	18.00 457	10.00 254	324 147.3	18.00 457	45.50 1150	18.00 457	10.00 254	630 285.8
12 300	14.00 356	60.25 1530	18.00 457	12.00 305	472 214.1	19.75 502	65.38 1661	18.00 457	12.00 305	880 400.0
14 350	15.00 381	65.00 1651	21.63 548	13.25 337	685 310.7	—	—	—	—	—
16 400	16.00 406	75.00 1905	23.63 600	15.25 387	1000 453.5	—	—	—	—	—
18 450	17.00 432	81.00 2067	29.50 749	17.25 438	1300 589.6	—	—	—	—	—
20 500	18.00 457	93.00 2362	29.50 749	19.25 489	1500 680.3	—	—	—	—	—
24 600	20.00 508	107.00 2718	31.50 800	23.25 591	2000 907.0	—	—	—	—	—

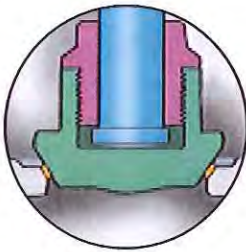
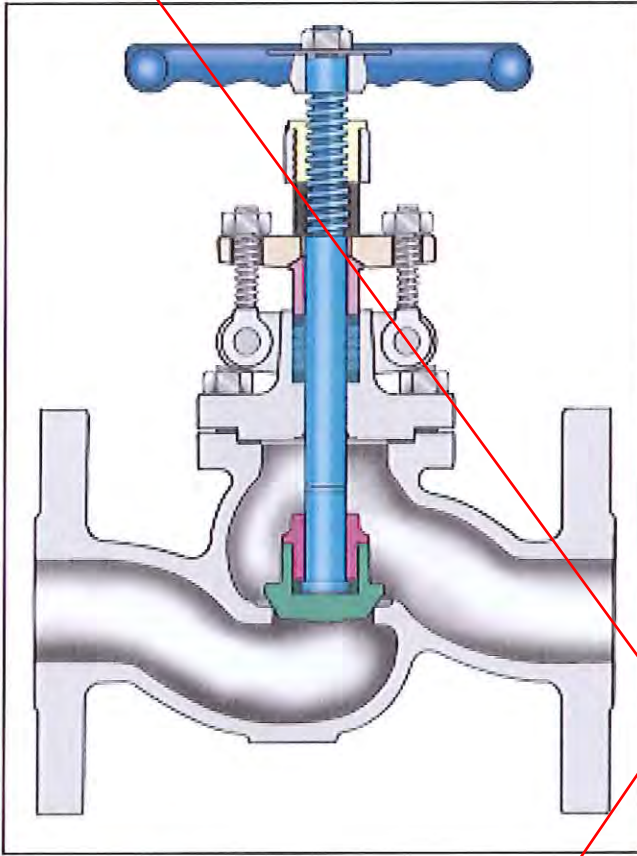
CLASS	FIGURE NUMBERS	
	STAINLESS SEAT	STELLITE SEAT
150	0064C-13SX or GX	0064C-13SY, GS or GY
300	1064C-13SX or GX	1064C-13SY, GS or GY



For API 603
GATE VALVES
see VEL-API-603
catalog.



**CAST STAINLESS STEEL GLOBE VALVES API 603
INTEGRAL SEAT, 2–6" (50–150 mm)
FLANGED, ASME CLASSES 150, 300, WALL THICKNESS TO B16.34**



**Optional integral
Stellited seat face
available for longer
service life.**

STANDARD MATERIALS

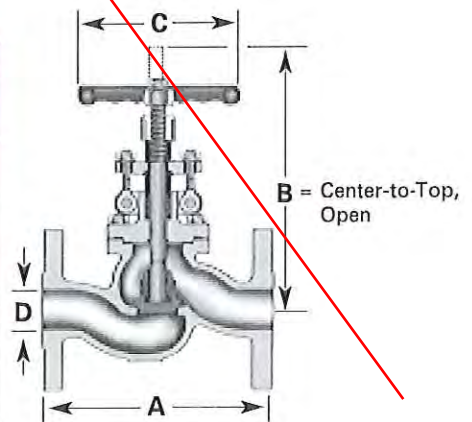
PART	MATERIAL	
Body	A 351 Gr. CF8M	
Bonnet	A 351 Gr. CF8M	
Disc	A 351 Gr. CF8M	
Stem	Gr. 316	
Disc nut	A 351 Gr. CF8M	
Gland pin	Gr. 316	
Gland	Gr. 316	
Gland flange	A 351 Gr. CF8M	
Yoke bushing	Austenitic ductile iron Gr. D-2C	
Handwheel	Malleable iron	
Handwheel nut	Carbon steel	
Name plate	Stainless steel	
Bonnet stud	Gr. B8M	
Bonnet nut	Gr. 8M	
Gland stud	Gr. 304	
Gland nut	Gr. 8M	
Gland packing	SX or SY GS, GX or GY	PTFE Graphite
Gasket	SX or SY GS, GX or GY	PTFE with stainless wire mesh Graphite with stainless steel foil

CLASS	FIGURE NUMBERS	
	STAINLESS SEAT	STELLITE SEAT
150	0074C-13SX or GX	0074C-13SY, GS or GY
300	1074C-13SX or GX	1074C-13SY, GS or GY

For API 603
GLOBE VALVES
see VEL-API-603
catalog.

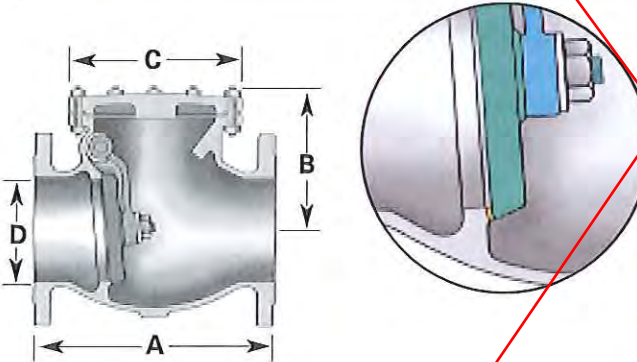
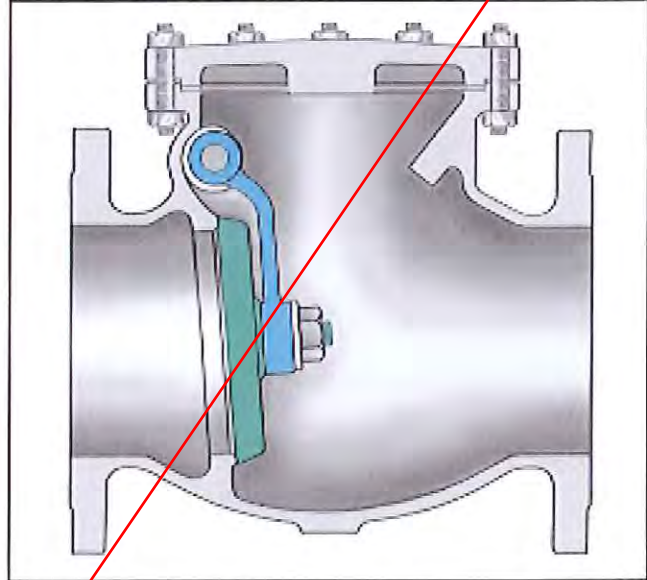
DIMENSIONS AND WEIGHTS

SIZE in mm	FLANGED, ASME 150 (PN 20)					FLANGED, ASME 300 (PN 50)				
	A	B	C	D	WEIGHT lb (kg)	A	B	C	D	WEIGHT lb (kg)
2 50	8.00 203	9.50 241	8.00 203	2.00 51	27 12.3	10.50 267	11.06 281	8.00 203	2.00 51	45 20.4
2½ 65	8.50 216	10.44 265	10.00 254	2.50 64	40 18.2	11.50 292	12.25 311	10.00 254	2.50 64	70 31.7
3 80	9.50 241	12.19 310	10.00 254	3.00 76	50 22.7	12.50 318	13.75 349	10.00 254	3.00 76	87 39.5
4 100	11.50 292	14.81 376	10.00 254	4.00 102	83 37.6	14.00 356	16.44 418	10.00 254	4.00 102	130 59.0
6 150	16.00 406	19.19 487	10.00 254	6.00 152	154 69.9	17.50 445	21.38 543	14.00 356	6.00 152	252 114.3





**CAST STAINLESS STEEL SWING CHECK VALVES API 603
INTEGRAL SEAT, 2–12" (50–300 mm)
FLANGED, ASME CLASSES 150, 300, WALL THICKNESS TO B16.34**



**Optional integral
Stellited seat
face available
for longer
service life.**

For API 603 CHECK VALVES
see VEL-API-603 catalog.

DIMENSIONS AND WEIGHTS

SIZE in mm	FLANGED, ASME 150 (PN 20)					FLANGED, ASME 300 (PN 50)				
	A	B	C	D	WEIGHT lb (kg)	A	B	C	D	WEIGHT lb (kg)
2 50	8.00 203	4.00 102	4.00 ⁽¹⁾ 102	2.00 51	21 9.5	10.50 267	4.75 121	5.00 ⁽¹⁾ 127	2.00 51	42 19.1
2½ 65	8.50 216	4.50 114	5.50 140	2.50 64	30 13.6	11.50 292	5.50 140	6.50 165	2.50 64	62 28.2
3 80	9.50 241	5.00 127	6.75 172	3.00 76	43 19.5	12.50 318	6.25 159	8.00 203	3.00 76	80 36.4
4 100	11.50 292	5.75 146	8.00 203	4.00 102	68 30.9	14.00 356	7.00 178	9.00 229	4.00 102	118 53.6
6 150	14.00 356	7.56 192	10.00 254	6.00 152	128 58.2	17.50 445	8.63 219	11.00 279	6.00 152	212 96.4
8 200	19.50 495	9.50 241	13.25 337	8.00 203	226 102.7	21.00 533	10.63 270	13.00 330	8.00 203	330 150.0
10 250	24.50 622	10.75 273	16.00 406	10.00 254	317 143.8	24.50 622	12.00 305	17.00 432	10.00 254	528 240.0
12 300	27.50 699	13.00 330	19.00 482	12.00 305	530 240.9	28.00 711	15.00 381	20.00 508	12.00 305	802 364

(1) Square.

CLASS	FIGURE NUMBERS	
	STAINLESS SEAT	STELLITE SEAT
150	0114C-13SX or GX	0114C-13SY, GS or GY
300	1114C-13SX or GX	1114C-13SY, GS or GY

STANDARD MATERIALS

PART	MATERIAL
Body	A 351 Gr. CF8M
Cover	A 351 Gr. CF8M
Disc	A 351 Gr. CF8M
Hinge	A 351 Gr. CF8M
Pin	Gr. 316
Plug	Gr. 316
Disc nut	Gr. 8M
Washer	Gr. 316
Cotter pin	Gr. 316
Cover stud	Gr. B8M
Cover nut	Gr. 8M
Gasket	SB, SX or SY
	GB, GS, GX or GY
	PTFE gasket and packing
	Graphite gasket and packing
Nameplate	Stainless steel

ACCESSORIES



GEAR ACTUATORS

Gearing is generally applied to valves to make operation easier. The gearing may be of the spur, bevel or worm type—any of which may be applied to Velan valves.

The gears and gear brackets may be either cast iron or cast steel and may have cast or cut teeth, depending on the loads and the application. Gearing is too often neglected when valve operation is considered, resulting in unsatisfactory operation requiring expensive changes.

	CLASS	OPTIONAL	STANDARD
GATE	150	6–24" (150–600 mm)	30–60" (750–1500 mm)
	300	6–16" (150–400 mm)	18–36" (450–900 mm)
	600	4–12" (100–400 mm)	14–36" (350–900 mm)
	900	3–6" (80–150 mm)	8–10" (200–250 mm)
	1500	3–4" (80–100 mm)	6–10" (150–250 mm)
GLOBE	150	6–12" (150–300 mm)	14–16" (350–400 mm)
	300	6–12" (150–300 mm)	14–16" (350–400 mm)
	600	4–10" (100–250 mm)	—
	900	2–4" (50–100 mm)	—
	1500	2–4" (50–100 mm)	—



ELECTRIC ACTUATORS

Motorized controls may be applied to valves of almost any size for operation in practically any position or location.

All units, whether installed directly on a valve or on a floor stand, can be manually operated in case of power failure. The units are available for either alternating or direct current.

Motor units supplied by Velan are the high torque type with windings impregnated to resist both oil and moisture. They are completely weather-proof, explosion-proof (optional) and dust and steam tight. Various sizes and styles are available for different applications, and systems and can be varied to fit special requirements.

CHAIN WHEELS

Chain wheels are available for all types of Velan cast steel valves. They may be substituted for a plain handwheel or may be used in addition to the existing handwheel.



CYLINDER ACTUATORS

The most commonly-used cylinders are actuated by air, but oil and water types are also available if required. In all designs, the valve stem normally serves as a piston rod with disc fastened directly

to them. Tail rods are also supplied as standard equipment to serve as position indicators and for emergency opening. Handwheels and gear heads can be mounted on top of cylinders for operation in an emergency which may arise due to the loss of operating medium in the cylinder.

Velan cylinders can be furnished with mounting pads for one of the commercial cylinders or valve positioners which provide throttling control. High pressure cylinders are also available for specific applications.

VALVE ACTUATOR SIZING

The Velan philosophy for selecting an actuator is to calculate the required thrust and torque to operate the valve at the required service conditions. A reasonable margin of excess actuator capability over that required is always allowed for in the final actuator selection, but grossly oversized actuators are avoided.

Because of the wide variations in system operating conditions, actuator sizing is based on the following:

ACTUATOR TYPE	LINE PRESSURE	DIFFERENTIAL PRESSURE (CLOSED)	POWER SUPPLY
ELECTRIC	Specified by customer	Specified by customer	Voltage, type, phase and frequency specified by customer
PNEUMATIC	Specified by customer	Specified by customer	Air pressure specified by customer
HYDRAULIC	Specified by customer	Specified by customer	Hydraulic pressure specified by customer
HANDWHEEL/GEAR ACTUATED	70% of CWP ⁽¹⁾ unless otherwise advised by customer	70% of CWP ⁽¹⁾ unless otherwise advised by customer	200 lb. rimpull ⁽²⁾ unless otherwise advised by customer

(1) CWP = cold working pressure per ASME B16.34 at 100°F (e.g., Class 150, CWP = 285 psig, 70% of CWP = 200 psig).

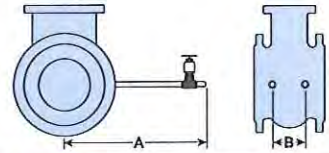
(2) Rimpull is defined as the total tangential force acting on the handwheel (e.g., 200 lb. rimpull requires 100 lb force per hand). This rimpull figure is given for closing/opening conditions. For running conditions (travel from open to closed or vice versa), the rimpull is considerably less. For details, contact the company.

FLOOR STANDS

Floor stands are available in a number of sizes, and the size to be used depends on the stem size and stem load of the valve.

BYPASSES

AVAILABLE FOR ALL VELAN CAST STEEL VALVES
IN ACCORDANCE WITH MSS-SP45 - SERIES A
API 600 GLOBE (Note: Dimensions are in inches)

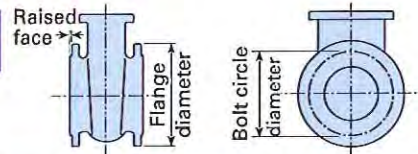


SIZE in	CLASS 150				CLASS 300				CLASS 600			
	BYPASS	A	ELBOW	B	BYPASS	A	ELBOW	B	BYPASS	A	ELBOW	B
3	1/2	13.00	1/2	6.38	1/2	11.50	1/2	6.13	1/2	13.00	1/2	8.25
4	1/2	13.00	1/2	7.50	1/2	16.50	1/2	7.00	1/2	15.00	1/2	9.50
6	3/4	11.13	3/4	11.00	3/4	14.75	3/4	11.00	3/4	13.00	3/4	11.00
8	3/4	11.50	3/4	14.00	3/4	13.00	3/4	14.00	3/4	13.00	3/4	11.25
10	1	18.00	1	14.88	1	18	1	15.00	—	—	—	—
12	1	18.00	1	19.00	1	18	1	18.00	—	—	—	—
14	1	18.00	1	19.50	1	18	1	19.50	—	—	—	—
16	1	18.00	1	24.00	1	18	1	24.00	—	—	—	—

API 600 GATE (Note: Dimensions are in inches)

SIZE in	CLASS 150				CLASS 300				CLASS 600			
	BYPASS	A	ELBOW	B	BYPASS	A	ELBOW	B	BYPASS	A	ELBOW	B
3	1/2	10.50	1/2	4.75	1/2	12.25	1/2	6.25	1/2	12.31	1/2	6.25
4	1/2	13.00	1/2	5.63	1/2	13.00	1/2	6.50	1/2	14.00	1/2	6.50
6	3/4	14.00	3/4	6.13	3/4	14.00	3/4	9.00	3/4	15.00	3/4	9.00
8	3/4	17.00	3/4	6.81	3/4	17.00	3/4	10.00	3/4	17.38	3/4	10.00
10	1	18.00	1	7.69	1	18.00	1	11.00	1	18.50	1	11.00
12	1	18.00	1	8.13	1	18.00	1	12.50	1	18.50	1	12.50
14	1	23.00	1	9.00	1	18.50	1	16.00	1	18.50	1	19.13
16	1	24.00	1	10.00	1	18.50	1	15.50	1	20.50	1	20.00
18	1	26.63	1	12.00	1	19.50	1	14.00	1	20.50	1	24.00
20	1	26.63	1	12.00	1	19.50	1	16.00	1	20.50	1	24.00
24	1	28.75	1	12.25	1	22.50	1	18.25	1	22.50	1	32.00
30	1	33.63	1	14.00	1	26	1	24.00	1	27	1	36.00
36	1	34.00	1	15.25	1	28	1	50.00	1	30	1	35.00
42	1	32.00	1	18.00	—	—	—	—	—	—	—	—
48	1	38.00	1	22.00	—	—	—	—	—	—	—	—
60	1	44.00	1	24.00	—	—	—	—	—	—	—	—

FLANGES, WEIGHTS & CV FLOW COEFFICIENTS



API 600 CAST STEEL VALVES CLASS 150

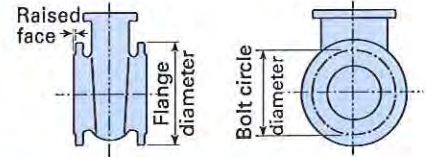
DRILLED AND FACED AS FOLLOWS: 2-24" ASME B16.5⁽¹⁾

ASME CLASS	DIMENSIONS IN INCHES						WEIGHT IN LBS.						CV FLOW FLOW COEFFICIENTS		
	SIZE in	FLANGE DIAM.	BOLT CIRCLE DIAM.	HOLE DIAM.	QTY. HOLES	DIAM. BOLTS	GATE		GLOBE		SWING		GATE	GLOBE	CHECK
							BW	FL	BW	FL	BW	FL			
150 1/16 RAISED FACE	2	6.00	4.75	0.75	4	3/8	42	48	48	55	31	40	260	35	95
	2 1/2	7.00	5.50	0.75	4	3/8	50	59	54	58	35	44	420	60	150
	3	7.50	6.00	0.75	4	3/8	67	78	82	102	59	78	625	92	220
	4	9.00	7.50	0.75	8	3/8	97	117	120	152	98	121	1150	180	410
	6	11.00	9.50	0.88	8	3/8	180	198	240	280	179	212	2650	430	950
	8	13.50	11.75	0.88	8	3/8	278	319	405	435	314	360	4850	810	1750
	10	16.00	14.25	1.00	12	3/4	456	515	500	550	513	586	7750	1400	2800
	12	19.00	17.00	1.00	12	3/4	646	738	1050	1200	602	823	11,500	1950	4100
	14	21.00	18.75	1.13	12	1	875	954	1700	1850	765	980	14,000	2500	6200
	16	23.50	21.25	1.13	16	1	1120	1200	2300	2500	1120	1300	19,000	3400	8400
	18	25.00	22.75	1.25	16	1 1/2	1485	1570	2640	2850	1450	1660	24,000	4500	11,000
	20	27.50	25.00	1.25	20	1 1/2	1825	1910	—	—	1700	2050	31,000	—	13,500
	24	32.00	29.50	1.38	20	1 1/2	2870	2960	—	—	2900	3300	45,000	—	20,000
	26 ⁽¹⁾	34.25	31.75	1.38	24	1 1/2	3600	3700	—	—	3600	4000	53,000	—	23,500
	28 ⁽¹⁾	36.50	34.00	1.38	28	1 1/2	4400	4500	—	—	4300	5000	62,000	—	28,000
	30 ⁽¹⁾	38.75	36.00	1.37	28	1 1/2	4705	4750	—	—	6300	7000	73,000	—	33,000
	32 ⁽¹⁾	41.75	38.50	1.62	28	1 1/2	5800	6000	—	—	—	—	81,000	—	—
	36 ⁽¹⁾	46.00	42.75	1.63	32	1 1/2	6500	6850	—	—	8500	9500	108,000	—	48,000
	40 ⁽¹⁾	50.75	47.25	1.62	36	1 1/2	8400	9000	—	—	—	—	130,000	—	—
	42 ⁽¹⁾	53.00	49.50	1.63	36	1 1/2	10,000	11,000	—	—	—	—	142,000	—	—
48 ⁽¹⁾	59.50	56.00	1.63	44	1 1/2	14,000	15,000	—	—	—	—	190,000	—	—	
54 ⁽¹⁾	66.25	62.75	1.88	44	1 1/2	21,000	23,000	—	—	—	—	238,000	—	—	
60 ⁽¹⁾	73.00	69.25	1.88	52	1 1/2	22,600	26,600	—	—	—	—	300,000	—	—	

(1) 30" and up: ASME B16.47 Series A (MSS-SP-44), for Series B (API 605) contact the factory.

FLANGES, WEIGHTS & CV FLOW COEFFICIENTS

API 600 CAST STEEL VALVES CLASS 300, 600, 900 & 1500
DRILLED AND FACED AS FOLLOWS: 2-24" ASME B16.5



ASME CLASS	DIMENSIONS IN INCHES						WEIGHT IN LBS.						CV FLOW FLOW COEFFICIENTS		
	SIZE in	FLANGE DIAM.	BOLT CIRCLE DIAM.	HOLE DIAM.	QTY. HOLES	DIAM. BOLTS	GATE		GLOBE		SWING		GATE	GLOBE	CHECK
							BW	FL	BW	FL	BW	FL			
300 1/16 RAISED FACE	2	6.50	5.00	0.75	8	3/8	46	60	45	60	37	45	260	35	95
	2 1/2	7.50	5.88	0.88	8	3/8	55	76	63	72	49	57	420	60	150
	3	8.25	6.62	0.88	8	3/8	90	115	88	114	70	96	625	92	220
	4	10.00	7.88	0.88	8	3/8	136	166	130	171	110	150	1150	180	410
	6	12.50	10.62	0.88	12	3/8	245	314	261	337	204	265	2650	430	950
	8	15.00	13.00	1.00	12	3/8	415	506	447	565	360	455	4850	810	1750
	10	17.50	15.25	1.13	16	1	646	762	1000	1150	582	650	7750	1325	2800
	12	20.50	17.75	1.25	16	1 1/4	900	1100	1300	1550	825	945	11,500	1950	4100
	14	23.00	20.25	1.25	20	1 1/4	1392	1720	1800	2100	1200	1350	14,000	2500	6200
	16	25.50	22.50	1.38	20	1 1/4	1870	2220	2300	2700	1500	1800	19,000	3400	8400
	18	28.00	24.75	1.38	24	1 1/4	2405	2960	2640	3200	2000	2400	23,500	4500	11,000
	20	30.50	27.00	1.38	24	1 1/4	3260	3700	—	—	2600	3000	30,000	—	13,500
	24	36.00	32.00	1.63	24	1 1/2	4250	5100	—	—	3000	4050	44,000	—	20,000
	26 ⁽¹⁾	38.25	34.50	1.75	28	1 1/2	5000	5500	—	—	4000	5000	53,000	—	23,500
	28 ⁽¹⁾	40.75	37.00	1.75	28	1 1/2	7000	7500	—	—	5000	6000	62,000	—	28,000
	30 ⁽¹⁾	43.00	39.25	1.88	28	1 1/2	8550	9000	—	—	—	—	73,000	—	—
32 ⁽¹⁾	45.25	41.50	2.00	28	1 1/2	8200	8800	—	—	—	—	81,000	—	—	
36 ⁽¹⁾	50.00	46.00	2.13	32	2	13,500	15,500	—	—	—	—	108,000	—	—	
600 1/4 RAISED FACE	2	6.50	5.00	0.75	8	3/8	60	72	60	72	48	52	260	35	95
	2 1/2	7.50	5.88	0.88	8	3/8	89	102	89	100	59	87	420	60	150
	3	8.25	6.62	0.88	8	3/8	130	157	130	150	96	130	625	92	220
	4	10.75	8.50	1.00	8	3/8	224	275	213	285	167	225	1150	180	410
	6	14.00	11.50	1.13	12	1	394	540	415	515	332	476	2650	430	950
	8	16.50	13.75	1.25	12	1 1/4	726	884	1050	1220	525	715	4850	800	1750
	10	20.00	17.00	1.38	16	1 1/4	1125	1405	1550	1830	1000	1250	7750	1250	2800
	12	22.00	19.25	1.38	20	1 1/4	1490	1812	—	—	1500	1750	11,500	—	4100
	14	23.75	20.75	1.50	20	1 1/4	2200	2500	—	—	1750	2050	13,000	—	5900
	16	27.00	23.75	1.62	20	1 1/2	3000	3700	—	—	2400	3100	18,000	—	7800
	18	29.25	25.75	1.75	20	1 1/2	4000	4800	—	—	3200	4000	22,000	—	9900
	20	32.00	28.50	1.75	24	1 1/2	5600	6800	—	—	4500	6100	27,000	—	12,000
	24	37.00	33.00	2.00	24	1 1/2	8000	9800	—	—	6400	7600	40,000	—	18,000
	30 ⁽¹⁾	44.50	40.25	2.12	28	2	12,000	14,000	—	—	—	—	52,000	—	—
	36 ⁽¹⁾	51.75	47.00	2.62	28	2 1/2	17,000	19,500	—	—	—	—	72,000	—	—
	900 1/4 RAISED FACE	2	8.50	6.50	1.00	8	3/8	150	185	—	—	135	165	230	—
2 1/2		9.63	7.50	1.12	8	1	235	270	—	—	175	210	560	—	200
3		9.50	7.50	1.00	8	3/8	235	270	—	—	175	210	560	—	200
4		11.50	9.25	1.25	8	1 1/4	270	355	—	—	245	330	1050	—	380
6		15.00	12.50	1.25	12	1 1/4	830	980	—	—	485	635	2400	—	875
8		18.50	15.50	1.50	12	1 1/2	1220	1500	—	—	700	900	4200	—	1325
10		21.50	18.50	1.50	16	1 1/2	2000	2400	—	—	—	—	6750	—	1525
12		24.00	21.00	1.50	20	1 1/2	3170	3670	—	—	—	—	9700	—	—
1500 1/4 RAISED FACE	2	8.50	6.50	1.00	8	3/8	150	185	—	—	135	165	230	—	80
	2 1/2	9.63	7.50	1.12	8	1	255	325	—	—	205	275	510	—	185
	3	10.50	8.00	1.25	8	1 1/4	255	325	—	—	205	275	510	—	185
	4	12.25	9.50	1.37	8	1 1/4	430	520	—	—	340	430	925	—	330
	6	15.50	12.50	1.50	12	1 1/2	1045	1205	—	—	805	965	2100	—	750
	8	19.00	15.50	1.75	12	1 1/2	1850	2550	—	—	1350	2050	3650	—	1325
	10	23.00	19.00	2.00	12	1 1/2	2600	3300	—	—	—	—	5850	—	—

(1) 30" and up: ASME B16.47 Series A (MSS-SP-44), for Series B (API 605) contact the factory.

ENGINEERING DATA

PRESSURE-TEMPERATURE RATINGS STANDARD CLASS VALVES, FLANGED AND BUTT WELD END

NOTE: FOR SPECIAL CLASS VALVES, WHICH HAVE HIGHER RATINGS CONTACT THE COMPANY.

CAST

ASTM MATERIAL STANDARD—TO ASME B16.34

ASME Boiler and Pressure Vessel Code Section II materials that also meet the requirements of the listed ASTM specifications.

psig/°F (bar/°C) CLASSES 150–4500

A216 Gr. WCB

TEMP. °F	WORKING PRESSURE by classes, psig						
	150	300	600	900	1500	2500	4500
100	285	740	1480	2220	3705	6170	11110
200	260	675	1350	2025	3375	5625	10120
300	230	655	1315	1970	3280	5470	9845
400	200	635	1270	1900	3170	5280	9505
500	170	600	1200	1795	2995	4990	8980
600	140	550	1095	1640	2735	4560	8210
650	125	535	1075	1610	2685	4475	8055
700	110	535	1065	1600	2665	4440	7990
750	95	505	1010	1510	2520	4200	7560
800	80	410	825	1235	2060	3430	6170
850 ⁽¹⁾	65	270	535	805	1340	2230	4010
900 ⁽¹⁾	50	170	345	515	860	1430	2570
950 ⁽¹⁾	35	105	205	310	515	860	1545
1000 ⁽¹⁾	20	50	105	155	260	430	770

(1) Permissible, but not recommended for prolonged usage above 800°F (427°C).

TEMP. °C	GAGE WORKING PRESSURE BY RATING NUMBER, bar						
	PN 20	PN 50	PN 100	PN 150	PN 250	PN 420	PN 760
38	19.6	51.1	102.1	153.2	255.3	425.5	765.8
50	19.2	50.1	100.2	150.2	250.4	417.3	751.1
100	17.7	46.4	92.8	139.1	231.9	386.5	695.7
150	15.8	45.2	90.5	135.7	226.1	378.9	678.4
200	14.0	43.8	87.6	131.5	219.1	365.2	657.3
250	12.1	41.7	83.4	125.2	208.6	347.7	625.8
300	10.2	38.7	77.5	116.2	193.7	322.8	581.0
350	8.4	37.0	73.9	110.9	184.8	308.0	554.4
375	7.4	36.5	72.9	109.4	182.3	303.9	547.0
400	6.5	34.5	69.0	103.5	172.5	287.5	517.5
425	5.6	28.8	57.5	86.3	143.8	239.6	431.4
450 ⁽¹⁾	4.7	20.0	40.1	60.1	100.2	168.9	300.5
475 ⁽¹⁾	3.7	13.5	27.1	40.6	67.7	112.9	203.2
500 ⁽¹⁾	2.8	8.8	17.6	26.4	44.0	73.3	131.9
525 ⁽¹⁾	1.9	5.2	10.4	15.5	25.9	43.2	77.7
540 ⁽¹⁾	1.3	3.3	6.5	9.8	16.3	27.2	48.9

A217 Gr. WC6

TEMP. °F	WORKING PRESSURE by classes, psig						
	150	300	600	900	1500	2500	4500
100	280	750	1500	2250	3750	6250	11250
200	260	750	1500	2250	3750	6250	11250
300	230	720	1445	2165	3610	6015	10830
400	200	695	1385	2080	3465	5775	10400
500	170	665	1330	1995	3325	5540	9965
600	140	605	1210	1815	3025	5040	9070
650	125	590	1175	1765	2940	4905	8925
700	110	570	1135	1705	2840	4730	8515
750	95	530	1065	1595	2660	4430	7970
800	80	510	1015	1525	2540	4230	7610
850	65	485	975	1460	2435	4060	7305
900	50	450	900	1350	2245	3745	6740
950	35	320	640	955	1595	2655	4785
1000	20	215	430	650	1080	1800	3240
1050	20 ⁽¹⁾	145	290	430	720	1200	2160
1100	20 ⁽¹⁾	95	190	290	460	800	1440

(1) For welding end valves only. Flanged end ratings terminate at 1000°F (538°C).

TEMP. °C	GAGE WORKING PRESSURE BY RATING NUMBER, bar						
	PN 20	PN 50	PN 100	PN 150	PN 250	PN 420	PN 760
38	20.0	51.7	103.4	155.2	258.6	431.0	775.9
50	19.5	51.7	103.4	155.2	258.6	431.0	775.9
100	17.7	51.4	103.0	154.5	257.4	429.1	772.4
150	15.8	49.6	99.6	149.2	248.8	414.5	746.3
200	13.9	48.1	95.9	143.9	239.8	399.6	719.6
250	12.1	46.2	92.4	138.6	231.0	385.0	692.6
300	10.2	42.9	85.8	128.6	214.4	357.2	642.8
350	8.3	40.3	80.3	120.8	201.1	335.4	603.5
375	7.4	38.9	77.6	116.6	194.1	323.3	582.0
400	6.5	36.5	73.3	109.8	183.1	305.0	548.7
425	5.6	35.2	70.2	105.4	175.7	292.6	526.3
450	4.6	33.7	67.7	101.4	169.1	281.9	507.2
475	3.7	31.7	63.4	95.1	158.2	263.9	475.0
500	2.8	25.3	50.6	75.7	126.1	210.1	378.6
525	1.9	18.1	36.3	54.5	90.8	151.2	272.5
550	1.4 ⁽¹⁾	12.7	25.4	38.1	63.6	105.9	190.7
575	1.4 ⁽¹⁾	8.8	17.7	26.3	44.0	73.4	132.1
600 ⁽²⁾	1.4 ⁽¹⁾	6.0	12.0	18.3	30.3	50.5	90.8

(2) Not to be used over 593°C.

A217 Gr. WC9

TEMP. °F	WORKING PRESSURE by classes, psig						
	150	300	600	900	1500	2500	4500
100	280	750	1500	2250	3750	6250	11250
200	260	750	1500	2250	3750	6250	11250
300	230	730	1455	2185	3640	6070	10925
400	200	705	1410	2115	3530	5880	10585
500	170	665	1330	1995	3325	5540	9965
600	140	605	1210	1815	3025	5040	9070
650	125	590	1175	1765	2940	4905	8925
700	110	570	1135	1705	2840	4730	8515
750	95	530	1065	1595	2660	4430	7970
800	80	510	1015	1525	2540	4230	7610
850	65	485	975	1460	2435	4060	7305
900	50	450	900	1350	2245	3745	6740
950	35	375	755	1130	1885	3145	5665
1000	20	260	520	780	1305	2170	3910
1050	20 ⁽¹⁾	175	350	525	875	1455	2625
1100	20 ⁽¹⁾	110	220	330	550	915	1645

(1) For welding end valves only. Flanged end ratings terminate at 1000°F (538°C).

TEMP. °C	GAGE WORKING PRESSURE BY RATING NUMBER, bar						
	PN 20	PN 50	PN 100	PN 150	PN 250	PN 420	PN 760
38	20.0	51.7	103.4	155.2	258.6	431.0	775.9
50	19.5	51.7	103.4	155.2	258.6	431.0	775.9
100	17.7	51.6	103.1	154.6	257.7	429.5	773.2
150	15.8	50.3	100.3	150.6	250.9	418.3	753.0
200	13.9	48.8	97.5	146.3	244.1	406.6	731.9
250	12.1	46.3	92.7	139.1	231.9	386.3	695.0
300	10.2	42.9	85.8	128.6	214.4	357.2	642.8
350	8.3	40.3	80.3	120.8	201.1	335.4	603.5
375	7.4	38.9	77.6	116.6	194.1	323.3	582.0
400	6.5	36.5	73.3	109.8	183.1	305.0	548.7
425	5.6	35.2	70.2	105.4	175.7	292.6	526.3
450	4.6	33.7	67.7	101.4	169.1	281.9	507.2
475	3.7	31.7	63.4	95.1	158.2	263.9	475.0
500	2.8	27.7	55.7	83.4	139.0	231.8	417.4
525	1.9	21.6	43.3	64.9	103.4	160.6	325.3
550	1.4 ⁽¹⁾	15.4	30.7	46.1	77.0	127.9	230.7
575	1.4 ⁽¹⁾	10.6	21.1	31.7	52.7	87.7	158.1
600 ⁽²⁾	1.4 ⁽¹⁾	6.9	13.8	20.7	34.6	57.4	103.2

(2) Not to be used over 593°C.

ENGINEERING DATA

A217 Gr. C5

TEMP. °F	WORKING PRESSURE by classes, psig						
	150	300	600	900	1500	2500	4500
100	290	750	1500	2250	3750	6250	11250
200	260	745	1490	2235	3725	6205	11170
300	230	715	1430	2150	3550	5965	10740
400	200	705	1410	2115	3530	5880	10585
500	170	665	1330	1995	3325	5540	9965
600	140	605	1210	1815	3025	5040	9070
650	125	590	1175	1765	2940	4905	8825
700	110	570	1135	1705	2840	4730	8515
750	95	530	1055	1595	2640	4400	7920
800	80	510	1015	1525	2540	4230	7610
850	65	485	965	1450	2415	4030	7250
900	50	370	740	1110	1850	3085	5555
950	35	275	550	825	1370	2285	4115
1000	20	200	400	595	995	1655	2985
1050	20 ⁽¹⁾	145	290	430	720	1200	2160
1100	20 ⁽¹⁾	100	200	300	495	830	1490
1150	20 ⁽¹⁾	60	125	185	310	515	925
1200	15 ⁽¹⁾	35	70	105	170	285	515

(1) For welding end valves only. Flanged end ratings terminate at 1000°F (538°C).

TEMP. °C	GAGE WORKING PRESSURE BY RATING NUMBER, bar						
	PN 20	PN 50	PN 100	PN 150	PN 250	PN 420	PN 760
38	20.0	51.7	103.4	155.2	258.6	431.0	775.9
50	19.5	51.7	103.3	155.0	258.6	430.3	774.6
100	17.7	51.1	102.3	153.4	257.2	425.9	766.8
150	15.8	49.3	98.6	148.2	246.8	411.2	740.5
200	13.9	48.7	97.4	146.1	243.7	406.0	730.8
250	12.1	46.3	92.7	139.1	231.9	386.3	695.0
300	10.2	42.9	85.8	128.6	214.4	357.2	642.8
350	8.3	40.3	80.3	120.8	201.1	335.4	603.5
375	7.4	38.9	77.5	116.4	193.9	323.0	581.5
400	6.5	36.5	72.6	109.2	181.8	303.0	545.4
425	5.6	35.2	70.1	105.4	175.6	292.4	526.1
450	4.6	33.7	67.1	100.8	167.9	280.1	504.0
475	3.7	27.6	55.0	82.6	137.7	229.7	413.5
500	2.8	21.3	42.6	64.0	106.4	177.4	319.5
525	1.9	16.1	32.3	48.3	80.5	134.1	241.7
550	1.4 ⁽¹⁾	12.1	24.3	36.0	60.3	100.3	180.8
575	1.4 ⁽¹⁾	9.0	17.9	26.6	44.3	74.1	133.2
600	1.4 ⁽¹⁾	6.2	12.6	18.8	31.1	52.0	93.4
625	1.3 ⁽¹⁾	3.9	8.1	12.0	20.0	33.3	59.9
650	1.0 ⁽¹⁾	2.4	4.8	7.2	11.7	19.7	35.5

A217 Gr. C12

TEMP. °F	WORKING PRESSURE by classes, psig						
	150	300	600	900	1500	2500	4500
100	290	750	1500	2250	3750	6250	11250
200	260	750	1500	2250	3750	6250	11250
300	230	730	1455	2185	3640	6070	10925
400	200	705	1410	2115	3530	5880	10585
500	170	665	1330	1995	3325	5540	9965
600	140	605	1210	1815	3025	5040	9070
650	125	590	1175	1765	2940	4905	8825
700	110	570	1135	1705	2840	4730	8515
750	95	530	1065	1595	2660	4430	7970
800	80	510	1015	1525	2540	4230	7610
850	65	485	975	1460	2435	4060	7305
900	50	450	900	1350	2245	3745	6740
950	35	375	755	1130	1855	3145	5655
1000	20	255	505	760	1270	2115	3805
1050	20 ⁽¹⁾	170	345	515	855	1430	2570
1100	20 ⁽¹⁾	115	225	340	565	945	1695
1150	20 ⁽¹⁾	75	150	225	375	630	1130
1200	20 ⁽¹⁾	50	105	155	255	430	770

(1) For welding end valves only. Flanged end ratings terminate at 1000°F (538°C).

