Alfa Laval
Contherm

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Instruction And Parts Manual

Alfa Laval

Contherm

Chapter 1

Safety Summary

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Chapter 1 Safety Summary

1.1 INTRODUCTION

The CONTHERM® Scraped Surface Heat Exchanger (SSHE), manufactured by Alfa Laval Contherm Inc., is a high-speed machine designed, engineered, and manufactured for safe and efficient operation when installed, operated, and maintained by knowledgeable and responsible personnel.

Do not install, operate, or service the CONTHERM until you have read this manual and understand how to use the equipment. To help ensure your safety and avoid damage to the CONTHERM, we have provided safety precautions in this manual to identify potentially dangerous or hazardous situations. While we cannot foresee every potential safety hazard that may occur with the equipment at your facility, you can eliminate and prevent many of them if you follow all of the instructions provided in this manual.

Unsafe and hazardous conditions may occur if the equipment is used by improperly trained personnel or without regard or knowledge of applicable safety precautions. These unsafe and hazardous conditions may cause serious personal injury and/or damage to the equipment.

1.2 SAFETY PRECAUTIONS

Each safety precaution in this manual is indicated by the following symbol:

This symbol is shown whenever you need to be aware of a potentially hazardous condition.

Three types of safety precautions are used in this manual, with each type determined by the level of hazard seriousness the user is exposed to.

Danger: Immediate hazards which WILL result in severe personal injury or death.

Warning: Hazards or unsafe practices which COULD result in severe personal injury or death.

Caution: Hazards or unsafe practices which COULD result in minor personal injury or product or property damage.

In addition to following the safety precautions provided in this manual, use common sense when operating or working with the CONTHERM SSHE. In particular, be aware of problems or hazards unique to your facility and/or operating environment. If you have any safety concerns that are not addressed within this manual, please notify your supervisor and/or your local Alfa Laval Contherm Inc. or Tetra Laval representative.

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Chapter 2

Warranty And Product Support

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Chapter Two Warranty And Product Support

Chapter 2 Warranty And Product Support

2.1 INTRODUCTION

Alfa Laval Contherm Inc. offers a warranty on the materials, workmanship and equipment of the CONTHERM to the original purchaser of the CONTHERM. The specific details of this warranty are identified in Section 2.2, Warranty Information.

Alfa Laval Contherm Inc. also offers a wide range of product support services to its customers. These services are identified in Section 2.3, Product Support Services.

Table 2-1 shows how the warranty and product support services information in this chapter are organized:

Table 2-1. Warranty And Product Support Services Information

Section	Description
2.2	**WARRANTY INFORMATION**
2.2.1	CONTHERM Warranty
2.2.2	Warranty Exclusions
2.2.3	Additional Warranties
2.2.4	Equipment Manufactured By Others
2.3	**PRODUCT SUPPORT SERVICES**
2.3.1	Returned Materials
2.3.2	Damaged Shipments
2.3.3	Service Department
2.3.4	Ordering Parts
2.3.5	Replacement Parts Policy
2.3.6	Office And Service Locations

2.2 WARRANTY INFORMATION

This section describes the warranty on the materials, workmanship and equipment of the CONTHERM SSHE offered by Alfa Laval Contherm Inc. to the original purchaser of the CONTHERM. In addition to stating the specific conditions of this warranty, this section identifies warranty exclusions, additional warranties, and the warranties applicable to equipment manufactured by others.

2.2.1 CONTHERM SSHE WARRANTY

Alfa Laval Contherm Inc. offers the following warranty on the materials, workmanship and equipment of the CONTHERM SSHE to the original purchaser of the CONTHERM.

CONTHERM SSHE Warranty

1. Alfa Laval Contherm Inc. warrants to the original purchaser that all equipment manufactured by Alfa Laval Contherm Inc. is free from defects in material and workmanship.
2. Alfa Laval Contherm Inc. guarantees to repair or replace FOB (Freight On Board) point of shipment any such equipment found to be defective, provided that written notice of the alleged defect is received by Alfa Laval Contherm Inc. within 90 days from the date of shipment.
3. Alfa Laval Contherm Inc. guarantees the inner product cylinder against excessive wear for one (1) year from date of shipment. This guarantee is for repair or replacement of the inner cylinder only.

2.2.2 Warranty Exclusions

The guarantees offered within the body of the Alfa Laval Contherm Inc. Warranty are excluded from the Warranty for damage caused by any or all of the following factors:

- Ordinary wear and tear.
- Erosion or corrosion.
- Misuse, abuse, or improper handling by the purchaser or any third party.

2.2.3 Additional Warranties

Alfa Laval Contherm Inc. makes no additional warranties, expressed or implied, whether of merchantability or otherwise, other than that stated in Section 2.2.1, CONTHERM SSHE WARRANTY. The manufacturer shall not be responsible for any indirect, special or consequential damages, nor any other claims arising out of the sale or use of its equipment beyond the remedy stated in Section 2.2.1, CONTHERM SSHE WARRANTY.

2.2.4 Equipment Manufactured By Others

Equipment, parts or accessories manufactured by others carry the guarantee offered by the original manufacturer of the equipment, parts or accessories only. Any warranties or claims which differ from the foregoing are unauthorized by Alfa Laval Contherm, Inc. and become the warranty solely of the party making them, unless specifically authorized in writing by an officer of Alfa Laval Contherm, Inc.

Should any provision of the foregoing be held ineffective, the remaining provision shall continue in full force and effect.

2.3 PRODUCT SUPPORT SERVICES

Alfa Laval Contherm Inc. offers ongoing product and technical support through a worldwide network of trained, technical support personnel. These technical service representatives are available to assist and support you upon request, and are often utilized in the following situations:

- During equipment installation.
- For supervising the initial start-up.
- For resolving problems that occur after start-up.

2.3.1 Returned Materials

Do not return any material or equipment until you have obtained approval from Alfa Laval Contherm Inc. All materials and/or equipment returned for credit are subject to service and transportation charges. Securely package all materials and/or equipment authorized for return to ensure their undamaged return.

2.3.2 Damaged Shipments

Alfa Laval Contherm Inc. carefully packages its equipment to protect it from normal hazards that may occur during shipment. If our equipment is damaged when it arrives, the consignee must immediately file a damage report with the carrier and forward a copy of this claim to the Alfa Laval Contherm Inc., Newburyport, Massachusetts, USA facility.

2.3.3 Service Department

Alfa Laval Contherm Inc. maintains a trained service department for servicing and supporting its equipment. Our technical service representatives are available for assistance, supervision of start-up operations, and resolving problems occurring after start-up. We charge a per diem rate plus expenses for these services and will provide a quotation of these services to you upon request.

Within your equipment's warranty period, all charges for service and parts attributed to defective material or workmanship will be paid by Alfa Laval Contherm Inc. However, if the service call is necessary due to the improper operation or application of the equipment, then the service call and the necessary parts will be charged to the account of the purchaser.

2.3.4 Ordering Parts

When ordering parts or requesting information about service or installation, always provide us with the Model and Serial Numbers of your CONTHERM(s).

2.3.5 Replacement Parts Policy

When a model is discontinued or declared obsolete, Alfa Laval Contherm Inc. will maintain, where justified, a stock of spare parts for its manufactured machines for five years. After five years, Alfa Laval Contherm Inc. will provide replacement parts for the obsoleted or discontinued product on a custom manufacturing basis for ten more years.

Alfa Laval Contherm Inc. strongly recommends that you maintain an adequate inventory of critical items for any model declared obsolete. After five years, you may experience a lengthy delay in receiving these items as they will then be manufactured on a custom order basis. Critical items for your equipment are identified in the list of recommended spare parts provided in Chapter Nine, Spare Parts Information.

Alfa Laval Contherm Inc. will help its customers obtain parts for equipment that the company sells but does not manufacture for a one year period after the model has been discontinued. After one year, you should deal directly with the original manufacturer.

2.3.6 Office And Service Locations

Alfa Laval Contherm Inc. offers its customers a worldwide network of technical sales and service representatives. For your convenience, we encourage you to work with our local representatives in your area. If you cannot locate an Alfa Laval Contherm Inc. or Alfa Laval representative in your area, please contact us directly at the following location

Alfa Laval Contherm Inc.
111 Parker Street
Newburyport, MA 01950, USA
Telephone: (508) 465-5777
Telefax: (508) 465-6006

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Chapter 3

General Description

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Chapter Three General Description

Chapter 3 General Description

3.1 INTRODUCTION

This chapter provides a general description of the CONTHERM® Scraped Surface Heat Exchanger (SSHE) manufactured by Alfa Laval Contherm Inc.

CONTHERM®, a registered trademark of Alfa Laval Contherm Inc., is identified as the “CONTHERM” from this point on within this manual and is formatted in upper case to differentiate it from its manufacturer, Alfa Laval Contherm Inc. Whenever you see the terms, CONTHERM or CONTHERM SSHE, they are referring to the CONTHERM® SSHE.

This chapter provides you with the following general information on the CONTHERM:

- A functional description.
- A description of its physical characteristics.
- A description of its major components.
- A description of its standard media packages.

The information in this chapter is organized as shown in Table 3-1.

Table 3-1. CONTHERM General Description

Section	Description
3.2	Functional Description
3.3	Physical Characteristics
3.4	Heat Exchange (Product) Cylinder
3.5	Rotor
3.6	Blades
3.7	Product Heads
3.8	Seals
3.9	Drives
3.10	Mounting Columns
3.11	Rotor Lifting Device
3.12	Pin Units
3.13	Control Panels
3.14	Media Packages

3.2 FUNCTIONAL DESCRIPTION

The CONTHERM® Scraped Surface Heat Exchanger is widely used within the processed foods, pharmaceuticals, and cosmetics industries. Most of the product applications for the CONTHERM fall into four major categories:

1. Heating and cooling viscous products that would normally form a film on heat transfer surfaces.
2. Crystallization of products.
3. Heating and cooling products containing discrete particles.
4. Cooling liquids in which a change of state may be anticipated, such as in slush freezing.

The CONTHERM is designed to be vertically mounted, a configuration that offers the following benefits to the customer:

- ***Minimal Space Requirements***: Requires only 3.6 square feet of floor space (0.3 square meters) when mounted on a floor column, and even less when wall or ceiling mounted.
- ***Reduced Risk***: Rotor and scraper blades are raised and lowered hydraulically thereby minimizing the risk of injury to the operator and damage to the CONTHERM.
- ***Air Purging***: Complete air purging occurs at the beginning of the run.
- ***Reduced Product Loss***: Less product loss at the time of shutdown because product can be drained by gravity or chased effectively without excessive mixing of product and "chase medium."

If available head (vertical) room in a customer's facility does not permit a vertical configuration, the CONTHERM can be mounted horizontally, but with the subsequent loss of some of the benefits offered by the vertical configuration.

Figure 3-1 identifies and shows the location of the major components of a standard CONTHERM. The cut-away portion of this illustration identifies the unit's internal components. A cross-sectional view of the CONTHERM is shown in Figure 3-2.

As shown in Figures 3-1 and 3-2, the CONTHERM consists of an inner heat transfer cylinder surrounded by an outer, insulated media jacket. The inner heat transfer cylinder contains a rotor with attached scraping blades. Product is pumped into and through the heat transfer cylinder via a product inlet port located near the base of the CONTHERM. At the same time, circulating heating or cooling media is pumped into and down through the annular space between the CONTHERM's heat transfer cylinder and the insulated outer jacket via a media inlet port located near the top of the CONTHERM. This media either heats or cools the product flowing through the heat transfer cylinder as determined by each product's specific processing requirements.

Heat transfer is accomplished by conduction, aided by the convection current created by the rotor's scraping blades. When the CONTHERM is in use, its rotor is turning at a predetermined rate. The centrifugal force generated by the rotor's rotation keeps the rotor's scraper blades in contact with the internal wall of the heat transfer cylinder. The scraper blades agitate and scrape the product from the walls of the cylinder.

The product exits the heat transfer cylinder from the upper product port of the CONTHERM, heated or cooled to the desired temperature. The circulating heating or cooling media exits the unit via the lower media port located near the bottom of the CONTHERM.

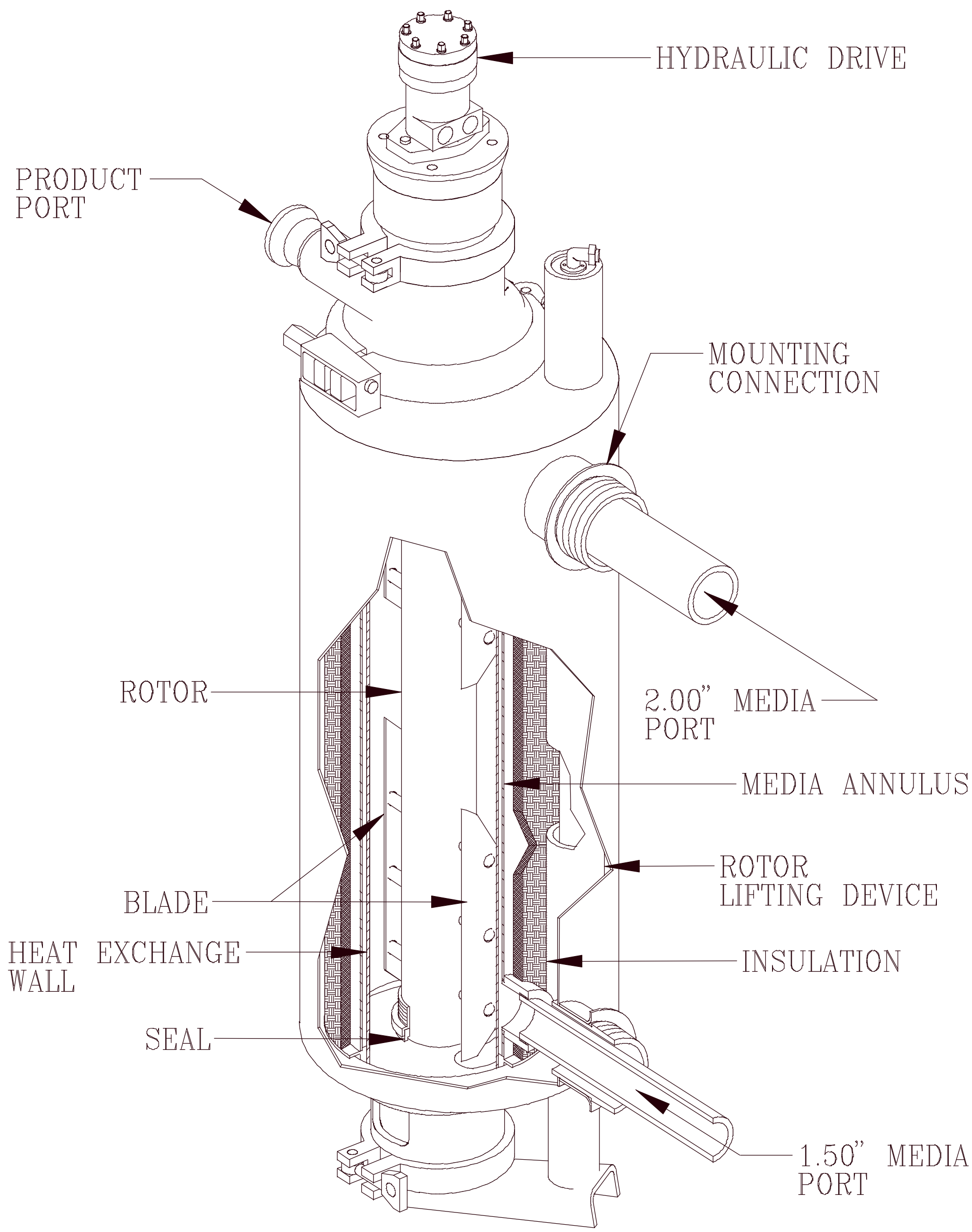


Figure 3-1. Standard CONTHERM™ Scraped Surface Heat Exchanger (SSHE)

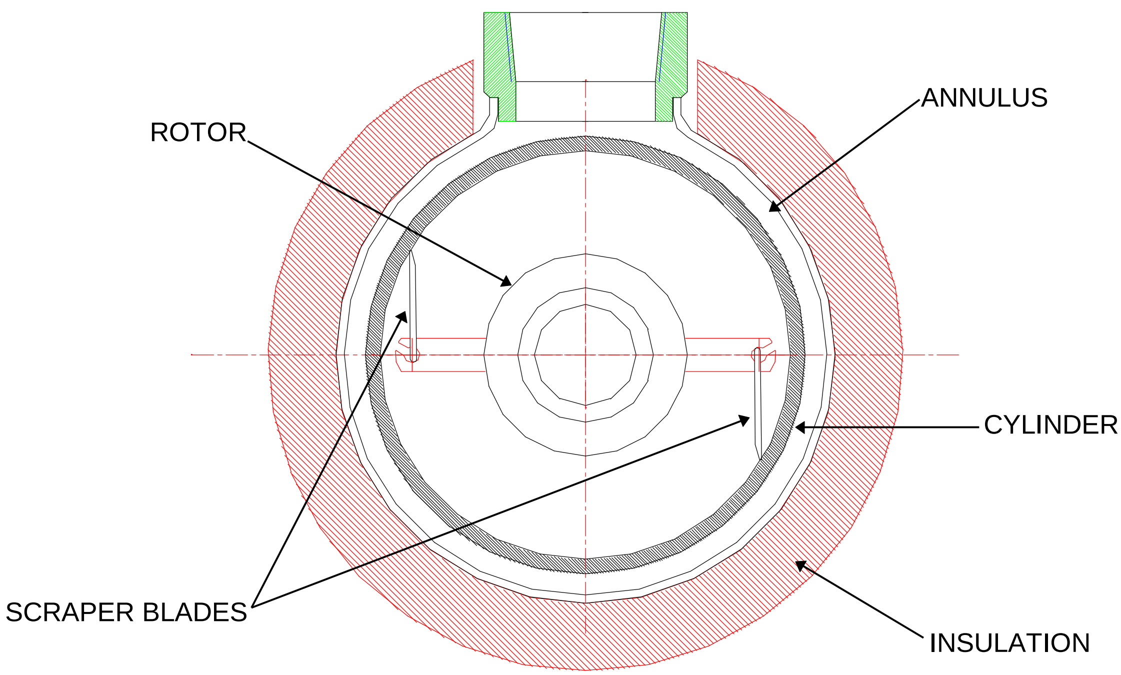


Figure 3-2. Cross-sectional View Of Standard CONTHERM SSHE

3.3 PHYSICAL DESCRIPTION

The standard CONTHERM consists of a 6-inch (152 millimeter) nominal inside diameter heat exchange cylinder and either three, six, or nine square feet of heat transfer surface area. The heat transfer surface area of your CONTHERM is indicated by its Model Number. Product contact surfaces, such as rotors and product heads, are of 316L Stainless Steel.

Three different models of the standard CONTHERM are available. The dimensions for each model are shown in Figure 3-3. These models and their corresponding heat transfer areas are identified in Table 3-2.

Table 3-2. The Three Standard CONTHERM Models

Model Number	Heat Transfer Area (Square Feet And Square Meters)
6 x 3	3-ft^2 (0.28-M^2)
6 x 6	6-ft^2 (0.56-M^2)
6 x 9	9-ft^2 (0.84-M^2)

3.3.1 Temperature Ratings

The CONTHERM is rated to support the use of product and media within the following temperature range:

Temperature Range: -30^{o}F to 300^{o}F (-34.4^{o}C to 149^{o}C)

3.3.2 Pressure Ratings (Maximum)

The maximum working pressures on the product and media sides of the CONTHERM's heat exchange cylinder are indicated on the inspection plate mounted on the exterior of the CONTHERM. The standard CONTHERM is rated to support the use of product and media within the following pressure range:

Product: 300 psi at 300°F (20.7 Bar at 149°C)
Media: 250 psi at 300°F (17.2 Bar at 149°C)

3.3.3 Noise Levels

The airborne noise level of a single CONTHERM is 72 dB.

3.3.4 Testing Requirements And Documentation

All pressure vessels are designed, constructed and stamped per A.S.M.E. code section VIII, Div. 1. The CONTHERM meets all requirements for the CE Certificate of Incorporation.

3.4 HEAT EXCHANGE (PRODUCT) CYLINDER

The CONTHERM's inner heat exchange cylinder assembly is designed to provide maximum heat transfer to the product. The physical features of each cylinder are determined by the product application.

The following features of the cylinder are selected to match the CONTHERM's product application:

- Material Of Construction
- Media Annulus Type
- Expansion Joint

3.4.1 Materials Of Construction

The heat transfer cylinder of the CONTHERM can be one of three materials:

1. Stainless Steel (316L).
2. Nickel.
3. Ferrous (The ferrous cylinder is a mild steel that is only used with a Bimetallic coating.)

NOTE: If your CONTHERM is supplied with a specific purpose heat exchange cylinder material, refer to the appropriate Appendix for its description and other applicable information. All appendices are included in the back of this manual.

The inside diameter of the heat exchange cylinder may also be plated or coated, as determined by the requirements of the product being processed. When processing abrasive products or products that require the use of stainless steel blades for improved scraping, the addition of a hard coating to the cylinder wall is necessary. Stainless steel and nickel cylinder materials are chrome-plated by electroplating. For heavy duty applications, a triple layer of chrome may be applied for added hardness and durability. The cylinder which offers the greatest wear characteristics is the mild steel cylinder with a hard alloy bimetallic coating.

The inside diameter of the cylinder is available in the following configurations:

1. With No Coating.
2. With a Single Chrome Coating (Thickness: 0.005 inch (1.27 mm)).
3. With a Triple Chrome Coating (Thickness: 0.015 inch (3.81 mm)).
4. With a Bimetallic Coating.

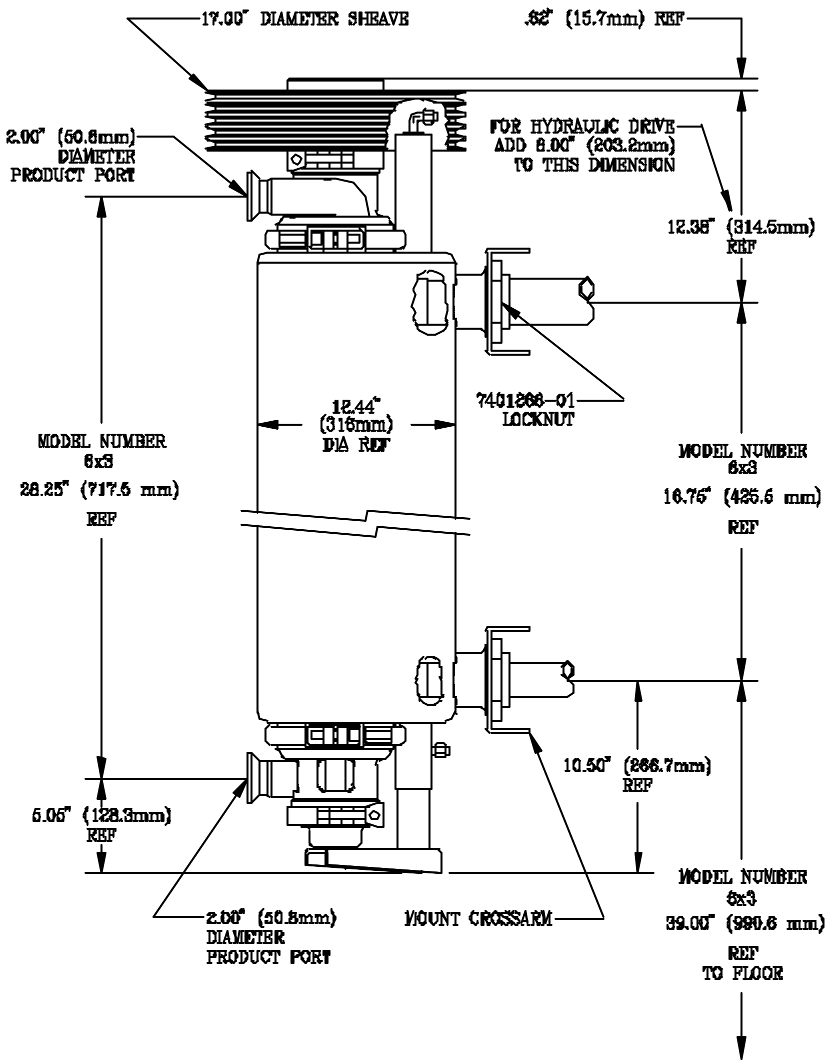
3.4.2 Media Annulus

The CONTHERM's media annulus, the space between the CONTHERM's heat exchange cylinder and the insulated media jacket, is provided in either a plain or a coiled design.

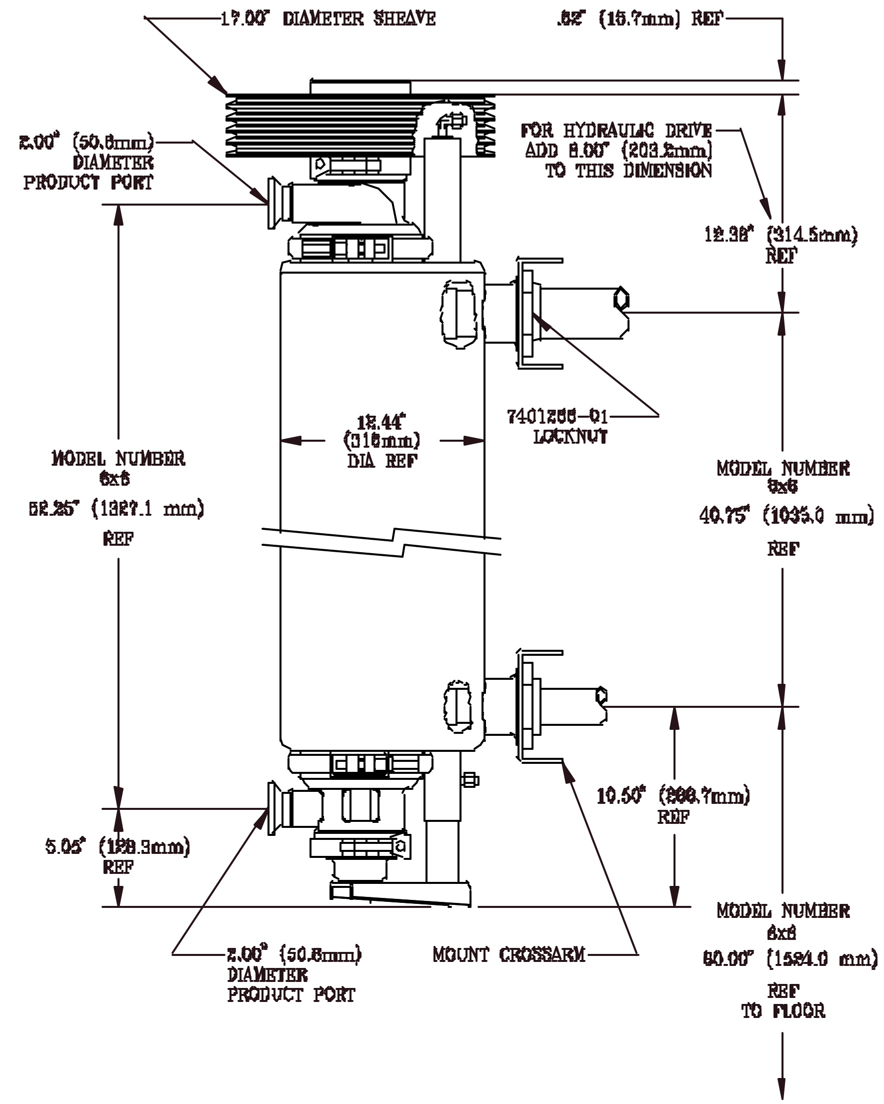
A coiled design is used to create turbulence within the annulus. The style of media annulus selected is determined by the type of media that will be used.

Insert Figure 3-3 -- 11 x 17 foldout drawing

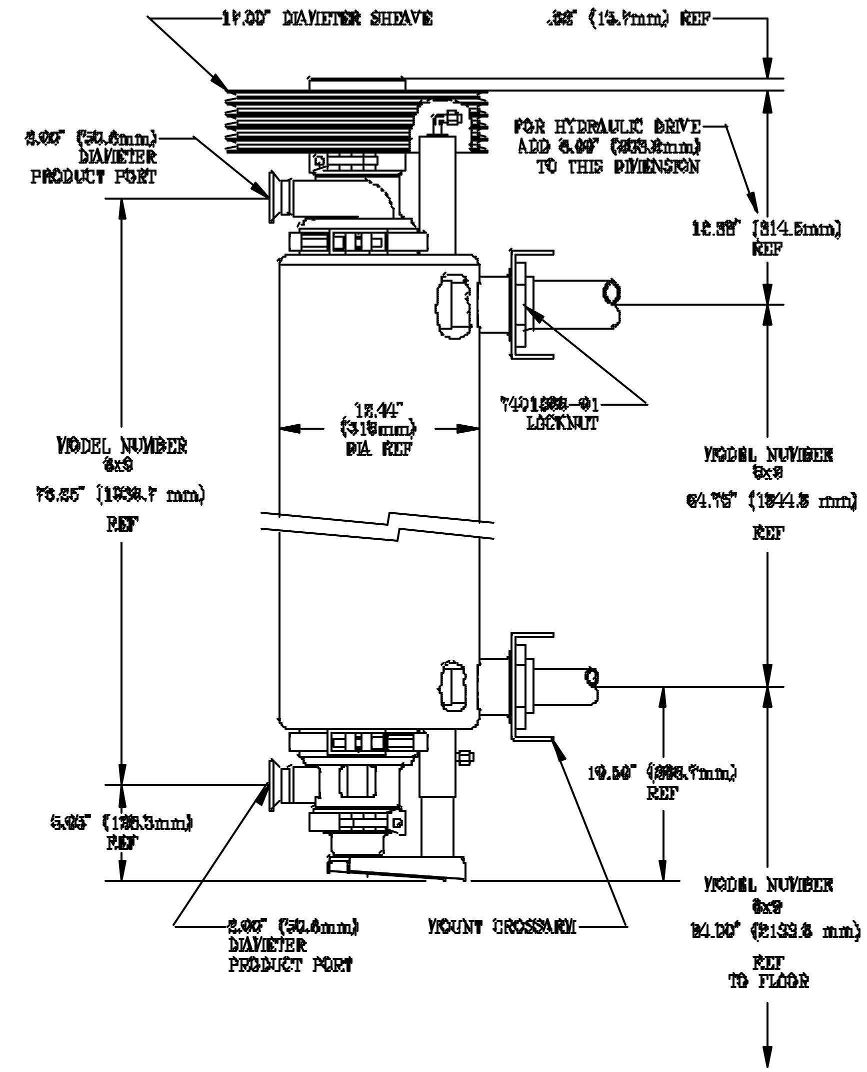
Figure 3-3. Dimensions For Each Of The Three Standard CONTHERMs



CONTHERM Model 6 x 3



CONTHERM Model 6 x 6



CONTHERM Model 6 x 9

Figure 3-3. CONTHERM Dimensions

(Blank Page: To Be Used As Back Side of Figure 3-3)

Coiled Annulus

The coiled annulus is used for circulating media such as water, glycol, oil or steam. A stainless steel tube is wound around the product cylinder. As a result, the media entering the top of the CONTHERM is forced to follow a swirling path down through the annular space in a flow that is counter-current to the product.

This small channel distributes the media throughout the annulus and aides in increasing the velocity to a turbulent level which enhances heat transfer. Two coil widths are available:

1. 10-inch Wide (254 mm) Media Channel
2. 5-inch Wide (12.7 mm) Media Channel

The standard coil that is normally used is wound to create a 10-inch (254 mm) wide media channel. If the flow rate of the media is limited, it is sometimes necessary to use a 5-inch (127 mm) wide coil. The smaller channel width of the 5-inch (12.7 mm) coil increases the media velocity above that of the 10-inch (254 mm) coil.

Plain Annulus

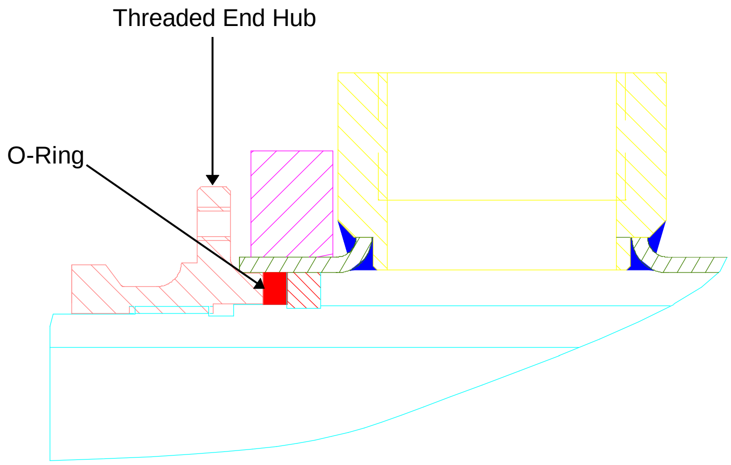
The plain annulus is used for expansion refrigerants such as Ammonia and Freon™. Expansion refrigerants normally use flooded systems. In these systems, the refrigerant is not pumped through the CONTHERM at high flow rates; instead, a constant level is maintained within the media annulus. The level within the CONTHERM is maintained by accumulators (refer to description provided in Chapter Five, Installation). The latent heat of evaporation is the driving force for heat exchange with expansion refrigerants. For improved efficiency, the coil within the annulus is removed so that the vapors being formed can rise through the annulus unimpeded.

3.4.3 Expansion Joints

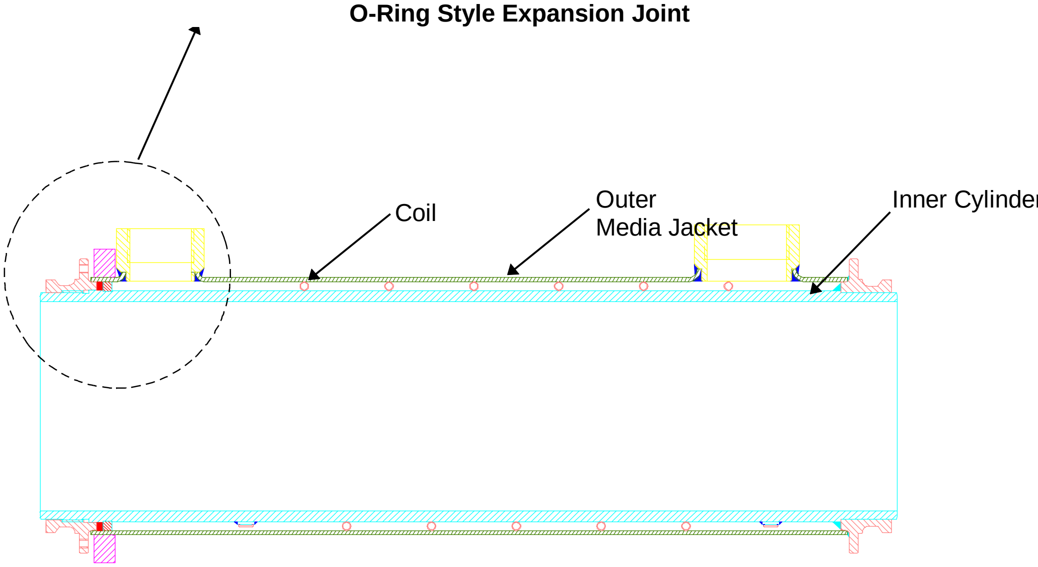
The expansion joint allows for thermal expansion and contraction of the inner cylinder of the CONTHERM and the outer media jacket. Two types of expansion joints are available:

1. O-Ring Style Expansion Joint.
2. Bellows Style Expansion Joint.

The application and the type of media determines which expansion joint shall be used. O-Ring Style expansion joints are used with circulating media to seal the media channel and allow for expansion. An O-ring style expansion joint for a cylinder equipped with a coiled media annulus is shown in Figure 3-4.



O-Ring Style Expansion Joint



Coiled Inner Cylinder Assembly

Figure 3-4. O-Ring Style Expansion Joint For A Coiled Inner Cylinder Assembly

Contherm Inc. designed the Bellows as an improved expansion joint for use with expansion refrigerants. The Bellows provides an improved media channel for thermal expansion when expansion refrigerants are being used as the cooling media. A Bellows-style expansion joint for a cylinder equipped with a plain media annulus is shown in Figure 3-5.

Prior to the development of the Bellows, the expansion joint design used a rubber O-ring to seal one end of the media channel. A threaded end hub compressed the O-ring to form the seal for the media. With this type of expansion joint, periodic maintenance of the O-ring was required. With our improved Bellows expansion joint design, periodic maintenance of the expansion joint is no longer required because the end hub located at each end of the CONTHERM cylinder assembly is welded. The weld seals the media channel and removes the need for the O-ring.

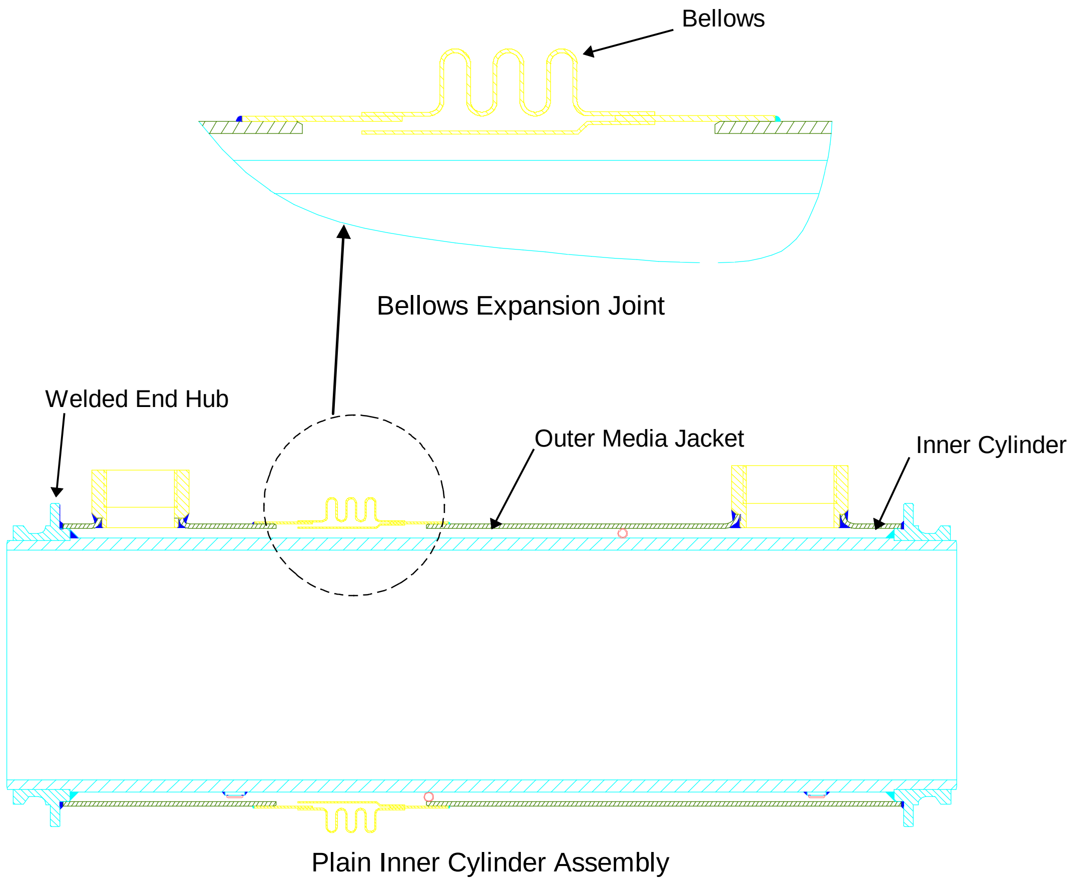


Figure 3-5. Bellows Style Expansion Joint For A Plain Inner Cylinder Assembly

3.5 ROTOR

Each CONTHERM rotor is constructed of Stainless Steel (316L) and is equipped with pins for supporting the scraping blades. The rotor rotates within the cylinder via a motor and coupling, allowing the blades to scrape the inner surface of the cylinder wall.

Four different diameter rotors are available for use on a CONTHERM:

- 3-inch diameter rotor (76.2 mm)
- 4-inch diameter rotor (102 mm)
- 4.5-inch diameter rotor (114 mm)
- 5-inch diameter rotor (127 mm)

In general, the largest rotor diameter that can be used without damaging product/particle integrity is the one that is recommended for use in the CONTHERM. Other factors that must also be considered when selecting a rotor include the following:

1. Heat Transfer.
2. Particulates.
3. Residence time in the heat exchange cylinder.
4. Pressure drop.

3.5.1 Rotor Diameter

The size of the rotor directly affects all of the preceding factors (heat transfer, particulates, residence time, and pressure drop). Larger diameter rotors decrease the product residence time within the unit while increasing the heat transfer, which is essential for heat sensitive products. Smaller diameter rotors allow for passage of larger particulates while maintaining product quality and minimal pressure drop, which is essential for highly viscous products containing particulates.

Table 3-3 identifies the rotor sizes and the maximum allowable particulate size.

NOTE: All products, particulates and applications are different. In some instances, the maximum allowable particulate size could be exceeded.

Table 3-3. Rotor Sizes And Maximum Allowable Particulate Size

Rotor Size	Maximum Allowable Particulate Size
3-inch (76 mm)	Particulate processing up to 1-inch (26 mm) cubes; high viscosity applications where pressure drop is of concern.
4-inch (102 mm)	Particulate processing up to 0.5 inch (13 mm) cubes.
4.5-inch (114 mm)	Particulate processing up to 0.25 inch (7 mm) cubes.
5-inch (127 mm)	No particles; optimum heat transfer.

3.5.2 Rotor Pin And Blade Configurations

The Rotor Pin and Blade Configurations directly affect the product quality and are chosen based on the product application. Table 3-4 identifies the rotor pin and blade configurations offered by Alfa Laval Contherm Inc. and also identifies typical applications for each configuration.

Table 3-4. Rotor Pin And Blade Configurations

Rotor Configuration	Typical Applications
2-Bladed	Shear sensitive products. Typical applications include gels and starch solutions.
4-Bladed	Heat sensitive products. Provides twice the scraping of 2-Bladed or Staggered configurations. Typical applications include eggs and dairy products.
Staggered	Viscous food and particulate processing. Typical applications include mechanically deboned meat, soups and sauces

Other rotor options for the standard CONTHERM include the following:

1. Heavy Duty Pin Spacing.
2. Water Heated Rotors.
3. Use of a High Torque Spline.

Heavy Duty Pin Spacing

Heavy duty pin spacing provides three additional rotor pins per blade. This rotor pin configuration is utilized for highly viscous products that require extra support for the blades.

Water Heated Rotors

Water heated rotors are typically used in applications where the product may adhere to, and turn with, the rotor. This results in loss of efficiency and creates higher demands on the drive motor. This process is known as “mass rotation.” Specific applications where mass rotation may occur are in the production of shortening and margarine where the product is being crystallized at a very fast rate and has a tendency to adhere to the rotor.

High Torque Spline

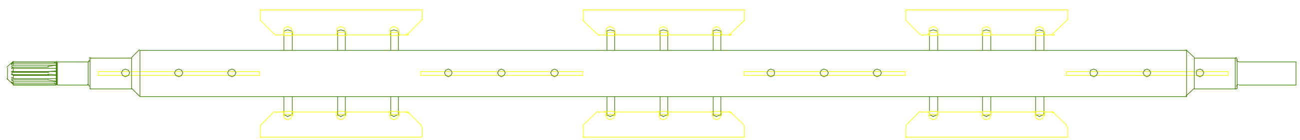
The spline connection at the top of the CONTHERM rotor is available in two sizes:

a) 1.5-inch (Standard size).

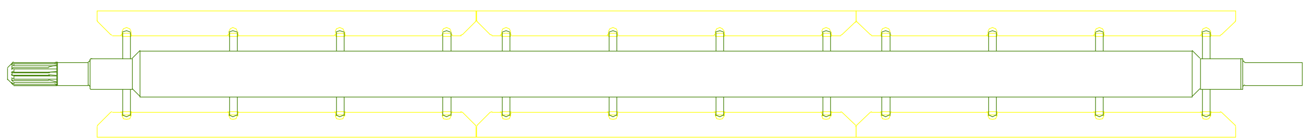
b) 2-inch (Heavy Duty size).

The heavy duty spline is used when there is high torque on the rotor spline from processing high viscous products. A typical application requiring the high torque spline is the chilling of mechanically deboned meat (MDM).

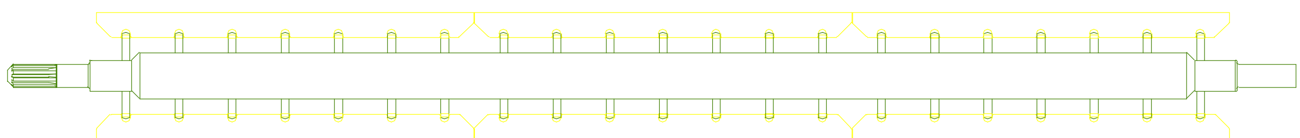
Figure 3-6 identifies typical rotor configurations that can be provided with the Model 6X9 CONTHERM.



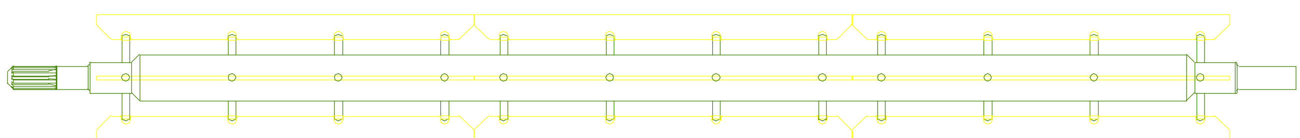
Staggered



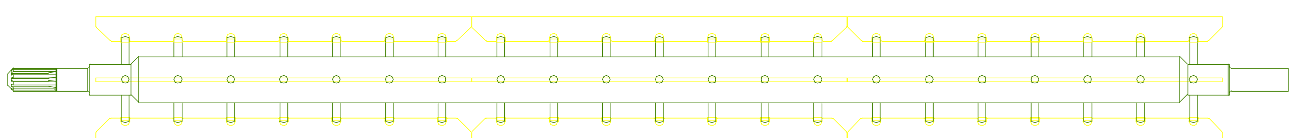
2-Bladed



2-Bladed with Heavy Duty Pin Spacing



4-Bladed



4-Bladed with Heavy Duty Pin Spacing

Figure 3-6. Typical Rotor Configurations Used With Model 6X9 CONTHERM.

3.5.3 Rotor Hold Down Feature

The vertical design of the CONTHERM calls for product to enter the lower product head, rise through the product cylinder and exit at the top of the unit. The flow of product can cause an upward force to be exerted on the rotor assembly significant enough to actually raise the rotor within the cylinder.

This upward force of the rotor would damage the bearings and spring loaded seal(s) over time if it were not for the CONTHERM's Rotor Hold Down feature. The Rotor Hold Down Feature consists of a modified lower bearing assembly and retaining bolt that is fixed to the bottom of the rotor to hold it in place. The CONTHERM's Rotor Hold Down feature is shown in Figure 3-7.

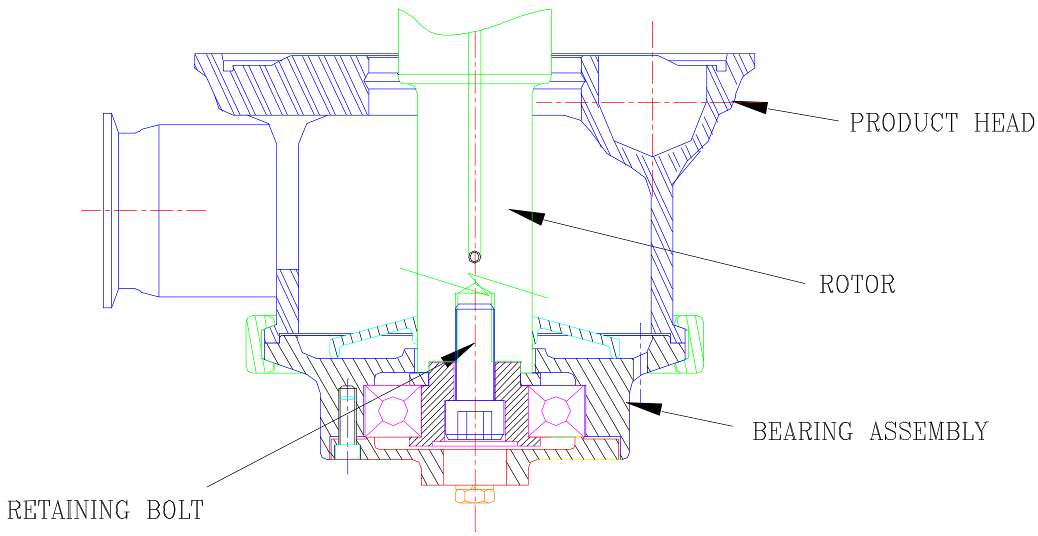


Figure 3-7. Rotor Hold Down Feature.

3.6 BLADES

This section describes the blades and blade styles that are available for use with the CONTHERM. The blade selection process is determined primarily by the cylinder material and rotor configuration.

3.6.1 Blade Selection

Blade selection is determined by the cylinder material and rotor configuration. The Stainless Steel (410) Blade and the Alfalon II Blade are most suitable for the majority of applications used by the CONTHERM today. Alfa Laval Contherm Inc. also offers other blade materials such as nylon and teflon.

The stainless steel blade offers superior scraping ability, but can only be used with cylinders that have a hard coating. The blades that are used should be of a softer material than the cylinder so that the blade, and not the cylinder surface, will wear over time. The Alfalon II is a plastic blade that has been developed to provide exceptional strength and wear characteristics. The Nylon and Teflon blades are manufactured from a softer material than that of the Alfalon II.

The plastic blades are provided with stainless steel inserts that are molded into the blade. These inserts are placed at the attachment points of the blade and fit into the grooves of the stationary rotor pins. The insert can be of 410 or 17-4 stainless steel material.

The general criteria for blade material selection is provided in Table 3-5. The actual style of the blade is determined by the rotor configuration.

Table 3-5. Blade Material Selection Criteria

Blade Material	Applications & Description
Stainless Steel	It is primarily used for duties where the product has a tendency to burn on, freeze on, or adhere to the cylinder wall. The cylinder must always have a hard coating. Maximum temperature rating: 600°F (315°C)
Alfalon II	The plastic Alfalon II blades can be used on all cylinder materials that Alfa Laval Contherm Inc. offers. Alfalon II blades are used for general heating and cooling applications. Maximum temperature rating: 392°F (200°C)

3.6.2 Blade Styles

The following blade styles are available for the scraping blades:

- Blade Length
- Hole Configuration On The Blade
- Slotted Blade Configuration
- Spring Loaded Blade Configuration

Table 3-6 describes these blade styles in more detail.

Table 3-6. Scraper Blade Styles

Blade Style	Description
Length	Alfa Laval Contherm Inc. offers blades in two lengths: 10.5 in. (26.7 cm) long for the staggered configuration and 24 in. (61 cm) long for the 2- or 4-bladed rotor design.
4-Hole	Standard heating and cooling applications with low to medium viscosity utilize a 24 in. (61 cm), four hole blade with pin spacing 6.75 in. (17.1 cm) apart.
7-Hole	Applications with a high viscosity utilize a 24 in. (6 cm), seven hole blade with pin spacing 3.38 in. (8.6 cm) apart. This is referred to as “Heavy Duty” pin spacing in Section 7.3, Rotors.
Slotted	Slotted blades are used primarily for products that are extremely viscous. The slots within the blade allow the product to pass through the blade, lessening the resistance of the rotor. This helps to reduce the load on the drive motor. A second use for the slotted blade is to increase the mixing efficiency. Each blade length and style can be slotted.
Springs	Some products have a tendency to lift the blade from the cylinder surface. Springs can be placed on the rotor pins and affixed to the blade to ensure constant contact between the blade and cylinder. Each blade length and style can be spring loaded. For most products, springs are not necessary. Products such as pet food or peanut butter may require this option.

Teflon Blades:

Teflon blades are constructed differently than other blades in that the teflon scraping piece is fitted to a stainless steel support bar. Compressing a stainless steel fastener onto the teflon scraping piece holds it to the support bar. The teflon material is very soft and cannot be held to the rotor with only the stainless steel blade inserts. A teflon blade configuration is shown in Figure 3-8.

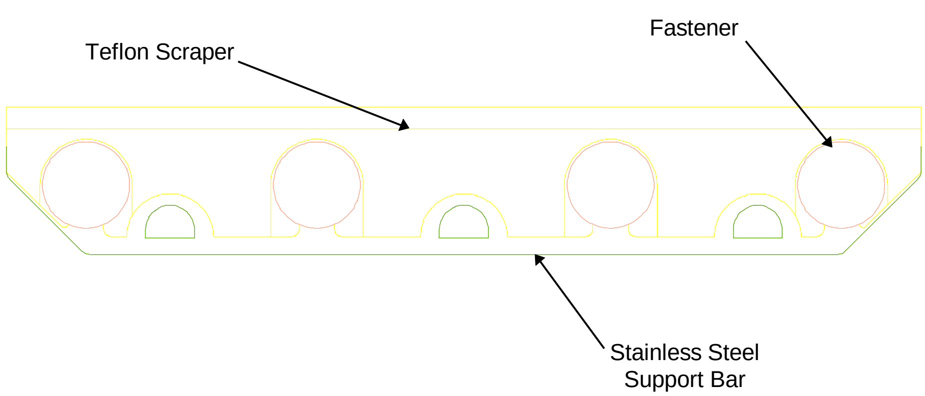
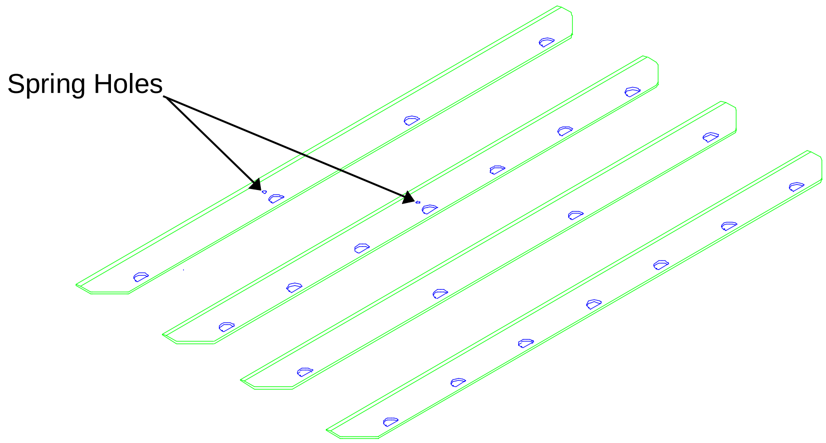


Figure 3-8. 10.5 Inch (267 mm) Staggered Teflon Blade

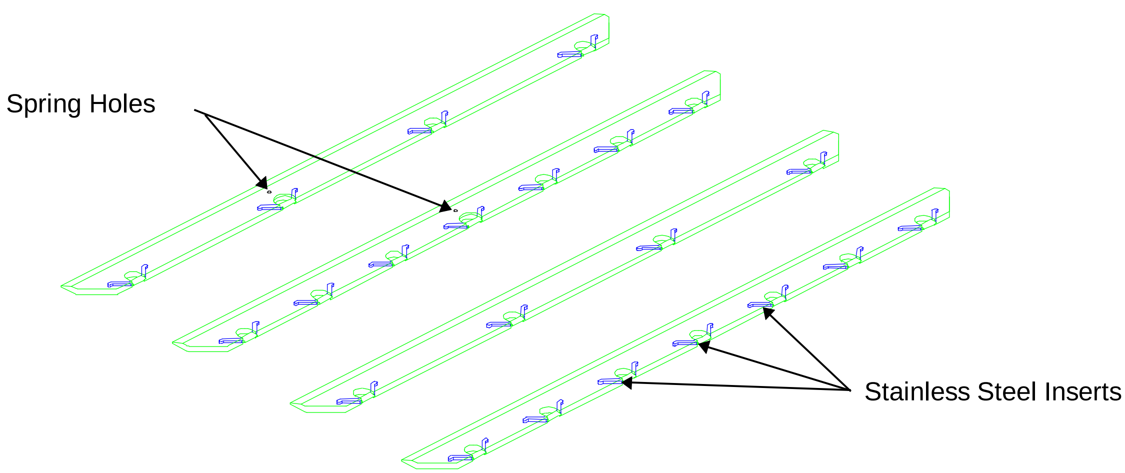
Table 3-7 shows the number of blades provided for each of the three CONTHERM Models, based on the blade configuration that is being utilized. Typical stainless steel and plastic blades for the CONTHERM are shown in Figure 3-9.

Table 3-7. CONTHERM Model And Blade Configurations

Blade Configuration	**CONTHERM Model Number**		
	6 x 3 (# of Blades)	**6 x 6 (# of Blades)**	**6 x 9 (# of Blades)**
2 - Bladed	2	4	6
4 - Bladed	4	8	12
Staggered	6	10	14



Various 24-Inch (610-mm) Stainless Steel Blades



24-Inch (610-mm) Plastic Blades with stainless steel inserts

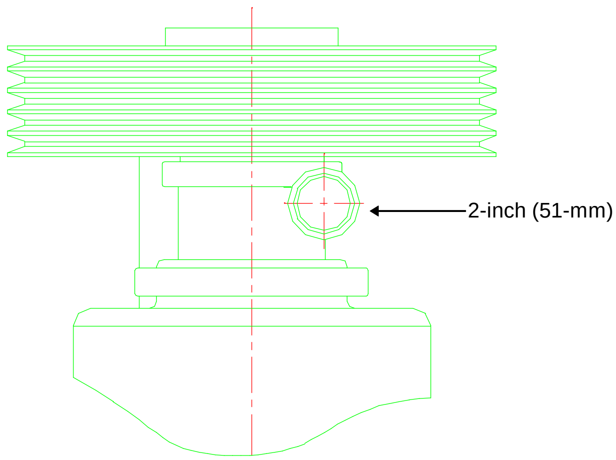
Figure 3-9. Typical Stainless Steel And Plastic Blades Used With The CONTHERM

3.7 PRODUCT HEADS AND PORTS

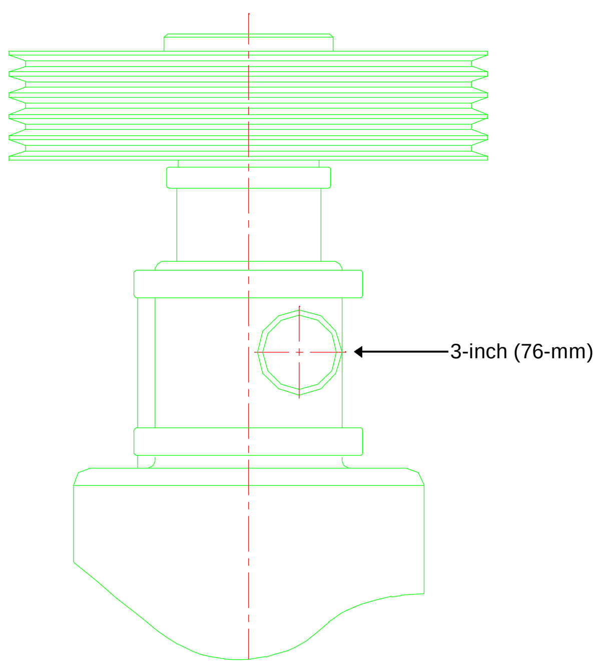
The standard CONTHERM is equipped with separate, 2-inch (51 mm) tangential product inlet and outlet ports. Larger port sizes are available, but require the use of Extended Heads. The 2-inch (51 mm) Tangential Heads are used for most applications.

With the Extended Tangential Heads, 3-inch (76 mm) product ports can be supplied. The larger port sizes are used to minimize pressure drop in product piping.

Figure 3-10 shows a drawing of both the tangential and extended product heads.



2-inch (51-mm) Tangential Heads



3-inch (76-mm) Tangential Heads

Figure 3-10. Standard Heads (With 2-inch Ports) And Extended Heads (With 3-inch Ports).

3.7.1 Eccentric Heads

Eccentric Heads shift the center-line of the rotor by 1/8-inch, resulting in an off-center rotor. During rotation, the clearance between the rotor and the cylinder wall differs at the extremes by 1/4-inch. Eccentric Heads are used when there is a possibility of “mass rotation.” Mass rotation occurs when the product sticks to the rotor and turns as a solid mass with the rotor. The varying clearances between the rotor and cylinder created by the Eccentric Head design reduces mass rotation which results in higher heat transfer efficiencies and lower horsepower demands on the drive system.

Figure 3-11 shows a rotor equipped with concentric and eccentric heads. There are only a few products that require this type of head configuration.

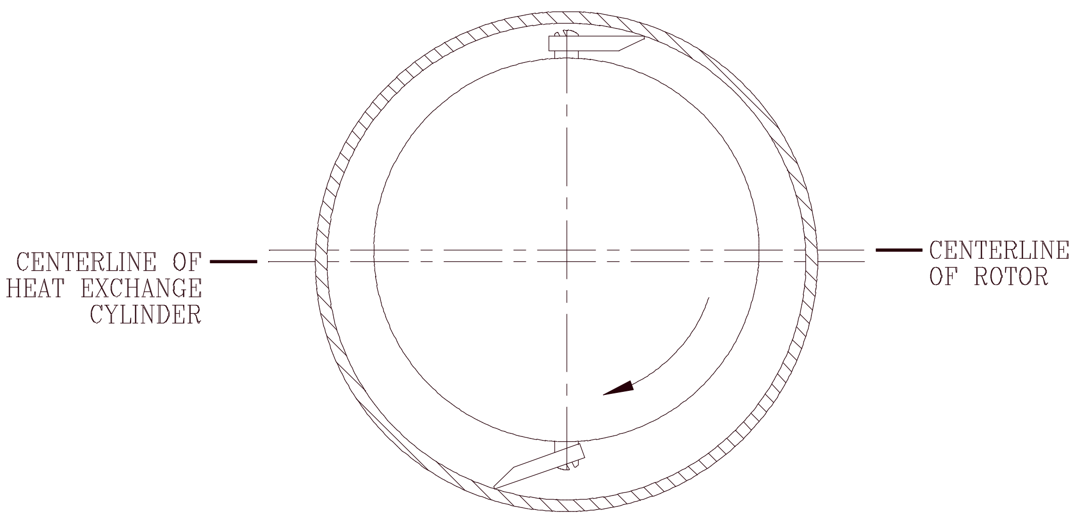


Figure 3-11. Rotor And Cylinder Relationship with Concentric and Eccentric Heads

3.8 SEALS

The CONTHERM requires product seals at each end of the cylinder to prevent product from escaping from the inside of the cylinder and external contamination from entering the interior of the cylinder.

Alfa Laval Contherm Inc. offers the following seal designs and materials for its standard CONTHERMs:

1. Standard Seals
2. Hard Face Seals
3. Flushed Carbon Seals
4. Flushed Hard Face Seals
5. Huhnseals

The specific seal design and materials selected for the standard CONTHERM are determined by the product application.

NOTE: If your CONTHERM is supplied with a special purpose seal design, such as Packing Gland Seal, refer to the appropriate Appendix included in the back of this manual for the seal's description and other applicable information.

An overview of the standard seal designs and materials offered by Alfa Laval Contherm Inc. is provided in Table 3-8.

Table 3-8. Rotary Seal Designs Offered By Alfa Laval Contherm Inc.

Material	Application Information
Standard	A single product seal used for general heating and cooling applications of non abrasive products.
Flushed Standard	A dual seal used for minimizing product leaks or sterilizing the non product side of the seal. Used in general heating, cooling and sterilization processes.
Hard Face	A single product seal used for abrasive or crystallized products.
Flushed Hard Face	A dual seal used for minimizing product leaks and aseptic processing of abrasive products and crystallized products.
Huhnseal	A heavy duty, spring loaded seal. Used for highly abrasive products. Offers extra long life. This assembly requires rotor modifications and is not interchangeable.

3.8.1 Standard Seal Assembly

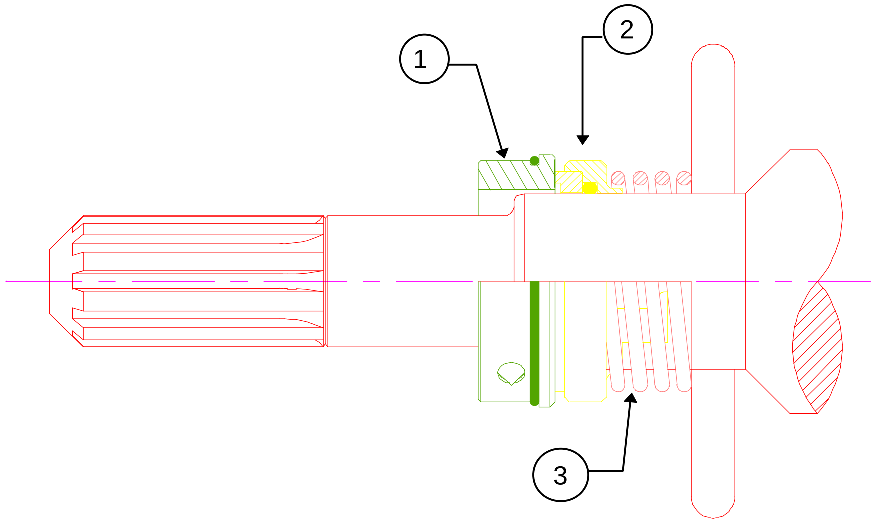
The seal in the Standard Seal Assembly is a mechanical seal created by two very flat surfaces that are in intimate contact with each other. One surface is the seal face of a 2-inch (51 mm) rotating seal assembly that is located on the rotor. The other surface is the face of a stationary seal bushing that is installed into the product head. The rotating seal assembly is held on the rotor ends by a bayonet locking pin and is spring loaded to ensure that the seal faces remain in constant contact. For the standard seal, the contact surfaces are a rotating carbon ring against a stainless steel, stationary seal bushing coated with chrome oxide.