TEMP. °C	GAGE WORKING PRESSURE BY RATING NUMBER, bar						
	PN 20	PN 50	PN 100	PN 150	PN 250	PN 420	PN 760
38	20.0	51.7	103.4	155.2	258.6	431.0	775.9
50	19.5	51.7	103.4	155.2	258.6	431.0	775.9
100	17.7	51.6	103.1	154.6	257.7	429.5	773.2
150	15.8	50.3	100.3	150.6	250.9	418.3	753.0
200	13.9	48.8	97.5	146.3	244.1	406.6	731.9
250	12.1	46.3	92.7	139.1	231.9	386.3	695.0
300	10.2	42.9	85.8	128.6	214.4	357.2	642.8
350	8.3	40.3	80.3	120.8	201.1	335.4	603.5
375	7.4	38.9	77.6	116.6	194.1	323.3	582.0
400	6.5	36.5	73.3	109.8	183.1	305.0	548.7
425	5.6	35.2	70.2	105.4	175.7	292.6	526.3
450	4.6	33.7	67.7	101.4	169.1	281.9	507.2
475	3.7	31.7	63.4	95.1	158.2	263.9	475.0
500	2.8	27.7	55.7	83.4	139.0	231.8	417.0
525	1.9	21.4	42.8	64.1	107.1	178.6	321.1
550	1.4 ⁽¹⁾	15.0	30.0	45.0	75.0	125.1	225.0
575	1.4 ⁽¹⁾	0.4	21.0	31.4	52.1	87.2	156.7
600	1.4 ⁽¹⁾	7.2	14.3	21.5	35.8	59.9	107.5
625	1.4 ⁽¹⁾	4.9	9.9	14.8	24.7	41.5	74.5
650	1.4 ⁽¹⁾	3.4	7.2	10.7	17.6	29.7	53.1

A351 Gr. CF8M⁽³⁾, A351 Gr. CF3M⁽²⁾

TEMP. °F	WORKING PRESSURE BY CLASSES, psig						
	150	300	600	900	1500	2500	4500
100	275	720	1440	2160	3600	6000	10800
200	235	620	1240	1860	3095	5160	9280
300	215	560	1120	1680	2795	4660	8390
400	195	515	1025	1540	2570	4280	7705
500	170	480	955	1435	2390	3980	7165
600	140	450	900	1355	2255	3760	6770
650	125	445	890	1330	2220	3700	6660
700	110	430	870	1305	2170	3620	6515
750	95	425	855	1280	2135	3560	6410
800	80	420	845	1265	2110	3520	6335
850	65	420	835	1255	2090	3480	6265
900	50	415	830	1245	2075	3460	6230
950	35	385	775	1160	1930	3220	5795
1000	20	350	700	1050	1750	2915	5245
1050 ⁽³⁾	20 ⁽¹⁾	345	695	1030	1720	2865	5155
1100 ⁽³⁾	20 ⁽¹⁾	305	610	915	1525	2545	4575
1150 ⁽³⁾	20 ⁽¹⁾	235	475	710	1185	1970	3550
1200 ⁽³⁾	20 ⁽¹⁾	185	370	555	925	1545	2775
1250 ⁽³⁾	20 ⁽¹⁾	145	295	440	735	1230	2210
1300 ⁽³⁾	20 ⁽¹⁾	115	235	350	585	970	1750
1350 ⁽³⁾	20 ⁽¹⁾	95	190	290	460	800	1440
1400 ⁽³⁾	20 ⁽¹⁾	75	150	225	380	630	1130
1450 ⁽³⁾	20 ⁽¹⁾	60	115	175	290	485	875
1500 ⁽³⁾	20 ⁽¹⁾	40	85	125	205	345	620

(1) For welding end valves only. Flanged end ratings terminate at 1000°F (538°C).

(2) CF3M: Not to be used over 850°F (454°C).

(3) At temperatures over 1000°F (538°C), use only when the carbon content is 0.04% or higher.

TEMP. °C	GAGE WORKING PRESSURE BY RATING NUMBER, bar						
	PN 20	PN 50	PN 100	PN 150	PN 250	PN 420	PN 760
38	19.0	49.7	99.3	149.0	248.3	413.8	744.8
50	18.3	48.1	96.3	144.4	240.6	401.0	721.9
100	16.1	42.3	84.6	126.8	211.0	351.7	633.2
150	14.8	38.6	77.1	115.7	192.4	320.8	577.7
200	13.6	35.8	71.2	107.0	178.5	297.2	535.2
250	12.0	33.5	66.8	100.3	167.0	278.2	500.8
300	10.2	31.6	63.1	95.0	158.1	263.6	474.6
350	8.3	30.4	61.0	91.3	152.3	253.9	456.9
375	7.4	29.6	59.9	89.7	149.3	249.1	448.3
400	6.5	29.3	59.0	88.2	147.2	245.4	441.9
425	5.6	29.0	58.3	87.3	145.6	242.9	437.2
450	4.6	29.0	57.7	86.7	144.3	240.4	432.8
475	3.7	28.7	57.3	86.1	143.4	239.0	430.3
500	2.8	27.3	54.8	82.1	136.7	228.0	410.5
525	1.9	25.2	50.6	75.9	126.4	210.7	379.2
550 ⁽²⁾	1.4 ⁽¹⁾	24.0	47.8	71.8	119.8	199.5	359.0
575 ⁽²⁾	1.4 ⁽¹⁾	22.8	45.4	68.3	114.1	190.1	341.9
600 ⁽²⁾	1.4 ⁽¹⁾	19.9	39.9	59.7	93.5	166.0	298.6
625 ⁽²⁾	1.4 ⁽¹⁾	15.7	31.7	47.4	79.2	131.7	237.3
650 ⁽²⁾	1.4 ⁽¹⁾	12.6	25.3	37.9	63.2	105.7	189.8
675 ⁽²⁾	1.4 ⁽¹⁾	10.1	20.6	30.8	51.4	86.1	154.8
700 ⁽²⁾	1.4 ⁽¹⁾	8.3	16.9	25.1	42.0	69.8	125.8
725 ⁽²⁾	1.4 ⁽¹⁾	6.9	13.9	21.1	35.0	58.2	104.9
750 ⁽²⁾	1.4 ⁽¹⁾	5.7	11.3	17.1	28.7	47.7	85.7
775 ⁽²⁾	1.4 ⁽¹⁾	4.6	9.0	13.7	22.8	38.1	68.4
800 ⁽²⁾	1.4 ⁽¹⁾	3.5	7.0	10.6	17.4	29.2	52.6

SPECIFICATION OF CAST VALVE MATERIALS

BODY AND BONNET, WEDGE-DISC-PACKING FLANGE

DESCRIPTION	CARBON STEEL			ALLOY STEEL				STAINLESS STEEL					
	ASTM DESIGNATION	A216 WCB	A352 LCB	A352 LCC	1¼ CR ½ Mo	2¼ CR-1 Mo	5 CR	9 CR-1Mo	13 CR		316	316L	304
COMPOSITION %	Carbon	0.25 ⁽¹⁾	0.25 ⁽¹⁾	0.25	0.20	0.18	0.20	0.20	0.15	0.10-0.40	0.08	0.03	0.08
	Manganese	1.00	1.00	1.20	0.50-0.80	0.40-0.70	0.40-0.70	0.35-0.65	1.00	1.00	1.50	1.50	1.50
	Phosphorus	0.04	0.04	0.04	0.04	0.40	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	Sulphur	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.040	0.040	0.040	0.040	0.040
	Silicon	0.60	0.60	0.60	0.60	0.60	0.75	1.00	1.50	1.50	1.50	1.50	2.00
	Nickel	0.50	—	0.50	0.50	0.50	0.50	0.50	1.00	1.00	9.00-12.00	9.00-13.00	8.00-11.00
	Chromium	0.50	—	0.50	1.00-1.50	2.00-2.75	4.00-6.50	8.00-10.00	11.5-14.0	11.5-14.0	18.00-21.00	17.00-21.00	18.00-21.00
	Molybdenum	0.20	—	0.20	0.45-0.65	0.90-1.20	0.45-0.65	0.90-1.20	0.50	0.50	2.0-3.00	2.0-3.00	0.50
	Copper	0.30	0.30	0.30	0.50	—	0.50	0.50	—	—	—	—	—
	Heat Treat.	Anneal	Quench and Temper		Temper	Temper	Temper	Temper	Solution anneal				
Tensile psi min.	70,000	65,000-90,000	70,000-95,000	70,000-90,000	70,000-90,000	90,000-115,000	90,000-115,000	90,000-115,000	100,000	70,000	70,000	70,000	
Yield psi min.	36,000	35,000	40,000	40,000	40,000	60,000	60,000	65,000	70,000	30,000	30,000	30,000	
Elong. % Min.	22	24	22	20	20	18	18	18	15	30	30	35	
R. Area % Min.	35	35	35	35	35	35	35	30	25	—	—	—	
Hardness HB	187 max.	197 max.	200 max.	207 max.	207 max.	241 max.	241 max.	327-381	475 min.	—	187 max.	—	
Parts	BODIES-BONNETS-LARGE DISCS							DISC MATERIALS		BODIES-BONNETS-DISCS			

(1) Velan standard: 0.25 or less.

TRIM SPECIFICATION

ASTM DESIGNATION	BAR STOCK								CAST			
	CR 13		Stainless Steels			Monel		Hastelloy	Monel	Stellite 6	Austenitic Ductile	
	A 479 410*	A 582 416*	A 479 316 St. Hard.	A 479 316	A 564 630	B 164 Monel	AMS 4676A K-Monel	B574 N 10276	A 494 M-25S	AMS 5387 A	A 439 D-2C	
COMPOSITION %	Carbon	0.15	0.15	0.08	0.08	0.07	0.3	0.25	0.010	0.25	0.9-1.4	2.90
	Manganese	1.00	1.25	2.00	2.00	1.00	2.0	1.50	1.0	1.50	1.0	1.80-2.40
	Phosphorus	0.040	0.06	0.045	0.045	0.040	—	0.02	0.04	0.03	0.04	0.08
	Sulphur	0.030	0.15 min.	0.030	0.030	0.030	0.024	0.010	0.03	0.03	0.04	—
	Silicon	1.00	1.00	1.00	1.00	1.00	0.5	1.00	0.08	3.5-4.5	1.5	1.00-3.00
	Nickel	—	—	10.00-14.00	10.00-14.00	3.00-5.00	63.0	63.00-70.00	Balance	Balance	3.0	21.00-24.00
	Chromium	11.50-13.50	12.00-14.00	16.00-18.00	16.00-18.00	15.00-17.50	—	—	14.5-16.5	—	27.0-31.0	0.50
	Molybdenum	—	—	2.00-3.00	2.00-3.00	—	—	—	15.0-17.0	—	1.5	—
	Copper	—	—	—	—	3.00-5.00	28.0-34.0	Balance	—	27.0-33.0	—	—
	Aluminum	—	—	—	—	—	3.00	—	3.00	—	—	—
	Cobalt	—	—	—	—	—	—	—	—	—	Balance	—
	Tungsten	—	—	—	—	—	—	—	—	—	3.5-5.5	—
	Iron	—	—	—	—	—	—	—	—	3.50	3.0	—
Special Condition	Temper	Hard	Level 2	—	—	Hot worked	Hot Fin.	—	Age Hard.	—	—	
Heat Treat.	Class 2	Hard Temper	Sol. Ann.	Sol. Ann.	H 1100	—	—	—	—	—	—	
Tensile psi min.	110,000	—	95,000	75,000	140,000	80,000	140,000	100,000	—	130,000	58,000	
Yield psi min.	85,000	—	75,000	30,000	115,000	40,000	100,000	41,000	—	—	28,000	
Elong. % min.	15	—	25	30	14	30	20	40	—	1	20	
R. Area % min.	45	—	40	40	45	—	—	—	—	—	—	
Hardness HB	269 max.	293-352	—	—	302 min.	—	326 min.	—	300 min.	344 min.	121-171	

* 13 CR or Monel trim also available in soft form (less than 237 HB). Non-cobalt hardfacing also available.

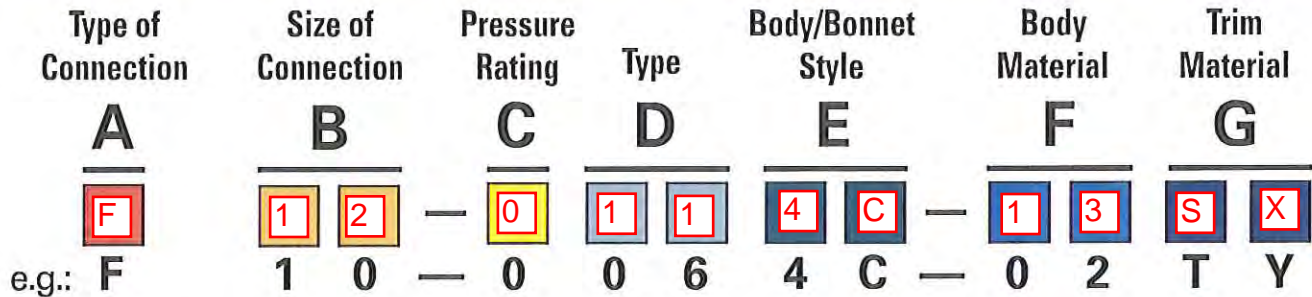
SOUR SERVICE VALVES

To meet NACE STANDARD MR0175 Valen manufactures the complete range of valves shown in this catalog in compliance with NACE standard MR0175. Trim materials must be selected by customers from table based on experience in corrosion resistance against sulphides (sour gas) found in processing crude oil.

For trim material (wedge/disc surface, seat surface, stem) see page 37.

TRIM	
NA, ND, NE, NF:	B7M / 2HM RC. 22 MAX.
NB, NC, NN:	B7M / 2HM OR B8M / 8

CAST STEEL GATE, GLOBE & CHECK VALVES



Example: Flanged 3" class 150 cast carbon steel full bore gate valve with TY trim.

The figure numbers shown on this key are designed to cover essential features of Velan valves. Please use figure numbers to ensure prompt and accurate processing of your order. A detailed description must accompany any special orders.

A TYPE OF CONNECTION			
A - Special	F - Flanged B16.5 (B16.47 series A)	R - Flanged ring joint	U - Undrilled flanges
B - Butt weld	P - Flanged B16.47 series B (API 605)	X - Butt weld (intermediate class)	
C - Combination			
D - DIN flanged			
E - Welded stubs			
B SIZE OF CONNECTION			
Customers have the choice of specifying valve size as part of the valve figure number (B) using the numbers below, or indicating valve size separately.			
EXAMPLES:			
F10-0064C-02TY (valve size is part of figure number)			
3"F-0064C-02TY (valve size is shown separately)			
08 - 2" (50 mm)	16 - 10" (250 mm)	26 - 26" (650 mm)	44 - 44" (1100 mm)
09 - 2½" (65 mm)	18 - 12" (300 mm)	28 - 28" (700 mm)	46 - 46" (1150 mm)
10 - 3" (80 mm)	19 - 14" (350 mm)	30 - 30" (750 mm)	48 - 48" (1200 mm)
11 - 3½" (90 mm)	20 - 16" (400 mm)	32 - 32" (800 mm)	54 - 54" (1350 mm)
12 - 4" (100 mm)	21 - 18" (450 mm)	34 - 34" (850 mm)	60 - 60" (1500 mm)
13 - 5" (125 mm)	22 - 20" (500 mm)	36 - 36" (900 mm)	99 - Special
14 - 6" (150 mm)	23 - 22" (550 mm)	40 - 40" (1000 mm)	
16 - 8" (200 mm)	24 - 24" (600 mm)	42 - 42" (1050 mm)	
C PRESSURE RATING			
0 - 150	1 - 300	2 - 600	3 - 1500 7 - 900
D VALVE TYPE			
01 - Flow control	07 - Stop globe	09 - Needle	99 - Special
06 - Full port gate	08 - Stop check	11 - Swing check	
E BODY / BONNET STYLE			
4 - Vertical	A - Special	C - Bolted bonnet (cast)	E - Extended bonnet (cryogenic)
		V - Cast bolted bonnet bellows seal	
F BODY MATERIAL			
01 - Special	09 - C12	19 - Monel M35	31 - LCC
02 - WCB	11 - CF8	23 - Alloy 20	34 - C12A (F91)
03 - WC1	12 - CF3	25 - LCB	38 - LC1
04 - C5	13 - CF8M	27 - LC3	39 - LC2
05 - WC6	14 - CF3M	28 - CG8M	46 - GS-C25N
06 - WC9	15 - CF8C	29 - CG3M	

G TRIM				API Number	If applicable BELLOWS ⁽²⁾
CODE	WEDGE/DISC SURFACE ⁽¹⁾	SEAT SURFACE ⁽¹⁾	STEM		
MS	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	316		321
MY	CF8M or 316	Stellite 6 ⁽³⁾	316	12	321
TS	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	13 CR (410) ⁽⁴⁾	5	321
TY	13 CR (410 or CA15)	Stellite 6 ⁽³⁾	13 CR (410)	8	
NA	13 CR (410 or CA15) HRC 22 max	Stellite 6 ⁽³⁾	13 CR (410) HRC 22 max.	8 ⁽⁵⁾	
NB	CF8M	Stellite 6 ⁽³⁾	316	12 ⁽⁶⁾	321
NC	Monel	Stellite 6 ⁽³⁾	Monel	11 ⁽⁶⁾	Hastelloy C
ND	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	630 (H1150M)		
NE	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	13 CR (410) HRC 22 max.	5 ⁽⁶⁾	
NF	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	Same as Body		
NG	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	316		321
NN	CF8M	Stellite 6 ⁽³⁾	316		IN 625
NX	Monel	Monel	Monel		
AS	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	321		321
AY	CF8C/F321	Stellite 6 ⁽³⁾	321		321
CC	Alloy 20	Alloy 20	Alloy 20	13	
ES	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	347		
EY	CF8C/F347	Stellite 6 ⁽³⁾	347		
HC	Hastelloy C	Stellite 6 ⁽³⁾	Hastelloy C		Hastelloy C
MF	CF8M or 316 w/ Teflon insert ⁽⁵⁾	Stellite 6 ⁽³⁾	316		
MH	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	316		Hastelloy C
MN	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	316		IN 625
MX	CF8M	316	316	10	
TF	13 CR (410 or CA15) w/ Teflon insert ⁽⁵⁾	Stellite 6 ⁽³⁾	13 CR (410)		
TH	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	13 CR (410) ⁽⁴⁾		Hastelloy C
TN	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	13 CR (410) ⁽⁴⁾		IN 625
XS	Stellite 6 ⁽³⁾	Stellite 6 ⁽³⁾	Monel		
XX	Monel	Monel	Monel	9	
XY	Monel	Stellite 6 ⁽³⁾	Monel	11	
SX ⁽⁷⁾	Same as body	Integral	Same as body	10	
GX ⁽⁷⁾	Same as body	Integral	Same as body	10	
SY ⁽⁷⁾	Same as body	Stellite 6 ⁽³⁾	316	12	
GY ⁽⁷⁾	Same as body	Stellite 6 ⁽³⁾	316	12	
GS	Stellite 6 ⁽³⁾	Integral	316		
SB ⁽⁷⁾	Bronze	Integral	316		

(1) Base material is either the same as the body or solid trim at manufacturer's option.
 (2) Bellows material shown as standard, Inconel can be used in lieu of 321 and Hastelloy C in lieu of Inconel, where design and/or pressure class applicable.
 (3) Stellite 6 or Stellite 21 based on material or application at manufacturer's option.
 (4) 616HT Manufacturer's Std. (F91 and C12A only).
 (5) Inserts may be in seat or wedge at manufacturer's option.
 (6) NACE service valves are supplied with all materials conforming to NACE MR0175. (Including bolting with max. hardness of RC22).
 (7) SB, SX, SY PTFE gasket and packing GS, GX, GY Graphite gasket and packing.

Note: For a more detailed list of available trims, contact the factory or visit our web site at www.velan.com

**THE MOST COMPREHENSIVE LINE OF INDUSTRIAL FORGED AND CAST STEEL,
GATE, GLOBE, CHECK, BALL, KNIFE GATE AND BUTTERFLY VALVES**

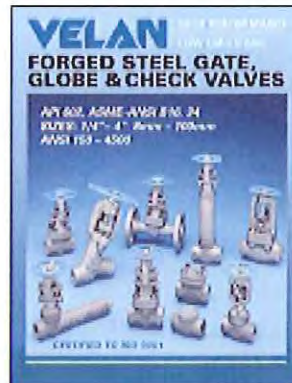
ASME Pressure Classes 150–4500 in Carbon, Alloy and Stainless Steel



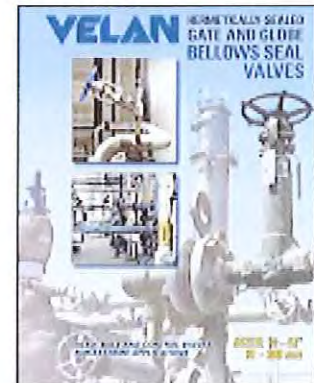
VEL-PS



VEL-BG



VEL-SFV



VEL-BS



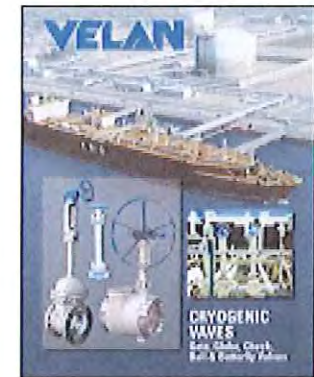
VEL-PRO-CV



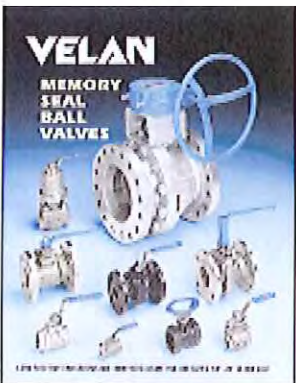
VEL-API-603



VEL-KGV



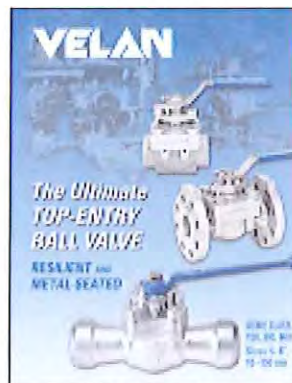
VEL-CRYO



VEL-BV



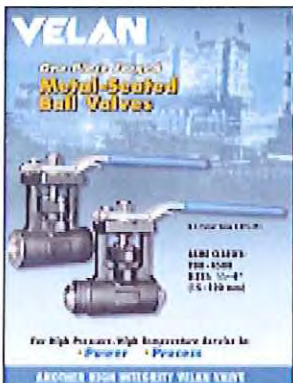
VEL-UB



VEL-GP2BV



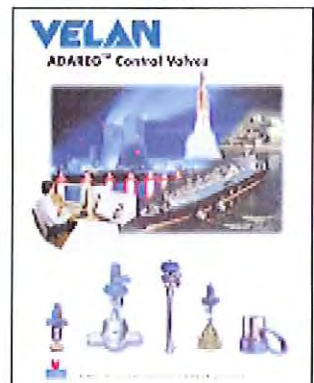
VEL-MS



VEL-PBV



VEL-BF



VEL-ADCV

VEL-CSV-2002



Swing Check Valve, 3/4 In, NPT, 316 SS

Swing Check Valve, Check, Material of Construction 316 Stainless Steel, Size 3/4 In., NPT Connection, Length 3-5/32 In., Width (In.) 2.76, Overall Height (In.) 5.00, Top of Handle to Inlet Center (In.) 1.97, Rated For 200 PSI, Cracking Pressure (PSI) 2.85, Max. Temp. (F) 353, Mounting Position Horizontal, Seal PTFE

Grainger Item #	4VMU1
Brand	GRAINGER APPROVED VENDOR
Mfr. Model #	4VMU1
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	0.99
Availability	Typically in Stock
Catalog Page No.	4412

Price shown may not reflect your price. Log In or register.

Additional Info

316 Stainless Steel Swing Check Valves

Provide excellent corrosion and chemical resistance. Horizontal mounting. For use in plumbing and heating applications.

- Max. pressure: 200 psi Max. temp.: 353°F

Tech Specs

Item: Swing Check Valve

Type: Check

Material of Construction: 316 Stainless Steel

Size: 3/4"

Connection: NPT

Length: 3-5/32"

Width (In.): 2.76

Overall Height (In.): 5.00

Top of Handle to Inlet Center (In.): 1.97

Rated For: 200 PSI

Cracking Pressure (PSI): 2.85

Max. Temp. (F): 353

Mounting Position: Horizontal

Seal: PTFE

Package Quantity: 1

Notes & Restrictions

There are currently no notes or restrictions for this item.

MSDS

This item does not require a Material Safety Data Sheet (MSDS).

Required Accessories

There are currently no required accessories for this item.

Amercoat® 240

Universal epoxy coating

Product Data/ Application Instructions

- Formulated for direct-to-metal application with excellent substrate wetting while retaining excellent edge coverage
- Exceptional corrosion protection in salt and fresh water immersion and corrosive chemical environments
- Surface tolerant, lowers the cost of surface preparation
- Excellent adhesion to tight rust
- Compatible with water jetted or hand and power tool cleaned surfaces.
- Low temperature cure down to 0°F (-18°C) without additives or alternate curing agents
- Fast dry-to-recoat and rapid handling properties
- High-build (up to 12 mils) in one coat
- Abrasion resistant

Very low solvent content meets VOC requirements, reduces the risk of pinholing and solvent entrapment at the substrate-coating interface, often a major cause of coating failure with conventional epoxies and lower solids systems.

Typical Uses

Tank Linings and Pipe Coatings

- Ballast and fuel tanks
- Bilges, wet voids and other damp areas
- Crude oil tanks

Ships, Offshore and Marine Structures

- Exterior hull above and below waterline
- Decks and superstructures, piping, and equipment
- Interior surfaces

Fabrication and New Construction

- Heavy industry, structural steelwork, bridges, tankage
- Speeds up production, even at low temperatures
- A single coat multi-purpose, surface-tolerant coating

Qualifications

- *Classified by Marintek, as class B1 for use in ballast water tanks*
- *Tested by NOHC as being suitable as a lining for grain storage containers.*
- *Lloyd's Register - Provisionally recognized as acceptable for saltwater ballast tanks and double bottom tanks; Certificate Number MATS/3404/1*
- *NAVSEA - MIL-PRF23236 (D) Classes 5, 7, and 17 Type VII Grade C*
- *NAVSEA - MIL-PRF-24647*
- *Certified by Det Norske Veritas (DNV) to comply with IMO Resolution MSC.215(82) Performance Standard for Protective Coatings (PSPC) for seawater ballast tanks.*
- *Meets performance requirements of Mil-PRF-4556(F)*

Physical Data

Finish	Semigloss		
Color*	Buff, Haze gray, Pastel green, Oxide red, White		
Components	2		
Curing mechanism	Solvent release and chemical reaction between components		
Specific gravity	1.58 g/cm ³		
Volume solids (ISO 3233 modified)	87% ± 3%		
Dry film thickness (per coat)	4-12 mils (100-300 microns) depending on system **		
Coats	1 or 2		
Theoretical coverage per mil (25 microns)	ft ² /gal	m ² /L	
	1395	33.5	
6 mils (150 microns)	233	5.6	
***VOC (EPA 24) mixed	lb/gal	g/L	
	1.2	145	
VOC (EC SED 1999/13/EC)	lb/gal	g/L	g/kg
	1.28	153	102
Temperature resistance	dry		
	°F	°C	
continuous	250	121	
Flash point (SETA)	°F	°C	
Amercoat 240 resin	122	50	
Amercoat 240 cure	138	59	
T-10 Thinner	80	27	
Amercoat 12	2	-17	

Suitable for the following Cargoes:

- Crude Oil
- Fuel Oils
- Sour Crude Oil
- Bunker Oil
- Drilling Mud
- Brine
- Aviation Fuel
- Dry Bulk Commodities
- 50% Sodium Hydroxide
- Seawater
- Fresh Water

Notes:

* Surface discoloration may occur upon exposure to sunlight, elevated temperatures or chemicals. However, this does not impact performance.

** For IMO-MS.C.215(82) (PSPC) a minimum of 6 mils (160 microns) per coat is recommended to achieve the required 320 microns for the total system.

** VOC figures quoted are according to both EPA Method 24 which is practically determined and EC directive 1999/13/EC which is theoretically determined.

Surface Preparation

Coating performance is, in general, proportional to the degree of surface preparation. Abrasive blasting is usually the most effective and economical method. When this is impossible or impractical, Amercoat 240 can be applied over mechanically cleaned surfaces. All surfaces must be clean, dry and free of all contaminants, including salt deposits. Contact PPG for maximum allowable salt containment levels.

Steel—Remove all loose rust, dirt, grease or other contaminants by one of the following depending on the degree of cleanliness required: SSPC-SP2, 3, 6, 7 or 10 (ISO 8501-1 St-2, St-3, Sa 1, Sa 2.5). These minimum surface preparation standards apply to steel that has been previously abrasive blasted. The choice of surface preparation will depend on the system selected and end-use service conditions.

For more severe service and immersion, clean to SSPC-SP10 (ISO 8501-1 Sa 2.5). Blast to achieve an anchor profile of 2-3 mils (50-75 microns) as indicated by a Keane-Tator Surface profile Comparator or Testex Tape. Previously blasted steel may be ultra-high pressure water jetted to NACE No. 5/SSPC-SP 12 WJ-2L. The wet surface can be dried by blowing with dry compressed air giving special attention to horizontal surfaces and recesses.

Pre-primed steelwork —Amercoat 240 can be applied over steelwork shop primed with inorganic zinc silicate. Surfaces must be clean, dry and free of oil, grease, salts and other contamination by detergent washing and high pressure water washing. Specific attention should be paid to removal of white zinc salts. Weld areas, damaged and corroded areas should be blast cleaned to SSPC-SP 6 (ISO 8501-1 Sa 2.5). Overall sweep-blasting may be necessary for widespread breakdown of the zinc silicate shop primer.

Aluminum—Remove oil, grease or soap film with neutral detergent or emulsion cleaner, treat with Alodine® 1200, Alumiprep® or equivalent, or blast lightly with fine abrasive.

Galvanizing—Remove oil or soap film with detergent or emulsion cleaner, then use zinc treatment such as Galvaprep® or equivalent, or blast lightly with fine abrasive.

Concrete—Light abrasive blast per ASTM D4259 to remove all chalk, and surface glaze or laitance. If blasting is not possible, acid etch uncoated concrete per ASTM D4260 to obtain a glaze-free surface with a slightly granular texture. Rinse with clean water and allow to dry thoroughly. After blasting or acid etching, fill all small holes or voids with material such as Amercoat 114A filler compound.

Aged coatings—All surfaces must be clean, dry, tightly bonded and free of all loose paint, corrosion products or chalky residue. Abrade surface, or clean with Prep 88. Amercoat 240 is compatible over most types of properly applied and tightly adhering coatings, however, a test patch is recommended to confirm compatibility.

Repair—Prepare damaged areas to original surface preparation specifications, feathering edges of intact coating. Thoroughly remove dust or abrasive residue before touch-up.

Typical Systems

1 st coat	2 nd Coat	3 rd coat
Amercoat 240	None	None
Amercoat 240	Amercoat® 229 Series, 450 Series, Amershield, PSX® 700	None
Amercoat 240	Amercoat 240	None
Amercoat 240 ‡	Amercoat 240	PPG Antifoulings
Dimetcote® 9 Series,		
Amercoat 68 Series or Dimetcote 302H	Amercoat 240	None
Dimetcote 9 Series, Amercoat 68 Series or Dimetcote 302H	Amercoat 240	450 Series, 229 Series, PSX 700

Tank Coating System—Two coats of Amercoat 240 at 4 to 12 mils (100 to 300 microns) per coat, to give a total of 12-16 mils (300-400 microns) plus stripe coating over sharp edges, cutouts and welds. Use contrasting colors for each coat and stripe coat.

‡ *Outside the U.S., a tiecoat such as Amercoat 71TC is required. In the U.S. tie coats are typically avoided for VOC compliance.*

Application Data

Applied over	Steel, concrete, aluminum, galvanizing
Surface preparation	
Steel	Abrasive blasting, manual preparation or UHP waterjetting SSPC-SP 2, SP 3, SP 7, SP6, SP10 (ISO 8501-1 St-2, St-3, Sa 1, Sa 2, Sa 2.5)
Concrete	ASTM D4259 or 4260
Aluminum	Alodine®, Alumiprep® or light abrasive blast
Galvanizing	Galvaprep® or light abrasive blast
Method	Airless or conventional spray. Brush or roller (may require additional coats).
Mixing ratio (by volume)	4 part resin to 1 part cure
Induction time (minutes)	70°F/21°C 15
Environmental conditions	
air and surface temperature	20° to 122°F (-7° to 50°C)
material temperature	50° to 80°F (10° to 27°C)
Surface temperatures must be at least 5°F (3°C) above dew point to prevent condensation. At freezing temperatures, surface must be free of ice.	
Thinner	T-10
Equipment cleaner	Thinner or Amercoat 12
Pot life	
(including induction time)	°F/°C
	90/32
	40 min.
	80/27
	60 min.
	70/21
	90 min.

Drying time @ 6 mils (150 microns) DFT (hours)

	°F/C				
	90/32	70/21	50/10	32/0	16/-5
dry to touch	3	5	10	24	28
dry hard	6	8	13	30	48

Cure to Immersion* - Tank Lining Service

°F/C (days)	120/49	90/32	70/21	50/10	32/0	20/-7
	2	3	7	7	7	7

* These cure-to-immersion times refer to tanks with forced ventilation. On underwater hull systems with PPG Antifoulings, the vessel can be launched after the specified dry-to-launch period indicated in the application instruction for the antifouling.

Recoat/Topcoat time @ 6 mils (150 microns) DFT

	°F/C				
minimum (hours)	90/32	70/21	50/10	32/0	20/-7
Amercoat 240	3	5	10	24	28
Amercoat 229 Series, 450 Series, PSX 700	4	8	16	36	48

	°F/C				
maximum (months)**	90/32	70/21	50/10	32/0	20/-7
Amercoat 240	6	6	6	6	6
Amercoat 229 Series, 450 Series, PSX 700	3	3	3	3	3

Drying times are dependent on air and surface temperatures as well as film thickness, ventilation and relative humidity. Maximum recoating time is highly dependent upon actual surface temperatures - not simply ambient air temperatures. Surface temperatures should be monitored, especially with sun-exposed or otherwise heated surfaces. Higher surface temperatures shorten the maximum recoat window.

** Surface must be clean and dry. Any contamination must be identified and adequately removed. A detergent wash with Prep 88 or equivalent is required prior to application of topcoats after 30 days of exposure. However particular attention must be paid to surfaces that have been exposed to sunlight and where chalking may be present. In those situations, a further degree of cleaning may be required. PPG Technical Service can advise on suitable cleaning methods. If the maximum recoat/topcoat time is exceeded, then roughen surface.

Requirements for Water Ballast Tanks subject to IMO-MSC.215(82) (PSPC):

- steel; ISO 8501-3:2006 grade P2, with all edges treated to a rounded radius of minimum 2mm or subject to three pass grinding
- steel or steel with not approved zinc silicate shop primer; blast cleaned to ISO-Sa2½, blast profile 30 - 75µm
- steel with approved zinc silicate shop primer, weld seams and areas of damage shop primer or breakdown should be blast cleaned to ISO-Sa2½, blasting profile 30 - 75µm
 - for shop primer with IMO type approval; no additional requirements
 - for shop primer without IMO type approval; blast cleaned to ISO-Sa2 removing at least 70% of intact shop primer, blasting profile 30 - 75µm
- dust quantity rating “1” for dust size class “3”, “4” or “5”, lower dust size classes to be removed if visible on the surface to be coated without magnification (ISO 8502-3:1992)

Application Equipment

The following is a guide; suitable equipment from other manufacturers may be used. Changes in pressure, hose and tip size may be needed for proper spray characteristics.

Airless spray—Standard equipment with pump ratio of 45:1 or larger, with a 0.021- to 0.025-inch fluid tip, ¾"(9mm) ID hose with 50 ft. maximum length. Long hose runs or location of work at heights 20-30 feet (6-9m) higher than the pump location may require higher pump ratios, increase hose diameters or other adjustments. A typical arrangement for shipyard use would include a 68:1 (or higher) pump ratio with ½" (12mm) to ¾"(18mm) fluid hose. Nozzle pressure should be approximately 1800-2300 psi.

Conventional spray—Standard conventional air spray equipment. A moisture and oil equipment trap in the main air supply line, a pressure material pot, and separate regulators for air and fluid pressure are recommended.

Power mixer—Jiffy Mixer powered by an air or explosion-proof electric motor.

Brush or roller—Additional coats may be required to attain proper thickness. (Brushing and rolling typically give about 3 mils [75 microns] dft.)

To obtain the maximum performance, adhere to all application instructions, precautions, conditions and limitations. For conditions outside the requirements or limitations described, contact your PPG representative.

Application Procedure

1. Flush all equipment with thinner or Amercoat® 12 before use. Stir resin using an explosion-proof power mixer to disperse into a homogeneous mixture.
2. Add cure to resin. Mix thoroughly until uniformly blended to a workable consistency.

Induction time (minutes)	70°F/21°C
	15
3. Do not mix more material than can be used within the expected pot life, 1.5 hours at 70°F. Higher material temperatures will shorten the pot life considerably.
4. For optimum application, material should be between 50° to 90°F (10° to 32°C).
5. Use only T-10 thinner at 10% by volume, maximum.
6. Below 50°F additional thinning may be needed and multiple coats required to achieve specified thickness.
7. To minimize orange peel appearance, adjust conventional spray equipment to obtain adequate atomization at lowest air pressure.
8. Apply a wet coat in even, parallel passes with 50 percent overlap to avoid holidays, bare areas and pinholes. If required, cross spray at right angles.
9. When applying directly over inorganic-zincs or zinc-rich primers, a mist coat/full coat technique may be required to minimize bubbling. This will depend on the age of the primer, surface roughness and conditions during curing.
10. Ventilate confined areas with clean air during application, between coats, and while curing the final coat. Prevent moisture condensation on the surface between coats.
11. Repair damaged areas by brush or spray.
12. Clean equipment with thinner or Amercoat 12 immediately after use.

Note: Consult Code of Federal Regulations Title 29, Labor, parts 1910 and 1915 concerning occupational safety and health standards and regulations, as well as any other applicable federal, state and local regulations on safe practices in coating operations.

For compliance with IMO standard for Ballast Tank Coatings, please refer to the project Ballast Tank Coatings Specification.

Shipping Data

Packaging unit-US	1 gal lbs/kg	5 gal lbs/kg
Shipping weight (approx.)		
1-gal unit		
240 resin	11.8/5.4	5.4/2.45
240 cure	2.0/0.9	0.9/0.41
5-gal unit		
240 resin	59.0/26.80	26.8/12.20
240 cure	9.1/4.10	4.1/1.86
Packaging unit-European manufacture		
20 L unit	kg/lbs.	
240 resin (16 L)	28.2/62.0	
240 cure (4 L)	7.2/15.8	

Shelf life when stored indoors at 40° to 100°F (4° to 38°C)
resin and cure 3 years from date of
manufacture.

Numerical values are subject to normal manufacturing tolerances, color and testing variances. Allow for application losses and surface irregularities.