The Standard Seal Assembly is shown in Figure 3-12. The location of the seal parts of the Standard Seal Assembly in relation to the rotor and product heads is shown in Figure 3-13.

3.8.2 Hard Face Seal Assembly

The seal in the Hard Face Seal Assembly is a single seal assembly that functions just like the 2-inch (51 mm) standard seal assembly, but in this case the rotating seal face is of silicon carbide or tungsten material. A groove located on the rotary seal shell indicates that this is a hard face seal assembly.

The Hard Face Seal Assembly is shown in Figure 3-12. The location of the seal parts of the Hard Face Seal Assemblies in relation to the rotor and product heads is shown in Figure 3-13.



Callout	Description
1	Stationary Seal Bushing
2	Rotary Seal Assembly
3	2-inch (51-mm) Spring

Figure 3-12. Standard And Hard Face Seal Assemblies

3.8.3 Flushed Standard Seal Assembly

The Flushed Standard Seal Assembly is a dual seal that allows the Standard 2-inch (51 mm) seal to be used in conjunction with a 1.5 inch (38 mm) seal to form a chamber for flushing or sterilizing the non-product side of the seal. Flushing with water helps to minimize seal leaks and applying low pressure steam (15 psi - 1 Bar) sterilizes the non-product side of the seal for aseptic applications. The 1.5 inch seal is also spring loaded, with contact surfaces being a carbon ring against a stainless steel seal bushing coated with chrome oxide. Flexible hoses are provided for flushing media.

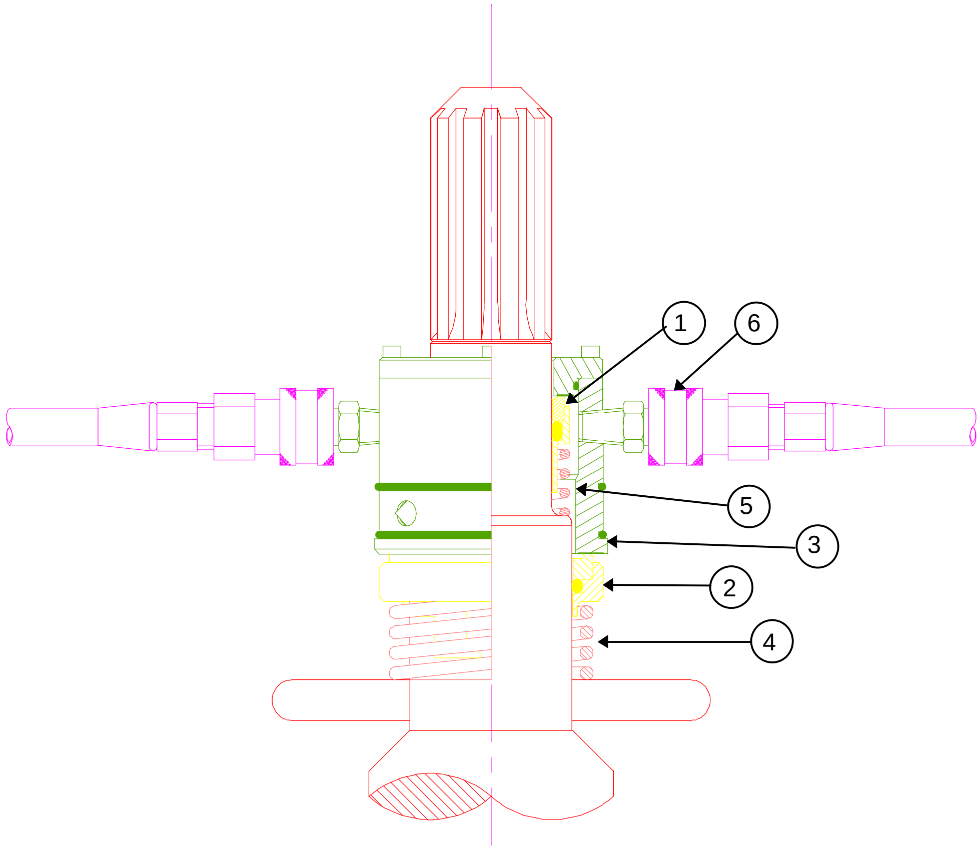
The Flushed Standard Seal Assembly is shown in Figure 3-14. The location of the seal parts of the Flushed Standard Seal Assembly in relation to the rotor and product heads is shown in Figure 3-15.

Note: This seal option cannot be used on units containing a 2-inch high torque spline. In order to create the flushing chamber, the rotor must have the standard 1.5-inch rotor end.

3.8.4 Flushed Hard Face Seal Assembly

The Flushed Hard Face Seal Assembly uses the Flushed Standard Seal Assembly in combination with a second seal. The secondary seal face can be of the standard carbon or hard face material. Flexible hoses are provided for flushing media. The Flushed Hard Face Seal Assembly is shown in Figure 3-14. The location of the seal parts of the Flushed Hard Face Seal Assembly in relation to the rotor and product heads is illustrated in Figure 3-15.

Note: This seal option cannot be used on units containing a 2-inch high torque spline. In order to create the flushing chamber, the rotor must have the standard 1.5 inch rotor end.



Callout	Description
1	1.5 inch (38 mm) Rotary Seal Assembly
2	2.0 inch (51 mm) Rotary Seal Assembly
3	Stationary Seal Bushing Assembly
4	2.0 inch (51 mm) Spring
5	1.5 inch (38 mm) Spring
6	Flushing Media Connection

Figure 3-14. Standard And Hard Face Flushed Seal Assemblies

Insert Figure 3-13 (11 x 17 foldout drawing)

Figure 3-13. Parts Location Of The Standard And Hard Face Seal Assemblies In Reference To The Rotor And Product Heads

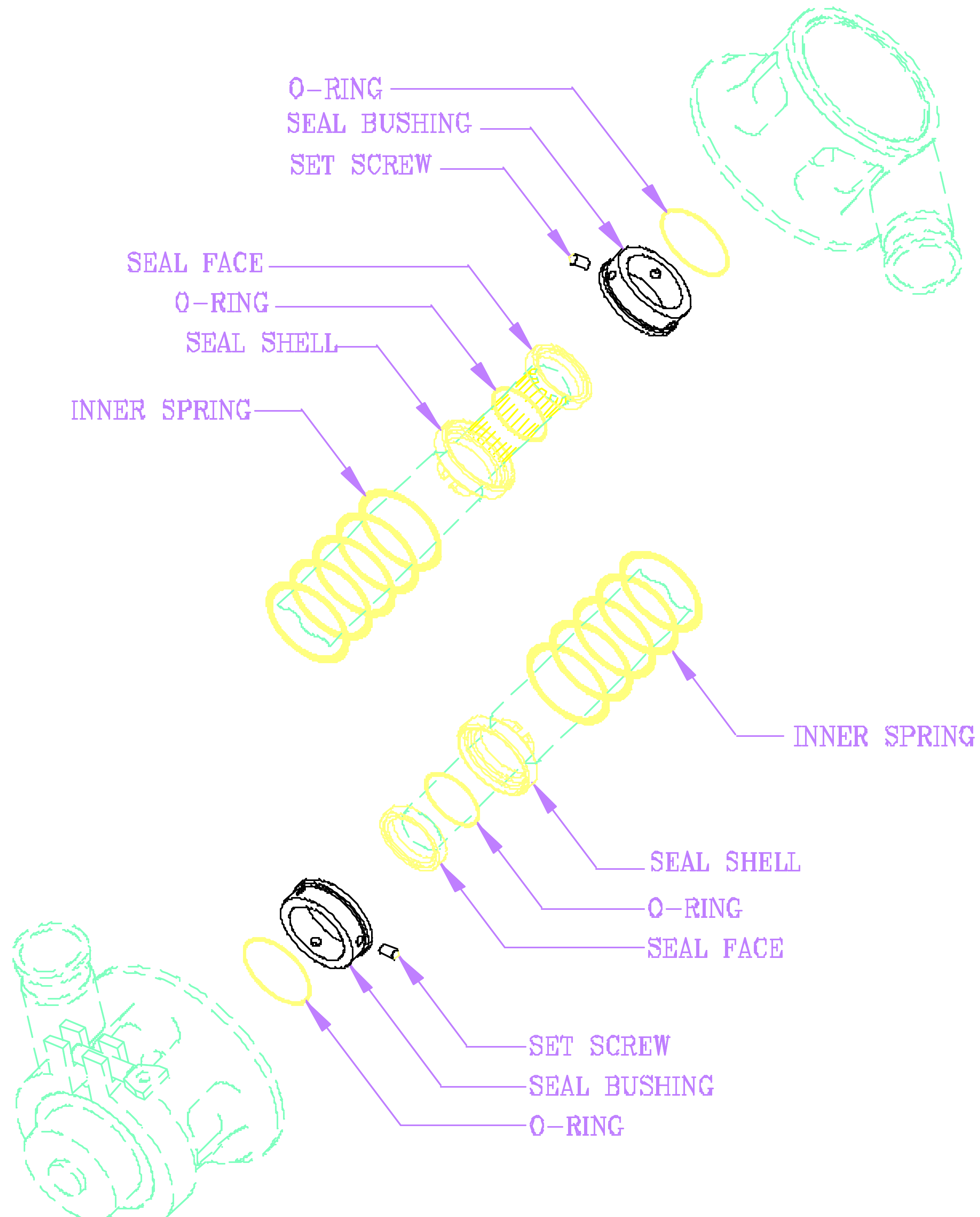


Figure 3-13. Parts Location Of Standard And Hard Face Seal Assemblies

Backside of Figure 3-13 (11 x 17 foldout drawing)

Insert Figure 3-15 (11 x 17 foldout drawing)

Figure 3-15. Parts Location Of The Standard And Hard Face Flushed Seal Assembly In Reference To The Rotor And Product Heads

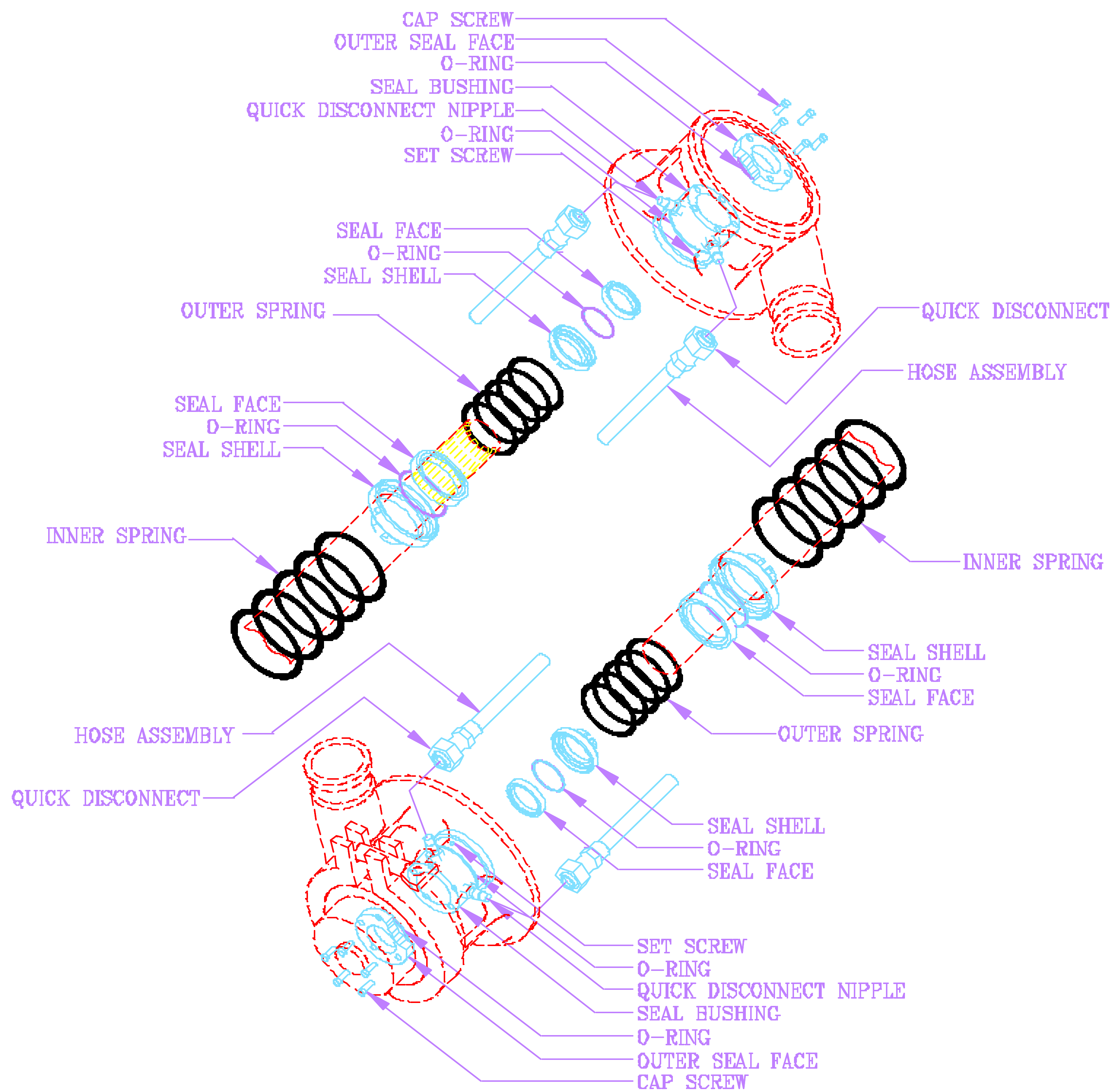


Figure 3-15. Parts Location Of Standard And Hard Face Flushed Seal Assemblies

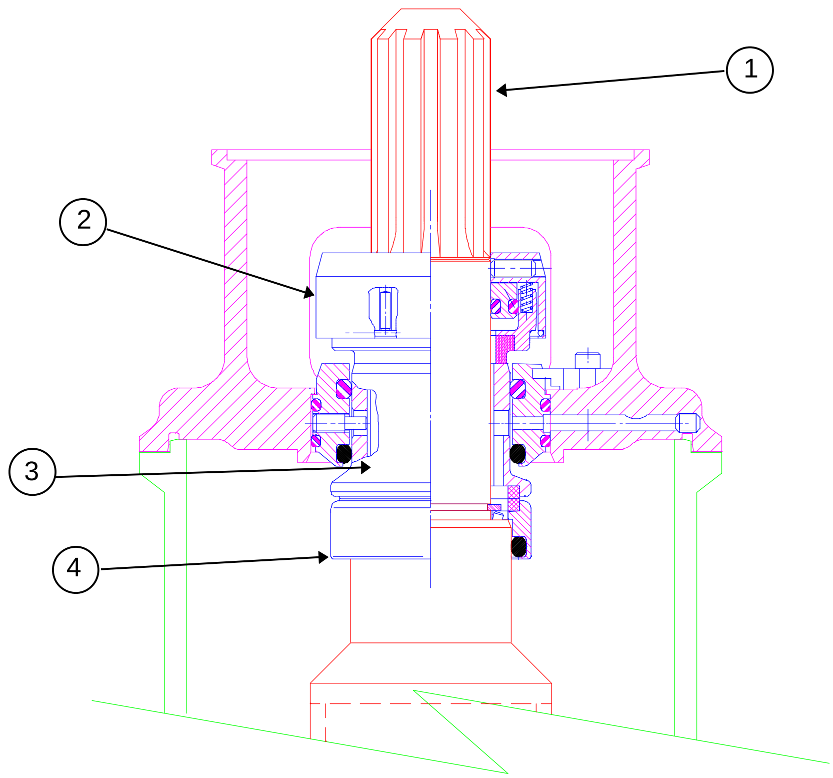
Backside of Figure 3-15 (11 x 17 foldout drawing)

3.8.5 Huhnseal Seal Assembly

The Huhnseal is a spring loaded, hygienically designed rotary seal that allows the CONTHERM to be used for long production runs without requiring any maintenance. The Huhnseal is shown in Figure 3-16.

The location of the springs that are used to close the two seal faces together is the major difference between the Huhnseal and the other rotary seals. With a Huhnseal, the springs are located outside of the seal and flushing area, and do not come into contact with the product; with the other rotary seals, the springs are located within the seal and flushing areas, and are in contact with the product or flushing media.

The benefits of the Huhnseal's flushed, hygienic seal assembly are readily apparent when cleaning the CONTHERM. With other rotary seals, during the cleaning of the CONTHERM, the product can build up and get caught within the springs of the seals.



Callout	Description
1	Rotor
2	Huhnseal Stop Ring Assembly
3	Huhnseal Seal Ring Assembly
4	Huhnseal Seal Seat

Figure 3-16. Huhnseal Seal Assembly

With the exception of the Huhnseal, the seal assemblies (Standard Seal, Hard Face Seal, Flushed Standard Seal, and Flushed Hard Face Seal) described in this Chapter are interchangeable, providing that a bayonet locking pin is provided for the secondary seal when used in flushed or aseptic applications.

3.8.6 Rotary Seal Face Materials

Table 3-9 identifies the three seal face materials that may be used with the Standard Seal, Hard Face Seal, Flushed Standard Seal, and Flushed Hard Face Seal Rotating Seal Assemblies. The table also provides material and application information.

Table 3-9. Rotary Seal Face Materials

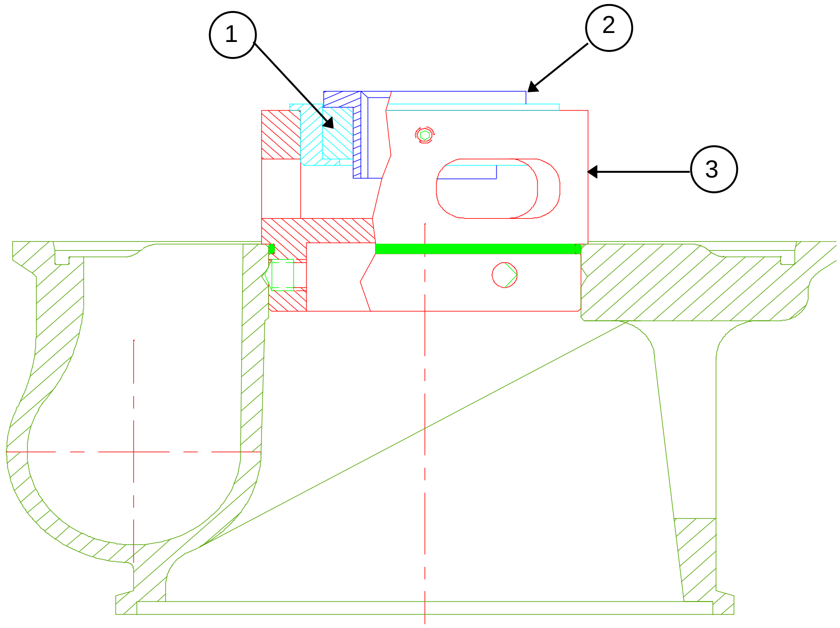
Material	Application Information
Standard (Carbon)	The Carbon seal face is considered to be the standard as it is the most common of the seal face options. Applications include general heating and cooling of non-abrasive products (i.e., sauces, fruit preparations, MDM).
Hardface (Silicon Carbide)	Silicon Carbide is used for heating and cooling of gritty or abrasive products (i.e., chocolate, caramel).
Hardface (Tungsten Carbide)	Typical applications include shortening, margarine and other applications where crystallization is occurring with cooling. **Note**: Product crystals could be abrasive and interfere with the product seal. Tungsten seals produce more heat when in operation than Silicon Carbide. This extra heat helps melt any crystals in the seal area thereby minimizing product leaks

Notes:
1. Standard Carbon Seals can be lapped to increase the life of the seal.
2. The Hard Face Seals cannot be lapped, but still offer extended life beyond that of the Standard Carbon.

3.8.7 Inboard Bearing

The use of an inboard bearing on the lower end of the CONTHERM is an option that can be used to replace the lower mechanical seal assembly. This option will ensure that there will be no product leaks. The inboard bearing option is available for each product head and is often used when supplying 3-inch (76 mm) product ports for large particulates or for reducing elevated pressure drop in the product piping.

A stainless steel bearing sleeve, located on the rotor end, rotates on a stationary carbon or plastic material in the bearing assembly. Normally, the rotor would extend through the product head when utilizing mechanical seals. As shown in Figure 3-17, no modifications are required to the 2-inch (51 mm) tangential product head when using the inboard bearing assembly because the bearing is designed to sit in the head. It acts as a plug to product flow.



Callout	Description
1	Stationary Carbon
2	Bearing Sleeve
3	Inboard Seal Plug

Figure 3-17. Inboard Bearing Assembly

3.9 DRIVES

Three standard drive system packages are available for the CONTHERM:

1. Electric Direct Drive
2. Electric With Belts & Sheave
3. Hydraulic

Information describing each package is provided in Table 3-10. Each of the three drives is shown in Figure 3-18.

Table 3-10. CONTHERM Standard Drive System Packages

Drive Type	Description
Electric Direct Drive	In-line design offers compact installation. Low rotor speeds easily available. Extends ceiling requirements by 25- to 30-inches (635 mm to 762 mm) over belt and sheave design.
Electric With Belts & Sheave	Traditional SSHE drive system. Belts and sheaves provide the option for changing rotor speeds by changing sheave sizes.
Hydraulic	Easy to vary speed. However, hydraulic systems can be noisy and dirty if not designed and maintained properly. Requires a hydraulic power pack at customer site.

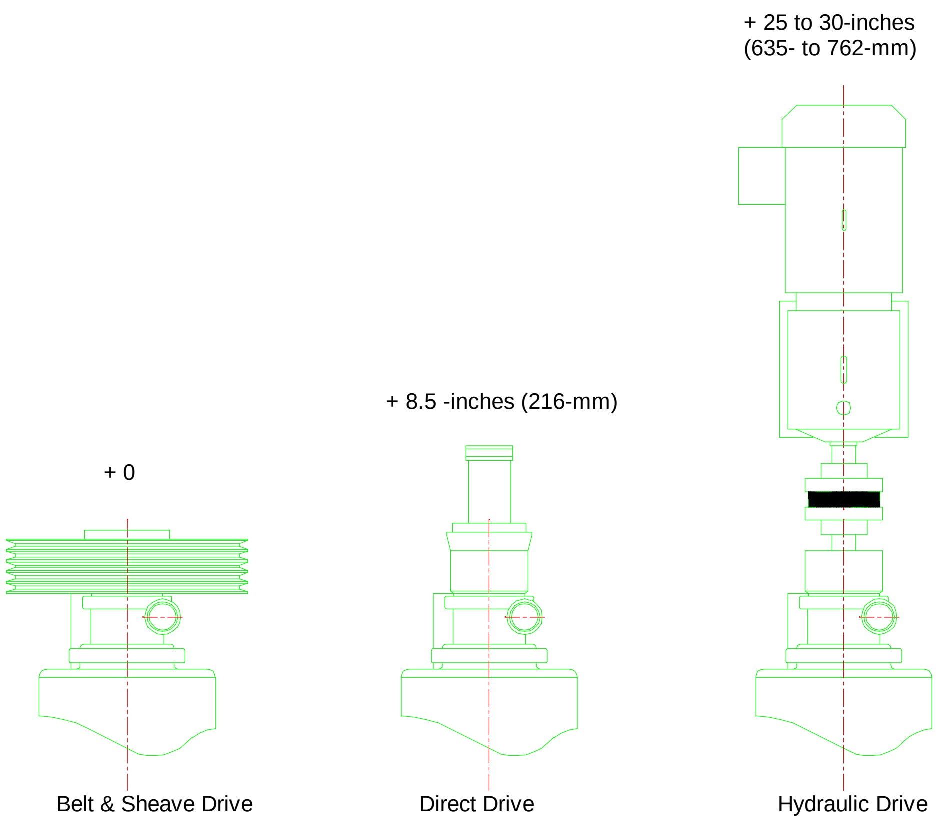


Figure 3-18. The Three Standard Drive Systems

3.9.1 Horsepower And Rotor Speed Requirements

Selection of the proper rotor speed is critical to the operation and efficiency of the CONTHERM. Most applications require rotor speeds of 200 to 300 rpm, using motors of 7.5 to 10 HP. Products with excessive viscosity sometimes require 15 and even 20 HP. Table 3-11 provides sample power requirements for various applications using a Model 6X9 CONTHERM. Smaller units require proportionally lower horsepower. Lower rotor speeds may be acquired for special applications.

Table 3-11. Examples Of CONTHERM Power Requirements

Horsepower	RPM's	Application
7.5 HP (5.6 kW)	200-300	Heating or cooling of low viscosity products, such as soups, sauces and fruit preparations.
10 HP (7.5 kW)	200-300	General heating or cooling of moderately viscous products, such as shampoos and tomato pastes.
10 HP (7.5 kW)	450-500	Heating of heat sensitive products where product contact time on the cylinder surface needs to be minimized. Applications include cheese sauces or concentrated dairy products. **Note: CONVAP Applications** CONVAPs are used to enhance heat transfer of the product as well as to avoid product degradation when using extreme steam temperatures. Applications include fruit concentrates, pectin and lecithin. The CONVAP is described in Chapter 10.
15 HP (11.2 kW)	200-250	Cooling of viscous products, such as MDM, shortening, and margarine.

3.10 MOUNTING COLUMNS

The standard CONTHERM mounting assembly is of complete stainless steel construction and provides for the vertical positioning of the CONTHERM cylinder. The assembly can be manufactured to accommodate up to six cylinders. If the drive system is supplied by Alfa Laval Contherm Inc., then the appropriate motor mounting hardware is provided.

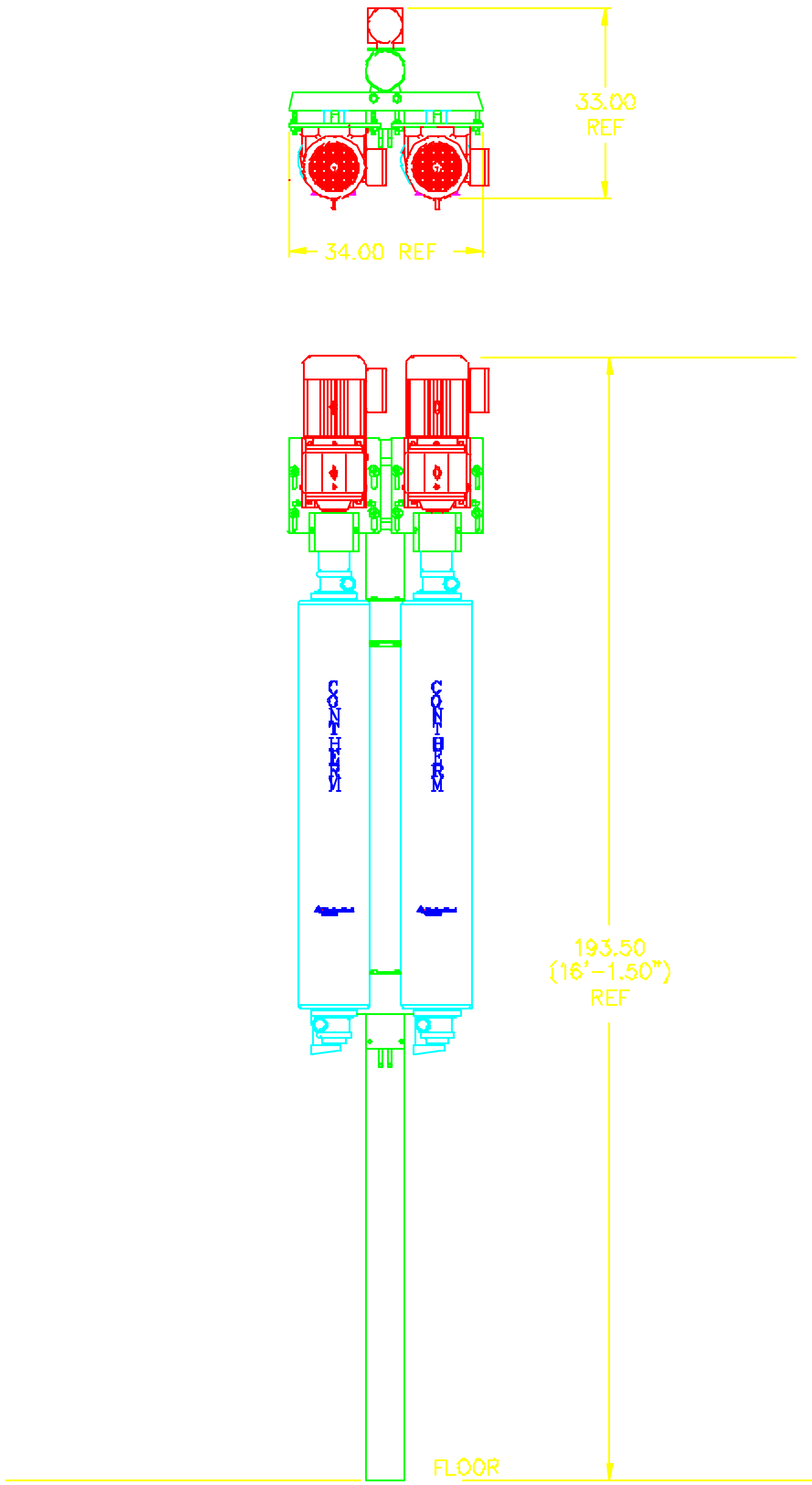
The CONTHERM can be erected horizontally if ceiling height or customer preference dictates. In these cases, a stainless steel horizontal mount can be supplied. Vertical mounting is preferred due to the space saving benefit realized as shown in Figure 3-19.

Floor space comparison for 18 square feet of heat transfer area:

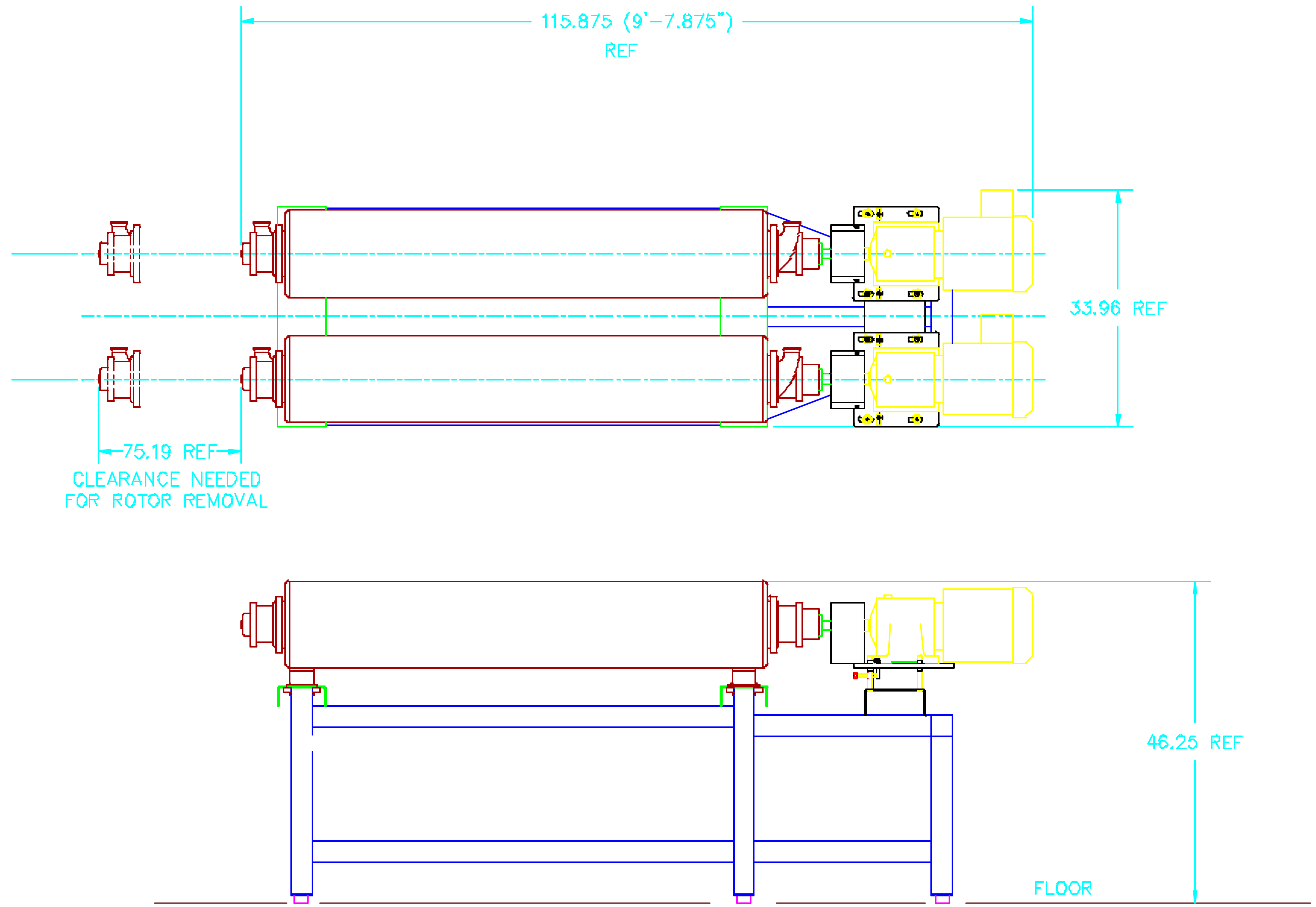
1. The CONTHERM vertical design requires a maximum of 8 square feet of floor space.
2. Conventional horizontal design demands 25 square feet of floor space plus the additional space necessary for rotor removal.

Insert Figure 3-19 (11 x 17 foldout drawing)

Figure 3-19. CONTHERM Mounting Configurations



VERTICAL MOUNTING CONFIGURATION



HORIZONTAL MOUNTING CONFIGURATION

Figure 3-19. Mounting Configurations

Backside of Figure 3-19 (11 x 17 foldout drawing)

3.11 ROTOR LIFTING DEVICE

A rotor lifting device is supplied as standard equipment with all vertical installations of the CONTHERM. The package allows for simple and easy inspection of the following:

1. Inner cylinder surface.
2. Rotor and blade assembly.
3. Top rotating seal assembly.
4. Lower rotating and fixed seal assemblies.
5. Lower bearing.

The Rotor Lifting Device is shown in Figure 3-20. By using the lifting device, one operator can easily inspect, conduct maintenance and reassemble the CONTHERM. A horizontal scraped surface heat exchanger requires additional maintenance, personnel and lifting equipment. The use of the vertical CONTHERM can result in considerable time and labor savings.

When the CONTHERM is to be mounted horizontally, a rotor trough is provided for manual rotor removal.

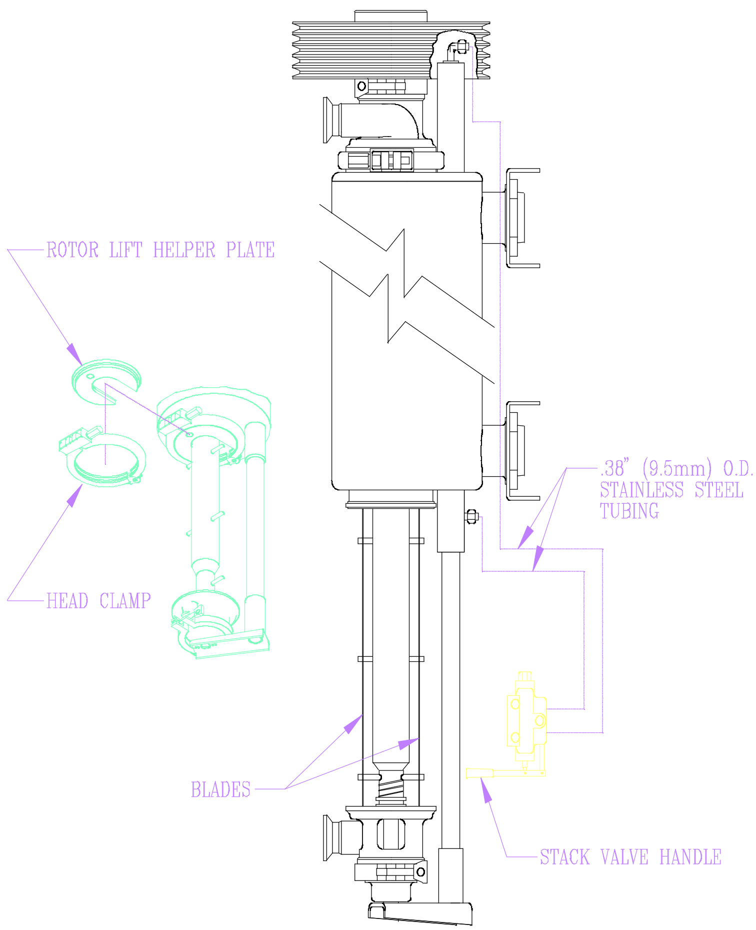


Figure 3-20. Hydraulic Rotor Lifting Device

3.12 PIN UNIT

The processing of many fats & oils may require mechanical working and texturizing. A CONTHERM Pin Unit provides the agitation required during crystallization to produce a smooth and consistent product. The Pin Unit is available in three sizes, each of which is identified in Table 3-12.

Table 3-12. Pin Unit: Sizes And Dimensions

Pin Unit	Capacity	Dimensions (Diameter x Length) (Inches)	Dimensions (Diameter x Length) (Millimeters)
6 x 72	Liter	6-in. x 72-in.	152-mm x 1818-mm
10 x 48	Liter	10-in. x 48-in.	254-mm x 1219-mm
10 x 72	Liter	10-in x 72-in.	254-mm x 1818-mm.

A cross-section of the CONTHERM showing the CONTHERM's Pin Unit is shown in Figure 3-21.

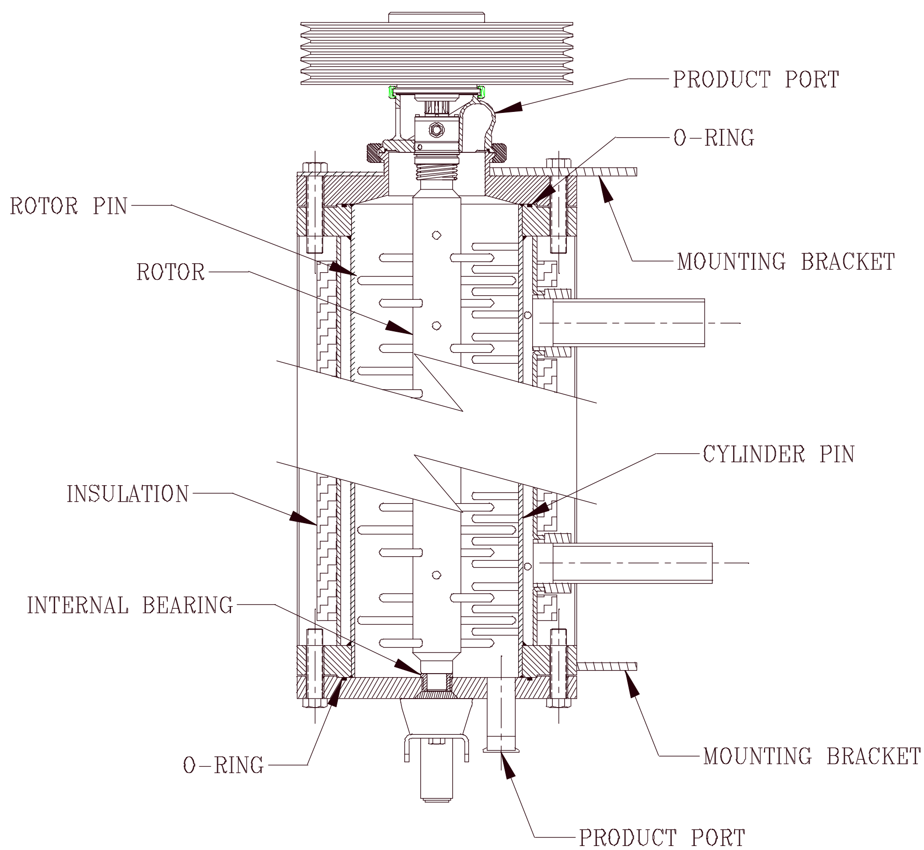


Figure 3-21. CONTHERM Pin Unit

3.13 CONTROL PANEL

Control panels are only supplied by Alfa Laval Contherm Inc. with domestic capital equipment orders and rental systems. These control panels are of Stainless Steel NEMA IV Construction and have the following dimensions (approximate):

Control Panel Dimensions: 24-in. x 30-in. x 12-in. (61-cm x 76-cm x 31-cm)

The following list summarizes the features provided with the control panel.

1. On/Off switches for main power; hydraulic lift motor; CONTHERM motors; product pump; and media switches.
2. Manual/Automatic Maintain Status Control of the refrigerant with On/Off/Auto switch for control of hot gas supply. When in the Auto position, an ammeter (or tachometer) senses the rotor load.
3. A single or dual indicating (or recording) temperature controller for control of the final heating and/or cooling CONTHERM(s), with a 2- to 4-inch (51- to 102-mm) sanitary sensing element and tee.

3.14 MEDIA PACKAGES (HEATING AND COOLING)

Alfa Laval Contherm Inc. offers the following heating and cooling media packages for its CONTHERMs:

1. **Steam And Hot Water Heating Packages**

   Steam is the most common heating media for the CONTHERM. Typical steam temperatures in the CONTHERM range from 250°F to 330°F (121°C to 165°C).

2. **Refrigeration Package (Ammonia/Freon)**

   Ammonia and Freon expansion refrigerants allow for very low media temperatures. Typical temperatures for the CONTHERM are from 32°F to -20°F (0°C to -30°C)

3. **Water/Brine Recirculation Package**

   Typically, water and/or glycol cooling systems are used because they are less expensive to operate and maintain than expansion refrigerant systems. Water or glycol cooling systems are often used for precooling the product before final cooling takes place with an expansion refrigerant. Even though the temperature of brine solutions can drop as low as -20°F (-30°C) at high concentrations, this increased concentration decreases the efficiency of the coolant.

Refer to Chapters Five and Six for detailed descriptions of each of these media packages. Chapter Five contains detailed installation information and configuration drawings for each of the media packages. Chapter Six provides detailed operating procedures for each of these CONTHERM media packages.

Alfa Laval
Contherm

Chapter 4

CONTHERM
Serial Number Information

Table Of Contents

Chapter Four CONTHERM Serial Number And Model Identification

Chapter 4 CONTHERM Serial Number Information

4.1 INTRODUCTION

Alfa Laval Contherm Inc. assigns a unique serial number to each CONTHERM manufactured at its factory. The serial number is inscribed on the inspection plate mounted on the exterior of the CONTHERM and on the inner cylinder assembly.

The serial number, in addition to identifying a specific CONTHERM, provides the following configuration related information about the CONTHERM and its heat exchange cylinder:

1. Identifies if the CONTHERM is equipped with a hydraulic rotor lift system.
2. Identifies the type of product heads the CONTHERM uses.
3. Describes the base material used to manufacture the heat exchange cylinder.
4. Identifies the configuration of the heat exchange cylinder's media annulus.
5. Identifies the coating or plating applied to the inside diameter of the heat exchange cylinder.

The information in this chapter is organized as shown in Table 4-1.

Table 4-1. CONTHERM Serial Number Related Information

Section	Description
4.2	Information Provided By The CONTHERM Serial Number
4.3	Material Configurations For CONTHERM Heat Exchange Cylinders

4.2. SERIAL NUMBER INFORMATION

An example of a serial number for a standard CONTHERM is shown in Figure 4-1. In this example, the serial number inscribed on the inspection plate is “HC9999NPC.”

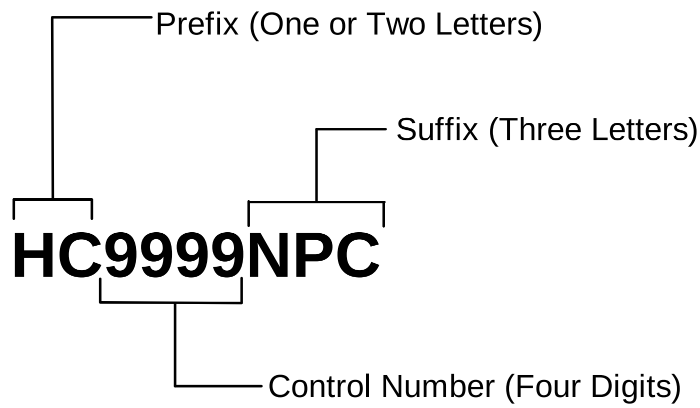


Figure 4-1. Components Of The CONTHERM’s Serial Number

As shown in Figure 4-1, the serial number consist of three major components:

1. A Prefix (with either one or two letters).
2. A Control Number (always has four digits).
3. A Suffix (always has three letters).

Table 4-2 identifies the prefix and suffix codes used by Alfa Laval Contherm Inc. for the standard CONTHERM, and also describes what each letter of the prefix and suffix indicates. The information provided by your CONTHERM’s serial number should be referenced whenever you correspond with Alfa Laval Contherm Inc. or order spare parts.

Table 4-2. Information Contained Within The CONTHERM's Serial Number

<table>
<tr><th>Serial Number Component</th><th>Letter Or Digit</th><th>Description*</th></tr>
<tr><td rowspan="3">Prefix
(Either one or two letters)</td><td>1st Letter -- "H"</td><td>The "H" indicates that the CONTHERM is equipped with a hydraulic rotor lift system.
<u>Example</u>: HC9999NPC
If the letter "H" is not in the prefix, then the CONTHERM is not equipped with a rotor lift system or the lift system is of original design.
<u>Example</u>: C9999NPC</td></tr>
<tr><td>2nd Letter -- "C"</td><td>The "C" indicates that the CONTHERM is equipped with cast product heads.
<u>Example</u>: HC9999NPC
If the letter "C" is not in the prefix, then the CONTHERM's product heads are of a fabricated design.
<u>Example</u>: H9999NPC</td></tr>
<tr><td>No Prefix</td><td>If there is no prefix in the CONTHERM's serial number, then the unit does not have a rotor lift system and is equipped with fabricated product heads.
<u>Example</u>: 9999NPC</td></tr>
<tr><td>Control Number
(Always four digits)</td><td>Four Digits</td><td>The four-digit Control Number is assigned by the pressure vessel authorities to the product (heat exchange) cylinder.
<u>Example</u>: HC9999NPC</td></tr>
<tr><td>Suffix
(Always three letters)</td><td>1st Letter
(N, S, or F)</td><td>The first letter of the suffix indicates the base material used to manufacture the product cylinder. The base material for a standard CONTHERM may be one of the following:
N -- Nickel
S -- Stainless Steel
F -- Ferrous Material
<u>Examples</u>: HC9999NPC
HC9999SPC
HC9999FPC</td></tr>
</table>

* The bold faced characters are provided only to emphasize the specific character associated with the example's Serial Number Component.

Table 4-2. Information Contained Within The CONTHERM's Serial Number, Continued

Serial Number Component	**Letter Or Digit**	**Description***
Suffix, Continued (Always three letters)	2nd Letter (P or C)	The second letter of the suffix describes the product cylinder's media annulus. The annulus may be one of two configurations: P -- Plain Media Annulus C -- Coiled Media Annulus Examples: HC9999N**P**C HC9999S**C**C
	3rd Letter (N, C, T, or B)	The third letter of the suffix identifies the plating or coating applied to the inside diameter of the product cylinder. The product cylinder's inside diameter may have one of the following coating or plating configurations: N -- No Plating C -- Hard Plating T -- Triple Layer of Hard Plating B -- Bi-Metallic Coating Examples: HC9999NP**N** HC9999NP**C** HC9999NP**T** HC9999NP**B**

* The bold faced characters are provided only to emphasize the specific character associated with the example's Serial Number Component.

4.3 MATERIAL CONFIGURATIONS FOR CONTHERM HEAT EXCHANGE CYLINDERS

This section identifies the materials most commonly used for standard CONTHERM heat exchange cylinders and several possible materials configurations that can be used.

Table 4-3 identifies the basic cylinder types and the corresponding applications in which they are used. The cylinders are listed in order of decreasing heat transfer. Table 4-4 identifies several possible materials configurations for the CONTHERM's heat exchanger cylinder. These combinations are based on the materials identified in the suffix portion of the unit's serial number as described in Table 4-2.

Table 4-3. CONTHERM Heat Exchange Cylinder Types And Applications

Cylinder Type	Application
Nickel	For non-corrosive products
Chromed Nickel	Use of Stainless Steel Blades
Bimetallic	Corrosion resistance and strong wear characteristics
Stainless Steel (316L)	Highly Acidic Products

Table 4-4. Typical Materials Configurations For CONTHERM Heat Exchange Cylinder

Heat Exchange Cylinder Configuration	Configuration Description
SCN or SPN (Stainless Steel)	The SCN and SPN configurations are used for general heating and cooling applications where a CIP Program would be detrimental to a Nickel or Chrome coating, and where the product has a low pH. AISI 316L steel and plastic blades are used.
SCC or SPC (Stainless Chromed Plating)	The SCC and SPC configurations are used for general heating and cooling of viscous products. AISI 316L steel and durable steel blades are used.
NCN or NPN (Nickel Plating)	The NCN and NPN configurations are used for general heating and cooling of products in non-corrosive environments. Plastic blades are used.
NPC (Nickel Chromed Plating)	The NPC configuration is used for applications that require the heavy duty chilling of viscous products. The Nickel used is 200 grade. A plain annulus is provided for use with ammonia and Freon refrigerants. The Nickel Chromed plating permits the use of stainless steel blades.

Table 4-4. Typical Materials Configurations For CONTHERM Heat Exchange Cylinder, Continued

Heat Exchange Cylinder Configuration	Configuration Description
NCC (Nickel Chromed Plating)	The NCC configuration is used for applications that require the heavy duty heating or cooling of viscous products. The Nickel used is 200 grade. A coiled annulus is provided for use with non-refrigerant types of media. The coiled annulus is used to create turbulence. The Nickel Chromed plating permits the use of stainless steel blades.
FCB or FPB (Bimetallic Plating)	The FCB and FPB configurations are used for general duty heating and cooling applications. These durable, long lasting materials offer a higher heat transfer efficiency than that of stainless steel, but are not as efficient as that provided by nickel. The FCB and FPB configurations are especially resistant to corrosion. Stainless steel blades can be used with both configurations.

Alfa Laval
Contherm

Chapter 5

Installation

Table Of Contents

Chapter Five Installation

Chapter 5 Installation

5.1 INTRODUCTION

This chapter describes how to safely install the CONTHERM® Scraped Surface Heat Exchanger (SSHE).

The installation procedures are organized as shown in Table 5-1.

Table 5-1. CONTHERM Installation Procedures

Section	Description
5.2	Uncrating And Unpacking The Equipment
5.3	Erecting The Vertical Mount
5.4	Mounting And Installing The CONTHERM In A Vertical Configuration
5.5	Mounting And Installing The CONTHERM In A Horizontal Configuration
5.6	Installing The Components Of The Rotor Lifting System
5.7	Installing A Steam Heating System
5.8	Installing A Hot Water Heating System
5.9	Installing a Refrigeration System (Ammonia or Freon)
5.10	Installing a Water or Brine Cooling System

Before performing any installation procedure, please review the safety precautions provided in Chapter One, Safety Summary.

WARNING

Do not install the CONTHERM or its equipment and parts until you have read this manual and are knowledgeable of the equipment and all applicable safety precautions.

5.2 UNCRATING AND UNPACKING THE EQUIPMENT

The equipment and parts of the CONTHERM are securely packaged, crated and sealed to ensure their undamaged delivery to your facility. Perform all steps of the procedure described in Table 5-3 upon receipt of shipment of your CONTHERM.

WARNING

The weight of the CONTHERM and its components is substantial. Do not attempt to move, remove or raise the CONTHERM without the use of the appropriate lifting equipment. If this equipment is not used, personal injury to yourself and damage to the equipment may occur.

Shipping Weights

The net weight and shipping weight for each CONTHERM Model is provided in Table 5-2.

Table 5-2. Net Weight And Shipping Weight Of The CONTHERM

Model	Net Weight (Pounds/Kilograms)	Shipping Weight (Pounds/Kilograms)
6 x 3	350 lb/159 kg	455 lb/206 kg
6 x 6	515 lb/234 kg	630 lb/236 kg
6 x 9	605 lb/274 kg	720 lb/326 kg

Perform all steps of the procedure described in Table 5-3 upon receipt of shipment of your CONTHERM.

Table 5-3. Unpacking And Uncrating The CONTHERM

Step	Action
1	Carefully open all crates, packages and containers. Try not to scratch or mark the items when you are unpacking them.
2	Use the packing list and this Instruction and Parts Manual to verify that all equipment has been received. The packing list identifies the contents of each crate.
3	If any part of the shipment is missing, notify your local Alfa Laval Contherm Inc. or Tetra Laval representative as soon as possible.
4	Report any shipment damage to the carrier and contact the Alfa Laval Contherm Inc., Newburyport, Massachusetts, USA facility.
5	After performing your initial inspection, leave all components in their crates and containers until you are ready to install them. This will help prevent damage to them and also ensure that they are not lost or misplaced.

5.3 ERECTING THE VERTICAL MOUNT

Before the CONTHERM can be mounted, its vertical mount must be erected. If the mount has been supplied by Alfa Laval Contherm Inc., then use the procedure provided in Table 5-4. If the mount has been supplied by another company, then use the procedure they have provided.

Two methods are recommended for erecting the vertical mount:

1. Bolted to the wall.
2. Bolted to the ceiling.

Both of these mounting methods are shown in Figure 5-1. The “A” Frame for bolting the mount to the wall and the ceiling plate for bolting the mount to the ceiling are not supplied by Alfa Laval Contherm Inc. You are responsible for obtaining these items from others.

Select the mounting method most appropriate for your facility. Refer to both Figure 5-1 and the mounting drawing supplied with your equipment while performing the following vertical mount erection procedure.

Table 5-4. Erecting The Vertical Mount

Step	Action
1	Secure the floor plate (P/N 7401337-01) to the floor by drilling a 1-inch (25.4 mm) DIA x 6-inch (152.40 mm) deep hole into the floor for the tie-down rod (P/N 7401836-01). If your configuration is using more than one column (refer to the mounting drawing), repeat the drilling for the additional floor plates. Cement the tie-down rod(s) into the hole(s) and allow the cement to cure. **Note**: “P/N” indicates an item’s Part Number.
2	Slide the floor plate (make sure that the “TOP” side is facing up) over the tie-down rod and secure it with a flat washer (P/N 7401244-04) and hex nut (P/N 7401248-01).
3	When the mount is fully assembled (column with mounting cross-arms and motor plates), raise the mount and lower each column down over the floor plate(s). Use a properly rated rope or chain sling to safely raise and lower each column.
4	Secure the top of the mount using one of the methods shown in Figure 5-1. **Note**: The hardware required to support the top of the mount is provided by others.
5	When the mount has been secured and each column of the mount is securely supported, the CONTHERM can now be erected onto the vertical mount. This procedure is described in the following section (5-*4, Mounting And Installing The CONTHERM In A Vertical Configuration)*.

5.4 MOUNTING AND INSTALLING THE CONTHERM IN A VERTICAL CONFIGURATION

After you have erected the vertical mount, you can mount and install the CONTHERM. Before starting this procedure, review the safety warning on page 5-2 and obtain the lifting equipment required to support the safe installation of this equipment.

When you are ready to install the CONTHERM, proceed to Table 5-5 and perform each step of the procedure in the sequence in which it is presented.

Table 5-5. Mounting And Installing The CONTHERM In A Vertical Configuration

Step	Action
1	Use a properly rated rope or chain sling (necessary to handle the weights shown in Table 5-2) to safely raise and remove the CONTHERM from its crate. If a rope sling is used, pass the rope through the slots on both the upper and lower head assemblies of the CONTHERM. If a chain sling is used, wrap the slots with cloth to protect their polished surfaces.
2	Remove the locknut (P/N 7401266-01) from each end of the CONTHERM's trim sheet (outer jacket). Refer to Figure 5-2.

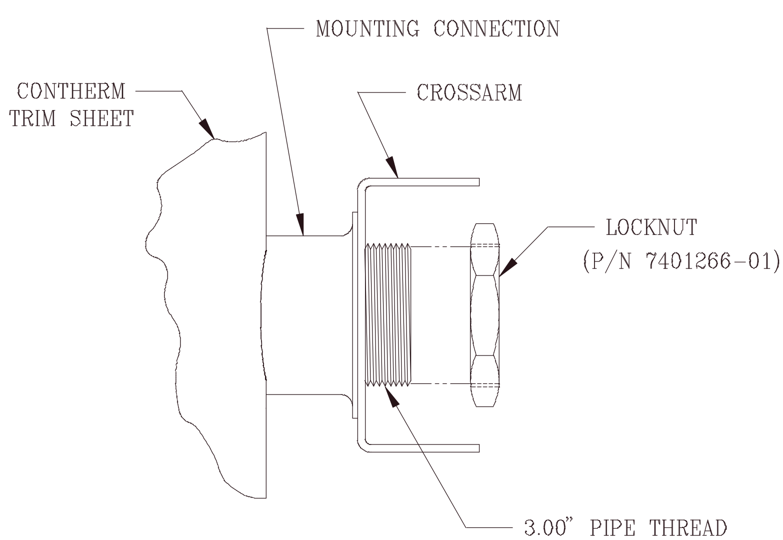
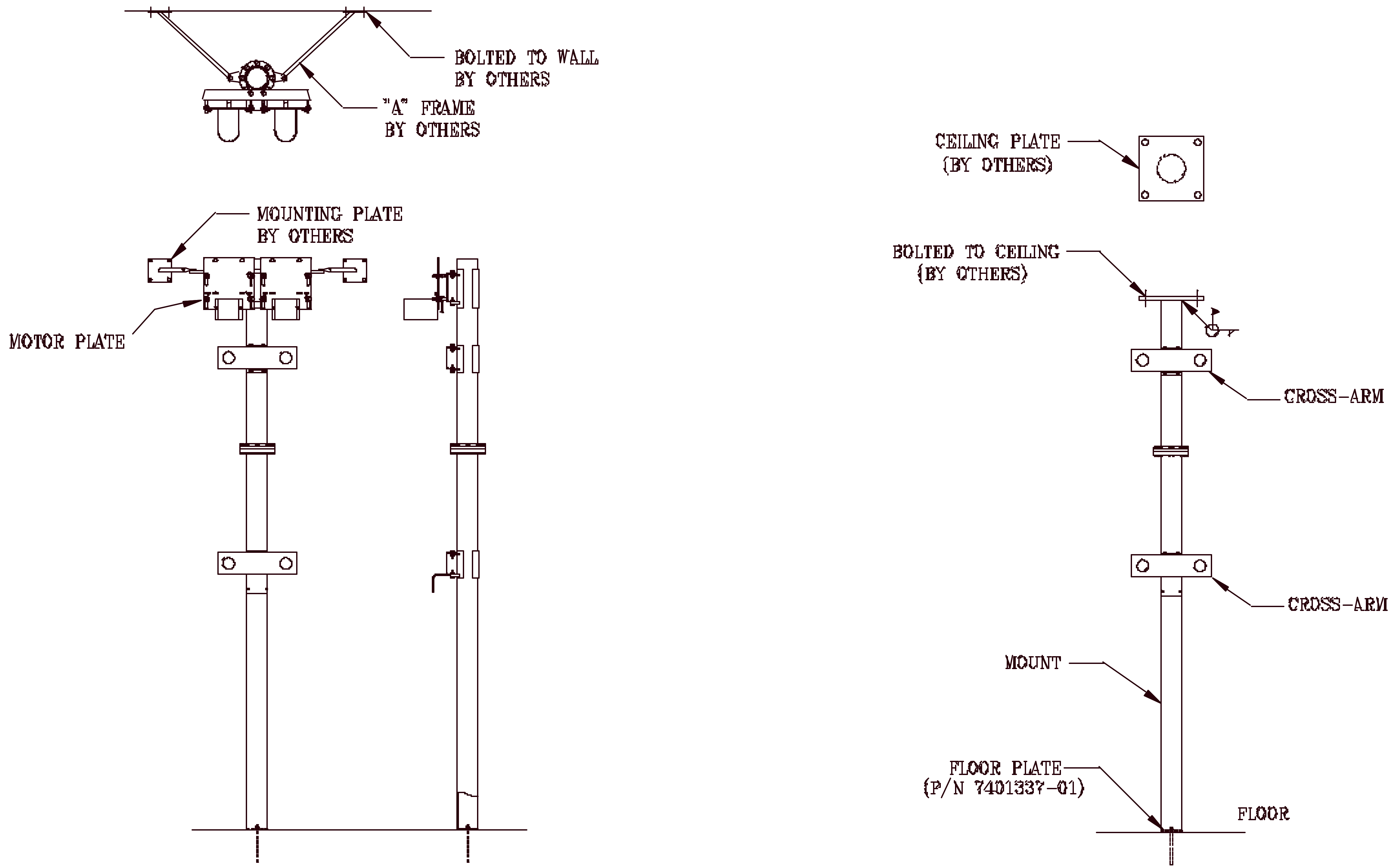


Figure 5-2. Side View Of CONTHERM Trim Sheet And Mounting Arm

Insert Figure 5-1 -- 11 x 17 foldout drawing

Figure 5-1. Two Recommended Vertical Mounting Configurations



WALL MOUNTED

CEILING MOUNTED

Figure 5-1. Two Recommended
Vertical Mounting
Configurations

This is a blank page; the back of Figure 5-1.

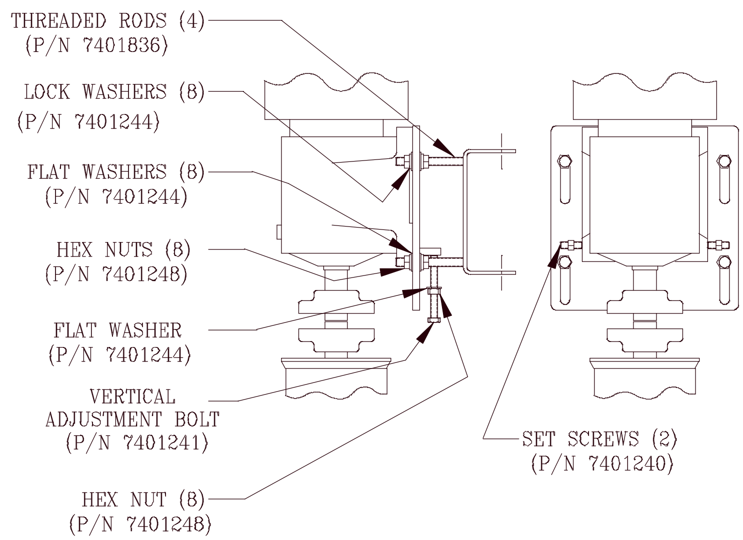
Back Side Of Figure 5-1.

Table 5-5. Mounting And Installing The CONTHERM In A Vertical Configuration, Continued

Step	Action
3	Raise the CONTHERM, with the drive end up, and insert the lower threaded connection of the trim sheet into the hole located on the lower mounting crossarm. Refer to Figure 5-2. Pivot the CONTHERM to engage the top mounting connection. Insert the upper threaded connection of the CONTHERM into the hole located on the upper mounting crossarm.
4	Secure the CONTHERM to the vertical mounting frame by threading the locknut on each connection. Make sure that each locknut is completely threaded onto the connection. Also secure the top connection. Use the supplied tightening tool (P/N 7403126-01) to tighten each locknut.
5	Remove the rope or chain sling from the slots on the upper and lower head assemblies of the CONTHERM.
6	If your CONTHERM has an electric drive belt and sheave system, proceed to Step 7. If your CONTHERM has an electric drive direct-coupled system, proceed to Step 11. If your CONTHERM has a hydraulic drive system, the mounting and installation of the CONTHERM is complete.
Electric Belt and Sheave Drive System	
7	Raise or attach the electric drive motor onto the motor swing post of the vertical mount (if equipped). Use two (2) hex head bolts to secure the motor to the swing post.
8	Pivot the motor about the motor swing post and shorten the center distance between the sheaves until the required belts can be put on the sheaves. Be careful not to use too much force when placing the belts on the sheaves.
9	Apply proper tension to the belts by using the take-up rod assembly (P/N 7401411) to extend the center distance between the sheaves.
10	You have now completed the mounting and installation of the CONTHERM with the electric belt and sheave drive system.
Electric Direct-Coupled Drive System	
11	If your CONTHERM was ordered before 1 January 1996, proceed to Step 12 for the procedure for installing the CONTHERM's flexible couplings. If your CONTHERM was ordered after 1 January 1996, proceed to Step 20.

Table 5-5. Mounting And Installing The CONTHERM In Vertical Configuration, Continued

Step	Action
12	Attach the motor to the motor plate with the bolts, lock washers, and nuts provided with the CONTHERM package. Each motor is provided with four bolts, flat washers, lock washers, and hex nuts. The CONTHERM Motor Plate Assembly is shown in Figure 5-3. The location of the motor plate on the vertical mount is preset by Alfa Laval Contherm Inc. at the factory.
13	Loosen the outside hex nut (P/N 7401248-02) on each of the four threaded rods (P/N 7401836) that secure the motor plate assembly to the vertical mount. Refer to Figure 5-3. Use the vertical adjustment bolt (P/N 7401241-16) to lower the motor plate assembly until the shaft ends of the motor and CONTHERM are touching.



Note: Refer to the supplied mounting drawing for hardware component parts number information.