This mixed product is photochemically reactive as defined by the South Coast Air Quality Management District's Rule 102 or equivalent regulations.

Safety Precautions

Read each component's material safety data sheet before use. Mixed material has hazards of both components. Safety precautions must be strictly followed during storage, handling, and use.

Caution – Improper use and handling of this product can be hazardous to health and cause fire or explosion.

Do not use this product without first taking all appropriate safety measures to prevent property damage and injuries. These measures may include, without limitation: implementation of proper ventilation, use of proper lamps, wearing of proper protective clothing and masks, tenting and proper separation of application areas. Consult your supervisor. Proper ventilation and protective measures must be provided during application and drying to keep solvent vapor concentrations within safe limits and to protect against toxic hazards. Necessary safety equipment must be used and ventilation requirements carefully observed, especially in confined or enclosed spaces, such as tank interiors and buildings.

This product is to be used by those knowledgeable about proper application methods. PPG makes no recommendation about the types of safety measures that may need to be adopted because these depend on application and space, of which PPG is unaware and over which it has no control.

If you do not fully understand the warnings and instructions or if you cannot strictly comply with them, do not use the product.

This product is for industrial use only. Not for residential use in California.



**PPG Protective &
Marine Coatings**

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Surface Preparation

Coating performance is, in general, proportional to the degree of surface preparation. All surfaces must be clean, dry and free of oil, grease, dirt, salt deposits or other contamination.

1. To provide a smooth appearance to the Amershield coating Amercoat® 851, flow control additive may be used. See Amercoat 851 Product Data Sheet for more information.
2. For faster drying at low temperatures, Amercoat 866M can be used with all Amershield products.

Steel – Mill scale and rust must be removed. Abrasive blast hot-rolled steel to SSPC-SP6 and rusted and pitted steel to SSPC-SP10. Clean cold-rolled steel to SSPC-SP1 using vapor degreasing or solvent emulsion to remove all oil, grease and contamination. Solvent wipe is not satisfactory. Contact Ameron for compatible phosphate surface treatments.

Aluminum – Remove oil, grease or soap film with neutral detergent or emulsion cleaner; treat with Alodine® 1200 or Alumiprep® or blast lightly with fine abrasive.

Galvanizing – Remove oil or soap film with neutral detergent or emulsion cleaner; treat with Galvaprep® Amchem Products or blast lightly with fine abrasive.

Amercoat 68HS – Wash off water soluble contaminants; remove oil, grease, etc., with a neutral detergent or emulsion cleaner. Solvent wipe is not satisfactory.

Concrete – Clean concrete and masonry surfaces, abrasive blast (ASTM D4259) or acid etch (ASTM D4260). Fill concrete voids with Nu-Klad® 114A or 965. Fill masonry block with Amerlock® 400BF block filler.

Coated surface – Clean by low pressure water cleaning (1000 psi or greater) water blast, abrasive blast (SSPC-SP7), solvent emulsion cleaning (SSPC-SP1) or power tool cleaning (SSPC-SP3). Surface must be clean, dry and free of oil, grease, dirt or other contamination. Apply test patch to confirm compatibility and adhesion.

Application Equipment

Power mixer – Jiffy mixer powered by an air or explosion-proof electric motor.

Airless and electrostatic spray – Standard equipment Graco, DeVilbiss, Nordson-Bede, Speeflo or others having a 28:1 or higher pump ratio and a fluid tip with a 0.015- to 0.021-inch (0.38- to 0.53-mm) orifice.

Conventional, air-assisted airless and electrostatic spray – Devilbiss, Binks or Graco production spray equipment with moisture and oil trap in the main air supply line.

Brush – Natural bristle. Maintain a wet edge.

Roller – Solvent resistant. Level any air bubbles with a bristle brush.

When brush or roller applied, multiple coats may be needed to achieve dry film thickness.

Application Procedures

1. Flush equipment with thinner or Amercoat 12.
2. Stir resin thoroughly, add cure and mix until uniform. Do not mix more material than will be used within pot life time. Mixing ratio is 4 parts resin to 1 part cure by volume.

Pot life (hours)	°F/°C			
	90/32	70/21	50/10	32/0
Amershield	1½	2½	5	-
Amershield with 866M	½	1	2	4

3. If thinning is necessary, add up to 1 pint Amercoat 65 per gallon of Amershield .

4. When applying by spray, adjust pressures for equipment configuration and environmental conditions to ensure proper atomization.

5. Apply a wet coat in even, parallel passes; overlap each pass 50 percent.

Drying time (ASTM D1640) (hours)	°F/°C			
	90/32	70/21	50/10	32/0
touch	1	2½	4	-
with 866M	½	¾	1	2½
through	5	10	72	-
with 866M	2	3	6	10

Using ½ pt Amercoat 866M per 5 gal Amershield

Recoat time (hours)	°F/°C				
	90/32	80/26	70/21	50/10	32/0
minimum	4	5½	8	48	-
with 866M	1½	1¾	2	4	8
maximum	12	24	168	168	-
with 866M	6	8	12	24	48

Roughen surface or use Amerase™ if maximum recoat time is exceeded.

Note: When applying directly over organic zinc at full thickness, bubbling may occur. A mist coat/full coat technique may be required to prevent application bubbling.

6. For colors, application of 8-mil wet film thickness (thinned) will normally provide 5-mil dry film thickness, Clear coat at 5-mils WFT will normally provide 3-mil DFT.

7. Clean all equipment with thinner or Amercoat 12 immediately after use.

Note: Moisture sensitive – Keep cure container tightly closed. Repeated moisture exposure will cause gellation and gassing; handle bulged containers with caution, lids may eject forcibly.

Repair

Spot blast or power tool clean bare substrate to the requirements shown under surface preparation. Feather edges of intact coating. Remove dust, dirt and contamination before recoating.

Shipping Data

Packaging units	1 gal	5 gal
cure	0.20 gal in 1-qt can	1 gal in 1-gal can
resin	0.80 gal in 1-gal can	4 gal in 5-gal can
Shipping weight (approx)	lb	kg
1-gal unit		
cure	2.2	1.0
resin	11.0	5.0
5-gal unit		
cure	10.4	4.7
resin	55.0	25.0
Shelf life when stored indoors at 40 to 100°F (4 to 38°C)		
resin	1 year from shipment date	
cure	1 year from manufacturer date	

Numerical values are subject to normal manufacturing tolerances, colors and testing variances. Appearance will vary depending on substrate and application method. Allow for application losses and surface irregularities. See application instructions for complete information and safety precautions.

This mixed product is nonphotochemically reactive as defined by the South Coast Air Quality Management District's Rule 102 or equivalent regulations.

Safety Precautions

Read each component's material safety data sheet before use. Mixed material has hazards of both components. Safety precautions must be strictly followed during storage, handling and use.

Limitation of Liability

Ameron's liability on any claim of any kind, including claims based upon Ameron's negligence or strict liability, for any loss or damage arising out of, connected with, or resulting from the use of the products, shall in no case exceed the purchase price allocable to the products or part thereof which give rise to the claim. **In no event shall Ameron be liable for consequential or incidental damages.**

Due to Ameron's policy of continuous product improvement, the information contained in this Product Data/Application Instructions sheet is subject to change without notice. It is the Buyer's responsibility to check that this issue is current prior to using the product. For the most up-to-date Product Data/Application Instructions always refer to the Ameron International Performance Coatings & Finishes website at www.ameroncoatings.com.

Warranty

Ameron warrants its products to be free from defects in material and workmanship. Ameron's sole obligation and Buyer's exclusive remedy in connection with the products shall be limited, at Ameron's option, to either replacement of products not conforming to this Warranty or credit to Buyer's account in the invoiced amount of the nonconforming products. Any claim under this Warranty must be made by Buyer to Ameron in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life, or one year from the delivery date, whichever is earlier. Buyer's failure to notify Ameron of such nonconformance as required herein shall bar Buyer from recovery under this Warranty.

Ameron makes no other warranties concerning the product. No other warranties, whether express, implied, or statutory, such as warranties of merchantability or fitness for a particular purpose, shall apply. In no event shall Ameron be liable for consequential or incidental damages.

Any recommendation or suggestion relating to the use of products made by Ameron, whether in its technical literature, or in response to specific inquiry, or otherwise, is based on data believed to be reliable; however, the products and information are intended for use by Buyers having requisite skill and know-how in the industry, and therefore it is for Buyer to satisfy itself of the suitability of the products for its own particular use and it shall be deemed that Buyer has done so, at its sole discretion and risk. Variation in environment, changes in procedures of use, or extrapolation of data may cause unsatisfactory results.



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AMERSHIELD

General air quality

Area should be sheltered from airborne particulates and pollutants. Ensure good ventilation during application and curing. Provide shelter to prevent wind from affecting spray patterns.

INSTRUCTIONS FOR USE

Mixing ratio by volume

4 parts base to 1 part hardener

Pre-mix base component with a pneumatic air mixer at moderate speeds to homogenize the container. Add hardener to base and agitate with a power mixer for 1-2 minutes until completely dispersed

Pot life

Temperature	50°F	70°F	90°F
Amershield	5 hours	2.5 hours	1.5 hours
Amershield with 866M accelerator	2 hours	1 hours	30 minutes

Airless spray

28:1 pump or larger, 0.013-0.015 fluid tip
Can be applied with plural component equipment

Air spray

Thin up to 20%, standard conventional equipment, 0.070" fluid orifice. A moisture and oil trap in the main line is essential. Product is sensitive to moisture contamination.

Brush & roll

Use a high quality natural bristle brush and / or solvent resistant, 1/4" or 3/8" nap roller. Ensure brush / roller is well loaded to avoid air entrainment. Multiple coats may be necessary to achieve adequate film build. *Amercoat* 851 flow control additive can be used to for enhanced flow and leveling with brush and roll application. Multiple coats may be required to achieve proper film build and hiding with roller application.

Thinner

Amercoat 923, *Amercoat* 65 (xylene), *Amercoat* 101 (recommended for > 90 °F), *Amercoat* 911

Cleaning solvent

Amercoat 12 Cleaner or *Amercoat* 65 thinner (xylene)

Primers

Amercoat 68HS, *Amercoat* 68MCZ, *Amercoat* 370, *Amercoat* 385, *Amercoat* 399, *Amerlock* 21400, *Pittguard* Epoxies, *Amercoat* 435, *Amercoat* 256

Safety precautions

For paint and recommended thinners see safety sheet 1430, 1431 and relevant material safety data sheets

This is a solvent borne paint and care should be taken to avoid inhalation of spray mist or vapor as well as contact between the wet paint and exposed skin or eyes.

DRY/CURE TIMES

Amershield @ 5 mils dft

	40°F	50°F	70°F	90°F
Dry to touch	8 hours	4 hours	2.5 hours	1 hour
Dry through	5 days	72 hours	10 hours	5 hours
Dry to recoat	72 hours	48 hours	8 hours	4 hours
Maximum recoat	168 hours	168 hours	96 hours	12 hours

Amershield with 866M Accelerator @ 5 mils dft

	20°F	32°F	50°F	70°F	90°F
Dry to touch	8 hours	4 hours	75 minutes	25 minutes	10 minutes
Dry through	16 hours	10 hours	6 hours	3 hours	2 hours
Dry to recoat	16 hours	8 hours	4 hours	2 hours	1.5 hours
Maximum recoat	96 hours	48 hours	24 hours	12 hours	6 hours

AMERSHIELD

- PRODUCT QUALIFICATIONS**
- Compliant with USDA Incidental Food Contact Requirements
 - Nuclear Service Level 2
 - NFPA Class A Flame Spread

AVAILABILITY

Packaging Available in 1-gallon and 5-gallon kits
 1-gallon kits have 0.8 gallons of base and 0.2 gallons of hardener
 5-gallon kits have 4 gallons of base and 1 gallon of hardener

Product codes	AM -3	White base
	AM -9	Black base
	AM -T1	Deep Tint base
	AM -T2	Light Tint base
	AM -T3	Neutral Tint base
	AM -T4	Red Tint base
	AM -T5	High Hiding Yellow Tint base
	AM -71	Safety Red base
	AM-81	Safety Yellow base
	AM-23	Pearl Gray base
	AM -B	Hardener (Part B)

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

WARRANTY STATEMENT

PPG warrants (i) its title to the products, (ii) that the quality of the product(s) conform to PPG's specifications for such products in effect at the time of manufacture and (iii) that the products shall be delivered free of the rightful claim of any third person for infringement of any U.S. patent covering the products. THESE ARE THE ONLY WARRANTIES PPG MAKES AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, UNDER STATUTE OR ARISING OTHERWISE IN LAW, FROM A COURSE OF DEALING OR USAGE OF TRADE, INCLUDING WITHOUT LIMITATION, ANY OTHER WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR USE, ARE DISCLAIMED BY PPG.

The information in this data sheet is based upon laboratory tests PPG believes to be accurate and is intended for guidance only. PPG may modify the information contained herein at any time as a result of practical experience and continuous product development. All recommendations or suggestions relating to the use of PPG products, whether in technical documentation, or in response to a specific inquiry, or otherwise, are based on data, which to the best of PPG's knowledge, are reliable. The products and information are designed for users having the requisite knowledge and industrial skills and it is the end-user's responsibility to determine the suitability of the product for its intended use.

PPG has no control over either the quality or condition of the substrate, or the many factors affecting the use and application of the product. Therefore, PPG does not accept any liability arising from loss, injury or damage resulting from such use or the contents of this data sheet (unless there are written agreements stating otherwise).

This data sheet supersedes all previous versions and it is the user's responsibility to ensure that this data sheet is current prior to using the product. The English text of this document shall prevail over any translation thereof.

LIMITATION OF LIABILITY

The information in this data sheet is based upon laboratory tests we believe to be accurate and is intended for guidance only. All recommendations or suggestions relating to the use of the products made by PPG Protective & Marine Coatings, whether in technical documentation, or in response to a specific enquiry, or otherwise, are based on data which to the best of our knowledge are reliable. The products and information are designed for users having the requisite knowledge and industrial skills and it is the end-user's responsibility to determine the suitability of the product for its intended use.

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The data contained herein are liable to modification as a result of practical experience and continuous product development.

This data sheet replaces and annuls all previous issues and it is therefore the user's responsibility to ensure that this sheet is current prior to using the product. The current data sheets are maintained at www.ppgpmc.com

The English text of this document shall prevail over any translation thereof.

Competitive Product Equivalents Devoe Coatings vs. Ameron

<u>Code</u>	<u>Devoe Coatings Product</u>	<u>Ameron</u>
5A	Devtar 5A Epoxy High Build Coating	Amercoat 78HB
88	Devprep 88 Water Based Alkaline Cleaner	Prep 88
99	Devclean 99 Graffiti Cleaner	Amerase
108	Devmat 100% Solids Epoxy Tank Lining	Amercoat 133/333, 351
109	Devmat 109 Epoxy Holding Primer	Amercoat 91
110	Devmat 110 100% Solids Epoxy Tank Coating	none at present
111	Devmat 111 100% Solids Epoxy Tank Coating	consider Amercoat 351
112	Devmat 112 100% Solids Epoxy Coating	none at present
122	Devran 122 100% Solids Multi-Purpose Floor Coating	Nu-Klad 120A
124	Devran 124 Chemical Resistant Floor Coating	Nu-Klad 103N
126	Devran 126 100% Solids Clear Epoxy Coating	Nu-Klad 127
133	Devran 133 100% Solids Epoxy Tank Coating	Amercoat 133/333, 351
140	Devran 140 Epoxy Repair Compound	consider Nu-Klad 114A
142C	Devmat 142C 100% Solids Epoxy Amine Caulk	consider Nu-Klad 114A
142HB	Devmat 142HB Epoxy Caulk	consider Nu-Klad 114A
144	Devmat 144 100% Solids Sprayable Epoxy Caulk	none
150	Devran 150 100% Solids Plural Component Epoxy	Amercoat 428PCLO
167	Pre-Prime 167 Rust Penetrating Sealer	Amerlock Sealer
168LTC	Pre-Prime 168 Low Temperature Cure Rust Penetrating Sealer	none
182	Devclad 182 Splash Zone Barrier Coating	Tideguard 182
189	Devgrip 189 Abrasion Resistant Solvent Free Epoxy	Amercoat 351
201	Devran 201 Polyamide Epoxy Exterior Primer	Amercoat 385
205	Devran 205 Universal Epoxy Primer	Amerlock 2/400 or 240
220	Devran 220MX Heavy Duty MIO Epoxy Coating	Amercoat 385PA red
220MX	Devran 220MX Heavy Duty MIO Epoxy Coating	Amercoat 385PA red
224HS	Devran 224HS High Build Epoxy Coating	Amerlock 2/400
229 H	Devran 229 Acrylic Epoxy Gloss Coating	Amercoat 229T
231	Bar-Rust 231 Multi-Purpose Epoxy Mastic	Amercoat 240
232	Devran 232 Heavy Duty Epoxy Coating	
233 H	Bar-Rust 233 H Multi-Purpose Epoxy Coating	Amerlock 2/400 or 240
235	Bar-Rust 235 Multi-Purpose Epoxy Coating	Amercoat 235
236K	Bar-Rust 236K Multi-Purpose Epoxy Coating	Amercoat 240
237C	Devgrip 237C Epoxy Non-Skid Coating	
237M	Devgrip 237M Epoxy Heavy Duty Non-Skid Coating	Amercoat 237M
238	Devgrip 238 Abrasion Resistant Solvent Free Epoxy	Amercoat 238
239	Bar-Rust 239 Epoxy Mastic	
247	Devtar 247 High Build Epoxy Mastic	
250	Devran 250 Direct To Metal Gloss Epoxy	
253	Devchem 253 Chemical Resistant Lining	Amercoat 253
253 KC	Devchem 253KC Chemical Resistant Lining	Amercoat 253
253 KS	Devchem 253 KS Chemical Resistant Lining	Amercoat 253

Competitive Product Equivalents Devoe Coatings vs. Ameron

Code	Devoe Coatings Product	Ameron
253 S	Devchem 253 S Sulfur Resistant Lining	Amercoat 253
256	Devchem 256 Chemical Resistant Lining	Amercoat 253
257	Devchem 257 Chemical Resistant Lining	Amercoat 253
261QC	Devran 261QC Low Temperature Cure Epoxy	Amercoat 370
265BHF	Devran 265BHF VOC Compliant Epoxy Block Filler	Amerlock 400 BF
302	Catha-Coat 302 Reinforced Inorganic Zinc Primer	Dimetcote 302H
302H	Catha-Coat 302H Reinforced Inorganic Zinc Primer	Dimetcote 302H
302HA	Catha-Coat 302 HA Reinforced Inorganic Zinc Primer	Dimetcote 302H
303H	Catha-Coat 303H Zinc Rich Epoxy Primer	Amercoat 68HS
304	Catha-Coat 304 Alkyl Silicate Inorganic Zinc Coating	Dimetcote 9
304H	Catha-Coat 304 H Alkyl Silicate Inorganic Zinc Coating	Dimetcote 9H
304V	Catha-Coat 304 V Alkyl Silicate Inorganic Zinc Coating	Dimetcote 9H
305	Catha-Coat 305 Water Based Inorganic Zinc Coating	Dimetcote 21-5
313	Catha-Coat 313 Organic Zinc Rich Epoxy Primer	Amercoat 68HS
315	Catha-Coat 315 Organic Zinc Rich Epoxy Primer	Amercoat 68HS
315 HA	Catha-Coat 315 HA Organic Zinc Rich Epoxy Primer	Amercoat 68HS
315 HB	Catha-Coat 315 HB Organic Zinc Rich Epoxy Primer	Amercoat 68HS
359	Devthane 359 High Build Gloss Aliphatic Urethane	Amershield
369	Devthane 369 Aliphatic Urethane Gloss Enamel	Amercoat 450H
378	Devthane 378 Aliphatic Urethane Semi-Gloss Enamel	Amercoat 450HSG
379 UA	Devthane 379 Aliphatic Urethane Gloss Enamel	Amercoat 450H
389	Devthane 389 Aliphatic Urethane Gloss Enamel	Amercoat 450H
430	Devguard 430 LOW VOC DTM Gloss Alkyd Enamel	Amercoat 5450
475	Devshield 475 Silicone Alkyd Gloss Enamel	Amercoat 5410 (GL)
495	Devplate 495 Vinyl Ester Epoxy	none
500	Hydro Strip 500 Paint Stripper	none
502	Hydro Strip 502 Paint Stripper	none
502	Devfloor 502 100% Solids Power Trowel Primer	Nu-Klad 127
503	Hydro Strip 503 Paint Stripper	none
504	Hydro Plus 504 Graffiti Remover	Amerase
505	Devfloor 505 Water-Based Epoxy Primer/Sealer	Nu-Klad 128
510	Devfloor 510 High Solids Epoxy Coating	Nu-Klad 126
514	Devfloor 514 100% Solids Clear Epoxy Coating	Nu-Klad 126 Clear
515	Devfloor 515 Epoxy Mortar Patch Kit	Nu-Klad 114A
516	Devfloor 516 Power Trowel 1/4" Topping	Nu-Klad 110C
517	Devfloor 517 100% Solids Epoxy Grout Coating	Nu-Klad 126
518	Devfloor 518 100% Solids Epoxy Texture Coat	broadcast aggregate
519	Devfloor 519 Epoxy Crack Filler	Nu-Klad 114A
522	Devfloor 522 3-Pack Epoxy Slurry System	consider Nu-Klad 120A
526	Devfloor 526 High Solids Epoxy Primer	Amerlock 2/400
527	Devfloor 100% Solids Epoxy Floor Coating	Nu-Klad 126

Competitive Product Equivalents Devoe Coatings vs. Ameron

Code	Devoe Coatings Product	Ameron
528	Devfloor 527 Epoxy "Oil-Stop" Primer	Amerlock Sealer
529	Devfloor 529 Urethane Epoxy Flexible Joint Filler	Nu-Klad 750A
550	Devchem 550 Heat-Cured Phenolic Coating	consider PSX-758
561	Devfloor 561 High Wear Urethane Floor Coating	PSX-700 or Amershield
562	Devfloor 562 Polyester Urethane Finish	Amershield
562 Clear	Devfloor 562 Clear Polyester Urethane Finish	Amershield Clear or 700A
563	Clear Waterborne Aliphatic Polyester Urethane Sealer/Finish	none
564	Devfloor 564 High Solids Polyester Urethane Finish	Amershield or PSX-700
565	Devfloor 565 Clear Polyester Urethane Finish	Amershield Clear or 700A
720	Devran 720 Two-Part WB Epoxy Pre-Construction Primer	Amercoat 3207
724	Devran 724 Gloss Epoxy Coating	none
744	Devran 744 Epoxy Tank Lining	240, 90HS or 395FD
755	Devchem 755 FDA Epoxy Lining	Amercoat 395FD
4000	Bloxfil 4000 Interior/Exterior HD Acrylic Block Filler	Amercoat 147
4010	Tru-Glaze 4010 Waterproofing Base Coat & Filler	consider Nu-Klad 114A
4020	Devflex 4020 DTM Flat Interior/Exterior Waterborne Primer	consider Amercoat 335
4030	Tru-Glaze-WB 4030 Waterborne Epoxy Primer	
4100	Devguard 4100 Alkyd Metal Primer	
4110	Speedname 4110 Q.D. Primer (4397)	
4120	All Purpose Metal & Galvanized Metal Primer	
4130	Devshield 4130 Rust Penetrating Metal Primer	Amerlock Sealer
4140	Rustguard 4140 Q.D. Shop Coat Primer	
4150	Rustguard 4150 Low VOC Shop Coat Primer	
4160	Multi-Purpose Tank & Structural Primer	
4165	Universal Metal Primer	
4180	Low VOC Alkyd Metal Primer	
4205	Devflex Interior/Exterior Latex Semi-Gloss Enamel	
4206	Devflex Interior/Exterior Acrylic Semi-Gloss Enamel	
4207	Devflex Waterborne Retarding Additive	none
4208	Devflex Interior/Exterior Waterborne Acrylic Gloss Enamel	
4300	Devguard 4300 Alkyd Industrial Flat Black Coating	
4308	Devguard Alkyd Industrial Gloss Enamel	Amercoat 5450
4318	Speedname 4318 Q. D. Gloss Enamel (4300)	
4328	Devshield Interior/Exterior Urethane Alkyd Gloss Enamel	none
4328-9020	Devshield 4328 Pure Aluminum Finish	
4348	Devguard Low VOC Alkyd Industrial Gloss Enamel	
4380	Uni-Grip 380 Modified Epoxy Flat Dry Fog Primer & Finish	
4382	Uni-Grip 4382 Modified Epoxy Eggshell Dry Fog Primer/Finish	
4406	Tru-Glaze-WB 4406 Waterborne Epoxy Semi-Gloss Coating	
4408	Tru-Glaze-WB 4408 Waterborne Epoxy Gloss Coating	Amercoat 335
4418	Tru-Glaze 4418 Waterborne Acrylic Epoxy Coating	Amercoat 335

Competitive Product Equivalents Devoe Coatings vs. Ameron

Code	Devoe Coatings Product	Ameron
4508	Tru-Glaze 4508 Chemical Resistant Epoxy Coating	
AS-75	Anti-Slip Floor & Deck Coating	
AS-150	Devran 150 Non-Slip Floor & Deck Coating	
AS-175	Non-Slip Floor & Deck Coating	
AS-250	Non-Slip Floor & Deck Coating	
AS-550	Non-Slip Floor & Deck Coating	
AS-2500	100% Solids Epoxy Non-Slip Floor Coating	Amercoat 136
HMP 771	Underwater Hull Coating	Amercoat 771
HT-10	HT-10 Modified Silicone High Heat Coating	Amercoat 3279
HT-12	HT-12 High Heat Silicone Coating	
HT-4	HT-4 Heat Resistant Silicone Acrylic	Amercoat 874HS
HT-403	HT-403 Heat Resistant Epoxy Coating	
HT-8	HT-8 Heat Resistant Modified Silicone Zinc	Amercoat 872

Terminator™ DP

Power Connection Kit

INSTALLATION PROCEDURES

For Power Connection, In-Line Splice Connection,
T-Splice Connection, or End Termination Applications



The Heat Tracing Specialists®

Terminator™ DP

The following installation procedures are suggested guidelines for the installation of termination connection systems. They are not intended to preclude the use of other methods and good engineering or field construction practices.

Receiving, Storing and Handling . . .

1. Inspect materials for damage incurred during shipping.
2. Report damages to the carrier for settlement.
3. Identify parts against the packing list to ensure the proper type and quantity has been received.

Kit Contents . . .



Item	Quantity	Description
1	1	Expediter Assembly Support Cap with O-Ring Threaded Grommet Compressor Support Base with O-Ring
2	1	Junction Box Lid
3	1	Junction Box Base with O-Ring
4	1	Nut
5	1	Banding
6	1	Banding Guide
7	1	Terminal Blocks with DIN Rail (22-8 AWG, 600 Vac, 50 Amp)
8	1	Junction Box Cord

Certifications/Approvals . . .



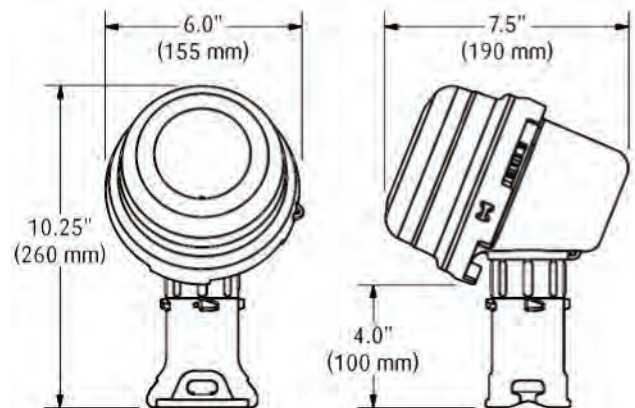
IP66 NEMA/Type 4X $-60^{\circ}\text{C} \leq T_a \leq +55^{\circ}\text{C}$
 Ordinary & Hazardous Locations
 Class I, Division 2, Groups A, B, C, & D, Zone 2 IIC
 Class II, Division 2, Groups F & G, Class III
 Listed Heat Tracing Cable System 137M



Tools Required . . .



Dimensions . . .



Installation Precautions . . .

- To minimize the potential for arcing and fire caused by product damage or improper installation use ground-fault protection. The National Electrical Code (NEC) and Canadian Electrical Code (CEC) require ground-fault protection of equipment for each branch circuit supplying electric heat tracing.
- Installation must comply with Thermon requirements and be installed in accordance with the NEC, CEC, or any other applicable national and local codes.
- Component approvals and performance ratings are based on the use of Thermon specified parts only. User supplied power connection fittings must be listed or certified for intended use.
- De-energize all power sources before opening enclosure.
- Keep ends of heating cable and kit components dry before and during installation.

Order Separately . . .

PETK Power and End Termination Kits (per cable)

PETK-1D for BSX, RSX, TSX, VSX

PETK-2D for KSX, HTSX

PETK-3D for HPT, FP

①



③



⑤



②



④

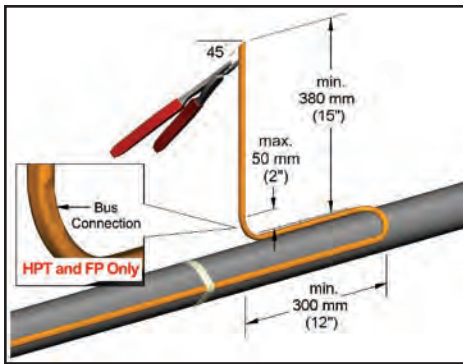


⑥

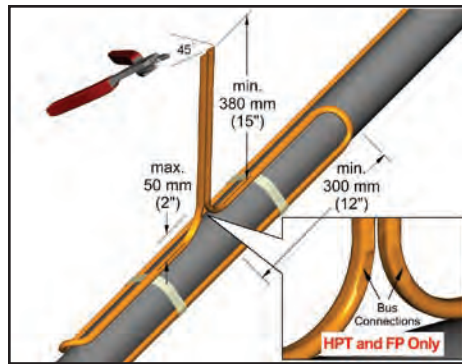


Item	Quantity	Description
1	1	RTV Tube
2	1	Power Connection Boot
3	1	End Cap
4	1	Tape Strip Teflon 6" (PETK-3D only)
5	1	End Termination Caution Label
6	1	GRW-G Grommet (PETK-3D only)

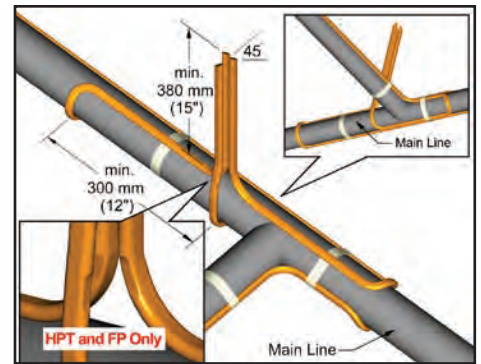
Terminator™ DP



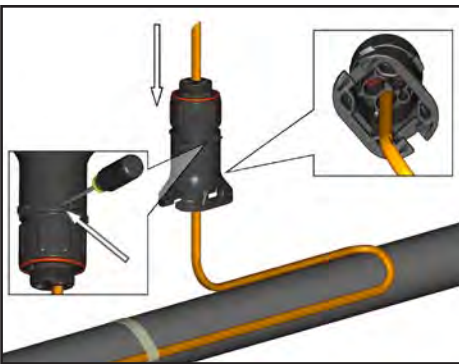
1a. For one, two or three cables. Locate bus connection (HPT and FP only) and cable as shown. Cut end of cable at angle to aid in piercing grommet. Leave additional cable for expansion loop.



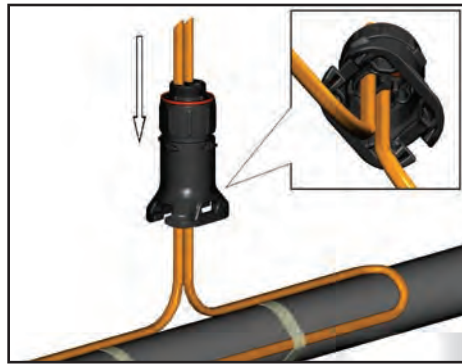
1b. Two cables.



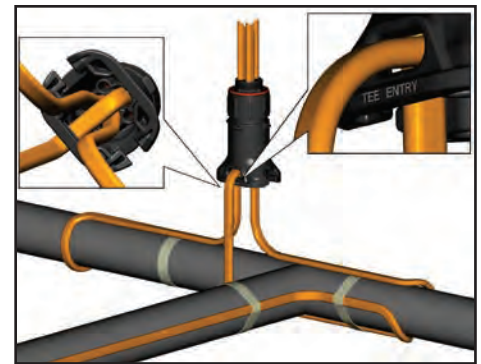
1c. Three cables.



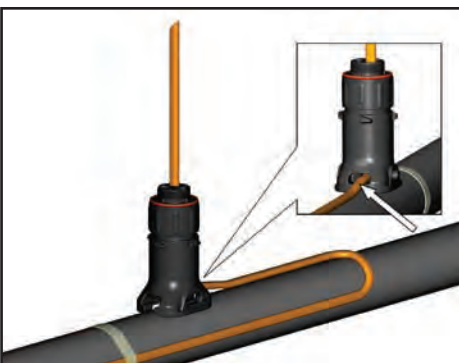
2a. For one, two or three cables. Insert cable into expediter. If mounted on bottom of pipe, punch out weep hole.



2b. Two cables.



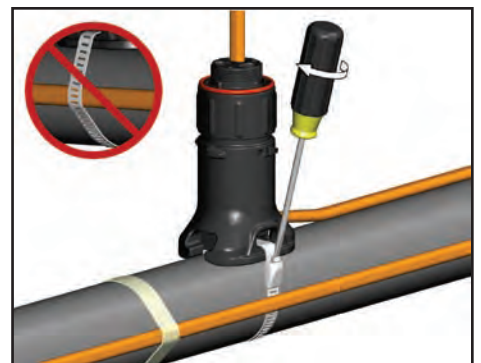
2c. Three cables.



3. Slide expediter toward pipe and route cable through support base entry.



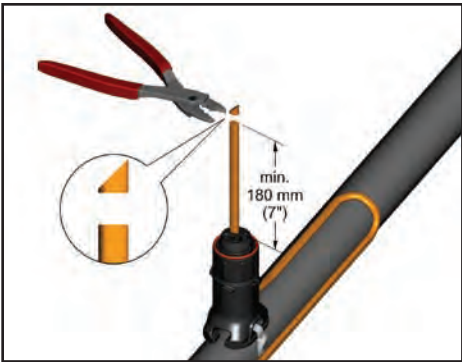
4. Insert banding guide into expediter and snap into place.



5. Mount expediter to pipe using pipe band. Do not band over cable.



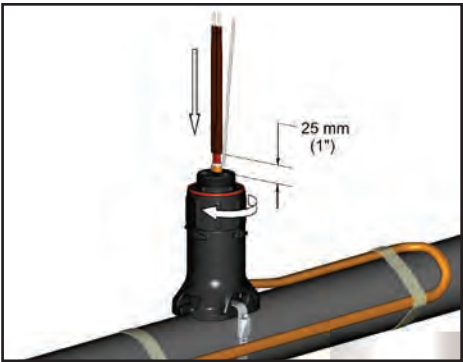
INSTALLATION PROCEDURES



6. Cut off end of cable.



7. Terminate cable with appropriate PETK termination kit. Refer to PETK installation instructions.



8. Push excess cable back through expediter. Tighten cap securely. Tape cable expansion loop to pipe.



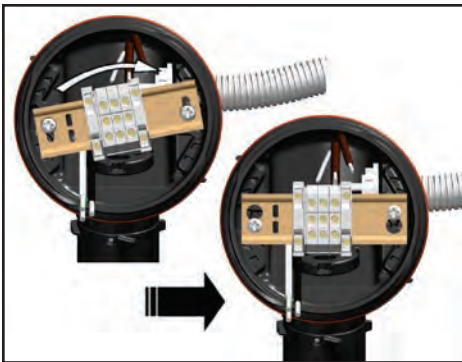
9. For power connection applications: Use dimple molded into side of junction box base to locate center of hole, drill for user supplied power connection fittings per manufacturer's recommendations.



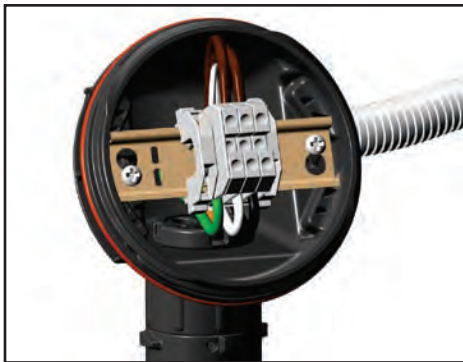
10. Mount junction box base on expediter. Make sure to align slots to properly orient junction box base. Tighten nut securely.



11. For power connection applications: Install power connection fittings (user supplied) and pull in power and ground wires.



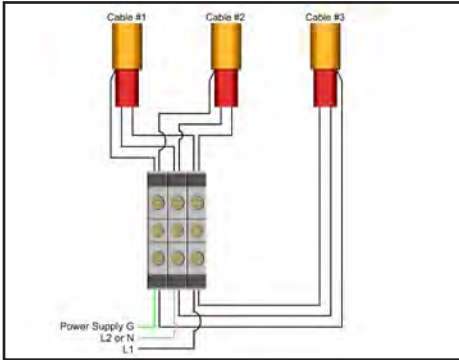
12. Install quick mount terminal blocks.



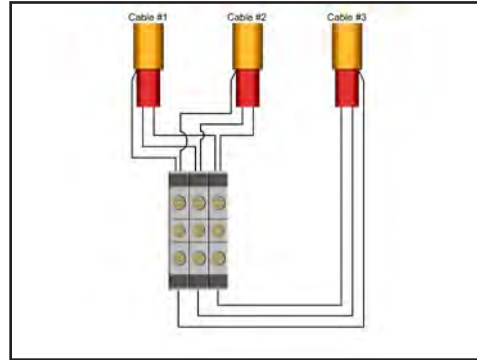
13. Complete system wiring. Refer to typical wiring details.

Terminator™ DP

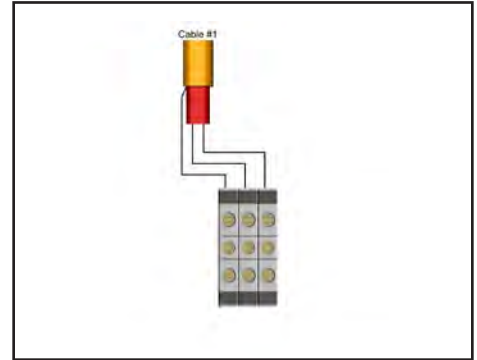
Typical Wiring Details



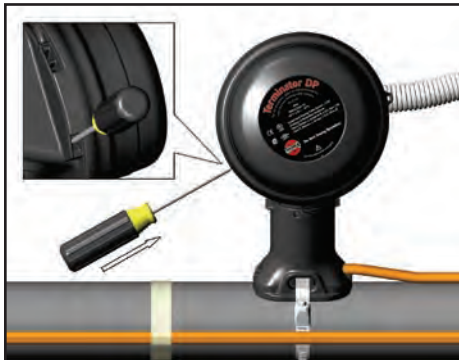
Power Connection (1 to 3 Cables). For 3 cable power connections, additional terminal blocks will be required when using 10mm² (#8 AWG) power supply wiring.



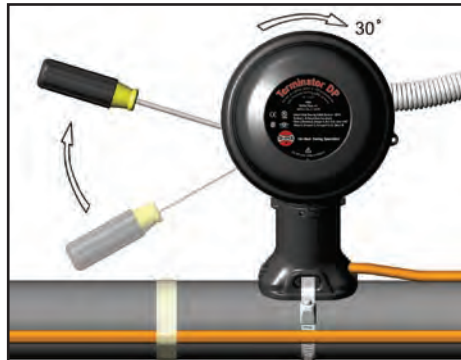
In-Line Splice and T-Splice



End Termination (1 Cable Only)



13. Install junction box lid and twist hand tight. Insert screwdriver into ratchet slots located on side of junction box base.