Figure 5-3. CONTHERM Motor Plate Assembly

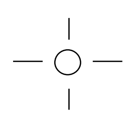
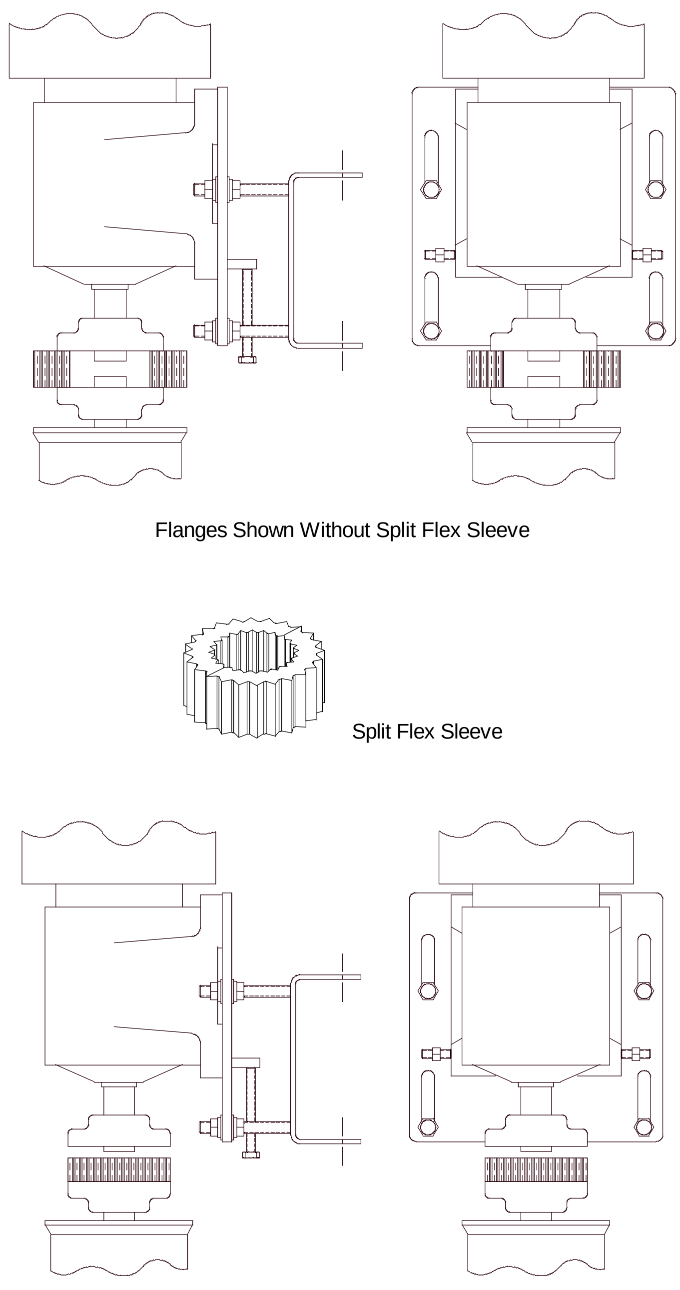
Step	Action
14	Align the flange coupling on the motor shaft with the flange coupling on the CONTHERM (both flanges are preset by Alfa Laval Contherm Inc. at the factory). Adjust the motor in all axes, both parallel and angular.  Alignment consists of aligning the outside diameter of the flanges with a straight edge along the front edge and at a 90^{o} interval without rotating the shaft. ***Side-side adjustment*** can be made by loosening the bolts holding the motor to the plate and adjusting the set screws located on both sides of the motor feet. ***Front-to-back*** and ***tilt*** adjustments can be made by adjusting the hex nuts on the horizontal threaded rod.

Table 5-5. Mounting And Installing The CONTHERM In Vertical Configuration, Continued

Step	Action
15	Use the vertical adjustment bolt to raise the motor plate assembly. Raise the assembly as high as necessary to insert the split flex sleeve into the lower flange. Refer to Figure 5-4.



Flanges Shown Without Split Flex Sleeve

Split Flex Sleeve

Flanges Shown With Split Flex Sleeve Inserted

Figure 5-4. Inserting Split Flex Sleeve Into Lower Flange

Table 5-5. Mounting And Installing The CONTHERM In Vertical Configuration, Continued

Step	Action
16	Align teeth of motor shaft flange with those of flex sleeve. Refer to Figure 5-5.

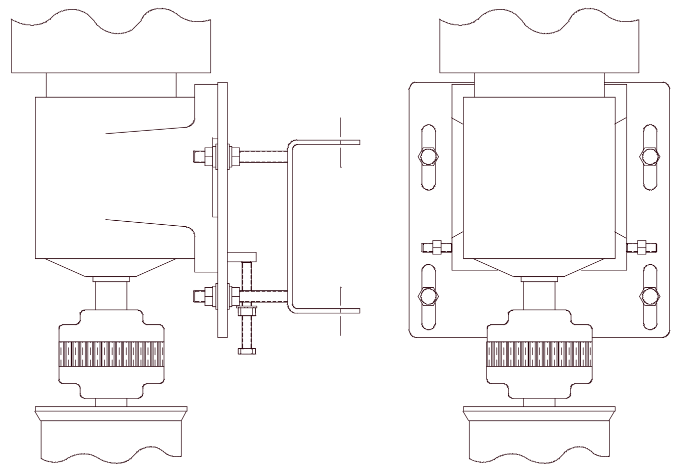


Figure 5-5. Aligning Teeth Of Motor Shaft Flange With Teeth Of Flex Sleeve.

Step	Action
17	Use the vertical adjustment bolt to lower the motor plate assembly so that the flange slides easily over the flex sleeve. Rotate the motor shaft flange if necessary. Continue to lower the assembly until the sleeve is completely seated in the teeth of both flanges. Refer to Figure 5-6.

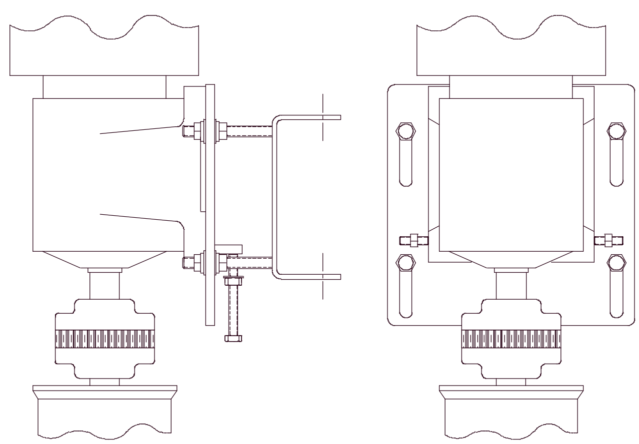


Figure 5-6. Seating The Flex Sleeve In The Teeth Of Both Flanges

Step	Action
18	Check the alignment of the flange again and make any required adjustments. Firmly tighten all of the nuts and bolts.
19	You have now completed erecting the CONTHERM with an Electric, Direct-Coupled Drive System (Flexible Couplings; for a CONTHERM ordered before 1 January 1996).

Table 5-5. Mounting And Installing The CONTHERM In Vertical Configuration, Continued

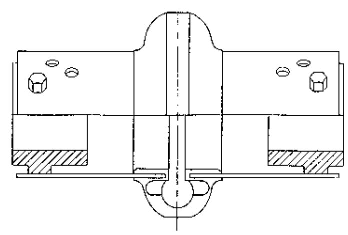
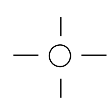
Step	Action
20	For CONTHERM's Ordered After 1 January 1996: Attach the motor to the motor plate with the bolts, lock washers, and nuts provided with the CONTHERM package. Each motor is provided with four bolts, flat washers, lock washers, and hex nuts. The CONTHERM Motor Plate Assembly is shown in Figure 5-3. The location of the motor plate on the vertical mount is preset by Alfa Laval Contherm Inc. at the factory to minimize the need for adjustments.
21	Assemble the flexible coupling in accordance with the following Installation Instructions. The coupling should be mounted with both hubs mounted inward as shown in Figure A.  Figure A. Both Hubs Mounted Inward
22	Inspect both driving (motor) and driven (CONTHERM) shafts and hub bores. Ensure that they are free of dirt and burrs. Verify that the keys fit shafts properly. Mount both hubs of the flexible coupling to the shafts, securing only one hub. The other hub will be used to perform minor spacing adjustments if necessary .
23	Loosen the outside hex nut (P/N 7401248-02) on each of the four threaded rods (P/N 7401836) that secure the motor plate assembly to the vertical mount. Refer to Figure 5-3. Use the vertical adjustment bolt (P/N 7401241-16) to lower the motor plate assembly until the shaft ends of the motor and CONTHERM are touching.
24	Align the hub on the motor shaft with the hub on the CONTHERM. Adjust the motor in all axes, both parallel and angular.  Alignment consists of aligning the outside diameter of the flanges with a straight edge along the front edge and at a 90^{o} interval without rotating the shaft. ***Side-side adjustment*** can be made by loosening the bolts holding the motor to the plate and adjusting the set screws located on both sides of the motor feet. ***Front-to-back*** and ***tilt*** adjustments can be made by adjusting the hex nuts on the horizontal threaded rod.

Table 5-5. Mounting And Installing The CONTHERM In Vertical Configuration, Continued

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>25</td><td>Use the vertical adjustment bolt to raise the motor plate assembly if required.</td></tr>
<tr><td>26</td><td>Check the alignment of the flange again and make any required adjustments. Firmly tighten all of the nuts and bolts.</td></tr>
<tr><td>27</td><td>Place half of the flexible coupling's elastomer element around the hubs and secure with the self-locking capscrews. The elastomer element will space the other hub. It is important to have the capscrew properly tightened. Tighten to the recommended capscrew torques. The following table lists the torque values for each coupling size. Use the value that matches your coupling's size.
<table>
<tr><th rowspan="2">COUPLING SIZE</th><th colspan="3">TORQUE - DRY</th></tr>
<tr><th>IN. LBS</th><th>FT. LBS</th><th>Nm</th></tr>
<tr><td>2
3
4
5
10</td><td>204</td><td>17</td><td>23</td></tr>
<tr><td>20
30
40
50</td><td>360</td><td>30</td><td>40</td></tr>
<tr><td>60
70
80</td><td>900</td><td>75</td><td>100</td></tr>
<tr><td>100
120</td><td>3240</td><td>270</td><td>370</td></tr>
<tr><td>140</td><td>7080</td><td>590</td><td>800</td></tr>
</table>
Now secure the other hub to the shaft.</td></tr>
<tr><td>28</td><td>Mount the other half of the flexible coupling's elastomer element to the hubs. Tighten all capscrews to the recommended capscrew torques. Refer to the torque values listed in Step 27.</td></tr>
<tr><td>29</td><td>You have now completed erecting the CONTHERM with the Electric, Direct-Coupled Drive System (Flexible Couplings; for a CONTHERM ordered after 1 January 1996).</td></tr>
</table>

5.5 MOUNTING AND INSTALLING THE CONTHERM IN A HORIZONTAL CONFIGURATION

A CONTHERM that is mounted horizontally requires additional floor space for maintenance and service to allow for rotor removal from the unit. This area must also be kept clear and unobstructed. The following sections describe how to assemble and set-up the horizontal mount and then how to install the CONTHERM on the mount.

5.5.1 Installing The Horizontal Mount

Figure 5-7 shows the horizontal mount for the CONTHERM that is provided by Alfa Laval Contherm Inc. This drawing also shows the rotor removal trough (P/N 7402714) that is provided with the mount to facilitate the rotor's removal from the CONTHERM. Refer to the detailed assembly drawing provided with the horizontal mount's hardware package for assembly and set-up instructions. After assembling the mount, ensure that the mount is level by using the adjustable feet on the legs of the mount.

If the mount has been supplied by your local Alfa Laval Company or another company, use the procedure they have provided.

5.5.2 Mounting And Installing The CONTHERM On A Horizontal Mount

After you have set-up and installed the horizontal mount, you can install and mount the CONTHERM. The only difference between horizontally and vertically mounted CONTHERMs is that horizontal units do not use hydraulic rotor lift systems. As a result, all maintenance and inspection requirements for the blades and seals of the horizontally mounted CONTHERMs are performed by manually removing the rotor from the units.

The spare parts requirements for the horizontally mounted CONTHERMs are identical to those of the vertically mounted units, with the exception of the Hydraulic Lift Repair Kit (P/N 7401604-01) which is not required.

The horizontally mounted CONTHERM can be driven by an electric or hydraulic drive system. The electric drive system may be a belt and sheave configuration or a direct-coupled configuration in which a gear motor is directly coupled to the rotor. The hydraulic drive system is identical to that of the vertically mounted unit, with the hydraulic oil driven motor mounted directly to the rotor shaft coupling.

Before starting this procedure, review the safety warning on page 5-2 and obtain the lifting equipment required to support the safe installation of this equipment. When you are ready to install the CONTHERM, proceed to Table 5-6 and perform each step of the procedure in the sequence in which it is presented.

DANGER

If your CONTHERM uses a belt and sheave electric drive system, a belt guard must be installed to prevent personal injury. The belt guard, which can be supplied by Alfa Laval Contherm Inc. or by others, restricts the user's access to any rotating parts on the CONTHERM.

Table 5-6. Installing And Mounting The CONTHERM Horizontally

Step	Action
1	Mount the CONTHERM to the horizontal mount. Refer to both Figure 5-7 and the detailed assembly drawing that was provided with the horizontal mount. Use a properly rated rope or chain sling (necessary to handle the weights shown in Table 5-2) to safely raise and remove the CONTHERM from its crate. If a rope sling is used, pass the rope through the slots on both the upper and lower head assemblies of the CONTHERM. If a chain sling is used, wrap the slots with cloth to protect their polished surfaces.
2	Remove the locknut (P/N 7401266-01) from each end of the CONTHERM's trim sheet (outer jacket). Refer to Figure 5-2.
3	Lift up the CONTHERM and position it over the horizontal mount. Align the unit's threaded connections on the trim sheet with the holes located on the horizontal mount. Lower the CONTHERM onto the horizontal mount and guide the threaded connections of the CONTHERM into the corresponding holes on the horizontal mount.
4	Secure the CONTHERM to the horizontal mounting frame by threading the locknut on each connection. Make sure that each locknut is completely threaded onto the connection. Use the supplied tightening tool (P/N 7403126-01) to tighten each locknut.
5	Remove the rope or chain sling from the slots on the upper and lower head assemblies of the CONTHERM.
6	If your CONTHERM has an electric drive belt and sheave system, proceed to Step 7. If your CONTHERM has an electric drive direct-coupled system, proceed to Step 10. If your CONTHERM has a hydraulic drive system, the mounting and installation of the CONTHERM is complete.
Electric Belt and Sheave Drive System	
7	Raise and attach the electric drive motor onto the motor swing post of the horizontal mounting frame (if equipped). Use two (2) hex head bolts to secure the motor to the swing post.
8	Pivot the motor about the motor swing post and shorten the center distance between the sheaves until the required belts can be put on the sheaves. Be careful not to use too much force when placing the belts on the sheaves.
9	Use the take-up rod assembly (P/N 7401411) to extend the center distance between the sheaves and apply the proper tension to the belts. You have now completed the mounting and installation of the CONTHERM with the electric belt and sheave drive system

Insert Figure 5-7 -- 11 x 17 foldout drawing

Figure 5-7. CONTHERM Horizontal Mount

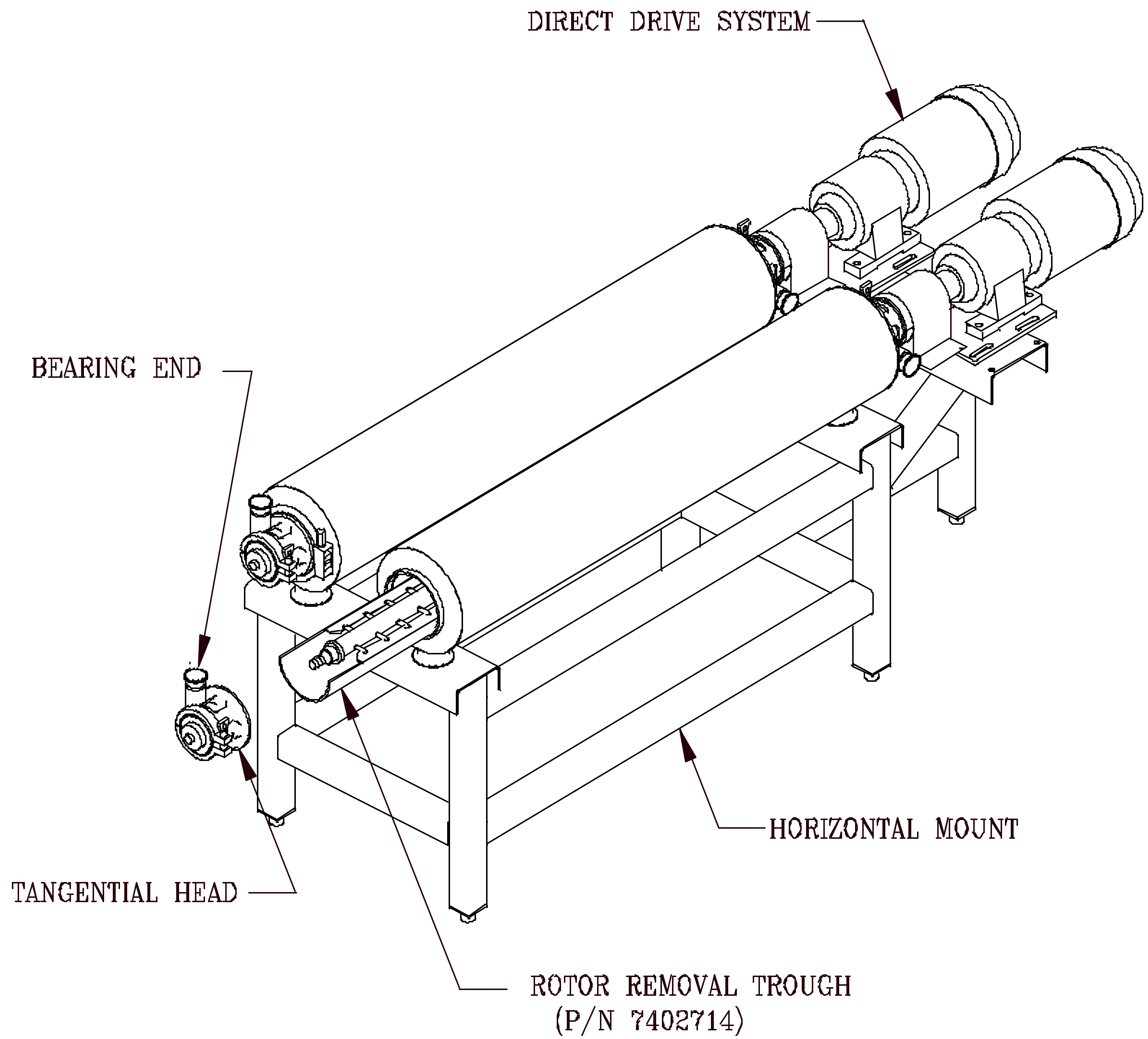


Figure 5-7. CONTHERM Horizontal Mount

Backside of Figure 5-7 -- 11 x 17 foldout drawing

Table 5-6. Installing And Mounting The CONTHERM Horizontally, Continued

Step	Action
Electric Direct-Coupled Drive System	
10	Raise and attach the motor to the motor plate on the horizontal mount with the bolts, lock washers, and nuts provided with the CONTHERM package. Each motor is provided with four bolts, flat washers, lock washers, and hex nuts. Refer to Figure 5-3. The location of the motor plate on the horizontal mount is preset by Alfa Laval Contherm Inc. at the factory.
11	Loosen the outside hex nut (P/N 7401248-02) on each of the four threaded rods (P/N 7401836) that secure the motor plate assembly to the horizontal mount. Refer to Figure 5-3. Use the adjustment bolt (P/N 7401241-16) to adjust position of the motor plate assembly until shaft ends of motor and CONTHERM are touching.
12	Align the flange coupling on the motor shaft with the flange coupling on the CONTHERM (both flanges are preset by Alfa Laval Contherm Inc. at the factory). Adjust the motor in all axes, both parallel and angular. Alignment consists of aligning the outside diameter of the flanges with a straight edge along the front edge and at a 90^o interval without rotating the shaft. ***Side-side adjustment*** can be made by loosening the bolts holding the motor to the plate and adjusting the set screws located on both sides of the motor feet. ***Front-to-back*** and ***tilt*** adjustments can be made by adjusting the hex nuts on the threaded rod.
13	If your CONTHERM was ordered <u>before</u> 1 January 1996, proceed to Step 14. If your CONTHERM was ordered <u>after</u> 1 January 1996, proceed to Step 18.
14	Use the adjustment bolt to adjust the position of the motor plate assembly as necessary to insert the split flex sleeve into the lower flange. Refer to Figure 5-4.
15	Align teeth of motor shaft flange with those of flex sleeve. Refer to Figure 5-5.
16	Use the adjustment bolt to position the motor plate assembly so that the flange slides easily over the flex sleeve. Rotate the motor shaft flange if necessary. Continue to adjust the position of the assembly until the sleeve is completely seated in the teeth of both flanges. Refer to Figure 5-6.
17	Check the alignment of the flange again and make any required adjustments. Firmly tighten all of the nuts and bolts. You have now completed erecting the CONTHERM with the electric, direct-coupled drive system.

Table 5-6. Installing And Mounting The CONTHERM Horizontally, Continued

Step	Action
Electric Direct-Coupled Drive System, Continued	
18	Use the adjustment bolt to adjust the position of the motor plate assembly if required.
19	Check the alignment of the flange again and make any required adjustments. Firmly tighten all of the nuts and bolts.
20	Place half of the flexible coupling's elastomer element around the hubs and secure with the self-locking capscrews. The elastomer element will space the other hub. Tighten to the recommended capscrew torques as identified in Step 27 of Table 5-5.
21	Mount the other half of the flexible coupling's elastomer element to the hubs. Tighten all capscrews to the recommended capscrew torques. Refer to the torque values listed in Step 27 of Table 5-5.
22	You have now completed erecting the CONTHERM with the Electric, Direct-Coupled Drive System (Flexible Couplings; for a CONTHERM ordered after 1 January 1996).

5.5.3 Rotor Removal Trough

As shown in Figure 5-7, the horizontal mount provided by Alfa Laval Contherm Inc. includes a rotor removal trough (P/N 7402714). This device will help you manually remove the rotor from the CONTHERM. It should be stored in an easy to access location to minimize down time when performing maintenance on the CONTHERM.

To remove the rotor from the CONTHERM, perform the procedure provided in Table 5-7.

<table>
<tr>
<td>WARNING</td>
<td>
1. Do not attempt to disassemble the CONTHERM if its rotor is rotating.
2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping.
3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps.
4. Keep the area under the CONTHERM clear of hands, feet, piping and other obstructions.
5. Do not remove the lower head clamp or the lower bearing clamp until you have verified that the hydraulic Rotor Lifting System is turned on and is operating correctly.
6. The blades attached to the rotor's rotor pins may be very sharp. Wear protective gloves while handling the rotor.
</td>
</tr>
</table>

<table>
<tr>
<td>DANGER</td>
<td>
If your CONTHERM is equipped with spring loaded blades, be extremely careful when lowering or raising the rotor. You must hold these blades in place while lowering or raising the rotor.

If these blades are not held in place, the tension of the spring may cause the blades to be removed from the rotor with substantial force. Serious personal injury may occur if these blades come into contact with operating personnel.
</td>
</tr>
</table>

Table 5-7. Removing The Rotor From The CONTHERM With The Rotor Removal Trough

Step	Action
1	Remove the lower head assembly from the CONTHERM.
2	Lift the rotor slightly to permit the rotor removal trough (P/N 7402714) to be slid into the heat exchanger cylinder.
3	Use the rotor removal trough to pull out/slide the rotor from the heat exchanger cylinder.

5.6 INSTALLING THE COMPONENTS OF THE ROTOR LIFTING DEVICE

Each vertically mounted CONTHERM is provided with a hydraulically controlled rotor lifting system. This system, which is independent of the Rotor Drive System, permits the CONTHERM's rotor and blade assembly to be raised or lowered safely and easily for inspection, maintenance or manual cleaning.

The major components of the rotor lifting device include the following:

1. Hydraulic pump assembly, including oil reservoir, pump and 0.5 HP electric motor.
2. Hydraulic stack valve assembly.
3. Hydraulic lift cylinder assembly.
4. Appropriate interconnecting fittings and tubing.

The Rotor Lifting System's Stack Valve Assembly (P/N 7401305) is a hydraulic directional control valve used to lower or raise the CONTHERM's rotor assembly. Compression fittings for both supply and return lines, along with fittings for connections to the CONTHERM's hydraulic lift cylinder assembly, are located on the stack valve assembly.

Each Stack Valve Assembly can be configured to support either one or two center sections, with each center section containing a single handle for raising or lowering the rotor assembly of a corresponding CONTHERM.

It is essential that the operator can safely adjust and align the lower product head with one hand while manipulating the Stack Valve Assembly's handle with the other hand. If more than two center sections were used, it would be difficult for some operators to physically reach the lower product head and the Stack Valve Assembly's handle at the same time.

Figure 5-8 shows both a single and dual center section Stack Valve Assembly.

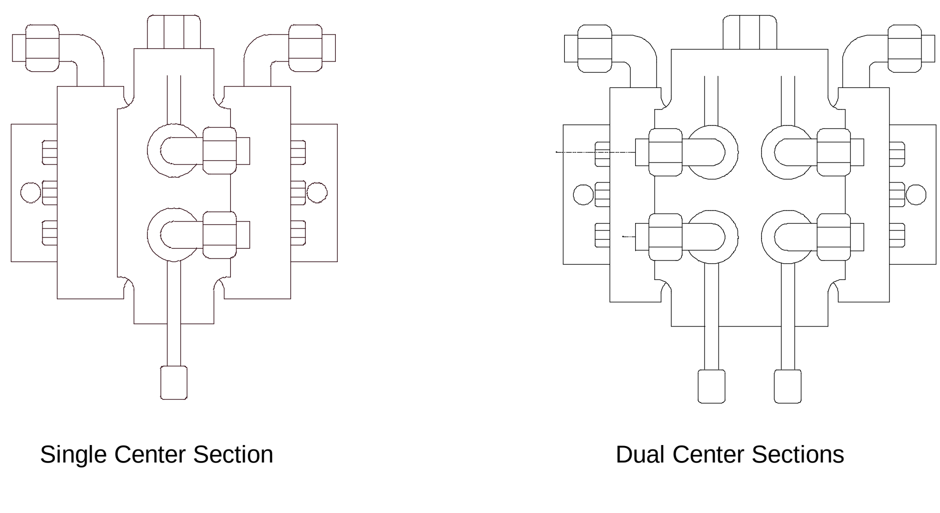


Figure 5-8. Single And Dual Center Section Stack Valve Assembly Configurations

Figure 5-9 shows two typical Rotor Lifting System configurations. One configuration utilizes a Stack Valve Assembly with a single center section while the other utilizes a Stack Valve Assembly with two center sections.

If your CONTHERM's mounting assembly has been provided by Alfa Laval Contherm Inc., the location of the stack valve assembly on the mount is predetermined at the factory. Otherwise, you must locate the assembly near the lower end of the CONTHERM, either on a mounting panel or an adjacent wall.

NOTES:

1) The operator **must** be able to adjust and align the lower product head with one hand while manipulating the stack valve handle with his or her other hand.
2) Locate the pump within 30-feet (9.14 M) of the Stack Valve Assembly. If the pump is more than 30-feet (9.14 M) away, the increase in pressure drop may cause the lift to work very slowly or not at all.
3) Do not use more than two center sections in any Stack Valve Assembly. If more than two are used, it may be difficult for the operator to access the lower product head and the Stack Valve Assembly's handle at the same time.

DANGER

1. The hydraulic pump's pressure is factory set. To prevent serious personal injury and equipment damage, DO NOT adjust the hydraulic pump pressure to exceed 450 PSI.
2. To ensure that the Product Head and the Rotor Assembly remains securely in place during the purging operation, do not disconnect either product head clamp (lower and upper clamps, P/N's: 7401106-01 and 7403038-01) or the Bearing Cap Clamp (P/N 7401579-01).

The procedure for installing the components of the Rotor Lifting Device is provided in Table 5-8. Refer to Figure 5-9 while performing this installation.

Table 5-8. Installing The Components Of Rotor Lifting Device

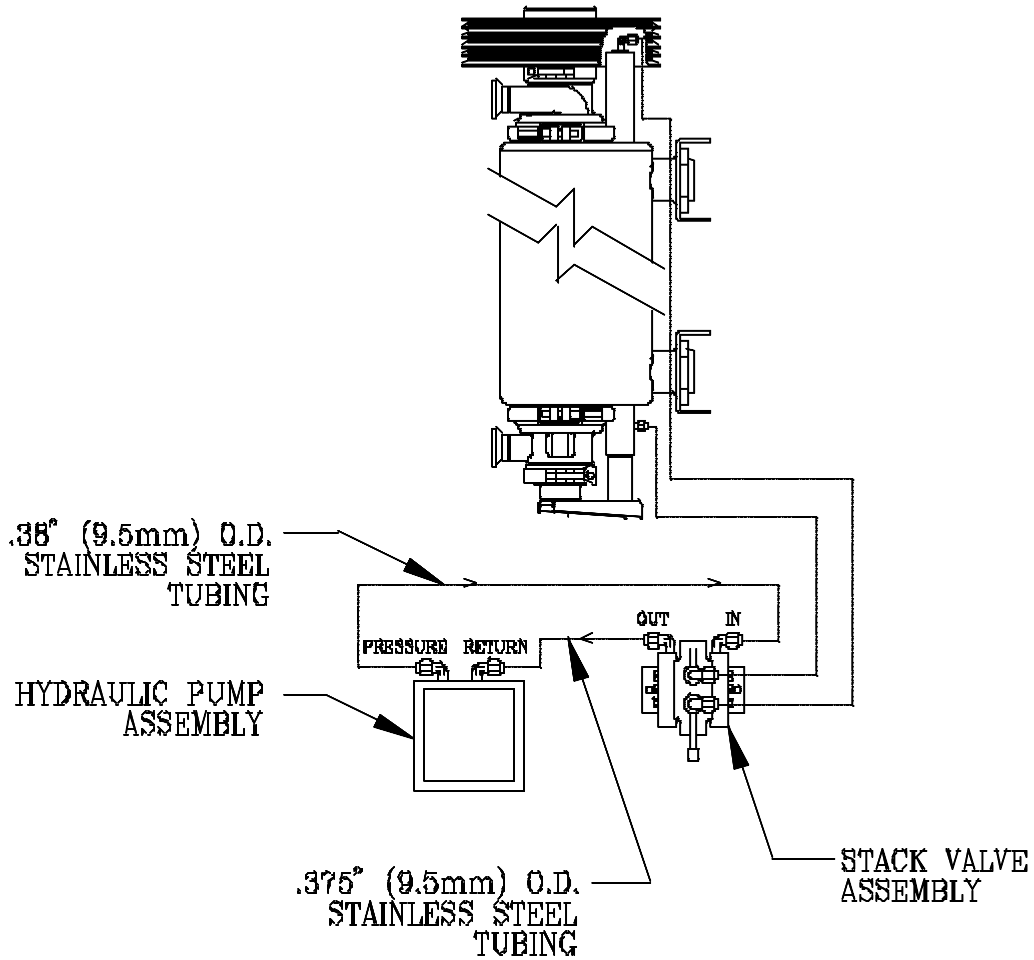
Step	Action
1	Run a length of supplied 0.38 inch (9 mm) O.D. tubing between each stack valve connection and the two fittings on each end of the CONTHERM's hydraulic lift assembly. Be careful while working with the tubing. Please avoid crimping the tubing and ensure that the tubing is not resting against the sheave or other moving parts.
2	Run a length of supplied 0.38 inch (9 mm) O.D. tubing between each stack valve connection and the two fittings on the hydraulic pump assembly. If your configuration utilizes two or more hydraulic stack valve assemblies, run the tubing in series as shown in the appropriate section of Figure 5-9.
3	Install the hydraulic pump assembly with the oil filter and breather cap in an upright position. The pump pressure is set at the factory. An adhesive sticker arrow on the pump indicates its upright position.

Table 5-8. Installing The Components Of Rotor Lifting Device, Continued

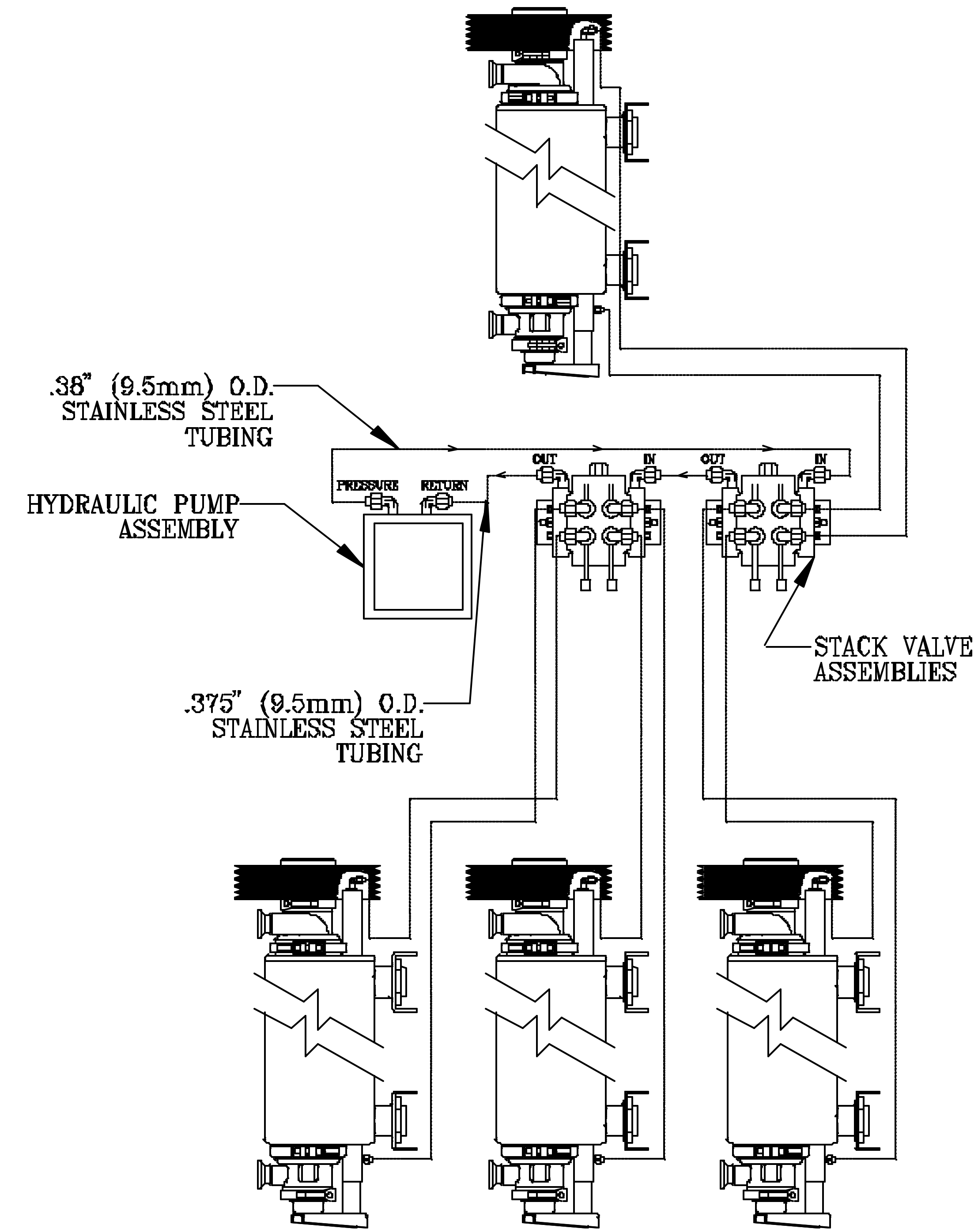
Step	Action
4	Add the initial charge of hydraulic oil to the Rotor Lifting Device. Depending on the size of your hydraulic pump assembly's supply reservoir, you will have to add either 2.5 U.S. gallons (9.5 liters) or 7.0 U.S. gallons (26.5 liters). If your hydraulic pump assembly has Part Number (P/N) 7402078-01, it has a 2.5 U.S. gallon supply reservoir. If it is P/N 7402078-02, it has a 7.0 U.S. gallon supply reservoir. **Note**: Use a high quality SAE 10 Grade Hydraulic Oil for applications operated in a temperature range of 0^o F (-18^o C) minimum to 160^o F (71^o C) maximum. Use a high quality SAE 20 Grade Hydraulic Oil for applications operated in a temperature range of 32^o F (0^o C) minimum to 200^o F (93^o C) maximum. Operate the hydraulic fluid at temperatures below 160^o F (71^o C) for optimal performance of both the pump and hydraulic oil.
5	After adding the initial charge of hydraulic oil to the hydraulic pump assembly's reservoir, purge the air from the CONTHERM's hydraulic rotor lifting cylinder. If your configuration uses more than one CONTHERM, then you must purge the air from every unit's rotor lifting cylinder. This is accomplished by operating the Rotor Lifting Device under its own weight as described below. If your CONTHERM does not have a Rotor Hold Down feature, go to Step 6. If your CONTHERM has a Rotor Hold Down feature, go to Step 13.
CONTHERM WITHOUT ROTOR HOLD DOWN FEATURE	
6	Use the Rotor Lift System and the Rotor Lift Helper Plate to lower the rotor assembly from the heat exchange cylinder and separate the lower product head assembly from the rotor. The procedure for operating the Rotor Lift Helper Plate is provided in "Table 6-5. Operating The Rotor Lift Helper Plate." in Section 6.3 of Chapter Six.
7	Remove the Shoulder Bolt Assembly (P/N 7401286-01) that attaches the Lift Beam Assembly (P/N 7401283-01) to the Bearing Cap (P/N 7401618-01). Refer to Figure 7-13 in Chapter Seven for parts location information.
8	Depress the Stack Valve Assembly's handle and lower the hydraulic lift beam until it is fully lowered.
9	Lift the Stack Valve Assembly's handle and raise the hydraulic lift beam to its initial position at the bearing cap.
10	Repeat Steps 8 and 9 several times or until piston movement is firm and smooth.
11	While purging the air from the system, slowly add oil to the reservoir as needed. Add oil until the level is at the height of the Breather Cap connection.
12	Reattach the lower product head assembly to the rotor and use the Rotor Lift Helper Plate to raise the rotor back into the cylinder. Refer to the procedure provided in Table 6-5.

Insert Figure 5-9 -- 11 x 17 foldout drawing

Figure 5-9. Two Typical Stack Valve Assembly Configurations



Stack Valve Assembly Configured With One Center Section



Stack Valve Assembly Configured With Two Center Sections

Figure 5-9. Two Typical Stack Valve Assembly Configurations

Backside of Figure 5-9 -- 11 x 17 foldout drawing

Table 5-8. Installing The Components Of Rotor Lifting Device, Continued

Step	Action
CONTHERM WITH ROTOR HOLD DOWN FEATURE	
13	Use the Rotor Lift System and the Rotor Lift Helper Plate to lower the rotor assembly from the heat exchange cylinder and separate the lower product head assembly from the rotor. The procedure for operating the Rotor Lift Helper Plate is provided in “Table 6-5. Operating The Rotor Lift Helper Plate.” in Section 6.3 of Chapter Six.
14	Remove the two (2) hex head bolts (P/N 7401241-21) that attach the Lift Beam Assembly (P/N 7401283-02) to the Bearing Cap Cover (P/N 7402993-01). Refer to Figure 7-14 in Chapter Seven for parts location information.
15	Depress the Stack Valve Assembly’s handle and lower the hydraulic lift beam until it is fully lowered.
16	Lift the Stack Valve Assembly’s handle and raise the hydraulic lift beam to its initial position at the bearing cap.
17	Repeat Steps 15 and 16 several times or until the piston movement is firm and smooth.
18	While purging the air from the system, slowly add oil to the reservoir as needed. Add oil until the level is at the height of the Breather Cap connection.
19	Reattach the lower product head assembly to the rotor and use the Rotor Lift Helper Plate to raise the rotor back into the cylinder. Refer to the procedure provided in Table 6-5.

5.7 INSTALLING A STEAM HEATING SYSTEM

Steam is the most common heating media for the CONTHERM. Typical steam temperatures in the CONTHERM range from 250°F to 330°F (121°C to 165°C). Steam enters the top media connection, in a counter current flow to the product, and condenses when it comes in contact with the product cylinder. The latent heat of condensation is the driving force for heat transfer for this system.

From the product cylinder, heat is transferred by conduction and the condensate is discharged through the bottom of the CONTHERM into a condensate leg. The end of the condensate leg should be fitted with a steam trap. Steam pressure and temperature are regulated by a back pressure valve located at the inlet of the CONTHERM.

Figure 5-10 shows a typical steam heating system configuration for a CONTHERM. Depending on your specific media, power, product, and plant layout, your installation configuration may vary from what is shown in this diagram. Regardless of the installation related differences, please note the location of the pressure/temperature gauges and valves in the product and media lines.

The pressure and temperature gauges are important tools that should be incorporated within your CONTHERM's steam heating system to monitor system performance and help aid in the performance of troubleshooting activities. Only use sensors that are calibrated to an approved standard.

If your steam heating configuration uses two or more CONTHERMs, place the element from the automatic temperature controller on the final (last) CONTHERM in the piping configuration. Also ensure that the condensate return line is large enough to carry condensate away from the CONTHERM.

NOTE: The Steam Trap should be located as far below the lower media connection (1.50 inches (38 mm)) on the CONTHERM as possible. A piping bypass should also be constructed around the Steam Trap.

5.7.1 Component Description

The following components are used in a standard CONTHERM steam heating package:

1. Remote or self actuating control valve.
2. Solenoid valve.
3. Pressure gauge.
4. Bypass and shut off valves.
5. Return Steam trap piping and bypass valves.
6. Purge valve.
7. Flanged connections to the CONTHERM.

Remote Or Self Actuating Control Valve

Three methods are available for controlling the steam pressure within the CONTHERM:

1. By Hand - Physically setting the regulator to the desired pressure.
2. Current Controller - Used with thermocouple sensors.
3. Pressure Controller - Used with pressure sensor.

Each controller is available with a chart recorder mechanism or an indicator. The steam valve is pneumatically or electronically controlled by the controller. To maintain a constant pressure level, the steam valve will open an amount that is proportional to the difference between the set point temperature and the actual temperature sensed at the product outlet port.

Insert Figure 5-10 -- 11 x 17 foldout drawing

Figure 5-10. Typical Steam Heat System Configuration

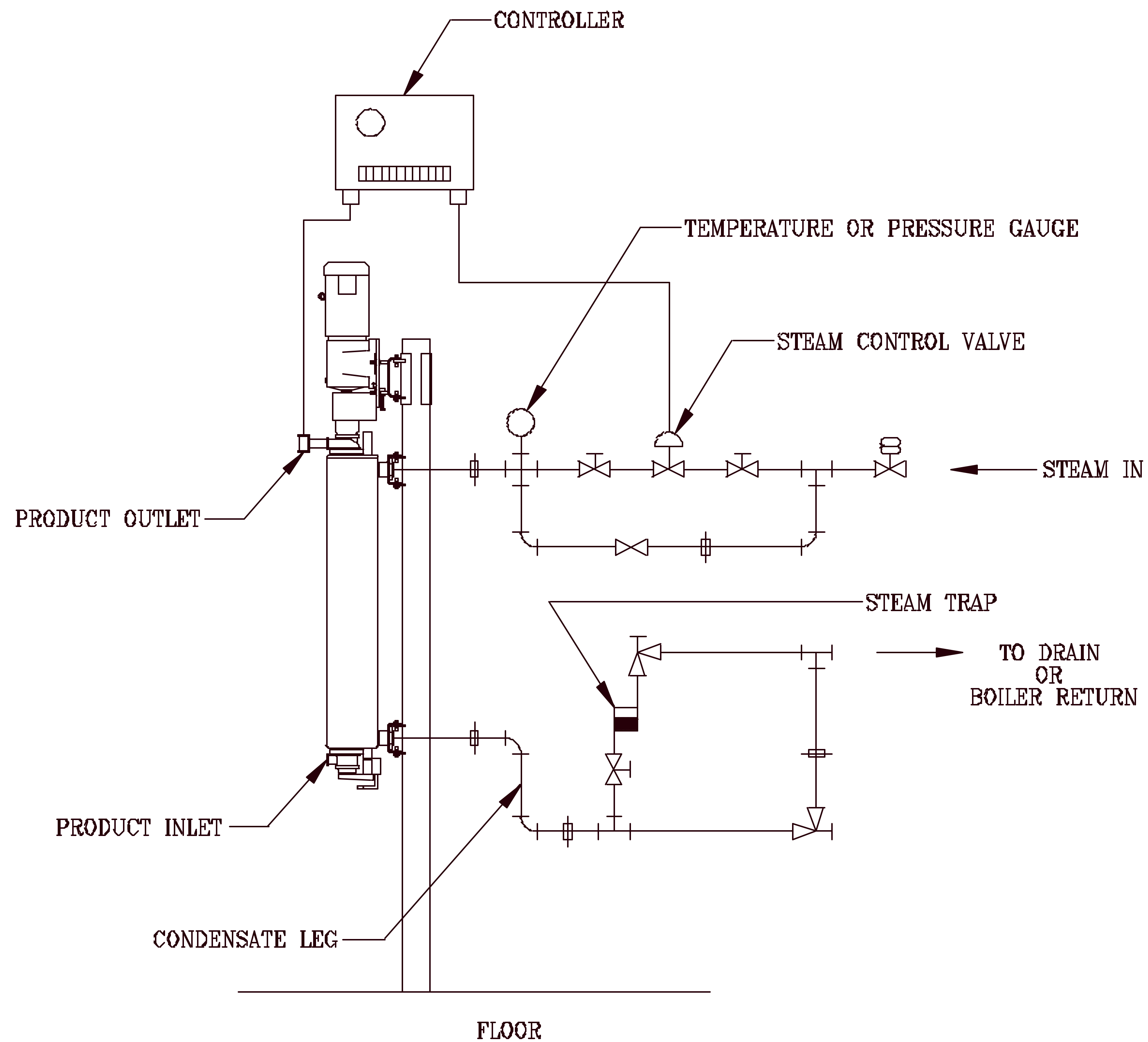


Figure 5-10. Typical Steam Heat System Configuration

Backside of Figure 5-10 -- 11 x 17 foldout drawing

Solenoid Valve

The solenoid valve acts as an on/off switch for the steam.

Bypass And Shut Off Valves

If the “Remote or Self Actuated Control Valve” is not functioning properly, the shut off valves can be used to isolate the control valve for servicing. Piping that bypasses the control valve allows the operator to continue to heat with steam (temporarily) until the control valve is repaired.

Purge Valve

The purge valve allows condensate to drain from the CONTHERM and the steam piping.

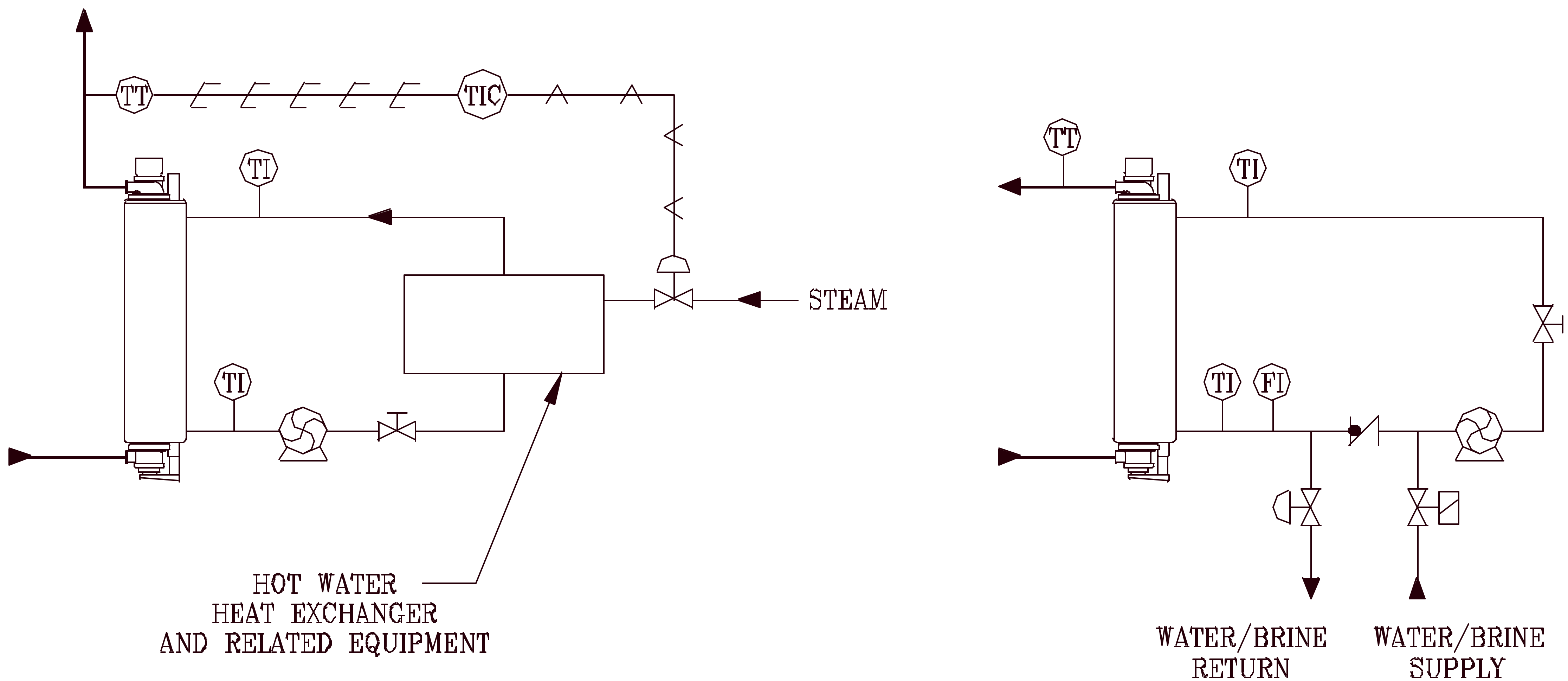
5.8 INSTALLING A HOT WATER HEATING SYSTEM

Figure 5-11 shows two typical hot water heating system configurations for a CONTHERM. The first configuration utilizes a dedicated hot water system for the CONTHERM. In this configuration, the CONTHERM is provided with its own water/steam heat exchanger. The second configuration shown in Figure 5-11 utilizes a central hot water supply. Both systems will function adequately providing that the equipment has been properly sized and installed.

Depending on your specific media, power, product, and plant layout, your installation configuration may vary from what is shown in Figure 5-11. Regardless of these installation differences, note the location of the pump, heat exchanger and related equipment, and thermometers in the product and media lines. The thermometers are important tools that should be incorporated within your CONTHERM's hot water heating system to monitor system performance and aid in the performance of troubleshooting activities. Only use sensors that are calibrated to an approved standard.

Insert Figure 5-11 -- 11 x 17 foldout drawing

Figure 5-11. Typical Hot Water Heating System Configuration



SYSTEM CONFIGURED WITH ITS OWN
WATER/STEAM HEAT EXCHANGER

SYSTEM CONFIGURED WITH A
CENTRALIZED HOT WATER SUPPLY

Figure 5-11. Typical Hot Water Heating System Configuration

Backside Of Figure 5-11 -- 11 x 17 foldout drawing

5.9 INSTALLING AN AMMONIA OR FREON® FULL-FLOODED REFRIGERATION SYSTEM

Your CONTHERM's refrigeration system, whether supplied by Alfa Laval Contherm Inc. or by others, should be tailored to meet your product's specific requirements, and should only be installed and tested by a qualified refrigeration technician. The following general guidelines are provided to help with the installation of your refrigeration system. Please refer to the drawings that were provided with your refrigeration system for specific details about your system.

Ammonia and Freon expansion refrigerants allow for very low media temperatures. Typical temperatures for the CONTHERM are from 32°F to -20°F (0°C to -30°C). A typical refrigeration system configuration for a CONTHERM is shown in Figure 5-12. Depending on your specific media, power, product, and plant layout, your installation may vary from what is shown.

When using an expansion refrigerant, such as ammonia or Freon, the CONTHERM is typically configured as a flooded system as opposed to a pumped system. A flooded system uses an accumulator of suitable size and positioning to provide a reservoir so that the entire media annulus of the CONTHERM is full of liquid refrigerant.

An important optional feature available with CONTHERM refrigeration systems using ammonia or Freon is the Maintain Status feature. This feature will prevent complete freezing of the product in the CONTHERM if the product flow is interrupted for any reason. When the flow of product is interrupted long enough so that freezing of the product may occur, the Maintain Status feature will raise the pressure of the cooling media to a higher level than the normal operating pressures. This higher pressure will in turn raise the temperature of the refrigerant to a level above the freezing point of the product. Once the system has returned to within its normal operating range, the pressure is reduced to continue the cooling of product. If freeze up does occur, emergency hot gas will quickly flush the system and raise the temperature of the cooling media and the product.

5.9.1 Component Description

The following components are typical of those used in standard CONTHERM refrigeration (ammonia and Freon) media packages. Each package is pre-piped and tested for pressure rating.

Components In A Standard Ammonia Refrigeration Package Include:

1. Ammonia accumulator.
2. Dual back pressure regulator.
3. Hand expansion valve.
4. Liquid level control.
5. Safety relief valve.
6. Purge valve.
7. Down leg.
8. Hot gas defrost.
   a) Solenoid valve.
   b) Hand valve.
   c) Check valve.
9. Flanged connections to the Contherm.

Freon systems use the same components as described for the ammonia package above with the addition of a sight glass and a copper sniffer line for purging the system of oil.

Accumulators Used In Ammonia/Freon Refrigeration Systems

The accumulator size (diameter) is based on the refrigeration load of the system. The following sizes are available:

1. 10.75-inches (273-mm)
2. 12.75-inches (323-mm)
3. 16.00-inches (406-mm)

Dual Back Pressure Regulator

The primary back pressure regulator valve controls the flow of refrigerant gas so as to maintain a constant upstream pressure/temperature in the accumulator. It is the setting of this valve that determines the product temperature. If freeze up of product occurs, an auxiliary back pressure regulator is utilized which is set at a higher pressure than the primary regulator. This action is called “Maintain Status” because the auxiliary regulator maintains a high enough back pressure to raise the product temperature above its freezing point in the CONTHERM.

Liquid Level Control

Two types of liquid level control can be used. The first is the TDS (Thermal Differential Sensor). The TDS, in conjunction with an in-line solenoid valve and hand expansion valve, controls the refrigerant liquid level within the accumulator. The TDS operates as a simple thermostat. The second option for maintaining the refrigerant level in the accumulator is a float switch.

Safety Relief Valve

The refrigeration safety relief valve prevents pressure in the accumulator from rising above a safe limit. With a suitable relief valve installed on the accumulator, the refrigerant is released at a controlled rate and a safe pressure is maintained in the accumulator.

Purge Valve

A refrigeration system that uses ammonia must have a purge valve located at a low point so that the oil that accumulates in the refrigerant line can be drained from the system.

Down Leg

The down leg is a steel pipe that extends from the bottom of the accumulator to the floor. This provides added support for the accumulator.

Hot Gas Defrost

The hot gas defrost consists of the following valves:

1. Solenoid Valve

   The hot gas solenoid valve is an on/off valve that allows hot gas to get piped into the refrigeration system. When energized, the hot gas will flow through the CONTHERM’s media annulus to prevent product freeze-up.

2. Hand Valve

   The hand valve is used to control the flow of hot gas into the refrigeration system.

3. Check Valve

   The check valve prevents liquid refrigerant from flowing back into the hot gas line.

Insert Figure 5-12 -- 11 x 17 foldout drawing

Figure 5-12. Typical Refrigeration System Configuration

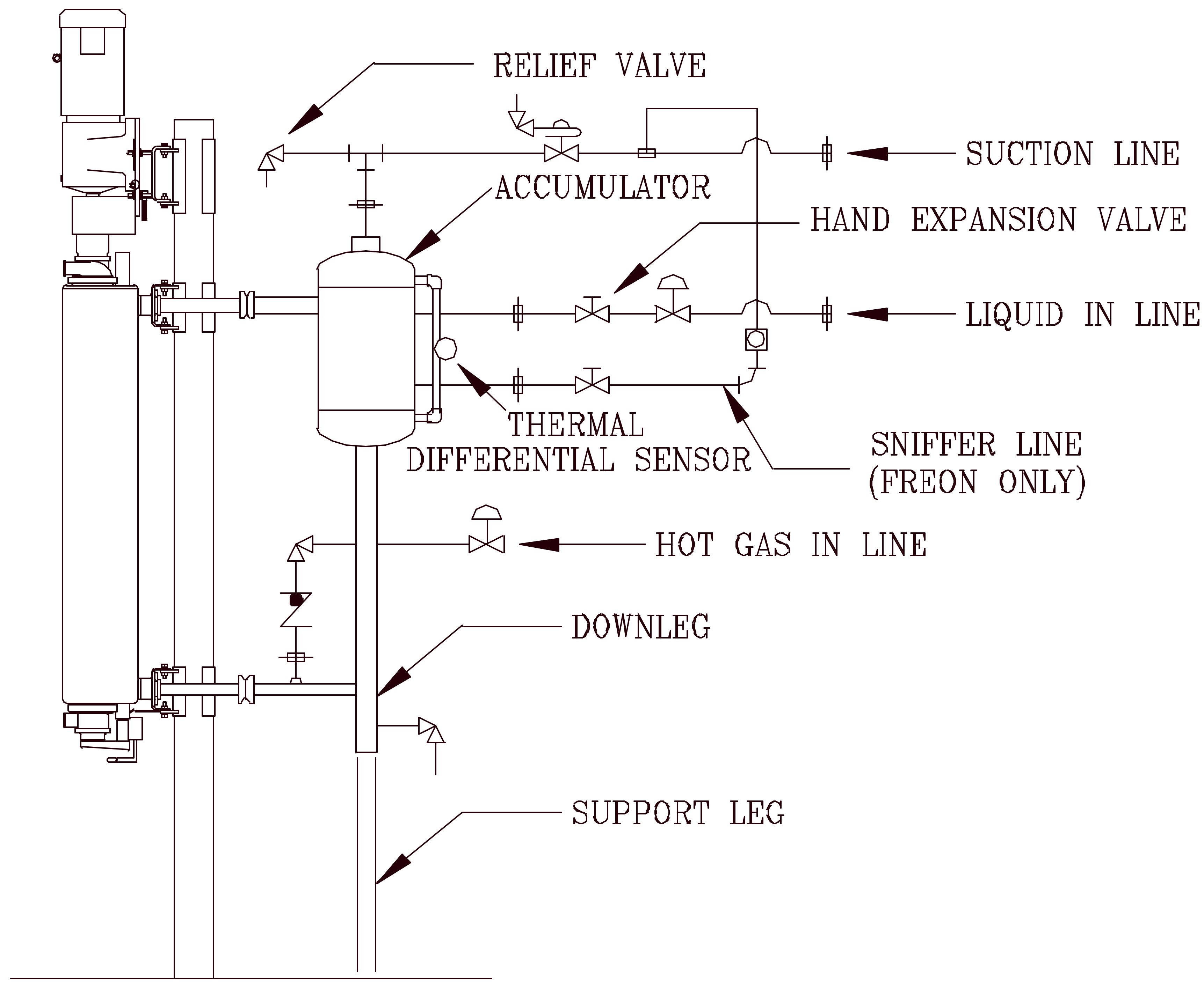


Figure 5-12. Typical Refrigeration System Configuration

Backside Of Figure 5-12 -- 11 x 17 foldout drawing

Sniffer Line

A sniffer line is used with Freon based refrigeration systems to purge the oil from the accumulator. This oil is floating on top of the Freon. The oil is then recirculated back into the suction line of the system by a needle valve that is in-line to continuously allow the flow of the oil. A sight glass and moisture indicator are used to show if oil or moisture exists in the lines.

The following paragraphs identify several precautionary steps that you should take when installing and piping your refrigeration system.

1. Install a hand expansion valve in the “Liquid In Line” between the solenoid and the accumulator to control the inrush of liquid refrigerant. This valve should be adjusted so that the solenoid remains open roughly 70% of the time after the temperature is stabilized.
2. Install an indicator lamp to show when the liquid line solenoid is open.
3. If your refrigeration system was supplied by Alfa Laval Contherm Inc., adjust the thermal differential sensor to control the level of the liquid refrigerant. Adjust this sensor so that the refrigerant’s liquid level is two to four inches (51 mm to 102 mm) below the upper 2.00" (51 mm) connection on the CONTHERM.
4. Install a relief valve and ensure that it is properly vented. The purge valve should be located at the low point of the system to permit the removal of oil contamination from the ammonia refrigerant. The system should be purged regularly to prevent oil from blanketing the heat exchanger surface and reducing thermal efficiency.
5. Install a Sniffer Line if your refrigeration system is using Freon. This line should be connected as shown in Figure 5-12. When installed correctly, a small, but constant, amount of liquid flow will be maintained thereby ensuring the removal of the oil, which floats on top of the Freon refrigerant.

5.10 INSTALLING A WATER OR BRINE COOLING SYSTEM

Typically, water and/or glycol cooling systems are used because they are less expensive to operate and maintain than expansion refrigerant systems. Water or glycol cooling systems are often used for precooling the product before final cooling takes place with an expansion refrigerant. Even though the temperature of brine solutions can drop as low as -20°F (-30°C) at high concentrations, this increased concentration decreases the efficiency of the coolant.

Alfa Laval Contherm Inc.'s Scraped Surface Heat Exchangers are designed for counter-current flow between the product and the media. Product enters the cylinder at the bottom while the inlet for the coolant is at the top. It is extremely important that pumps, pipe lines and valves be sized and installed properly to ensure that the flow rate of the media reaches a turbulent level. This is particularly important if cooling with glycol coolants, as their higher viscosity promotes laminar flow in the media jacket which can significantly reduce the CONTHERM's thermal efficiency.

Two typical CONTHERM cooling system configurations are shown in Figure 5-13. One configuration shows an open loop set-up where product temperature control is required. In this configuration, the cooling water/brine is piped in a series arrangement through each CONTHERM. This arrangement minimizes water consumption while maintaining high velocities through the media annulus thereby ensuring efficient heat transfer.

The other configuration shows a temperature control loop using a centrifugal pump. In this configuration, the pump circulates the cooling fluid through the CONTHERM's media jacket. In configurations with more than one CONTHERM, this set-up is usually utilized for the final CONTHERM when the product outlet temperature must be controlled.

If your refrigeration system has been supplied by Alfa Laval Contherm Inc., follow the instructions that were provided for your system.

Depending on your specific media, power, product, and plant layout, your installation may vary from what is shown in Figure 5-13. Regardless of these installation differences, please note the location of the pumps, valves and thermometers in the product and media lines. The thermometers are important tools that should be incorporated within your CONTHERM's cooling system to monitor system performance and aid in the performance of troubleshooting activities. Only use sensors that are calibrated to an approved standard.

5.10.1 Component Description

The following components are typical of those used in standard CONTHERM Water/Brine media recirculation packages:

1. Supply line solenoid valve and thermometer.
2. Centrifugal pump.
3. Check valve.
4. Flow metering valve.
5. Return line remote actuated control valve.

Supply Line Solenoid Valve And Thermometer

The Supply Line Solenoid Valve acts as an On/Off switch for the media flow. A temperature indicator is in-line to indicate the inlet temperature.

Centrifugal Pump

The centrifugal pump provides the required velocities of media for turbulent flow within the CONTHERM's media annulus.

Insert Figure 5-13 -- 11 x 17 foldout drawing

Figure 5-13. Two Typical CONTHERM Cooling System Configurations

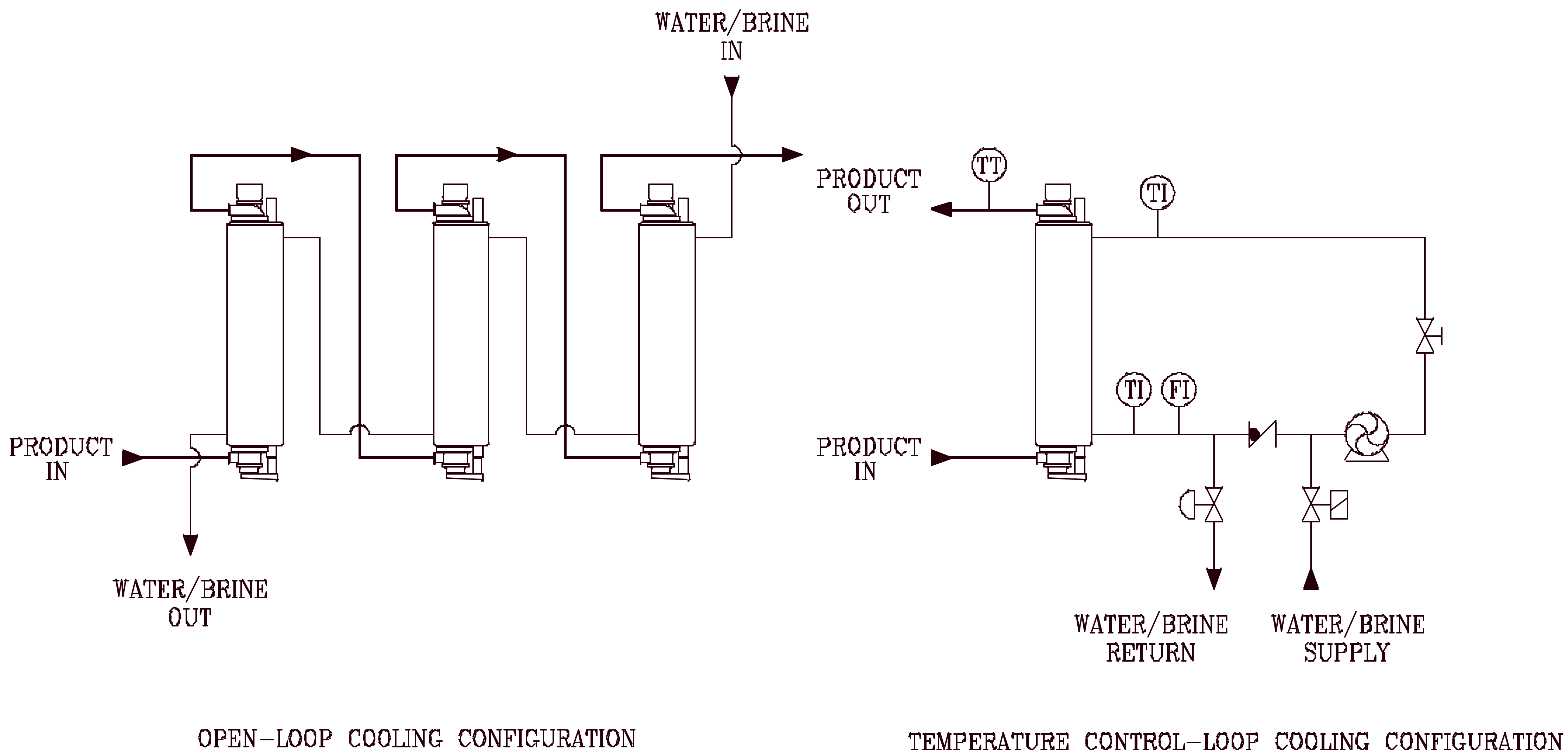


Figure 5-13. Two Typical Cooling System Configurations

Backside Of Figure 5-13 -- 11 x 17 foldout drawing

Check Valve

The check valve releases the supply line media into the return line when the supply line media exceeds the centrifugal pump's flow rate. Media in the return line cannot flow through the check valve back into the supply line.