14. Use screwdriver to ratchet on junction box lid. Lid will rotate 30 degrees.



15. Lid latch mechanism fully engaged. To remove lid, repeat steps 13 and 14 but in the opposite direction.



INSTALLATION PROCEDURES



ISO 9001
REGISTERED

THERMON . . . The Heat Tracing Specialists®

100 Thermon Dr. • PO Box 609 • San Marcos, TX 78667-0609
Phone: 512-396-5801 • Facsimile: 512-396-3627 • **1-800-820-HEAT**
www.thermon.com In Canada call **1-800-563-8461**

Specifications and information are subject to change without notice.

RTD-100

Temperature Sensor

Product Specifications

Application . . .

Electric Heat Tracing Control

The RTD-100 is designed for use as control input for freeze protection and temperature maintenance applications requiring pipewall or tankwall temperature sensing.

A cast-aluminum NEMA 4/7 enclosure and terminal block allows ease of wiring into a single unit that can be installed directly onto a heat traced pipe. The RTD-100 housing and mounting pad are stainless steel.

The RTD-100 is suitable for use in heat tracing applications where surface temperatures do not exceed 900°F (482°C).

Ratings/Specifications . . .

Electrical connectionceramic strip w/brass terminals
 Enclosure rating.....NEMA 4/7
 Enclosure hub size..... 3/4" NPT female hub
 RTD leads.....22 AWG fiberglass
 RTD type.....3-wire platinum thin film
 RTD resistance..... 100 ohms at 32° (0°C)
 RTD calibration

Per ASTM E1137, DIN standard 43760/BS1904/IEC 751
 Temperature coefficient.....00385 Ohms/Ohms - °C
 Maximum sensor temperature..... 900°F (482°C)
 Sensor housing material316 stainless steel

Note . . .

1. For additional options or enclosure materials contact Thermon.



Construction . . .

- 1 Junction Box With Terminal Strip
- 2 RTD Housing
- 3 Pipe Strap (purchased separately)
 - B4 = pipe dia. up to 4"
 - B10 = pipe dia. up to 10"
 - B21 = pipe dia. up to 21"

Certifications/Approvals . . .



Canadian Standards Association

The RTD-100 is CSA certified for use in North America.

Ordinary Locations

Hazardous (Classified) Locations

- Class I, Division 2, Groups A, B, C and D
- Class II, Division 2, Groups E, F and G



The RTD-100-D1 (pictured at left) is provided with a cast aluminum enclosure and is CSA certified for use in North America.

Ordinary Locations

Hazardous (Classified) Locations

- Class I, Division 1, Groups B, C and D
- Class II, Division 2, Groups E, F and G



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RTD-100

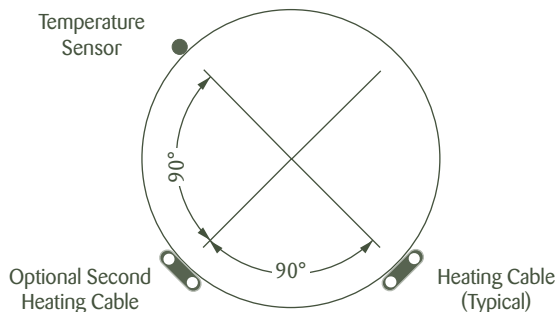
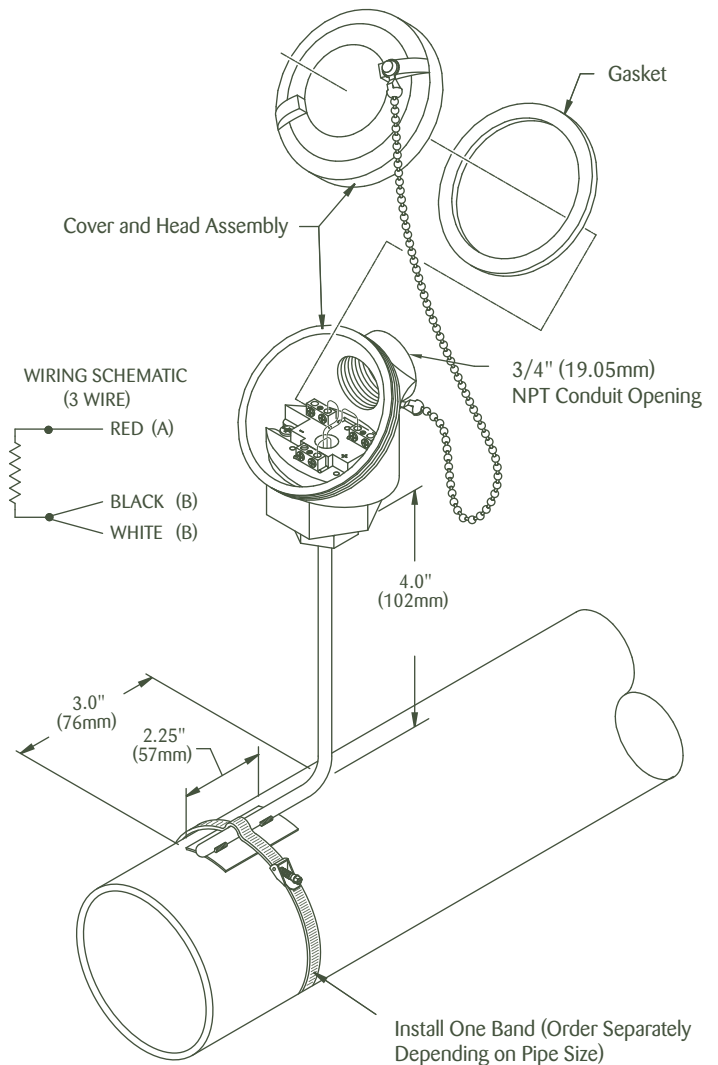
Temperature Sensor

Product Specifications

The following installation procedures are suggested guidelines for the installation of a Thermon temperature sensor. They are not intended to preclude the use of other methods utilizing accepted engineering or field construction practices. Temperature sensors are used for freeze protection or temperature maintenance of piping, tanks and instrumentation.

Temperature Sensor Installation . . .

1. Upon receipt, check to make sure the proper type has been received.
2. Store in a dry place.
3. Ensure that temperature sensor/junction box combination is suitable for the area classification.
4. Mount the temperature sensor/junction box vertically upright and in a position that will prevent condensation from draining into the enclosure from the connected conduit. **Do not bend sensor or lead. Adequately support conduit leading to enclosure.**
5. The sensor should be placed at least 90° around the circumference from the heating cable, or at least 2" (5 cm) from the cable. Mount the sensor in a location that is representative of the overall system temperature away from valves, pipe supports, nozzles, or other heat sinks. Fasten the temperature sensor securely to the pipe/vessel with banding (purchased separately), being sure that the entire length of the sensor is in intimate contact with the pipe surface. The sensor may be covered with a parallel pass of metallic tape to enhance heat transfer (not shown).
6. **Power should always be disconnected and a lockout/tagout procedure performed prior to opening the box enclosure for maintenance.**
7. Any modification to the enclosure or deviation from these procedures may affect unit's rating or approvals. Contact factory if modifications are necessary.



Heating Cable vs. Sensor Location (Line Sensing Control)



BSX™ Self-Regulating Heating Cable

Product Specifications

Application . . .

Freeze Protection or Process Temperature Maintenance

BSX self-regulating heating cables are designed to provide freeze protection or process temperature maintenance to metallic and nonmetallic piping, tanks and equipment. The heat output of BSX cable varies in response to the surrounding conditions along the entire length of a circuit. Whenever the heat loss of the insulated pipe, tank or equipment increases (as ambient temperature drops), the heat output of the cable increases. Conversely, when the heat loss decreases (as the ambient temperature rises or product flows), the cable reacts by reducing its heat output. BSX cables are approved for use in ordinary (nonclassified) areas and hazardous (classified) areas.

Ratings . . .

Available watt densities	3, 5, 8, 10 w/ft @ 50°F (10, 16, 26, 33 w/m @ 10°C)
Supply voltages.....	110-120 or 208-277 Vac
Max. maintenance temperature	150°F (65°C)
Max. continuous exposure temperature	
Power-off	185°F (85°C)
Minimum installation temperature	-60°F (-51°C)
Minimum bend radius	
@ 5°F (-15°C)	0.38" (10mm)
@ -76°F (-60°C)	1.25" (32 mm)
T-rating ¹	
3, 5, 8 w/ft (10, 16, 26 W/m)	T6 185°F (85°C)
10 w/ft (33 W/m)	T5 212°F (100°C)

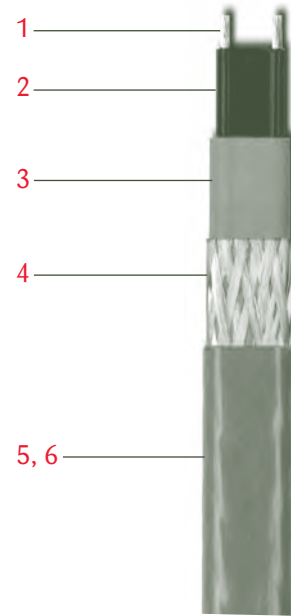
Basic Accessories² . . .

Power Connection: All BSX cables require a Terminator, PCA or ECA power connection kit for terminating the circuit before connecting to power.

End-of-Circuit Termination: BSX cables require the ET-6 end cap for terminating at the end of the circuit.

Notes . . .

1. T-rating per the National Electrical Code and Canadian Electrical Code.
2. Information on additional accessories to complete a heater circuit installation and to comply with approval requirements may be found in the "Self-Regulating Cables Systems Accessories" product specification sheet (Form TEP0010).



Construction . . .

- 1 Nickel-Plated Copper Bus Wires (16 AWG)
- 2 Radiation Cross-Linked Semiconductive Heating Matrix
- 3 Radiation Cross-Linked Dielectric Insulation
- 4 Tinned Copper Braid
- 5 Polyolefin overjacket provides additional protection to cable and braid where exposure to aqueous inorganic chemicals is expected.

Options . . .

- 6 FOJ Fluoropolymer overjacket over tinned copper braid provides additional protection to cable and braid where exposure to organic chemicals or corrosives is expected.



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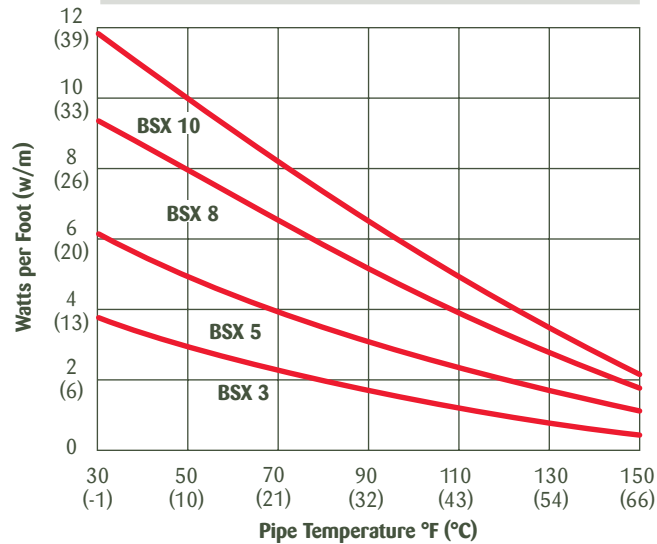
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Power Output Curves¹ . . .

The power outputs shown apply to cable installed on insulated metallic pipe (using the procedures outlined in IEEE Standard 515-2004) at the service voltages stated below. For use on other service voltages, contact Thermon.

Catalog Number 120 VacNominal	Catalog Number 240 VacNominal	Power Output at 50°F (10°C) w/ft (m)
BSX 3-1	BSX 3-2	3 (10)
BSX 5-1	BSX 5-2	5 (16)
BSX 8-1	BSX 8-2	8 (26)
BSX 10-1	BSX 10-2	10 (33)



Circuit Breaker Sizing² . . .

Maximum circuit lengths for various circuit breaker amperages are shown below. Breaker sizing should be based on the National Electrical Code, Canadian Electrical Code or any other applicable code. The National Electrical Code and Canadian Electrical Code require ground-fault protection of equipment for each branch circuit supplying electric heating equipment. Check local codes for ground-fault protection requirements.

Catalog Number	120 Vac Service Voltage Start-Up Temperature °F (°C)	Max. Circuit Length ³ vs. Breaker Size ft (m)		
		20A	30A	40A
BSX 3-1	50 (10)	360 (110)	360 (110)	360 (110)
	0 (-18)	325 (99)	360 (110)	360 (110)
	-20 (-29)	285 (87)	360 (110)	360 (110)
	-40 (-40)	260 (79)	360 (110)	360 (110)
BSX 5-1	50 (10)	240 (73)	300 (91)	300 (91)
	0 (-18)	205 (62)	300 (91)	300 (91)
	-20 (-29)	185 (56)	275 (84)	295 (90)
	-40 (-40)	165 (50)	250 (76)	265 (81)
BSX 8-1	50 (10)	190 (58)	240 (73)	240 (73)
	0 (-18)	150 (46)	225 (69)	240 (73)
	-20 (-29)	135 (41)	200 (61)	240 (73)
	-40 (-40)	120 (37)	180 (55)	215 (66)
BSX 10-1	50 (10)	160 (49)	200 (61)	200 (61)
	0 (-18)	110 (34)	170 (52)	200 (61)
	-20 (-29)	100 (30)	150 (46)	200 (61)
	-40 (-40)	90 (27)	135 (41)	180 (55)

Certifications/Approvals . . .



Factory Mutual Research
Ordinary Locations
Hazardous (Classified) Locations
Class I, Division 2, Groups B, C and D
Class II, Division 2, Groups F and G
Class III, Divisions 1 and 2
Class I, Zones 1 and 2, AEx e II (requires FOJ)



Underwriters Laboratories Inc.
Ordinary Locations
Hazardous (Classified) Locations
Class I, Division 2, Groups B, C and D
Class II, Division 2, Groups F and G
Class III, Divisions 1 and 2
Class I, Zones 1 and 2, AEx e II (requires FOJ)



Canadian Standards Association
Ordinary Locations
Hazardous (Classified) Locations
Class I, Divisions 1 & 2, Groups A, B, C and D
Class II, Divisions 1 & 2, Groups E, F and G
Ex e II

Notes . . .

- For more precise power output values as a function of pipe temperature, refer to CompuTrace®.
- Based on the trip current characteristic of Type QOB or Type QO equipment protection devices. For devices with other trip current characteristics, contact Thermon.
- The maximum circuit length is for one continuous length of cable, not the sum of segments of cable. Refer to CompuTrace® design software or contact Thermon for current loading of segments.

Catalog Number	240 Vac Service Voltage Start-Up Temperature °F (°C)	Max. Circuit Length ³ vs. Breaker Size ft (m)		
		20A	30A	40A
BSX 3-2	50 (10)	725 (221)	725 (221)	725 (221)
	0 (-18)	650 (198)	725 (221)	725 (221)
	-20 (-29)	575 (175)	725 (221)	725 (221)
	-40 (-40)	515 (157)	725 (221)	725 (221)
BSX 5-2	50 (10)	480 (146)	600 (183)	600 (183)
	0 (-18)	395 (120)	590 (180)	600 (183)
	-20 (-29)	350 (107)	525 (160)	590 (180)
	-40 (-40)	315 (96)	475 (145)	530 (162)
BSX 8-2	50 (10)	385 (117)	480 (146)	480 (146)
	0 (-18)	285 (87)	425 (130)	480 (146)
	-20 (-29)	255 (78)	380 (122)	480 (146)
	-40 (-40)	230 (70)	345 (116)	430 (131)
BSX 10-2	50 (10)	280 (85)	400 (122)	400 (122)
	0 (-18)	225 (69)	340 (104)	400 (122)
	-20 (-29)	200 (61)	300 (91)	400 (122)
	-40 (-40)	180 (55)	275 (84)	365 (111)



Systems Accessories

Thermon Heat Tracing Cables

Product Specifications

Terminator™ Nonmetallic Power Connection, Splice and End-of-Circuit Light Kits . . .

Terminator nonmetallic accessories are approved for ordinary and Division 2 hazardous locations. The kits have a maximum pipe exposure temperature rating of 482°F (250°C) with a minimum installation temperature of -76°F (-60°C).



Terminator DP... is designed to fabricate power connections, in-line/T-splice connections or for making end terminations. Electrical connections are made in terminal blocks utilizing nickel-plated copper terminals to ensure corrosion-free electrical integrity. The upfront positioning of the terminal block permits easy access during assembly and for future routine maintenance.

The Terminator DP kit includes; Type 4X junction box with integral gasket, three-point DIN mount terminal block with nickel-plated copper terminals (600 V, 50 A), pipe-mounted fitting, stainless steel pipe attachment band for piping 10" or less. (PETK/SCTK termination kit required, order separately)

Product Reference Legend:

DPBSX, RSX, HTSX, KSX, VSX, HPT, FP
DP-MTEK, HTEK,



Terminator DS/DE... is designed to fabricate in-line splices or end terminations.

Terminator DE-B... is designed to provide visual indication of an energized heating circuit.

Electrical connections are made using wire fasteners. Once the kit is assembled, a tool is required to remove the cover to gain access for maintenance or testing. (For applications requiring terminations to be made with terminal block connections, the Terminator DP or DL kit may be used.)

The Terminator DS/DE and DE-B kits include; Type 4X pipe-mounted fitting with locking splice cover, stainless steel pipe attachment band for piping 10" or less. (PETK/SCTK termination kit required, order separately)

Product Reference Legend:

DS/DEBSX, RSX, HTSX, KSX, VSX, HPT, FP
DE-BBSX, RSX, HTSX, KSX, VSX, HPT, FP



Terminator DL... is designed to provide visual indication of an energized heating circuit. The kit may be utilized as a power connection or an end termination kit. Electrical connections are made in terminal blocks utilizing nickel-plated copper terminals to ensure corrosion-free electrical integrity.

The Terminator DL kit includes; Type 4X junction box, yellow raised light, diode indicating lamp can be energized with up to 254 Vac without change in luminosity, three-point DIN mount terminal block with nickel-plated copper terminals, pipe-mounted fitting, stainless steel pipe attachment band for piping 10" or less. (PETK termination kit required, order separately)

Product Reference Legend:

DLBSX, RSX, HTSX, KSX, VSX, HPT, FP

TracePlus™ Nonmetallic Power Connection, Splice and End-of-Circuit Light Kits . . .

TracePlus nonmetallic accessories are approved for ordinary and Division 2 hazardous locations. The kits have a maximum pipe exposure temperature rating of 400°F (204°C) with a minimum installation temperature of -20°F (-29°C).



PCA... is designed to fabricate power connections, in-line/T-splice connections or for making end terminations.

The PCA kit includes; Type 4X junction box, pipe-mounted expediter, 2 stainless steel pipe attachment bands for piping 10" or less. (PETK/SCTK termination kit required, order separately)

Product Reference Legend:

PCA-HBSX, HTSX, KSX, HPT, FP
PCA-VRSX, VSX



PCS... is designed to fabricate accessible outside-the-insulation splices or end terminations.

The PCS kit includes; Type 4X pipe-mounted expediter with splice cover, 2 stainless steel pipe attachment bands for piping 10" or less. (SCTK termination kit required, order separately)

Product Reference Legend:

PCS-HBSX, HTSX, KSX, HPT, FP
PCS-VRSX, VSX



VIL-6... is designed to provide visual indication of an energized heating circuit. 120 Vac (option 1), 208 Vac (option 4), 240 Vac (option 2) or 277 Vac (option 3).

The VIL-6 kit includes; Type 4X junction box, pipe-mounted expediter, Amber light assembly, 2 stainless steel pipe attachment bands for piping 10" or less. (PETK termination kit required, order separately)

Product Reference Legend:

VIL-6-HBSX, HTSX, KSX, HPT, FP
VIL-6-VRSX, VSX



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Systems Accessories

Thermon Heat Tracing Cables

Product Specifications

Metallic Power Connection, Splice and End-of-Circuit Light Kits . . .

Thermon metallic accessories utilize epoxy-coated aluminum junction boxes and expeditors and are approved for ordinary and Division 2 hazardous locations. The kits have a maximum pipe exposure temperature rating of 482°F (250°C) with a minimum installation temperature of -60°F (-51°C).



ECA-1...is designed for connecting one or two heating cables to power or for splicing two cables together.

The ECA-1 kit includes; epoxy-coated Type 4X/7 junction box, pipe-mounted expediter, 2 stainless steel pipe attachment bands for piping 4" or less, heater cable grommet, 2 power connection boots, RTV adhesive, wire fasteners and grounding lug.

ECA-1-SR BSX, RSX, HTSX, KSX, VSX
ECA-1-ZN FP, HPT



ECT-2...is designed for connecting three heating cables to power or for splicing three cables together.

The ECT-2 kit includes; epoxy-coated Type 4X/7 junction box, pipe-mounted expediter, third cable entry assembly, 2 stainless steel pipe attachment bands for piping 4" or less, heater cable grommets, 3 power connection boots, RTV adhesive, wire fasteners and grounding lug.

ECT-2-SR BSX, RSX, HTSX, KSX, VSX
ECT-2-ZN FP, HPT



VIL-4C...is designed to provide visual indication of an energized heating circuit. 120 Vac (option 1), 208 Vac (option 4), 240 Vac (option 2) or 277 Vac (option 3).

The VIL-4C kit includes; pipe-mounted expediter, amber light assembly in Type 4X box, 2 stainless steel pipe attachment bands for piping 4" or less, heater cable grommet, power connection boot, RTV adhesive, 2 ring terminals and grounding splice lug.

VIL-4C-SR BSX, RSX, HTSX, KSX, VSX
VIL-4C-ZN FP, HPT

Cable End Termination Kits, Attachment Tapes and Miscellaneous Items . . .



PETK...circuit fabrication kit includes a power boot, end cap, RTV adhesive.

SCKT...splice connection/termination kit includes a power boot, wirenuts, RTV adhesive.

PETK-1D / SCKT-1D BSX, RSX, VSX
PETK-2D / SCKT-2D KSX, HTSX
PETK-3D / SCKT-3D FP, HPT



ET-6C, ET-7C, ET-8C...end termination kits are designed to properly terminate the end (away from power) of a heat tracing circuit. Each kit includes a rubber end cap, RTV adhesive and caution label.

ET-6C BSX, RSX, VSX
ET-7C HPT (BN)
ET-8C HTSX, KSX, FP & HPT (O)



TBX-3LC, TBX-4LC...power connection boots are used to prepare heating cable for connection to power. Kit includes rubber boot and RTV adhesive.

TBX-3LC BSX, RSX, VSX
TBX-4LC HTSX, KSX, FP & HPT



TB-2F, TB-3F, TB-4F...floating terminal blocks for use inside metallic (ECA, ECT) and non-metallic (PCA, PCS) junction boxes.

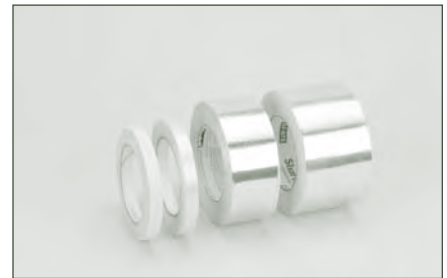
TB-2F 2-point-rated 65A @ 600 Vac, 22 - 6 AWG
TB-3F 3-point-rated 65A @ 600 Vac, 22 - 6 AWG
TB-4F 4-point-rated 30A @ 250 Vac, 26 - 10 AWG



CL...vinyl-based peel and stick caution labels are intended for direct exposure to industrial environments. Electrically heated pipelines and vessels are to be clearly identified at frequent intervals. Caution labels should be placed at 10'-20' (3-6 m) intervals or as required by code or specification.

B-4, B-10, B-21...stainless steel attachment bands for securing Thermon connection kits to pipes. Each connection kit includes two bands.

B-4...for pipes up to 4" (100 mm) diameter
B-10...for pipes up to 10" (250 mm) diameter
B-21...for pipes up to 21" (530 mm) diameter



FT-1L, FT-1H... fixing tapes for attaching heating cable to piping every 12" (30 cm) or as required by code or specification.

AL-20L, AL-20H, AL-30L, AL-30H... aluminum tape for continuous (longitudinal) covering.

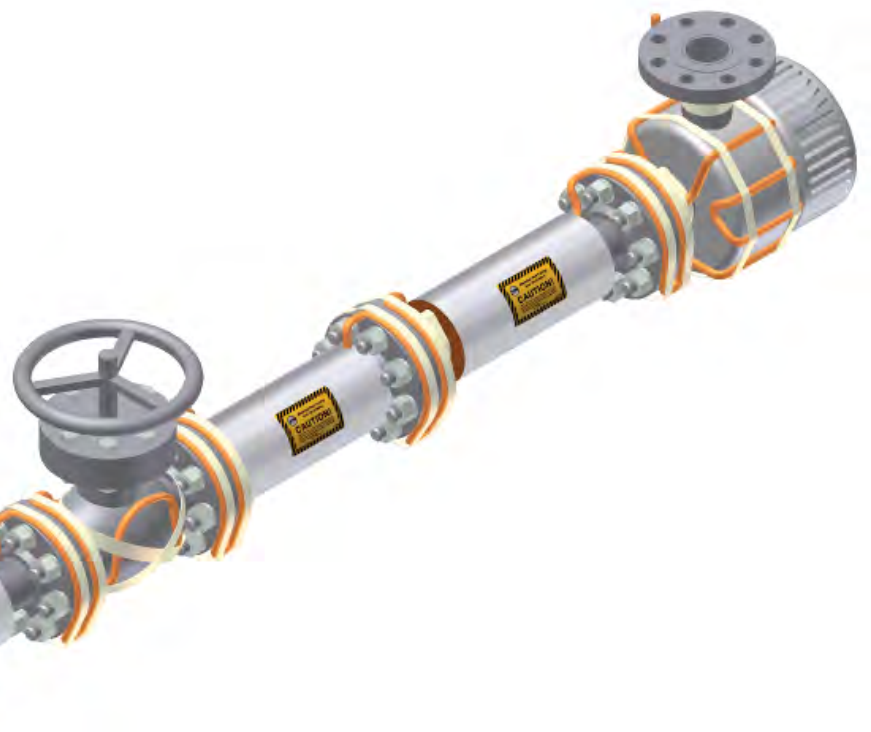
Catalog #	Temp. Max.	Min. Install	Dimensions
FT-1L	200°F	40°F	1/2" x 108'
FT-1H	500°F	-40°F	1/2" x 108'
AL-20L	150°F	40°F	2" x 150'
AL-20H	300°F	20°F	2" x 180'
AL-30L	150°F	40°F	3" x 150'
AL-30H	300°F	20°F	3" x 180'





Electric Heat Tracing

INSTALLATION PROCEDURES



The Heat Tracing Specialists®

Electric Heat Tracing

Complete Electric Heat Tracing System . . .

A complete electric heat tracing system will typically include the following components¹:

1. Electric heat tracing cable² (self-regulating, power-limiting, parallel constant watt or series constant watt).
2. Power connection kit.
3. RTD sensor or control thermostat³.
4. In-line/T-splice kit (permits two or three cables to be spliced together).
5. Cable end termination.
6. Attachment tape (use on 12" intervals or as required by code or specification).
7. "Electric Heat Tracing" label (peel-and-stick label attaches to insulation vapor barrier on 10' intervals or as required by code or specification).
8. Thermal insulation⁴ and vapor barrier (by others).

The absence of any of these items can cause a system to malfunction or represent a safety hazard.

Types of Heating Cables . . .

Self-Regulating Heating Cables:

- BSX™ Self-Regulating Heating Cable (refer to Form TEP0067)
- RSX™ Self-Regulating Heating Cable (refer to Form TEP0004)
- KSX™ Self-Regulating Heating Cable (refer to Form TEP0072)
- TSX® Self-Regulating Heating Cable (refer to Form TEP0006)
- HTSX™ Self-Regulating Heating Cable (refer to Form TEP0074)
- VSX™ Self-Regulating Heating Cable (refer to Form TEP0008)

Power-Limiting Heating Cable:

- HPT™ Power-Limiting Heating Cable (refer to Form TEP0011)

Parallel Constant Watt Heating Cable:

- FP Parallel Constant Watt Heating Cable (refer to Form TEP0016)

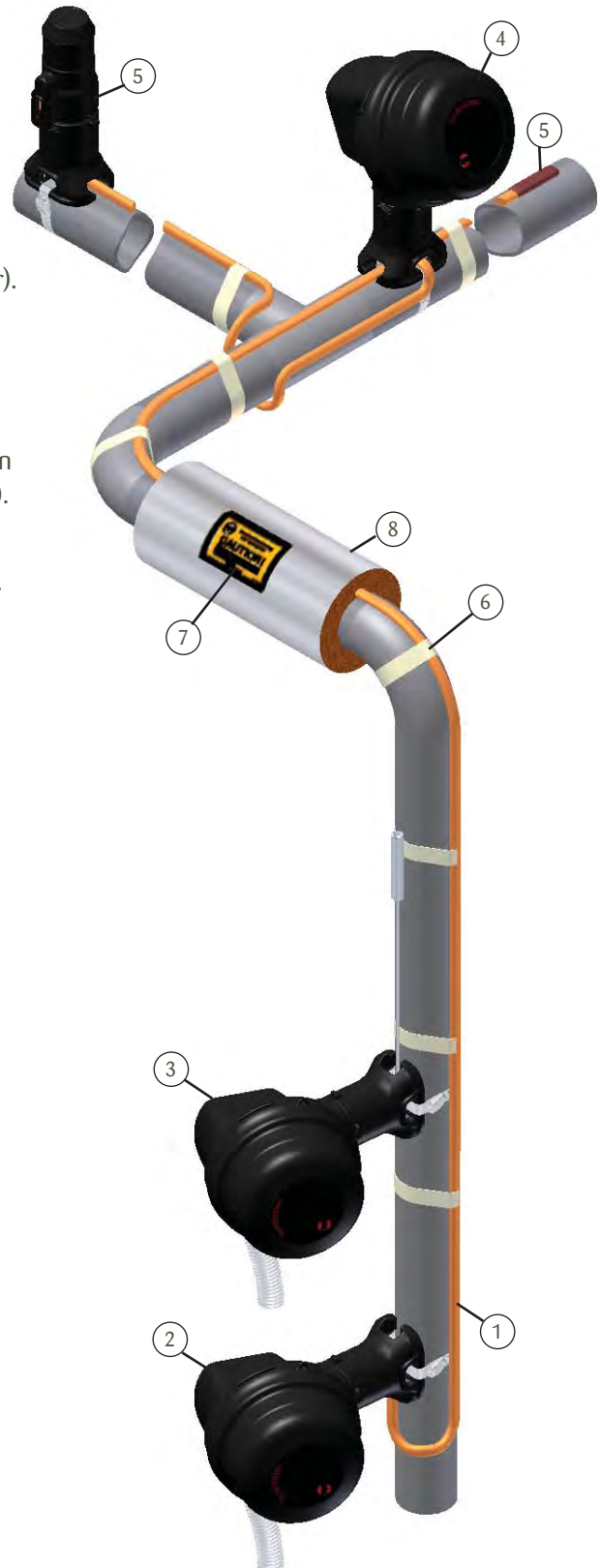
Series Constant Watt Heating Cables:

- TEK™ Series Constant Watt Heating Cable (refer to Form TEP0021)
- HTEK™ Series Constant Watt Heating Cable (refer to Form TEP0022)
- MIQ™ Mineral Insulated Heating Cable (refer to Form TEP0020)

Notes . . .

1. Illustration depicts a typical self-regulating heating circuit.
2. Ground-fault equipment protection is required for all heat tracing circuits.
3. Temperature control is recommended for all freeze protection and temperature maintenance heat tracing applications.
4. All heat-traced lines must be thermally insulated.

Illustration A: Typical Heat Tracing Installation



The Heat Tracing Specialists®



The National Electric Code and Canadian Electrical Code require ground-fault protection be provided for electric heat tracing .

INSTALLATION PROCEDURES

The following installation procedures are suggested guidelines for the installation of a Thermon electric heat tracing system¹. They are not intended to preclude the use of other methods utilizing accepted engineering or field construction practices.

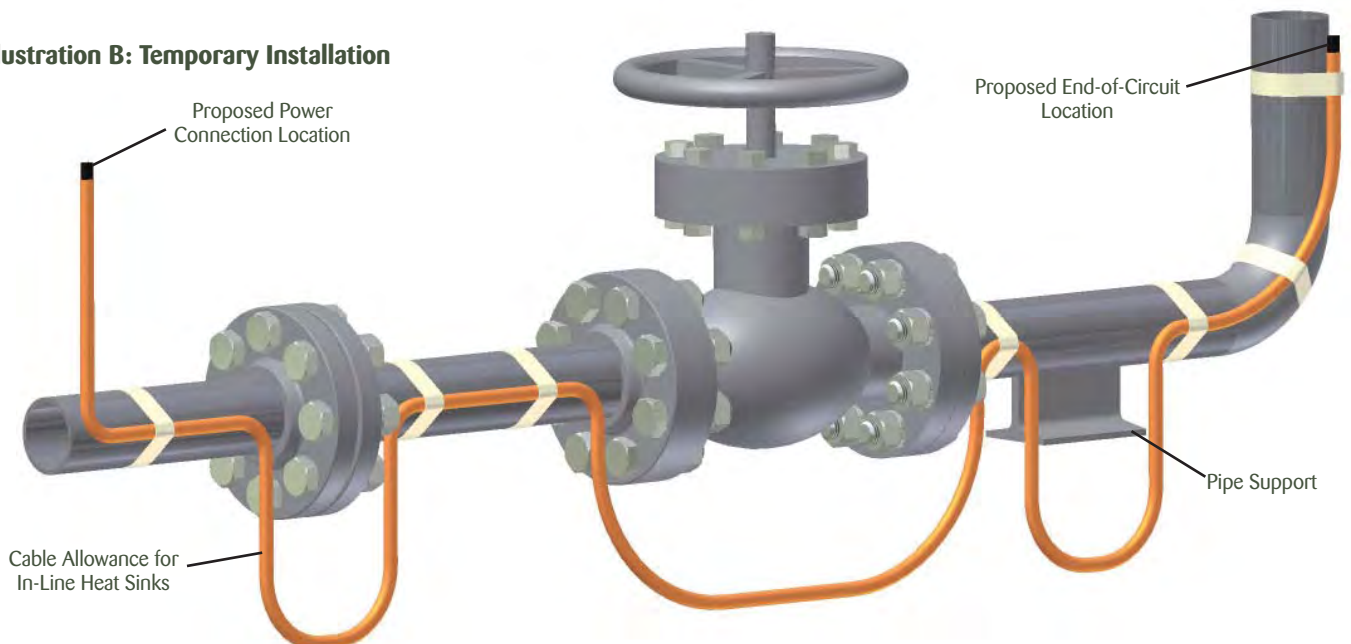
Upon Receiving, Cable . . .

1. Upon receiving heating cable, check to make sure the proper type and output have been received. All flexible cables have the catalog number, voltage rating and watt output printed on the jacket.
2. Visually inspect cable for any damage incurred during shipment. The heating cable should be tested to ensure electrical integrity with at least a 500 Vdc megohmmeter (megger) between the heating cable bus wires and the heating cable metallic braid. IEEE 515 recommends that the test voltage for polymer insulated heating cables be 2500 Vdc and 1000 Vdc for MI Cable. Minimum resistance should be 20 megohms. **(Record 1 on Cable Testing Report.)**



Connect the positive lead of the megger to the cable bus wires and the negative lead to the metallic braid.

Illustration B: Temporary Installation



Applications . . .

1. Electric heat tracing cables are used for freeze protection or temperature maintenance of piping, tanks and instrumentation.
2. Heat tracing cables may be installed in ordinary (nonclassified) and hazardous (classified) locations depending on the specific cable options and approvals².

Before Installing Cable . . .

1. Be sure all piping and equipment to be traced is completely installed and pressure tested.
2. Surface areas where heat tracing is to be installed must be reasonably clean. Remove dirt, rust and scale with a wire brush and oil and grease films with a suitable solvent.

Initial Installation . . .

1. Begin temporary installation at the proposed end-of-circuit location and lay out heating circuit on the pipe, allowing extra cable for the power connection and for any splice locations³. Refer to Illustration B for temporary installation.
2. Make heating cable allowances for valves, flanges, elbows and supports as per the applicable drawings and table on pages 3 and 4 of these installation procedures.

Notes . . .

1. Termination kits to fabricate a heat tracing circuit are not addressed in detail in these installation procedures. Refer to installation instructions included with cable termination kits or contact Thermon for specific instructions to fabricate heating cable.
2. For information on specific cable types and options, refer to Types of Heating Cables on page 1.
3. See product specifications sheet for heating cable minimum bend radius.

Electric Heat Tracing

Installation on Elbows, Supports and Flanges . . .

1. Install heating cable in accordance with Illustrations C, D and E below. Secure heating cable to piping using attachment tape.
2. Elbows: Locate the cable on the outside radius of an elbow to provide sufficient heat to compensate for the added piping material. Secure the cable to the pipe on each side of the elbow with attachment tape.
3. Pipe Supports: Insulated pipe supports require no additional heating cable. For uninsulated supports, allow two times the

length of the pipe support plus an additional 15" (40 cm) of heating cable.

4. Flanges: Allow cable to be looped around pipe on each side of and adjacent to the flange. Heating cable must maintain contact with flange when bending around pipe flanges to compensate for additional heat loss.
5. Refer to the product specifications sheet for minimum bend radius for the specific cable type. Do not exceed bend radius when completing installation.

Illustration C: Pipe Elbow

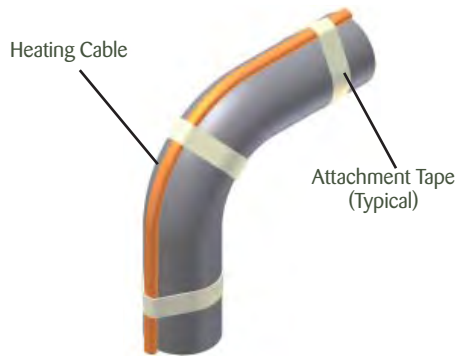


Illustration E: Pipe Flange

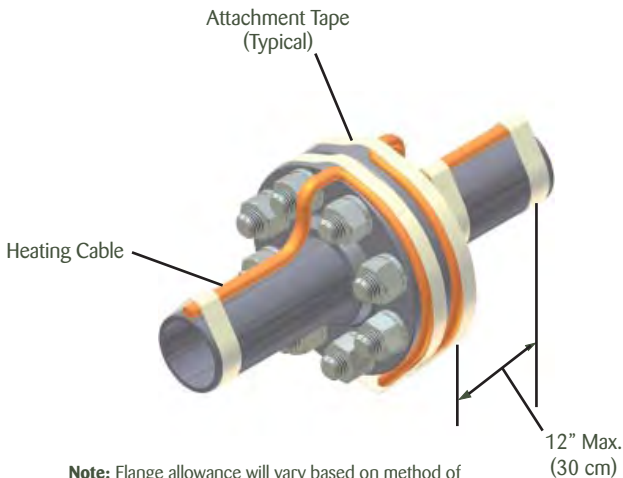
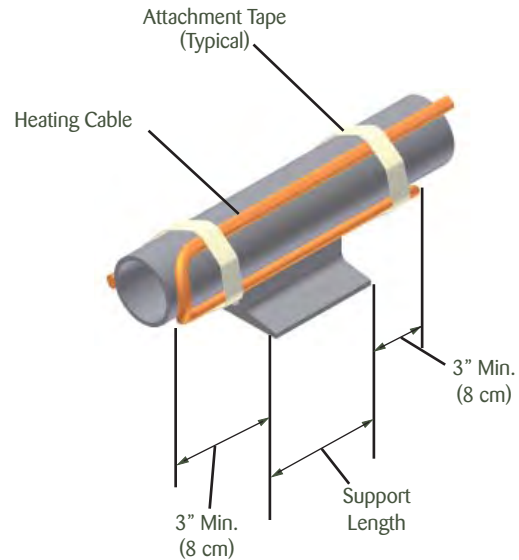


Illustration D: Pipe Support



Circuit Layout on Support



The Heat Tracing Specialists®

INSTALLATION PROCEDURES

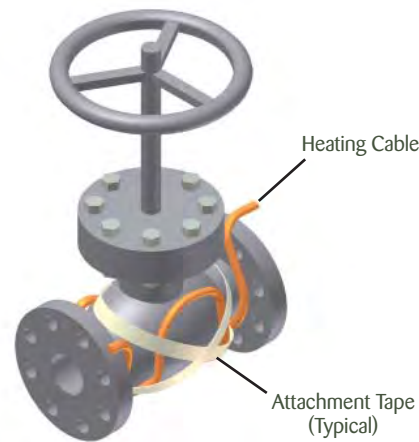
Installation on Valves and Pumps . . .