Flow Metering Valve

The flow metering valve is a manual valve for adjusting flow of media.

Return Line Remote Actuated Control Valve

This flow control valve opens an amount that is proportional to the difference between the set point temperature and the actual temperature sensed at the product outlet port.

Alfa Laval
Contherm

Chapter 6

Operation

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Chapter Six Operation

Chapter 6 Operation

6.1 INTRODUCTION

This chapter describes how to safely operate the CONTHERM® Scraped Surface Heat Exchanger (SSHE) and its related equipment. It is assumed that you have read the Safety Summary in Chapter One and have installed the CONTHERM and all related equipment in accordance with the procedures provided in Chapter Five, Installation.

WARNING

Do not operate the CONTHERM or its equipment and parts until you have read this manual, have installed the CONTHERM in accordance with the procedures provided in Chapter Five, Installation, and are knowledgeable of all related equipment and applicable safety precautions.

The procedures in Chapter Six are organized as shown in Table 6-1.

Table 6-1. CONTHERM Operating Procedures.

Section	Description
6.2	Operating The Hydraulic Rotor Lifting System
6.3	Operating The Rotor Lift Helper Plate
6.4	Pre-Testing Of The CONTHERM
6.5	Start-Up And Initial Testing Of The CONTHERM
6.6	Operating The CONTHERM With A Steam Heating System
6.7	Operating The CONTHERM With A Hot Water Heating System
6.8	Operating The CONTHERM With An Ammonia Or Freon Full-Flooded Refrigeration System
6.9	Operating The CONTHERM With A Water Or Brine Solution Cooling System
6.10	Shutting Down The CONTHERM
6.11	Cleaning The CONTHERM

6.2 OPERATING THE HYDRAULIC ROTOR LIFTING SYSTEM

Each vertically mounted CONTHERM is provided with a hydraulically controlled rotor lifting system. This system, which is independent of the Rotor Drive System, permits the CONTHERM's rotor and blade assembly to be raised or lowered safely and easily for inspection, maintenance or manual cleaning.

The major components of the rotor lifting device include the following:

1. Hydraulic pump assembly, including oil reservoir, pump and 0.5 HP electric motor.
2. Hydraulic stack valve assembly.
3. Hydraulic lift cylinder assembly.
4. Appropriate interconnecting fittings and tubing.

Refer to Chapter Five, Installation, for detailed information describing the installation of the components of the Rotor Lifting System.

The information in this section is organized as shown in Table 6-2.

Table 6-2. Rotor Lifting System Information

Section	Description
6.2.1	Hydraulic Stack Valve Assembly
6.2.2	Procedure For Adding Hydraulic Oil To Lift Pump Reservoir
6.2.3	Procedure For Operating Rotor Lifting System

6.2.1 Hydraulic Stack Valve Assembly

The Rotor Lifting System's Stack Valve Assembly (P/N 7401305) is a hydraulic directional control valve used to lower or raise the CONTHERM's rotor assembly. Compression fittings for both supply and return lines, along with fittings for connections to the CONTHERM's hydraulic lift cylinder assembly, are located on the stack valve assembly.

Each Stack Valve Assembly can be configured to support either one or two center sections, with each center section containing a single handle for raising or lowering the rotor assembly of a corresponding CONTHERM.

It is essential that the operator can safely adjust and align the lower product head with one hand while manipulating the Stack Valve Assembly's handle with the other hand. If more than two center sections were used, it would be difficult for some operators to physically reach the lower product head and the Stack Valve Assembly's handle at the same time.

Refer to Figures 5-8 and 5-9 in Chapter Five, Installation, for parts identification and location information. Figure 5-8 shows both a single and dual center section Stack Valve Assembly while Figure 5-9 shows two typical Rotor Lifting System configurations. One configuration utilizes a Stack Valve Assembly with a single center section while the other utilizes a Stack Valve Assembly with two center sections.

6.2.2 Procedure For Adding Hydraulic Oil To Lift Pump Reservoir

The fluid level (hydraulic oil) in the hydraulic lift pump reservoir must be checked at least once a week. The procedure for checking the fluid level and adding more fluid is described in Table 6-3.

Table 6-3. Adding Hydraulic Oil To Hydraulic Lift Pump Reservoir

Step	Action
1	Remove the hydraulic lift pump's breather cap.
2	Visually check the fluid level in the lift pump's reservoir.
3	Add more fluid (hydraulic oil) if necessary.
4	Put the breather cap back on the hydraulic lift pump.

6.2.3 Procedure For Operating Rotor Lift System

To operate the Rotor Lifting System, perform the procedure provided in Table 6-4. The major components of the Rotor Lifting System are identified and shown in Figure 6-1. Refer to this figure for component location information while performing the following procedure.

CAUTION

1. If your configuration utilizes two or more Stack Assemblies, do not operate more than one stack valve handle at a time.
2. Do not operate the Rotor Lifting System until you have checked all fittings. Tighten nuts or replace any leaking fittings before operating the system.

WARNING

1. Do not attempt to disassemble the CONTHERM if its rotor is rotating.
2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping.
3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps.
4. Keep the area under the CONTHERM clear of hands, feet, piping and other obstructions.
5. Do not remove the lower head clamp or the lower bearing clamp until you have verified that the hydraulic Rotor Lifting System is turned on and is operating correctly.
6. The blades attached to the rotor's rotor pins may be very sharp. Wear protective gloves while handling the rotor.

⚠	**DANGER**	If your CONTHERM is equipped with spring loaded blades, be extremely careful when lowering or raising the rotor. You must hold these blades in place while lowering or raising the rotor. If these blades are not held in place, the tension of the spring may cause the blades to be removed from the rotor with substantial force. Serious personal injury may occur if these blades come into contact with operating personnel.

Table 6-4. Operating The Hydraulic Rotor Lifting System

Step	Action
1	Turn off the CONTHERM’s Rotor Drive System.
2	Flush the CONTHERM with cold water before disassembling the unit.
3	Remove the product piping clamp from the lower end of the CONTHERM.
4	Start the hydraulic Rotor Lift Pump (P/N 7402078).
5	Lift up the handle on the Stack Valve Assembly (P/N 7401305) to eliminate any slack that may have occurred between the lift beam and the bearing cap, and to ensure that the lift is working properly. When done, release the handle and let it move back into its neutral position.
6	While keeping your hands and feet clear of the area directly below the CONTHERM, remove the lower head clamp (P/N 7401106-01 or 7403038-01).
7	Push the handle on the Stack Valve Assembly down and lower the rotor, using one hand to guide it down. When the top of the rotor is near the bottom of the cylinder, hold the rotor so that the top does not fall toward the cylinder wall. This will help prevent any damage from occurring to the seals and cylinder wall.
8	Guide the lower head assembly out of the cylinder with your free hand.
9	If your CONTHERM has spring loaded blades, be extremely careful when lowering and/or raising the rotor. As the rotor is lowered, these spring loaded blades must be held in place to prevent the possibility of the blades coming off from the force of the spring.
RAISING THE ROTOR	
10	To raise the rotor, reverse the performance of the previous steps of this procedure as described below.
11	If your CONTHERM uses spring-loaded rotor blades, you must hold the blades in place until half of their length has been moved back into the CONTHERM’s cylinder.
12	Before raising the rotor, ensure that the rotor is centered and verify that all rotor blades are properly secured to their supporting rotor pins. Also ensure that the upper seal is properly locked in place.

This is an 11 x 17 (B-Size) Foldout Drawing

Figure 4-1. Rotor Lifting System

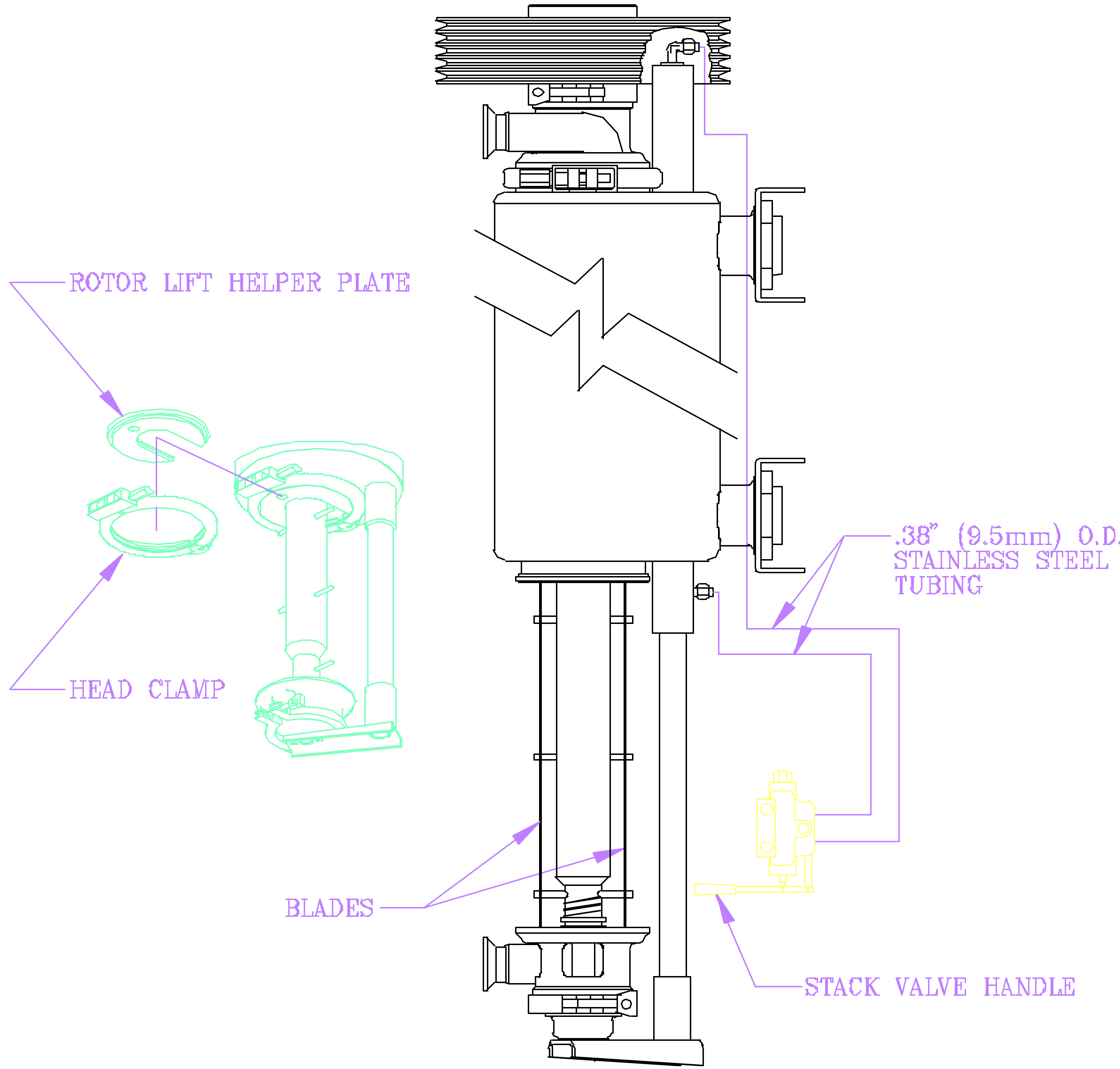

Figure 6-1. Rotor Lifting System

Back Side Of Figure 4-1. Rotor Lifting System

Table 6-4. Operating The Hydraulic Rotor Lifting System, Continued

Step	Action
13	Guide the lower head assembly into the cylinder with your free hand.
14	Pull the handle on the Stack Valve Assembly up and raise the rotor, using one hand to guide it up. When the top of the rotor is near the bottom of the cylinder, hold the rotor so that the top does not fall toward the cylinder wall. This will help prevent any damage from occurring to the seals and cylinder wall.
15	While keeping your hands and feet clear of the area directly below the CONTHERM, reattach the lower head clamp (P/N 7401106-01 or 7403038-01). **Note**: Do <u>not</u> over tighten the product head clamp. Minimal force applied with a hand wrench is sufficient for tightening the nut. A torque of 10 foot-pounds (13.5 Newton-Meters) is recommended.
16	When the rotor has been raised all the way into the cylinder and the lower head clamp has been put back onto the CONTHERM, release the handle on the Stack Valve Assembly (P/N 7401305) and let it move back into its neutral position.
17	Turn off the hydraulic Rotor Lift Pump (P/N 7402078).
18	Re-attach the product piping clamp to the lower end of the CONTHERM.
19	Verify that the CONTHERM has been reassembled correctly.
20	The CONTHERM is now ready to go back into service.

6.3 OPERATING THE ROTOR LIFT HELPER PLATE

The Rotor Lift Helper Plate (P/N 7401322) is used with the hydraulic lifting system to aid in the inspection of the lower head assembly, seals and bearings. The procedure for operating the CONTHERM's Rotor Lift Helper Plate is provided in Table 6-5. Refer to Figure 6-1 for component identification and location information.

CAUTION	1. If your configuration utilizes two or more Stack Assemblies, do not operate more than one stack valve handle at a time. 2. Do not operate the Rotor Lifting System until you have checked all fittings. Tighten nuts or replace any leaking fittings before operating the system.

WARNING	1. Do not attempt to disassemble the CONTHERM if its rotor is rotating. 2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping. 3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps. 4. Keep the area under the CONTHERM clear of hands, feet, piping and other obstructions. 5. Do not remove the lower head clamp or the lower bearing clamp until you have verified that the hydraulic Rotor Lifting System is turned on and is operating correctly. 6. The blades attached to the rotor's rotor pins may be very sharp. Wear protective gloves while handling the rotor.

DANGER	If your CONTHERM is equipped with spring loaded blades, be extremely careful when lowering or raising the rotor. You must hold these blades in place while lowering or raising the rotor. If these blades are not held in place, the tension of the spring may cause the blades to be removed from the rotor with substantial force. Serious personal injury may occur if these blades come into contact with operating personnel.

Table 6-5. Operating The Rotor Lift Helper Plate

Step	Action
1	Turn off the CONTHERM's Rotor Drive System.
2	Flush the CONTHERM with cold water before disassembling the unit.
3	Remove the product piping clamp from the lower end of the CONTHERM.
4	Start the hydraulic Rotor Lift Pump (P/N 7402078).
5	Lift up the handle on the Stack Valve Assembly (P/N 7401305) to eliminate any slack that may have occurred between the lift beam and the bearing cap, and to ensure that the lift is working properly. When done, release the handle and let it move back into its neutral position.
6	While keeping your hands and feet clear of the area directly below the CONTHERM, remove the lower head clamp (P/N 7401106-01 or 7403038-01).
7	Push the handle on the Stack Valve Assembly down and lower the rotor, approximately halfway out of the cylinder, using one hand to guide it down. Hold the rotor so that the top does not fall toward the cylinder wall. This will help prevent any damage from occurring to the seals and cylinder wall.
8	Carefully remove the exposed rotor blades and adjust the rotor if necessary.
9	Pull the handle on the Stack Valve Assembly up and raise the rotor until at least one free set of blade pins are inserted into the cylinder.
10	Clamp the Rotor Lift Helper Plate securely in place as shown in Figure 6-1. Ensure that the pins are resting securely on the plate and that the plate is securely in place. **NOTE**: If your CONTHERM has a Rotor Hold Down feature, you must remove the socket head cap screw (P/N 7401242-03).
11	Continue to lower the rotor and bottom head assembly. When you can observe that the rotor is being supported by the Helper Plate, then you can remove and separate the bottom head assembly from the rotor.
RAISING THE ROTOR	
12	To raise the rotor, reverse the performance of the preceding steps as described below.
13	Reattach bottom head assembly to rotor, unclamp Rotor Lift Helper Plate, and then reattach any rotor blades that were removed to their rotor pins.
14	Before raising the rotor, ensure that the rotor is centered and verify that all rotor blades are properly secured to their supporting rotor pins. Also ensure that the upper seal is properly locked in place.
15	Raise the rotor and bottom head assembly.
16	If your CONTHERM uses spring-loaded rotor blades, you must hold the blades in place until half of their length has been moved back into the CONTHERM's cylinder.

Table 6-5. Operating The Rotor Lift Helper Plate, Continued

Step	Action
17	Guide the lower head assembly into the cylinder with your free hand.
18	Pull the handle on the Stack Valve Assembly up and raise the rotor, using one hand to guide it up. When top of the rotor is near the bottom of the cylinder, hold rotor so that top does not fall toward the cylinder wall. This will help prevent any damage from occurring to the seals and cylinder wall.
19	While keeping your hands and feet clear of the area directly below the CONTHERM, reattach lower head clamp (P/N 7401106-01 or 7403038-01).
20	When the rotor has been raised all the way into the cylinder and the lower head clamp has been put back onto the CONTHERM, release the handle on the Stack Valve Assembly (P/N 7401305) and let it move back into its neutral position. **Note**: Do <u>not</u> over tighten the product head clamp. Minimal force applied with a hand wrench is sufficient for tightening the nut. A torque of 10 foot-pounds (13.5 Newton-Meters) is recommended.
21	Turn off the hydraulic Rotor Lift Pump (P/N 7402078).
22	Re-attach the product piping clamp to the lower end of the CONTHERM.
23	Verify that the CONTHERM has been reassembled correctly.
24	The CONTHERM is now ready to go back into service.

6.4 CONTHERM PRE-TEST

Before operating the CONTHERM, review your configuration and ensure that it has been installed in accordance with all applicable drawings and installation procedures. After verifying the proper installation of the CONTHERM, perform the pretest procedure provided in Table 6-6 to verify its operational status.

Table 6-6. CONTHERM Pre-Test Procedure

Step	Action
1	To ensure that your CONTHERM is ready to begin operation, perform the following steps: a) If your CONTHERM has a belt and sheave electric drive, go to Step 2. b) If your CONTHERM has a direct-coupled electric drive, go to Step 4. c) If your CONTHERM has a hydraulic drive, go to Step 6.
CONTHERM Equipped With Belt And Sheave Electric Drive	
2	Ensure that proper tension exists on the belts. Adjust if necessary. The ideal tension is the lowest tension at which the belt will not slip under peak load conditions.
3	Start the motor and verify that the rotor rotates in the same direction as the arrow on the label (decal) located on the front of the unit. The rotation should be from right to left.
CONTHERM Equipped With Direct-Coupled Electric Drive	
4	Ensure that the flexible couplings of the electric drive motor and the CONTHERM are aligned properly. Adjust if necessary. Refer to Step 13, Table 5-5 in Chapter 5, Installation, for the procedure on how to align these couplings on CONTHERMs ordered before 1 January 1996, and to Step 23, Table 5-5, for CONTHERMs ordered after 1 January 1996.
5	Start the motor and verify that the rotor rotates in same direction as the arrow on the label (decal) located on front of the unit. The rotation should be from right to left.
CONTHERM Equipped With Hydraulic Drive	
6	Turn on the water and ensure that water is flowing through the hydraulic power pack's oil cooler.
7	Close the adjustable flow control valve(s) located on the supply line and open the by-pass on the power pack to its lowest pressure setting. Refer to Figure 6-2 for parts location information for the hydraulic drive unit.
8	Start the hydraulic power pack and adjust the pressure setting to the recommended operating pressure.
9	Open the adjustable flow control valves(s) and adjust the hydraulic motor(s) to the desired speed. Verify that the rotor rotates in the same direction as the arrow on the label (decal) located on the front of the unit. The rotation should be from right to left.

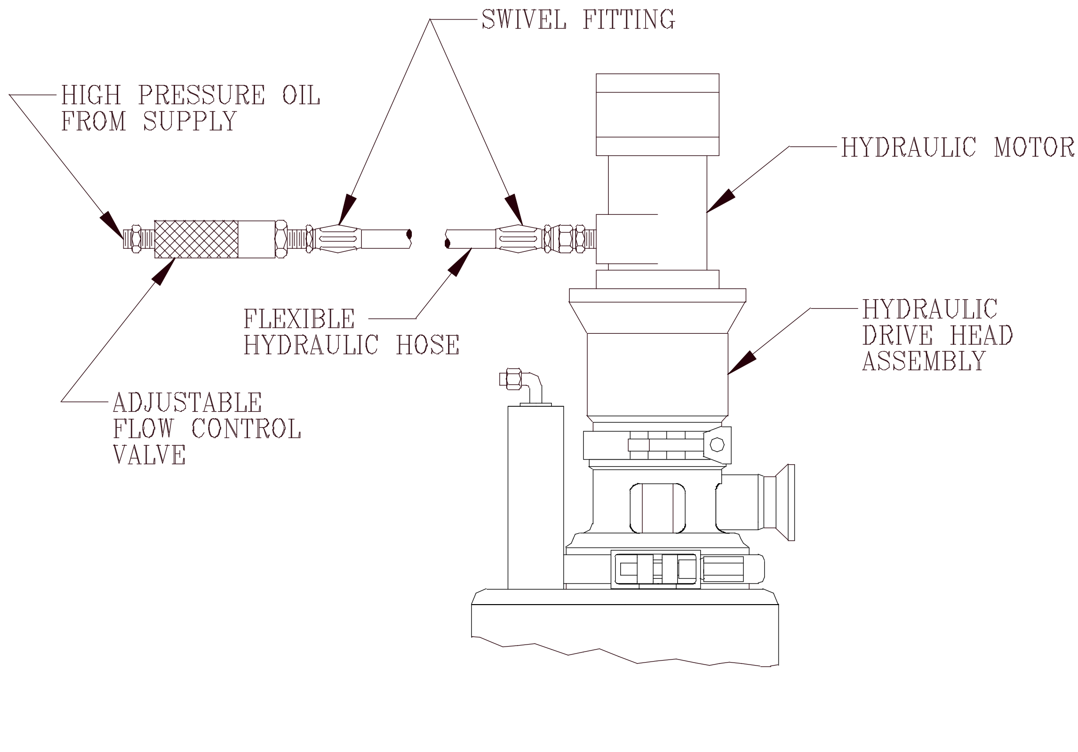

Figure 6-2. Hydraulic Drive Adjustable Flow Control Valves

6.5 START-UP AND INITIAL TESTING OF THE CONTHERM

After you have verified the proper installation and the operational readiness of the CONTHERM, you are ready to start the CONTHERM and perform initial testing with your company's product.

Sections 6.6 through 6.9 of this manual describe the start-up and initial testing procedures for CONTHERM's configured for use in the following systems:

- Steam Heated
- Hot Water Heated
- Refrigerated (Ammonia or Freon Full-Flooded)
- Water or Brine Cooled

After reading and reviewing the guidelines and precautions provided in Table 6-7, proceed to the appropriate section for your CONTHERM's detailed start-up and initial testing procedures. If you follow and understand the guidelines and precautions provided in Table 6-7, your CONTHERM will function as the efficient heat exchanger that it is designed and engineered to be.

Note: The use of the CONTHERM and its equipment for processes other than those it was designed for is discouraged and may result in the voiding of warranties.

CAUTION The media piping should be self-supporting to avoid stress on the media connections. Otherwise, excessive temperatures may occur on the piping. The piping should only be installed and tested by qualified personnel.

Table 6-7. Start-Up And Initial Testing Guidelines

Step	Action
1	Do not proceed with the start-up and initial testing of the CONTHERM unless you have read this manual.
2	Ensure that the hydraulic lift system is operating properly.
3	Flush the product chamber and thoroughly clean it of all foreign materials before operating the rotor.
4	Jog all motors and pumps to ensure their proper operation.
5	Verify the settings of the air supply and all pressure level controls.
6	Test all solenoids for proper operating voltage.
7	Use water as the "product" for all initial tests.
8	Ensure that the rotor blades are installed properly.
9	Ensure that leaks are not present at any of the product or media connections. **Note**: Some early seepage around the product seals is normal. This will usually disappear as the seals seat themselves.
10	Place thermometers and pressure gauges in both the product and media lines. Use sensors that are calibrated to an approved standard as these gauges will be useful when troubleshooting system problems.

6.6 OPERATING THE CONTHERM IN A STEAM HEATING CONFIGURATION

The installation and set-up of the CONTHERM for a steam heating configuration is described in *Chapter Five, Section 5.7 Installing A Steam Heating System*. An installation drawing of the configuration is provided in Figure 5-10. Please refer to these portions of Chapter Five as necessary while performing the initial start-up and operating procedure that is provided in Table 6-8.

Table 6-8. Start-Up And Operation Of Steam Heated CONTHERM

Step	Action
1	Using water as the test "product," start flowing the water through the CONTHERM via the product inlet. When water begins exiting the unit's product chamber via the product outlet, start the rotor. **Note**: For best results, adjust the flow rate and temperature profile of the water to that of the actual product.
2	Slowly open the steam valve a small amount and then check the media piping for leaks.
3	Verify that the steam trap is working properly. A small amount of condensate and vapor should be discharged at regular intervals.
4	Set the automatic temperature controller to 150° F (66° C). After several minutes of operation, check the product inlet and outlet temperatures. The outlet temperature gauge should read approximately 150° F (66° C). Repeat this step for several other temperature settings.
5	Set the automatic temperature controller to your desired product temperature setting. Verify that the product outlet temperature gauge reaches this temperature within five to ten minutes.
6	When you are satisfied that the CONTHERM is operating properly with water as the product, drain and flush the water "product" from the system.
7	Your unit is now ready to begin service. **Note**: 1) The product should be flowing through the system and diverted back to the source before steam is turned on. Divert the product back to the source until the product is at the desired temperature, then begin the forward (process) flow. 2) To avoid scorching the product onto the heat exchanger's cylinder wall, do not allow steam to enter the CONTHERM before the product has completely filled the heat exchange cylinder.

CAUTION

Always close the steam shut-off valve when the rotor is stopped. Otherwise blades that are in contact with the hot cylinder may be damaged.

6.7 OPERATING THE CONTHERM IN A HOT WATER HEATING CONFIGURATION

The installation and set-up of the CONTHERM for a hot water heating configuration is described in *Chapter Five, Section 5.8 Installing A Hot Water Heating System*. An installation drawing of the configuration is provided in Figure 5-11. Refer to these portions of Chapter Five as necessary while performing the initial start-up and operating procedure that is provided in Table 6-9.

Please note that Figure 5-11 shows two typical hot water heating system configurations for a CONTHERM. The first configuration utilizes a dedicated hot water system for the CONTHERM. In this configuration, the CONTHERM is provided with its own water/steam heat exchanger. The second configuration utilizes a central hot water supply. Both systems will function adequately providing that the equipment has been properly sized and installed.

Table 6-9. Start-Up And Operation Of Hot Water Heated CONTHERM

Step	Action
1	Using water as the test "product," start flowing it through the CONTHERM via the product inlet. When water begins exiting the unit's product chamber via the product outlet, start the rotor. **Note**: For best results, adjust the flow rate and temperature profile of the water to that of the actual product.
2	Turn on the hot water system and then check the media piping for leaks.
3	Set the automatic temperature controller to 120° F (49° C). After several minutes of operation, check product inlet and outlet temperatures. The outlet temperature gauge should read approximately 120° F (49° C). Repeat this step for several other temperature settings.
4	Set the automatic temperature controller to your desired product temperature setting. Verify that the product outlet temperature gauge reaches this temperature within five to ten minutes.
5	When you are satisfied that the CONTHERM is operating properly with water as the product, drain and flush the water "product" from the system.
6	Your CONTHERM is now ready to begin service. **Note**: The product should be flowing through the system and diverted back to the source before the hot water is turned on. Divert the product back to the source until the product is at the desired temperature, then begin the forward (process) flow.

6.8 OPERATING THE CONTHERM IN AN AMMONIA OR FREON FULL-FLOODED REFRIGERATION CONFIGURATION

The installation and set-up of the CONTHERM for a refrigerated configuration is described in *Chapter Five, Section 5.9 Installing An Ammonia Or Freon Full-Flooded Refrigeration System*. An installation drawing of the configuration is provided in Figure 5-12. Refer to these portions of Chapter Five as necessary while performing the initial start-up and operating procedure that is provided in Table 6-10.

When an expansion refrigerant such as ammonia or Freon is used, the CONTHERM is typically configured as a flooded system as opposed to a pumped system. A flooded system uses an accumulator of suitable size and positioning to provide a reservoir so that the entire media annulus of the CONTHERM is filled with liquid refrigerant.

The warm product entering the CONTHERM causes the liquid refrigerant to boil in the media channel. The latent heat of evaporation of the refrigerant is the driving force for heat transfer in this system. The boiling of liquid refrigerant in the CONTHERM's media annulus forms vapors that rise through the media channel and escape through the top media connection into the accumulator vessel.

As the refrigerant vapors exit the top of the CONTHERM, liquid refrigerant is continuously entering the system from the bottom. Vapors are recirculated to a compressor where they are condensed to a liquid and sent back to the accumulator vessel at high pressure. A back pressure valve is installed for controlling the pressure and temperature within the accumulator and the CONTHERM.

6.8.1 Maintain Status Feature

An important feature provided by Alfa Laval Contherm Inc. with its refrigerant systems is the Maintain Status feature. This feature prevents the product from completely freezing inside the CONTHERM if there is an interruption of the product flow.

When the flow of product is interrupted long enough so that freezing of the product may occur, the Maintain Status feature will automatically raise the pressure of the cooling media to a higher level than the normal operating pressures. This higher pressure will in turn raise the temperature of the refrigerant to a level above the freezing point of the product. When the system has returned to within its normal operating range, the pressure is reduced to continue the cooling of product. If freeze up does occur, emergency hot gas will quickly flush the system and raise the temperature of the cooling media and the product.

Normally, when the product becomes too cold in the product cylinder (due to a product flow stoppage or a temperature controller malfunction, etc.), the product becomes thicker and increases the load on the CONTHERM's drive system. With the Maintain Status feature, the load on the CONTHERM's drive system is monitored. An ammeter is used with CONTHERM's equipped with electric drives and a tachometer is used with CONTHERM's equipped with hydraulic drives.

When the drive system's sensor reaches a predetermined set point (Set Point One), the main back pressure regulator closes. The closure of this regulator causes the refrigerant pressure and temperature to increase back to the preset auxiliary back pressure valve setting values. Warming of the product occurs followed by a corresponding reduction in the load sensed by the drive system sensor. The system is then automatically returned to normal operation.

If the drive overload condition persists, as may occur with a serious refrigeration malfunction, the product will continue to be cooled and will become even thicker, further increasing the load on the CONTHERM's drive system. In such a situation, the Maintain Status feature's drive system sensor will reach the next predetermined set point (Set Point Two). When this setpoint is reached, the liquid line solenoid valve will close and the CONTHERM's rotor will stop. Hot gas will automatically be introduced to the annulus for one to three minutes. If this occurs, the operator must manually restart the entire system.

If your CONTHERM is not equipped with the Maintain Status feature, then the drive sensor is not provided as part of the system and the procedures described in the previous paragraph (i.e., closing of the main back pressure valve and the liquid line solenoid valve, the shut down of the CONTHERM's rotor, and the input of hot gas) must be performed manually.

CAUTION Do not cool the water below 40^{o} F (4.4^{o} C).

Table 6-10. Start-Up And Operation Of CONTHERM With Ammonia Or Freon Full-Flooded Refrigeration System

Step	Action
1	Start flowing the test product (water) through the CONTHERM via the product inlet. When water begins exiting the unit's product chamber via the product outlet, start the rotor. **<u>Note</u>**: For best results, adjust the water inlet flow rate and temperature profile to that of the actual product.
2	Turn on the refrigeration system after the desired water flow rate is obtained.
3	Set the temperature controller, if provided, or adjust the back pressure regulator for your desired temperature setting. The product outlet temperature gauge should register the desired temperature within several minutes. Set the controller or adjust the back pressure regulator for several other temperatures and verify that the product outlet temperature reaches the new setting within several minutes.
4	When you are satisfied that the CONTHERM is operating properly with water as the product, shut off the refrigerant, and drain and flush the water "product" from the system.
5	Your CONTHERM is now ready to begin service. **<u>Note</u>**: 1) For applications operated at below freezing temperatures, the product should be flowing through the system and diverted back to the source before the refrigerant media is turned on. This will prevent a freeze up from occurring as the product will not be exposed to a colder than normal cylinder surface. Divert the product back to the source until the product is at the desired temperature, then begin the forward flow. 2) An adjustable back pressure regulator is required for systems that do not have a product temperature controller. This regulator will be used to control the temperature of the refrigerant.

6.9 OPERATING A WATER OR BRINE COOLED CONTHERM

The installation and set-up of the CONTHERM for a water or brine cooled configuration is described in *Chapter Five, Section 5.10 Installing A Water Or Brine Cooling System*. Typical installation drawings of the configuration are provided in Figure 5-13. Refer to these portions of Chapter Five as necessary while performing the initial start-up and operating procedure that is provided in Table 6-11.

Two typical CONTHERM cooling system configurations are shown in Figure 5-13. One configuration shows an open loop set-up where product temperature control is required. In this configuration, the cooling water/brine is piped in a series arrangement through each CONTHERM. This arrangement minimizes water consumption while maintaining high velocities through the media annulus thereby ensuring efficient heat transfer.

The second configuration shows a temperature control loop using a centrifugal pump. In this configuration, the pump circulates the cooling fluid through the CONTHERM's media jacket. In configurations with more than one CONTHERM, this set-up is usually utilized for the final CONTHERM when the product outlet temperature must be controlled.

Table 6-11. Start-Up And Operation Of Water Or Brine Cooled CONTHERM

Step	Action
1	Using water as the test "product," start flowing it through the CONTHERM via the product inlet. When water begins exiting the unit's product chamber via the product outlet, start the rotor. **Note**: For best results, adjust the flow rate and temperature profile of the water to that of the actual product.
2	Turn on the water or brine cooling system. Inspect the media piping for leaks. If your system does not contain a temperature control loop, adjust the coolant flow to control the product outlet temperature and proceed to Step 5.
3	Set the automatic temperature controller to 50° F (10° C). After several minutes of operation, check product inlet and outlet temperatures. The outlet temperature gauge should read approximately 50° F (10° C). Repeat this step for several other temperature settings.
4	Set the controller to your desired product temperature setting. The product outlet temperature gauge should reach this temperature within five to ten minutes.
5	When you are satisfied that the CONTHERM is operating properly with water as the product, drain and flush the water "product" from the system.
6	Your CONTHERM is now ready to begin service. **Note**: The product should be flowing through the system and diverted back to the source before the cooling media is turned on. This will prevent a freeze up from occurring as the product will not be exposed to a colder than normal cylinder surface. Divert the product back to the source until the product is at the desired temperature, then begin the forward (process) flow.

6.10 SHUTTING DOWN THE CONTHERM

Shutting down the CONTHERM at the end of a production run is a simple process. When the production run is complete, chase the product from the cylinder with rinse water. As there is very little water product mixture in the CONTHERM, product loss is minimal. When the product has been rinsed/cleared from all lines, shut off the appropriate media source (refrigerant, cooling or heating media).

At this point, the CONTHERM may be cleaned in accordance with the information provided in the following section, *Section 6.11 Cleaning The CONTHERM*. After you have completed the cleaning process in accordance with the information provided in Section 6.11, you can shut off the CONTHERM's drive motors.

6.11 CLEANING THE CONTHERM

Both the CONTHERM and the CONVAP™ (described in Chapter Ten) are designed to be cleaned in place (CIP), using conventional CIP equipment and cleaning solutions. The selection of the appropriate cleaning solutions and the proper time/temperature relationships is critical to the integrity of the equipment. Specific product soils can cause variations in the cleaner and procedure selections.

For additional recommendations on cleaning and sanitizing your CONTHERM or CONVAP, contact your local Alfa Laval Contherm Inc., Tetra Laval, or WEST AGRO (an Alfa Laval Agri Company) representative.

To protect your equipment and your warranty, clean the CONTHERM and CONVAP in accordance with the following guidelines and the recommended cleaning program provided in Table 6-12.

6.11.1 Recommended Cleaning Guidelines

The following list provides recommended guidelines to follow when cleaning your CONTHERM and CONVAP equipment.

1. Do not use acid solutions lower than 3.5 pH or at temperatures higher than 68°F (20°C) on materials other than stainless steel cylinders.
2. Do not use acid cleaners on chromed cylinders.
3. Do not use nitric or sulfuric acid cleaning compounds on nickel cylinders. Only use the phosphoric acid or citric acid in the concentrations indicated in Table 6-12.
4. Do not heat cleaning solutions in the CONTHERM.
5. Do not air blow cleaning solutions from the CONTHERM. Cleaners should be rinsed from the equipment.

If you use cleaning agents that are not recommended and approved by Alfa Laval Contherm Inc. or if cleaning agents are used improperly, you may void your warranty for the heat exchange cylinder and blades. Consult your local Alfa Laval Contherm Inc. or Tetra Laval representative before deviating from any of the guidelines and/or the use of the recommended cleaning agents identified in this section of the manual.

Table 6-12 identifies the recommended steps in the cleaning program that are suitable for your CONTHERM and/or CONVAP. If you have a question about any of the steps in the cleaning program, contact your local Alfa Laval Contherm Inc., Tetra Laval, or WEST AGRO representative.

The following cleaning program steps are identified in Table 6-12:

1. Water Flush.
2. Alkaline Cleaner (Chlorine Additive).
3. Water Rinse
4. Acid Cleaner (Phosphoric).
5. Water Rinse.
6. Sanitize.

Table 6-12. Recommended Cleaning Program For The CONTHERM And CONVAP

1. Water Flush: To Remove Loose Soil	
Temperature:	60-120^{o} F (16-49^{o} C)
Time Duration:	5-10 minutes; until discharge is clear
Chemical Concentration:	Not Applicable
Solution pH:	Not Applicable
Recommended Product:	Not Applicable
2. Alkaline Cleaner (Chlorine): To Remove Remaining Soil	
Temperature:	160-190^{o} F (71-88^{o} C); match product temperature
Time Duration:	30-60 minutes
Chemical Concentration:	0.5 to 2% NaOH (200 PPM) Chlorine
Solution pH:	12-13 pH
Recommended Product:	High Temperature Alka-Plus Cleaner; Premium Plus Alkali
3. Water Rinse: To Remove And Neutralize Alkaline Cleaner	
Temperature:	60-120^{o} F (16-49^{o} C)
Time Duration:	Until discharge indicates 7.0 pH
Chemical Concentration:	Not Applicable
Solution pH:	Of available water supply
Recommended Product:	Not Applicable
4. Acid Cleaner (Phosphoric): To Remove Alkaline & Mineral Deposits	
Temperature:	68^{o} F (20^{o} C) Maximum
Time Duration:	10-20 minutes
Chemical Concentration:	0.05%
Solution pH:	3.5-4.0 pH
Recommended Product:	Manual-Mate LF Acid
5. Water Rinse: To Neutralize Acid Cleaner	
Temperature:	68^{o} F (20^{o} C) Maximum
Time Duration:	Until discharge indicates 7.0 pH
Chemical Concentration:	Not Applicable
Solution pH:	Of available water supply
Recommended Product:	Not Applicable

Table 6-12. Recommended Cleaning Program For The CONTHERM And CONVAP, Continued

6. Sanitize: To Sanitize Surface	
Temperature:	68^{o} F (20^{o} C)
Time Duration:	30 seconds to 2 minutes
Chemical Concentration:	Depends on type of sanitizer product used
Solution pH:	Depends on type of sanitizer product used
Recommended Product:	Megasan (3.5 - 4 pH); Acidet (3.5 - 4 pH); LCS (Chlorine); Teramine (Quaternary Ammonium Compound)

Notes:

1. The cleaning program described in Table 6-12 is recommended for the cleaning associated with the processes used by most CONTHERMs and CONVAPs. Certain soils of products with a pH range of 3 - 4 may require less cleaning time or lower cleaning temperatures.
2. Soils of products with pH values higher than the 3 - 4 range, and which precipitate out as a result of high temperatures encountered during production processing, will require maximum cleaning time and temperatures.
3. If the cleaning program provided in Table 6-12 does not provide adequate cleaning for equipment used in low acid aseptic processes, consult your local Alfa Laval Contherm Inc., Tetra Laval, or WEST AGRO representative for alternative cleaning programs.
4. You can improve the cleaning of CONTHERMs used to process stringy or chunky products by periodically pulsing or reversing the rotation of the rotor during the cleaning cycle.

Alfa Laval
Contherm

Chapter 7

Maintenance

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Chapter Seven Maintenance

Chapter 7 Maintenance

7.1 INTRODUCTION

You must perform periodic maintenance on the equipment and components of your CONTHERM to ensure its safe and efficient operation. This chapter provides a recommended schedule for performing these maintenance actions.

In addition to the maintenance schedule, detailed procedures for performing all maintenance actions required to support the equipment and components of your CONTHERM are provided.

The maintenance information in this chapter is organized as shown in Table 7-1.

Table 7-1. Organization Of The Maintenance Information

Section	Description
7.2	Scheduled Maintenance
7.3	Seals
7.4	Scraping Blades
7.5	Bearings
7.6	Heat Exchange Cylinder
7.7	Rotor Stop Adjustment (Non Hold Down Style)
7.8	Hydraulic Stack Valve Assembly
7.9	Disassembly And Reassembly Of The CONTHERM

WARNING

Do not perform maintenance on the CONTHERM or its equipment and parts until you have read this manual and are knowledgeable of the equipment and all applicable safety precautions.

7.2 SCHEDULED MAINTENANCE

Table 7-2 provides a schedule for performing periodic maintenance on the equipment and components of your CONTHERM. This schedule has been developed to support a CONTHERM operated in a production run of approximately 40 to 50 hours per week. This table has been provided by Alfa Laval Contherm Inc. as a suggested maintenance guideline. You may want to develop a more comprehensive list of maintenance actions that is tailored to your specific facility and product application.

Table 7-2. Scheduled Maintenance For The CONTHERM

Component	Maintenance Action	Time Period
Product Seals	Inspection.	Weekly and when lowering the rotor.
Blades	Inspection and dressing edge.	Inspect daily for first week of operation. Then on an as required basis.
Bearings	Inspection.	Monthly.
Inside Surface Of Cylinder	Clean-in place (CIP).	Daily.
Hydraulic Lines	Clean by flushing.	Before initial operation.
O-Rings	Inspection and lubrication.	Each time the CONTHERM is opened.
Hydraulic Lift Pump	Check oil level.	Weekly.

7.3 SEALS

This section describes how to inspect, replace, and test the CONTHERM's rotary and balanced seals. These seals are required to seal the externally driven rotor and blade assembly that is installed within the CONTHERM's heat exchange cylinder. The rotor and blade assembly operates through the stationary product heads located at either end of the CONTHERM's heat exchange cylinder.

Rotary seals at each end of the heat exchange cylinder are used to "seal" the CONTHERM's heat exchange cylinder, both internally and externally. These seals prevent product from escaping from within the cylinder and outside contamination from entering the cylinder. The seal is created between two very flat surfaces, one on the rotor (the seal face) and the other installed into the product head (seal bushing). These surfaces are maintained in intimate contact with each other. It is the integrity of the contact between these surfaces that ensures a leak proof seal. Refer to *Chapter Three, Section 3.8 SEALS*, for a detailed description of the CONTHERM's seals.

The Balanced Seal is an alternate seal that is primarily used for high pressure applications.

NOTE: If your CONTHERM is equipped with special purpose seals, refer to the appropriate Appendix for its description and other applicable information.
All appendices are included in the back of this manual.

The maintenance of the following seals is described in this section:

1. Rotary Seals
    - Standard Rotary Seal
    - Hard Face Rotary Seal
    - Flushed Standard Rotary Seal
    - Flushed Hard Face Rotary Seal
    - Huhnseal
2. Balanced Seals

Table 7-3 shows how the information in this section is organized.

Table 7-3. CONTHERM Seal Maintenance Information

Section	Description
7.3.1	Standard And Hard Face Rotary Seals
7.3.2	Flushed Standard And Flushed Hard Face Rotary Seals
7.3.3	Balanced Seals
7.3.4	Seal Inspection And Replacement
7.3.4.1	Replacing A Seal Bushing
7.3.4.2	Replacing A Seal Face
7.3.4.3	Lapping A Seal Face
7.3.4.4	Testing Integrity Of Replacement Seal
7.3.4.5	Replacing A Seal Locking Pin
7.3.5	Huhnseals

7.3.1 Standard And Hard Face Rotary Seals

The Rotary Seals used in the CONTHERM provide dependable sealing action for extended periods of time. The actual lifecycle of the rotary seal will be determined by the following combination of factors:

1. The product being processed.
2. The length of the duty cycles.
3. The temperature at which the CONTHERM is operated.

Because the rotary seal is maintained by the continuous moving contact between the two surfaces, the integrity of this sealing action will degrade over time. To ensure that the rotary seals are operating properly, you must perform periodic inspections of them as indicated in Table 7-2.

The seal in the Hard Face Seal Assembly is a single seal assembly that functions just like the 2-inch (51 mm) Standard Seal Assembly, but in this case the rotating seal face is of silicon carbide or tungsten material. A groove located on the rotary seal shell indicates that this is a hard face seal assembly.

Figures 7-1 and 7-2 identify the assemblies and components of the Standard And Hard Face Rotary Seals. Figure 7-1 shows these rotary seals in a CONTHERM equipped with cast product heads, while Figure 7-2 shows the seals in a CONTHERM equipped with tangential product heads.

Table 7-4 identifies the assemblies and components of the Standard And Hard Face Rotary Seals.

Table 7-4. Assemblies And Components Of the Standard And Hard Face Rotary Seals

Assembly/Component	Part Number (P/N)	Quantity
Seal Bushing Assembly	P/N 7402743-01	2
O-Ring	P/N 7401137-17	2
Seal Bushing	P/N 7401402-01	2
Set Screw	P/N 7401240-07	6
Seal Shell Assembly, 2.00 inch	P/N 7401268-02	2
Seal Face	P/N 7401323	2
O-Ring	P/N 7401137-18	2
Seal Shell	P/N 7401401-03	2
Inner Spring	P/N 7401862-01	2

As shown in Figures 7-1 and 7-2, the Standard And Hard Face Rotary Seals utilize the same assemblies and components for both the upper and lower product heads of the CONTHERM.

Insert Figure 7-1 -- 11 x 17 foldout drawing

Figure 7-1. Standard And Hard Face Seal Assemblies In CONTHERM With Cast Heads

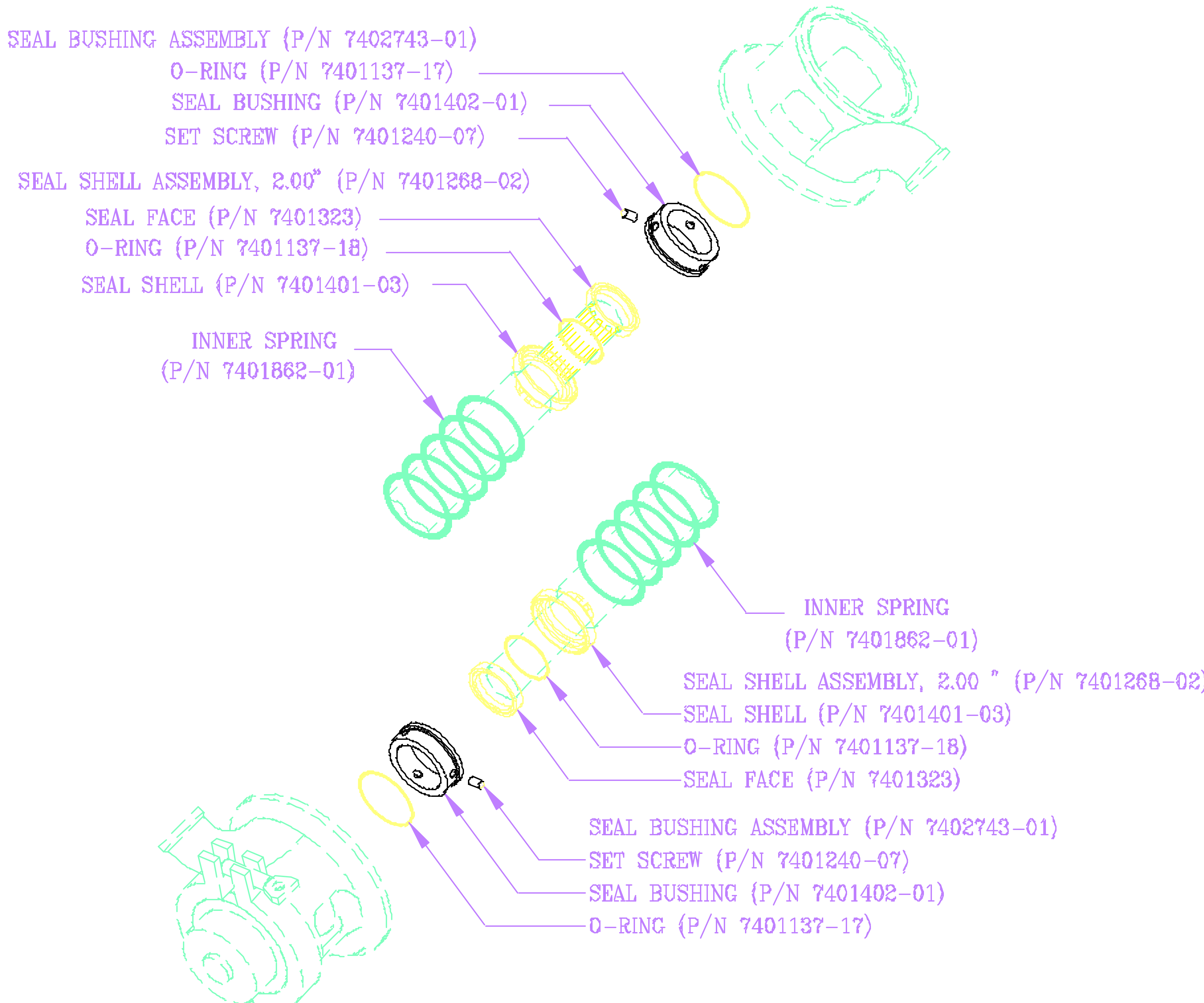


Figure 7-1. Standard And Hard Face Seal Assemblies, Cast Heads

Backside of Figure 7-1 -- 11 x 17 foldout drawing

Insert Figure 7-2 -- 11 x 17 foldout drawing

Figure 7-2. Standard And Hard Face Seal Assemblies In CONTHERM With Tangential Heads

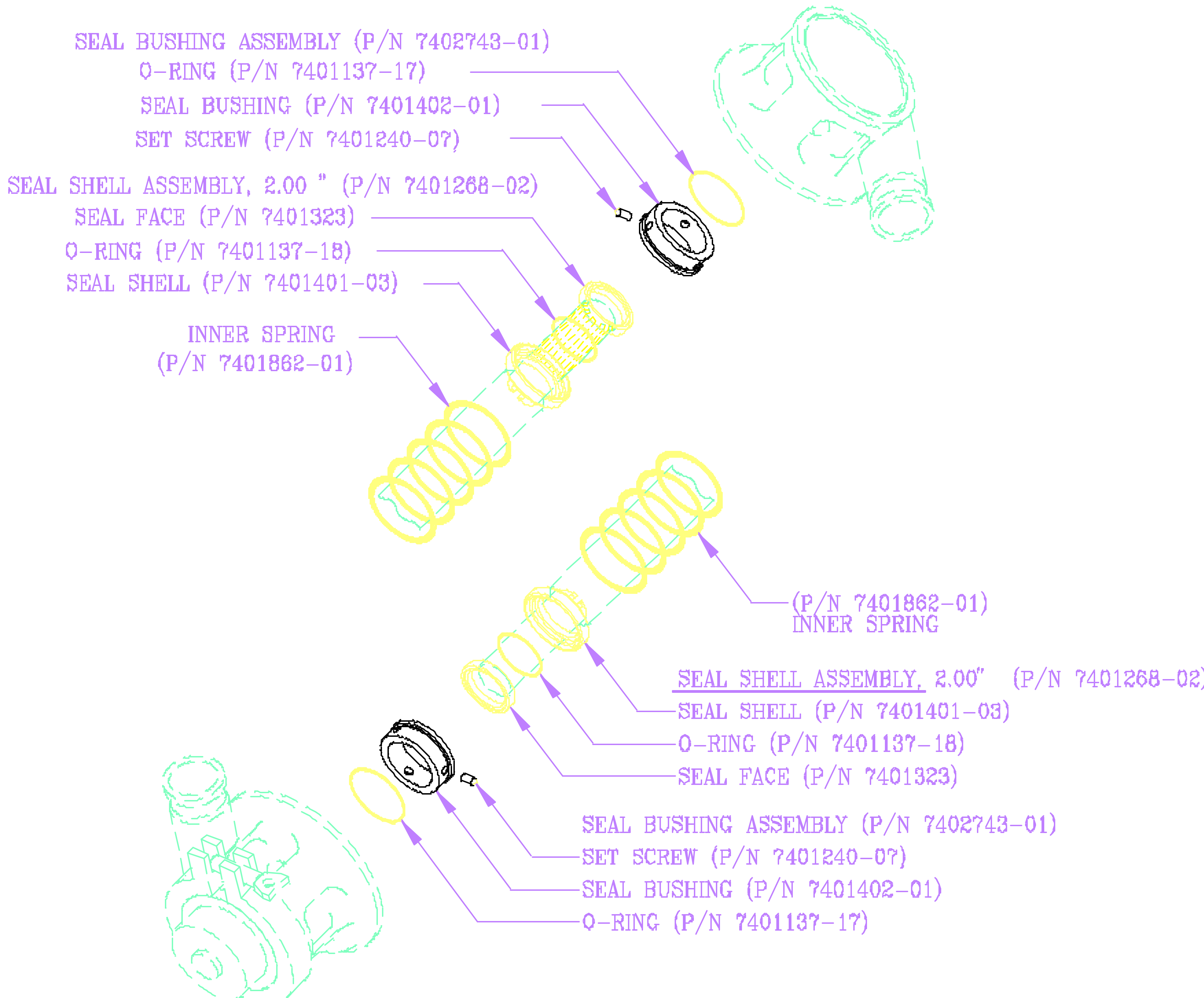


Figure 7-2. Standard And Hard Face Seal Assemblies, Tangential Heads

Backside of Figure 7-2 -- 11 x 17 foldout drawing

7.3.2 Flushed Standard And Flushed Hard Face Rotary Seals

The Flushed Standard Rotary Seal is used for applications that require aseptic sealing. It provides the same rotary sealing action as that of the standard rotary seal, but with one additional feature -- it sterilizes the non-product side of the seal and keeps it sterile during the CONTHERM's processing cycle. Sterilization is accomplished by applying steam at approximately 15 PSIG (1 BAR) during the product's sterilization and processing cycles.

The Flushed Hard Face Seal Assembly uses the Hardface Seal Assembly in combination with a second seal. The secondary seal face can be of the standard carbon or hard face material. Flexible hoses are provided for flushing media.

The inspection, maintenance, testing and seal bushing replacement procedures for the Flushed Standard and Flushed Hard Face Seal Assemblies are identical to those performed for the Standard Rotary And Hard Face Seals.

NOTE: The orientation of the flush connections is determined by the type of product heads used with your CONTHERM.

Figures 7-3 and 7-4 identify the assemblies and components of the Flushed Standard and Flushed Hard Face Seal Assemblies. Figure 7-3 shows the seals in a CONTHERM equipped with cast product heads, while Figure 7-4 shows the seals in a CONTHERM equipped with tangential product heads.

Tables 7-5 and 7-6 identify the assemblies and components of the Flushed Standard and Flushed Hard Face Seal Assemblies in CONTHERMs equipped with cast and tangential product heads, respectively.

Table 7-5. Assemblies And Components Of Flushed Standard and Flushed Hard Face Seal Assemblies In CONTHERMs With Cast Product Heads

Assembly/Component	Part Number (P/N)	Quantity
Flushed Seal Bushing Assembly (Upper And Lower Product Heads)	P/N 7401319-01	2
Cap Screw	P/N 7401242-06	2
Outer Seal Face	P/N 7401258-01	2
O-Ring	P/N 7401137-22	2
Seal Bushing	P/N 7401257-01	2
Quick Disconnect Nipple	P/N 7402077-01	2
O-Ring	P/N 7401137-17	4
Set Screw	P/N 7401240-07	6
Seal Shell Assembly, 1.50 inch	P/N 7401267-01	2
Seal Face	P/N 7401404-01	2
O-Ring	P/N 7401137-05	2
Seal Shell	P/N 7401403-01	2

Table 7-5. Assemblies And Components Of Flushed Standard and Flushed Hard Face Seal Assemblies In CONTHERMs With Cast Product Heads, Continued

Assembly/Component	Part Number (P/N)	Quantity
Seal Shell Assembly, 2.00 inch	P/N 7401268-02	2
Seal Face	P/N 7401323	2
O-Ring	P/N 7401137-18	2
Seal Shell	P/N 7401401-03	2
Hose Assembly	P/N 7401752-01	2
Quick Disconnect	P/N 7402077-01	2
Inner Spring	P/N 7401862-01	2
Outer Spring	P/N 7401388-01	2

Table 7-6. Assemblies And Components Of Flushed Standard and Flushed Hard Face Seal Assemblies In CONTHERMs With Tangential Product Heads

Assembly/Component	Part Number (P/N)	Quantity
Flushed Seal Bushing Assembly (Upper And Lower Product Heads)	P/N 7401319-02	2
Cap Screw	P/N 7401242-06	2
Outer Seal Face	P/N 7401258-02	2
O-Ring	P/N 7401137-22	2
Seal Bushing	P/N 7401257-02	2
Quick Disconnect Nipple	P/N 7402077-01	2
O-Ring	P/N 7401137-17	2
Set Screw	P/N 7401240-07	6
Seal Shell Assembly, 1.50 inch	P/N 7401267-01	2
Seal Face	P/N 7401404-01	2
O-Ring	P/N 7401137-05	2
Seal Shell	P/N 7401403-01	2
Seal Shell Assembly, 2.00 inch	P/N 7401268-02	2
Seal Face	P/N 7401323	2
O-Ring	P/N 7401137-18	2
Seal Shell	P/N 7401401-03	2

Insert Figure 7-3 -- 11 x 17 foldout drawing

Figure 7-3. Flushed Standard And Flushed Hard Face Seal Assemblies In CONTHERMs With Cast Product Heads

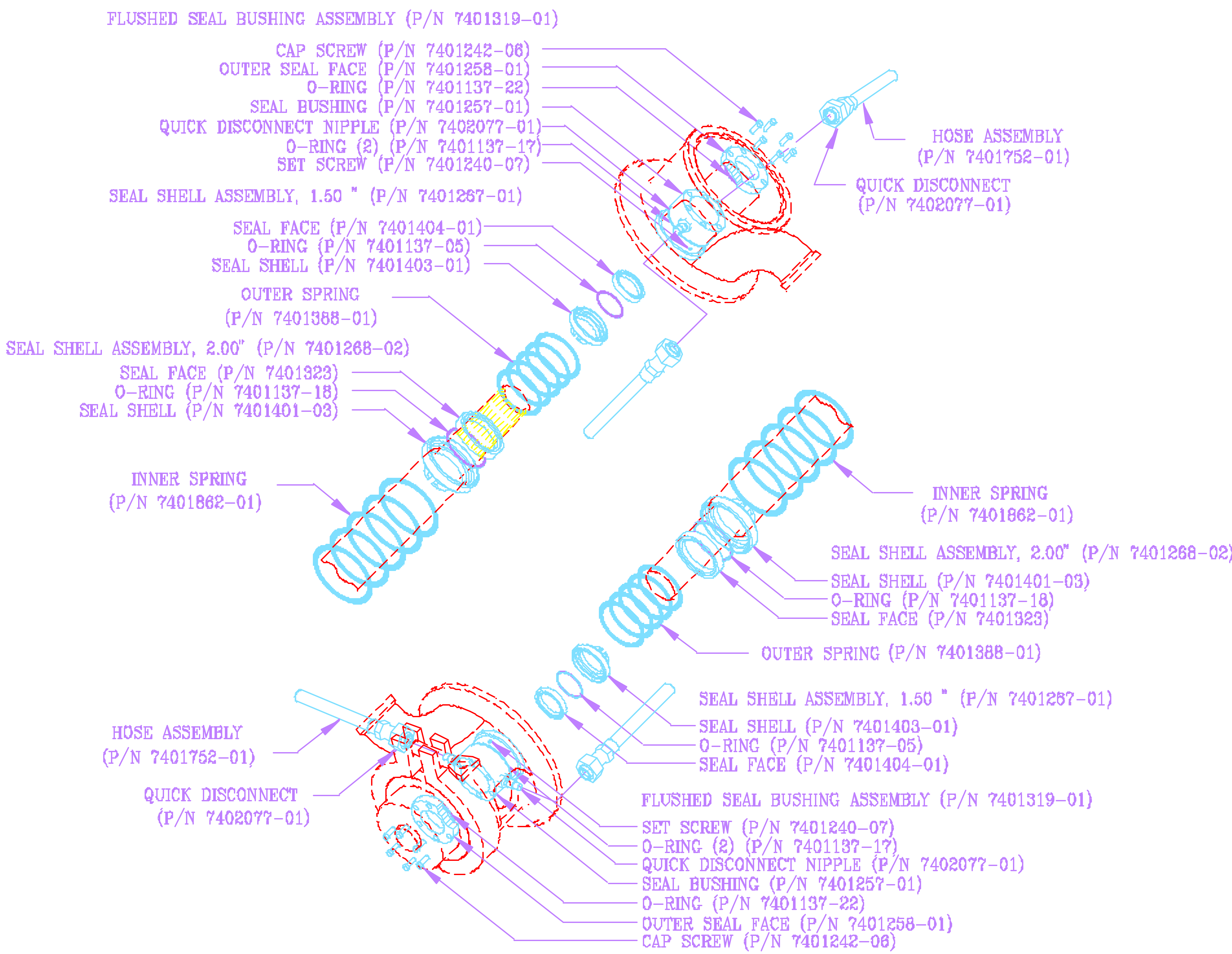


Figure 7-3. Flushed Standard And Flushed Hard Face Seal Assemblies, Cast Heads

Backside of Figure 7-3 -- 11 x 17 foldout drawing

Insert Figure 7-4 -- 11 x 17 foldout drawing

Figure 7-4. Flushed Standard And Flushed Hard Face Seal Assemblies In CONTHERM With Tangential Product Heads

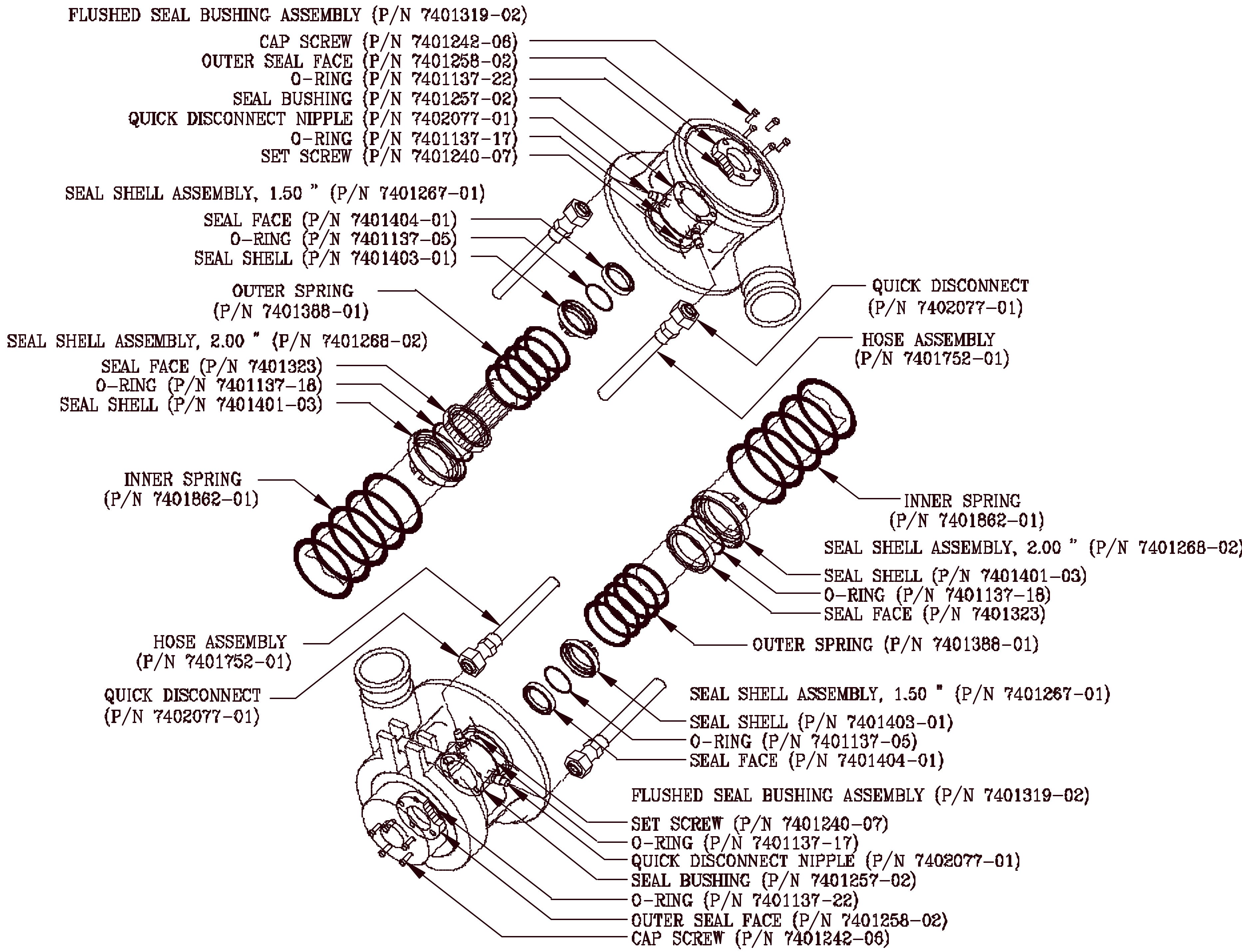


Figure 7-4. Flushed Standard And Flushed Hard Face Seal Assemblies, Tangential Heads

Backside of Figure 7-4 -- 11 x 17 foldout drawing

Table 7-6. Assemblies And Components Of Flushed Standard and Flushed Hard Face Seal Assemblies In CONTHERMs With Tangential Product Heads, Continued

Assembly/Component	Part Number (P/N)	Quantity
Hose Assembly	P/N 7401752-01	2
Quick Disconnect	P/N 7402077-01	2
Inner Spring	P/N 7401862-01	2
Outer Spring	P/N 7401388-01	2

As shown in Figures 7-3 and 7-4, the Flushed Standard and Flushed Hard Face Seal Assemblies utilize the same assemblies and components for both the upper and lower product heads of the CONTHERM.