1. Install heating cable in accordance with Illustrations F and G below. Secure heating cable to piping using attachment tape.
2. Additional cable is required to provide extra heat at valves, pumps and miscellaneous equipment to offset the increased heat loss associated with these items. Refer to Table 1 for estimated cable requirements for installation on typical valves and pumps.
3. Install heating cable on valves and pumps utilizing a looping technique (this allows the valve or pump to be removed if required). Crossing constant watt heating cable over itself should be avoided.
4. Refer to the product specifications sheet for minimum bend radius for the specific cable type. Do not exceed bend radius when completing installation.

Table 1: Valve and Pump Allowances

Pipe Size	Valve Type			Pump Type	
	Screwed	Flanged	Welded	Screwed	Flanged
½"	6"	1'	0	1'	2'
¾"	9"	1' 6"	0	1' 6"	3'
1"	1'	2'	1'	2'	4'
1¼"	1' 6"	2'	1'	3'	4' 6"
1½"	1' 6"	2' 6"	1' 6"	3'	5'
2"	2'	2' 6"	2'	4'	5' 6"
3"	2' 6"	3' 6"	2' 6"	5'	7'
4"	4'	5'	3'	8'	10'
6"	7'	8'	3' 6"	14'	16'
8"	9' 6"	11'	4'	19'	22'
10"	12' 6"	14'	4'	25'	28'
12"	15'	16' 6"	5'	30'	33'
14"	18'	19' 6"	5' 6"	36'	39'
16"	21' 6"	23'	6'	43'	46'
18"	25' 6"	27'	6' 6"	51'	54'
20"	28' 6"	30'	7'	57'	60'
24"	34'	36'	8'	68'	72'
30"	40'	42'	10'	80'	84'

Illustration F: Typical Valve Detail

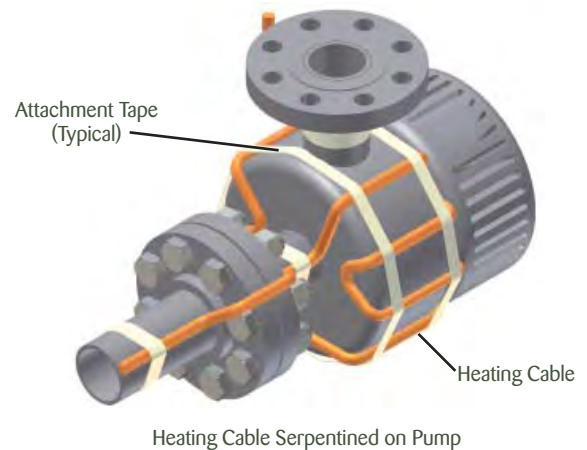


Heating Cable Serpentine on Valve



Circuit Layout on Valve

Illustration G: Typical Pump Detail



Heating Cable Serpentine on Pump



Circuit Layout on Pump

Electric Heat Tracing

Completing the Installation . . .

- Begin final cable attachment by securing the end-of-circuit termination kit and working back toward the power supply.
 - Flexible heating cables are to be installed using attachment tape. Circumferential bands of tape should be installed at 12" (30 cm) intervals to keep the cable in proper contact with the pipe. Refer to Table 2 below to calculate the number of rolls of attachment tape required based on the pipe diameter¹.
 - MIQ mineral insulated heating cables are typically installed with stainless steel banding. These cables may also be installed with heat transfer compound and metal channels.
 - If applicable, refer to installation details provided with the project drawings or contact Thermon for additional information regarding installation.
- In addition to the circumferential tape requirements, a continuous covering of aluminum foil tape may be required when:
 - Spray or foam urethane² thermal insulation is applied.
 - Heat tracing nonmetallic piping.
 - Design requirements dictate the use of aluminum tape to improve heat transfer.
- Complete splice connections (if required) in accordance with the installation instructions provided with the splice kit.
- Before making power connections, The heating cable should be tested to ensure electrical integrity with at least a 500 Vdc megohmmeter (megger) between the heating cable bus wires and the heating cable metallic braid. IEEE 515 recommends that the test voltage for polymer insulated heating cables be 2500 Vdc and 1000 Vdc for MI Cable. Minimum resistance should be 20 megohms. **(Record 2 on Cable Testing Report.)**
- Install power connection kit in accordance to the detailed installation instructions provided with the kit. (MIQ series resistance heating circuits are typically prefabricated at the factory. Pipe-mounted junction boxes to complete a typical MIQ circuit connection to power may not be supplied as part of the system.)
- Secure temperature sensor (if required) to pipe utilizing attachment tape. Locate temperature sensor as shown in Illustration H.

Notes . . .

- Table 2 assumes circumferential bands every 12" (30 cm) along the length of the process piping.
- Verify exposure temperature of heating cable versus curing temperature of insulation.

Illustration H: Heating Cable vs. Sensor Location

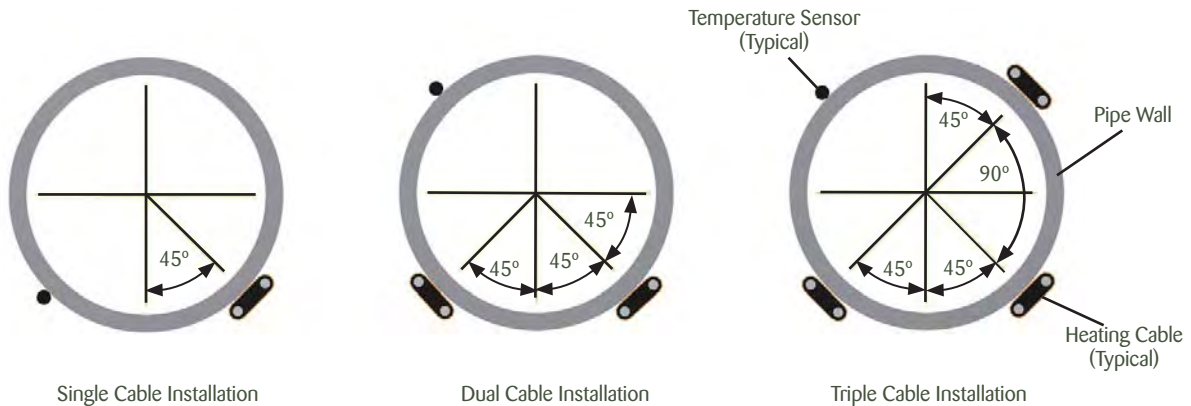


Table 2: Attachment Tape (Value Represents Approximate Linear Pipe Length Allowance Per Roll)

Tape Length	Pipe Diameter in Inches															
	½"-1"	1¼"	1½"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"
36 yd	130'	115'	110'	95'	75'	65'	50'	40'	35'	30'	26'	23'	21'	19'	16'	13'
60 yd	215'	195'	180'	160'	125'	105'	80'	65'	55'	50'	43'	38'	35'	31'	27'	22'

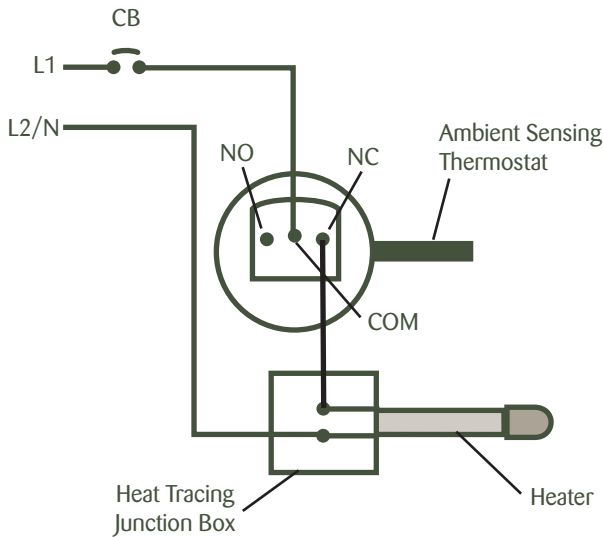


The Heat Tracing Specialists®

INSTALLATION PROCEDURES

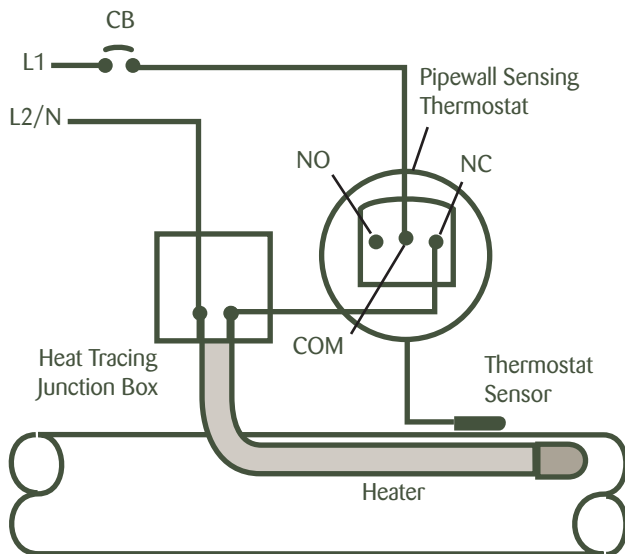
Final Connections . . .

1. Follow the circuit fabrication instructions for the specific cable type. Power connection and end-of-circuit termination kits are designed for each type of cable; substitutions should not be made.
2. For ambient controlled power, the heating circuit should be connected directly to the switched power feed wiring.



(SPDT Thermostat Shown)

3. For pipewall sensing thermostatic control, the heating circuit is to be connected in series with the control contacts as shown in Illustration I. The pipewall sensing thermostat may require more than one support point.



(SPDT Thermostat Shown)

Thermal Insulation . . .

1. The need for properly installed and well-maintained thermal insulation cannot be overemphasized. Without insulation, heat losses are generally too high to be offset by a conventional heat tracing system.
2. In addition to piping and in-line equipment such as pumps and valves, all heat sinks must be properly insulated. This includes pipe supports, hangers, flanges and, in most cases, valve bonnets.
3. Regardless of the type or thickness of insulation used, a protective barrier should be installed. This protects the insulation from moisture intrusion, physical damage and helps ensure the proper performance of the heat tracing system. Seal around all penetrations through the thermal insulation.
4. After the installation of the thermal insulation and weather barrier but BEFORE ENERGIZING THE HEATING CIRCUIT, the megohmmeter test should be repeated. This should call attention to any damage to the heating cable that may have occurred during the insulation installation. **(Record 3 on Cable Testing Report)**
5. Apply caution labels to insulation weather barrier at required intervals along pipe

Final Inspection and Documentation . . .

1. It is recommended that the circuit be temporarily energized so that the volts, amps, pipe temperature and ambient temperature may be recorded. This information may be of value for future reference and should be maintained for the historical operating data log **(Record 4 on Cable Testing Report)**.
2. Stabilized design can be used for self-regulating heating cables to assign a lower T-class through the use of the Thermon CompuTrace software or Thermon Engineering.
3. Stabilized design can be used for power-limiting and constant watt heating cables without a limiting device to determine the T-class through the use of the Thermon CompuTrace software or Thermon Engineering.
4. A sample historical operating data log form is included in the Electric Heat Tracing Maintenance and Troubleshooting Guide, Thermon Form TEP0066).



The National Electric Code and Canadian Electrical Code require ground-fault protection be provided for branch circuits supplying electric heat tracing.

Cable Testing Report

1. Refer to Thermon Installation Procedures, FORM PN 50207, for general installation procedures, requirements and guidelines.
2. Upon receiving heating cable, check the cable to make sure the proper type and output have been received. All flexible cables have the catalog number, voltage rating and watt output printed on the outer jacket.
3. Visually inspect cable for any damage incurred during shipment. The heating cable should be tested to ensure electrical integrity with at least a 500 Vdc megohmmeter (megger) between the heating cable bus wires and the heating cable metallic braid. IEEE 515 recommends that the test voltage for polymer insulated heating cables be 2500 Vdc and 1000 Vdc for MI cable. Minimum resistance should be 20 megohms.

(Record 1 on Cable Testing Report.)

- A. Connect the positive lead of the megger to the cable bus wires.
 - B. Connect the negative lead of the megger to the metallic braid.
 - C. Energize the megger and record the reading. Readings between 20 megohms and infinity are acceptable. Readings below 20 megohms may mean the electrical insulation has been damaged. Recheck the heating cable for physical damage between the braid and the heating element; small cuts or scuffmarks on the outer jacket will not affect the megger reading unless there was actual penetration through the braid and dielectric insulation jacket.
4. Once the installation is complete, but prior to installation of thermal insulation, recheck the heating cable with at least a 500 Vdc megohmmeter (megger) between the heating cable bus wires and the heating cable metallic braid. IEEE 515 recommends that the test voltage for polymer insulated heating cables be 2500 Vdc and 1000 Vdc for MI cable. Minimum resistance should be 20 megohms. **(Record 2 on Cable Testing Report.)**
 5. After the thermal insulation is installed, the megohmmeter test should be repeated. Minimum resistance should be 5 megohms. **(Record 3 on Cable Testing Report.)**
 6. After the thermal insulation is installed and power supply is completed, record the panel and circuit breaker information. Ensure all junction boxes, temperature controllers, cable glands, etc. are properly secured. Set the temperature controller (if applicable) to the manual setting and apply rated voltage to the heat tracing circuit(s) for 5 minutes. Record the ambient temperature, measure and record the circuit(s) voltage and current. **(Record 4 on Cable Testing Report.)**



NOTE: To ensure the heating cable warranty is maintained through installation, the testing outlined on this sheet must be completed on the installed heating cables, and the test results recorded and mailed/faxed to:

Thermon Customer Service
100 Thermon Drive
San Marcos, Texas 78666
Fax: 512-754-2420



The Heat Tracing Specialists®

Cable Testing Report

make additional copies as required for each circuit.

Customer: _____
Address: _____

Phone No: _____
Project Reference: _____

Contractor: _____
Address: _____

Phone No. _____

Record 1: Prior to Installation

Cable Type: _____
Reel Length: _____
Reel Number: _____
Insulation Resistance M Ohms: _____
Tested By: _____
Witnessed By: _____

Date: _____
Date: _____

Record 2: After Installation of Heating Cable

Insulation Resistance M Ohms: _____
Heater Length: _____
Heater Number: _____
Tested By: _____
Witnessed By: _____

Date: _____
Date: _____

Record 3: After The Thermal Insulation Is Installed

Insulation Resistance M Ohms: _____
Tested By: _____
Witnessed By: _____

Date: _____
Date: _____

Record 4: Final Commissioning

Panel Number: _____
Breaker Number: _____
Volts: _____
Ambient Temperature (deg. F): _____
Recorded Amps (After 5 Min.): _____
Tested By: _____
Witnessed By: _____

Date: _____
Date: _____



The Heat Tracing Specialists®



The Heat Tracing Specialists®

www.thermon.com

With Design, Manufacturing, and Warehouse Facilities Worldwide.

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REGISTERED


Corporate Headquarters

100 Thermon Dr. • San Marcos, TX 78667-0609 • USA

Phone: 512-396-5801 • Fax: 512-396-3627 • **1-800-820-HEAT**

www.thermon.com

In Canada call **1-800-563-8461**



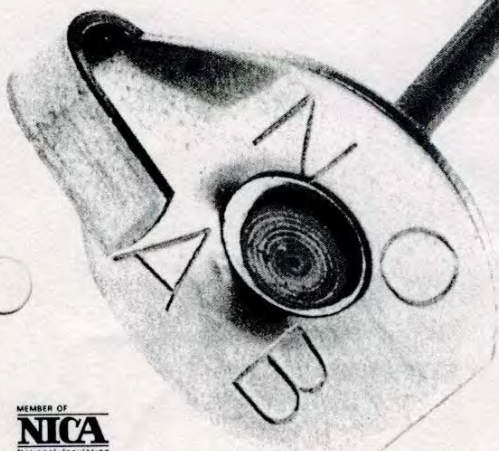
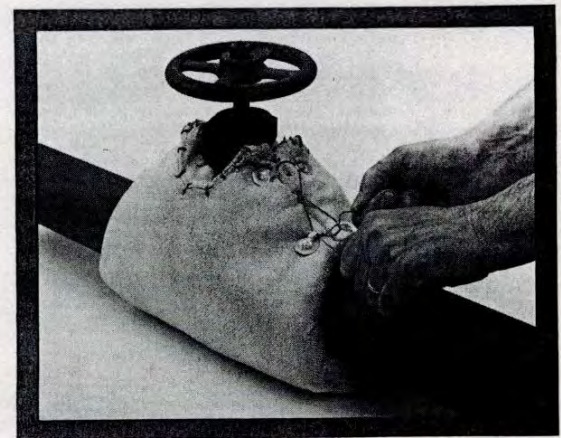
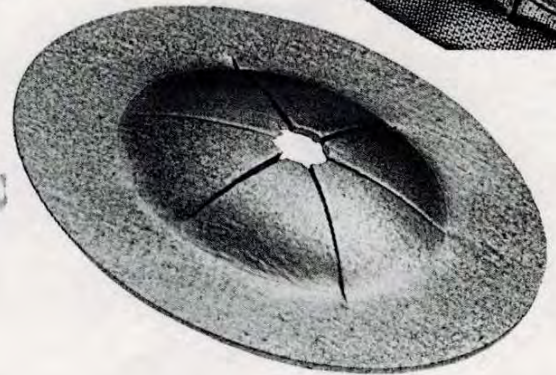
LACE UP your blankets . . . ANCHOR DOWN your costs!

Wherever you require the use of removable blankets or covers, may we suggest using AGM's Series NLA LACING ANCHORS along with our Self-Locking Washers. This is AGM's answer to the Insulation Industry's need for a low cost, quality fastener.

The Anchors are available with 12 ga. (2.69mm) and 14 ga. (2.03mm) spindles in standard lengths in both Steel and Stainless Steel.

For asbestos-free applications, we can furnish "NO AB" die-stamped on the head to denote no asbestos, without additional cost. Free samples are available upon request from

AGM - a company built on tradition.



MEMBER OF
NICA
National Insulation
Contractors Association

Litho in USA



Industries, Inc.

110 Shawmut Road, Canton, MA 02021 Tel: (617) 828-4705/Telex: 92-4440

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1-89



TRYMER 3000

TRYMER 3000 Brand Polyisocyanurate Foam Insulation

TRYMER* 3000 Brand Polyisocyanurate Foam Insulation is a polyurethane modified polyisocyanurate cellular plastic supplied in the form of bunstock for fabrication into sheets, pipe, tank and vessel covering, and other shapes¹ for a variety of thermal insulation applications. Although similar in physical form to polyurethane foams, TRYMER 3000 has improved dimensional stability over a wider range of temperatures. TRYMER 3000 has been specifically formulated to provide excellent thermal insulation properties without the use of CFC blowing agents.

TRYMER 3000 is available as bunstock 48" (122 cm) wide by 18" (46 cm) high by 36" (91 cm), 96" (244 cm) or 108" (274 cm) lengths for further fabrication into various sizes and shapes to meet various end use needs. Custom lengths are available. Contact your local Dow representative for details.

Applications

TRYMER 3000 is used extensively in industrial and commercial applications within the service temperature range of -297°F to +300°F (-183°C to +149°C)². Because of the critical technical design aspects of many of these applications, qualified designers or consultants should design the total system. Dow can provide general guidelines and recommendations on many typical applications for TRYMER 3000. Call 1-800-441-4369 or contact your local Dow representative for details. Some typical applications include:

- Core material for architectural and structural panels
- Core material for factory built panelized constructions
- Pipe, tank, and vessel insulation
- Insulation for shipping containers, trucks, or rail cars
- Fabricated pipe fitting insulation
- Flat or tapered boardstock for roof insulation

Like all cellular plastics, this product will degrade upon prolonged exposure to sunlight. A covering to block ultraviolet radiation must be used to prevent this degradation. Other coverings to protect the foam from the elements and to meet applicable fire regulations may also be required. Consultation with local building code officials, design engineers/specifiers, or insurance personnel is recommended before application.

Safety Considerations

TRYMER 3000 requires some care in handling. All persons who work with these materials must know and follow the proper handling procedures. The current Material Safety Data Sheet contains additional information on the safe handling, storage, and use of this material. A copy of the MSDS can be obtained by calling 1-800-441-4369 or by contacting your local Dow representative.

NOTICE: No freedom from any patent owned by Seller or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for Customer's use and for ensuring that Customer's workplace and disposal practices are in compliance with applicable laws and other governmental enactments. Seller assumes no obligation or liability for the information in this document. NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

Published December 1998.

*Trademark of The Dow Chemical Company

TRYMER* 3000 Brand Polyisocyanurate Foam Insulation

PHYSICAL PROPERTIES (1)	ASTM METHOD	ENGLISH UNITS	ENGLISH VALUES (2)	METRIC UNITS	METRIC VALUES (2)
Density (3)	D 1622	lb/ft ³	3.0	kg/m ³	48
Compressive Strength (3) Parallel to Rise (Thickness) Perpendicular to Rise (Width) Perpendicular to Rise (Length)	D 1621	lb/in ²	50 40 45	kPa	350 280 310
Compressive Modulus Parallel to Rise (Thickness) Perpendicular to Rise (Width) Perpendicular to Rise (Length)	D1621	lb/in ²	1100 900 1200	kPa	7500 6200 8300
Shear Strength Parallel to Rise	C 273	lb/in ²	40	kPa	270
Shear Modulus Parallel to Rise	C 273	lb/in ²	375	kPa	2600
Tensile Strength Parallel to Rise (Thickness)	D 1623	lb/in ²	50	kPa	350
Tensile Modulus Parallel to Rise (Thickness)	D 1623	lb/in ²	1900	kPa	13100
Flexural Strength Parallel to Rise Perpendicular to Rise (Width)	C 203	lb/in ²	80 65	kPa	550 450
Flexural Modulus Parallel to Rise Perpendicular to Rise (Width)	C 203	lb/in ²	2400 1200	kPa	16500 8300
k-Factor (75°F(24°C) mean temp.) Initial Aged 180 days @ 75°F (24°C)	C 518	BTU·in/hr·ft ² ·°F	0.142 0.190	W/m°C	0.020 0.027
R-Value/in (75°F(24°C) mean temp) Initial Aged 180 days @ 75°F (24°C)	C 518	Hr·ft ² ·°F/BTU	7.0 5.3	m ² ·°C/W	1.24 0.93
Closed Cell Content	D 2856	%	97	%	97
Water Absorption	C 272	% by Volume	0.6	% by Volume	0.6
Water Vapor Permeability	E 96	Perm-Inch	2.9	(ng/Pa·s·m)	4.4
Dimensional Stability (4) @ -40°F (-40°C), 7 days Length Volume @ 158°F (70°C)/97% Relative Humidity, 7 days Length Volume @ -10°F (-23°C), 7 days Length Volume @ 300°F (149°C), 7 days Length Volume	D 2126	% Change % Change % Change % Change % Change % Change % Change % Change	-0.2 -0.2 1.0 1.2 0.2 0.2 -0.3 to 1.0 0.8	% Change % Change % Change % Change % Change % Change % Change % Change	-0.2 -0.2 1.0 1.2 0.2 0.2 -0.3 to 1.0 0.8
Service Temperature (5)		°F	-297 to +300	°C	-183 to +149
Surface Burning Characteristics (1" thickness) (6)	E 84	Flame spread/smoke	15 / 295	Flame spread/smoke	15 / 295
Color			Tan		Tan

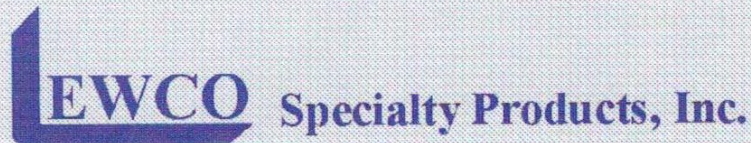
- (1) All properties are measured at 74°F, unless otherwise indicated.
- (2) Unless otherwise indicated, data shown are typical values obtained from representative production samples. This data may be used as a guide for design purposes, but should not be construed as specifications. For Property ranges and specifications, consult your Dow representative.
- (3) Average value through foam cross section.
- (4) Frequent and severe thermal cycling can produce dimensional changes significantly greater than those stated here. Special design considerations must be made in systems that cycle frequently.
- (5) Above 300°F, discoloration and charring will occur, resulting in an increased k-factor in the discolored area.
- (6) This numerical flame spread data is not intended to reflect hazards presented by this or any other material under actual fire conditions.

For Technical Information:
1-800-441-4369

Visit us at: www.styrofoam.com

For Sales Information:
1-800-232-2436





6859 Renoir Avenue
Baton Rouge, LA 70806

Tel: (225) 924-3221
Fax: (225) 927-2918

LEWCO 1700 SA-2 Silicone Impregnated Fiberglass Fabric

Product Specifications

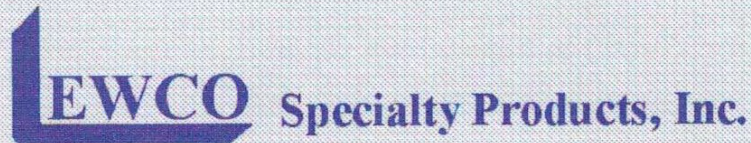
LEWCO Style 1700 SA-2 is an asbestos free woven fiberglass fabric impregnated with a special chemical, water and oil resistant silicone rubber. LEWCO Style 1700 SA-2 is a flexible, light to medium weight fabric for removable insulation blankets.

Typical Properties

E Glass Melting Point	1523 ° F
Maximum Temperature	500 ° F
Minimum Temperature	-80 ° F
Type Weave	4 Harness Satin
Type Fiberglass	E Glass
Weight	17.0 Oz./Sq. Yd.
Thickness	.017 Inches
Width	60 Inches
Tensile Strength	500 * 400 W F

This information is given in good faith and is believed to be accurate. It is intended for use by persons skilled in the art of fabricating and applying removable/reusable insulation or like products. All liabilities are borne by the user. LEWCO does not take any responsibility for misuse of this product. LEWCO recommends testing before use.

S1700SA2-5/2004MED



6859 Renoir Avenue
Baton Rouge, LA 70806

Tel: (225) 924-3221
Fax: (225) 927-2918

LEWCO MAT INSULATION

Product Specifications

LEWCO Mat Insulation is composed of 100% select grade Type "E" glass fibers needled together into mat form. LEWCO Mat is processed in such a way to maximize thermal efficiency. It is non-respirable, incombustible, asbestos free and contains no resinous or inorganic binders. This material has been tested and conforms to Mil-DTL-24244D(SH), USCG Subpart 164.009, ASTM E84 industry standards and NRC 1.36. Other densities available upon request.

Typical Properties

Melting Point	1523 ° F
Maximum Temperature	1200 ° F
Continuous Temperature	1000 ° F
Thickness	1/8", 1/4", 1/2", 1" and 1 1/2"
Roll Width	30" and 60"
Roll Length	Various Lengths Available
Density	6 – 7# / Cu. Ft. and 9 – 11# Cu. Ft.

Thermal Conductivity "K" Factor

	LEWCO	LEWCO	Temp Mat	Ceramic Fiber Blanket	
Temperature	6-7#	9-11#	9-11#	6#	8#
300 ° F	.292	.35	.40	.388	.282
500 ° F	.350	.48	.50	.520	.428
700 ° F	.445	.64	.65	.680	.589

This information is given in good faith and is believed to be accurate. We do not imply or express a license to operate under or infringe on any patents that may apply. This product is intended for use by persons skilled in the use of this product. All liabilities are borne by the user of this product. LEWCO recommends testing before use.
SLEWCOMAT-08/09/04MED-Rev.01

**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 RELATED DATA SHEETS
 - 9.04.1 HUBBELL SUPPORT GRIPS
 - 9.04.2 PUMP LIFTING EYE



Conditions: 300 GPM @ 30' TDH, Acetic acid N Propyl Acetate

PIONEER SELF PRIMING ELECTRIC DRIVEN PUMP PACKAGE:

Model: P3O87L3-HO-7.5-4

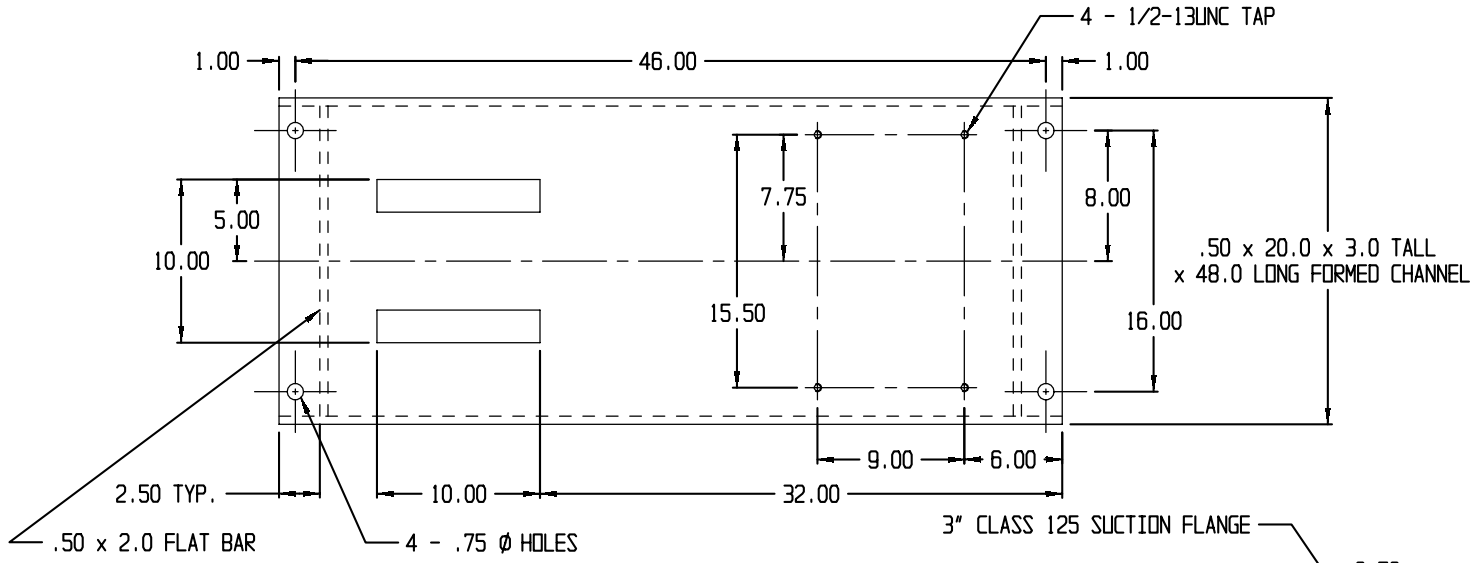
- Pioneer Self Priming Heavy Duty Solids Handling Pump
- 316 Stainless Steel Construction with Mechanical Seal
- 7.19 Inch Trimmed Diameter 316 Stainless Steel Impeller
- Oil Lubricated Bearing Frame
- Suction and Discharge Spool Flanges
- 7.5 HP, 1800 RPM, 3 PH, 230/460 V, 60 Hz, TEFC, Premium Efficiency Baldor Motor
- Rigid Steel Base to Support Pump and Motor with Coupling and Guard
- See Attached Specification Sheet for Complete Details
- Entire Package Completely Assembled, Primed & Painted Pioneer Green before Shipment

TABLE III -- TYPICAL ACOUSTIC PERFORMANCE
TEFC/SUPER-E LOW NOISE MOTORS

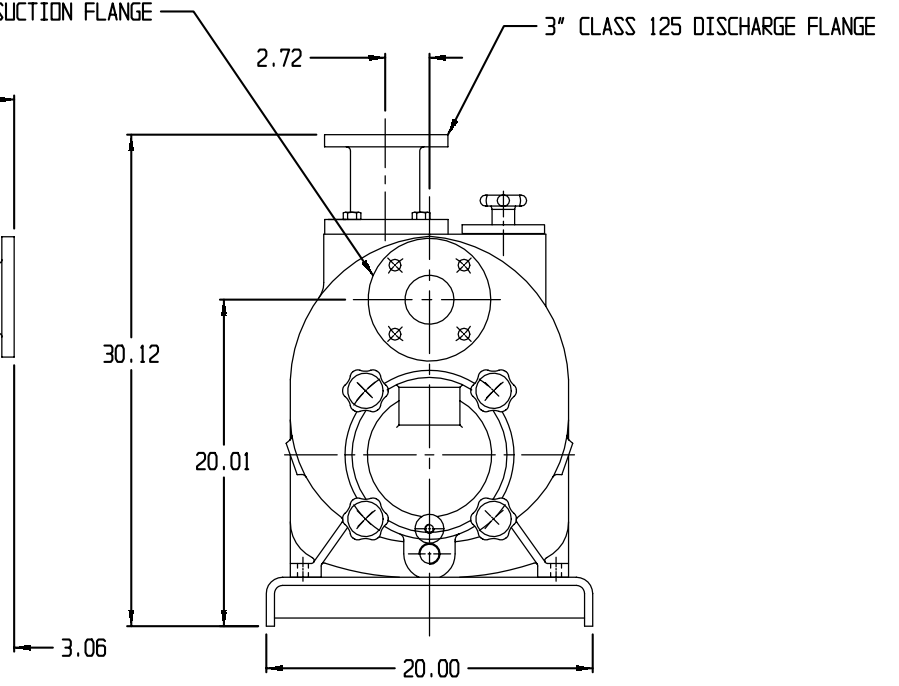
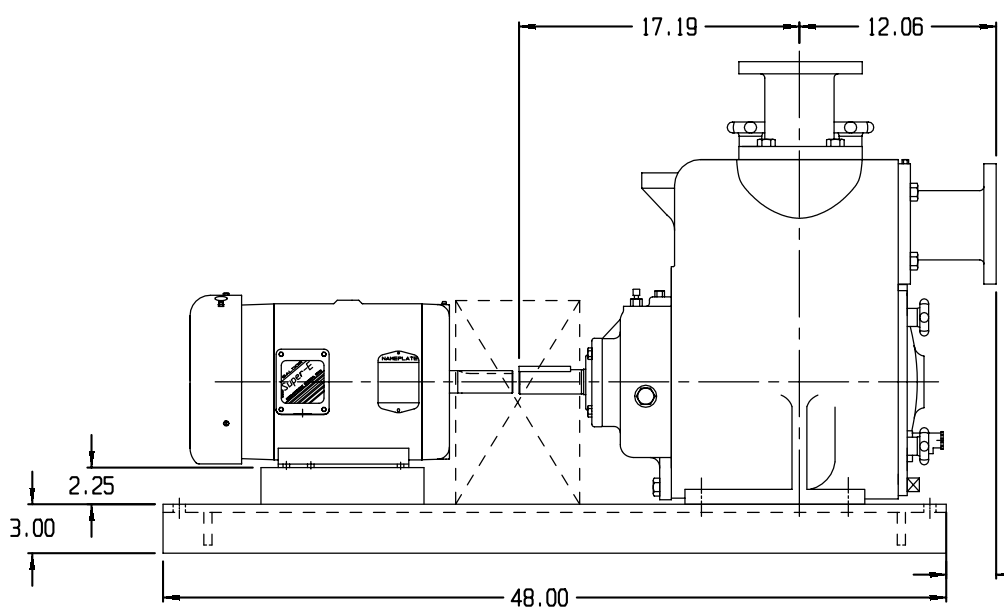
ALL VALUES LISTED ARE dBA

FRAME SIZE		PWL				SPL @ 3'				SPL @ 5'			
BALDOR	NEMA	3600 RPM	1800 RPM	1200 RPM	900 RPM	3600 RPM	1800 RPM	1200 RPM	900 RPM	3600 RPM	1800 RPM	1200 RPM	900 RPM
33	42												
34	48												
35, 305	56	70	67	52		62	59	44		59	56	41	
35, 306	140	70	67	52		62	59	44		59	56	41	
36, 306	180	70	67	54		62	59	46		59	56	43	
37, 307	210	70 (5.25)	70	60		62	62	52		59	59	49	
39, 309	250	76 (6.00)	70	67		67	61	52		64	58	49	
40, 310	280	79 (6.00)	75	64		70	66	55		67	63	52	
42, 312	320	84 (6.00)	75	68		75	66	58		72	63	55	
44, 314	360	87 (7.50)	78	71		77	68	61		74	65	58	
316	400	89 (7.75)	79	76		79	69	66		76	66	63	
318	445	93 (8.50)	84	82		83	73	70		80	70	67	
318	449	97 (12.00)	90	89		87	80	79		84	77	76	
318	449	97 (12.00)	98	97		86	87	86		83	84	83	
500	5000	104	104	97		93	93	86		90	90	85	
580	5800	104	111	112		93	100	101		89	97	97	

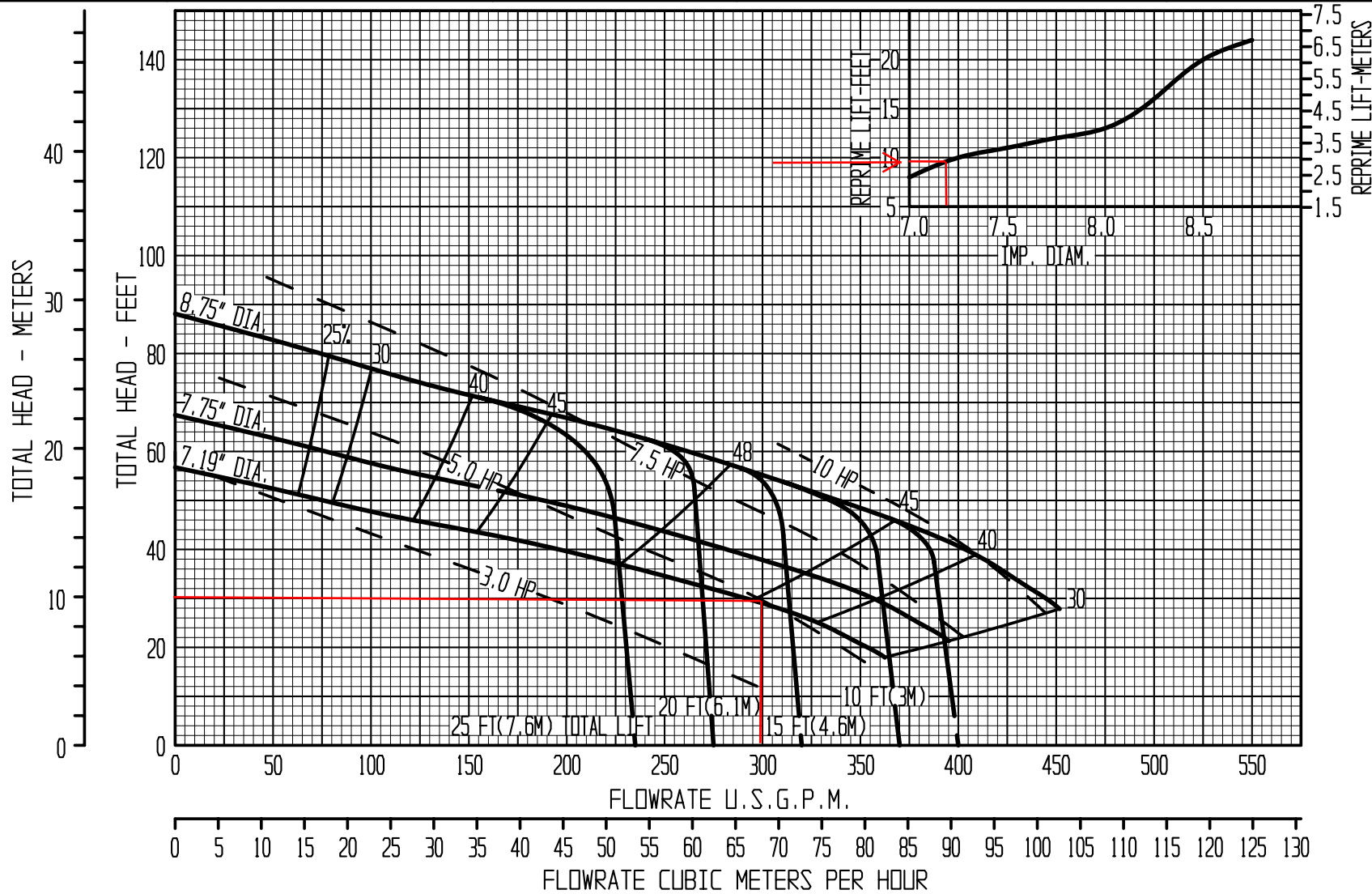
NOTES: PWL (SOUND POWER LEVEL) REF. 10^{-12} watts
 SPL (SOUND PRESSURE LEVEL) REF .0002 μ bar or 20×10^{-6} Pa or 20×10^{-6} N/m²
 REF DOCUMENTS: MG1-1998, Rev 1, 9.4.1, 9.4.2
 (Fan Size)



MODEL: P3 FLANGED
 MOTOR: 7.5 HP, 1800 RPM
 230/460 VOLT, 60 HZ
 3 PHASE, 213T TEFC
 MOUNT: BASE, COUPLING & GUARD



MODEL: P3 | SPEED: 1750 RPM | SIZE: 3" x 3" | IMPELLER DIA. VARIOUS | SOLIDS SIZE: 2.50" | DWG NO.



NOTES:

MODEL: P3

PIONEER PUMP, INC.

SELF PRIMING SERIES

DWG NO.

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April 9, 2013

Romtek Utilities, Inc.

Attention: Mr. Andy Drake

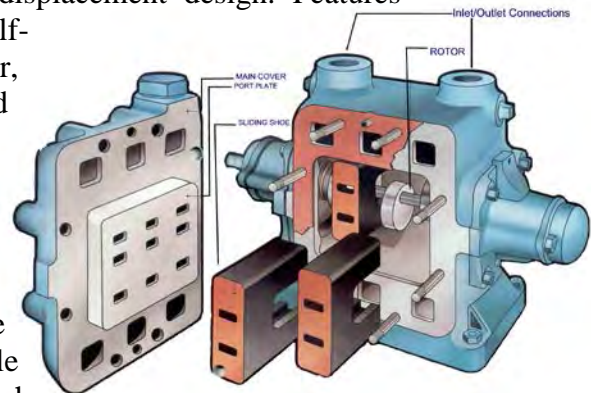
Subject: Megator L75DD Direct Drive **ALUMINUM** Sliding Shoe Pump Unit

Reference: RFQ – REVISED PART B

Pursuant to your request, thank you for considering Megator Corporation for your pumping needs. To follow is detailed information, specifications and pricing for the model discussed. Please do not hesitate to contact us with any questions you have.

The Sliding-Shoe Pump is a unique positive displacement design. Features include exceptional suction performance, self-priming, dry suction, self-compensation for wear, easy maintenance and repair, and handling thin and thick liquids with low shear and low emulsification characteristics.

The Sliding-Shoe pump is designed to operate consistently without the need for maintenance. If maintenance is required, the spare parts can be replaced very quickly and easily resulting in little down time. The reason is a simple design, which allows for front cover access to working parts. Few working parts ultimately mean fewer problems. And when replacement shoes or port plate is required, the task is done quickly and easily without disturbing the drive, bearings, shaft seals or pipe connections. Low emulsification characteristics make the Megator Sliding Shoe Pump ideal for use with an Oil Water Separator and a key component of the System 3.



Megator Corporation is pleased to offer the following proposal for your acceptance:

Megator L75 Megator Positive Displacement Self-Priming Pump Assembly with **ALUMINUM** body, stainless steel internals, shaft seals complete on direct drive base with a 1 HP 3/60/230/460V, 1800 rpm, TEFC electric motor (Instrumentation and local controls by others).

Conditions of Service

Capacity 6.5 gpm
Max. Total Head 100 ft. / 45 psi
(Less suction below)
Max. Total Suction Lift..... 23 ft.
Pump Speed.....1730 rpm

Sump Skimmer complete with 1 ½” x 10’ Urethane hose and Poly quick disconnect couplings:

Delivery: 12 – 14 weeks

SLIDING-SHOE PUMP

**BUILT TO LAST.
NOT TO REPLACE.**



MEGATOR  **R**

PUMP COMPARISON

Due to the fact that the Megator Sliding Shoe Pump is a unique design, we are frequently asked by our prospective clients why they should install the Sliding Shoe Pump. Below is a comparison of the Sliding Shoe Pump in contrast to other pump designs.

PISTON & PLUNGER PUMPS

The absence of valves ensures greater reliability and easier maintenance.

Weight and space occupied are a fraction of that of a piston or plunger pump of equivalent rating.

The elimination of gearing and crank mechanism saves lubrication and maintenance.

Shock and vibration in pipelines are avoided by the smooth laminar flow of the Sliding Shoe Pump.

GEAR, VANE, SCREW & PROGRESSIVE CAVITY PUMPS

Effective pumping and self-priming in the Sliding Shoe Pump is not dependent on fine fits or clearances.

Positive seating and self-compensation for wear enable the Sliding Shoe Pump to keep going under conditions too severe for ordinary rotary positive pumps.

Sliding Shoe Pumps are not confined to liquids having recognized lubricating or sealing properties, as they work with equal efficiency and length of life on water and similar “non-lubricating” liquids.

Sliding Shoe Pumps will run for long periods with a completely dry suction without overheating or damage.

CENTRIFUGAL PUMPS

Self-priming of the Sliding Shoe Pump is spontaneous, without the use of any added priming device, and is completely reliable, even when the pump is in an old and worn condition.

Small seepages can be dealt with continuously and any increased flow up to the full capacity of the pump is instantly picked up. The last drop can be removed from containers.

Very high suction lifts and long suction lines can be handled reliably without reduction in capacity. Entrapped air presents no difficulty.

Fluid pumped at a given speed, instead of falling away rapidly with increase in head, is practically constant at all heads and suction lifts within the range of the pump.

The Sliding Shoe Pump cannot overload the motor as a result of reduced head, and for this reason smaller motors can generally be used.

Sliding Shoe Pumps have high efficiency over a wide range of heads and not merely at or near a single “duty point”.

The Sliding Shoe Pump at a given speed will work efficiently and give the same capacity with liquids of very low or very high viscosity.



THE SLIDING SHOE PUMP

Megator H-300 Cast Iron Pump, used in Mining & Railway applications.



Oily Waste Transfer Pump used in Navy surface ship bilge systems.



Oily Waste Transfer Pump on separator duty.



Megator, helping to guard your investment with rugged, dependable equipment, designed for efficiency and easy maintenance.



THE MOST SENSIBLE DESIGN ON

The Megator Sliding-Shoe Pump

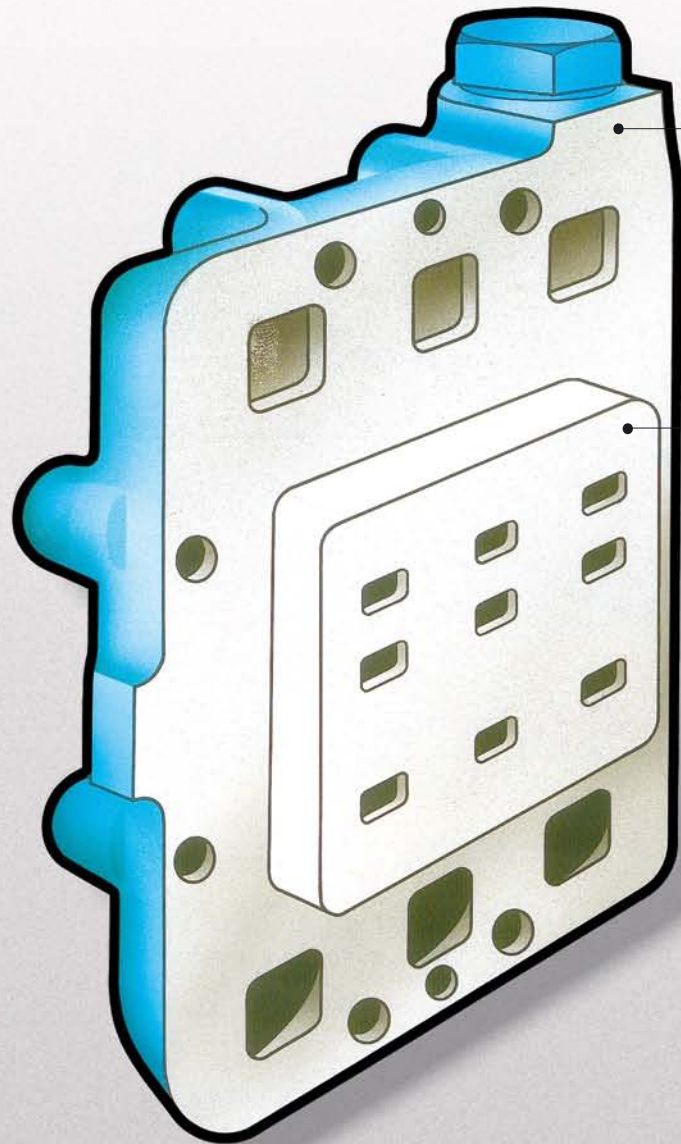
A positive pump with super-suction, self-priming, and dry-running abilities allows easy access to working parts resulting in reduced maintenance costs and down time.

First and foremost, the Sliding Shoe Pump is designed to operate consistently without the need for maintenance. But when maintenance is required, you won't have to spend your valuable time disassembling a complex piece of advanced technology. In fact, to access the heart of the pump, all you do is remove a few fasteners and remove the front cover. You'll reveal the most impressively simple pump design in existence. Few working parts ultimately means fewer problems. And when replacement of shoes or port plate is required, the task is done quickly and easily; without disturbing the drive, bearings, shaft seals or pipe connections.

Sensible design also means sound performance. The Sliding Shoe Pump offers more basic advantages than any other pump. In fact, when the pump was originally created, the most attractive features of various pumps on the market were incorporated into the design of the Sliding Shoe Pump. The problems which plagued other pumps were, of course, excluded from Megator's design.

The Sliding Shoe Pump primes itself instantly and can run without harm during dry suction. Every last drop is removed whether you're dealing with thin or viscous liquids. The pump delivers full capacity at high suction lifts. It's self-compensating for wear. And, as already stated, but worth repeating, it gives single-cover access to working parts.

The Pump provides exceptional suction performance, versatility, and ability to pump constant capacity against heads to 250 feet, and is used in a variety of applications: particularly where simple, rugged construction, inherent self-priming and high suction lift can save time and money.

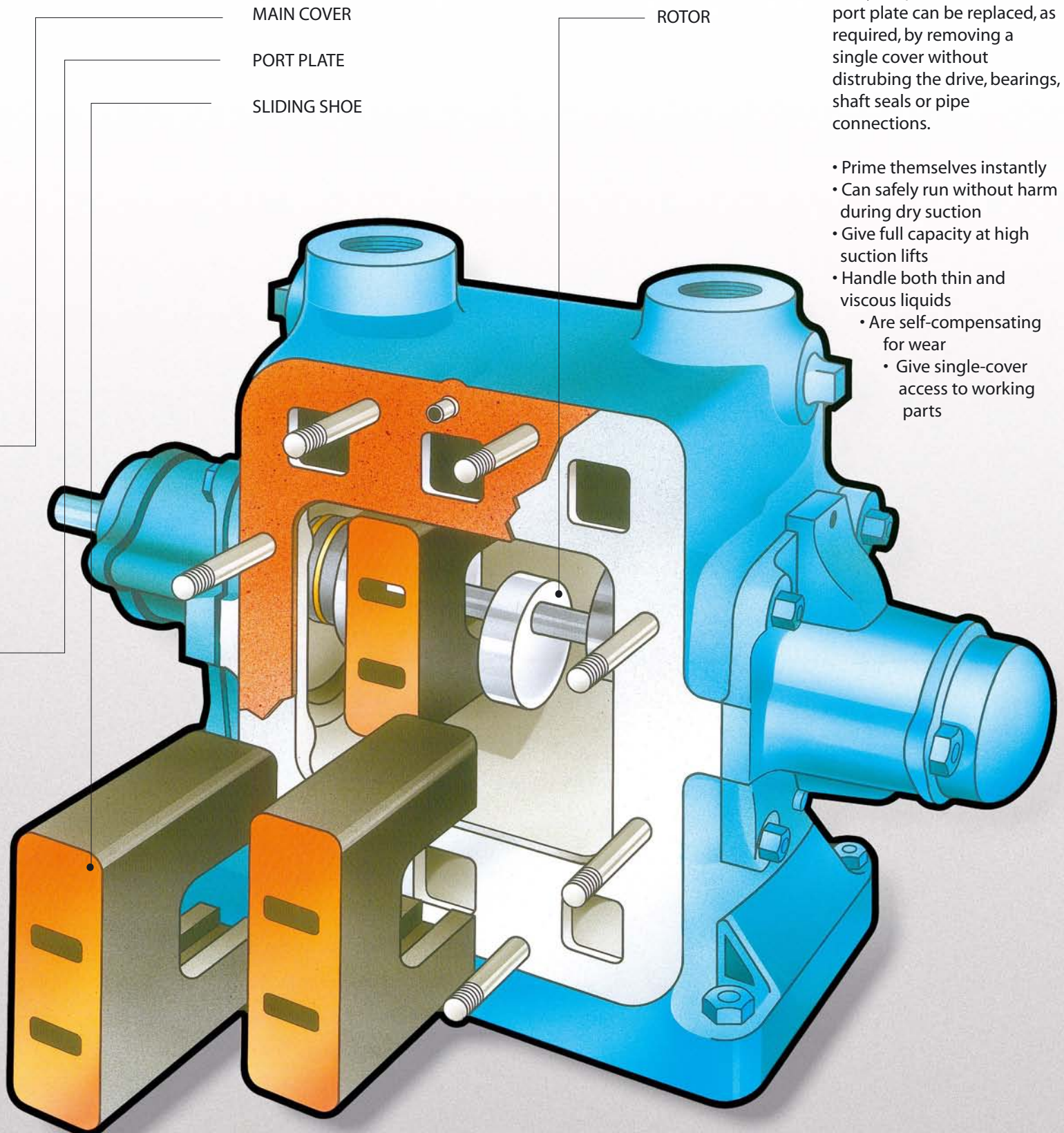


THE MARKET

SIMPLE AND ACCESSIBLE.

The working parts of the Sliding Shoe Pump can be easily inspected. Shoes and port plate can be replaced, as required, by removing a single cover without disturbing the drive, bearings, shaft seals or pipe connections.

- Prime themselves instantly
- Can safely run without harm during dry suction
- Give full capacity at high suction lifts
- Handle both thin and viscous liquids
- Are self-compensating for wear
- Give single-cover access to working parts





TAKING ON THE TOUGHEST JOBS

with Versatility and Consistency

ISO 9002 Certified

Sliding Shoe Pumps are available in our L-range designating total heads to 100 feet or H-range designating total heads to 250 feet. They have a maximum total suction lift to 27 feet. Suction and discharge ports 3/4" to 4".

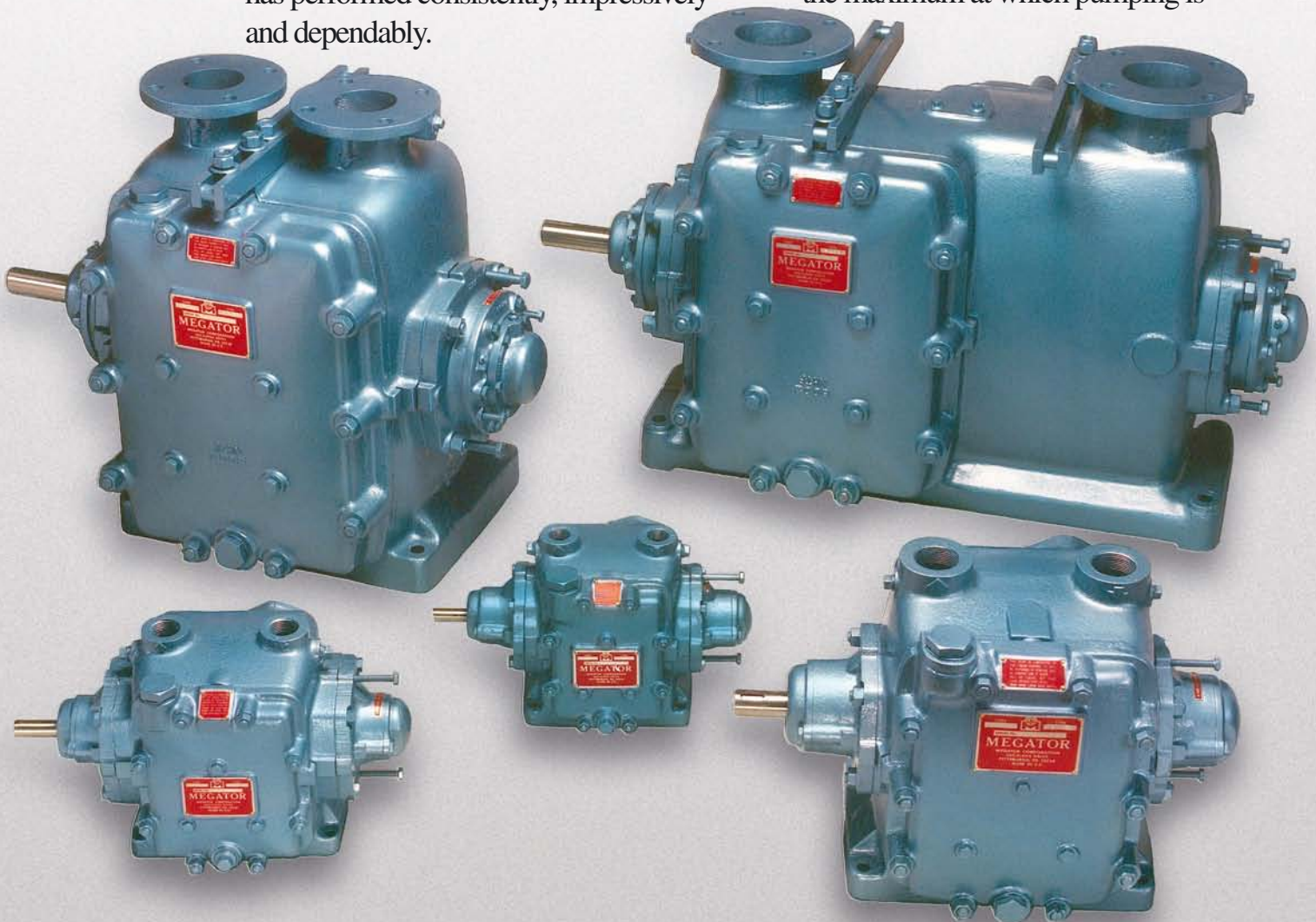
Pump Construction: cast iron, cast iron with Impreglon coating, bronze or aluminum

From the mines to the marines, the Sliding Shoe Pump has seen the worst of it. Specifically, recovering oil from sumps, pits, ponds, oil traps and other such areas. Gathering water in mines. Stripping sludge from tank bottoms. Pumping starch adhesive. Pumping diesel fuels and lubricating oils. And pumping liquids with minimal aeration, emulsification, or shearing.

In each application, the Sliding Shoe Pump has performed consistently, impressively and dependably.

The Sliding Shoe Pump delivers "super-suction" performance which it owes to a unique design feature. The working parts are entirely submerged and liquid sealed; even when pumping nothing but air. Liquid sealing also allows for self-priming and enables the pump to safely run with a completely dry suction without depending on a by-pass or other easily blocked device.

Importantly, the Sliding Shoe Pump will efficiently handle liquids of any viscosity to the maximum at which pumping is

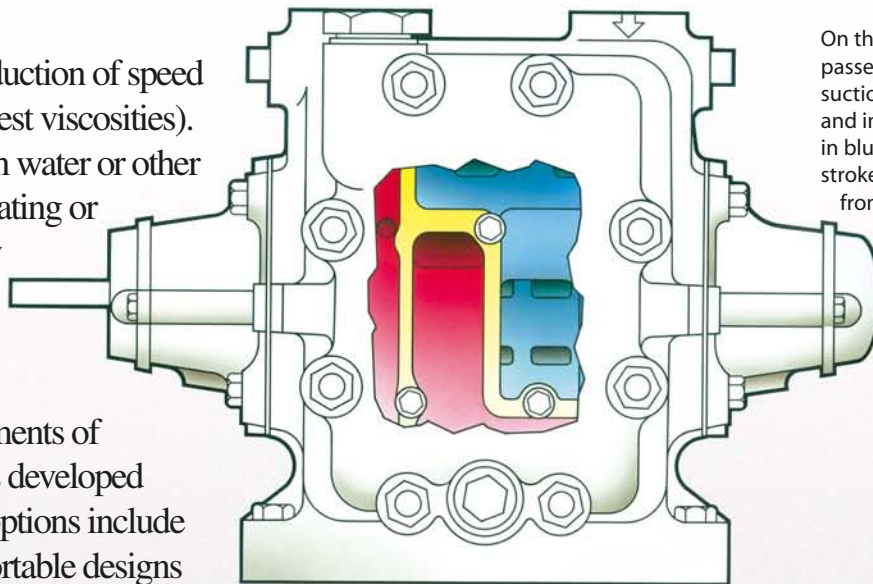


IN INDUSTRY

economically feasible (some reduction of speed being necessary only at the highest viscosities). The Pump is equally effective on water or other thin liquids that have little lubricating or penetrating properties. It readily handles free-flowing or viscous liquids, or a mixture of both.

To meet the specialized requirements of different industries, Megator has developed versatile assemblies. Available options include stationary, skid mounted, and portable designs featuring electric, gasoline, diesel, air, or hydraulic drives.

The pump is also available in a wide range of sizes. So you can be sure to get the right pump for your particular needs.



On the suction stroke, liquid passes down through the suction ports in the plate and into the shoes, as shown in blue. On the discharge stroke, liquid is displaced from the shoes through the discharge ports as shown in red.



Model H-300 for direct-drive arrangement.



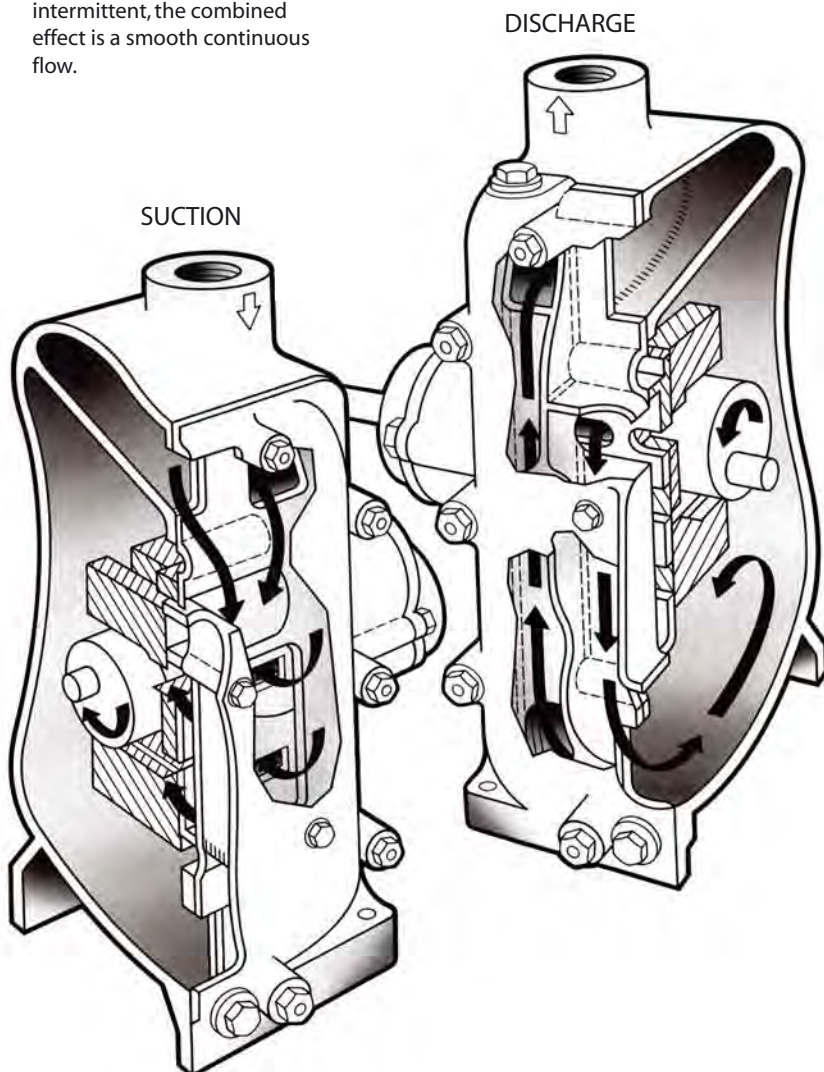
DEPENDABLE PUMPING ACTION- SMOOTH CONTINUOUS FLOW

"If it ain't broke, don't fix it" This old adage reflects the cautious, sensible approach we've taken when considering design changes on the Sliding Shoe Pump. The modern trend in pump design has been in the direction of greater technical complexity which, experience has shown, usually means a greater probability of downtime. The Sliding Shoe Pump is built to not break down; which is why industries of all kinds have come to rely on our pump.



Model H-300 for waste treatment.

The figure below illustrates the working cycle of a Sliding Shoe Pump. Although the displacement in each shoe is intermittent, the combined effect is a smooth continuous flow.



HOW THE PUMP WORKS

Pumping action is derived from the rotation of three or more eccentric discs, each of which is closely fitted into a displacement chamber or shoe of plastic material lined with synthetic rubber. The eccentric movement of each disc comprises horizontal and vertical components. The horizontal motion provides displacement; the disc reciprocates in the shoe like a piston in a cylinder. The vertical motion controls the valving, the entry and the discharge of the liquid through the pump.

When the pump is started, a hydraulic pressure differential is created which ensures a tight seal and maintains the shoes in close contact with a flat port plate forming the division between the suction and discharge sides of the pump. The plate has ports opposite each shoe, respectively, leading from the suction branch and into the discharge side of the pump. On the suction stroke, liquid passes down through the main cover and is drawn into the shoes through the suction ports in the plate. On the discharge stroke, liquid is displaced from the shoes through the discharge ports.

The liquid then passes down through the main cover into the bottom of the body before flowing through another passage in the main cover to the discharge branch. This arrangement helps to scavenge the bottom of the body and prevent the accumulation of solids. The outstanding performance of the pump does not depend upon fine clearances.

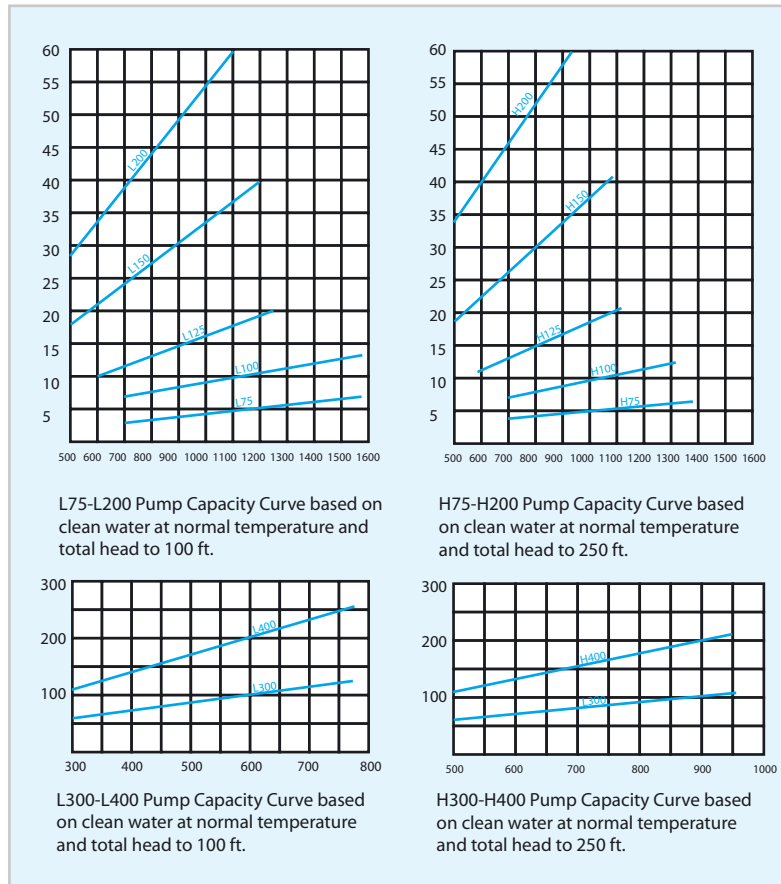
BUILT TO LAST, NOT TO REPLACE.

Megator developed a heavy-duty, reliable pump that can conceivably outlast any job it is assigned to.



The Sliding Shoe Pump is constructed of cast iron, cast iron with an Impreglon coating, bronze or aluminum. Port plates and rotors are made of precipitation-hardened stainless steel which can be coated for even greater wear resistance. Bearings are eccentric-locking with an inner ring of hardened stainless steel, which guarantees easy removal and quick access to shaft seals. Shaft seals are exposed to the cooling and flushing effect of the liquid flowing through the pump body.

If there is any possibility of excessive head or throttling of the discharge, a relief valve capable of passing the full pump capacity should be installed. The relief valve can be arranged to bypass to suction but an open and visible discharge is generally preferable.



Photo, Top Left Model H-400 pumps on refinery duty.

Photo, Left Sliding Shoe Pumps serving municipal authority.

All these features make the Sliding Shoe Pump the most sensible, reliable pump in operation. Just as reliable as your Megator representative. So if you have any questions, give him a call at 412-963-9200 Outside PA call 800-245-6211.

Web: www.megator.com

e-mail: info@megator.com

Specifications and Dimensions

Megator Types L&H Pumps

Standard Ratings

HIGH SUCTION RATINGS

For very high suction lifts, high viscosities and dirty liquids consult factory.

CHARACTERISTICS

The Sliding-Shoe Pump delivers its rated capacity at any head and any suction lift within its range. The head developed is the head imposed by the system at the rated flow. A head-capacity curve on the conventional basis would be a straight line.

INTERMEDIATE CAPACITIES

For intermediate capacities, pumps can be run at speeds lower than those listed in the tables. The head is independent of the speed. The capacity at a given head is approximately proportional to the speed.

MOTOR HOSEPOWERS

The standard motors listed provide for the maximum heads.

Pump	Capacity		Maximum Total Head		Motor HP		Maximum Total Suction Lift				Pump rev/min
	U.S. gal/min	feet water	lbs/in ²	WATER	4500 SSU	WATER		4500 SSU			
						feet	in Hg	feet	in Hg		

TYPE L Belt-Drive: Total Heads To 100 Feet

L75	6	100	45	¾	1	23	20	20	18	1575
L100	12	100	45	1½	2	23	20	20	18	1575
L125	20	100	45	1½	3	23	20	20	18	1290
L150	40	100	45	3	5	23	20	20	18	1225
L200	60	100	45	5	7½	23	20	20	18	1120
L300	120	100	45	7½	15	20	17	18	16	760
L400	240	100	45	15	30	20	17	18	16	760

TYPE H Belt-Driven: Total Heads To 250 Feet

H75	6	250	110	1	2	23	20	20	18	1390
H100	12	250	110	2	3	23	20	20	18	1345
H125	20	250	110	3	5	23	20	20	18	1200
H150	40	250	110	5	7½	23	20	20	18	1120
H200	60	250	110	7½	10	22	19	20	18	960
H300	100	250	110	10	20	22	19	20	18	960
H400	200	250	110	20	40	22	19	20	18	960

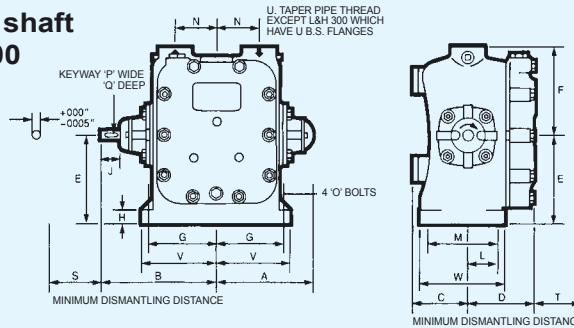
TYPE L Direct-Coupled: Total Heads To 100 Feet

L75	6.5	100	45	¾	1	23	20	20	18	1730
L100	13	100	45	1½	2	23	20	20	18	1730
L125	18	100	45	1½	3	23	20	20	18	1150
L150	36	100	45	3	5	23	20	20	18	1150
L200	60	100	45	5	7½	23	20	18	16	1150
L300	130	100	45	7½	15	20	17	18	16	865
L400	260	100	45	15	30	20	17	18	16	865

TYPE H Direct-Coupled: Total Heads To 250 Feet

H75	7.5	250	110	1	2	23	20	20	18	1730
H100	15	250	110	2	3	23	20	20	18	1730
H125	18	250	110	3	5	23	20	20	18	1150
H150	40	250	110	5	7½	23	20	20	18	1150
H200	54	250	110	7½	10	21	18	20	18	865
H300	90	250	110	10	20	21	18	20	18	865
H400	180	250	110	20	40	21	18	20	18	865

Pumps with bare shaft L & H 75 - L&H 300

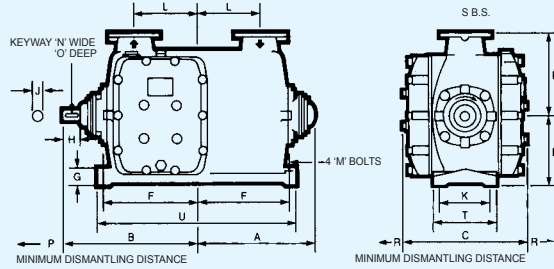


Approximate weights

	lbs.		lbs.
L75	38	H75	51
L100	56	H100	71
L125	80	H125	100
L150	122	H150	168
L200	166	H200	221
L300	406	H300	452

Pump type	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
L75	6¼	7¾	3¼	4	4½	4½	3⅝	¾	1½	½	1⅝	4	2⅜	5/16	¼	1/16	—	9¼	3	¾	3¼	4¾	—
L100	7	8⅞	4	4⅝	5	5	4	⅞	1½	½	2	5¼	2⅜	⅜	⅞	1/16	—	10¼	3¾	1	4⅝	6	—
L125	7½	9	4½	5⅝	6	6¼	5	7/8	1⅝	5/8	2⅝	6¼	3¼	⅜	3/16	3/32	—	12¼	4	1¼	5⅞	7⅞	—
L150	8⅝	10	4½	6	7¼	7½	5¾	1¼	1¾	¾	2⅝	6	3½	½	3/16	3/32	—	13¾	5	1½	6⅝	7¼	—
L200	9⅝	11⅞	5⅝	6⅝	8½	8¾	6	1¼	1⅞	1	2⅞	7	3¾	½	¼	1/8	—	14¾	5½	2	6⅝	8¼	—
L300	13½	16	7⅞	9¾	11	13	8	2	4	1¼	4¼	11	4⅞	5/8	5/16	9/64	—	20	12	3	8⅞	12⅞	—
H75	6½	8	3½	4½	4½	4½	3⅝	7/8	1½	5/8	1⅞	4¾	2⅜	3/16	3/16	3/32	—	10	3¼	¾	3¼	5½	—
H100	7½	9¼	4⅞	4⅞	5	5	4	7/8	2	¾	2	5¼	2⅜	⅜	3/16	3/32	—	11½	4¼	1	4⅝	6	—
H125	8⅝	10½	4½	5⅝	6	6¼	5	7/8	2	1	2⅝	6¼	3¼	⅜	¼	1/8	—	13¼	5	1¼	5⅞	7⅞	—
H150	9½	11⅞	4¾	6⅞	7¼	7½	5¾	1¼	2⅞	1⅞	3	7	3½	½	5/16	7/64	—	14½	5½	1½	6⅝	8¼	—
H200	10¼	12½	6⅞	6¾	8½	8⅞	6	1¼	2¾	1¼	3⅞	8½	3¾	½	5/16	7/64	—	15½	6½	2	6⅝	9¾	—
H300	14	17	7⅞	9¾	11	13	8	2	4	1½	4¼	11	4⅞	5/8	3/8	5/32	—	21	12	3	8⅞	12⅞	—

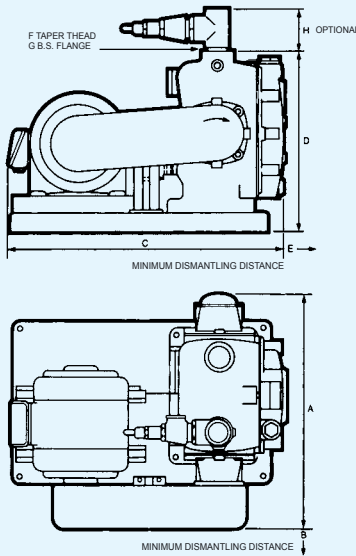
L & H 400



Pump type	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	U	V	Approx. wt. in lbs.
L400	18 1/4	21 5/8	19 1/2	11	13	14 3/4	2 5/16	4	1 1/4	8	10	3/4	5/16	5/64	30	12	4	10	31 1/2	—	710
H400	18 3/4	22 5/8	19 1/2	11	13	14 3/4	2 5/16	4	1 1/2	8	10	3/4	5/8	5/32	31	12	4	10	31 1/2	—	730

ROTATION Standard rotation is clockwise facing driving end and the standard assembly is with the suction at the non-drive end. Pump cannot be operated in the reverse direction but can be assembled so that the drive is at the opposite end.

Belt-driven assemblies



Pump type	A	B	C	D	E	F	G	H	Approx. wt. in lbs.
L75	14 3/4	9 1/4	20 3/4	10 1/2	3	3/4	—	3	105
L100	15 3/4	10 1/4	21 3/4	11 1/2	3 3/4	1	—	3 1/2	135
L125	17	12 1/4	23 1/2	14	4	1 1/4	—	3 3/4	155
L150	19	13 3/4	27 1/4	16 3/4	5	1 1/2	—	4	220
L200	20 3/4	14 3/4	30	20 1/4	5 1/2	2	—	4 1/4	320
L300	30	20	34 1/4	26 3/8	12	—	3	7	560
L400	44	30	54	26 1/2	12	—	4	9	1160
H75	15 1/4	10	21 1/8	10 1/2	3 1/4	3/4	—	3	120
H100	17 1/4	11 1/2	23 3/4	11 1/2	4 1/4	1	—	3 1/2	150
H125	19 5/8	13 1/4	26	14	5	1 1/4	—	3 3/4	205
H150	21 1/2	14 1/2	28 1/4	16 3/4	5 1/2	1 1/2	—	4	260
H200	23 1/2	15 1/2	30 1/4	20 3/8	6 1/2	2	—	4 1/4	355
H300	32	21	34 1/4	26 3/8	12	—	3	7	890
H400	44	31	54	26 1/2	12	—	4	9	1600

SUCTION LIFT

The suction lifts listed assume normal temperature and elevation. Installations combining suction lift with temperatures or elevations above normal should be referred to Megator.