7.3.3 Balanced Seals

The Balanced Seal Assembly is an alternative sealing option, primarily used for high pressure applications. It is a special option and cannot be interchanged with any other seal assembly. The balanced seal provides the same rotary sealing motion as that of the rotary seal. The inspection, maintenance, testing and seal bushing replacement procedures for the balanced seal are the same as those of the conventional rotary seal.

The balanced seal assembly has been designed to function properly throughout the range of high product pressures encountered by the CONTHERM when cooling and crystallizing fats and oils. The design of this seal assembly also prolongs the life of the seal face.

Figures 7-5 and 7-6 identify the assemblies and components of the balanced seal. Figure 7-5 shows a balanced seal in a CONTHERM equipped with cast product heads, while Figure 7-6 shows the balanced seal in a CONTHERM equipped with tangential product heads. Table 7-7 identifies the assemblies and components of the balanced seal.

Table 7-7. Assemblies And Components Of the Balanced Seal

Assembly/Component	Part Number (P/N)	Quantity
Seal Bushing Assembly (Upper And Lower Product Heads)	P/N 7402743-01	2
O-Ring	P/N 7401137-17	2
Seal Bushing	P/N 7401402-01	2
Set Screw	P/N 7401240-07	6
Seal Face	P/N 7401323-01	2
Seal Shell	P/N 7401925-01	2
Inner Spring	P/N 7401927-01-01	2
O-Ring	P/N 7401137-23	2

As shown in Figures 7-5 and 7-6, the balanced seal utilizes the same assemblies and components for both the upper and lower product heads.

Insert Figure 7-5 -- 11 x 17 foldout drawing

Figure 7-5. Balanced Seal Assembly In CONTHERMs With Cast Heads

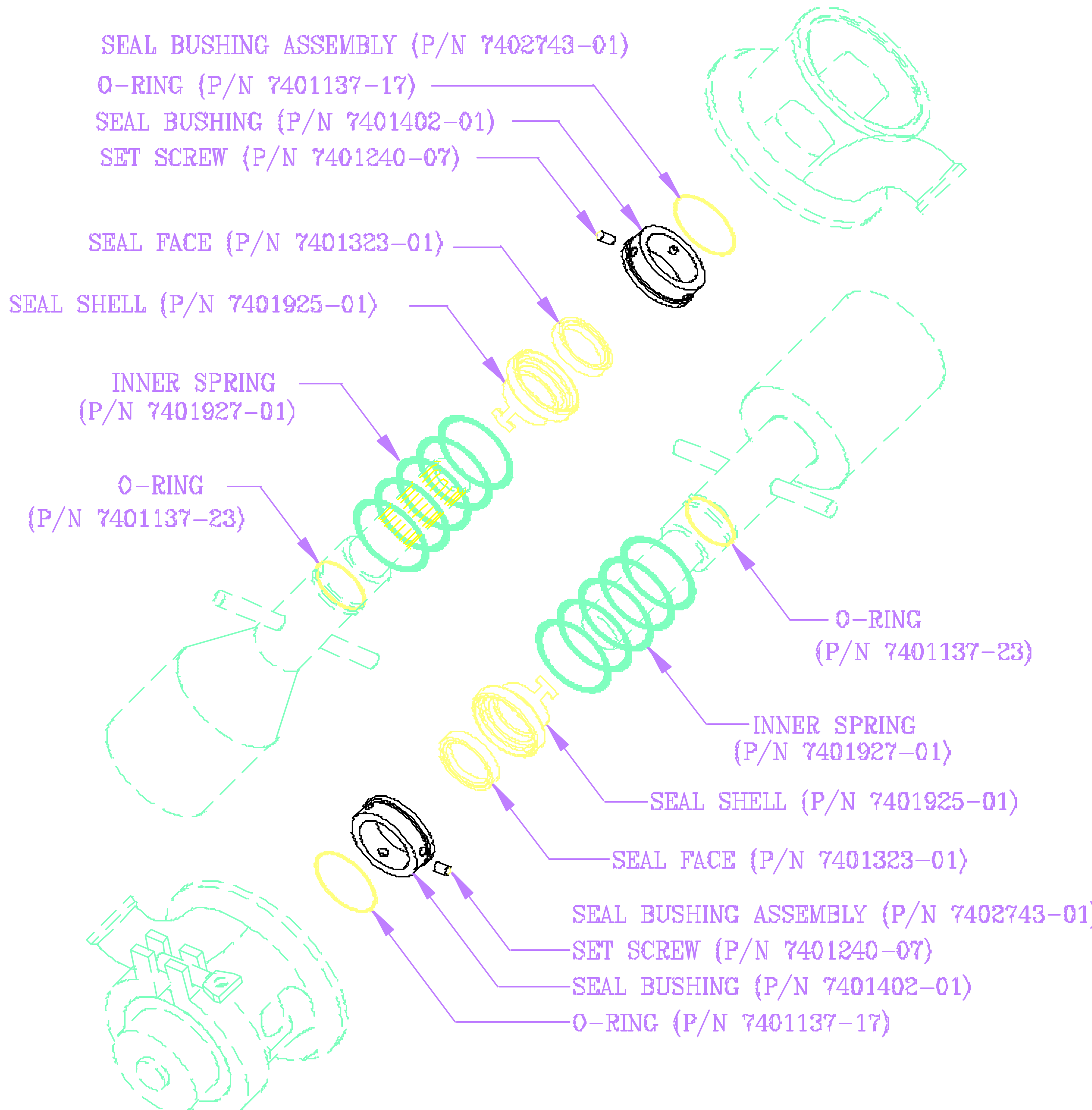


Figure 7-5. Balanced Seal Assemblies, Cast Heads

Backside of Figure 7-5 -- 11 x 17 foldout drawing

Insert Figure 7-6 -- 11 x 17 foldout drawing

Figure 7-6. Balanced Seal Assembly In CONTHERM With Tangential Product Heads

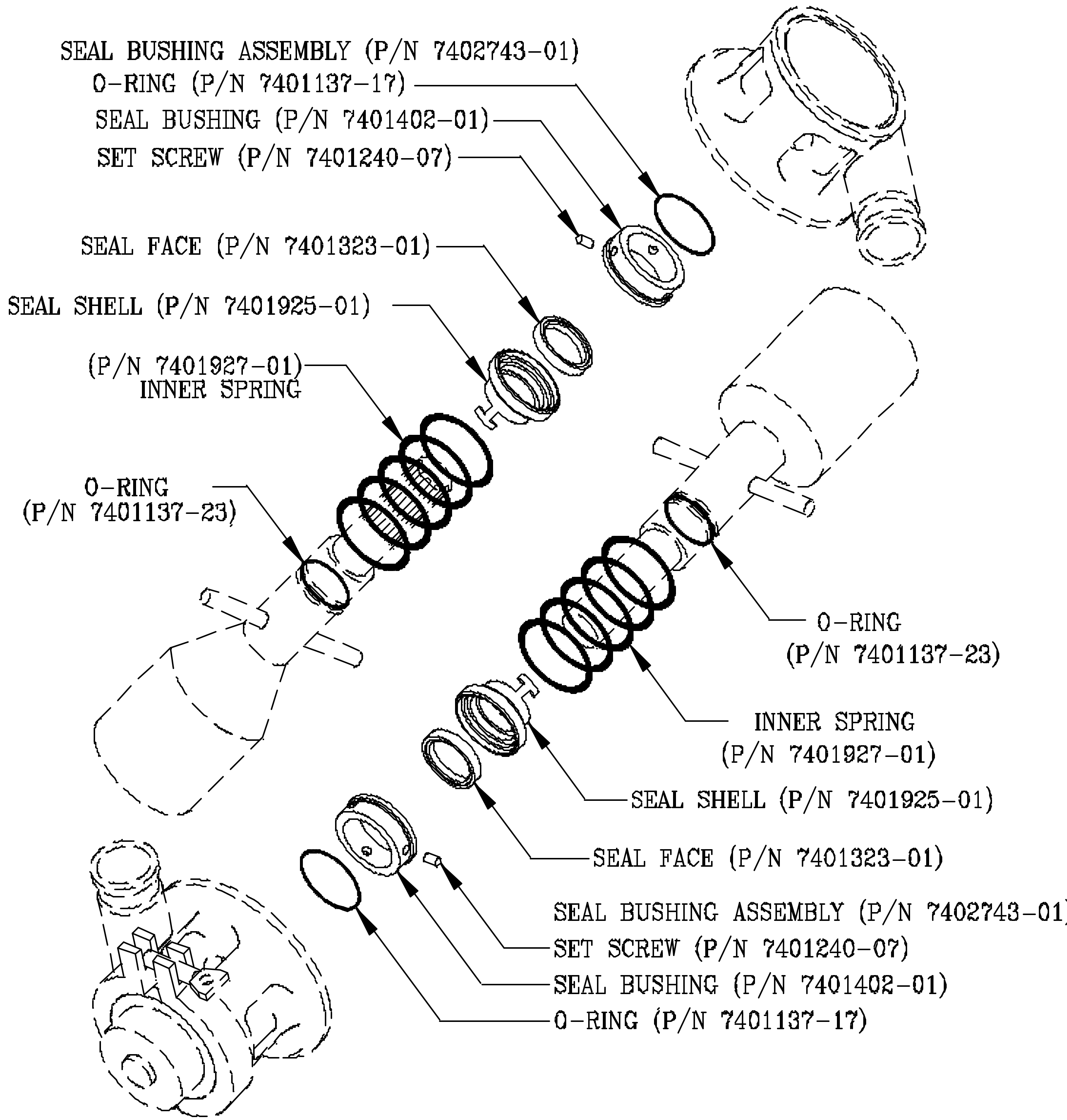


Figure 7-6. Balanced Seal Assemblies, Tangential Product Heads

Backside of Figure 7-6 -- 11 x 17 foldout drawing

7.3.4 Seal Inspection And Replacement

This section describes how to inspect and replace the CONTHERM's seals (Standard and Hard Face Rotary Seals, Flushed Standard and Flushed Hard Face Rotary Seals, and Balanced Seals). Seal inspection and replacement are easy tasks that can be performed by one individual in only a few minutes. The seal inspection process basically consists of looking for signs of chipping, evidence of leaks, worn or failed O-rings, or a roughened seal face or seal bushing. A detailed Seal Inspection and Replacement procedure is provided in Table 7-8.

Equipment Needed

You will need the following items to properly maintain and replace a seal:

- Lapping Film, 30 micron (P/N 7402087-02)
- Lapping Film, 15 micron (P/N 7402087-01)
- Chipping Tool (a straight slot screwdriver will be adequate)
- Oven capable of providing a temperature of 550^{o}F (290^{o}C)
- Hex Wrench (0.156-inch)
- Heat Protective Gloves
- Lapping Plate, flat to three light bands (P/N 7401603-01)

NOTE: If either of the lapping films are unavailable, you can substitute #400 grit abrasive paper for the 30 micron film and crocus cloth for the 15 micron film.

CAUTION

1. If your configuration utilizes two or more Stack Assemblies, do not operate more than one stack valve handle at a time.
2. Do not operate the Rotor Lifting System until you have checked all fittings. Tighten nuts or replace any leaking fittings before operating the system.

WARNING

1. Do not attempt to disassemble the CONTHERM if its rotor is rotating.
2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping.
3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps.
4. Keep the area under the CONTHERM clear of hands, feet, piping and other obstructions.
5. Do not remove the lower head clamp or the lower bearing clamp until you have verified that the hydraulic Rotor Lifting System is turned on and is operating correctly.
6. The blades attached to the rotor's rotor pins may be very sharp. Wear protective gloves while handling the rotor.

Table 7-8. Seal Inspection And Replacement

Step	Action
1	Using the rotor lift helper plate, prepare the CONTHERM for inspection of the lower seal. **Note**: You must use the Rotor Lift Helper Plate to inspect the seals. Refer to Table 6-5, Operating The Rotor Lift Helper Plate in Chapter Six, Operation, for its detailed operating procedure.
2	Inspect the lower seal. If your inspection indicates the need to replace any component of the seal assembly, remove the seal shell by disengaging it from the rotor's locking pin. Push the seal shell assembly and rotate it to disengage the locking pin. Remove the seal bushing from the product head by loosening the three set screws (Refer to Section 7.3.4.1, Replacing The Seal Bushing, for the detailed procedure).
3	After completing the inspection and/or component replacement of the lower seal, raise the lower product head to engage the rotor.
4	Release the lower head clamp at the cylinder end hub and remove the rotor lift helper plate.
5	Lower the rotor assembly to allow replacement of the bottom row of blades.
6	Inspect the CONTHERM's upper product seal by lowering the rotor until the upper product head assembly is completely lowered and the upper seal is exposed.
7	If your inspection indicates the need to replace any component of the upper seal assembly, remove the seal shell by disengaging it from the rotor's locking pin. Push the seal shell assembly and rotate it to disengage the locking pin. Remove the seal bushing from the product head by loosening the three set screws (Refer to the following section, Section 7.3.4.1, Replacing The Seal Bushing, for the detailed procedure).
8	After completing the inspection and/or component replacement for the upper seal, raise the hydraulic rotor lift to mate the lower head assembly to the cylinder and the hub. Then reattach the lower product head clamp. **Note**: Do not over tighten the product head clamp. Minimal force applied with a hand wrench is sufficient for tightening the nut. A torque of 10 foot-pounds (13.5 Newton-Meters) is recommended.

7.3.4.1 Replacing The Seal Bushing

Table 7-9 provides a detailed procedure for replacing the seal bushing. This procedure applies to the seal bushing (P/N 7401402-01) used in the Standard and Hard Face Rotary Seals and the Balanced Seals, and the seal bushing (P/N 7401257-01) used in the Flushed Standard and Flushed Hard Face Rotary Seals.

Table 7-9. Replacing The Seal Bushing

Step	Action
1	If the seal bushing shows wear or is cracked or chipped, it must be replaced. **Note**: This procedure assumes that you have been referenced here from the procedure provided in Table 7-8, Inspecting And Replacing A Seal. Please review all Safety Precautions included in Section 7.3.4, Seal Inspection And Replacement, before continuing.
2	Loosen the three set screws (P/N 7401240-07) from the inside of the seal bushing and push the bushing out from the product head.
3	Remove the three (3) set screws, if present, from the new seal bushing.
4	Fill the three vacant holes in the seal bushing with a food grade silicone type cement.
5	Install the new seal bushing into the product head. Verify that the bushing is positioned absolutely flat against the product head.
6	Insert the three set screws into the seal bushing. Snug up these screws (lightly tighten) with an 0.156 inch hex wrench. The three set screws should be tightened to approximately 20 to 24 in-lb. **Note**: Do not over tighten these set screws. If they are over tightened, their sealing surface will become distorted.

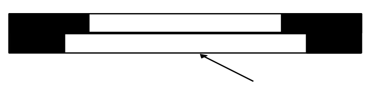
7.3.4.2 Replacing The Seal Face

The seal face must be replaced if it is cracked or broken, or is worn down to the point where there is no longer any seal face protruding from the seal shell. Alfa Laval Contherm Inc. recommends that you always have at least one spare seal face assembly available so that replacement may be performed quickly and without undue delay.

Replacing the seal face is an easy and straightforward procedure, but it must be done correctly to ensure that the seal will function properly. Table 7-10 provides a detailed procedure for replacing the seal face.

> **Note**: The procedure in Table 7-10 assumes that you have been referenced here from the procedure provided in Table 7-8, Inspecting And Replacing A Seal. Please review all Safety Precautions included in Section 7.3.4, Seal Inspection And Replacement, before continuing.

Table 7-10. Replacing The Seal Face

Step	Action
1	After removing the O-ring, chip out the damaged seal face. **Note**: Use care when chipping out the seal face. Do not scratch or distort the seal shell.
2	Wash the seal shell with detergent and water to remove any product residue and/or remains of the seal face. Rinse thoroughly.
3	Place the seal shell in an oven at 550°F (290°C) for 30 minutes.
4	Place a new seal face in a freezer for approximately one hour.
5	Remove the new seal face from the freezer and place it on a lapping plate, with the relieved side down. 
6	Use heat protective gloves to remove the seal shell from the oven and place it over the seal face. Press the seal shell down evenly over the seal face and rotate it to ensure proper seating.
7	Allow the assembly to cool to room temperature. **Note**: Do <u>not</u> use water to cool the assembly as this will crack the seal face.
8	Lap the seal face in accordance with the procedure provided in Table 7-11 of the following section, Section 7.3.4.3, Lapping A Seal Face.
9	Install a new O-ring and apply a food grade lubricant to the inside of the seal shell. Install the seal assembly onto the rotor.
10	Test for leaks by operating the CONTHERM with water as the product for several minutes. If a small leak occurs, allow the unit to operate for at least 20 minutes to permit the sealing surfaces to lap themselves for a precision fit. If the leak continues, check and verify that the seal has been properly assembled and installed.

7.3.4.3 Lapping A Seal Face

If the seal has a slightly roughened or pitted surface, it may be possible to lap the surface and salvage the seal face. Table 7-11 provides a detailed procedure for lapping a seal face.

Note: The procedure in Table 7-11 assumes that you have been referenced here from the procedure provided in Table 7-8, Inspecting And Replacing A Seal. Please review all Safety Precautions included in Section 7.3.4, Seal Inspection And Replacement, before continuing.

Table 7-11. Lapping A Seal Face

Step	Action
1	Remove the seal shell assembly from the rotor.
2	Place a piece of the 30 micron film on an adequate lapping plate. **Note**: Any surface other than a lapping plate will destroy the surface of the seal face.
3	Using very light pressure, move the seal shell, with the carbon face down, over the film in a figure “8" type of motion.
4	Examine the surface often as the 30 micron film removes material rapidly.
5	When the defect appears to have been removed, replace the 30 micron film with the 15 micron film. Repeat the lapping with the 15 micron film, using the same figure “8” type of motion, until the seal face is polished.
6	When the seal face is polished with the 15 micron film, replace the film with ordinary bond paper and repeat the polishing to wipe away any remaining residue.
7	Install the seal shell assembly onto the rotor assembly.

7.3.4.4 Replacing The Seal Locking Pin

When a seal leak is detected, visually inspect the CONTHERM's rotor and verify that the seal locking pin (P/N 7401439-01) is not broken or damaged. If it is broken or damaged, follow the directions provided in Table 7-12 to replace it.

The seal pin locations for rotors with external bearings are identified and shown in Figure 7-7 and Table 7-13. Figure 7-8 and Table 7-14 identify the seal pin locations for rotors with internal bearings.

Note: The procedure in Table 7-12 assumes that you have been referenced here from the procedure provided in Table 7-8, Inspecting And Replacing A Seal. Please review all Safety Precautions included in Section 7.3.4, Seal Inspection And Replacement, before continuing.

Table 7-12. Replacing The Seal Locking Pin

Step	Action
1	Remove the CONTHERM's rotor and move it to an area where you can easily work on it.
2	If required, drill a hole, using a #32 (0.116-inch DIA.) drill bit, to a depth of 0.50 inch (12.7 mm). **Note**: Refer to Tables 7-13 and 7-14 and Figures 7-7 and 7-8 for the specified dimensions required for rotor type and configuration information.
3	Install a seal locking pin into the 0.50 inch (12.7 mm) deep hole and tap the pin with a hammer to properly set it into the rotor.
4	Repeat Steps 2 and 3 for any other damaged seal locking pins.

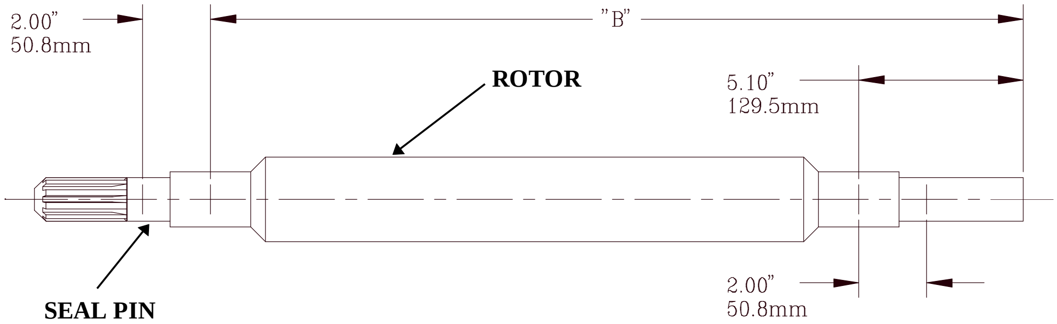


Figure 7-7. Seal Pin Locations For Rotors With External Bearings

Table 7-13. Seal Pin Locations For Rotors With External Bearings

Rotor Type	CONTHERM Model “B”		
	6 x 3	6 x 6	6 x 9
Standard Rotor	27.28 inches (692.9 mm)	51.28 inches (1302.5 mm)	75.28 inches (1912.1 mm)
Standard Rotor (Extended for Vapor Dome)	37.52 inches (953.0 mm)	61.52 inches (1562.6 mm)	85.52 inches (2172.2 mm)
Standard Rotor (Extended Top & Bottom for Head Extension)	38.14 inches (968.8 mm)	62.14 inches (1578.4 mm)	86.14 inches (2188.0 mm)
Standard Rotor (Extended Top for Head Extension)	32.71 inches (830.8 mm)	56.71 inches (1440.4 mm)	80.71 inches (2050.0 mm)
Standard Rotor (Extended Top for Vapor Dome and Extended Bottom for Head Extension)	42.95 inches (1090.9 mm)	66.95 inches (1700.5 mm)	90.95 inches (2310.1 mm)

NOTE: Dimensions provided for the external bearing style are from the end of the rotor with the rotor end (P/N 7401410) removed. The dimensions provided in Table 7-13 are for the “B” dimension shown in Figure 7-7.

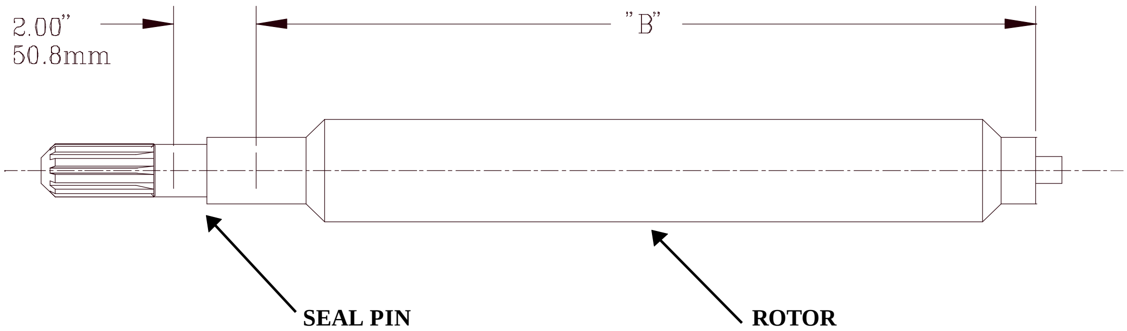


Figure 7-8. Seal Pin Locations For Rotors With Internal Bearings

Table 7-14. Seal Pin Locations For Rotors With Internal Bearings

Rotor Type	**CONTHERM Model "B"**		
	6 x 3	**6 x 6**	**6 x 9**
Inboard Rotor	21.66 inches (550.2 mm)	45.66 inches (1159.8 mm)	69.66 inches (1769.4 mm)
Inboard Rotor (Extended for Vapor Dome)	31.90 inches (810.3 mm)	55.90 inches (1419.9 mm)	79.90 inches (2029.5 mm)
Inboard Rotor (Extended for Head Extension)	27.09 inches (688.1 mm)	51.09 inches (1297.7 mm)	75.90 inches (1907.3 mm)

NOTE: The dimensions provided in Table 7-14 are for the "B" dimension that is shown in Figure 7-8.

7.3.4.5 Testing For Integrity After Maintenance

To verify the integrity of the CONTHERM after performing maintenance on the seals, operate the CONTHERM using water as the product for several minutes. If a leak occurs, allow the unit to operate for at least 20 minutes to permit the sealing surfaces to lap.

7.3.5 Huhnseals

The Huhnseal is a heavy duty, spring loaded, hygienically designed rotary seal that allows the CONTHERM to be used for long production runs without requiring maintenance. It provides extra long life and is used in the processing of highly abrasive products. The Huhnseal requires rotor modifications and is not interchangeable with other mechanical rotary seals. Refer to Chapter Three, Section 3.8.5, for a more detailed description of the Huhnseal Seal Assembly.

7.3.5.1 Inspecting And Replacing The Huhnseal

This section describes how to inspect and replace the CONTHERM's Huhnseals. Seal inspection and replacement are easy tasks that can be performed by one individual in only a few minutes. The seal inspection process basically consists of looking for signs of chipping, evidence of leaks, worn or failed O-rings, or a roughened seal face or seal bushing. The procedure for inspecting the Huhnseal and replacing it with a new one is described in Table 7- 15.

Equipment Needed

Use the following equipment to inspect and replace the Huhnseal.

- Silicone Based Gel
- Gage Block, P/N 7403809-01
- Small screwdriver
- Huhnseal Rebuilding Kit (Available from Alfa Laval Contherm Inc. Contact your local Alfa Laval Contherm Inc. or Tetra Laval representative for more information.)

CAUTION	1. If your configuration utilizes two or more Stack Assemblies, do not operate more than one stack valve handle at a time. 2. Do not operate the Rotor Lifting System until you have checked all fittings. Tighten nuts or replace any leaking fittings before operating the system.

WARNING	1. Do not attempt to disassemble the CONTHERM if its rotor is rotating. 2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping. 3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps. 4. Keep the area under the CONTHERM clear of hands, feet, piping and other obstructions. 5. Do not remove the lower head clamp or the lower bearing clamp until you have verified that the hydraulic Rotor Lifting System is turned on and is operating correctly. 6. The blades attached to the rotor's rotor pins may be very sharp. Wear protective gloves while handling the rotor.

Table 7-15. Inspection And Replacement Of The Huhnseal

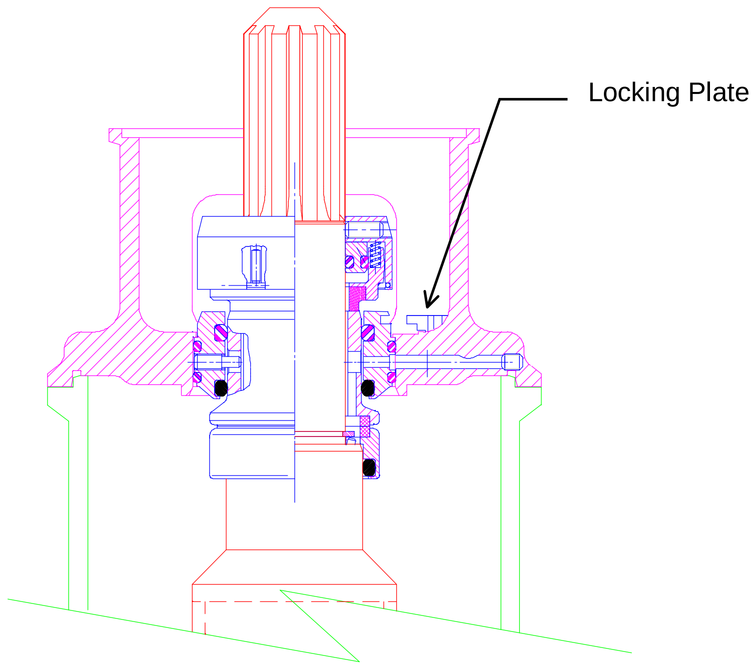
Step	Action
1	Disengage the locking plate from the top Seal Assembly (and from the lower Seal Assembly if it is equipped with a locking plate) prior to to trying to lower the rotor. 
2	Remove the rotor from the CONTHERM. Refer to the appropriate portion of Section 7.5, Bearings, for the detailed procedure describing how to remove the rotor from CONTHERMs equipped with the Rotor Hold Down Feature. **Note**: You must use the Rotor Lift System to lower the CONTHERM's rotor for removal from the unit. Refer to Table 6-4, Operating The Hydraulic Rotor Lifting System in Chapter Six, Operation, for its detailed operating procedure.
3	Loosen the set screws located on the Stop Ring Assembly.
4	Remove the rotor's upper and lower seal assemblies.
5	Inspect the Huhnseal's seal assemblies and O-rings on each end of the rotor.
6	If necessary, replace the old seals and install new Huhnseals on each end of the rotor.

Table 7-15. Inspection And Replacement Of The Huhnseal, Continued

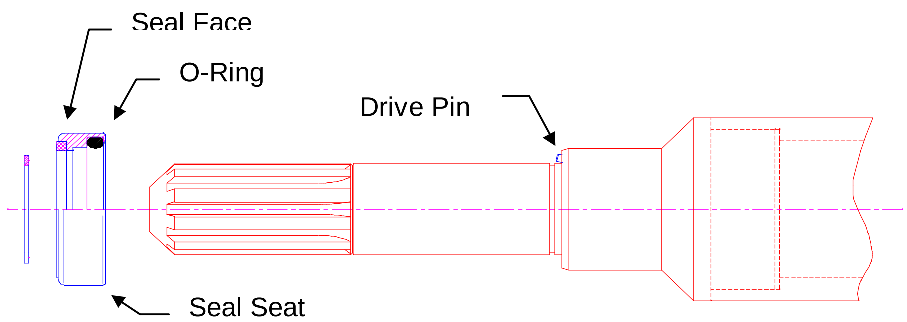
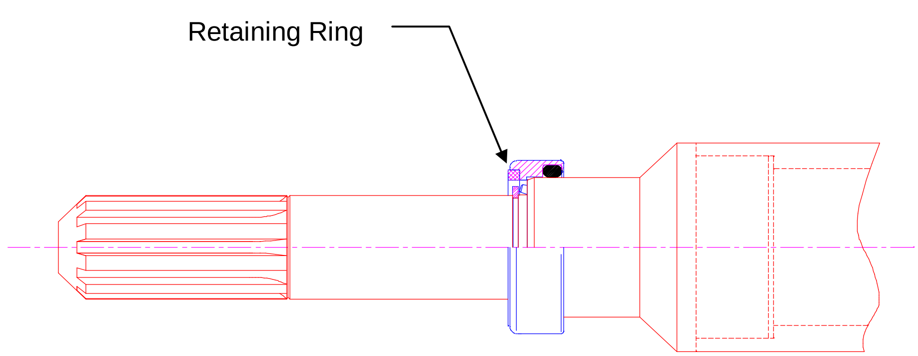
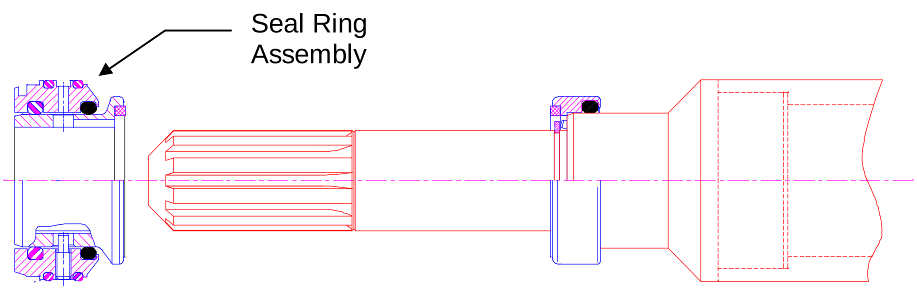
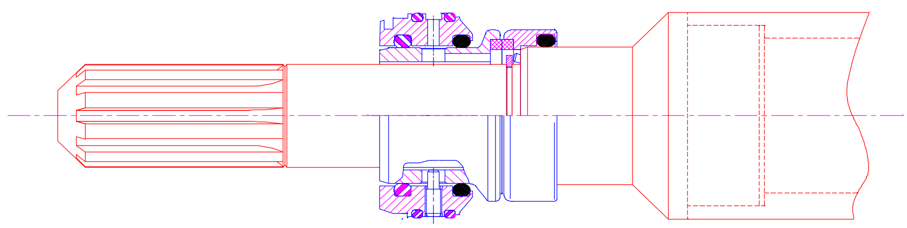
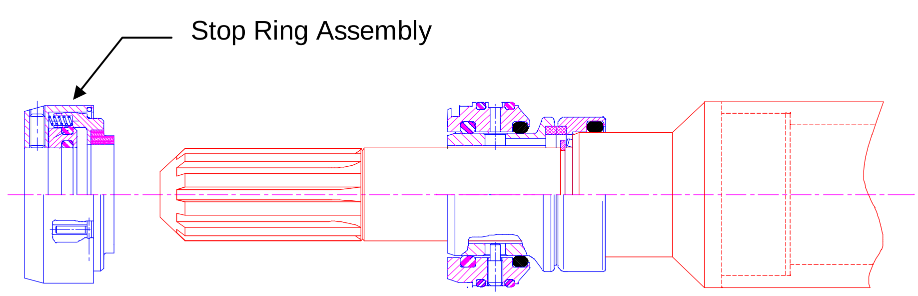
Step	Action
7	Lubricate the O-ring of the Huhnseal's seal seat with a silicone based gel and install the seal seat onto the rotor. Refer to the following figure. **Note**: The slot of the seat must line up with the drive pin located on the rotor. 
8	Install the Huhnseal's retaining ring onto the rotor. Refer to the following drawing. **Note**: Be careful while installing the ring onto the rotor. Do not mar or scratch the seal face. 

Table 7-15. Inspection And Replacement Of The Huhnseal, Continued

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>9</td><td>Place the Huhnseal’s Seal Ring Assembly onto the rotor. Refer to the following drawings.




</td></tr>
<tr><td>10</td><td>Install the Huhnseal’s Stop Ring Assembly onto the rotor as shown in the following drawings.



</td></tr>
</table>

Table 7-15. Inspection And Replacement Of The Huhnseal, Continued

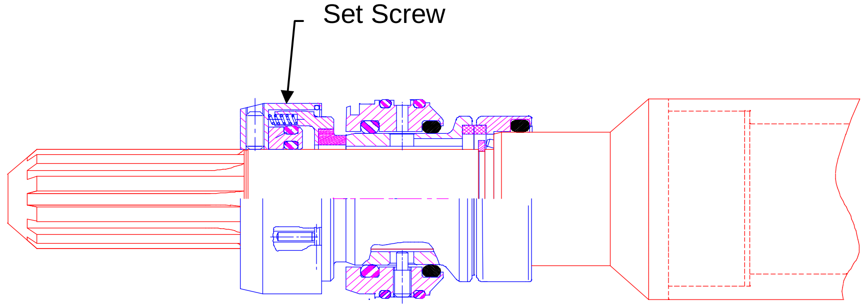
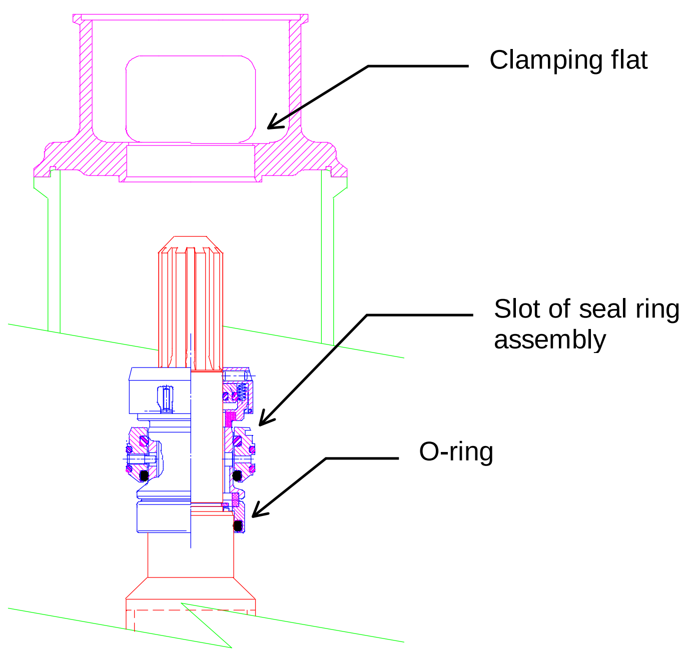
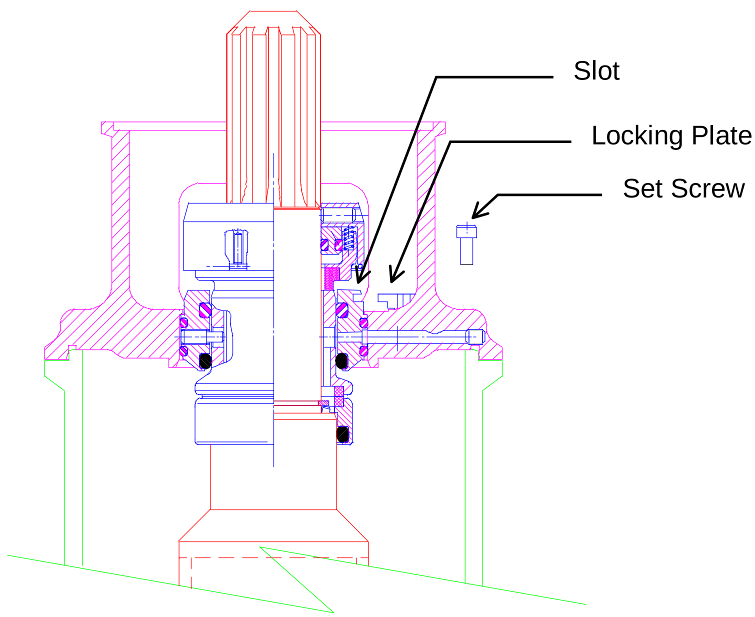
Step	Action
10, Continued	Compress the Stop Ring Assembly until a measurement of 3.838 inch is attained between the top of the Stop Ring Assembly and the back edge of the seal seat. When this dimension is attained, lock the Stop Ring Assembly onto the rotor by tightening the set screws. Use the gage block, P/N 7403809-01, that is supplied with each Huhn seal kit to help perform this compression procedure. 
11	Repeat Steps 7 though 10 for the Huhnseal Seal Assembly on the other end of the CONTHERM's rotor.
12	Lubricate the two O-rings located on the outside diameter of the Huhnseal's Seal Ring Assembly. Install the rotor, with seal assembly(s) into the CONTHERM unit. **Note**: Use the Rotor Lift System to raise the CONTHERM's rotor back into the unit. Refer to Table 6-4, Operating The Hydraulic Rotor Lifting System in Chapter Six, Operation. **Important**: Please carefully note the location of the slot in the Huhnseal's Seal Ring Assembly. This slot **<u>must</u>** align with the center of the clamping flat located on the product head. 

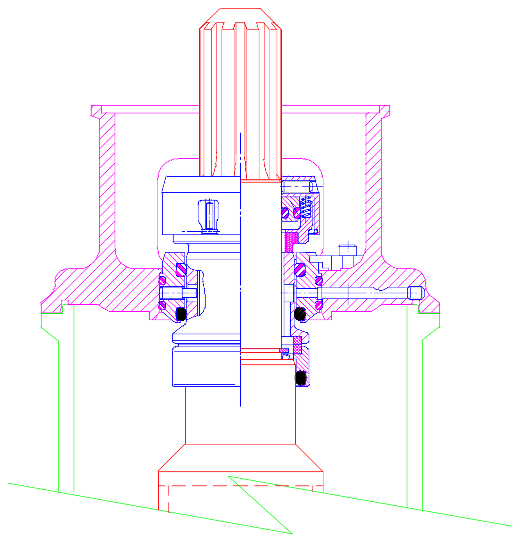
Table 7-15. Inspection And Replacement Of The Huhnseal, Continued

Step	Action
12, Continued	After the CONTHERM's rotor has been completely installed, verify that the Seal Ring Assembly is completely seated into the product head. The assembly is completely seated when the entire slot of the seal ring is protruding through the product head. If this is **not** the case, use a small screwdriver to "pull up" on the seal ring.
13	Slide the locking plate into the slot of the Huhnseal's Seal Ring Assembly. Secure the seal assembly into place by tightening the two set screws. Refer to the following drawings. The first drawing provides parts location and identification information. The second drawing, shown on the next page, shows the Huhnseal Seal Assembly secured into place on the product head. 

CAUTION

Do not operate the CONTHERM until you have properly adjusted the CONTHERM's Rotor Stop. Refer to Section 7.7, Rotor Stop Adjustment (Non Hold Down Style) for the detailed procedure.

Table 7-15. Inspection And Replacement Of The Huhnseal, Continued

Step	Action
13, Continued	Seal Ring Assembly Shown Secured To Locking Plate And Product Head:  Huhnseal Seal Assembly shown secured into place on the product head.

7.4 SCRAPING BLADES

The following sections describe how to install, inspect, and maintain the blades used with your CONTHERM. Table 7-16 shows how the information in this section is organized.

Table 7-16. Installation And Maintenance Procedures For The Scraping Blades

Section	Description
7.4.1	Installing The Scraping Blades
7.4.2	Inspecting The Scraping Blades
7.4.3	Maintenance Of The Scraping Blades
7.4.4	Maintenance Of The Blade Pins

CAUTION Stainless Steel Scraping Blades can only be used in CONTHERMs that have plated or coated heat exchange cylinders.

7.4.1 Installing The Scraping Blades

Blade pins are used to attach the scraping blades to the rotor. A slot at each end of the blade pin will accept the blade. For CONTHERMs with plastic blades, each blade's insert rod is inserted into the slot on the blade pin. If stainless steel blades are used, the back edge of the blade is inserted into the slot.

After the blades are installed, they must be rotated into their proper position on the rotor. When the blades are in their correct position, they will be secured and held firmly in place.

NOTE: If your CONTHERM was supplied prior to 1 January 1984, all the slots in the blade pins are oriented identically. After 1 January 1984, all blade pins, with the exception of the top pin for each blade, have been turned (rotated) 180°.

Figure 7-9 shows the blade pin orientation for blade pins manufactured and provided by Alfa Laval Contherm Inc. after 1 January 1984. The procedure for installing the CONTHERM's plastic or stainless steel blades is provided in Table 7-17.

Table 7-17. Installing The Blades

Step	Action
1	Place the plastic blade's insert rod or the stainless steel blade's back edge into the slot for the top (uppermost) blade pin. The beveled side of the blade should be facing toward the rotor.
2	Rotate the blade, beveled side first, until the rest of the blade can be inserted into the remaining pins.

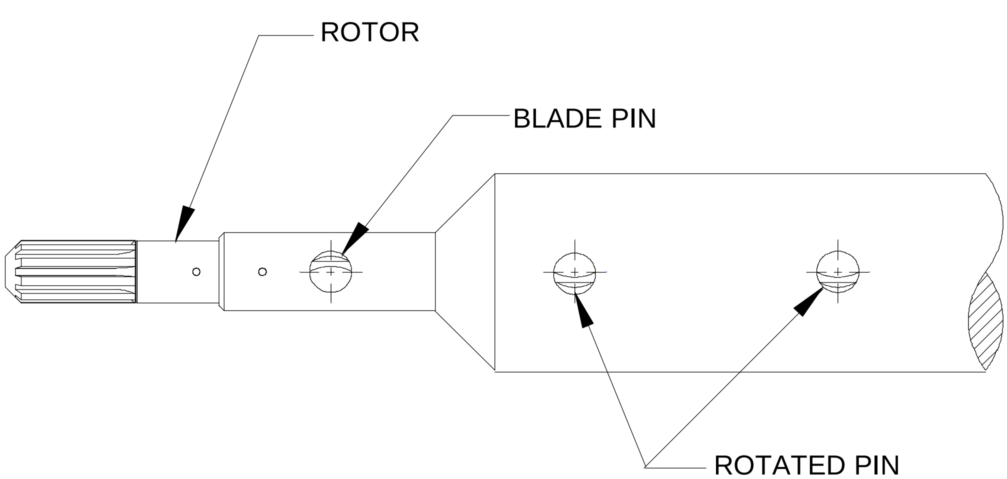


Figure 7-9. Blade Pin Orientation

7.4.2 Inspecting The Scraping Blades

The CONTHERM's blades should be inspected regularly to ensure the continued operational efficiency of the unit. Blade inspection should be performed in accordance with the schedule recommended in Table 7-2, Scheduled Maintenance For The CONTHERM.

Use the procedure provided in Table 7-18 to inspect your CONTHERM's plastic or stainless steel blades.

Table 7-18. Inspecting The Blades

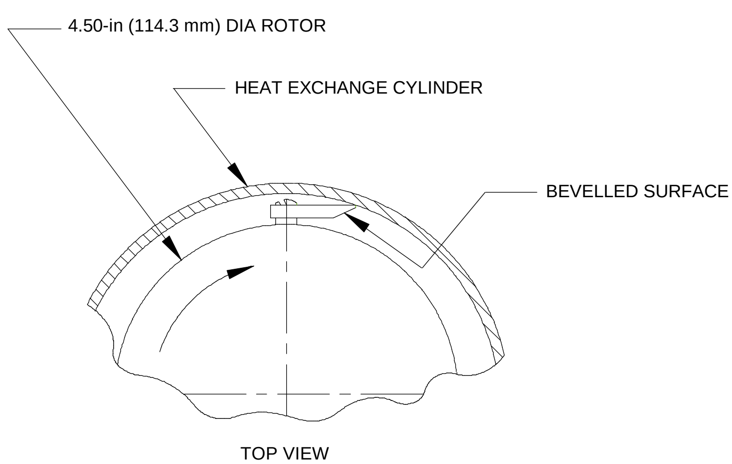
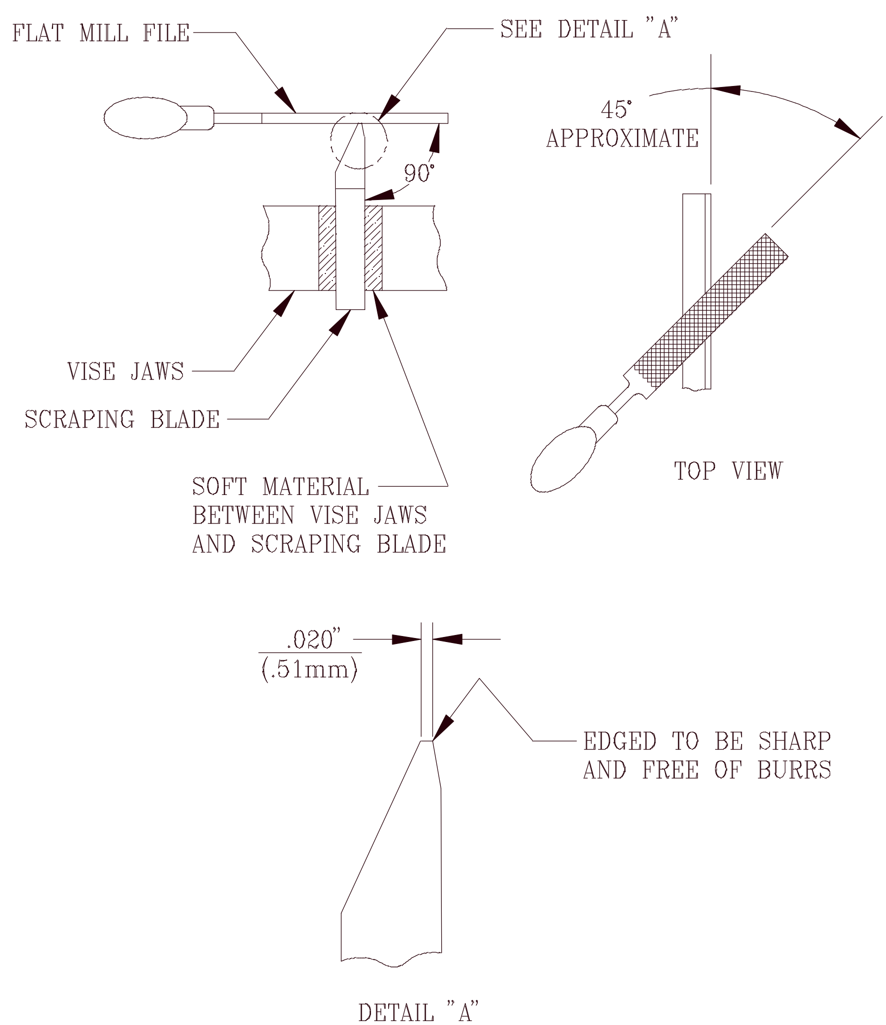
<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Remove the CONTHERM's lower head clamp (P/N 7401106-01 or 7403038-01) and lower the rotor, using the hydraulic rotor lifting device.
Note: Refer to Table 6-4, Operating The Hydraulic Rotor Lift System, and Table 6-5, Operating The Rotor Lift Helper Plate in Chapter Six, Operation, for the detailed operating procedures for the rotor lift system and rotor lift helper plate.</td></tr>
<tr><td>2</td><td>With the rotor lowered, visually inspect the blades to determine if there is a razor sharp edge along the blade's scraping surface.
Note: The parting edge of the blade should not be sharp.
If a razor sharp edge is discovered, dress the blade's edge as described in Table 7-19, Dressing The CONTHERM's Scraping Blades, Section 7.4.3, Maintenance Of The Scraping Blades.</td></tr>
<tr><td>3</td><td>Visually inspect the metallic inserts of the plastic or stainless steel blades for wear or breakage. If wear or breakage is found, replace the blade.</td></tr>
<tr><td>4</td><td>Install the new blades with the beveled surface pointing toward the center of the cylinder as shown in Figure 7-10. Inspect the blades and verify that they are installed properly and are secured to the rotor.</td></tr>
<tr><td colspan="2">

Figure 7-10. Orientation Of Blade's Beveled Surface In Heat Exchange Cylinder</td></tr>
<tr><td>5</td><td>Use the rotor lift system to raise the rotor assembly.</td></tr>
<tr><td>6</td><td>Tighten the CONTHERM's lower head clamp</td></tr>
</table>

7.4.3 Maintenance Of The Scraping Blades

Inspect your CONTHERM's scraping blades periodically to ensure that a razor sharp edge is not present on their scraping surface. If a razor sharp edge is found, remove it by dressing the blade as shown in Figure 7-11 and described in Table 7-19.

Table 7-19. Dressing The CONTHERM's Scraping Blades

Step	Action
1	Remove the blade from the rotor.
2	With the blade clamped in a vise, pass a file over the scraping edge to create a flat of approximately 0.020 inches (0.5 mm). Refer to Figure 7-11.**The blade may be dressed until its width is 1.25"(31.8 mm).**
	 Figure 7-11. Dressing The CONTHERM's Scraping Blades.
3	Clean the scraping blade thoroughly and then reattach the blade to the rotor.
4	Repeat Steps 1 through 3 for any other blades needing to be dressed.

7.4.4 Maintenance Of The Blade Pins

If your CONTHERM's scraping blades begin to wear unevenly or start to break, the blade pin slot may be distorted. Distortion may result from any of the following conditions:

1. Improper removal of the blades during inspection and maintenance.
2. Excessive force on the blade caused by icing on the cylinder's inner diameter wall.
3. Excessive force on the blade caused by the burning-on of the product onto the cylinder's inner diameter wall.

When the slot is at the proper width, the scraping blade is captivated onto the blade pin (P/N 7401759-01 or -02). If the slot has been widened, the blade may disengage from the pin, which may result in breakage or uneven wear.

The procedure for repairing a damaged blade pin is provided in Table 7-20. Refer to Figure 7-12 while performing this procedure.

Table 7-20. Replacing A Damaged Blade Pin

Step	Action
1	Place a 0.125 inch (3.2 mm) thick feeler gauge into the slot of the damaged blade pin to determine the extent of the distortion.
2	Hold a striking pad against the top of the blade pin and strike the pad with a hammer.
3	Check the 0.125 inch (3.2 mm) thick feeler gauge until the proper opening is obtained. Check the width of the blade pin's slot frequently.
4	Maintain a perpendicular orientation between the centerline of the blade pin and the centerline of the rotor.
5	Repeat Steps 1 through 4 for any other damaged blade pins.

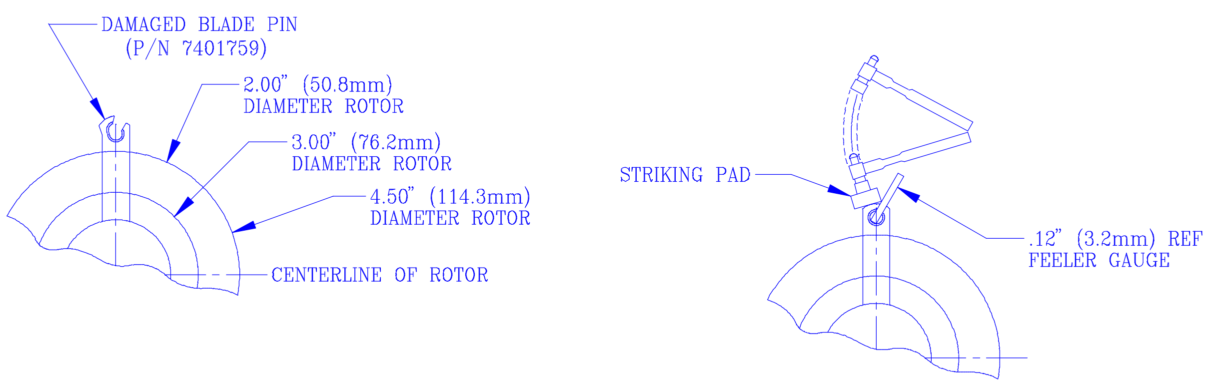


Figure 7-12. Repairing A Damaged Blade Pin

7.5 BEARINGS

Each CONTHERM has two bearings:

1. The Lower Bearing.
2. The Upper (Drive Head) Bearing.

This section describes how to inspect and replace the CONTHERM's bearings. The procedures in this section are organized as shown in Table 7-21.

Table 7-21. CONTHERM Bearing Related Maintenance Procedures

Section	Description
7.5.1	Inspecting The Bearings
7.5.2	Replacing The Lower Bearings (Non Hold Down Style)
7.5.3	Replacing The Lower Bearings (Hold Down Style)
7.5.4	Replacing The Upper Bearings On Electric Motor Drive Systems (Belt & Sheave)
7.5.5	Replacing The Upper Bearings On Electric Motor Drive Systems (Direct Coupled)
7.5.6	Inspection And Replacement Of Internal Bearings

7.5.1 Inspecting The Bearings

You should inspect the CONTHERM's lower and upper (drive head) bearings once per month if the CONTHERM is being operated in a humid environment, and once every three months if the unit is being operated in a dry environment. The bearings supplied by Alfa Laval Contherm Inc. are supplied pre-greased and sealed to withstand the aggressive cleaning cycles and equipment wash downs that the CONTHERMs are often subjected to. These pre-greased and sealed bearings prevent the loss or removal of lubrication during cleaning cycles and equipment wash downs.

To inspect a bearing, rotate it's inner race with your hand. If it turns smoothly, the bearing is good. If it does not turn smoothly or it feels rough, replace the bearing.

The CONTHERM's lower bearing, when used in normal operating conditions, is good for six to twelve months. Its actual operational life will be determined by the CONTHERM's hours of use and operating speed, and by how long the bearing shield remains intact. The CONTHERM's upper bearing, when operated under normal conditions, has an operational life of 12 to 18 months.

Premature wearing of a bearing may be caused by a mechanical problem such as the improper adjustment of the rotor stop or the improper installation of the bearing or bearing cap.

7.5.2 Replacing The Lower Bearings (Non Hold Down Style)

The procedure for replacing the CONTHERM's lower bearing is provided in Table 7-22. Refer to Figure 7-13 while performing this procedure. Figure 7-13 shows the location and identifies the parts of the lower bearing.

CAUTION

1. Always use the Rotor Lift Helper Plate to inspect the lower bearings.
2. If your configuration utilizes two or more Stack Assemblies, do not operate more than one stack valve handle at a time.
3. Do not operate the Rotor Lifting System until you have checked all fittings. Tighten nuts or replace any leaking fittings before operating the system.
4. To avoid damaging the rotor's lower blades, do not directly release the Bearing Cap Clamp (P/N 7401579-01) and lower the Lift Beam. If this occurs, the rotor will only be supported by its blades and the edges of the blades will be resting on the inside of the lower product head, a situation that may result in the unnecessary chipping and cracking of the lower blades.

WARNING

1. Do not attempt to disassemble the CONTHERM if its rotor is rotating.
2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping.
3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps.
4. Keep the area under the CONTHERM clear of hands, feet, piping and other obstructions.
5. Do not remove the lower head clamp or the lower bearing clamp until you have verified that the hydraulic Rotor Lifting System is turned on and is operating correctly.
6. The blades attached to the rotor's rotor pins may be very sharp. Wear protective gloves while handling the rotor.

Table 7-22. Replacing The Lower Bearings (Non Hold Down Style)

Step	Action
1	Using the rotor lift helper plate, prepare the CONTHERM for inspection of the lower bearings. **Note**: You must use the Rotor Lift Helper Plate to inspect the seals. Refer to Table 7-5, Operating The Rotor Lift Helper Plate in Chapter Six, Operation, for its detailed operating procedure.
2	Release the Bearing Cap Clamp (P/N 7401579-01) and move the lower product head aside. Refer to Figure 7-13 for parts identification and parts location information.
3	Remove the shoulder bolt (P/N 7401286-01) and the sleeve (P/N 7401289-01) from underneath the Lift Beam Assembly (P/N 7401283-01) to detach the bearing cap (P/N 7401618-01).
4	Use a gear puller to remove the lower bearing (P/N 7401391-01) from the bearing cap.
5	Press a new bearing into the bearing cap. Verify that it is seated completely and squarely into the bearing cap.
6	Secure the bearing cap to the lift beam assembly with the sleeve and shoulder bolt.
7	Place the lower product head onto the bearing cap, and attach with the bearing cap clamp.
8	Raise the hydraulic rotor lifting system to engage the rotor into the bearing cap.
9	Release the rotor lift helper plate.
10	Lower the rotor and replace the row of blades.
11	Use the hydraulic lift system to raise the lower product head and mate it with the end hub of the CONTHERM’s heat exchange cylinder. Secure the product head and the cylinder with the lower product head clamp (P/N 7401106-01 or P/N 7403038-01).

(NOTE: This will be an 11 x 17 foldout drawing; it will be Figure 22 of the original manual.)

Figure 7-13. Replacing The Lower Bearings (Non Hold Down Style)

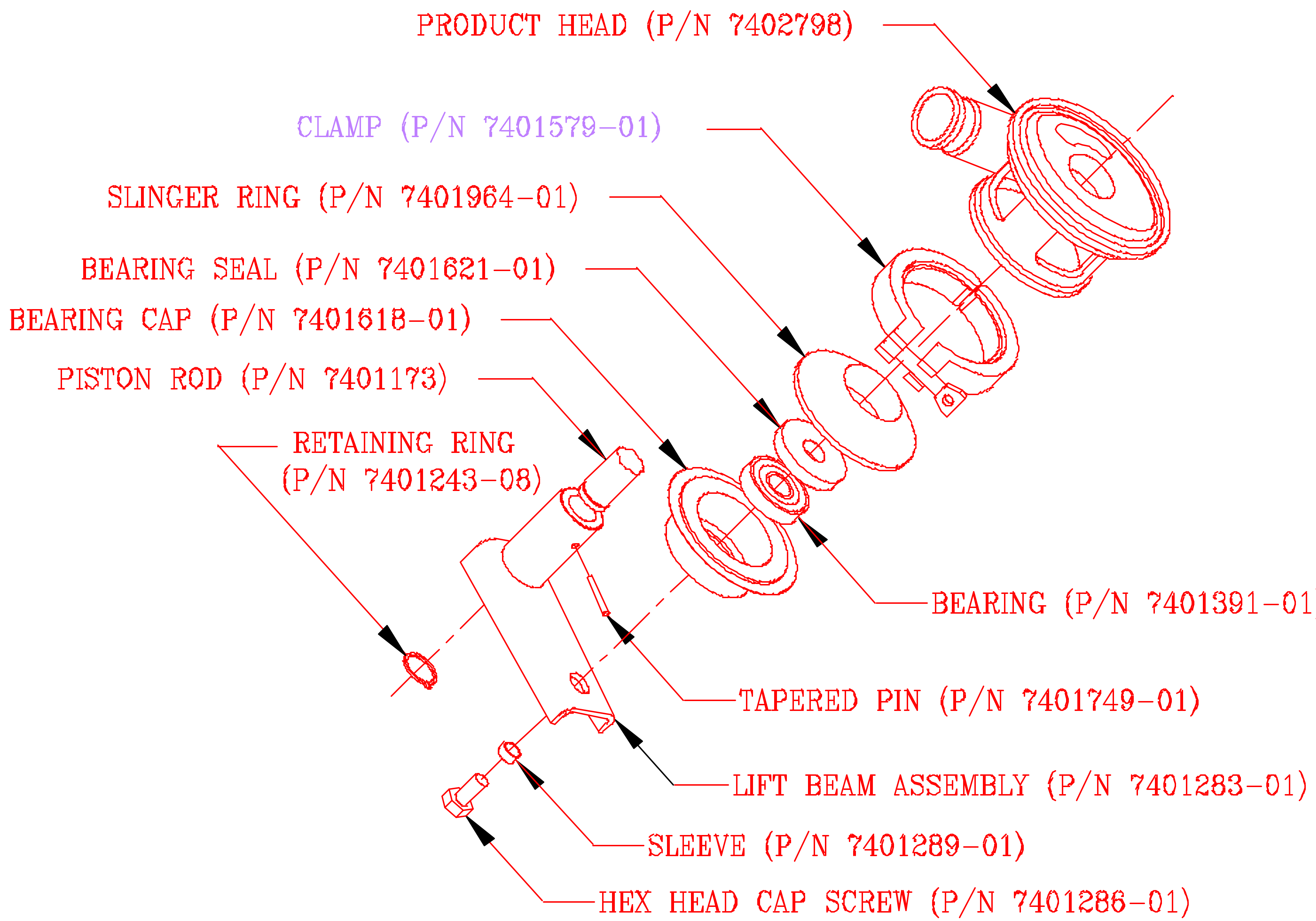


Figure 7-13. Lower Bearings, Non-Hold Down Style

Backside of Figure 7-13

7.5.3 Replacing The Lower Bearings (Hold Down Style)

The procedure for replacing the CONTHERM's lower bearing (Hold Down Style) is provided in Table 7-23. Refer to Figure 7-14 while performing this procedure. The drawing provided in Figure 7-14 shows the location and identifies the parts of the lower bearing.

NOTE: Before performing this procedure, read and review all safety precautions provided on page 7-43. These precautions, which were provided for the Non Hold Down Style Rotor, also apply to the Hold Down Style Rotor.

Table 7-23. Replacing The Lower Bearings (Hold Down Style)

Step	Action
1	Remove the Socket Head Cap Screw (P/N 7401242-03) to release the rotor assembly from the lower product head assembly.
2	Using the rotor lift helper plate, prepare the CONTHERM for inspection of the lower bearings. **Note**: You must use the Rotor Lift Helper Plate to inspect the seals. Refer to Table 6-5, Operating The Rotor Lift Helper Plate in Chapter Six, Operation, for its detailed operating procedure.
3	Release the Bearing Cap Clamp (P/N 7401579-01) and move the lower product head aside. Refer to Figure 7-14 for parts identification and parts location information.
4	Remove the two (2) hex head bolts (P/N 7401241-21) which secure the Lift Beam Assembly (P/N 7401283-02) to the bearing cap cover (P/N 7402993-01).
5	Remove the three (3) socket head cap screws (P/N 7401242-10) from the bearing cap cover. **Note**: There is a press fit between the bearing and both the rotor end (P/N 7402982-02) and the bearing cap (P/N 7402992-01).
6	Press both the rotor end and the lower bearing out of the bearing cap. Inspect the rotor end for signs of wear. If signs of wear exist, replace the rotor end.
7	If necessary, press a new rotor end into the new bearing. Press the new bearing into the bearing cap. Ensure that it is seated completely and squarely into the bearing cap. **Note**: Make sure that the spacer (P/N 7402979-02) is in place before you press the new bearing back into the bearing cap.
8	Replace the bearing cap cover plate and tighten the three (3) socket head cap screws.
9	Secure the bearing cap to the lift beam with the two (2) hex head bolts.
10	Place the lower product head onto the bearing cap and attach with the bearing cap clamp.