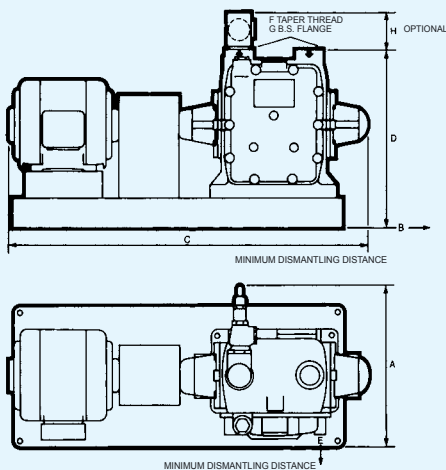
TEMPERATURE

The Sliding-Shoe Pump allows for temperatures up to 150° F, subject to the note on suction lift. Where higher temperatures are involved, it is advisable to consider them in conjunction with the other working conditions and such cases should be referred to Megator.

DIRTY LIQUIDS

Reduced pump speeds give a markedly increased resistance to wear and are preferably used for dirty liquids. Under severe conditions still lower speeds may provide the most economical installation.

Direct-coupled assemblies



Pump type	A	B	C	D	E	F	G	H	Approx. wt. in lbs.
L75	10 3/4	9 1/4	25 3/8	10 1/2	3	3/4	—	3	135
L100	10 3/4	10 1/4	28 3/4	13	3 3/4	1	—	3 1/2	170
L125	12 1/4	12 1/4	30 1/4	15 1/4	4	1 1/4	—	3 3/4	195
L150	12 7/8	13 3/4	34 3/4	17 3/4	5	1 1/2	—	4	310
L200	14 1/4	14 3/4	40 7/8	21 1/4	5 1/2	2	—	4 1/4	460
L300	18 1/2	20	54	28	12	—	3	7	700
L400	21	30	67	28	12	—	4	9	1500
H75	14	10	28 1/4	10 1/2	3 1/4	3/4	—	3	150
H100	14	11 1/2	30 1/2	13	4 1/4	1	—	3 1/2	190
H125	13	13 1/4	35 7/8	15 1/4	5	1 1/4	—	3 3/4	260
H150	14 1/4	14 1/2	41 1/4	18 3/4	5 1/2	1 1/2	—	4	380
H200	15 1/4	15 1/2	43 7/8	21 1/4	6 1/2	2	—	4 1/4	510
H300	18 1/2	21	53	28	12	—	3	7	1100
H400	20	31	69	28	12	—	4	9	2100

As research and development proceed continuously, Megator reserves the right to make detailed modifications of design or dimensions without notice. Certified drawings are available to cover specific orders.

BENEFITS

- Self-priming
- Operates with dry suction
- Simple to install
- High suction lift
- Constant capacity at varying heads
- Single cover access
- Simple to operate
- Self-compensating for wear
- The same pump for water and oils
- Remove the last drop from containers
- Minimal shear/emulsification

FEATURES

- Capacities to 264 gpm
- Suction lifts to 27 ft.
- Viscosities to 21,000 SSU
- Heads to 250 ft.
- Available in bronze, cast iron, cast iron with Impreglon coating & aluminum casings
- Air, diesel, electric, hydraulic or gasoline driven
- Variable speed inverter control (VFD)
- Direct coupled or belt drive options
- Available assemblies include stationary, skid-mounted & mobile options

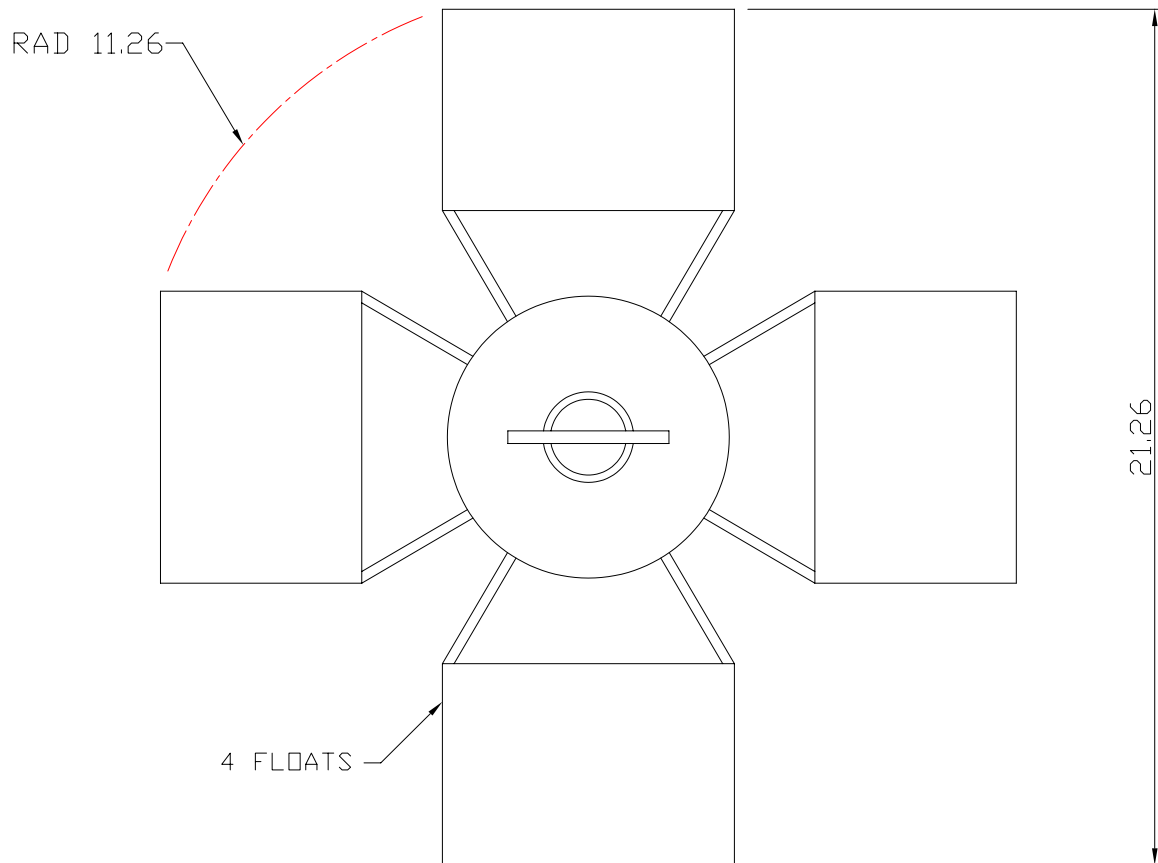
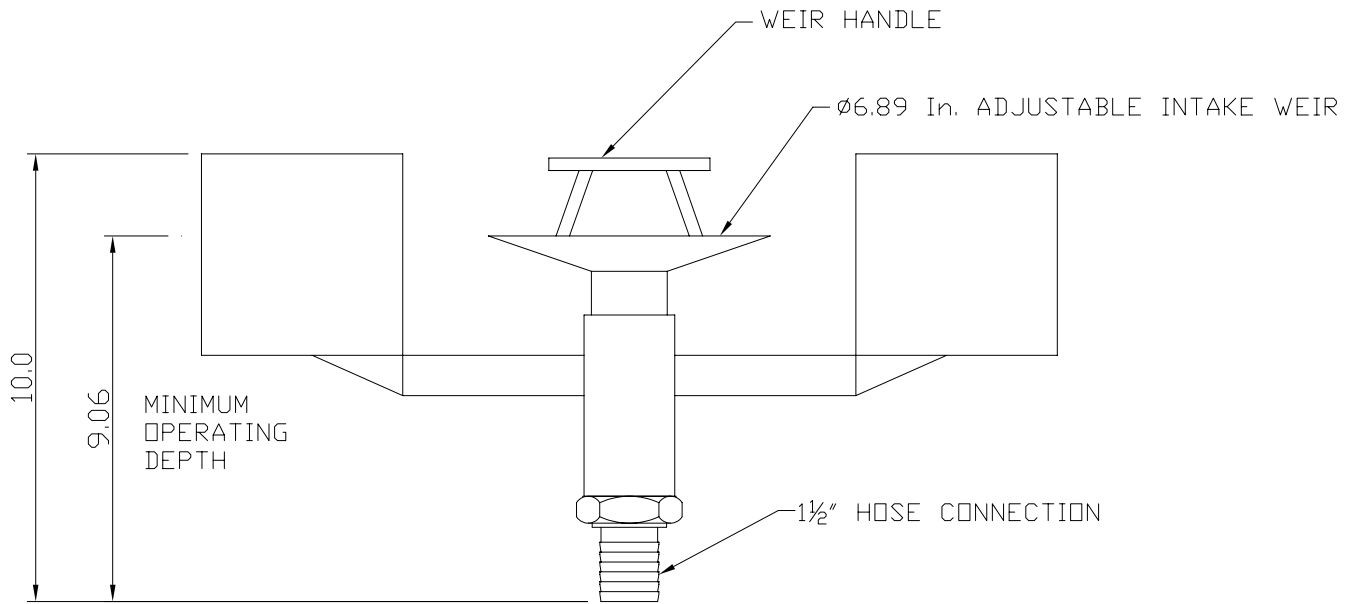


526 ALPHA DRIVE, PITTSBURGH, PA 15238

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E-MAIL: INFO@MEGATOR.COM WWW.MEGATOR.COM

DISTRIBUTOR



MATERIAL - STAINLESS STEEL 304
 WEIGHT - 22 Lb.
 SUPPLIED WITH 10 FT SUCTION HOSE & COUPLINGS
 ALL DIMENSIONS IN INCHES UNLESS STATED

**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

Flush Diaphragm Submersible Liquid Level Sensor



AST4520

ISO9001:2008



The AST4520 Flush Submersible Series is the cost effective solution for level monitoring of turbulent tanks with viscous media. Approved to **UL/cUL913 Class 1 Division 1 IS, Groups C and D with an approved barrier**, the product ensures a safe, reliable source for level measurement.

The AST4520 is offered with pressure ranges from 0-2.5 to 0-15 PSIG. The AST4520 steel cage front end design allows for proper flow of media while keeping the sensor at the bottom of the tank or well. With an engraved stainless steel housing and Kynar PVDF cable, this sensor is built to handle the toughest environments.

Benefits

- Engraved 316L Housing
- Protective Steel Cage Assembly
- Kynar PVDF Cable
- Compatible with a Wide Range of Chemicals
- Ruggedly Designed for Harsh Waste Water Environments
- Suitable for Waste, Salt, Brackish, or Fresh Water Systems
- EMI/RFI and Reverse Polarity Protection
- Lightning and Surge Protection
- Competitively Priced for OEM Applications
- ABS (American Bureau of Shipping)

Approved

Applications

- Lift Stations - Wastewater, Storm Water, Industrial Applications
- Food Tanks
- Viscous Media Tanks
- Heavy Oil

Environmental Data

Temperature

Operating	-40 to 85°C (-40 to 185°F)
Storage	-40 to 100°C (-40 to 212°F)

Thermal Limits

Compensated Range	0 to 55°C (30 to 130°F)
TC Zero	<±1.5% of FS
TC Span	<±1.5% of FS

Other

Shock	100G, 11 msec, 1/2 sine
Vibration	10G peak, 20 to 2000 Hz.
EMI/RFI Protection:	Yes
Rating:	IP-68

Performance @ 25°C (77°F)

Accuracy*	< ±0.25% BFSL
Stability (1 year)	±0.25% FS, typical
Over Range Protection	2X Rated Pressure
Burst Pressure	5X or 1,250 PSI (whichever is less)
Pressure Cycles	> 50 Million

*Accuracy includes non-linearity, hysteresis & non-repeatability

Electrical Data

Output	4-20mA
Excitation	10-28VDC
Output Impedance	>10k Ohms
Current Consumption:	20mA, typical
Bandwidth	(-3dB): DC to 250 Hz
Output Noise:	-
Zero Offset:	<±1% of FS (<±4% 1PSI)
Span Tolerance:	<±2% of FS (<±4% 1PSI)
Output Load:	0-800 Ohms@10-28VDC
Reverse Polarity Protection	Yes

Ordering Information

AST4520 Y 00010 P 4 X 1 355

Series Type

Process Connection

Y= G1/2 with steel cage

Pressure Range

Insert 5-digit pressure range code

Pressure Unit

H= Inches H2O P= PSI

Outputs

4= 4-20mA (2 wire loop powered)

Electrical

(for wiring information visit: <http://www.astensors.com/mediacenter.php>)

X= Optional Length (see options)

Wetted Material

1 = 316L / 304 SS / Kynar

Options Cable Lengths:

353 = 25 ft. (7.62 m)

354 = 50 ft. (15.24 m)

355 = 75 ft. (22.86 m)

	Gage PSIG	Pressure Range Code	Feet of Water Column @ 4°C (approx.)
AST4520	0-15	00015	34.60
	0-10	00010	23.07
	0-7.5*	00208*	17.30
	0-5	00005	11.53
	0-2.5*	00069*	5.77

*2.5 and 7.5 PSI Sensor must be ordered in inches of H₂O.

Barrier Installation

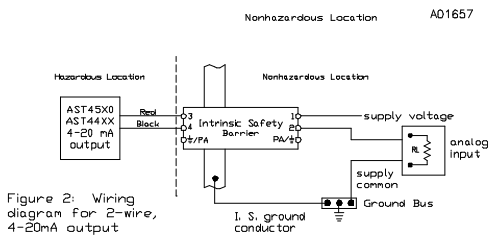


Figure 2: Wiring diagram for 2-wire, 4-20mA output

The transducers listed below are designed for installation in a Class I, Division 1, Groups C and D, Division 1 hazardous location when connected to Associated Apparatus as described in note 1.

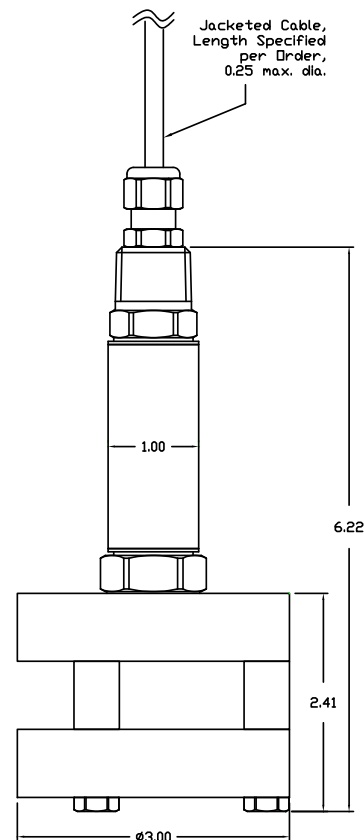
Entity Parameters

$V_{max} = 28V_{dc}$
 $I_{max} = 175mA$ I_{max} is the total current available from the Associated Apparatus under any condition.
 $C_i = 0.44\mu f$
 $L_i = 0$

Notes:

- Associated Apparatus shall provide intrinsically safe connections which meet the following parameters:
 $V_{oc} \text{ or } V_t \leq V_{max}$ $C_a \geq C_i + C_{leads}$
 $I_{sc} \text{ or } I_t \leq I_{max}$ $L_a \geq L_i + L_{leads}$
- Control Room apparatus shall not generate in excess of 250V (V_{unax}).
- Installation should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70.

Dimensional Data





The NIVA level controller MS 1 C is the ideal solution to control liquids with limited switching space. For example in:

- Chemical plants
- Electro plating shops
- Purifying Plants



The NIVA level controller MS1 C was designed for an extremely high resistance to chemical liquids and for use at high temperatures up to 100 °C (212 °F).

Available versions:

Type	Cable	Length (m)	Order-no.
W	Teflon/FEP 4 x 0.5	5	40 000705
W	Teflon/FEP 4 x 0.5	10	40 000710
W	Teflon/FEP 4 x 0.5	20	40 000720

W = Changeover (SPDT)

Other cable types and lengths are available upon request

Application:

For use in chemically loaded liquids at temperatures up to 100 °C (212 °F).

Electronic connection

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

Technical data subject to change

Technical data:

Specific weight: 0.95–1.05 or according to specification
 Max. temperature: 100 °C (212 °F)
 Breaking capacity: 1 mA / 4 V - 5 A / 250 V *
 Switch point: 10°
 Protective system: IP 68 / 2 bar
 Protection class: II
 Cable cross section: 4 x 0.5 mm²
 Height / diameter: 180 / 100 mm (7 in / 3.9 in)
 Housing quality: Polypropylene (PP)
 Housing Colour: Grey
 Cable quality: Teflon (FEP)
 Cable colour: Black
 Cable seal: Viton

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



Potential equalization wire

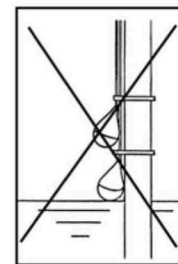
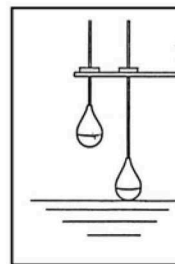
CE
73/23/EEC



1mA/4V-5A/250V

☐ ⚡ ⚡ ⚡ μ T80
γ 0,95 - 1,05

MS 1



<p> (GB) Connection of Level Regulators (D) Anschluss der Niveaugler (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) Pinnansäätimen liittäminen (RUS) подсоединение регулятора уровня (PL) Przyłącze regulatorów poziomu (H) A szintszabályozók csatlakoztatása (CZ) Připoj regulátorů hladiny (SK) Pripoj regulátorov hladiny (SL) Priključitev regulatorjev nivoja (HR) Cijev za regulator razine (SC) Cev za spravu za regulisanje nivoa (GR) Σύνδεση ρυθμιστή στάθμης (TR) Seviye regülatörlerinin bağlanması </p>	<p> ① grey grau gris grigio gris cinzento grijs grå grå grå harmaa серый kolor szary szürke šedý sivý siv sivo sivo γκριζο gri </p>	<p> ② black schwarz noir nero negro preto zwart sort svart svart musta чёрный kolor czarny fekete černý černý črno crni crni μαύρο siyah </p>	<p> ③ brown braun brun marrone 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 tyhjentäminen (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 (SC) 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 væskenniveau Larm vid hög vätskenivå Alarm ved høyt væskennivå 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 täyttäminen (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 (SC) 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 væskenniveau Larm vid låg vätskenivå Alarm ved lavt væskennivå 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 nizkom 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>

**EC Declaration of Conformity**

according to

**EC Directive 2006 /95 / EC
EC Directiv RoHS 2002 / 95 / EC**

We

**NOLTA GmbH
35091 Cölbe**

hereby declare, that the products we manufacture conform in conception, design and circulated model to the relevant basic health and safety requirements of EC directives. If any changes are made to the level – controllers without our prior consent, this declaration loses its validity.

Products:

Level – Controllers

Type:

MS 1 C

Applied harmonized standards:

- **DIN EN 60730-1 (VDE 0631-1):2005-12+Ber.1:2007-11
+/A2:2008-04+/A15:2007-08+/A16:2008-02**
- **DIN EN 60730-2-16 (VDE 0631-2-16):200208+/A11:2005 11**
- **DIN IEC 60730-1 (VDE 0631-1):2008-10+/A3:2005-01**

Cölbe, 14.04.2009

.....
Dr.-Ing. Jochen Knake / Geschäftsführer.....
Wolfgang Seip / Quality Manager

**END
OF
SECTION**

11. ELECTRICAL INTERCONNECTIONS/ ELECTRICAL CORED HOLES

This section includes data and drawings for typical field wiring.

11.01 TYPICAL FIELD WIRING PLAN

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.

**END
OF
SECTION**

12. CONTROL PANEL/ ELECTRICAL & COMMUNICATIONS

This section includes design and data pertinent to the control panel and electrical communication.

This section is structured as follows:

12.01 STANDARD TEMPERATURE SPECIFICATIONS

12.02 POWER QUALITY DISCLAIMER

12.03 ELECTRICAL SYSTEM DESIGN VOLTAGE

12.04 SPECIFICATIONS – CONTROL PANEL SCOPE OF SUPPLY

12.05 ONE-LINE DRAWING

12.01

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.

12.03 ELECTRICAL SYSTEM DESIGN VOLTAGE



5/17/13
BAE ACETIC ACID PLANT
TENNESSEE

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.

12.04 SPECIFICATIONS—CONTROL PANEL SCOPE OF SUPPLY

Control Panel Scope of Supply 5/17/13 BAE ACETIC ACID PLANT TENNESSEE

General information

- ELECTRICAL SERVICE - 480V, 3 Phase
- PUMPS - (3) 7.5HP, 460V, 3 PH, 11 FLA, TRIPLEX configuration
- PUMPS - MODEL PIONEER , P3087L3-H0-7.5-4
- PUMPS - (1) 5HP, 460V, 3PH, 7.6 FLA Oil Seperator Pump
- PRIMARY CONTROLLER - SIEMENS PLC configured for TRIPLEX
- CONTROL PANEL MOUNTING - FLOOR MOUNT

Liquid level sensing

- PRIMARY LEVEL SENSING - AST 4520 TRANSDUCER WIRED FOR INTRINSICALLY SAFE
- BACKUP LEVEL SENSING - (2) NOLTA MS1C FLOATS WIRED FOR INTRINSICALLY SAFE

Station Control Panel General Description

Qty.	Description
1	NEMA 3R PAINTED STAINLESS STEEL, 60"H X 36"W X 20"D enclosure w/ 8" mounting base.
-	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.
-	8" mounting plinth provides additional space for routing conduits and cables into the control panel.

Service Compartment

1	125A 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	5KVA control power transformer, 1 phase, 480VAC/120VAC, externally mounted.

MCC Compartment

- 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.
- 4 Pump motor circuit breakers.
- 4 Soft Starters.
- 1 Door interlock circuit breaker
- 2 Ventilation fans thermostatically operated w/shrouds
- 1 Compartment service light door operated.
- Pump terminal blocks for field wiring terminations.
- Compartment interconnection seal barrier.

Control Compartment

- 1 Enclosure light and door activated switch
- 1 Siemens HMI KTPC Color #6AV6647-0AC11-3AX0
- 1 Siemens PLC 314C-2PN/DP #6ES7314-6EH04-0AB0
- 1 Siemens Mounting Rail #6ES7390-1AE80-0AA0
- 1 Siemens Power Supply #6ES7307-1BA01-0AA0
- 1 Siemens Micro Memory Card #6ES7953-8LF20-0AA0
- 1 Siemens Digital Input Card #6ES7321-1BH02-0AA0
- 1 Siemens 40-pole connector #6ES7392-1AM00-0AA0
- 1 Siemens 20-pole connector #6ES7392-1AJ00-0AA0
- 1 Weidmuller 24Vdc Power Supply #9925340024
- 1 Redundant back up control system consisting of two floats.
- 5 Separate circuit breakers mounted on the operator interface to control the following
 - 1. Convenience outlet dead front mounted- 5A
 - 2. Convenience outlet external mounted - 10A (Field installed)
 - 3. Heat Tape 1 - 15A GFCI, 30mA trip w/Lockout Provision
 - 4. Heat Tape 2 - 15A GFCI, 30mA trip w/Lockout Provision
 - 5. Heat Tape 3 - 15A GFCI, 30mA trip w/Lockout Provision
- 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
- 1 Emergency stop switch mounted on the control panel outer door.
- 1 Intrinsically safer barrier for two floats.
- 1 Intrinsically safe barrier for pressure transducer.
- 1 UL 698A Label.

- 2 Warning arc flash and shock hazard label Emedco #QS3743 or equivalent.
- 1 Danger 480 volts label Emedco #QS3647 or equivalent.
- Terminal blocks used for interconnecting field devices
- Panel wiring numbering.

Controller Details

Digital inputs Processor

- I 0.0 Redundant High Level Alarm
- I 0.1 Low Level Alarm
- I 0.2 Power Fault (OR combination of Phase and TVSS)
- I 0.3 Intrusion Alert
- I 0.4 Emergency Stop
- I 0.5 Force Main Pressure Switch
- I 0.6 Pump 1 Auto - HOA
- I 0.7 Pump 1 Hand - HOA
- I 1.0 Pump 1 Running
- I 1.1 Pump 1 Fault
- I 1.2 Pump 1 Reset
- I 1.3 Pump 2 Auto - HOA
- I 1.4 Pump 2 Hand - HOA
- I 1.5 Pump 2 Running
- I 1.6 Pump 2 Fault
- I 1.7 Pump 2 Reset
- I 2.0
- I 2.1
- I 2.2
- I 2.3
- I 2.4
- I 2.5
- I 2.6
- I 2.7

Digital outputs Processor

- Q 0.0 Pump 1 Call
- Q 0.1 Pump 2 Call
- Q 0.2 Pump 3 Call
- Q 0.3 Pump 4 Call
- Q 0.4 System Reset
- Q 0.5 High Level Alarm
- Q 0.6 System Alarm
- Q 0.7 Pump 1 Reset
- Q 1.0 Pump 2 Reset
- Q 1.1 Pump 3 Reset
- Q 1.2 Pump 3 Reset
- Q 1.3
- Q 1.4
- Q 1.5
- Q 1.6
- Q 1.7

Analog inputs Processor

AI 0.0 Level Transducer
AI 0.1 Pump 1 Current
AI 0.2 Pump 2 Current
AI 0.3 Pump 3 Current

Analog outputs Processor

AO 0.0
AO 0.1

SLOT 4 Input Module

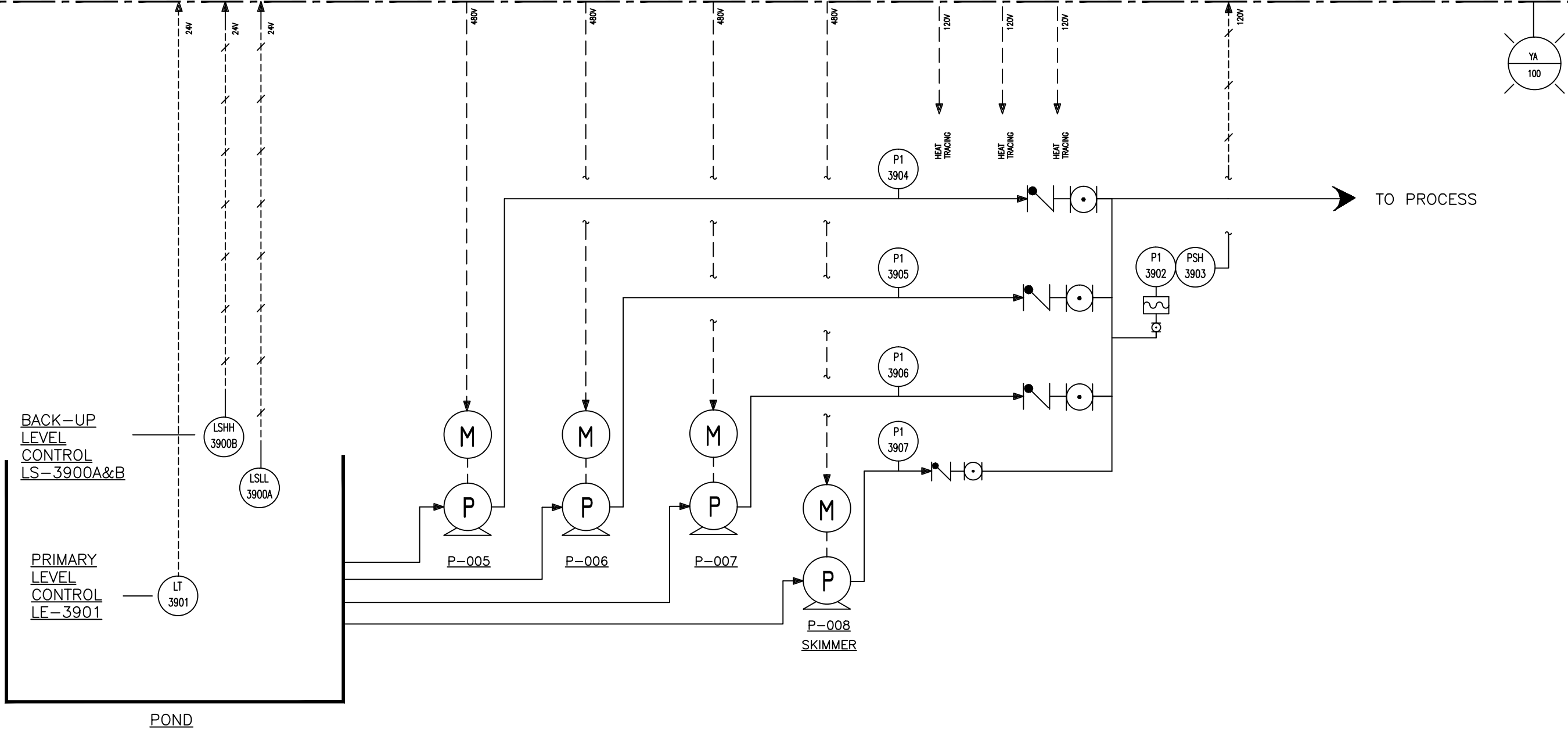
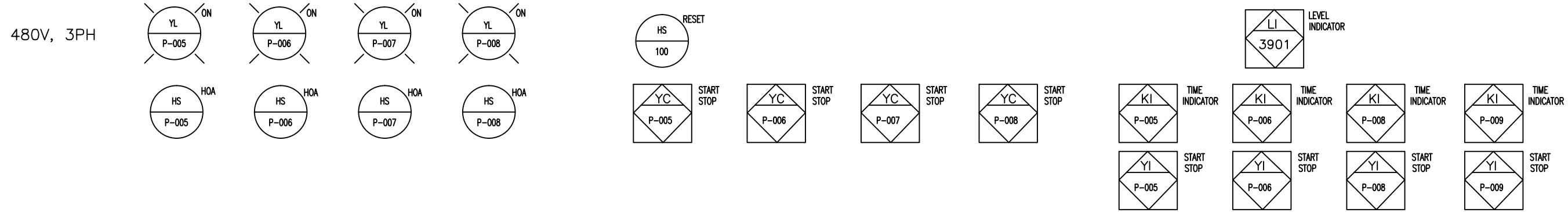
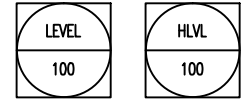
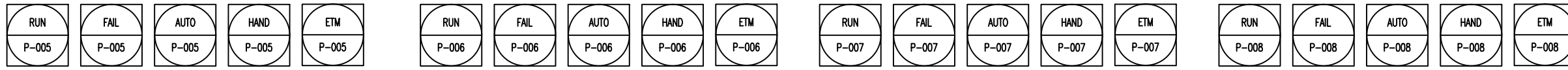
Digital inputs Slot 4

I 4.0 Pump 3 Auto - HOA
I 4.1 Pump 3 Hand - HOA
I 4.2 Pump 3 Running
I 4.3 Pump 3 Overload
I 4.4 Pump 3 Reset
I 4.5 Pump 4 Auto - HOA
I 4.6 Pump 4 Hand - HOA
I 4.7 Pump 4 Running
I 5.0 Pump 4 Overload
I 5.1 Pump 4 Reset
I 5.2 System Alarm Reset
I 5.3
I 5.4
I 5.5
I 5.6
I 5.7

SCADA

CONTROL PANEL

FIELD



BACK-UP
LEVEL
CONTROL
LS-3900A&B

PRIMARY
LEVEL
CONTROL
LE-3901

POND

P-008
SKIMMER

TO PROCESS

SHEET 1 OF 4

NO.	DESCRIPTION	DATE	REV	BY
1				

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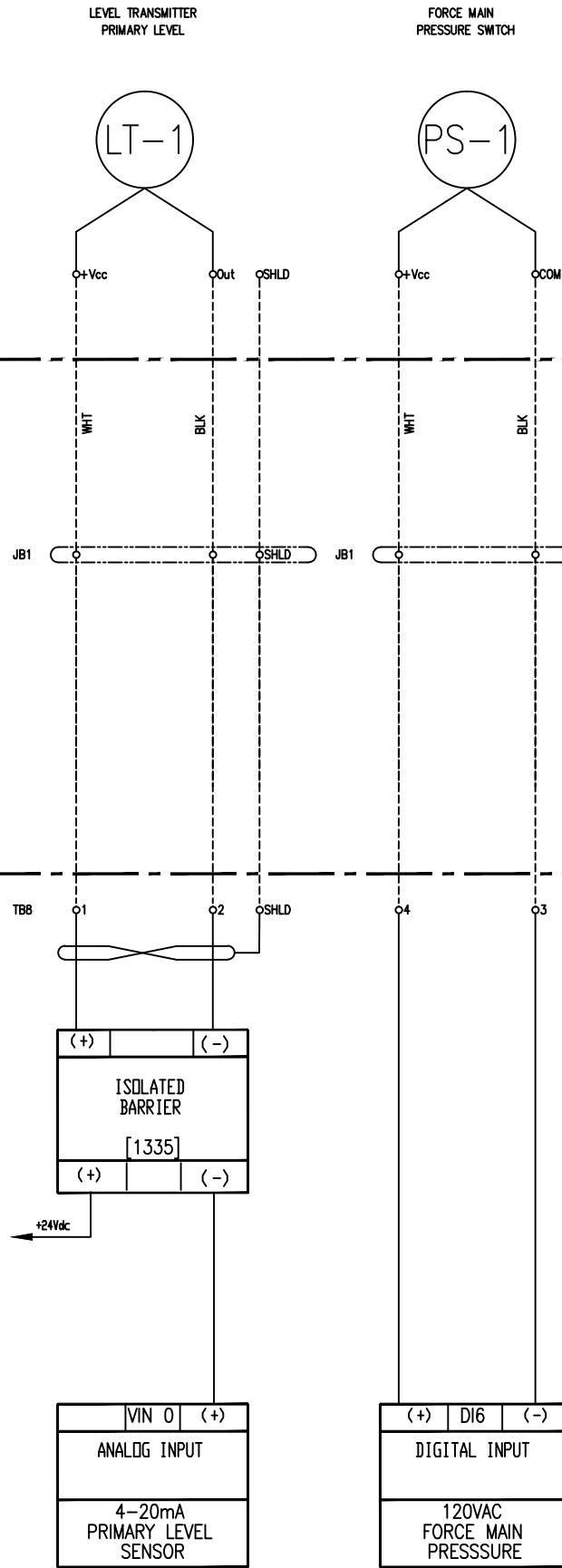
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WWW.romtecutilities.com

BAE ACETIC ACID PLANT
P&ID
DIAGRAM
DRAWING

DEVICE

FIELD

CONTROL PANEL



SHEET

2 OF 4

REV	DATE	DESCRIPTION	BY
1			

DSN: KAS
 DRN: KAS
 CKD: KAS
 4/12/13

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BAE ACETIC ACID PLANT

CONNECTION DIAGRAM
DRAWING

SHEET

2 OF 4

P&ID SYMBOLS (GENERAL INSTRUMENT OR FUNCTION SYMBOLS)

INSTRUMENT/FUNCTION SYMBOLS				
	PRIMARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNTED	AUXILIARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR	AUXILIARY LOCATION NORMALLY INACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS				
SHARED DISPLAY, SHARED CONTROL				
COMPUTER FUNCTION				
PROGRAMMABLE LOGIC CONTROL				

SYMBOL	DESCRIPTION
	FLOW INDICATOR
	INSTRUMENTS SHARING COMMON HOUSING
	INDICATOR LIGHT

INSTRUMENTATION IDENTIFICATION

TABLE	
	J-1 COMPONENT FUNCTION NUMBER
	J-2 COMPONENT SEQUENCE (CONTROL LOOP) NUMBER
	J-2A COMPONENT SEQUENCE # CONT'D
	J-3 VENDOR DESIGNATION
	J-4 PANEL NUMBER
	J-5 APPLICABLE NOTES
	J-6 SYSTEM ACRONYM
	J-7 ASME TEST SYMBOL FOR TEST ONLY OR TEST PLUS NORMAL USE
	J-8 SET-POINT(S)
	J-9 FUNCTION (SEE INSTRUMENT/FUNCTION SYMBOLS)

NOTE:
INSTRUMENTATION FUNCTION IDENTIFIERS (J-1) AND FUNCTION SYMBOLS PER ANSI/ISA S5.1.

ISA FUNCTIONAL IDENTIFICATION LETTERS

	FIRST - LETTER		SUCCEEDING - LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE	COLOR		CONTROL	
D	DENSITY/GRAVITY	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO			
G	VISCOSITY		GLASS, VIEWING DEVICE		
H	HAND	HAZE			HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOTOR	MOMENTARY	MALFUNCTION		MIDDLE, INTERMEDIATE
N	USER CHOICE		USER'S CHOICE		USER'S CHOICE
O	OPTICAL		ORIFICE, RESTRICTION		
P	PRESSURE, VACUUM	VAPOR PRESSURE	POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY, SULFUR		SWITCH	
T	TEMPERATURE	TEMP. (FLASH PT.)		TRANSMIT	TIME
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION	VAPOR		VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATUS OR PRESENCE	Y AXIS		RELAY, COMPUTE, COVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR	

NOTE:
NOT ALL SYMBOLS WILL APPLY TO THIS PROJECT

DWG. _____
 DSN. KAS
 DRN. KAS
 CKD. KAS
 4/12/13

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 P&ID
 ISA SYMBOL PAGE

BY	
DESCRIPTION	
REVISIONS	
DATE	
REV	

SHEET
 3 OF 4
 JOB NUMBER

PROCESS LINE TYPES

LINE TYPES		
SYMBOL	LINE TYPE	DESCRIPTION
	CONTINUOUS	PRIMARY PROCESS FLOW LINE
	CONTINUOUS	SECONDARY PROCESS FLOW LINE
	CONTINUOUS	INSTRUMENT SUPPLY OR CONNECTION TO PROCESS
	CONTINUOUS	UNDEFINED SIGNAL
	CONTINUOUS	PNEUMATIC SIGNAL
	HIDDEN2	ELECTRIC SIGNAL
	CONTINUOUS	HYDRAULIC SIGNAL
	CONTINUOUS	CAPILLARY TUBE
	CONTINUOUS	INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
	CONTINUOUS	MECHANICAL LINK
OPTIONAL BINARY (ON-OFF) SYMBOLS		
	CONTINUOUS	PNEUMATIC BINARY SIGNAL
	DASHED2	ELECTRIC BINARY SIGNAL
	CONTINUOUS	ELECTRICAL HEAT TRACING
	CONTINUOUS/DASHED2	STEAM HEAT TRACING
	DASHED2	BURIED LINES
	PHANTOM	EXISTING
	CENTER	FP - FLOOR PENETRATION RP - ROOF PENETRATION WP - WALL PENETRATION SB - SYSTEM BREAK

GENERAL INSTRUMENT OR FUNCTION SYMBOLS

SYMBOL	DESCRIPTION
	P =PURGE OR FLUSHING DEVICE R =RESET FOR LATCH-TYPE ACTUATOR I =UNDEFINED INTERLOCK LOGIC
	S=SOLENOID D=DIGITAL P=PILOT T=TRAP M=MAGNETIC FLOWMETER SP=SET POINT
	ROOT EXTRACTION
	BIAS
	MULTIPLY
	HIGH SELECTING
	LOW SELECTING
	HIGH LIMITING
	LOW LIMITING
	PROPORTIONAL
	REVERSE PROPORTIONAL
	SUMMING
	DIVIDING
	EQUIPMENT TAG
	PIPE OR WIRE IS CONTINUED ON DRAWING X (INCLUDING SHEET NUMBER), GRID COORDINATE (Y-#); FLOW IS TO THAT DRAWING.
	PIPE OR WIRE IS CONTINUED ON DRAWING X (INCLUDING SHEET NUMBER), GRID COORDINATE (Y-#); FLOW IS FROM THAT DRAWING.
	PIPE OR WIRE IS CONTINUED ON DRAWING X (INCLUDING SHEET NUMBER), GRID COORDINATE (Y-#); FLOW IS IN BOTH DIRECTIONS

DWG.	-	DSN.	KAS	DRN.	KAS	CKD.	KAS	REV	DATE	DESCRIPTION	BY
© ROMTEC INC. ALL RIGHTS RESERVED. THESE PLANS AND DRAWINGS MAY NOT BE REPRODUCED, ADAPTED, OR FURTHER DISTRIBUTED, AND NO COMPONENTS MAY BE CONSTRUCTED FROM THESE PLANS, WITHOUT WRITTEN PERMISSION OF ROMTEC, INC.											
ROMTEC UTILITIES 18240 NORTH BANK ROAD ROSEBURG, OR 97470 (541)-496-9678 FAX (541)-496-0804 WWW.romtecutilities.com											
BAE ACETIC ACID PLANT P&ID ISA SYMBOL PAGE											
SHEET 4 OF 4 JOB NUMBER											

**END
OF
SECTION**

13. PUMP ELECTRICAL CONNECTION ENCLOSURE/ PANEL

This section includes design and data pertinent to the pump electrical connection enclosure/panel.