Table 7-23. Replacing The Lower Bearings (Hold Down Style), Continued

Step	Action
11	Raise the hydraulic rotor lifting system to engage the rotor into the rotor end. Replace the socket head cap screw (7401242-03) to secure the rotor to its replaceable end.
12	Continue to raise the hydraulic lifting system to release the rotor lift helper plate.
13	Lower the rotor and reattach the row of blades.
14	Use the hydraulic lift system to raise the lower product head and mate it with the end hub of the heat exchange cylinder and secure with the lower product head clamp (P/N 7401106-01 or P/N 7403038-01).

(NOTE: This will be an 11 x 17 foldout drawing; it will be Figure 22A of the original manual.)

Figure 7-14. Lower Bearings (Hold Down Style)

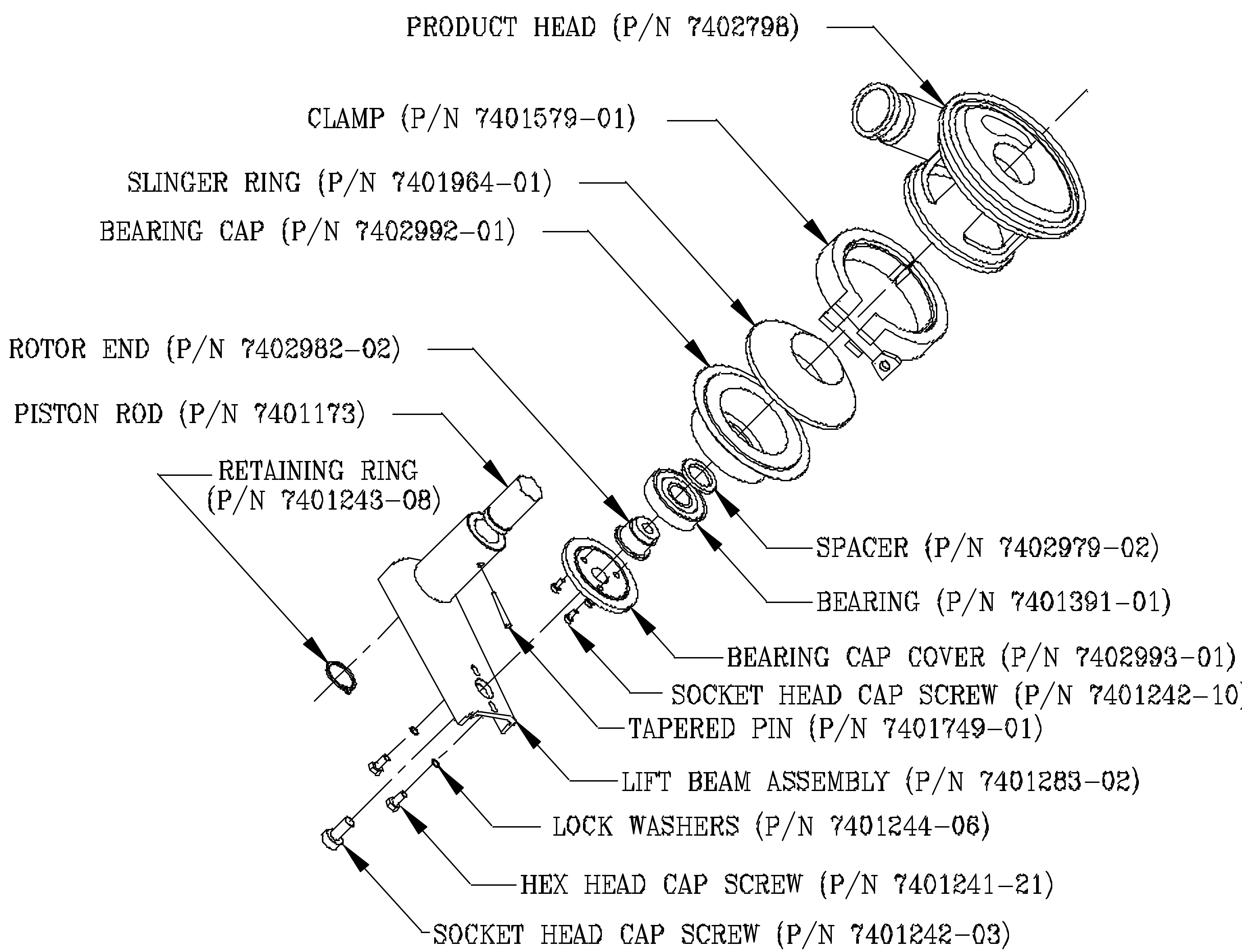


Figure 7-14. Lower Bearings, Hold Down Style

Backside of Figure 7-14

7.5.4 Replacing The Upper Bearings On Electric Motor Drive Systems (Belt & Sheave)

The procedure for replacing the upper bearing on CONTHERM's equipped with a belt and sheave, electric motor drive system is provided in Table 7-24. Refer to Figures 7-15 and 7-16 while performing this procedure. The drawings show the location and the identification of the parts of the upper bearing. Figure 7-15 shows the upper bearing for a CONTHERM equipped with a Rotor Stop, while Figure 7-16 shows a unit without a Rotor Stop.

WARNING	1. Do not attempt to disassemble the CONTHERM if its rotor is rotating. 2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping. 3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps.

Table 7-24. Replacing The Upper Bearings On A Belt And Sheave, Electric Motor Drive System

Step	Action
1	Turn off the motor's power supply and disconnect the V-belts from the sheaves. Refer to Figure 7-15 or 7-16, as applicable to your CONTHERM's configuration, while performing this procedure.
2	Release and remove the clamp (P/N 7401579-01) from the bearing housing.
3	Remove the sheave assembly along with the coupling, bearings, and bearing housing assembly (P/N 7402605-01).
4	Place the sheave assembly upside down so that it rests on its flange.
5	Remove the retaining ring (P/N 7401243-02) from the outside diameter of the spline coupling (P/N 7401309 or P/N 7401627). P/N 7401627 is used with a 2.00 inch spline.
6	Use a gear puller to remove the bearing housing (P/N 7401620-01), including the bearings (P/N 7401361-01), from the coupling.
7	Remove the retaining ring (P/N 7401243-09) from the non-clamped end of the bearing housing.
8	Use a hydraulic press to press both the bearings (P/N 7401361-01) and the spacer (P/N 7401108-01) out of the bearing housing.

Table 7-24. Replacing The Upper Bearings On A Belt And Sheave, Electric Motor Drive System, Continued

Step	Action
9	Discard the worn bearings and install two (2) new bearings into the bearing housing. Carefully press the bearings into the housing to avoid damage. **Note**: Make sure that the spacer (P/N 7401108-01) is in place between the bearings before pressing the new bearings back into bearing cap.
10	Place the retaining ring (P/N 7401243-09) back onto the inside diameter of the bearing housing at the non-clamped end.
11	Press the bearing housing, using the spline coupling for support, onto the spline coupling. Continue to press the housing assembly until there is sufficient clearance to replace the retaining ring (P/N 7401243-02) onto the outside diameter of the spline coupling. **Note**: Do not use the sheave for support while pressing the bearing housing onto the spline coupling.
12	Verify that the bearing housing rotates freely on the coupling assembly (P/N 7401309 or P/N 7401627).
13	Replace the sheave/bearing housing assembly onto the product head and secure it with a clamp (P/N 7401579-01).

(NOTE: This will be an 11 x 17 foldout drawing; it will be Figure 23 of the original manual.)

Figure 7-15. Upper Bearings On A Belt And Sheave, Electric Drive Motor System With Rotor Stop

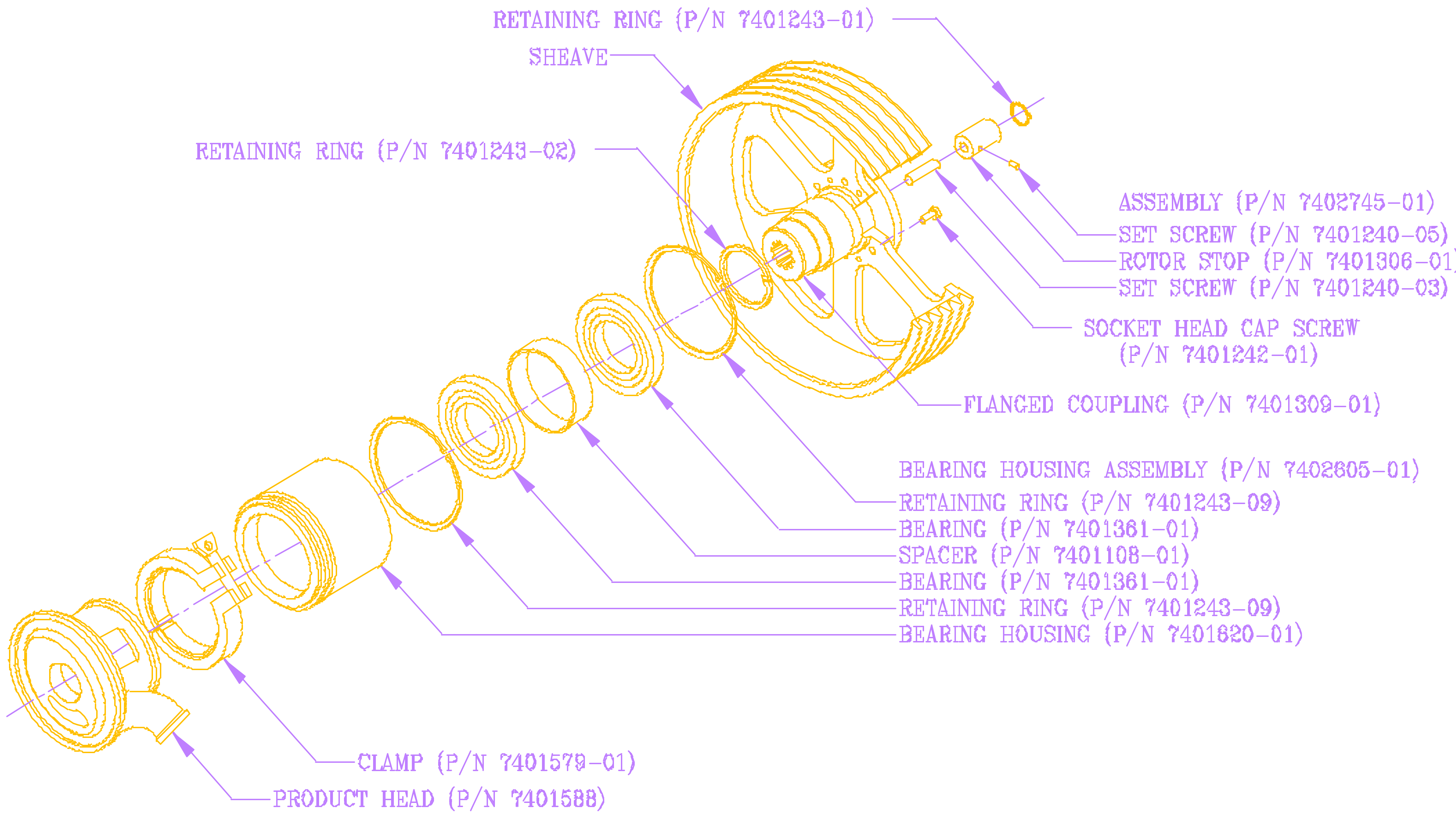


Figure 7-15. Upper Bearings, Belt & Sheave, Electric Motor Drive, With Rotor Stop

Backside of Figure 7-15

(NOTE: This will be an 11 x 17 foldout drawing; it will be Figure 23A of the original manual.)

Figure 7-16. Upper Bearings On A Belt And Sheave, Electric Drive Motor System Without Rotor Stop

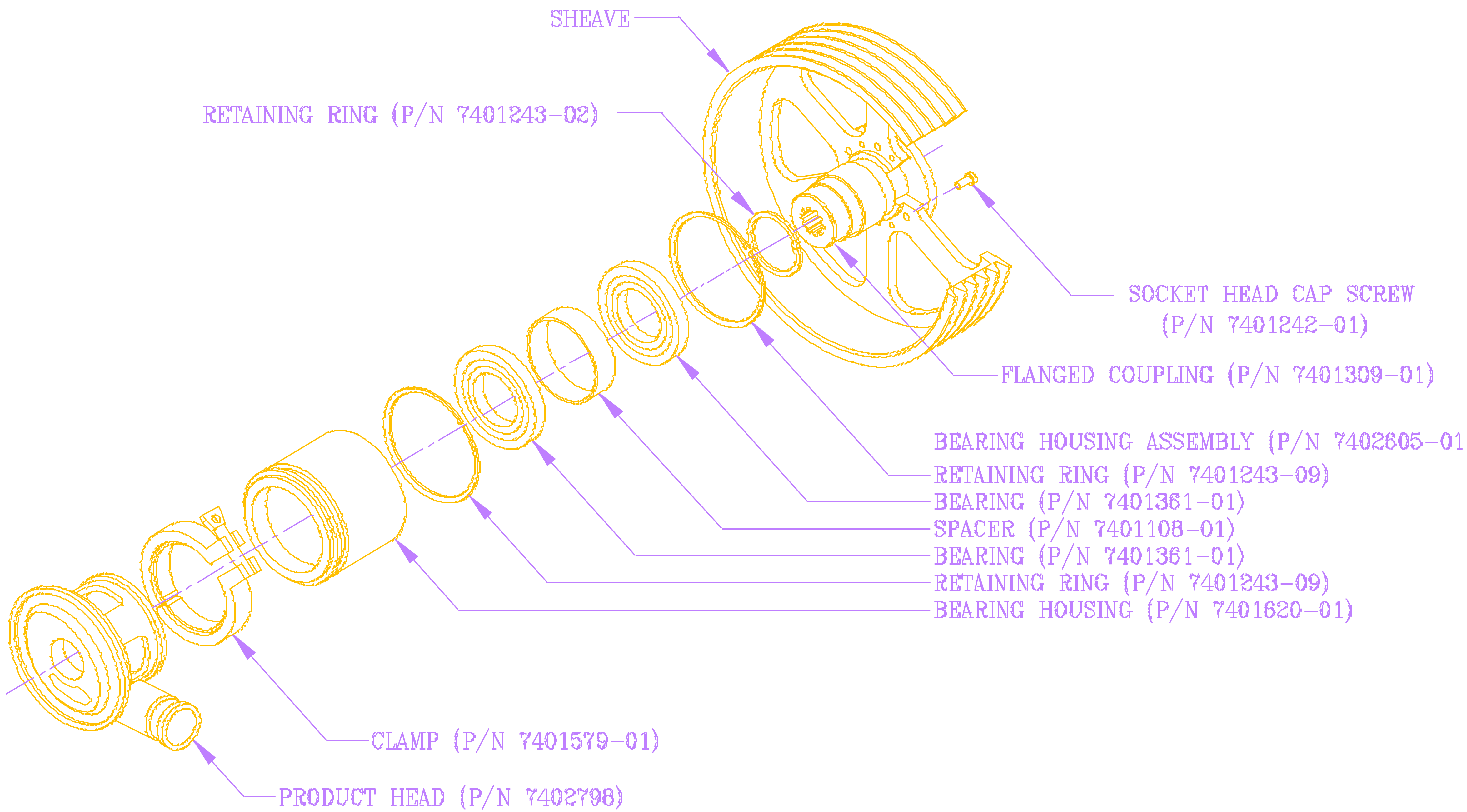


Figure 7-16. Upper Bearings, Belt & Sheave, Electric Motor Drive Without Rotor Stop

Backside of Figure 7-16

7.5.4 Replacing Upper Bearings On Direct Coupled, Electric Motor Drive Systems

The procedure for replacing the upper bearing on CONTHERM's equipped with a direct coupled, electric motor drive system is provided in Table 7-25. Refer to Figures 7-17 through 7-19 while performing this procedure. The drawings show the location and the identification of the parts of the upper bearing. Figure 7-17 shows the upper bearing for a CONTHERM equipped with a direct coupled Electric Drive System, while Figures 7-18 and 7-19 show units equipped with hydraulic drives, both with and without a Rotor Stop, respectively.

WARNING	1. Do not attempt to disassemble the CONTHERM if its rotor is rotating. 2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping. 3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps.

Table 7-25. Replacing Upper Bearings On A Direct Coupled, Electric Motor Drive System

Step	Action
1	Turn off the power to the motor.
2	Remove the coupling guard. Refer to the installation drawings that were provided with your mounting hardware.
3	Use the jack screw to raise the motor/plate assembly until you have enough room to remove the flex sleeve (hydraulic drive configurations only).
4	Release and remove the clamp (P/N 7401579-01) so that you can then remove the bearing housing from the product head.
5	Remove the cover plate (P/N 7402763-01).
6	Turn the bearing housing (P/N 7401620-01) upside down. While applying pressure to the inner race of the bearing (P/N 7401361-01), press out the drive coupling (P/N 7401203-02 for hydraulic drives and P/N 7402768-01 for direct drives) and the bearings from the bearing housing.
7	Use a gear puller to remove the two (2) worn bearings (P/N 7401361-01) from the drive coupling.
8	Install two (2) new bearings (P/N 7401361-01) onto the drive coupling (P/N 7401203-02), one at each end. Carefully press each bearing onto the drive coupling to avoid causing any damage.
9	Press the drive coupling, with the bearings, into the bearing housing (P/N 7401620-01) from the non-clamped end. Orient the drive coupling so that the rotor mating end enters first.

Table 7-25. Replacing Upper Bearings On A Direct Coupled, Electric Motor Drive System, Continued

Step	Action
10	Attach the assembled bearing housing to the product head and secure it with the clamp.
11	Reinstall the flexible coupling and lower the motor/plate assembly. Refer to Chapter Five for the procedure for aligning the couplings correctly. For CONTHERMs ordered before 1 January 1996, proceed to Step 12 of Table 5-5, Chapter Five, Installation. For units ordered after 1 January 1996, proceed to Step 20 of Table 5-5.

(NOTE: This will be an 11 x 17 foldout drawing; it will be Figure 24 of the original manual.)

Figure 7-17. Upper Bearings, Direct Coupled, Electric Drive Motor System

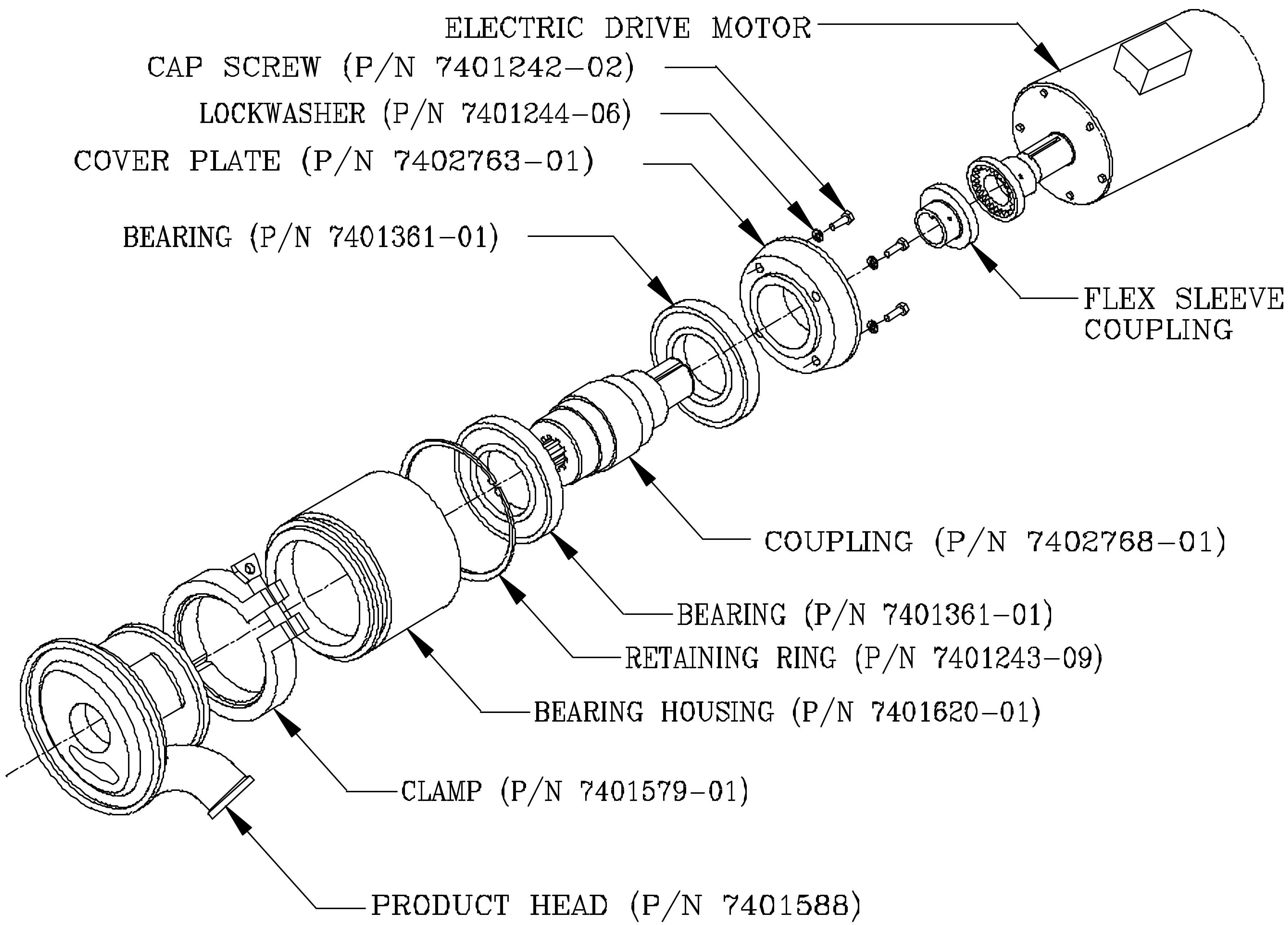


Figure 7-17. Upper Bearings, Direct Coupled, Electric Drive Motor

Backside of Figure 7-17

(NOTE: This will be an 11 x 17 foldout drawing; it will be Figure 24A of the original manual.)

Figure 7-18. Upper Bearings, Hydraulic Drive Motor System With Rotor Stop

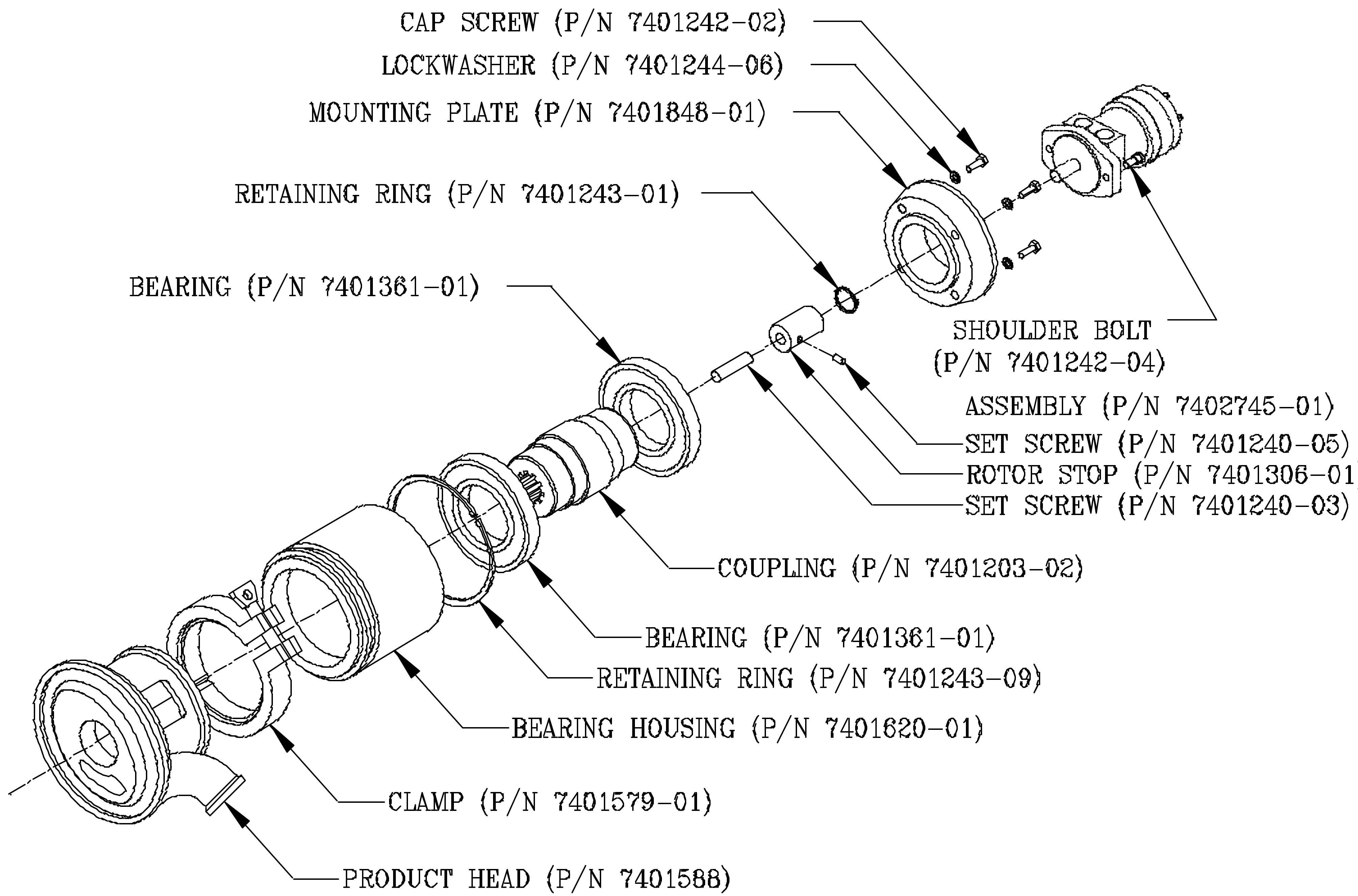


Figure 7-18. Upper Bearings, Hydraulic Drive Motor With Rotor Stop

Backside of Figure 7-18

(NOTE: This will be an 11 x 17 foldout drawing; it will be Figure 24B of the original manual.)

Figure 7-19. Upper Bearings, Hydraulic Drive Motor System Without Rotor Stop

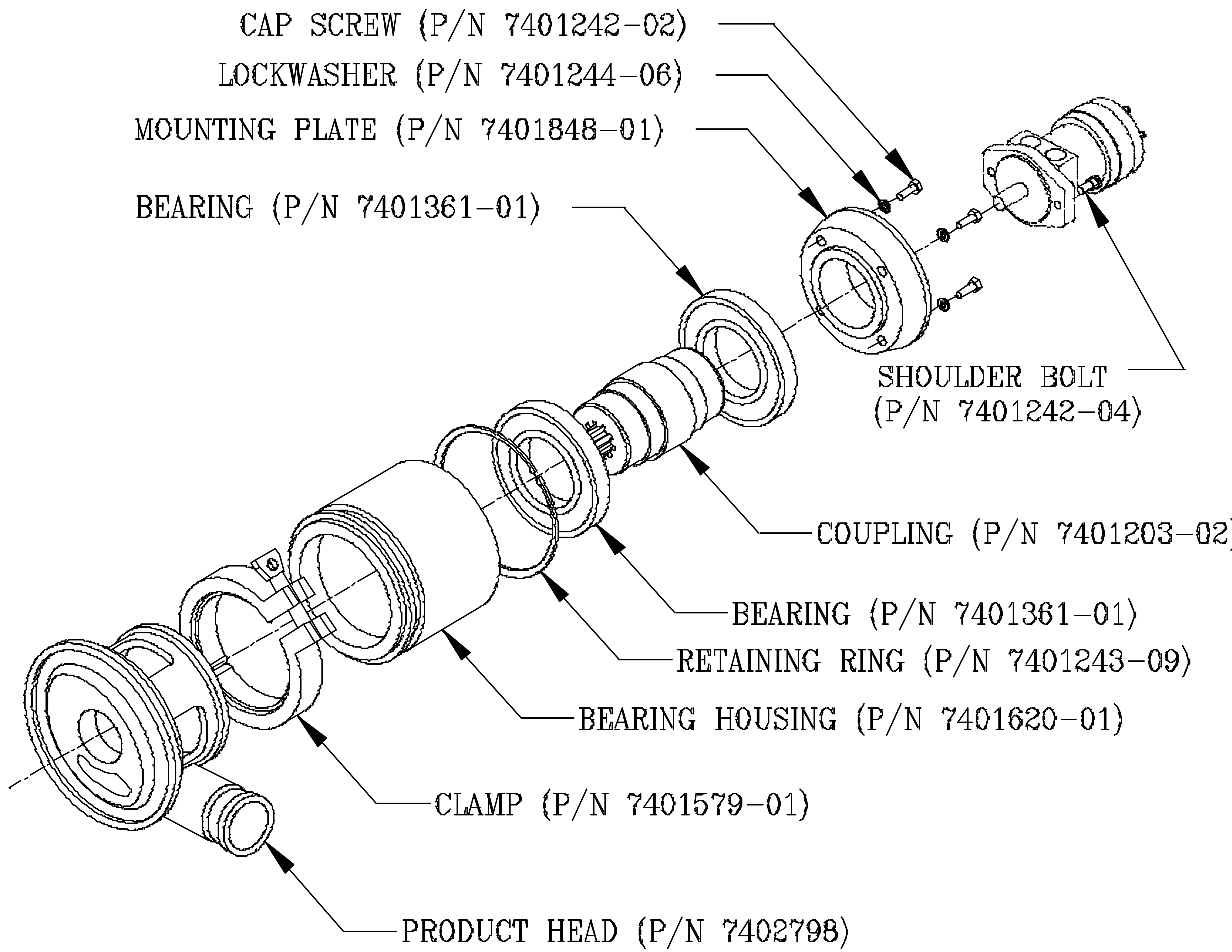


Figure 7-19. Upper Bearings, Hydraulic Drive Motor Without Rotor Stop

Backside of Figure 7-19

7.5.5 Inspecting And Replacing Internal Bearings

CONTHERMs equipped with a 3.00-inch DIA (76.20 mm) lower product head (either tangential or cast) can utilize internal bearings for the lower bearing. This section describes how to inspect and replace these internal bearings. If your CONTHERM has internal bearings, perform the procedure in Table 7-26 to inspect and replace them. Figure 7-20 shows parts location and identification information for the CONTHERM's internal bearings.

The upper head bearing and seal replacement procedures are the same as those performed for a standard CONTHERM.

CAUTION

1. Always use the Rotor Lift Helper Plate to inspect the lower bearings.
2. If your configuration utilizes two or more Stack Assemblies, do not operate more than one stack valve handle at a time.
3. Do not operate the Rotor Lifting System until you have checked all fittings. Tighten nuts or replace any leaking fittings before operating the system.
4. To avoid damaging the rotor's lower blades, do not directly release the Bearing Cap Clamp (P/N 7401579-01) and lower the Lift Beam. If this occurs, the rotor will only be supported by its blades and the edges of the blades will be resting on the inside of the lower product head, a situation that may result in the unnecessary chipping and cracking of the lower blades.

WARNING

1. Do not attempt to disassemble the CONTHERM if its rotor is rotating.
2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping.
3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps.
4. Keep the area under the CONTHERM clear of hands, feet, piping and other obstructions.
5. Do not remove the lower head clamp or the lower bearing clamp until you have verified that the hydraulic Rotor Lifting System is turned on and is operating correctly.
6. The blades attached to the rotor's rotor pins may be very sharp. Wear protective gloves while handling the rotor.

Table 7-26. Replacing The Internal Bearings

Step	Action
1	Using the rotor lift helper plate, prepare the CONTHERM for inspection of the lower bearings. **Note**: You must use the Rotor Lift Helper Plate to inspect the seals. Refer to Table 6-5, Operating The Rotor Lift Helper Plate, Chapter Six, Operation, for its detailed operating procedure.
2	Visually inspect the bearing sleeve (P/N 7401482-01) for wear and replace if necessary. **Note**: The bearing sleeve may be attached to the rotor end or located in the internal bearing assembly (P/N 7401470-01 or -02 or -03).
3	Inspect the internal bearing assembly's carbon thrust ring (P/N 7401469-01) for cracks. If replacement is required, unscrew the two set screws (P/N 7401240-08) to remove the internal bearing assembly from the support plate. **Note**: The internal bearing assembly consists of a carbon thrust ring that is installed into stainless steel retainer ring (P/N7401471-01). This assembly is secured to the support plate in the head by two set screws (Support Plate Assembly, P/N 7402199-01).
4	Inspect the thrust ring for cracks and replace if required. Unscrew both set screws to remove the internal bearing assembly from the support plate.
5	Carefully chisel the carbon thrust ring out of the retainer ring. Avoid damaging the stainless steel ring.
6	Clean the retainer ring with detergent and water.
7	Place retainer ring into an oven capable of maintaining 550°F (290°C) for 30 minutes.
8	Use heat protective gloves to remove the stainless steel retainer ring from the oven and place it on a lapping plate.
9	Insert the carbon thrust ring into the retainer ring. Ensure that it is squarely seated on the bottom.
10	Allow the Internal Bearing Assembly to cool to room temperature. **Note**: Do <u>not</u> quench with water as this will crack the new thrust ring.
11	Insert the Internal Bearing Assembly into the stainless steel retainer and refasten it to the support plate with the two set screws (P/N 7401240-08).
12	Place the bearing sleeve (P/N 7401482-01) back onto the rotor end.
13	Raise the hydraulic rotor lift beam to engage the rotor onto the bearing sleeve. Align the pin in the rotor end with the sleeve.
14	Release the lower head clamp and remove the rotor lift helper plate.
15	Lower the rotor to install the row of blades.

Table 7-26. Replacing The Internal Bearings, Continued

Step	Action
16	Raise the hydraulic rotor lift to mate the head plate with the tangential head, then secure them with a clamp (P/N 7401106-01 or 7403038-01).

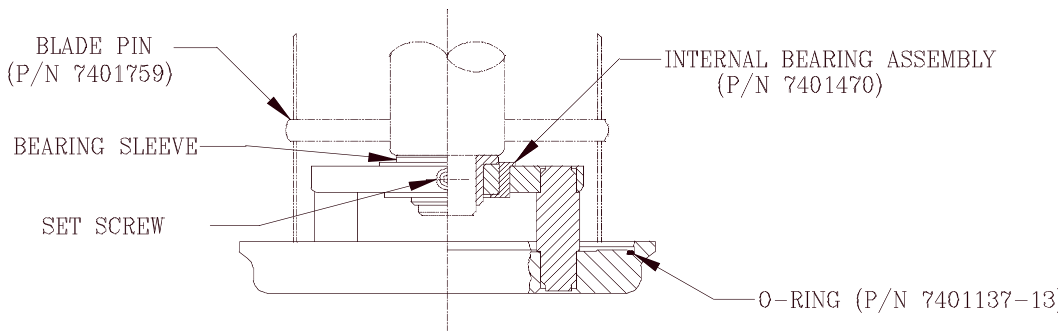


Figure 7-20. Internal Bearings

7.6 HEAT EXCHANGE CYLINDER

The inside surface of the CONTHERM's heat exchange cylinder should be cleaned in place on a daily basis (CIP) as recommended in Table 7-2. Periodic inspection of the cylinder and its media annulus should also be performed to ensure the proper operation of the CONTHERM and the long term use of the cylinder. This section describes how to inspect and maintain your CONTHERM's heat exchange cylinder.

Table 7-27 identifies the maintenance procedures that are provided in this section.

Table 7-27. Heat Exchange Cylinder Maintenance Procedures

Section	Description
7.6.1	Inspecting The Cylinder
7.6.2	Replacing The Cylinder
7.6.3	Cleaning The Media Annulus

7.6.1 Inspecting The Cylinder

The inside diameter of the heat exchange cylinder is a finely honed or chromed surface. It should be visually inspected on a routine basis to assure the proper operation of the CONTHERM. Use the procedure provided in Table 7-28 to inspect your CONTHERM's heat exchange cylinder.

CAUTION	1. If your configuration utilizes two or more Stack Assemblies, do not operate more than one stack valve handle at a time. 2. Do not operate the Rotor Lifting System until you have checked all fittings. Tighten nuts or replace any leaking fittings before operating the system.

WARNING	1. Do not attempt to disassemble the CONTHERM if its rotor is rotating. 2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping. 3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps. 4. Keep the area under the CONTHERM clear of hands, feet, piping and other obstructions. 5. Do not remove the lower head clamp or the lower bearing clamp until you have verified that the hydraulic Rotor Lifting System is turned on and is operating correctly. 6. The blades attached to the rotor's rotor pins may be very sharp. Wear protective gloves while handling the rotor.

Table 7-28. Inspecting The Heat Exchange Cylinder

Step	Action
1	Use the hydraulic rotor lifting system to lower the rotor from the CONTHERM. **Note**: Refer to Table 6-4, Operating The Hydraulic Rotor Lifting System in Chapter Six, Operation, for its detailed operating procedure.
2	After lowering the rotor from the CONTHERM, inspect the walls of the cylinder for the presence of any unusual pitting or scoring conditions. If these conditions are found, please contact your local Alfa Laval Contherm Inc. or Tetra Laval representative for additional assistance.

7.6.2 Replacing The Cylinder

If your inspection shows the need to replace the CONTHERM's heat exchange cylinder, refer to the disassembly procedure for the CONTHERM that is provided in Section 7.9, Disassembly and Re-assembly of the CONTHERM.

Each replacement heat exchange cylinder that is supplied by Alfa Laval Contherm Inc. is provided with a new inspection plate that identifies the new cylinder's serial number, and four drive screws (P/N 7402084-01) for mounting this new inspection plate to the outside surface of your CONTHERM.

Before you mount the new inspection plate, you must remove the existing inspection plate from the CONTHERM. To remove the existing inspection plate, grind back the head of the four drive screws. Then remove the plate and pull out the remaining screw shafts. The new plate is pre-formed at the factory and is to be attached directly to the CONTHERM's outside surface (trim sheet) using the four, new drive screws that were supplied with the replacement cylinder.

7.6.3 Cleaning The Media Annulus

Due to contaminants that may exist in some water and steam supplies, fouling of the CONTHERM's media annulus may gradually occur over time. At some point, this fouling, if it occurs, could begin to affect the CONTHERM's thermal efficiency. Fouling is usually caused by mineral deposits accumulating on the outer surface of the heat exchange cylinder. When present, these deposits can be observed at the media inlet and outlet port connections.

To remove this fouling layer of mineral deposits, circulate a standard demineralizing agent throughout the annulus until the fouling layer is removed. Table 7-29 identifies typical demineralizing procedures recommended by Alfa Laval Contherm Inc. for removing mineral deposits from the outer surface of the cylinder.

Table 7-29. Recommended Demineralizing Procedures

Cylinder Material	Action
All Stainless Steels	1. Rinse. 2. Acid wash (2.0 to 2.2 pH, 120^{o}F to 140^{o}F (49^{o}C to -60^{o}C) for 30 to 45 minutes. 3. Rinse. 4. Neutralize (Use a mild general cleaner). 5. Rinse.
Blended Metals Or Nickel	1. Rinse. 2. Acid wash (2.25 to 2.25 pH, 110^{o}F to 120^{o}F (43^{o}C to -49^{o}C) for 30 to 60 minutes. 3. Rinse. 4. Neutralize (Use a mild general cleaner). 5. Rinse.

7.7 ROTOR STOP ADJUSTMENT (NON HOLD DOWN STYLE)

The Rotor Stop Assembly limits the lifting capability of the rotor caused by the force of the product moving through the cylinder. The Rotor Stop is located at the top of CONTHERM's equipped with either electric motor or hydraulic drive systems.

The Rotor Stop, which is preset at the factory, should be adjusted periodically to compensate and correct for variables such as vibrations, changes in the rotor, product heads, bearings, etc., which may affect or change the preset factory setting.

Table 7-30 identifies the Rotor Stop Adjustment procedures contained in this section.

Table 7-30. Rotor Stop Adjustment Maintenance Procedures

Section	Description
7.7.1	Re-adjusting The Rotor Stop in CONTHERM's Equipped With Hydraulic Drives
7.7.2	Re-adjusting The Rotor Stop in CONTHERM's Equipped With Electric Drives

7.7.1 Re-adjusting The Rotor Stop In CONTHERM's Equipped With Hydraulic Drives

The procedure for re-adjusting the Rotor Stop setting for CONTHERMs equipped with hydraulic drive systems is provided in Table 7-31. Refer to Figure 7-21 for parts location and identification information while performing this procedure.

⚠ **WARNING**	1. Do not attempt to disassemble the CONTHERM if its rotor is rotating. 2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping. 3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps.

Table 7-31. Re-adjusting The Rotor Stop In CONTHERMs Equipped With Hydraulic Drive Systems

Step	Action
1	Remove the CONTHERM's hydraulic motor by removing the socket head shoulder bolts (P/N 7401242-04).
2	Inspect the self-locking, set screw (P/N 7401240-04) that is located in the center of the hydraulic drive coupling. The locking nylon strip on the set screw may become ineffective from wear. If the nylon strip is worn, use a new set screw or a thread locking compound when re-assembling the hydraulic motor.
3	Back off the set screw. Then tighten it until you feel the screw make contact with the top of the rotor.
4	After the screw has touched the top of the rotor, back off the screw one complete turn. If a thread locking compound has been applied, allow the compound to set up before using the CONTHERM.
5	Re-assemble the hydraulic motor onto its mounting plate. Secure the motor with the shoulder bolts.

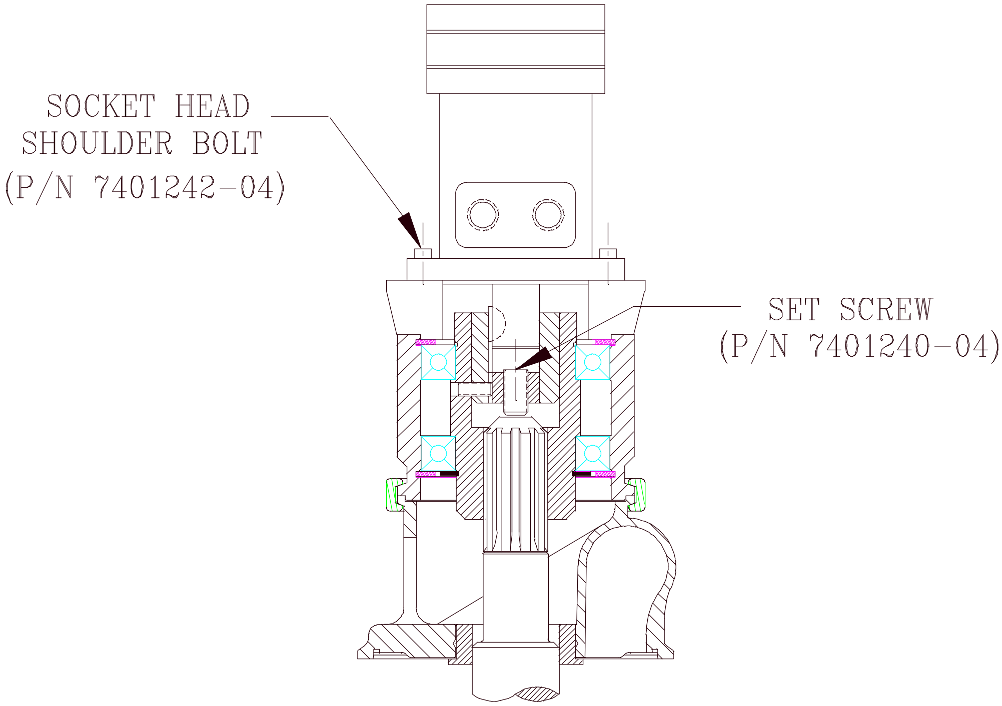


Figure 7-21. Readjusting The Rotor Stop On A CONTHERM With A Hydraulic Drive

7.7.2 Re-adjusting The Rotor Stop In CONTHERM's Equipped With Electric Motor Drive Systems

The procedure for re-adjusting the Rotor Stop setting for CONTHERMs equipped with electric motor drive systems (Belt & Sheave) is provided in Table 7-32. Refer to Figure 7-22 for parts location and identification information while performing this procedure.

WARNING	1. Do not attempt to disassemble the CONTHERM if its rotor is rotating. 2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping. 3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps.

Table 7-32. Re-adjusting Rotor Stops In CONTHERMs Equipped With Electric Motor Drive Systems (Belt & Sheave)

Step	Action
1	Remove the retaining ring (P/N 7401243-01 for a 1.5 inch spline or P/N 7401243-11 for a 2.0 inch spline) from the flanged coupling assembly (P/N 7401309).
2	Remove the rotor stop assembly (P/N 7402745-01 or 7402750-01) from the coupling. The rotor stop assembly should move freely. Debris or dirt may work its way into the coupling. If this has occurred, remove the bearing housing assembly (P/N 7402605-01) and push the rotor stop out from the opposite end. Clean the rotor stop and coat it with a thin film of lubricant.
3	Loosen the set screw (P/N 7401240-02) that is located on the side of the rotor stop so that the set screw (P/N 7401240-03) that is located in the center of the rotor stop moves freely.
4	Reinsert the rotor stop assembly into the flanged coupling.
5	Adjust the set screw (P/N 7401240-03) in the center of the rotor stop so that the top of the rotor stop is positioned 0.50 inches (12.7 mm) below the top of the flanged coupling, or 0.12 inches (3.2 mm) below the bottom of the retaining ring groove.
6	Remove the rotor stop assembly again and tighten the set screw on the side, locking the position of the center set screw.
7	Place the complete assembly back into the flanged coupling. Then reinsert the retaining ring into its groove.

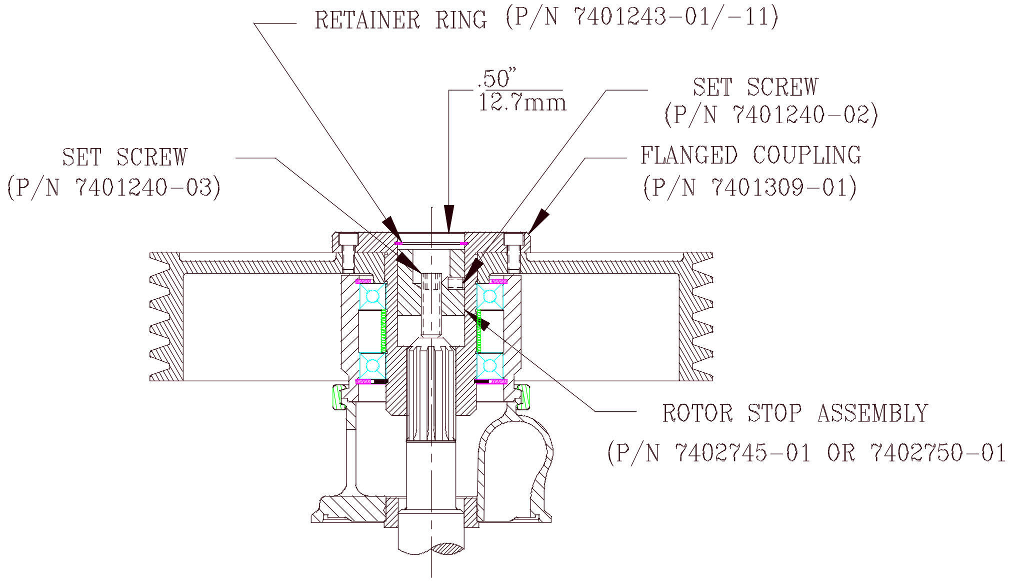


Figure 7-22. Readjusting Rotor Stop On A CONTHERM With An Electric Motor Drive (Belt & Sheave)

7.8 STACK VALVE ASSEMBLY

This section provides the procedure for disassembling and reassembling the CONTHERM's Stack Valve Assembly (P/N 7401305). The Rotor Lifting System's Stack Valve Assembly is a hydraulic directional control valve used to lower or raise the CONTHERM's rotor assembly. Compression fittings for both supply and return lines, along with fittings for connections to the CONTHERM's hydraulic lift cylinder assembly, are located on the stack valve assembly. A detailed description of the Stack Valve Assembly is provided in Chapter Five, Installation, and Chapter Six, Operation.

Figure 7-23 identifies all components of the Stack Valve Assembly and provides parts location information.

Maintenance of the Stack Valve Assembly consists of replacing the assembly's O-rings. The Stack Valve Assembly can be configured with either one or two center sections. Each center section contains a single handle for raising or lowering the rotor assembly of a corresponding CONTHERM.

The procedure for replacing O-Rings in the CONTHERM's Stack Valve Assembly is provided in Table 7-33. Refer to Figure 7-23 for parts location and identification information while performing this procedure.

(NOTE: This will be an 11 x 17 foldout drawing; it will be Figure 6 of the original manual.)

Figure 7-23. Stack Valve Assembly

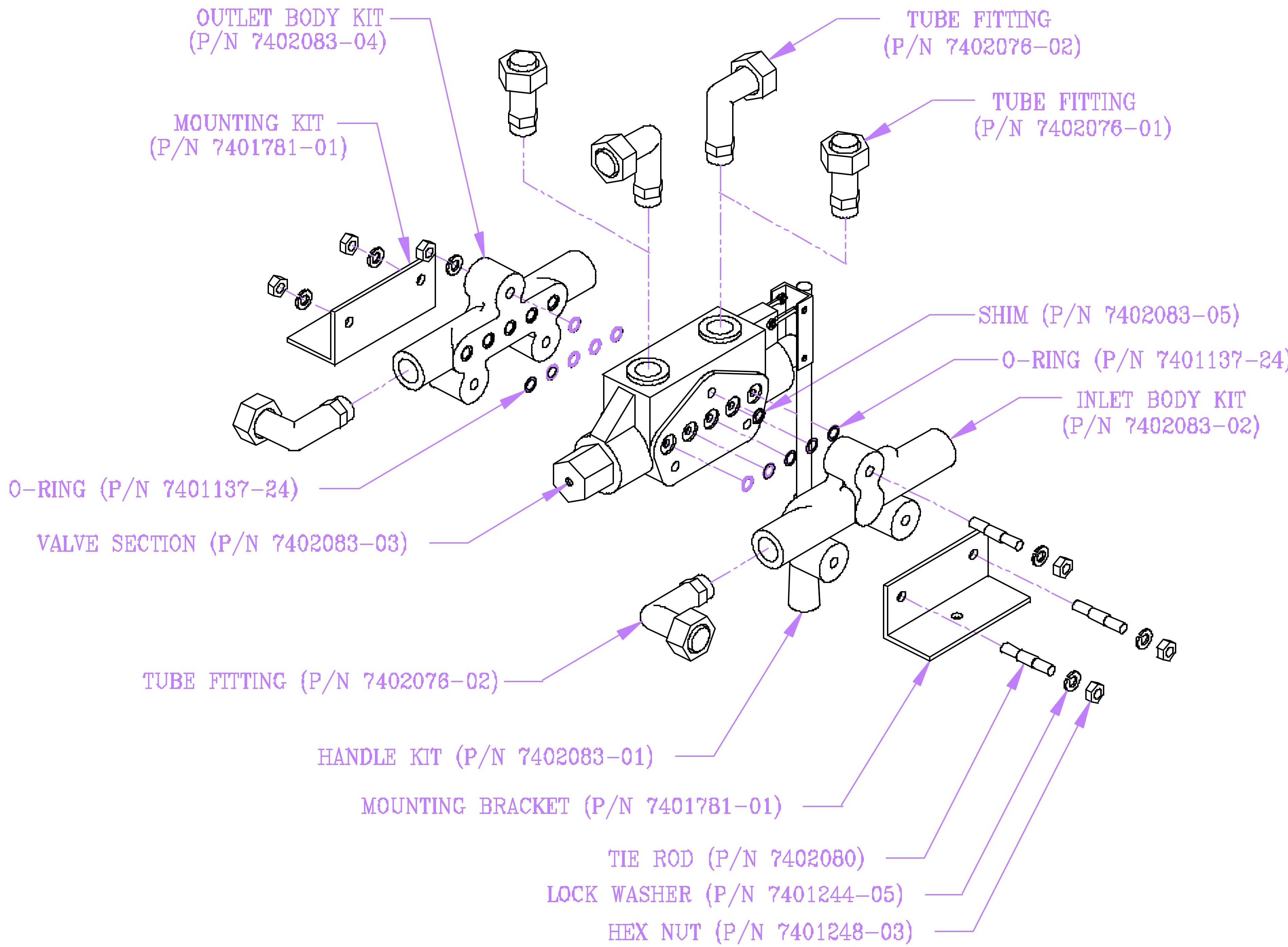


Figure 7-23. Stack Valve Assembly

Backside of Figure 7-23

7.8.1 Replacing O-Rings In The Stack Valve Assembly

The procedure for replacing O-Rings in the CONTHERM's Stack Valve Assembly is provided in Table 7-33. Refer to Figure 7-23 for parts location and identification information while performing this procedure.

WARNING	1. Do not attempt to disassemble the CONTHERM if its rotor is rotating. 2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping. 3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps.

Table 7-33. Replacing O-Rings In The Stack Valve Assembly

Step	Action
1	Drain the hydraulic fluid from the CONTHERM's Rotor Lift System and disconnect all hydraulic lines (tubing) from the Stack Valve Assembly's center section. **Note**: Ensure that all of the CONTHERM's clamps are securely fastened before proceeding.
2	Remove the two hex nuts (P/N 7401248-03) from the mounting bracket (P/N 7401781-01) located on the inlet side of the center section assembly. Refer to Figure 5-23.
3	Remove the Inlet Body (P/N 7402083-02) from the center section.
4	Carefully remove all five O-rings (P/N 7401137-24) from the center section. Clean the area on the center section of any debris or O-ring remains. Install five new O-rings.
5	Reattach the Inlet Body to the center section assembly.
6	Reattach the mounting bracket and refasten it with the two hex nuts.
7	Remove the two hex nuts (P/N 7401248-03) from the mounting bracket (P/N 7401781-01) located on the outlet side of the center section assembly. Refer to Figure 5-23.
8	Remove the Outlet Body (P/N 7402083-04) from the center section.
9	Carefully remove the five O-rings (P/N 7401137-24) from the center section. Clean the area on the center section of any debris or O-ring remains and install five new O-rings.
10	Reattach the Outlet Body to the center section assembly.
11	Reattach the mounting bracket and refasten it with the two hex nuts.

7.9 DISASSEMBLY AND REASSEMBLY OF THE CONTHERM

This section provides the detailed procedures for disassembling and reassembling a vertically mounted CONTHERM. Table 7-34 identifies the disassembly/reassembly procedures that are contained in this section.

Table 7-34. CONTHERM Disassembly And Reassembly Procedures

Section	Description
7.9.1	Disassembly Of The CONTHERM
7.9.2	Replacing The CONTHERM's Expansion Joint
7.9.3	Reassembly Of The CONTHERM
7.9.4	Disassembly Of The CONTHERM's Hydraulic Lift Cylinder

Note: When removing parts or assemblies from the CONTHERM, place and arrange them systematically on a wooden skid or other protective surface.

7.9.1 Disassembly Of The CONTHERM

The procedure for the disassembly of the CONTHERM is provided in Table 7-35. Refer to Figures 7-24 and 7-25 for parts location and identification information while performing this procedure. Figure 7-24 shows a CONTHERM equipped without a rotor Hold Down while Figure 7-25 shows a CONTHERM equipped with a Hold Down.

CAUTION	1. If your configuration utilizes two or more Stack Assemblies, do not operate more than one stack valve handle at a time. 2. Do not operate the Rotor Lifting System until you have checked all fittings. Tighten nuts or replace any leaking fittings before operating the system.

WARNING	1. Do not attempt to disassemble the CONTHERM if its rotor is rotating. 2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping. 3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps. 4. Keep the area under the CONTHERM clear of hands, feet, piping and other obstructions. 5. Do not remove the lower head clamp or the lower bearing clamp until you have verified that the hydraulic Rotor Lifting System is turned on and is operating correctly. 6. The blades attached to the rotor's rotor pins may be very sharp. Wear protective gloves while handling the rotor.

Table 7-35. Disassembly Of The CONTHERM

Step	Action
1	Disconnect the CONTHERM's power supply. **Hydraulic Drives** If your CONTHERM has a hydraulic drive system, turn off the hydraulic power pack and disconnect the hydraulic hoses. **Electric Drives (Belt And Sheave)** If your CONTHERM has a belt and sheave, electric drive system, disconnect the power to the motor and remove the drive belts from sheaves. **Electric Drives (Direct Coupled)** If your CONTHERM has a direct coupled, electric drive system, disconnect the power to the motor and disengage the coupling.
2	Drain the heat exchange cylinder. Be careful as hot product or CIP solution may still remain in the cylinder.
3	Remove any connecting product piping from the unit.
4	Shut off and remove all of the media supply and return lines from the CONTHERM.
5	Use the hydraulic rotor lift system to lower the rotor assembly. Remove the blades and rotor to a safe location. **Note**: Refer to Table 6-4, Operating The Hydraulic Rotor Lifting System in Chapter Six, Operation, for its detailed operating procedure.
6	Return the hydraulic rotor lift beam to its operating position. Replace the clamp (P/N 7401106-01 or 7403038-01) at the cylinder to product head connection.
7	Disconnect and drain the hydraulic lift cylinder. Manually extend the piston rod to drain the oil from the lift cylinder.
8	Support the weight of the CONTHERM by using a properly rated lifting device. Ensure that the support slings are placed correctly to prevent any damage from occurring to the CONTHERM. When all clamps are secure, pass a sling through the slots on the CONTHERM's upper product head.
9	Remove both locknuts (P/N 7401266-01) and then gently lower the CONTHERM into a horizontal position. Use protective supports to prevent scratching the CONTHERM's outer surface (trim sheet).
10	Release the drive system by removing the clamp (P/N 7401579-01) from between the bearing housing and the product head.
11	Loosen and remove the clamp (P/N 7401106-01 or 7403038-01). Remove the upper product head and the O-ring from the heat exchange cylinder. Be careful not to damage the seal bushing located in the product head.

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Figure 7-24. CONTHERM Without A Rotor Hold Down

CALLOUT	DESCRIPTION	PART NUMBER (P/N)
1	O-Ring	7401137-13
2	Carbon Seal Seal Assembly	7401405-01
3	Outer Jacket Assembly	7401136
4	Inner Cylinder Assembly	
5	Hydraulic Lift Assembly	7401168
6	Insulation	7401677
7	Carbon Seal Seal Assembly	7401405-01
8	O-Ring	7401137-13
9	O-Ring	7401137-19
10	Replaceable Rotor End	7401410
11	Cap Screw	7401242
12	Product Head Assembly	7402798
13	Clamp Assembly	7403038-01
14	Blade	
15	Blade Pin	7401759
16	Rotor	
17	Clamp Assembly	7403038-01
18	Product Head	7402798
19	Sheave Assembly	7401311
20	Rotor Stop Assembly	7402745

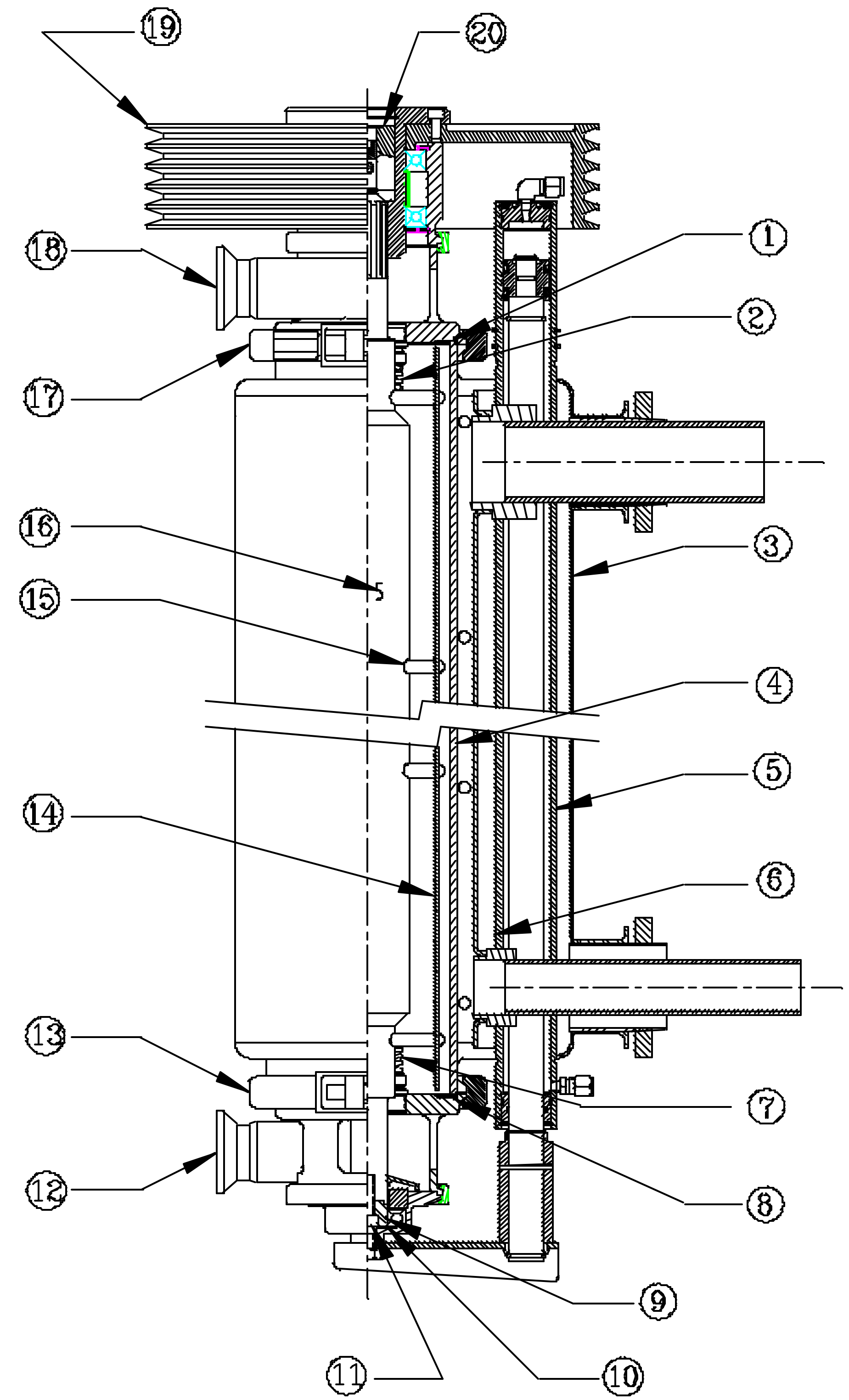

Figure 7-24. CONTHERM Without Rotor Hold Down

Backside of Figure 7-24

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Figure 7-25. CONTHERM With A Rotor Hold Down

CALLOUT	DESCRIPTION	PART NUMBER (P/N)
1	O-Ring	7401137-13
2	Carbon Seal Seal Assembly	7401405-01
3	Outer Jacket Assembly	7401136
4	Inner Cylinder Assembly	
5	Hydraulic Lift Assembly	7401168
6	Insulation	7401677
7	Carbon Seal Seal Assembly	7401405-01
8	O-Ring	7401137-13
9	Replaceable Rotor End	7402982-02
10	Cap Screw	7401242-03
11	Product Head Assembly	7402798
12	Clamp Assembly	7403038-01
13	Blade	
14	Blade Pin	7401759
15	Rotor	
16	Clamp Assembly	7403038-01
17	Product Head	7402798
18	Sheave Assembly	7401311

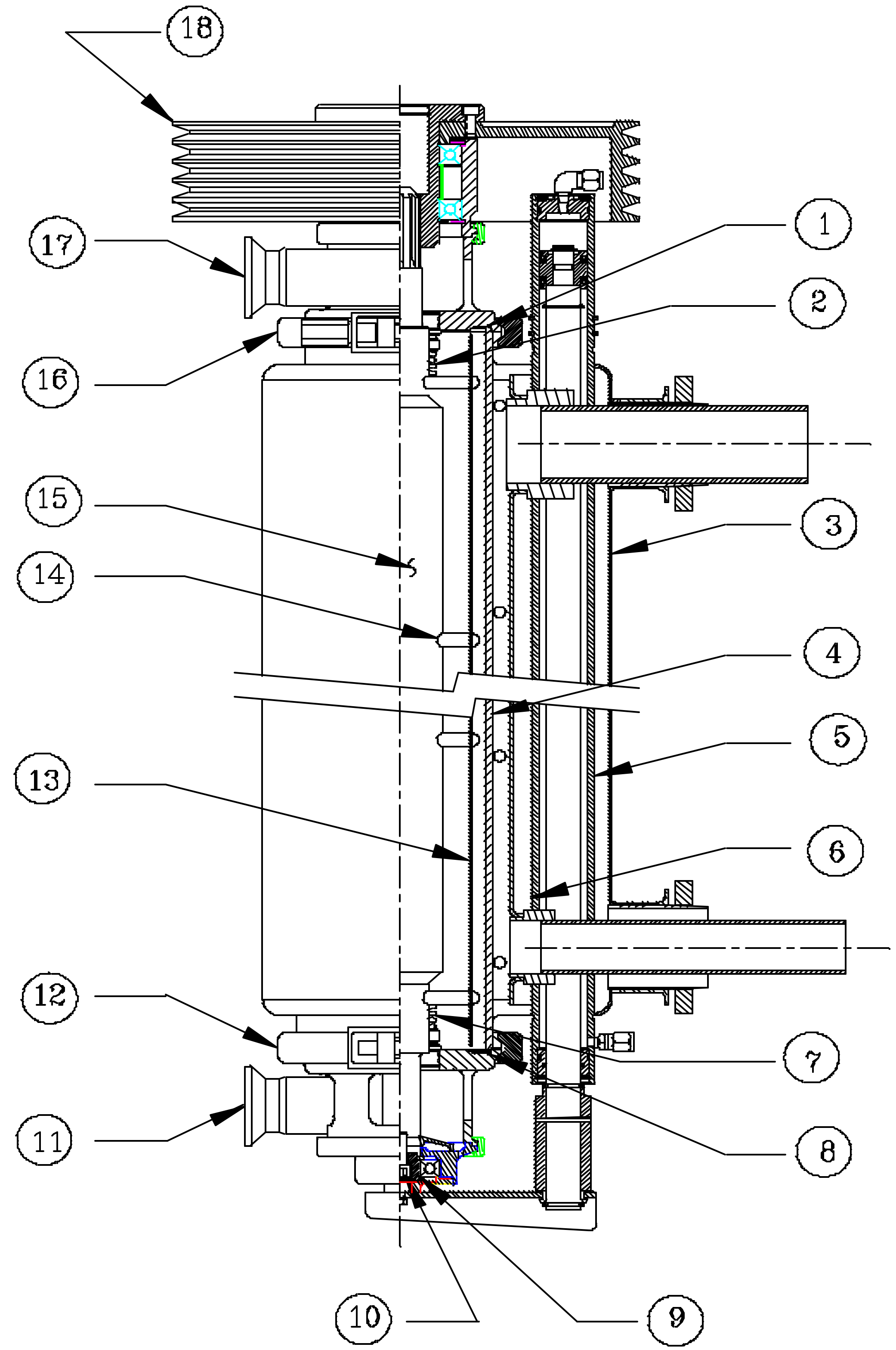

Figure 7-25. CONTHERM With Rotor Hold Down

Backside of Figure 7-25

Table 7-35. Disassembly Of The CONTHERM, Continued

Step	Action
12	Remove the shoulder bolts from the hydraulic lift beam to release the lift beam from the bearing cap.
13	Repeat Step 11 for the lower product head.
14	Release the retaining ring (P/N 7401243-06) from the top end of the hydraulic lift cylinder.
15	Remove the six, hex head bolts (P/N 7401241-01), located at the top of the CONTHERM's outer trim sheet, and pry off the cylinder head trim assembly (P/N 7401141-01), sliding it along the hydraulic lift cylinder. Refer to Figure 7-26 for parts location and identification information.

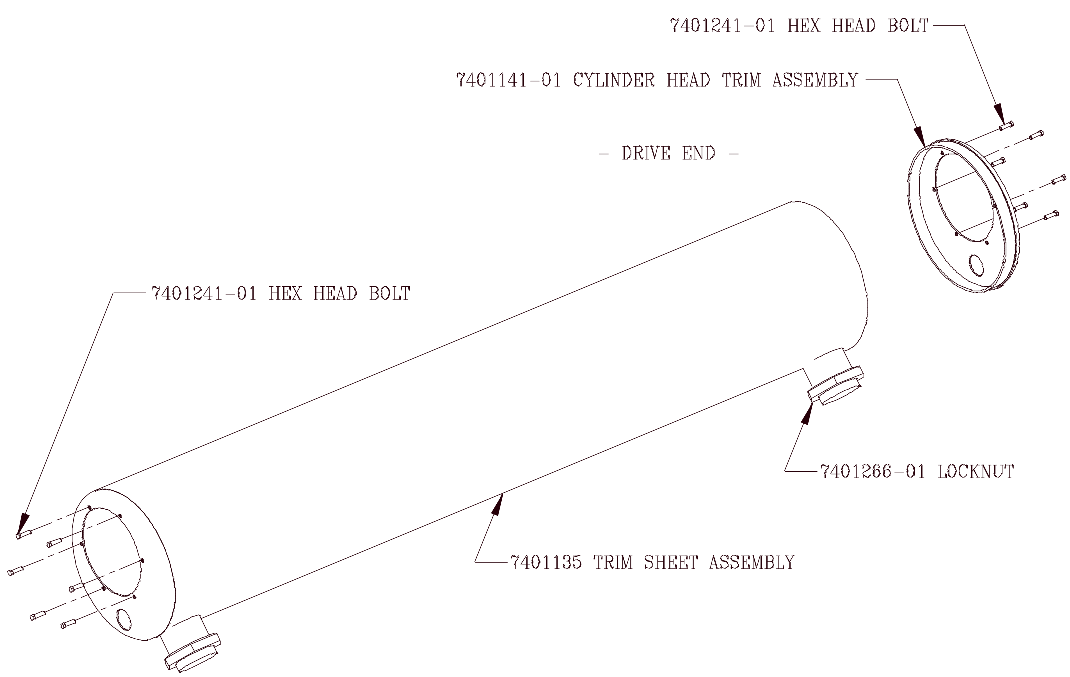

Figure 7-26. CONTHERM's Exterior Trim Sheet

Step	Action
16	Remove the heat exchange cylinder assembly by removing the six (6) additional hex head bolts (P/N 7401241-01) that are located at the opposite end of the trim sheet. Remove the complete cylinder assembly from the trim sheet.
17	Support each end of the inner cylinder so as not to damage the insulation covering the cylinder.

7.9.2 Replacing The CONTHERM's Expansion Joint

The procedure for replacing the CONTHERM's expansion joint is provided in Table 7-36. Refer to Figures 7-27 and 7-28 for parts location and identification information while performing this procedure. Figure 7-27 shows the CONTHERM's expansion joint and related assemblies for CONTHERMs manufactured before 1 August 1991 while Figure 7-28 shows a vertical cross-sectional view of the bellows type expansion seal that has been utilized on CONTHERMs manufactured since 1 October 1994.

NOTE: On 1 August 1991, a design change was incorporated on specific CONTHERM units that involved the design of the internal expansion joint. This change only affects those CONTHERM units that are designed for use with a primary refrigerant such as ammonia or Freon.

All CONTHERM units manufactured before 1 August 1991 utilized a double O-ring method to seal the media channel and to allow for thermal expansion/contraction of the inner cylinder. Refer to Figure 7-25 for detailed information on the parts location and identification information. The seal was created by compressing the smaller O-ring (P/N 7401137-33) and the larger O-ring (P/N 7401137-32) against the Back-up ring.

This double O-ring design has been replaced by a single gasket (P/N 7403031-01) on CONTHERMs equipped for use in refrigerant applications. This seal consists of a single piece of molded neoprene. When this seal is compressed between the End hub and the Back-up ring, it more evenly fills the void, producing a better and more reliable seal.

This single gasket seal can also be used in existing CONTHERM units where the double O-ring style is now installed. The installation, maintenance and inspection procedures for the expansion joint gasket are the same as those performed for the double O-ring configurations.

NOTE:

1. The single gasket seal (P/N 7403031-01) has been implemented on all CONTHERMs manufactured since 1 October 1991. The Part Number identification for an expansion joint other than for refrigerant use is P/N 7403031-02.

2. On 1 October 1994, another expansion joint option was phased in for all new CONTHERMs, except for those that utilize a coiled annulus. This expansion joint uses a bellows on the media jacket to allow for the expansion/contraction of the product cylinder. Existing CONTHERMs, made before 1 October 1994, however, can not be retrofitted to utilize this configuration.

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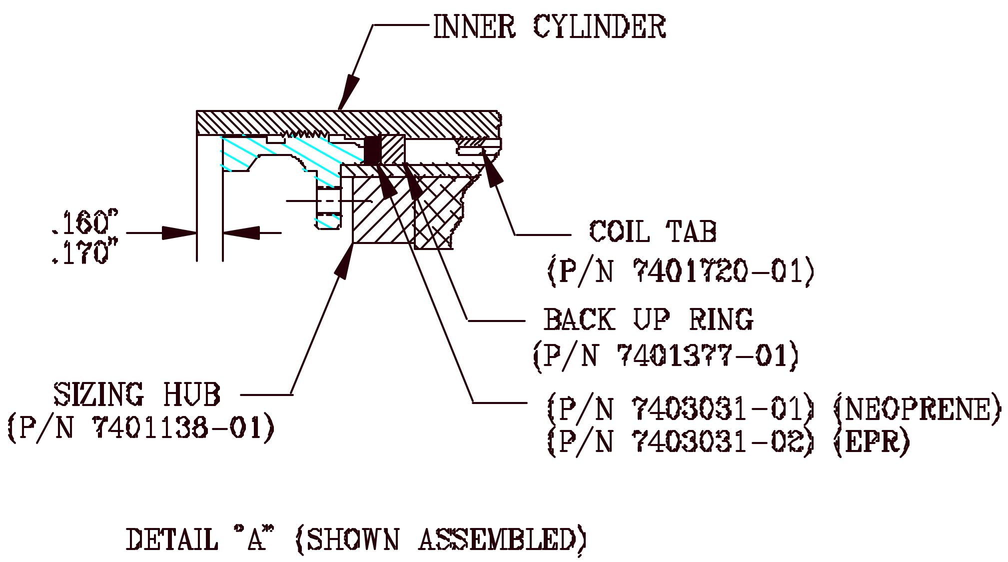
Figure 7-27. CONTHERM Expansion Joint



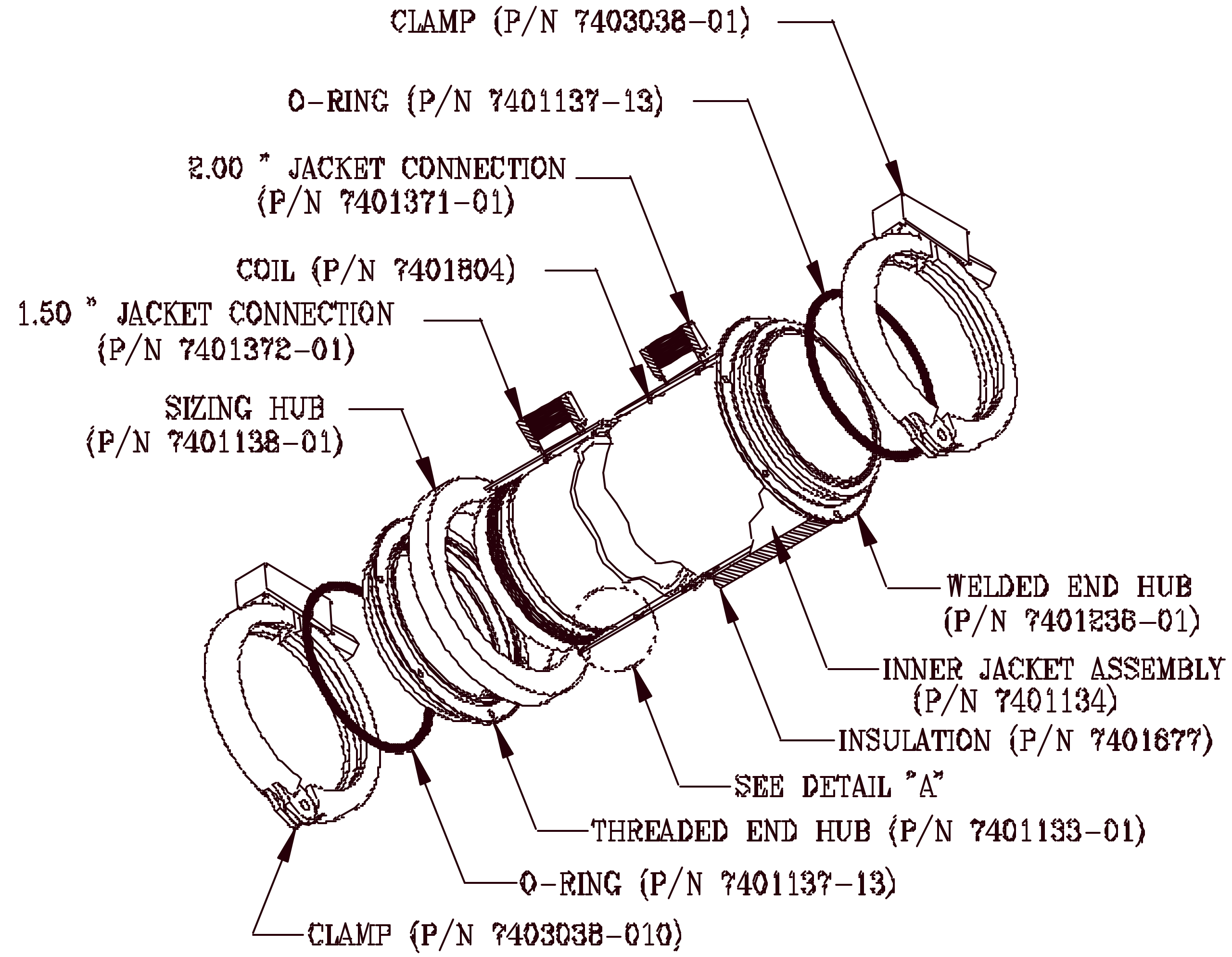


Figure 7-27. CONTHERM Expansion Joint

Backside of Figure 7-27 11 x 17 foldout

Table 7-36. Replacing The CONTHERM's Expansion Joint

Step	Action
1	This procedure assumes that you have disassembled the CONTHERM in accordance with all directions provided in Table 7-35. Review all safety precautions identified in Section 7.9.1, Disassembly Of The CONTHERM before proceeding to the next Step in this procedure.
2	Located at the end of the heat exchange cylinder, closest to the 1.50 inch media connection, is the threaded end hub (P/N 7401133-01). Remove the end hub from the cylinder by turning it counterclockwise. **Note**: A custom designed tool (P/N 7403313-01) is available from Alfa Laval Contherm Inc. for removing the end hub from the heat exchange cylinder.
3	Remove the O-ring that is located between the inner cylinder and the inner jacket assemblies. (Refer to Figure 7-27).
4	Install a new O-ring into the expansion joint and apply lubrication to the O-ring. Apply a film of lubricant to the mating face of the threaded end hub (P/N 7401133-01).
5	Thread the end hub (P/N 7401133-01) onto the cylinder until a dimension of 0.160 inches to 0.170 inches (4.06 mm to 4.32 mm) between the cylinder edge and the end hub face is attained. **Note**: To ensure proper alignment, one of the tapped holes in the end hub (P/N 7401133-01) must be on a common centerline with the 1.50 inch media connection.

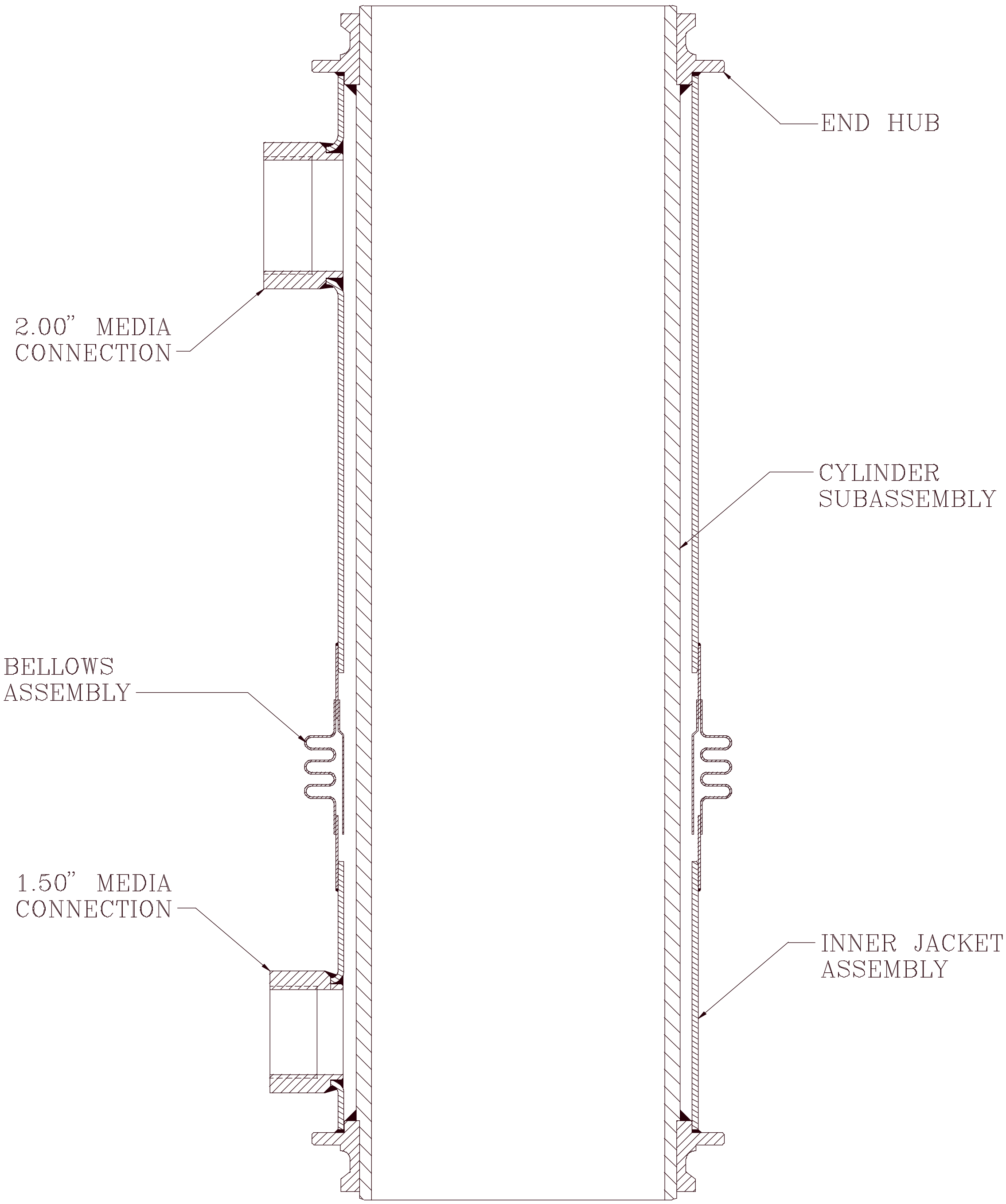


Figure 7-28. CONTHERM's Bellows Type Expansion Joint

7.9.3 Reassembly Of The CONTHERM

The procedure for reassembling the CONTHERM is provided in Table 7-37.

Table 7-37. Reassembly Of The CONTHERM

Step	Action
1	This procedure assumes that you have disassembled the CONTHERM in accordance with all directions provided in Table 7-35. Review all safety precautions identified in Section 7.9.1, Disassembly Of The CONTHERM before proceeding to the next Step in this procedure.
2	Return the cylinder assembly to the trim sheet, 1.50 inch media connection end first. Align the media connection with the mounting connection of the trim sheet.
3	Replace the six, hex head bolts at the lower end of the trim sheet.
4	Return the cylinder head trim assembly (P/N 7401141-01) to the open end of the trim sheet by sliding it along the hydraulic lift cylinder. Using a soft head mallet, insert the cylinder head trim assembly (P/N 7401141-01) onto the trim sheet. Align the holes with the end hub and attach with the six, hex head bolts.
5	Bolt the lift beam to the product head and replace the retaining ring (P/N 7401243-06).
6	Re-attach both product head assemblies to the cylinder end hubs. Replace the bearing and drive system assembly to top product head.
7	Tighten all clamps.
8	Lift the CONTHERM back onto the mount, replacing the locknuts (P/N 7401266-01).
9	Connect the lift cylinder hydraulic connections. Purge the air from the hydraulic lines. (Refer to Chapter Five, Installation.)
10	Using the hydraulic rotor lift system, lower the bottom head assembly and install the rotor, top end first, with the seals properly attached, into the CONTHERM. Carefully insert the lower end of the rotor into the lower head assembly so as to avoid damage to the seal bushing and the lower bearing.
11	Properly install the scraping blades onto the rotor. Refer to Section 7.4, Scraping Blades.
12	Raise the lower product head assembly and rotor, guiding the scraping blades, into the cylinder and secure with clamp.
13	Connect all media supply and return lines to the CONTHERM.
14	Attach any product piping to both product heads.
15	Re-attach the CONTHERM's drive transmission system. 1. Attach hydraulic hoses and turn on the hydraulic power rack. 2. Install the drive belts and supply power to the electric motor. 3. Install the flex sleeve to the drive coupling. Refer to Chapter Five, Installation for the proper alignment instruction.

7.9.4 Disassembly Of The CONTHERM’s Hydraulic Lift Cylinder

The procedure for disassembling the CONTHERM’s hydraulic lift cylinder is provided in Table 7-38. Refer to Figures 7-29 and 7-30 for parts location and identification information while performing this procedure. Figure 7-29 shows the disassembly of a CONTHERM without a rotor hold down while Figure 7-30 shows the disassembly of a CONTHERM with a rotor hold down.

CAUTION

1. If your configuration utilizes two or more Stack Assemblies, do not operate more than one stack valve handle at a time.
2. Do not operate the Rotor Lifting System until you have checked all fittings. Tighten nuts or replace any leaking fittings before operating the system.

WARNING

1. Do not attempt to disassemble the CONTHERM if its rotor is rotating.
2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM’s product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM’s clamps or its piping.
3. Relieve the system pressure in the CONTHERM before you release any of the unit’s clamps.
4. Keep the area under the CONTHERM clear of hands, feet, piping and other obstructions.
5. Do not remove the lower head clamp or the lower bearing clamp until you have verified that the hydraulic Rotor Lifting System is turned on and is operating correctly.
6. The blades attached to the rotor’s rotor pins may be very sharp. Wear protective gloves while handling the rotor.

Table 7-38. Disassembly Of The CONTHERM’s Hydraulic Lift Cylinder

Step	Action
1	Remove the piston rod (P/N 7401173), cylinder head (P/N 7401164-01) and piston (P/N 7401172-01) by releasing the retaining ring (7401243-07) located on the bottom end of the lift cylinder.
2	If a leak is detected at the top of the cylinder, remove the cylinder cap (P/N 7401162-01) and replace its O-ring (P/N 7401137-02). This is accomplished by releasing the retaining ring (P/N 7401243-07) located at the top of the lift cylinder and removing the cylinder cap.

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Figure 7-29. CONTHERM Hydraulic Lift Assembly, Without Hold Down

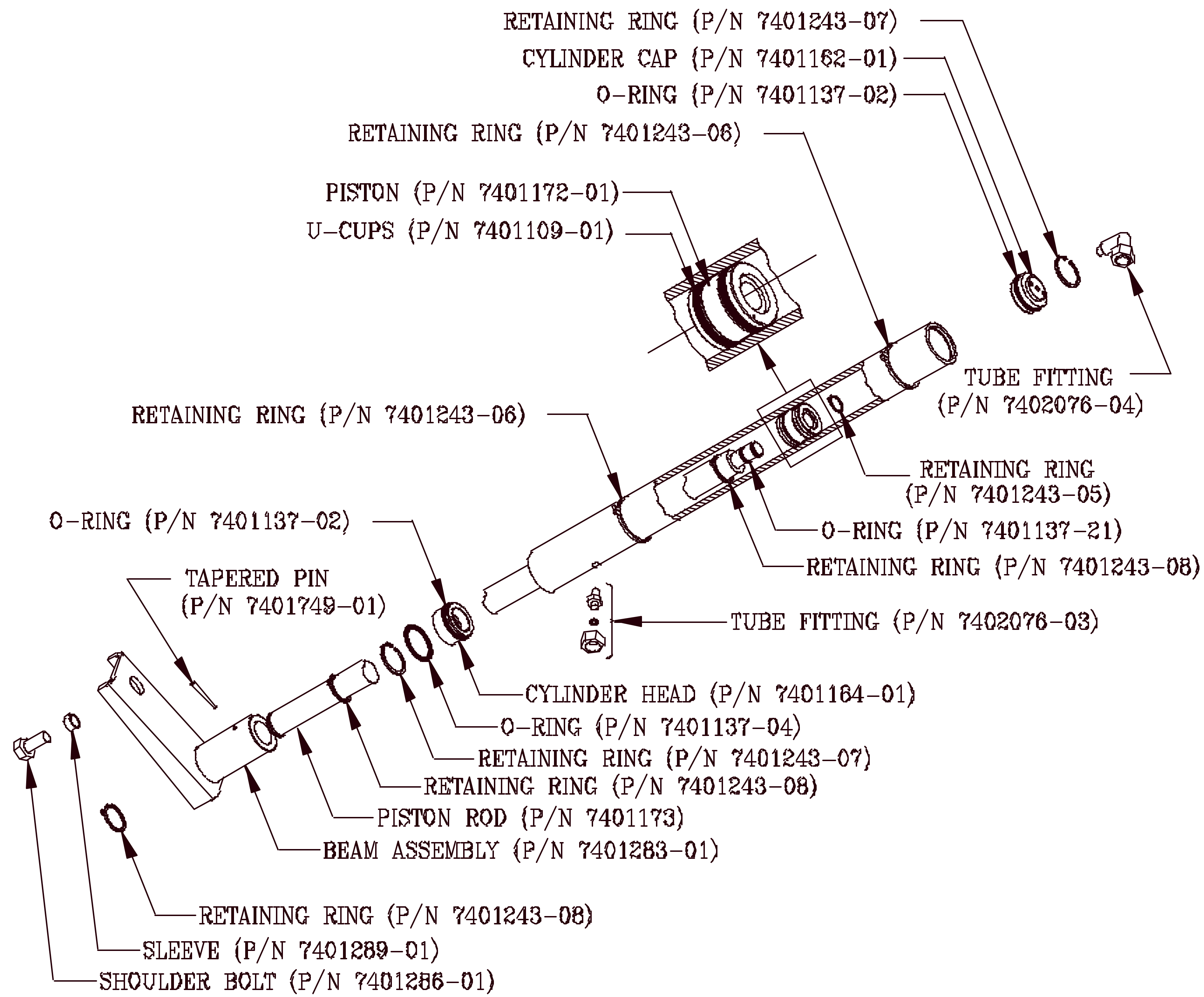

Figure 7-29. CONTHERM Hydraulic Lift Assembly, Without Hold Down

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Insert Figure 7-30 foldout 11 x 17 drawing file

Figure 7-30. CONTHERM Hydraulic Lift Assembly, With Hold Down

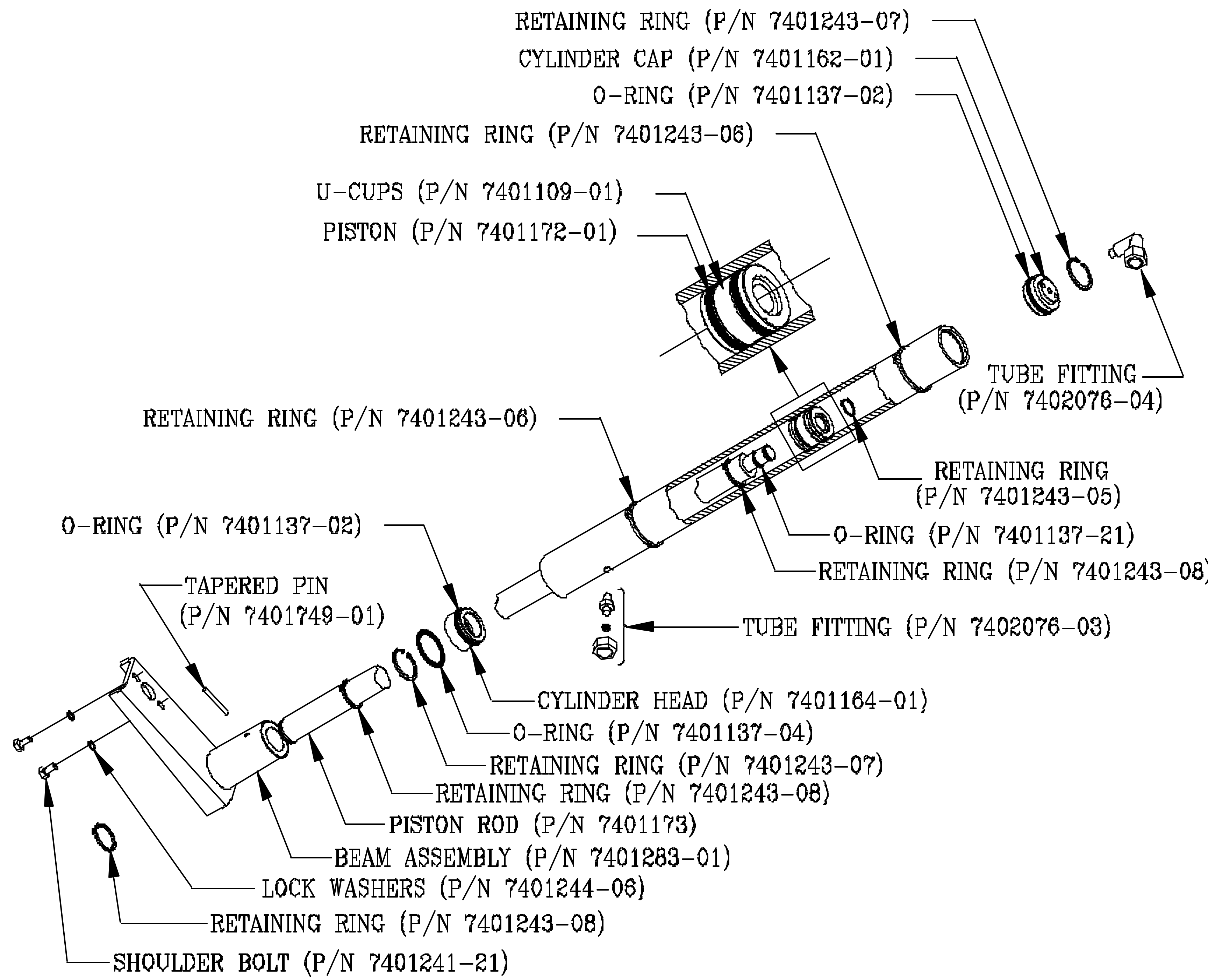

Figure 7-30. CONTHERM Hydraulic Lift Assembly With Hold Down

Backside of Figure 7-30 foldout 11 x 17 drawing file

Table 7-38. Disassembly Of The CONTHERM's Hydraulic Lift Cylinder, Continued

Step	Action
3	If the piston rod has not been operating smoothly, the U-cups (P/N 7401109-01) may be worn or faulty. Release the retaining ring (P/N 7401243-05) located at the end of the piston rod and remove the piston (P/N 7401172-01). Replace the two (2) U-cups on the piston. Refer to Figures 7-29 and 7-30 for parts location and identification information.
4	If a leak is found at the lower end of the lift cylinder, replace the two (2) O-rings (P/N 7401137-02 and 7401137-04). Release the retaining ring (P/N 7401243-05) from the piston rod (P/N 7401173) and remove the piston. Replace both O-rings on the cylinder head (P/N 7401164-01).
5	After the necessary maintenance is complete, reassemble both cylinder head (P/N 7401164-01) and piston (P/N 7401172-01) to the piston rod (P/N 7401173). Apply a film of lubricant to all O-rings and U-cups to ease assembly. Insert the piston rod into the lift cylinder from the lower end. Replace the cylinder cap (P/N 7401162-01) at the top end of the lift cylinder (P/N 7401168). Secure both ends by replacing the retaining ring (P/N 7401243-07).

Alfa Laval
Contherm

Chapter 8

Troubleshooting

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Chapter Eight Troubleshooting

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8.1 INTRODUCTION

This chapter describes how to safely troubleshoot the CONTHERM® Scraped Surface Heat Exchanger (SSHE) and its related equipment. The troubleshooting information is provided as a series of easy-to-follow tables, with each table addressing a specific topic or area. The information provided in this chapter reflects both the knowledge acquired by Alfa Laval Contherm Inc.'s engineers as well as operators experience with the CONTHERM.

If you experience a problem with the CONTHERM, first determine if it is described in one of the following tables. If it is identified, perform the remedy described for resolving the problem. If it is not identified and you cannot decide how to remedy it, contact your local Alfa Laval Contherm Inc. or Tetra Laval representative.

Before performing any troubleshooting task described in this Chapter, please review the safety precautions provided in Chapter One, Safety Summary.

Table 8-1 shows how the troubleshooting information in this chapter is organized.

Table 8-1. CONTHERM® Troubleshooting Information

Section	Category	Applicable Table(s)
8.2	**Seal Leaks** • Product Seals. • Flush Seals (Flushing media entering atmosphere).	Table 8-2. Product Seal Leaks Table 8-3. Flush Seal Leaks
8.3	**Lower Bearing** • Lower bearing wearing out prematurely.	Table 8-4. Lower Bearing
8.4	**Rotor Lift System** • System not operating smoothly in either direction. • System will lower but will not return. • Oil seeping from bottom of lift cylinder, around piston rod. • Oil leaking around cap at top of cylinder.	Table 8-5. Rotor Lift System

Table 8-1. CONTHERM® Troubleshooting Information, Continued

Section	Category	Applicable Table(s)
8.5	**Product Heating**	
	• Product not heated to specified temperature.	Table 8-6. Product Not Heated To Specified Temperature
	• Product burning onto cylinder wall.	Table 8-7. Product Burning Onto Cylinder Wall
8.6	**Product Cooling (Water/Glycol/Brine)**	
	• Product not cooling to specified temperature.	Table 8-8. Product Not Cooling To Specified Temperature
8.7	**Product Cooling (Ammonia/Freon)**	
	• Product not cooling to specified temperature.	Table 8-9. Product Not Cooling To Specified Temperature
	• System Freezes Up.	Table 8-10. System Freezes Up

WARNING

Read this manual before using or working on the CONTHERM®. Do not assemble, disassemble, clean, operate or maintain the CONTHERM® until you have read the manual and are thoroughly familiar and knowledgeable with all safety precautions and the equipment.

8.2 SEAL LEAKS

You can reduce the probability of a seal leak occurring in your CONTHERM system by performing maintenance on a regular basis as recommended in Chapter Seven, Maintenance. If a leak does occur, the following procedures show how to identify its cause and how to eliminate it.

The two most common leaks that may occur in your CONTHERM are the following:

1. Product Seal Leaks.
2. Flush Seal Leaks.

Product Seal Leaks

Product seal leaks may occur with CONTHERMs equipped with standard, conventional rotary seals. When a product seal leak occurs, the product in the CONTHERM's product cylinder leaks from the rotary seals via the seal face.

A product seal leak may be caused by any of the conditions identified in Table 8-2. To resolve the problem, perform the appropriate action as described in the table. When applicable, the table will direct you to the appropriate maintenance related procedure in Chapter Seven for correcting the problem.

Table 8-2. Product Seal Leaks

Problem	Possible Cause	How To Resolve
Product Seal Leaks (Product leaking from seal face)	1. Damaged or worn seal face.	Re-lap or replace seal face. Refer to Section 7.3.4, Seal Inspection And Replacement.
	2. Damaged or worn seal bushing.	Replace seal bushing. Refer to Section 7.3.4, Seal Inspection And Replacement.
	3. Defective O-Rings.	Replace O-Rings. Refer to Section 7.3.4, Seal Inspection And Replacement.
	4. Foreign matter lodged in O-Ring groove of seal shell.	Clean groove and replace O-Ring.
	5. Product has prevented inner spring from exerting proper pressure onto seal shell.	Thoroughly clean and replace the inner spring and the seal shell.
	6. Seal face not installed into seal shell properly.	Remove and replace seal face. Refer to Section 7.3.4, Seal Inspection And Replacement.
	7. Improper O-Ring material.	Consult your local Alfa Laval Contherm Inc. or Tetra Laval representative.
	8. Seal locking pin broken or damaged.	Replace seal pin(s). Refer to Section 7.3.4.5, Replacing A Seal Locking Pin.
	9. Rotor Stop Adjustment not set properly.	Set for maximum of 0.12 inch. Refer to Section 7.7.1 or 7.7.2, Rotor Stop Adjustment.

Flush Seal Leaks

Flush seals are used for product applications that require the processing of sterile products. When a flush seal leak occurs, flushing media either enters the product or the atmosphere. A flush seal leak may be caused by any of the conditions identified in Table 8-3. To resolve the problem, perform the appropriate action as described in the table. If applicable, the table will direct you to the appropriate maintenance related procedure in Chapter Seven to resolve the problem.

Table 8-3. Aseptic Seal Leaks

Problem	Possible Cause	How To Resolve
Flush Seal Leaks (Flushing media entering product or atmosphere)	1. Seal flushing fluid pressure too high.	Reduce fluid pressure to 15 psi (1 BAR).
	2. Damaged carbon seal face of aseptic seal.	Re-lap or replace seal face. Refer to Section 7.3.4, Seal Inspection And Replacement.
	3. Improper O-Ring material.	Consult your local Alfa Laval Contherm Inc. or Tetra Laval representative.
	4. Seal locking pin broken or damaged.	Replace seal pin(s). Refer to Section 7.3.4.5, Replacing A Seal Locking Pin.

8.3 LOWER BEARING

If the lower bearing on your CONTHERM is wearing out prematurely, the problem may be caused by one of the following conditions:

1. Broken bearing seal(s).
2. A worn rotor end.
3. An improperly set rotor stop.

To resolve the problem, perform the appropriate action as described in Table 8-4. When applicable, the table will direct you to the appropriate maintenance related procedure in Chapter Seven.

Table 8-4. Lower Bearing

Problem	Possible Cause	How To Resolve
Lower Bearing Wearing Out Prematurely	1. A broken bearing seal(s).	Replace the bearing. Refer to Section 7.5.2, Replacing Lower Bearings.
	2. A worn rotor end.	Replace Rotor End Assembly. Refer to Chapter Seven, Section 7.5.3, Replacing The Lower Bearings (Hold Down Style).
	3. An improperly set rotor stop. **Note**: Applies only to CONTHERMs with Non-Hold Down Style Rotors.	Reset the rotor stop. Refer to Section 7.7.1 or 7.7.2.

8.4 ROTOR LIFT SYSTEM

A hydraulic Rotor Lift System is provided as standard equipment with each vertically mounted CONTHERM. This system provides a safe and easy method for lowering or raising the CONTHERM's rotor and blade assembly for inspection, maintenance, or manual cleaning.

If the Rotor Lift System is installed, operated and maintained in accordance with the instructions provided in this manual, you should not experience problems with the system. However, if a problem with the system should occur, the following procedures show how to identify and resolve it.

The most common problems that may occur in the Rotor Lift System include the following:

1. Rotor Lift not operating smoothly in either direction.
2. Rotor Lift will lower but will not return.
3. Oil is seeping from the bottom of the lift cylinder around the piston rod.
4. Oil is leaking around the cap at top of the cylinder.

Table 8-5 describes each of the four possible Rotor Lift System problem areas. When applicable, the table will direct you to the appropriate maintenance related procedure in Chapter Seven.

Table 8-5. Rotor Lift System

Problem	Possible Cause	How To Resolve
Rotor Lift System Not Operating Smoothly In Either Direction	1. Air in system.	Bleed air by raising and lowering lift several times. Confirm that the supply tank has a vented cap to allow air to escape. Check oil supply level.
	2. Oil contamination due to water (oil has creamy and foamy appearance).	Drain contaminated oil from system and replace with clean oil.
Rotor Lift System Will Lower But Will Not Return	1. Stack valve blocked.	Disconnect lines to the stack valve and inspect for any restrictions.
	2. Hydraulic lift pump motor is not operating.	Check wiring and/or fuses.
	3. U-cups are damaged or twisted.	Disassemble hydraulic lift cylinder and inspect piston and U-cups. Refer to Section 7.9.4, Disassembly of Hydraulic Lift Cylinder.
Oil Seeping From Bottom Of Lift Cylinder Around Piston Rod	Damaged O-Rings.	Replace the following O-Rings: 1. O-Ring, P/N 7401137-02 2. O-Ring, P/N 7401137-04
Oil Leaking Around Cap At Top Of Cylinder	Damaged O-Ring.	Replace O-Ring, P/N 7401137-02.

8.5 PRODUCT HEATING

If your CONTHERM is installed, operated and maintained as described in this manual, your product will be heated to the desired temperature by the CONTHERM. However, if a product heating problem does occur, the following procedures will show you how to identify its cause and resolve the problem.

The two most common product heating problems that may occur in your CONTHERM are:

1. Product is not being heated to the specified temperature.
2. Product is burning onto the cylinder wall.

Product Not Heated To Specified Temperature

Table 8-6 identifies specific factors that may result in the product not being heated to the proper temperature. To resolve the problem, perform the appropriate action as described in the table. When applicable, the table will direct you to the appropriate maintenance related procedure in Chapter Seven.

Table 8-6. Product Not Heated To Specified Temperature

Problem	Possible Cause	How To Resolve
Product Not Heated To Specified Temperature	1. Product flow rate too high.	Decrease the product flow rate.
	2. Product input temperature too low.	Increase the temperature of the product entering the input port.
	3. Steam control valve improperly sized.	Re-size and replace the valve.
	4. Steam control valve not installed within five feet (1.5 meters) of the CONTHERM.	Relocate the steam valve.
	5. No condensate trap in the condensates return line.	Install a properly sized steam trap.
	6. Steam trap not functioning properly.	Open the bypass line at the trap. If the product temperature rises to the desired reading, the trap is not working properly. Replace the trap.
	7. Rotors turning in reverse direction.	CONTHERM with Electric Drive: Change the motor wiring. CONTHERM with Hydraulic Drive: Reverse the hoses.
	8. Rotor speed too low.	CONTHERM with Electric Drive: Change the motor pulley. Replace the motor sheave with a larger diameter sheave to increase the rotor speed. CONTHERM with Hydraulic Drive: Adjust the flow control valve.

Product Burning Onto Cylinder Wall

Table 8-7 identifies specific factors that may result in the product burning onto the cylinder wall. To resolve the problem, perform the appropriate action as described in the table. When applicable, the table will direct you to the appropriate maintenance related procedure in Chapter Seven.

Table 8-7. Product Burning Onto Cylinder Wall

Problem	Possible Cause	How To Resolve
Product Burning Onto Cylinder Wall	1. Product not flowing through CONTHERM before steam is turned on.	Start product flow through the CONTHERM before turning the steam on.
	2. Rotor not turned on before steam turned on.	Turn on the rotor as soon as the product enters the CONTHERM.
	3. Rotor stopped when product flow is interrupted.	Leave the rotor turning when the product flow has temporarily stopped (for short periods of time between 1 to 5 minutes).
	4. Steam leaking past the control valve when system is shut down.	Install a normally closed solenoid valve ahead of the steam control valve.
	5. Rotor speed too slow.	CONTHERM with Electric Drive: Change the motor pulley. Replace the motor sheave with a larger diameter sheave to increase the rotor speed. CONTHERM with Hydraulic Drive: Adjust the flow control valve.

8.6 PRODUCT COOLING (WATER/GLYCOL/BRINE)

If your CONTHERM is installed, operated and maintained as described in this manual, your product will be cooled to the desired temperature by the CONTHERM's coolant media (water/glycol/brine). However, if a product cooling problem does occur, the following procedure shows you how to identify its cause and resolve the problem.

Table 8-8 identifies specific factors that may result in the product not being cooled to the proper temperature. To resolve the problem, perform the appropriate action as described in the table. When applicable, the table will direct you to the appropriate maintenance related procedure in Chapter Seven.

Table 8-8. Product Not Cooling To Specified Temperature (Water/Glycol/Brine)

Problem	Possible Cause	How To Resolve
Product Not Cooling To Specified Temperature	1. Product flow rate too high.	Reduce the product's flow rate.
	2. Product input temperature too high.	Reduce the temperature of the entering product.
	3. Media temperature too high.	Reduce the temperature of the media.
	4. Media flow rate too low.	Increase the media flow rate.
	5. Rotor speed too slow.	CONTHERM with Electric Drive: Change the motor pulley. Replace the motor sheave with a larger diameter sheave to increase the rotor speed. CONTHERM with Hydraulic Drive: Adjust flow control valve.
	6. Rotor turning in reverse direction.	CONTHERM with Electric Drive: Change the motor wiring. CONTHERM with Hydraulic Drive: Reverse the hoses.
	7. Blade springs not reinstalled after maintenance.	Lower rotor for inspection, remove blades, and install any missing springs.
	8. Blades left off after maintenance.	Lower rotor for inspection. Install any missing blades. Return rotor to operating position.
	9. Brine/Glycol concentration too high.	Check the freezing points and lower the concentration (%).

8.7 PRODUCT COOLING (AMMONIA/FREON)

If your CONTHERM is installed, operated and maintained as described in this manual, your product will be cooled to the desired temperature by the CONTHERM's Ammonia/Freon coolant media. However, if a product cooling problem does occur, the following procedure shows how to identify its cause and resolve the problem.

The two most common product cooling problems that may occur in a CONTHERM using Ammonia/Freon media are the following:

1. Product is not being cooled to the correct temperature.
2. The system is freezing up.

Product Not Cooled To Specified Temperature

Table 8-9 identifies specific factors that may result in the product not being cooled to the proper temperature. To resolve the problem, perform the appropriate action as described in the table. If applicable, the table will direct you to the appropriate maintenance related procedure in Chapter Seven.

Table 8-9. Product Not Cooling To Specified Temperature (Ammonia/Freon)

Problem	Possible Cause	How To Resolve
Product Not Cooling To Specified Temperature	1. Product flow rate too high.	Reduce the product flow rate.
	2. Product input temperature too high.	Reduce the temperature of the product.
	3. Rotor turning in reverse direction.	CONTHERM with Electric Drive: Change the motor wiring. CONTHERM with Hydraulic Drive: Reverse the hoses.
	4. Rotor speed too slow.	CONTHERM with Electric Drive: Change the motor pulley. Replace the motor sheave with a larger diameter sheave to increase the rotor speed. CONTHERM with Hydraulic Drive: Adjust the flow control valve.
	5. Liquid level control on accumulator set too low or is defective.	Reset the level control. Inspect the electrical wiring. Replace defective accumulator.
	6. Ammonia system contaminated with oil.	Purge the oil from the system.
	7. Back pressure valve for refrigerant not properly adjusted.	Turn the adjustment screw until the product reaches the proper temperature. For automatic systems, check the operation of the controller and repair if necessary.

Table 8-9. Product Not Cooling To Specified Temperature (Ammonia/Freon), Continued

Problem	Possible Cause	How To Resolve
Product Not Cooling To Specified Temperature, Continued	8. Back pressure valve improperly sized.	Install a correctly sized valve.
	9. Suction line too small resulting in a pressure drop that will not allow back pressure valve to operate at its lowest temperature.	Re-size and replace the suction line.

System Freezing Up

Table 8-10 identifies specific factors that may result in the system freezing up. To resolve the problem, perform the appropriate action as described in the table. If applicable, the table will direct you to the appropriate maintenance related procedure in Chapter Seven.

Table 8-10. System Freezing Up (Ammonia/Freon)

Problem	Possible Cause	How To Resolve
System Freezing Up	1. Product flow has stopped.	Check the product pump. Repair or replace if necessary.
	2. Rotor has stopped.	Inspect the drive head. Repair or replace if necessary.
	3. Product input temperature has been lowered during processing run.	If the product flow should stop during operation, keep the rotors turning and place the refrigeration system under Maintain Status operation.
	4. Refrigeration system malfunction.	Check the operation of the refrigeration system.
	5. Set points on ammeter too high (CONTHERMs with Electric Drives).	Re-adjust the settings to properly activate the Maintain Status operation.
	6. Set points on tachometer too low (CONTHERMs with Hydraulic Drives).	Re-adjust the settings to properly activate the Maintain Status operation.

WARNING

Shut down system immediately and energize Hot Gas Defrost System if system freezes up to the point where rotor will no longer turn. Resume the product run only after system has been defrosted. Before resuming the run, readjust all valves to prevent freeze up problem from recurring.

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Chapter 9

CONTHERM
Spare Parts Information

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Chapter Nine CONTHERM Spare Parts Information

Chapter 9 CONTHERM Spare Parts Information

9.1 INTRODUCTION

This section contains the following spare parts related information for your CONTHERM:

1. A list of your CONTHERM's major components. The specific information for this list must be entered by you based on your CONTHERM's serial number and the information provided within the equipment's shipping/packaging list.
2. A list of the Start-Up Spares supplied by Alfa Laval Contherm Inc. with your standard CONTHERM.
3. A recommended spare parts list for supporting the operation of your CONTHERM for one year.

Table 9-1 shows how the spare parts information in this chapter is organized.

Table 9-1. CONTHERM Spare Parts Information

Section	Description
9.2	Major Components Of The CONTHERM
9.3	Start-Up Spares Provided With The CONTHERM
9.4	Recommended Quantity Of Start-Up Spares

9.2 MAJOR COMPONENTS OF THE CONTHERM

Table 9-2 identifies your CONTHERM's major components. You must enter the appropriate data for each category listed. This information will help you when ordering spare parts for your CONTHERM(s). By using this list in conjunction with Section 9.4, Recommended Quantity Of Start-Up Spares, you will ensure that all necessary parts will be available when you need them.

Table 9-2. Key Components Of Your CONTHERM(s)

CONTHERM # 1	**Model Number: ________**	**Serial Number: __________**
Component	**Description**	**Part Number**
Blades		
Seals		
Seal O-Rings		
Product Head O-Ring		
Product Port Gasket		
Expansion Joint O-Rings		
CONTHERM # 2	**Model Number: ________**	**Serial Number: __________**
Component	**Description**	**Part Number**
Blades		
Seals		
Seal O-Rings		
Product Head O-Ring		
Product Port Gasket		
Expansion Joint O-Rings		
CONTHERM # 3	**Model Number: ________**	**Serial Number: __________**
Component	**Description**	**Part Number**
Blades		
Seals		
Seal O-Rings		
Product Head O-Ring		
Product Port Gasket		
Expansion Joint O-Rings		
CONTHERM # 4	**Model Number: ________**	**Serial Number: __________**
Component	**Description**	**Part Number**
Blades		
Seals		
Seal O-Rings		
Product Head O-Ring		
Product Port Gasket		
Expansion Joint O-Rings		

Table 9-2. Key Components Of Your CONTHERM(s), Continued

CONTHERM # 5	**Model Number: ________**	**Serial Number: __________**
Component	**Description**	**Part Number**
Blades		
Seals		
Seal O-Rings		
Product Head O-Ring		
Product Port Gasket		
Expansion Joint O-Rings		
CONTHERM # 6	**Model Number: ________**	**Serial Number: __________**
Component	**Description**	**Part Number**
Blades		
Seals		
Seal O-Rings		
Product Head O-Ring		
Product Port Gasket		
Expansion Joint O-Rings		
CONTHERM # 7	**Model Number: ________**	**Serial Number: __________**
Component	**Description**	**Part Number**
Blades		
Seals		
Seal O-Rings		
Product Head O-Ring		
Product Port Gasket		
Expansion Joint O-Rings		
CONTHERM # 8	**Model Number: ________**	**Serial Number: __________**
Component	**Description**	**Part Number**
Blades		
Seals		
Seal O-Rings		
Product Head O-Ring		
Product Port Gasket		
Expansion Joint O-Rings		

9.3 START-UP SPARES PROVIDED WITH THE CONTHERM

Table 9-3 identifies the components (Start-Up Spares) that are provided by Alfa Laval Contherm Inc. with each CONTHERM.

Table 9-3. Start-Up Spares Provided With Each CONTHERM

Component	Part Number (P/N)	Quantity
Product Head O-Ring	7401137 +	Three per unit.
Rotor Lift Helper Plate	7401322	One plate per installation.
Standard Seal Face(s)	7401323-01, 7401404-01	One set per unit.
Blade	+	One blade per unit.
Bearing	7401391-01, 7401470-02	One lower bearing per installation.
Seal O-Rings	7401137 +	Six per unit.
Product Port Gaskets	+	Six per unit.

Note: The information denoted by the "+" is obtained from Table 9-2.

9.4 RECOMMENDED QUANTITY OF START-UP SPARES

Tables 9-4 through 9-7 identify the recommended quantities of spare parts (components) required to support the operation of one CONTHERM for one year. If you have more than one CONTHERM, please contact your local Alfa Laval Contherm Inc. representative for information on the recommended quantities of spare parts. Refer to Table 9-2 for the part numbers (P/Ns) and descriptions of the blades, product ports, and O-Rings used in your CONTHERM.

Always reference your CONTHERM's Model Number and Serial Number when ordering spare parts. This information is inscribed on the inspection plate that is located on the exterior of the CONTHERM. The spare parts information in this section is provided in four tables:

Table Number	Description
9-4	Recommended Quantities Of Spare Parts For CONTHERM With Standard Seals
9-5	Recommended Quantities Of Spare Parts For CONTHERM With Standard Flush Seals
9-6	Recommended Quantities Of Spare Parts For A CONTHERM With Standard Balanced Seals
9-7	Recommended Quantities Of Spare Parts For CONTHERM With Inboard Style Lower Bearing And Standard Seal At Drive End

Table 9-4. Recommended Quantities Of Spare Parts For CONTHERM With Standard Seals

Component	Part Number (P/N)	Quantity
Product Head O-Ring	7401137 +	24
Rotary Seal Assembly O-Ring	7401137 +	24
Standard Seal Face	7401323-01	6
Drive End Bearing	7401361-01	2
Outboard Bearing	7401391-01	1
Rotary Seal Shell	7401401-03	2
Replaceable Rotor End Assembly	7402747-01, 7402982-02	1
Seal Lapping Plate	7401603-01	1
Hydraulic Lift Repair Kit	7401604-01	1
Bearing Seal Plug	7401621-01	1
Inner Spring	7401862-01	2
Seal Face Lapping Film	7402087-01 (15 micron)	A package of 10
Seal Face Lapping Film	7402087-02 (30 micron)	A package of 10
Seal Bushing Assembly	7402743-01	2
Complete Set of Blades	+	1
Product Port Gasket	+	24

Table 9-5. Recommended Quantities Of Spare Parts For A CONTHERM With Standard Flush Seals

Note: In addition to the spare parts recommended in Table 9-4, CONTHERM's with Standard Flush Seals require the spare parts listed in Table 9-5.

Component	Part Number (P/N)	Quantity
Flush Rotary Seal O-Ring	7401137 +	24
Outer Seal Face O-Ring	7401137 +	6
Flush Seal Bushing Assembly	7401319-01, 7401319-02 *****	2
Outer Spring	7401388-01	2
Flush Rotary Seal Shell	7401403-01	2
Standard Seal Face	7401404-01	6

***** P/N 7401319-01 and P/N 7401319-02, Seal Bushing Assembly replaces P/N 7402743-01, Seal Bushing on unit's equipped with flush seals.

Table 9-6. Recommended Quantities Of Spare Parts For A CONTHERM With Standard Balanced Seals

Component	Part Number (P/N)	Quantity
Product Head O-Ring	7401137 +	24
Rotary Sleeve O-Ring	7401137 +	24
Standard Seal Face	7401323-01	6
Drive End Bearing	7401361-01	2
Outboard Bearing	7401391-01	1
Seal Bushing Assembly	7402743-01	2
Replaceable Rotor End Assembly	7402747-01, 7402982-02	1
Seal Lapping Plate	7401603-01	1
Hydraulic Lift Repair Kit	7401604-01	1
Bearing Seal Plug	7401621-01	1
Balance Seal Shell	7401925-01	2
Seal Spring	7401927-01	2
Seal Face Lapping Film	7402087-01 (15 micron)	One package of 10
Seal Face Lapping Film	7402087-02 (30 micron)	One package of 10
Complete Set of Blades	+	1
Product Port Gasket	+	24

Table 9-7. Recommended Quantities Of Spare Parts For A CONTHERM With An Inboard Style Lower Bearing And Standard Seal At The Drive End

Component	Part Number (P/N)	Quantity
Product Head O-Ring	7401137 +	24
Rotary Seal Assembly O-Ring	7401137 +	12
Standard Seal Face	7401323-01	3
Drive End Bearing	7401361-01	2
Rotary Seal Shell	7401401-03	1
Thrust Ring	7401469-01	3
Retainer Ring	7401471-01	1
Bearing Sleeve	7401482-01	2
Seal Lapping Plate	7401603-01	1
Hydraulic Lift Repair Kit	7401604-01	1
Inner Spring	7401862-01	1
Seal Face Lapping Film	7402087-01 (15 micron)	One package of 10
Seal Face Lapping Film	7402087-02 (30 micron)	One package of 10
Seal Bushing Assembly	7402743-01	1
Complete Set of Blades	+	1
Product Port Gasket	+	24

Note: The information marked with the “+” is available in Table 2-21.

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Chapter 10

Special Applications And Design Features

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Chapter Ten Special Applications And Design Features

Chapter 10 Special Applications And Design Features

10.1 INTRODUCTION

In addition to the standard CONTHERM, Alfa Laval Contherm Inc. offers several variations for use with special product applications. This chapter describes each of these variations, their design features, and the special product applications for which they are utilized.

The following variations of the standard CONTHERM are available from Alfa Laval Contherm Inc.:

1. CONVAP® Scraped Surface Evaporator (The “CONVAP”)
2. CONTHERM Equipped With Three-inch Diameter (76.2 mm) Product Heads
3. CONTHERM Equipped With Water-Heated Rotor
4. CONTHERM Equipped With Pin Unit
5. CONTHERM Equipped With Inverted Electric Drive Sheave
6. CONTHERM Equipped With Eccentric Product Heads

The operation, maintenance, and inspection of the units described in this Chapter are, for the most part, identical to those described for the standard CONTHERM. Where differences exist, they are noted and described.

Note: CONVAP® is a registered trademark of Alfa Laval Contherm Inc.

Chapter Ten is organized as shown in Table 10-1.

Table 10-1. Special Applications And Design Features.

Section	Description
10.2	CONVAP Scraped Surface Evaporator
10.3	CONTHERM Equipped With Three-inch Diameter (76.2 mm) Product Heads
10.4	CONTHERM Equipped With Water Heated Rotor
10.5	CONTHERM Equipped With Pin Unit
10.6	CONTHERM Equipped With Inverted Electric Drive Sheave
10.7	CONTHERM Equipped With Eccentric Product Heads

10.2 CONVAP® SCRAPED SURFACE EVAPORATOR

The CONVAP Scraped Surface Evaporator, referenced within this manual as the CONVAP, is basically a CONTHERM with two additional components, a vapor dome and a longer rotor, that operates under vacuum conditions. A single CONVAP consists of a scraped surface heat exchanger, a vapor dome, the appropriate size separator, a spray condenser and a mounting column. All service and maintenance procedures for the CONVAP are identical to those of the standard CONTHERM.

The CONVAP is a continuous, Scraped Surface Evaporator which can effectively concentrate products to extremely high solids levels. It is often used to process products that quickly become viscous as they are concentrated. The CONVAP is especially suitable for concentrating products that have been pre-concentrated by other means and have become too viscous to handle. For example, a CONVAP can take a sugar solution that has been condensed to 65% Total Solids in another evaporator and further condense it to 95% Total Solids.

Typical CONVAP applications include the production of purees, mashes, pulps, concentrates, and pastes from fruits and vegetables. The CONVAP is also used for processing protein solutions, sugar solutions, chemical and pharmaceutical solutions, and concentrating plant waste materials into a heavy slurry for easy disposal.

Unlike fixed clearance, wiped film or thin film evaporators, the CONVAP's scraping blades come into intimate contact with the product and cylinder wall. This contact removes any insulating film barrier that may form on the heat transfer surface. This rapid and continuous re-exposure of new product to the cylinder wall results in higher heat transfer to the product. High rotor speeds of 350-450 rpm result in a more uniform heat transfer, preventing localized heating and maintaining product quality.

The CONVAP's vertical design offers all of the benefits of the CONTHERM Scraped Surface Heat Exchanger:

1. Savings of floor space.
2. Minimum intermixing at changeover.
3. Complete drainage.
4. Ease of maintenance and inspection.
5. Full flooded system.

The CONVAP offers the same flexibility as the CONTHERM in that it can easily be adapted to process a number of different products. If product changes require a change of rotor, blades, seals, etc., the changeover process is quick and simple with the use of the unit's rotor lifting device. All CONVAP's are designed for clean in place (CIP) operation. This translates into a minimum down time requirement for product switch over.

Table 10-2 identifies the CONVAP related information presented in this section.

Table 10-2. Organization Of The CONVAP Information

Section	Description
10.2.1	Functional Description
10.2.2	Initial System Test
10.2.3	Product Start-up And Operation
10.2.4	Cleaning

10.2.1 Functional Description

Alfa Laval Contherm Inc. offers its CONVAPs in either a single or dual unit vertically mounted configuration. Each configuration includes a drive and a separator and spray condenser. CONVAPs are available with each of the motor designs previously described for the CONTHERM SSHEs.

Standard CONVAP Package

In addition to the components for the standard direct drive gear motor, belt & sheave unit, and hydraulic drive unit that were previously described for the CONTHERM SSHE, the CONVAP also uses the following components:

- Standard heat exchange cylinder material of stainless steel 316L with inside diameter honed and polished.
- 3.00-inch (76 mm) diameter extended 4-Bladed (Blades @ 90°) rotor.
- One (1) set of flushed standard seals.
- Vapor Dome, Separator (sized appropriately) and Spray Condenser.
- Solid Mounting Column.

A Dual CONVAP configuration is basically the same as that of the single CONVAP with the following exceptions:

- Two heat exchange cylinders are used.
- A common separator, condenser and mounting column are used for both CONVAPs.

Note: Pumps are not included in the basic CONVAP package. The product feed pump, product removal, vacuum and condensate removal pumps are not in the scope of supply.

CONVAP Options

The following options are offered by Alfa Laval Contherm Inc. for the CONVAP:

1. Drive Options.
2. Stripped CONVAP.
3. Condenser Options.

Drive Options

The following drive options are available:

- Belt & Sheave
- Hydraulic
- Direct Drive

Stripped CONVAP

The Stripped CONVAP package includes a vapor dome with mating ferrule, clamp & gasket, and extended rotor.

Condenser Options

The following condenser options are available:

- Appropriate spray condenser (Standard)
- 6-inch (152 mm) diameter shell & tube condenser with 64-Ft^2 (6-M^2) of surface area
- 8-inch (203 mm) diameter shell & tube condenser with 105-Ft^2 (10-M^2)of surface area

As described in Section 10.2, CONVAPs are designed for use in applications where the final product requires an increased percentage of solids. The CONVAP, operating under vacuum conditions, increases the percentage of solids by one of two methods:

1. Controlling the CONVAP's steam supply valve based on the product's temperature.
2. Controlling the CONVAP's steam supply valve based on the solids level of the product.

The specific approach used is determined by the characteristics of the product. For each method, the vacuum level must be tightly controlled at a fixed level to prevent fluctuations in the product's boiling point. For products in which the boiling point is a function of the product's solid level, solids control is achieved by monitoring the product's temperature and controlling the setting of the CONVAP's steam supply valve based on this temperature.

For products in which the solids level has minimal affect on the product's boiling point, solids control is achieved by utilizing a solids meter to directly monitor the solids level of the product exiting the CONVAP. The value measured determines when the CONVAP will adjust the steam supply valve to maintain the product's desired percent solids level.

Two typical CONVAP configurations are shown in Figures 10-1 and 10-2. The operation of the CONVAP in each configuration is described in the following paragraphs. The principal difference between the two configurations is that the one shown in Figure 10-1 utilizes a shell & tube condenser while the one shown in Figure 10-2 utilizes a spray condenser with an associated separation tank and condensate removal pump.