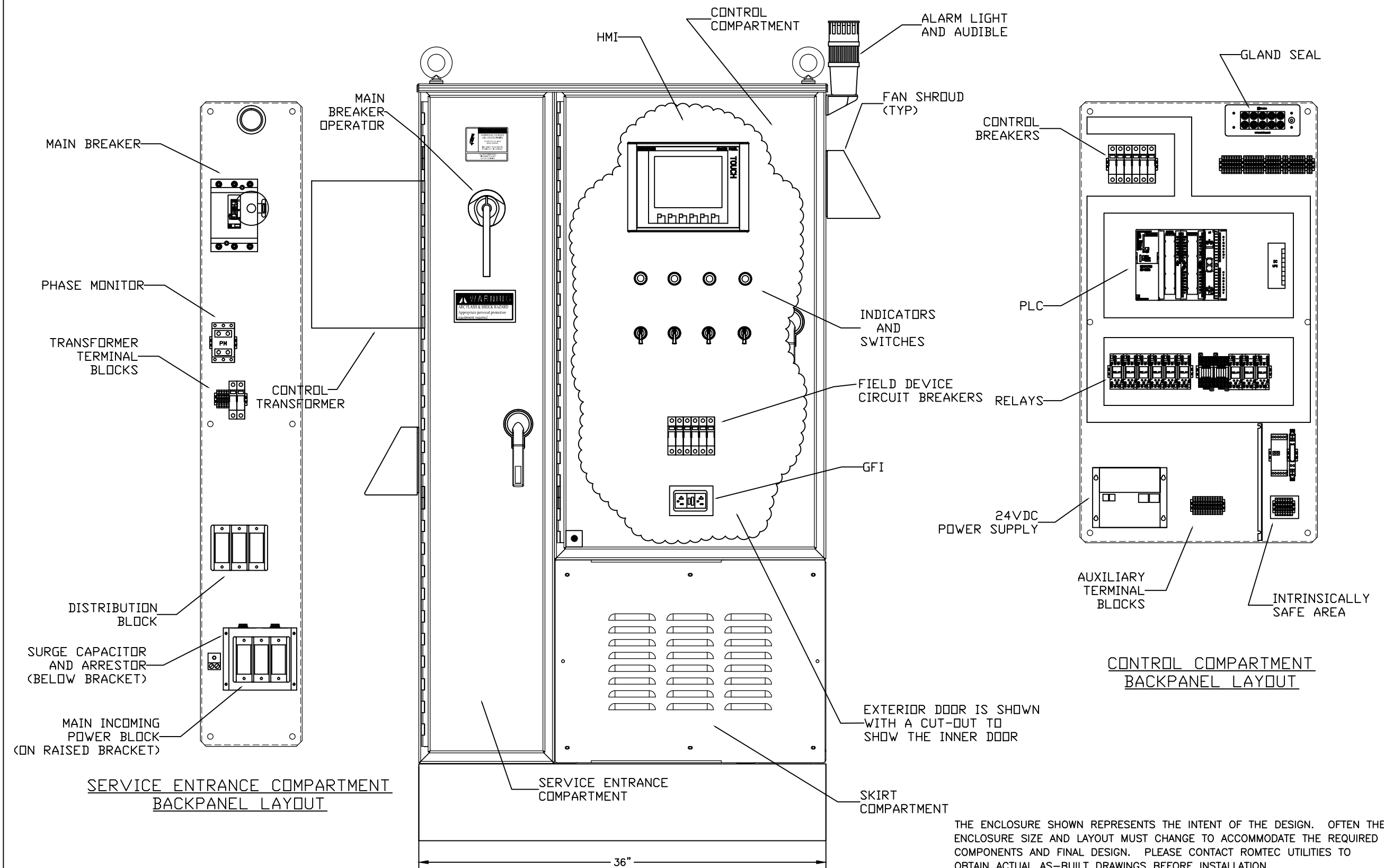
This section is structured as follows:

13.01 PUMP ELECTRICAL CONNECTION ENCLOSURE/PANEL DRAWINGS

13.02 JUNCTION BOX

13.03 ARC ARMOUR

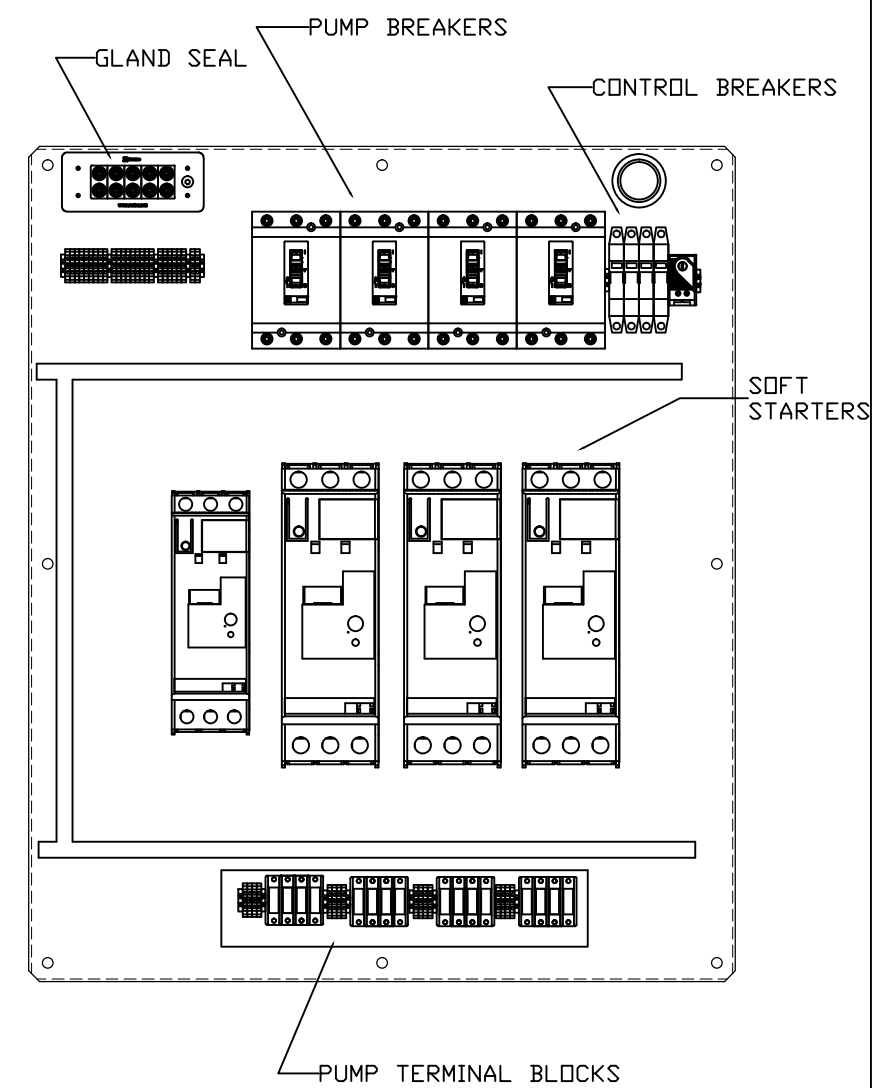
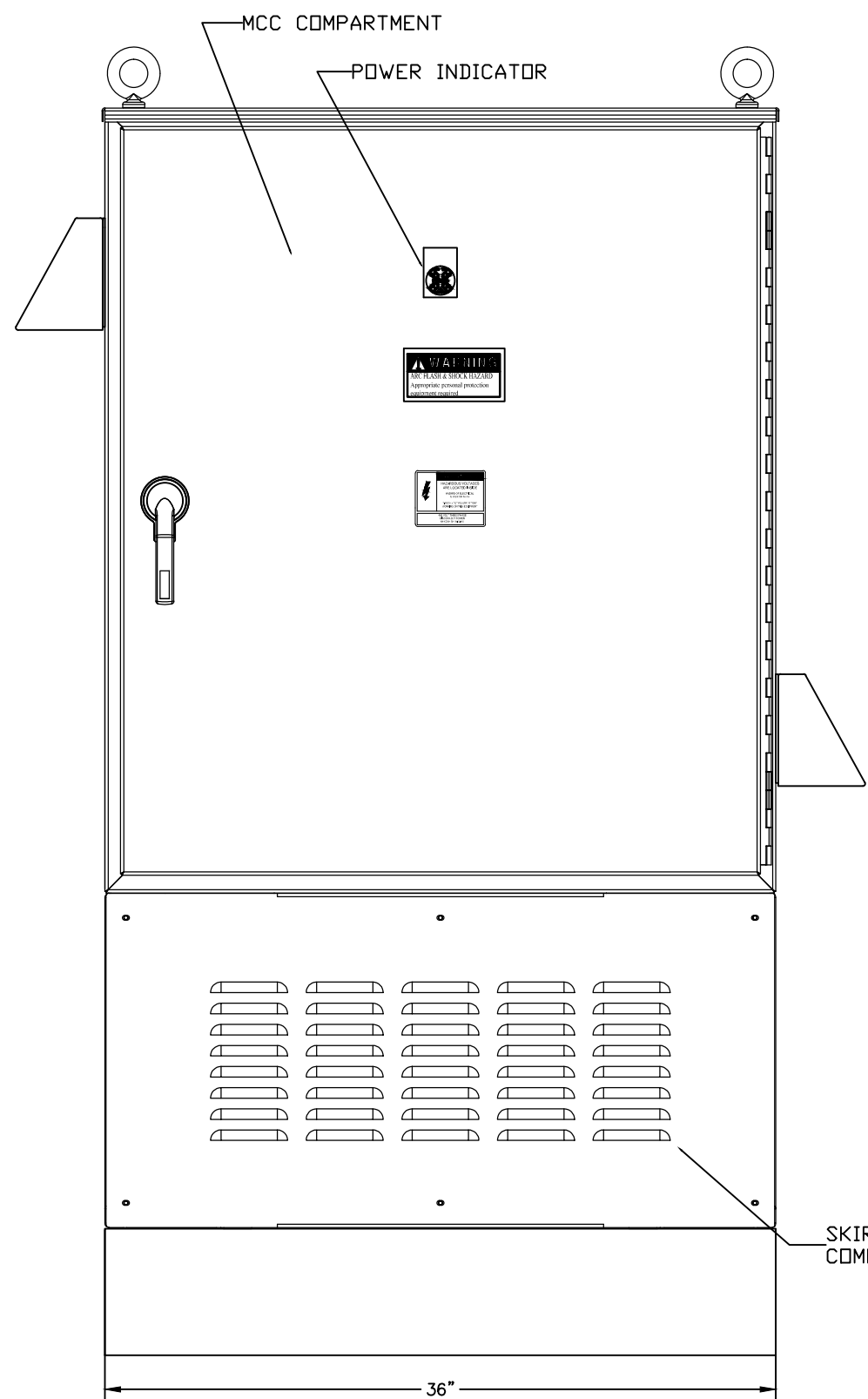
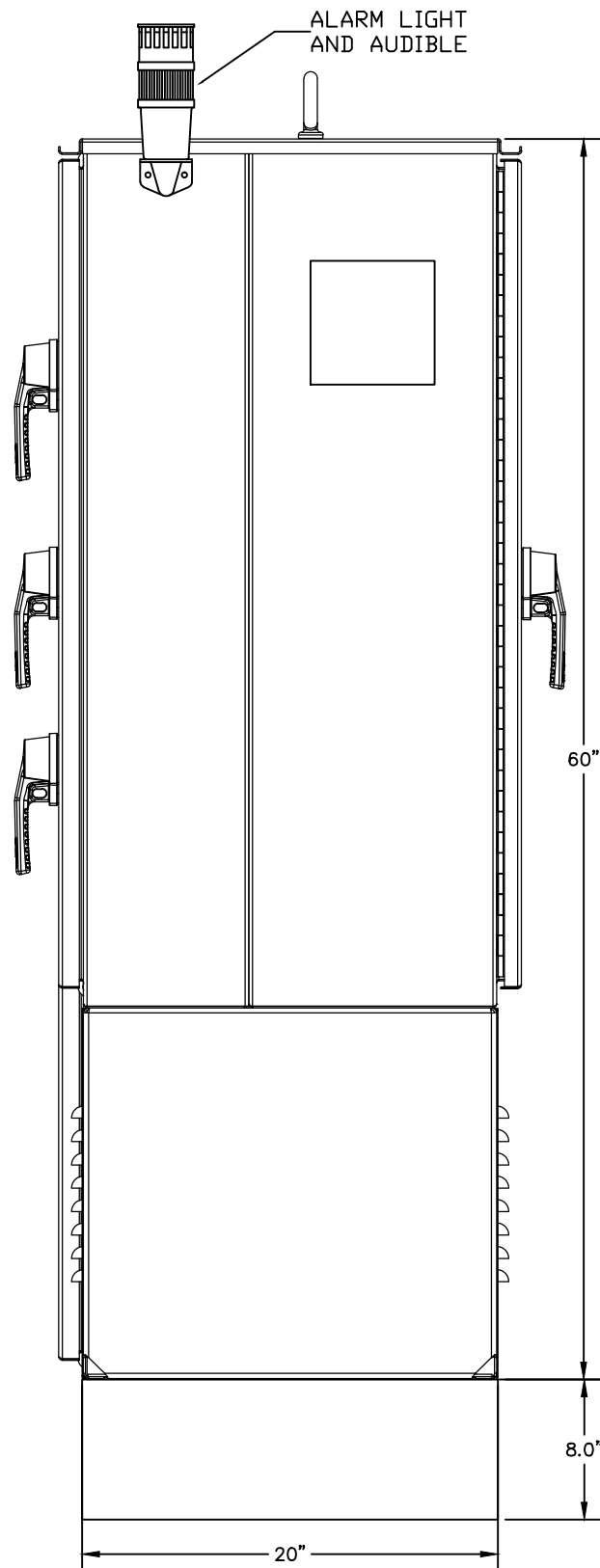
ARC ARMOR SIZE-1
WHITE STAINLESS STEEL ENCLOSURE
 (FRONT VIEW)



THE ENCLOSURE SHOWN REPRESENTS THE INTENT OF THE DESIGN. OFTEN THE ENCLOSURE SIZE AND LAYOUT MUST CHANGE TO ACCOMMODATE THE REQUIRED COMPONENTS AND FINAL DESIGN. PLEASE CONTACT ROMTEC UTILITIES TO OBTAIN ACTUAL AS-BUILT DRAWINGS BEFORE INSTALLATION.

VOLTAGE: 460 VAC	PHASE: 3 Ø	HERTZ: 60 HZ.	TOTAL F.L.A.: 53.75 FLA	ENCLOSURE TYPE: NEMA 3R				
LARGEST MOTOR; HP: 7.5HP	F.L.A.:	11FLA	SHORT CIRCUIT CURRENT: kA RMS	SYMMETRICAL, V MAX.	REV.	REVISION DESCRIPTION	DATE	DRWN.
Notes: 1) Level Switches Must Be Rated A Minimum Of 2 Amps @ 120 Volts 2) Torque 1/2" Field Terminals To 20 In. Lbs. 3/8" To 20 In. Lbs. 3) Field Wiring Must Be 60°C Copper Wire Minimum. 4) ----- = Items Not Supplied In Panel							DRWN.	DATE
							KAS	4/10/13
							SHEET 1 OF 2	
							DRWG. NO. BAE	

ARC ARMOR SIZE-1
WHITE STAINLESS STEEL ENCLOSURE
(BACK VIEW)

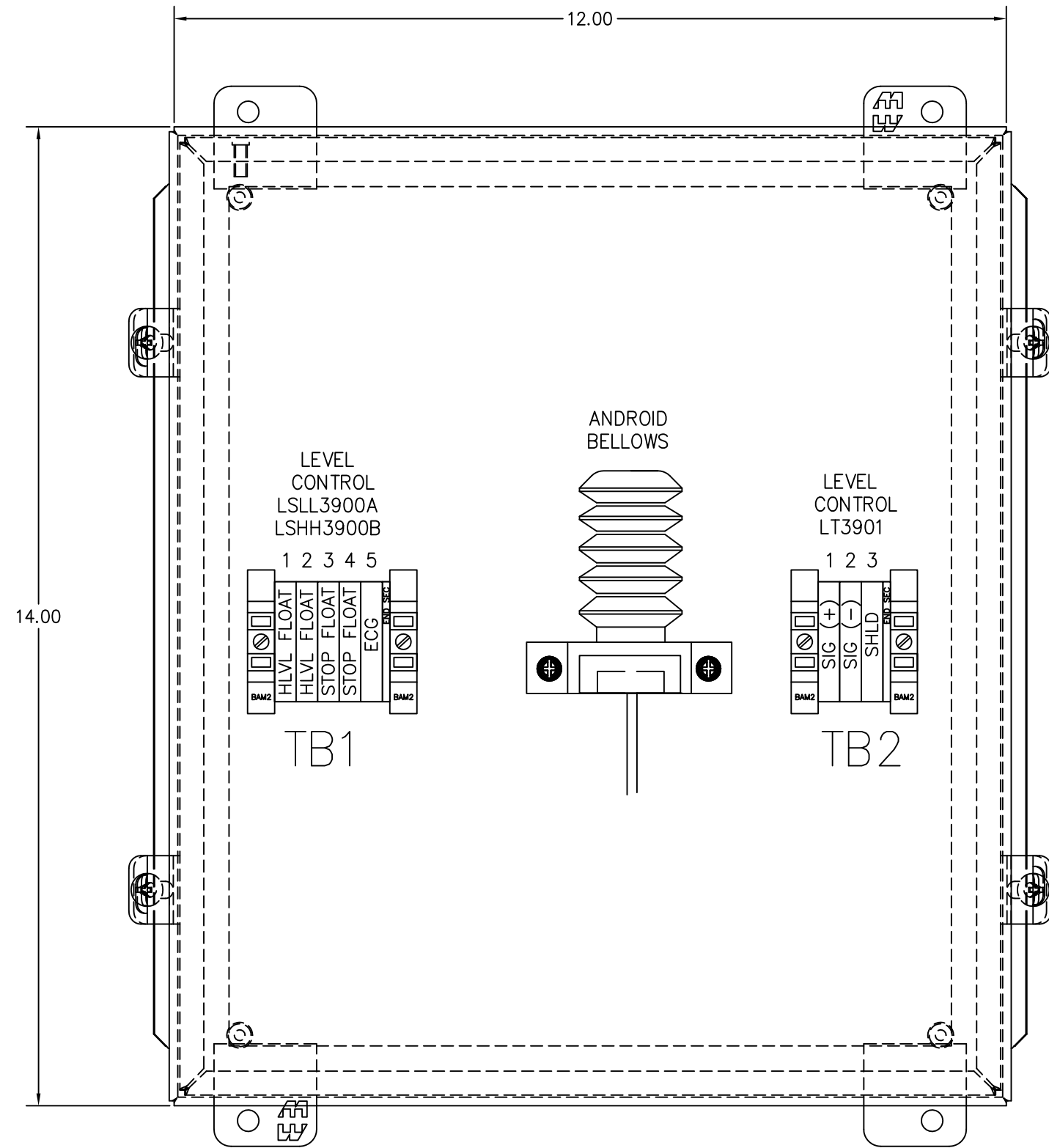


MCC COMPARTMENT
BACKPANEL LAYOUT

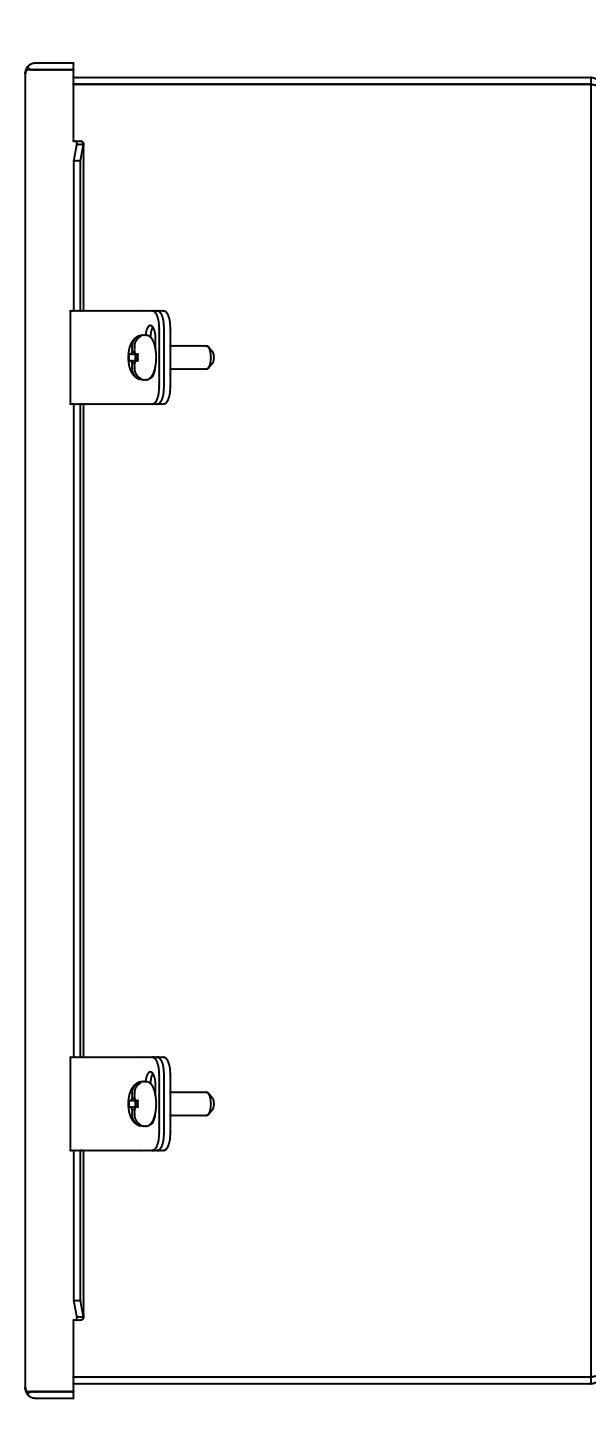
NOTE: MCC COMPARTMENT INTERLOCKED WITH MAIN
CIRCUIT BREAKER COMPARTMENT

THE ENCLOSURE SHOWN REPRESENTS THE INTENT OF THE DESIGN. OFTEN THE
ENCLOSURE SIZE AND LAYOUT MUST CHANGE TO ACCOMMODATE THE REQUIRED
COMPONENTS AND FINAL DESIGN. PLEASE CONTACT ROMTEC UTILITIES TO
OBTAIN ACTUAL AS-BUILT DRAWINGS BEFORE INSTALLATION.

VOLTAGE: 460 VAC	PHASE: 3 Ø	HERTZ: 60 HZ.	TOTAL F.L.A.: 53.75 FLA	ENCLOSURE TYPE: NEMA 3R				
LARGEST MOTOR; HP: 7.5HP	F.L.A.: 11 FLA	SHORT CIRCUIT CURRENT: kA RMS	SYMMETRICAL, V MAX.	REV.	REVISION DESCRIPTION	DATE	DRWN.	
Notes: 1) Level Switches Must Be Rated A Minimum Of 2 Amps @ 120 Volts 2) Torque 1/2" Field Terminals To 20 In. Lbs. 3/8" To 20 In. Lbs. 3) Field Wiring Must Be 60°C Copper Wire Minimum. 4) ----- = Items Not Supplied In Panel						DRWN.	DATE	SHEET 2 OF 2
						REC	1/20/11	DRWG. NO.
						KAS	4/10/13	BAE



FRONT VIEW



RIGHT SIDE VIEW

PART No. 1414N4SSM6
CUSTOMER FIELD CONNECTIONS

BAE ACETIC ACID PLANT

JUNCTION BOX 1

ROMTEC UTILITIES
18240 NORTH BANK ROAD
ROSEBURG, OR 97470
(541)-496-9678
FAX (541)-496-0804
WWW.romtecutilities.com

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NO.	DATE	DESCRIPTION	REVISIONS
1	9/20/12	DRN. KAS	
2		DRN. KAS	
3		CKD.	



The **ECO SMART STATION™** is housed in the innovative, multiple compartment **ARC ARMOR™ Enclosure**, reducing the risk of injury resulting from electric shock and exposure to arc flash.

Zone 1 - Service Compartment

Danger Zone: This zone contains the most dangerous arc flash potential and risk of electrical shock. Workers may require Personal Protective Equipment (PPE) when entering. “Lockout/Tagout” is supported.

Zone 2 - MCC Compartment

Danger Zone: When Zone 1 is energized, workers cannot gain access to Zone 2. Thereby, reducing accidental exposure to arc flash. There is visual indication when power is present in Zone 1. “Tagout/Lockout” is also supported.

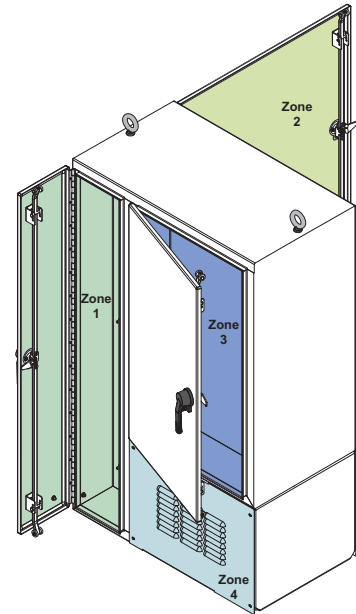
Zone 3 - Controls Compartment

Operator Safety Zone: Contains only low circuits (120VAC or lower only). Therefore, minimal PPE is required.

Zone 4 - Skirt Compartment

Gas Isolation Zone: Provides gas isolation from wet well in wastewater lift station applications.

For more information on the **ARC ARMOR™ Enclosure**, visit www.ArcArmorEnclosure.com.



Zone 3: Inner Door of Controls Compartment



Zone 1: Service Entrance Compartment



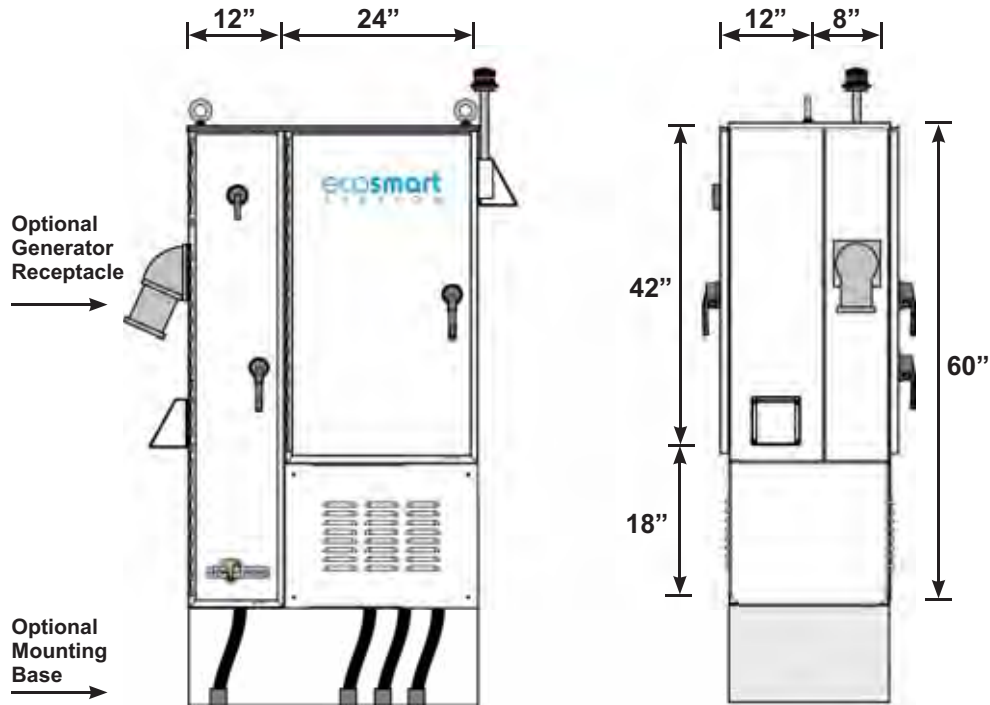
Zone 2: MCC Compartment



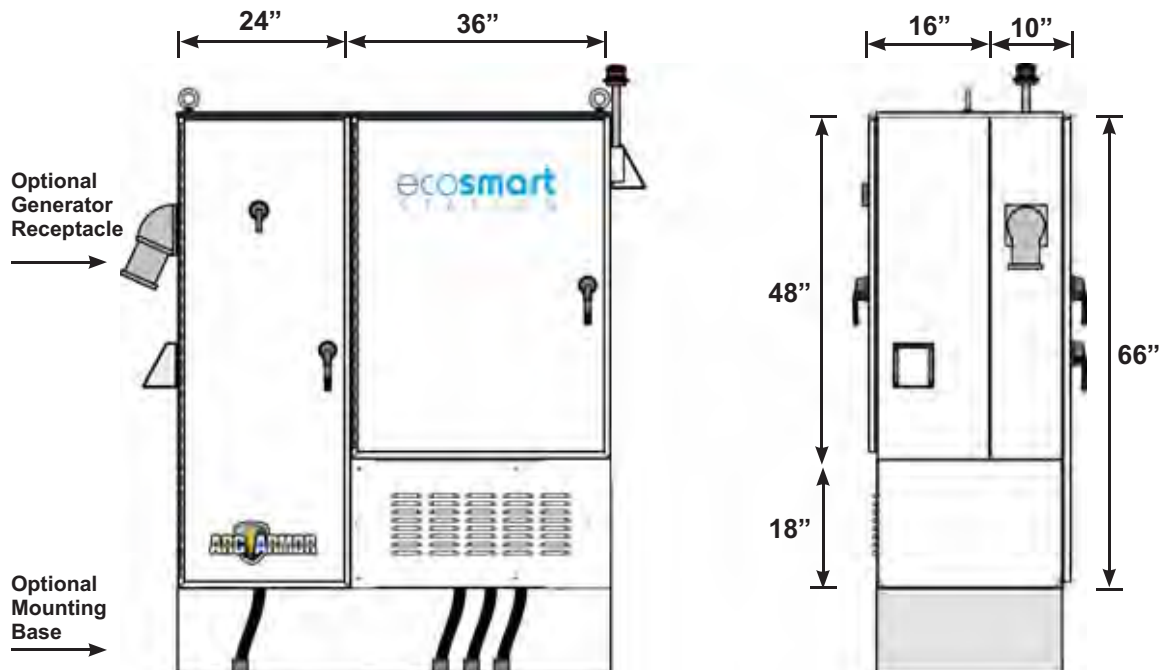
Zone 3: Controls Compartment

ECO SMART STATION™ Enclosure Overview

Size 1 Overall Dimensions: 60”H x 36”W x 20”D



Size 2 Overall Dimensions: 66”H x 60”W x 26”D



**END
OF
SECTION**

14. PRE-INSTALLATION

This section includes an example of the Romtec Utilities Installation Checklist that Romtec Utilities requires the owner/contractor to fill out prior to installation of the system.

14.01 PRE-INSTALLATION INFORMATION

14.02 PRE-INSTALLATION CHECKLIST

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
romtec3@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 _____).

2. ITEMS DELIVERED FOR INSTALLATION

PLEASE REVIEW

A. **Pump Skid Assembly**

- i. Ready to set
- ii. Pump discharge elbows attached
- iii. Lifting methodology included:
 1. **WARNING! WEIGHTS ARE SHOWN ON COMPONENT DRAWING!**
 2. The contractor must provide equipment capable of lifting the skid.
 3. **LIFTING STRAP RECOMMENDATIONS**
 - a. Straps and spreader bars should be used when lifting and moving the skid assembly.

B. **Accessory Pallet**

- i. Level sensing devices (store for installation at start-up)
- ii. **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.**

C. **Control Panel (if included in this shipment)**

- i. **WARNING!** Electrician to install per site engineer's direction.

- D. **Pumps**
 - i. Installed by Romtec Utilities before system construction.

3. THE FOLLOWING ARE STRONGLY RECOMMENDED ON SITE:

- A. One (1) six-foot level.
- B. Forklift to offload accessory pallet and control panel (may be shipped separately at a later date).
- C. 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.
- D. Review the site and **LOOK** for overhead obstructions before delivery.
- E. 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 is not ready for installation of the skid assembly, 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 pump skid assembly: _____

Note: All equipment necessary to off load the skid assembly 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. Is the contractor ready to begin construction? | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. 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"/> |
| 4. Has the contractor confirmed that the crane has appropriately stable ground from which to work? | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. 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><u>Note:</u> 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> | | |
| 6. Who will review and verify? _____ | | |
| 7. Will the contractor provide at least one laborer exclusively for unloading the truck and prepping parts per Romtec Utilities direction? | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Does the safety plan include components for high voltage (underground and overhead)? | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Have contractor's employees been instructed with respect to the safety plan? | <input type="checkbox"/> | <input type="checkbox"/> |

SAFETY DISCLOSURE & ACKNOWLEDGMENT

Installation Safety Threats

Installation of the equipment to be supplied may implicate specific potential safety threats, among others:

1. Misuse of machinery, such as cranes, used in installation.
2. 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

**END
OF
SECTION**

15. 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:

15.01 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 skid assembly 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 level control signal wires been pulled between the pump control panel and the reservoir?

Yes No Installed by _____

B. Have the level control wires been landed on the appropriate terminals inside the control panel?

Yes No Installed by _____

C. Have the panel power wires been installed between the main disconnect, automatic transfer switch (if present) and the pump control panel?

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: _____

Pump: P-4 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

B. Inspected pumps and cable for damage?

P-1: Yes No
 P-2: Yes No NA
 P-3: Yes No NA
 P-4: Yes No NA

C. Check oil in seal chamber for condition and quantity?

P-1: Yes No
 P-2: Yes No NA
 P-3: Yes No NA
 P-4: Yes No NA

D. Does impeller spin freely when rotated by hand?

P-1: Yes No **Verified by** _____
 P-2: Yes No NA
 P-3: Yes No NA
 P-4: Yes No NA

E. Discharge connection level and tight (verify with contractor)?

P-1: Yes No
 P-2: Yes No NA
 P-3: Yes No NA
 P-4: Yes No NA

F. Electrical connections tight and connected correctly?

P-1: Yes No
 P-2: Yes No NA
 P-3: Yes No NA
 P-4: Yes No NA

G. Pump station free of debris?

Yes No (Explain in Comments)

- H. Junction boxes, conduits, seals installed correctly?
 Yes No
- I. Is the system properly grounded and bonded?
 Yes No
- J. Are the working clearance requirements maintained as per code?
 Yes No
- K. Are all level sensing devices installed as designed & properly documented?
 Yes No
- L. Are the schematics on the door accurate?
 Yes No

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
Pump: <u>P-4</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
Pump: <u>P-4</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
Pump: <u>P-4</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 (viewed from pump suction): P-1 CW / CCW, P-2 CW / CCW, P-3 CW / CCW

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
 Pump: 4 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
 Pump: 4 T-1 _____ A T-2 _____ A T-3 _____ A

8. Abnormal noise/vibration?

P-1: Yes No
 P-2: Yes No NA
 P-3: Yes No NA
 P-4: Yes No NA

9. Does pump shut down and lockout when sensor lead(s) are disconnected?

P-1: Yes No
 P-2: Yes No NA
 P-3: Yes No NA
 P-4: Yes No NA

10. Have VFD's been programmed and do they work correctly (if applicable)?

P-1: Yes No
 P-2: Yes No NA
 P-3: Yes No NA
 P-4: 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. 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.
 Pump 4 - Pump off _____ psi. Pumping _____ psi. Pump on with valve closed _____ psi.

7. 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.

Lead pump start: Distance measured from floor _____ ft.
 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

8. SECONDARY LEVEL SETTINGS:

Pumps Start: Elevation _____ ft.
 Distance measured from floor _____ ft.

Pumps stop: Elevation _____ ft.
 Distance measured from floor _____ ft.

High level alarm: Elevation _____ ft.
 Distance measured from floor _____ ft.

Do all level settings match worksheet values?
 Yes No

*** DOES THE ABOVE MEET THE APPROVED SCOPE OF SUPPLY?**
YES ___ NO ___ EXPLAIN IN COMMENTS

COMMENTS

LIST ANY CORRECTIVE ACTION REQUIRED AND LIST RESPONSIBLE PARTY

9. **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: _____

16. AUTODESK DESIGN REVIEW DOWNLOAD PROCEDURE

This section explains how to use the file extension DWF that should be attached to this submittal.

16.01 AUTODESK DESIGN REVIEW DOWNLOAD PROCEDURE

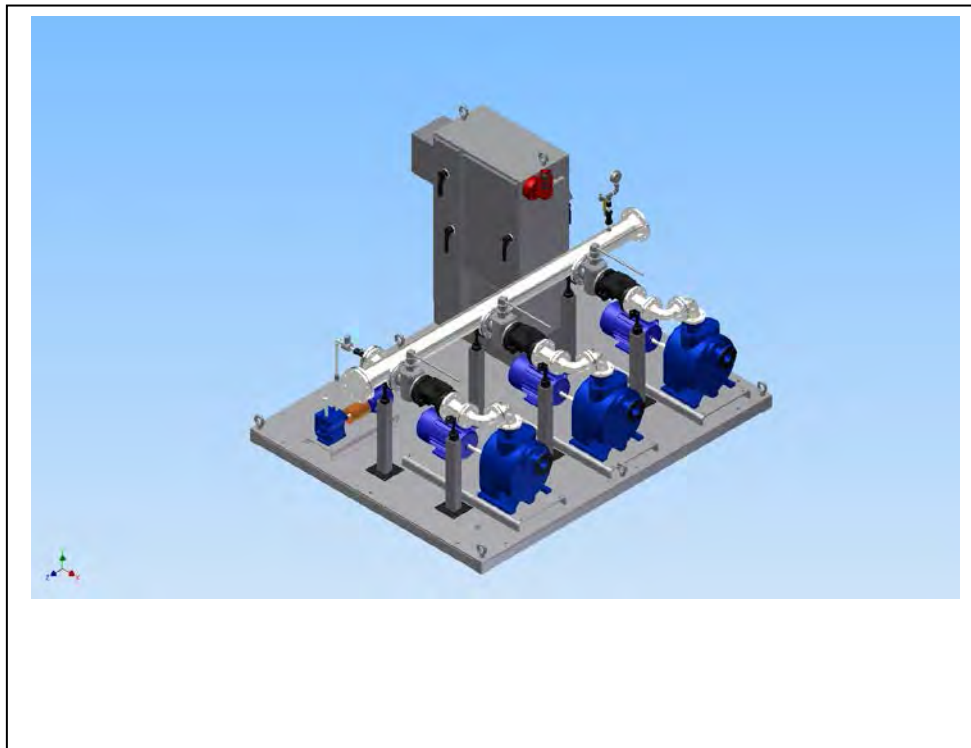
16.01 AUTODESK DESIGN REVIEW DOWNLOAD PROCEDURE

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
5.1.1. AutodeskDesignRevSetup.exe
6. Click on Run
7. Follow the Installation Tips on the screen
8. To view and manipulate your .DWF file double click on the .DWF file



**END
OF
SECTION**