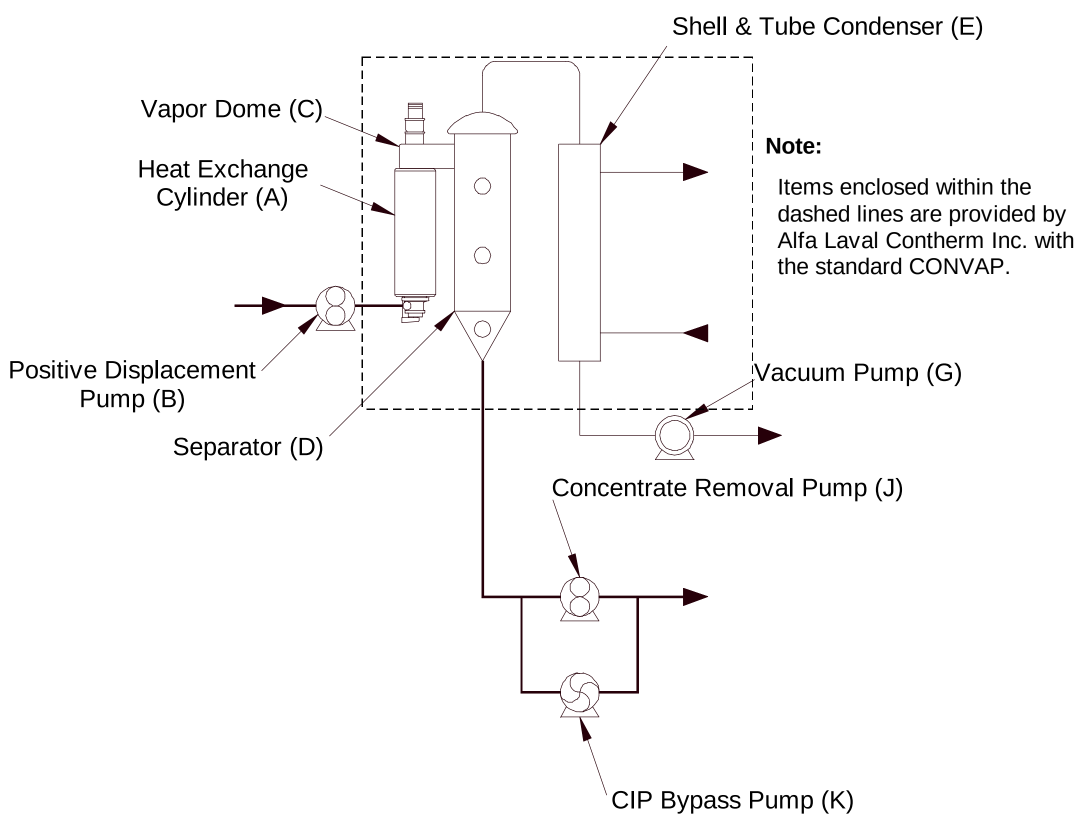


Figure 10-1. CONVAP Configured With Shell & Tube Condenser

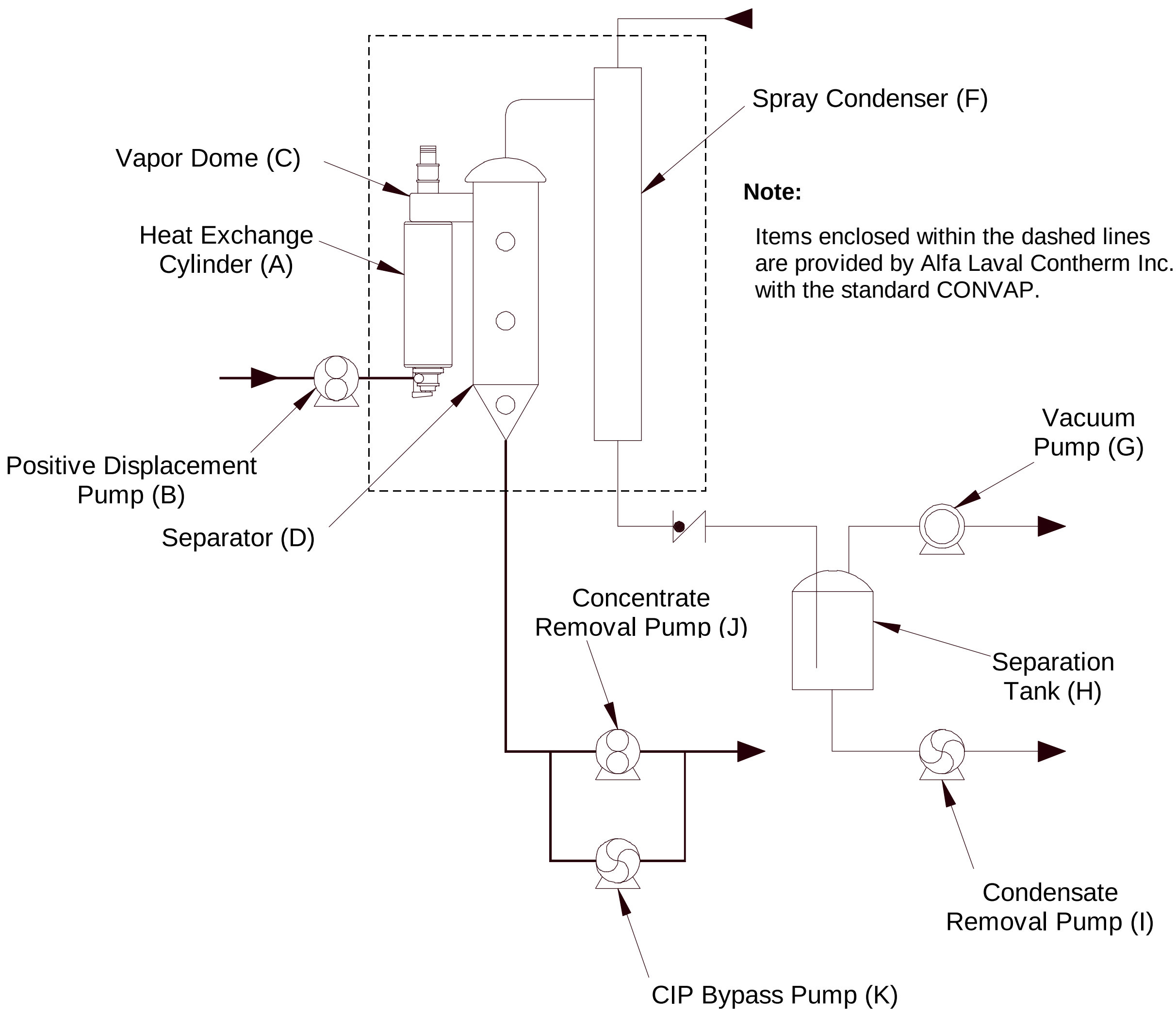


Figure 10-2. CONVAP Configured With Spray Condenser

The product enters the lower port of the CONVAP Scraped Surface Evaporator. As the product is pumped through the cylinder with a positive displacement pump (B), the heat of vaporization is supplied by the heating media. Operating under vacuum conditions, product vaporization occurs in the heat exchange cylinder (A). The system is operated under vacuum to enhance vaporization and lower the required temperature for evaporation.

The released vapor expands, increases in volume, and causes a thin film of product to move up the cylinder wall. When the vaporized product reaches the top of the heat exchange cylinder, it passes through the vapor dome (C) and is channeled into the separator (D) where the concentrate and vapor phases are separated. The concentrate exits at the bottom of the separator while the vapor exits at the top where it is condensed by an appropriate shell & tube condenser (E) or a spray condenser (F).

Note: A special vapor dome head is supplied with the CONVAP. This vapor dome is a full diameter extension of the cylinder that tees into the separator and allows for separation of product and vapors.

A specially designed baffle plate directs the flow of product and vapors inside the separator. The product then gravity feeds to the bottom of the separator vessel as the vapors are released through the top and condensed to liquid form in an external condenser. A level of concentrated product must be maintained within the separator for pumping from the separator.

A vacuum pump (G) is used to lower the heat exchanger's internal pressure. This pressure reduction also lowers the product's boiling point. The benefits provided by these pressure and boiling point reductions are twofold:

1. The probability of temperature degradation occurring with the product is decreased.
2. The operating efficiency of the CONVAP is increased as a direct result of the increased temperature difference between the product and the heating medium.

Condensate removal by the CONVAP is accomplished in one of two ways:

1. By using a shell & tube condenser (E) to cool the condensate indirectly with water and then remove it with a vacuum pump (refer to Figure 10-1). In this configuration, the vacuum pump uses the condensate to augment its service liquid. The temperature of the condensate is critical to the proper sizing of this pump.
2. By using a spray condenser (F). If a spray condenser is used, a separation tank (H) and a condensate removal pump (I) must be added to remove the large quantities of water consumed (refer to Figure 10-2). The cooling water is sprayed into the vapor stream, condensing the vapor, and together are collected in the separation tank. The condensate removal pump, which is usually a Low NPSH (Net Positive Suction Head) centrifugal pump, removes the liquid. The pumping action of this pump is controlled by level switches placed inside the separation tank.

For fine control of the solids level when using the spray condenser CONVAP configuration shown in Figure 10-2, Alfa Laval Contherm Inc. recommends over-concentrating the product and then mixing a small amount of the condensate into the concentrate stream ahead of (before) the solids or density meter. The solid or density meter controls the amount of condensate being returned to the product.

The concentrate removal pump (J) should be operated at a slightly higher rate (5-10%) than the required product exit rate. When operated at this rate, the pump will "scavenge" the separator and a natural fluid level will be maintained at the pump inlet due to the pump's specific NPSH requirements. This operating requirement is critical for those applications in which the concentrate temperature controls the steam flow. By operating the pump at a slightly higher rate, the process lag time will be kept to a minimum thereby providing more responsive control. If dwell (retention) time in the separator is desired, level sensors in the separation tank can be used to control the pump speed and maintain the desired liquid level.

10.2.2 Initial System Test

After you have verified that your CONVAP is installed properly, perform an initial system test to verify its proper operation. For this initial system test, use water as the test product.

Perform the Initial System Test in accordance with the procedure provided in Table 10-3. Refer to Figures 10-1 and 10-2 as necessary while performing this procedure.

Note: The use of the CONVAP and its equipment for processes other than those it was designed for is discouraged and may result in the voiding of warranties.

WARNING

Do not operate the CONVAP or its equipment and parts until you have read this manual, have installed the CONVAP in accordance with the procedures provided in Chapter Five, Installation, and are knowledgeable of all related equipment and applicable safety precautions.

Table 10-3. Initial System Test Of The CONVAP

Step	Action
1	Using water as the test "product," start flowing the water through the CONVAP via the product inlet port. **Note**: For best results, adjust both the flow rate and temperature profile of the water to that of the actual product.
2	Start the CONVAP's rotor.
3	When water reaches the separator, start the concentrate removal pump.
4	Start the vacuum system and adjust the system until the desired vacuum level is obtained. Turn on the cooling water for the condenser.
5	Turn on the steam and manually override the control system so that the output to the steam valve is approximately 30% of full scale. **Note**: The control system will not directly control the steam properly in this test because the system will be trying to detect changes in the product's percent solids. The water being used as the product in this test does not contain any solids that can be measured either directly with a solids meter or indirectly through a change in boiling point.
6	Measure the flow rate at the concentrate removal pump. Verify that the rate is lower than the flow rate at the system inlet. If the rate is lower, the CONVAP is operating properly. This difference in flow rates indicates that a portion of the water entering the CONVAP is being evaporated.
7	When you are satisfied that the CONVAP is operating properly with water as the product, drain and flush the water "product" from the heat exchange cylinder.
8	Your CONVAP is now ready to begin service.

10.2.3 Product Start-Up And Operation

The procedure for the start-up and operation of your CONVAP is provided in Table 10-4. Perform all steps of this procedure in the order in which they are presented. Two typical CONVAP configurations are shown in Figures 10-1 and 10-2. Refer to them as needed while performing this procedure.

Table 10-4. Start-Up And Operation Of The CONVAP

Step	Action
1	Turn on the positive displacement pump and start feeding (pumping) the product through the CONVAP via the product inlet port. Allow the product to fill the heat exchange cylinder. Use the vapor dome's sight glass to check the product level. **Note**: The product should be flowing through the system and diverted back to the source before steam is turned on. Divert the product back to the source until the product is at the desired temperature, then begin the forward flow.
2	Turn on the concentrate removal pump after a small level of the product has begun to accumulate in the separator. Use the separator's lower sight glass to check the product level. **Note**: At this point, the product may be recirculated to the supply tank or diverted to a salvage drum.
3	Start the CONVAP's rotor and the vacuum system. Allow the vacuum control to reach the desired vacuum level. Turn on the cooling water for the condenser.
4	Turn on the steam and adjust the controller's set point to the desired setting. **Note**: Refer to Section 10.2.1, Functional Description on page 10-3 for more detailed information.
5	Adjust the steam, vacuum level, and condenser cooling water flow rate as necessary to attain the desired product outlet concentration value.
6	Adjust the concentrate removal pump as necessary so that a small level of concentrate is maintained in the separator. **Note**: Refer to Section 10.2.1, Functional Description on page 10-3 for more detailed information.
7	Divert the concentrate to a forward flow when the product is at the desired temperature.
8	Monitor the steam, vacuum, condenser cooling water, and concentrate removal pump controls and ensure that they continue to operate properly.

10.2.4 Cleaning

You must use special care when cleaning your CONVAP. A typical CIP flow does not have the velocity required to properly clean all sections of the CONVAP. The vapor dome and the separator, in particular, are two areas that require additional cleaning. The CONVAP's Vapor Dome Assembly is shown in Figure 10-3. This drawing identifies all components of the assembly that must be carefully washed when cleaning the CONVAP.

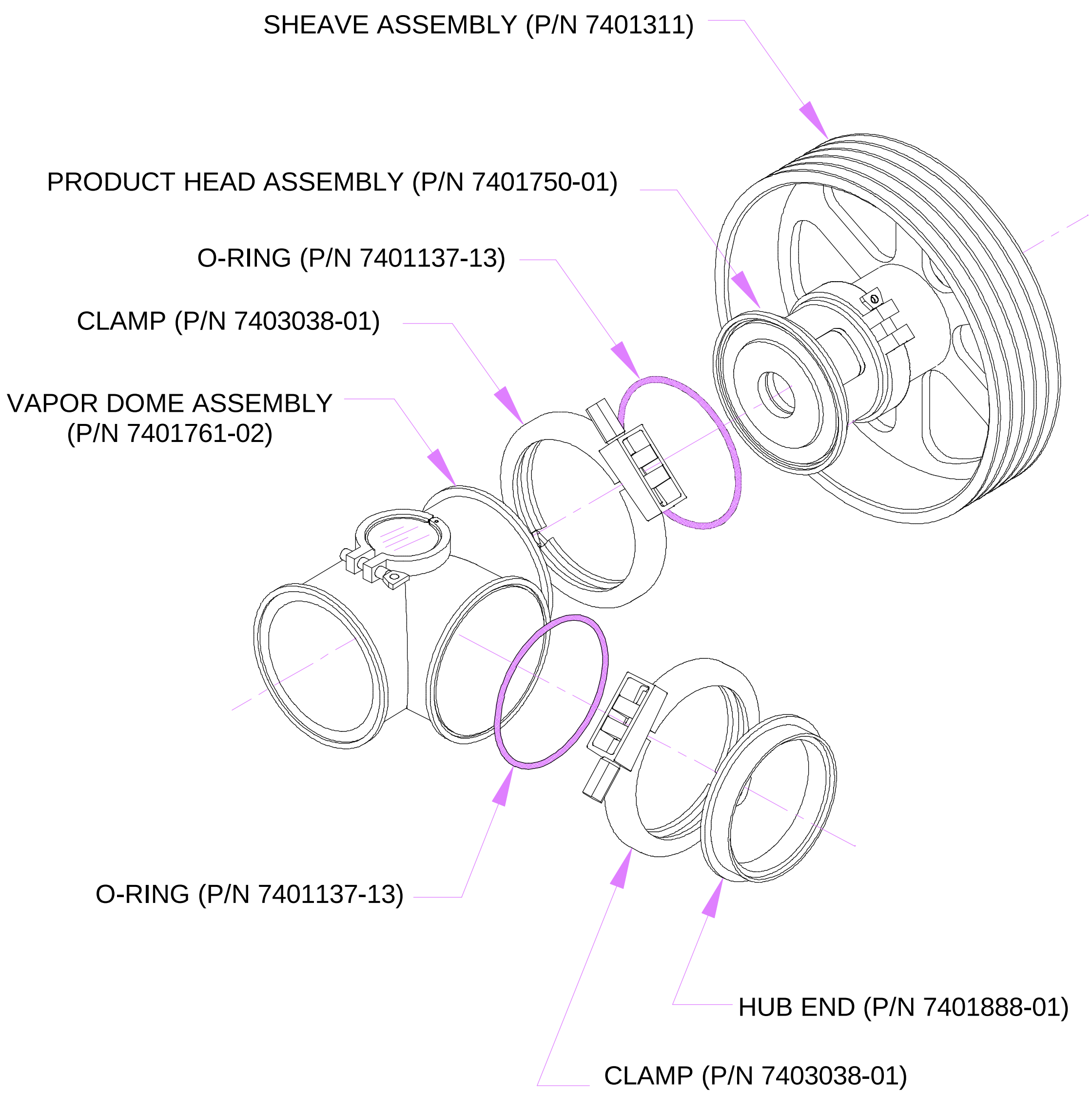


Figure 10-3. Vapor Dome Assembly

The separator is supplied with CIP spray balls to permit the use of a high pressure spray for cleaning the hard-to-reach sections. Clean the heat exchanger and vapor domes first, then clean the separator. The separator's baffle will prevent particles from splashing back into the vapor dome.

After you have performed a final cleaning of the separator, apply another short water rinse through the heat exchanger to ensure that all CIP solution has been rinsed from the system.

Notes:

1) Install a vacuum relief valve in the separator. Open this valve while performing the CIP to prevent the generation of a vacuum in the separator. This vacuum can occur when the CIP solution is removed from the separator. This relief valve will allow the discharge and CIP bypass pump to work more effectively.

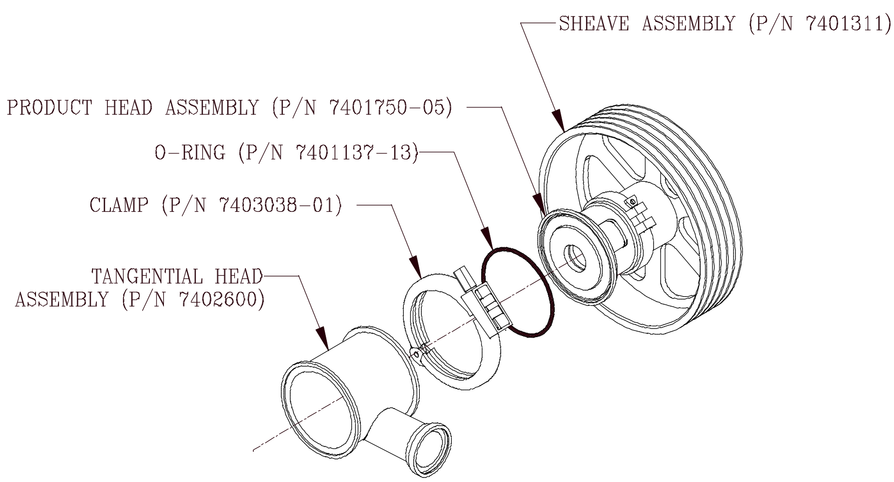
2) The concentrate removal pump (J) and the CIP bypass pump (K) must be properly sized so that they can quickly remove CIP flow from the separator. This will allow the CIP spray balls to work effectively and will also prevent the back flow of the CIP solution into the heat exchanger.

10.3 CONTHERM EQUIPPED WITH THREE-INCH (76.2 mm) DIAMETER PRODUCT HEADS

For applications requiring a larger diameter product port, the CONTHERM may be equipped with 3.00-inch (76.2 mm) diameter product heads. Two types of 3.00-inch (76.2 mm) product head designs are available from Alfa Laval Contherm Inc.:

1. Tangential. (Upper and lower product head).
2. In-line (Lower product head only).

The lower product head is available in either a tangential or in-line configuration while the upper product head is only available in a tangential configuration. The tangential product head design, shown in Figure 10-4, forces the incoming product to enter the heat exchanger cylinder in a circulating flow pattern. The upper tangential product head maintains this same circulating flow pattern for the exiting product.



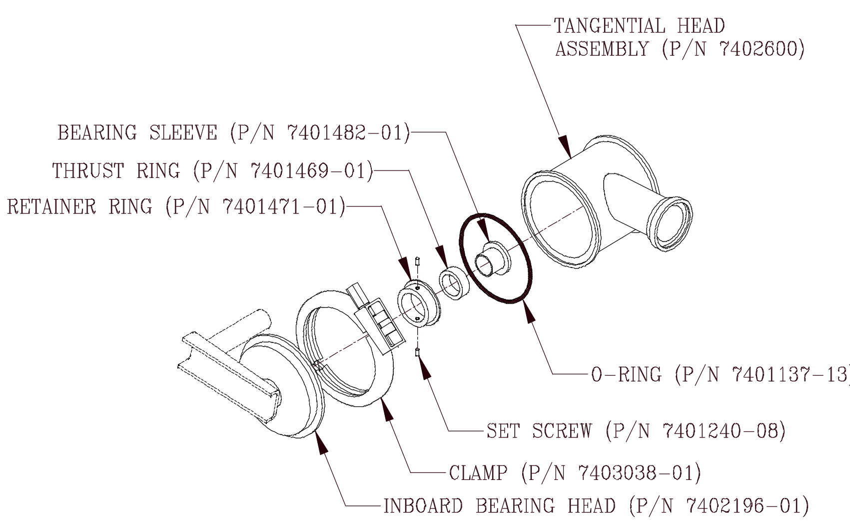


Figure 10-4. Three-Inch Diameter (76.2 mm) Tangential Product Head

The in-line configuration for the lower product head, shown in Figure 10-5, forces the product to enter the CONTHERM's heat exchanger cylinder in a direction along the rotor's centerline.

Both the in-line and tangential product heads use an internal bearing arrangement. This arrangement is described in Chapter Five, Maintenance. All inspection and maintenance requirements for CONTHERMs supplied with 3.00-inch (76.2 mm) diameter product heads are identical to those of a standard CONTHERM.

Typical applications that utilize 3.00-inch (76.2 mm) diameter product heads include the processing of large particulates, apple slices, and whole strawberries.

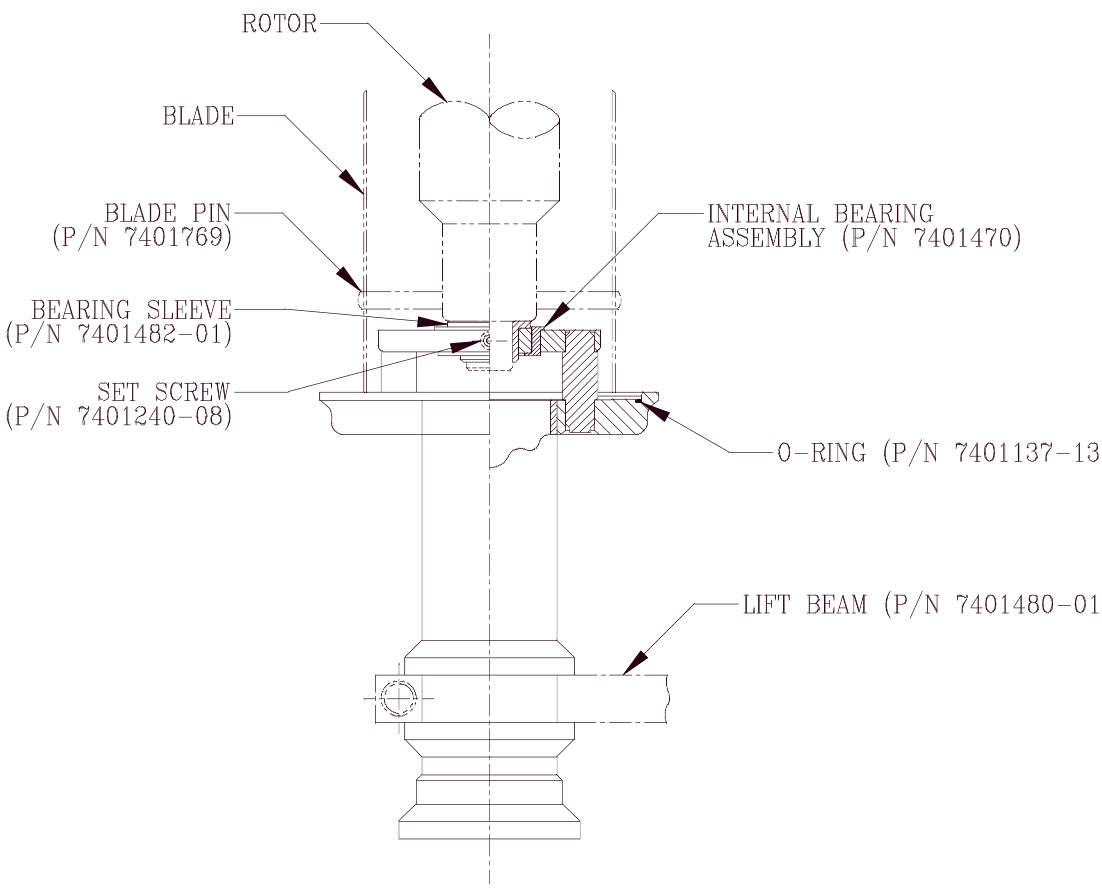


Figure 10-5. Three-Inch Diameter (76.2 mm) In-Line Product Head

10.3.1 Maintenance And Inspection Of CONTHERMs With 3.00-Inch (76 mm) Product Ports And An External Lower Bearing

This section describes how to maintain and inspect CONTHERMs equipped with 3.00-inch (76 mm) product ports and an external lower bearing.

The operation, maintenance, and inspection of the CONTHERM's blades, rotary seals, and heat exchange cylinder are identical to those of the standard CONTHERM described in Chapter Seven, Maintenance. Please refer to Chapter Seven as necessary.

The procedure for removing the upper seal and seal shell assemblies of a CONTHERM equipped with 3.00-inch (76 mm) product ports is provided in Table 10-5. Refer to Figure 10-6 and while performing this procedure. Figure 10-6 shows two views of a CONTHERM equipped with 3.00-inch (76 mm) product ports. One view shows a close-up that identifies the product clamp that must be removed to gain access to the upper seal and seal shell assembly. The second view shows a vertical profile of the CONTHERM with the rotor lowered from the heat exchange cylinder. The operator's access to the upper product head and seal area is clearly indicated at the top of the drawing.

Table 10-5. Removing The Upper Seal And Seal Shell Assembly Of A CONTHERM Equipped With 3.00-inch (76 mm) Diameter Product Heads

Step	Action
1	Turn off the CONTHERM's Rotor Drive System.
2	Flush the CONTHERM with cold water before disassembling the unit.
3	Remove the product piping clamp that secures the product head to the cylinder from the lower end of the CONTHERM. Refer to Figure 10-6, View One.
4	Start the hydraulic Rotor Lift Pump (P/N 7402078).
5	Lift up the handle on the Stack Valve Assembly (P/N 7401305) to eliminate any slack that may have occurred between the lift beam and the bearing cap, and to ensure that the lift is working properly. When done, release the handle and let it move back into its neutral position.
6	While keeping your hands and feet clear of the area directly below the CONTHERM, remove the lower head clamp (P/N 7401106-01 or 7403038-01).
7	Push the handle on the Stack Valve Assembly down and lower the rotor, using one hand to guide it down. When the top of the rotor is near the bottom of the cylinder, hold the rotor so that the top does not fall toward the cylinder wall. This will help prevent any damage from occurring to the seals and cylinder wall.
8	Guide the lower head assembly out of the cylinder with your free hand.
9	If necessary, remove the scraping blades. If your CONTHERM has spring loaded blades, be extremely careful when lowering and/or raising the rotor. As the rotor is lowered, these spring loaded blades must be held in place to prevent the possibility of the blades coming off from the force of the spring.

Table 10-5. Removing The Upper Seal And Seal Shell Assembly Of A CONTHERM Equipped With 3.00-inch (76 mm) Diameter Product Heads, Continued

Step	Action
10	Reach inside the heat exchange cylinder to access the upper seal assembly. Turn the seal shell (s) assemblies one-quarter turn to disengage the bayonet locking pin.
11	Remove the seal shell assembly and inspect it. Replace it if necessary.
12	Put the seal shell assembly back into the heat exchange cylinder and lock it into place with the bayonet locking pin.
13	Raise the rotor by reversing the performance of the previous steps of this procedure.
14	Before raising the rotor, ensure that the rotor is centered and verify that all rotor blades are properly secured to their supporting rotor pins. Also ensure that the upper seal is properly locked in place.
15	If your CONTHERM uses spring-loaded rotor blades, you must hold the blades in place until half of their length has been moved back into the CONTHERM's cylinder.
16	Replace the clamp that secures the product head to the heat exchange cylinder.

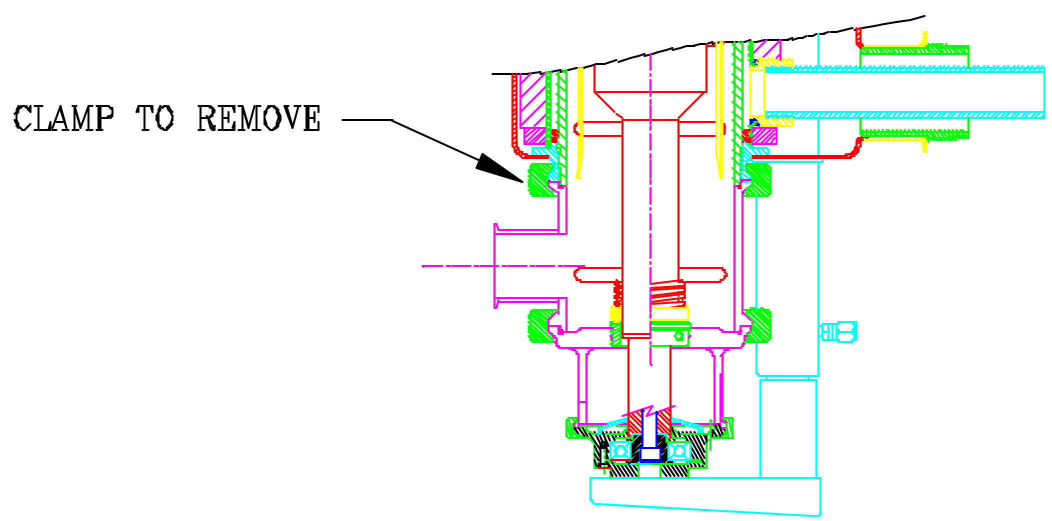
Inspection And Maintenance Of Lower And Upper Product Head Bearings

The procedures for inspecting and maintaining the lower and upper bearings of CONTHERMs equipped with 3.00 inch (76 mm) product ports are identical to those of the standard CONTHERM. These procedures are provided in Section 7.5, Bearings, of Chapter Seven.

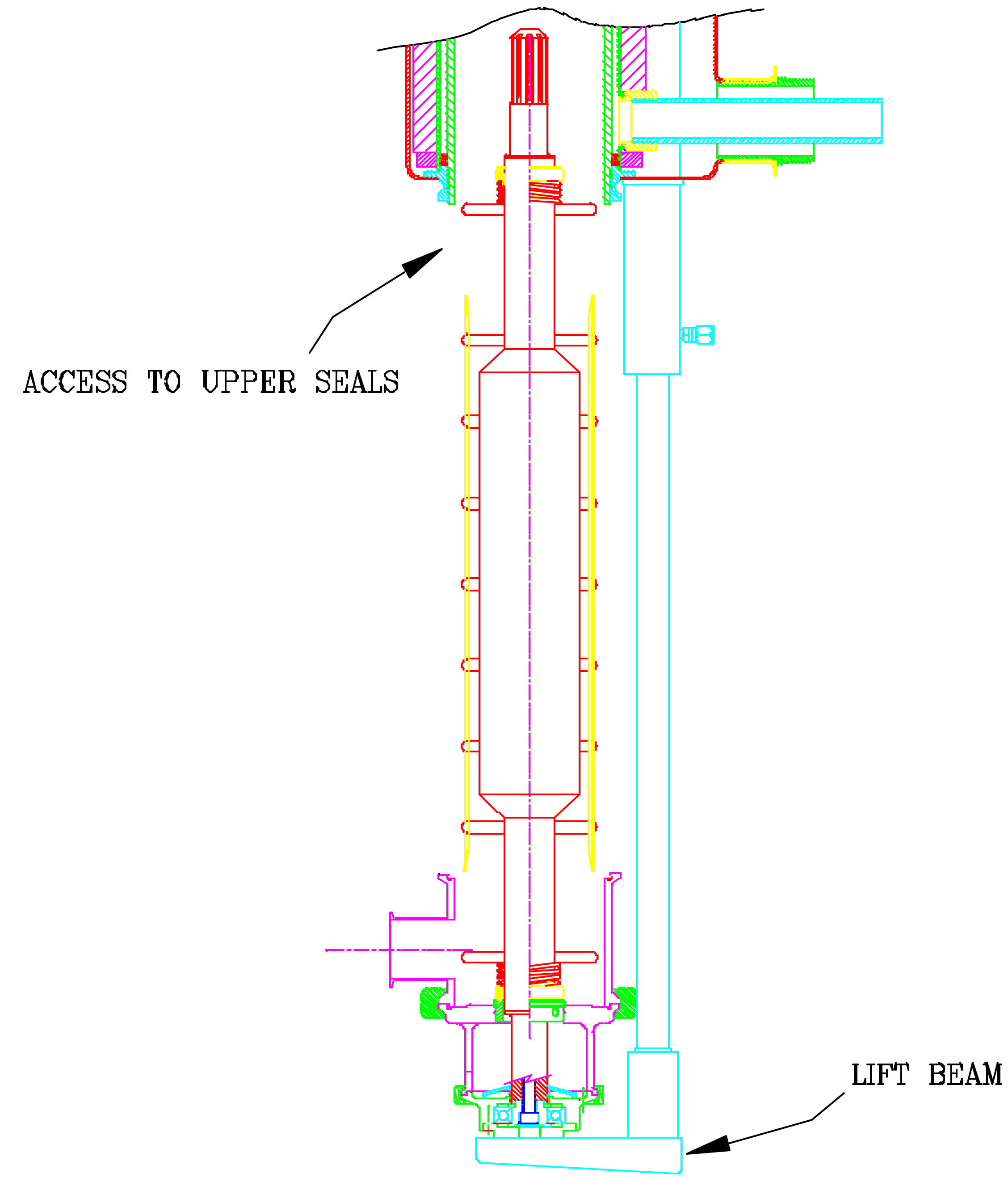
Separate procedures are provided for CONTHERMs with a Rotor Hold Down and CONTHERMs without a Rotor Hold Down. Please refer to the appropriate procedure in Section 7.5, Bearings, for your CONTHERM's configuration.

This is an 11 x 17 (B-Size) Foldout Drawing

Figure 10-6. CONTHERM With 3.00-Inch (76 mm) Product Ports



VIEW ONE: CLAMP REMOVAL



VIEW TWO: ACCESS TO UPPER SEAL ASSEMBLIES

Figure 10-6. CONTHERM Equipped With 3.00-Inch (76 mm) Product Ports

Back Side Of Figure 10-6. CONTHERM With 3.00-Inch (76 mm) Product Ports

10.4 CONTHERM EQUIPPED WITH WATER HEATED ROTOR

A water-heated rotor is used for product cooling applications that require the rotor to be warmed, usually to prevent crystallization of the product onto the rotor surface. They are typically used with fats and oils such as margarine and shortening. The maintenance and inspection requirements of blades, bearings, and seals for a CONTHERM with a water-heated rotor are the same as those of a standard CONTHERM.

The water-heated rotor uses an oil seal which is located in the bearing cap. This seal should be visually inspected for signs of wear and aging (i.e., cracking or drying) each time the CONTHERM is opened . The rotary union (P/N 7402096-01), located at the lower end of the rotor, allows for the circulation of warm water, typically at 120^{o} F (51.7^{o} C), through the inside of the rotor. A 0.38-inch NPT water supply line is attached to the lower elbow of the union and a 0.50-inch NPT return water line is connected to the main body of the union. Refer to Figure 10-7 for the identification and location of these components.

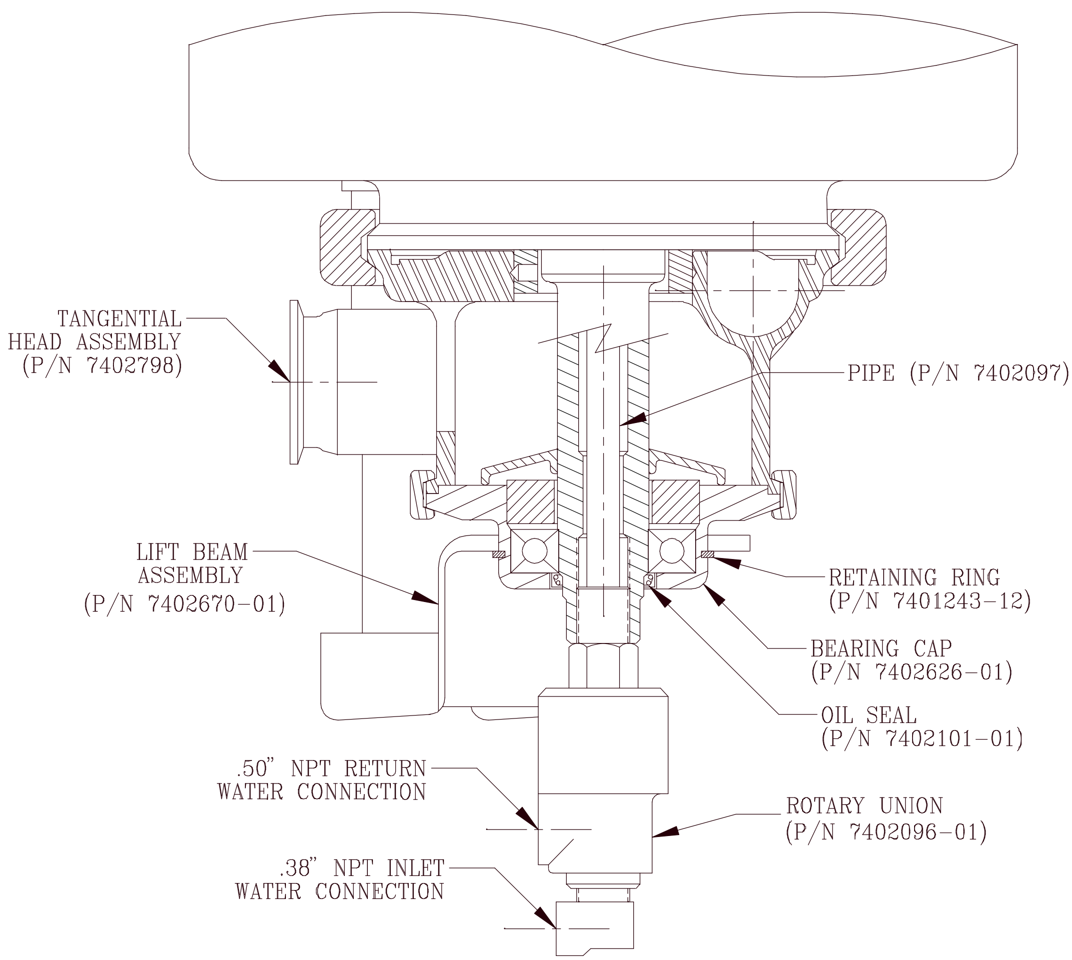


Figure 10-7. Water-Heated Rotor

Alfa Laval Contherm Inc. recommends the use of quick-disconnect fittings for these NPT water line connections. Water flows into the 0.38-inch inlet and is carried through a tube to the top of the rotor where it is allowed to flow down through the rotor's center section and back to the 0.50-inch outlet. The typical flow rate for the water through a water-heated rotor is 1 gallon per minute (3.785 liters per minute).

CAUTION For CONTHERMs equipped with a hydraulic rotor lifting system and water-heated rotors: Disconnect the water supply and the water return lines from the rotary union before lowering the rotor.

10.4.1 Removing And Installing The Rotary Union

The procedure for removing and installing the rotary union (P/N 7402096-01) is described in Table 10-6. Refer to Figure 10-7 as necessary while performing this procedure. Perform all steps of this procedure in the order in which they are presented.

Table 10-6. Removing And Installing The Rotary Union

Step	Action
Removing The Rotary Union	
1	Ensure that the lower product head is attached to the heat exchange cylinder.
2	Disconnect both the water supply line and the water return line from the rotary union (P/N 7402096-01).
3	While using a wrench to hold the rotor by its flats, unscrew the rotary union from the rotor.
4	Manually lower the rotary union, with the stainless steel pipe attached, from the CONTHERM.
Installing The Rotary Union	
1	Verify that the stainless steel pipe is firmly threaded into the rotary union.
2	Insert the opposite end of the stainless steel pipe into the lower end of the rotor and guide it along until the threads of the rotary union engage the rotor.
3	Tighten the connection with a wrench.
4	Reattach both water supply and return lines to the rotary union.

10.5 CONTHERM PIN UNIT

CONTHERM Pin Units are used to process products that require a mechanical working or texturizing, and are often used in the processing of many fats and oils. The CONTHERM Pin Unit produces this “working” or mild agitation during product solidification.

A 10-inch diameter Pin Unit is shown in Figure 10-8. The unit’s rotating rotor pins mesh with the fixed cylinder pins to produce a smooth and consistent product. The 10-inch diameter Pin Unit is shown with a low pressure (less than 15 psi (1 BAR)) jacket, for tempering with water. Also shown in Figure 10-8 is a Hydraulic Rotor Lift System. The components and operation of this system are identical to that provided with the standard CONTHERM. Refer to Chapter Six, Operation, for the detailed operating instructions for the Rotor Lift System.

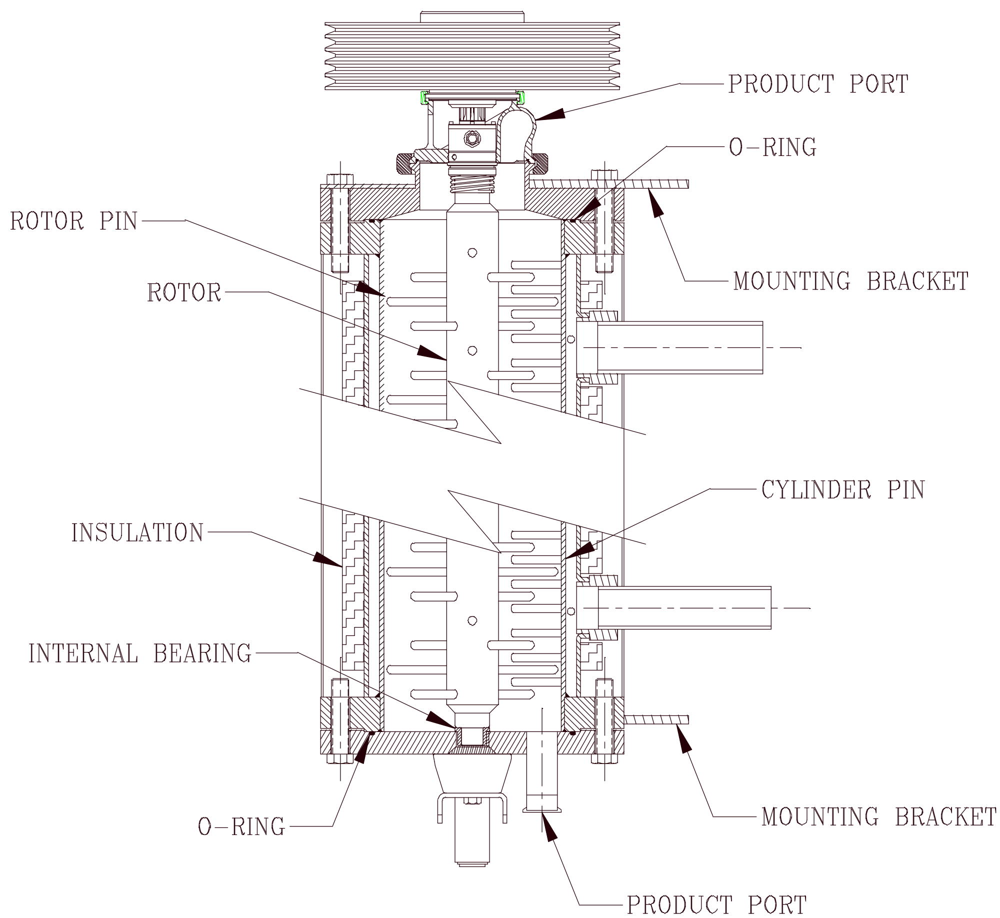


Figure 10-8. CONTHERM Pin Unit

The CONTHERM Pin Unit uses an internal bearing on the lower end of its rotor. The procedure for replacing this bearing is described in Table 10-7. The procedures for replacing the upper product head bearing and seal are the same as those performed for a standard CONTHERM.

CAUTION	1. Do not disassemble the CONTHERM Pin Unit if the CONTHERM's rotor is rotating 2. If your configuration utilizes two or more Stack Assemblies, do not operate more than one stack valve handle at a time. 3. Do not operate the Rotor Lifting System until you have checked all fittings. Tighten nuts or replace any leaking fittings before operating the system.
WARNING	1. Do not attempt to disassemble the CONTHERM if its rotor is rotating. 2. Hot product or CIP (Clean In Place) solutions may still be present in the CONTHERM's product chamber. Drain all product and CIP solutions from the unit before removing any of the CONTHERM's clamps or its piping. 3. Relieve the system pressure in the CONTHERM before you release any of the unit's clamps. 4. Keep the area under the CONTHERM clear of hands, feet, piping and other obstructions. 5. Do not remove the lower head clamp or the lower bearing clamp until you have verified that the hydraulic Rotor Lifting System is turned on and is operating correctly. 6. The blades attached to the rotor's rotor pins may be very sharp. Wear protective gloves while handling the rotor. 7. When lowering or raising the rotor pin unit, be careful to ensure that the rotor and the rotor pins do not contact or touch the cylinder pins. If necessary, rotate the rotor manually to prevent them from coming into contact with each other. Otherwise, serious damage to both the rotor and the cylinder may occur.

Table 10-7. Replacing The Internal Bearing On A CONTHERM Pin Unit

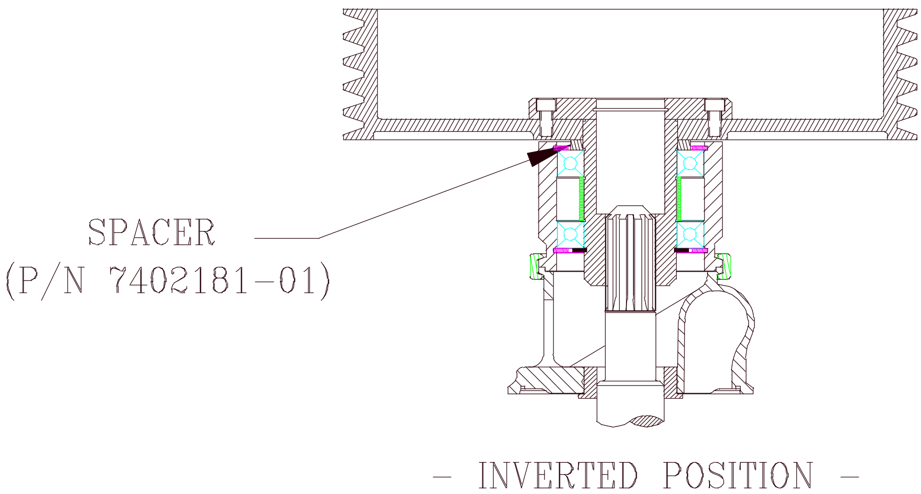
Step	Action
1	Turn off the rotor drive system. Do not disassemble the Rotor Pin Unit if its rotor is rotating.
2	Run a final rinse of cold water through the unit before disassembling the Pin Unit. Use care when disassembling the unit as hot product or CIP solutions may still remain in the product chamber. Remove the product piping clamp from the lower head of the Pin Unit.
3	Start the rotor lift pump.
4	Apply upward pressure to the handle of the stack valve to eliminate any slack that may have occurred between the lift beam and the lower product head assembly.
5	Keeping your hands and feet clear of the area directly below the Pin Unit, remove the hex head bolts which secure the lower product head to the cylinder flange.
6	Move the stack valve assembly's handle down and carefully lower the rotor. **Note**: If necessary, rotate the rotor manually to ensure that the rotor and the pins of the rotor pin unit do not touch the cylinder pins. If they come into contact with each other, serious damage to both the rotor and the cylinder may occur.
7	Remove the rotor from the lower product head assembly and inspect the internal bearing. If replacement is required, remove the worn bearing and insert a new one, aligning the groove in the bearing with the pin in the lower product head.
8	Inspect the upper seal as described in Chapter Seven, Section 5.3, Seals.
9	Install the rotor by inserting the top end into the Pin Unit. Then carefully insert the lower end of the rotor into the bearing sleeve of the product head assembly.
10	Use the hydraulic rotor lift system to raise the lower product head and rotor assembly into the product cylinder. Secure them to the cylinder with the hex head bolts. **Note**: If necessary, rotate the rotor manually to ensure that the rotor and the pins of the rotor pin unit do not touch the cylinder pins. If they come into contact with each other, serious damage to both the rotor and the cylinder may occur.
11	Turn off the rotor lift pump.

10.6 CONTHERM EQUIPPED WITH INVERTED ELECTRIC DRIVE SHEAVE

CONTHERMs equipped with either the 17.00-inch (431.8 mm) or the 23.00-inch (584.2 mm) diameter electric drive sheave can be inverted and mounted to allow more room between the product port and the sheave. The electric motor must then be adjusted to assure proper alignment of the sheaves. Figure 10-9 shows both the standard and inverted sheaves. The procedure for inverting an existing electric drive sheave is provided in Table 10-8.

Table 10-8. Inverting An Existing Electric Drive Sheave

Step	Action
1	Disassemble the drive head assembly of the CONTHERM as described in Section 5.9, Disassembly And Reassembly Of The CONTHERM, Chapter Seven.
2	Remove the sheave from the spline coupling by removing the six socket head cap screws (P/N 7401242-01) found on the flange of the spline coupling.
3	The 3.50-inch (88.9 mm) diameter x 0.31-inch (7.9 mm) high boss on the inside of the sheave must be machined off until it is flush with the spokes of the sheave.
4	Use the six socket head cap screws to re-attach the inverted sheave to the spline coupling.
5	Slide the spacer (P/N 7402181-01) onto the spline coupling until it touches the sheave.
6	Supported by the flange of the spline coupling, and **not** by the sheave, press the bearing housing onto the spline coupling. Continue to press the housing assembly until sufficient clearance exists to replace the spline coupling.



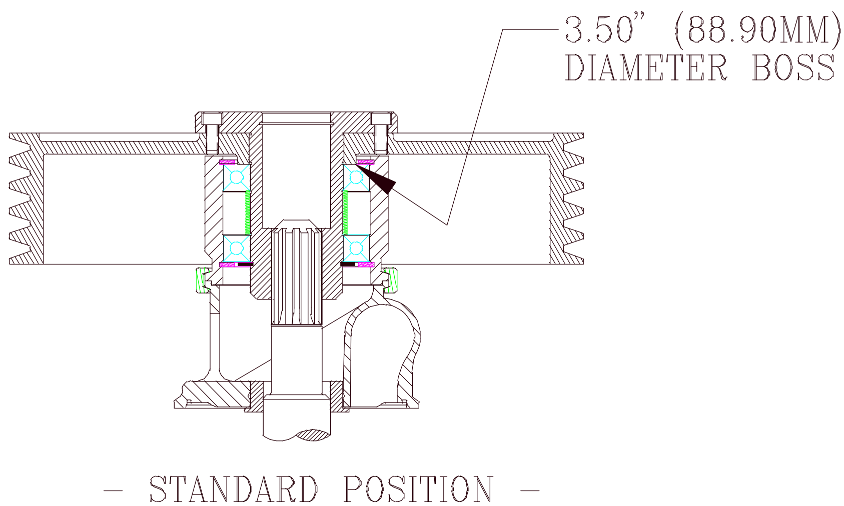


Figure 10-9. Inverted Electric Drive Sheave

10.7 CONTHERM EQUIPPED WITH ECCENTRIC PRODUCT HEADS

Eccentric product heads are used in the CONTHERM to prevent a condition identified as “mass rotation” from occurring within the heat exchange cylinder. When the CONTHERM is being used to process highly, viscous products, the concentric rotation of the rotor in the CONTHERM’s heat exchange cylinder may allow the product to adhere to the rotor and cause "mass rotation."

Mass rotation occurs when the product rotates directly with the rotor. This action reduces the mixing that occurs within the heat exchange cylinder resulting in a decrease in the system’s thermal efficiency. In addition to this reduction in thermal efficiency, mass rotation may result in the severe burning of the product on the cylinder’s product walls.

Eccentric product heads are used to force the rotor to rotate 0.12 inches (3.2 mm) off the centerline of the heat exchange cylinder. This offset forces the scraping blades to move in and out as the rotor rotates. This action improves mixing and reduces product build up on the rotor, resulting in increased thermal efficiency.

Eccentric product heads can only be used in pairs. Both the upper and lower heads must be of the eccentric type. The end hubs of the heat exchange cylinder must also be keyed to ensure proper alignment of the offset. A cross-sectional view of a CONTHERM showing the eccentric product heads is provided in Figure 10-10.

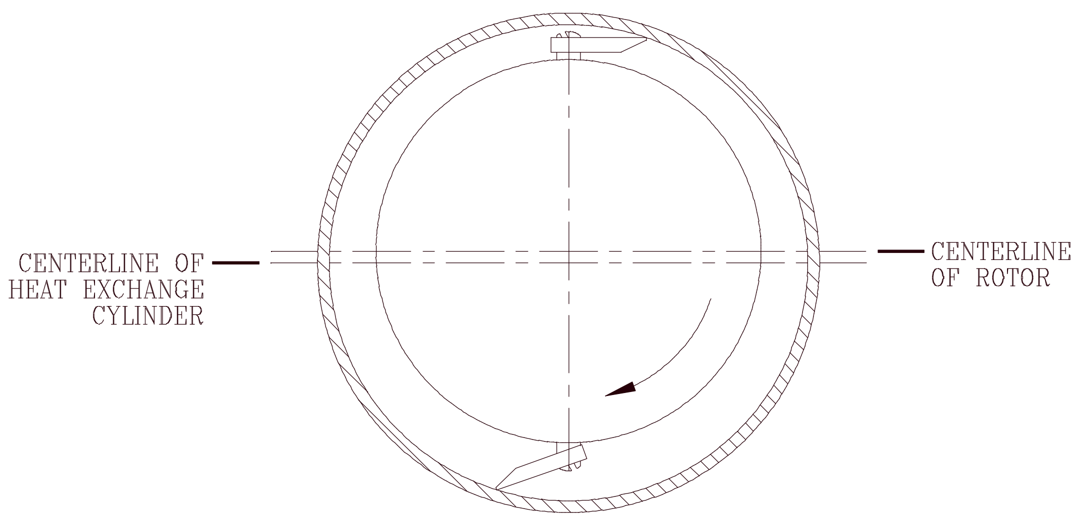


Figure 10-10. Eccentric Product Heads

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APPENDICES

APPENDICES

INTRODUCTION

This chapter contains several appendices which provide a wide range of useful information. These appendices are identified in the following table.

Instruction And Parts Manual Appendices

Appendix	Title
A	General Conversion Information
B	Steam: Temperature To Pressure Values
C	Refrigerant: Temperature Versus Pressure Values
D	Frictional Pressure Drop (PSI)
E	Cylinder Capacity
F	Cleaning The CONTHERM
G	Layout Drawings

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Appendix A

General Conversion Information

APPENDIX A
GENERAL CONVERSION INFORMATION

To Convert From...	To...	Multiply By...
Length		
Inches	millimeter	25.4
Feet	Meter	0.3048
Miles	Kilometers	1.609
Area		
Square Feet (Ft^2)	Square Meter (M^2)	0.0929
Temperature		
°F	°C	(°F - 32) x 5/9
°C	°F	(°C x 9/5) + 32
Mass		
Pounds (lbs)	Kilograms (kg)	0.4536
Volume		
Gallons	Liters	3.785
Energy		
BTU	kcal	0.252
Pressure		
Pounds/sq. inch (psi)	Bar	$6.895 * 10^{-2}$
Latent Heat		
BTU/lb	kcal/kg	0.555
U-Value / k-Value		

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Appendix B

Steam
Temperature -To-Pressure

APPENDIX B
STEAM: TEMPERATURE-TO-PRESSURE

Absolute Pressure (lb/in²/BAR)	Temperature (°F / °C)	Absolute Pressure (lb/in²/BAR)	Temperature (°F / °C)
14.696/1.01	212.0/100.0	135/9.3	350.2/178.6
15/1.03	213.0/100.6	140/9.7	353.0/178.3
20/1.4	228.0/108.9	145/10.0	355.8/179.9
25/1.7	240.0/115.6	150/10.3	358.4/181.3
30/2.1	250.3/121.3	155/10.7	361.0/182.8
35/2.4	259.3/126.3	160/11.0	363.5/184.2
40/2.8	267.2/130.7	165/11.4	366.0/185.6
45/3.1	274.4/134.7	170/11.7	368.4/186.9
50/3.4	281.0/138.3	175/12.1	370.8/188.2
55/3.8	287.1/141.7	180/12.4	373.1/189.5
60/4.1	292.7/144.8	185/12.8	375.3/190.7
65/4.5	298.0/147.8	190/13.1	377.6/192.0
70/4.8	302.9/150.5	195/13.4	379.7/193.2
75/5.2	307.6/153.1	200/13.8	381.8/194.3
80/5.5	312.0/155.6	205/14.1	383.9/195.5
85/5.9	316.2/157.9	210/14.5	385.9/196.6
90/6.2	320.3/160.2	215/14.8	387.9/197.7
95/6.5	324.1/162.3	220/15.2	389.9/198.8
100/6.9	327.8/164.3	225/15.5	391.8/199.9
105/7.2	331.4/166.3	230/15.9	393.7/200.9

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Appendix C

Refrigerant

Temperature-Versus-Pressure (PSIG)

APPENDIX C
REFRIGERANT: TEMPERATURE VERSUS PRESSURE (PSIG)

TEMPERATURE	REFRIGERANT				
(°F / °C)	**12**	**22**	**500**	**502**	**Ammonia**
-40/-40	11.0	0.5	7.6	4.1	8.7
-35/-37.2	8.4	2.6	4.6	6.5	5.4
-30/-34.4	5.5	4.9	1.2	9.2	1.6
-25/-31.7	2.3	7.4	1.2	12.1	1.3
-20/-28.9	0.6	10.1	3.2	15.3	3.6
-18/-27.8	1.3	11.3	4.1	16.7	4.6
-16/-26.7	2.0	12.5	5.0	18.1	5.6
-14/-25.6	2.8	13.8	5.9	19.5	6.7
-12/-24.4	3.6	15.1	6.8	21.0	7.9
-10/-23.3	4.5	16.5	7.8	22.6	9.0
-8/-22.2	5.4	17.9	8.8	24.2	10.3
-6/-21.1	6.3	19.3	9.9	25.8	11.6
-4/-20.0	7.2	20.8	11.0	27.5	12.9
-2/-16.7	8.2	22.4	12.1	29.3	14.3
0/-17.8	9.2	24.0	13.3	31.1	15.7
1/-17.2	9.7	24.8	13.9	32.0	16.5
2/-16.7	10.2	25.6	14.5	32.9	17.2
3/-16.1	10.7	26.4	15.1	33.9	18.0
4/-15.6	11.2	27.3	15.7	34.9	18.8
5/-15.0	11.8	28.2	16.4	35.8	19.6
6/-14.4	12.3	29.1	17.0	36.8	20.4
7/-13.9	12.9	30.0	17.7	37.9	21.2
8/-13.3	13.5	30.9	18.4	38.9	22.1
9/-12.8	14.0	31.8	19.0	39.9	22.9
10/-12.2	14.6	32.8	19.7	41.0	23.8
11/-11.7	15.2	33.7	20.4	42.1	24.7
12/-11.1	15.8	34.7	21.2	43.2	25.6
13/-10.6	16.4	35.7	21.9	44.3	26.5
14/-10.0	17.1	36.7	22.6	45.4	27.5
15/-9.4	17.7	37.7	23.4	46.5	28.4

APPENDIX C
REFRIGERANT: TEMPERATURE VERSUS PRESSURE (PSIG)

TEMPERATURE	REFRIGERANT				
(°F / °C)	12	22	500	502	Ammonia
23/-5.0	23.2	46.4	29.8	56.2	36.8
24/-4.4	23.9	47.6	30.6	57.5	37.9
25/-3.9	24.6	48.8	31.5	58.8	39.0
26/-3.3	25.4	49.9	32.4	60.1	40.2
27/-2.8	26.1	51.2	33.2	61.5	41.4
28/-2.2	26.9	52.4	34.2	62.8	42.6
29/-1.7	27.7	53.6	35.1	64.2	43.8
30/-1.1	28.4	54.9	36.0	65.6	45.0
31/-0.6	29.2	56.2	36.9	67.0	46.3
32/0.0	30.1	57.5	37.9	68.4	47.6
33/0.6	30.9	58.8	38.9	69.9	48.9
34/1.1	31.7	60.1	39.9	71.3	50.2
35/1.7	32.6	61.5	40.9	72.8	51.6
36/2.2	33.4	62.8	41.9	74.3	52.9
37/2.8	34.3	64.2	42.9	75.8	54.3
38/3.3	35.2	65.6	43.9	77.4	55.7
39/3.9	36.1	67.1	45.0	79.0	57.2
40/4.4	37.0	68.5	46.1	80.5	58.6
41/5.0	37.9	70.0	47.1	82.1	60.1
42/5.6	38.8	71.4	48.2	83.8	61.6
43/6.1	39.8	73.0	49.4	85.4	63.1
44/6.7	40.7	74.5	50.5	87.0	64.7
45/7.2	41.7	76.0	51.6	88.7	66.3
46/7.8	42.6	77.6	52.8	90.4	67.9
47/8.3	43.6	79.2	54.0	92.1	69.5
48/8.9	44.6	80.8	55.1	93.9	71.1
49/9.4	45.7	82.4	56.3	95.6	72.8
50/10.0	46.7	84.0	57.6	97.4	74.5
55/12.8	52.0	92.6	63.9	106.6	83.4
60/15.6	57.7	101.6	70.6	116.4	92.9
65/18.3	63.8	111.2	77.8	126.7	103.1
70/21.1	70.2	121.4	85.4	137.6	114.1

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Appendix D

Frictional Pressure Drop (PSI)

APPENDIX D
FRICTIONAL PRESSURE DROP (PSI)

Media Side Flow Through Jacket
10.00-inch (254.00-mm) Pitch Pressure Drop
(PSI/BAR)

MEDIA FLOW RATE	WATER	PROPYLENE GLYCOL (20%)		PROPYLENE GLYCOL (30%)	
(GPM/M³/HR)	86 °F/30 °C	32 °F/0 °C	86 °F/30 °C	32 °F/0 °C	86 °F/30 °C
10/2.27	12/.01	.26/.02	.12/.01	.41/.03	.14/.01
20/4.54	.42/.03	.63/.04	.48/.03	.81/.06	.54/.04
30/6.81	.87/.06	1.28/.09	.98/.07	1.38/.09	1.10/.08
40/9.08	1.43/.10	2.10/.14	1.65/.11	2.25/.16	1.80/.12
50/11.36	2.10/.14	3.15/.22	2.40/.17	3.45/.24	2.70/.19

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Appendix E

Cylinder Capacity

APPENDIX E
CYLINDER CAPACITY

SCN, STAGGERED, ALFALON II BLADES
2-INCH TANGENTIAL HEADS

Model	Capacity	3-in. Rotor (76-mm)	4-in. Rotor (102-mm)	4.5-in. Rotor (114-mm)	Refrigeration Capacity
6X3	US Gallon	2.5	2.1	1.9	0.38
	Liter	7.4	7.9	7.0	1.44
6X6	US Gallon	4.8	3.8	3.3	0.89
	Liter	18.1	14.5	12.3	3.37
6X9	US Gallon	7.1	5.6	4.7	1.4
	Liter	26.8	21.1	17.6	5.30

NCC, 4-BLADED, SST BLADES
2-INCH TANGENTIAL HEADS

Model	Capacity	3-in. Rotor (76-mm)	4-in. Rotor (102-mm)	4.5-in. Rotor (114-mm)	Refrigeration Capacity
6X3	US Gallon	2.4	2.0	1.8	0.42
	Liter	7.1	7.6	6.7	1.59
6X6	US Gallon	4.6	3.6	3.0	1.0
	Liter	17.3	13.7	11.5	3.79
6X9	US Gallon	6.8	5.2	4.3	1.56

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Appendix F

Cleaning The CONTHERM SSHE

APPENDIX F
CLEANING THE CONTHERM SSHE

The CONTHERM Scraped Surface Heat Exchanger and CONVAP Scraped Surface Evaporator have been designed to be cleaned in place (CIP) using conventional CIP equipment and solutions. Alfa Laval Contherm Inc. offers different heat exchange cylinder/blade combinations. The selection of the appropriate cleaning solutions and use of the proper time/temperature relationships to match these various surface/blade combinations is critical.

NOTE:	The use of acid cleaning solutions in a machine not designed for acid duty will result in permanent damage to the heat exchange surface or the blades, or both, and replacement or resurfacing will be necessary. The improper application of cleaning agents will void the warranty for cylinders and blades.

The following table provides a recommended cleaning program for the CONTHERM and CONVAP SSHEs.

RECOMMENDED CLEANING PROGRAM					
Cleaning Agents	**Temp.**	**Time**	**Chemical Concentration (Conc.)**	**Solution pH**	**Purpose**
Water Rinse	60-120°F 16-49°C	5 - 10 minutes; until discharge is clear	Not Applicable	Not Applicable	To remove loose soil
Caustic Alkaline Cleaner (Chlorine) Additive	160-190°F 71°C-88°C Match Product Temperature	30 - 60 minutes	0.5 to 2% NAOH 200 ppm Chlorine	12 - 13	To remove fat deposits & remaining soil
Water Rinse	60-120°F 16-49°C	Until discharge indicates pH of 7.0	Not Applicable	Available Water Supply	Remove and Neutralize Alkaline Cleaner
Acid Cleaner	135-145°F;	10 - 20 minutes	Up to 1%	3.5 - 4	Remove protein

Notes:

On other than Bimetallic and stainless steel barrels, the acid solution should not be lower than a pH of 3.5 or a temperature higher than 68°F (20°C). Chemical cleaners should always be rinsed from the CONTHERM Heat Exchanger. Do not air blow pipe lines to evacuate chemical solutions.

Certain product soils (pH of 3-4) may not require as much cleaning time, elevated temperatures or high CIP flow rate. Tenacious product soils, however, that have been precipitated as a result of high temperatures during processing will require both maximum cleaning time and temperature for satisfactory results.

CIP DESIGN TIPS:

1. It is generally recommended that CIP systems deliver a flow velocity of at least 5 feet/second in order to remove soil. Please note that the annular space in the CONTHERM Heat Exchanger may be substantially larger than the piping connected to and from the CONTHERM. To ensure turbulent flow in the cylinders, Alfa Laval Contherm Inc. strongly recommends that rotors be operated at full speed during the cleaning cycle.

Flow Rates Required to Achieve 5 Feet/Second		
Rotor Diameter	**Flow Rate**	
	(GPM)	**(Liter/hr.)**
3.00 inch	330	75,000
4.00 inch	250	57,000
4.50 inch	200	46,000
5.00 inch	135	31,000

2. With certain stringy or very sticky products, it may be advisable to install a reversing switch so that the rotors may periodically be operated backwards during the cleaning cycle.
3. Under no conditions are the CONTHERM Heat Exchangers to be used as the heaters for the cleaning solutions. The warranty is invalid if this condition exists. Precautions should be taken to insure that the steam cannot be turned onto the heat exchangers during CIP.
4. The first water rinse is the most important step. The remaining steps are far more

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Appendix G

Layout Drawings

APPENDIX G
LAYOUT DRAWINGS

Need drawings for this section.