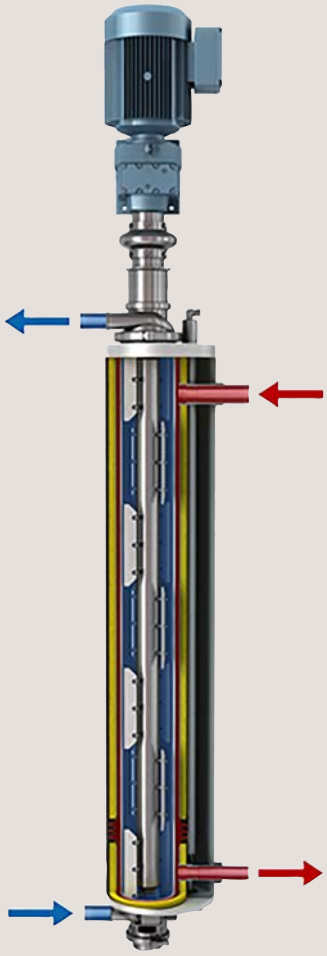
Instruction Manual

Contherm™ Single Wall Scrape Surface Heat Exchangers



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Original manual

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The information herein is correct at the time of issue but may be subject to change without prior notice

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1 CE Declaration of Incorporation for Machinery

CE Declaration of Incorporation for Machinery
Directive 98/37/EC, Annex 11 sub B

The Responsible Person

Name	Mr. Giovanni Treglia
Business Name	Alfa Laval Parma
Address	Via Botteri 13/A
	43122 PARMA
	ITALY
Manufacturer	Alfa Laval Inc.
Address	111 Parker Street
	Newburyport, MA 01950 USA

Description of Machinery:

Model: Contherm, Contherm Core, Contherm HP, Contherm Max, Convap

Alfa Laval Inc. herewith declares that the following national technical standards and specifications have been used: ASME Section VIII, Division 1.

Other Directives applied: 2014/68/EU, 1935/2004 & 2023/2006.

The Machinery to which this Declaration of Incorporation relates must not be put into service until the relevant Machinery into which it is to be incorporated has been declared in conformity with the provisions of the Machine Directive.

Kevin Davey
Quality Assurance

Signature

26 November 2018
Date

Alfa Laval Inc.
111 Parker Street
Newburyport, MA 01950 USA
Telephone: (978) 465-5777. Telefax: (978) 465-6006

1 CE Declaration of Incorporation for Machinery

Information contained in this manual is subject to change without notice and does not represent a commitment on the part of Alfa Laval Corporation. No part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, for any purpose, without the express written permission of Alfa Laval Corporation. Any comments regarding possible errors and omissions or suggestions for improvement of this publication would be gratefully appreciated. Please forward this information to the address below. If further clarification regarding this manual is required, please contact your local Alfa Laval representative.

Revision: 1 Date: 11/2018

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E-mail: uscontherm.support@alfalaval.com
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2.1 Introduction

Always read the manual before working with or using the Contherm™.

It is the responsibility of the end user to ensure that personnel working with our equipment are trained and comply to the latest industrial safety standards that apply to your country and location. Unsafe and hazardous conditions may occur if the equipment is used by untrained personnel or without regard or knowledge of applicable safety precautions. These unsafe and hazardous conditions or lack of proper use of personal protective equipment (PPE) may cause serious personal injury and/or damage to the equipment.

Inherent hazardous situations are commonly present in Contherm™ installations including slipping and tripping hazards, caustic or acidic fluids, high pressure, high or low temperature fluids or substances, elevated working and service points, low ceilings, electrical hazards and spaces that are not ergonomically ideal.

Equipment users must wear proper PPE suitable for the intended interaction when working on or around Contherm™ equipment. This includes but is not limited to safety glasses, gloves for both hot and cold temperatures, noise protection, chemical resistant outerwear, and slip resistant safety shoes.

2.2 Safety Precautions

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
Indicates hazards which will result in severe personal injury or death.

WARNING
Indicates hazards or unsafe practices which could result in severe personal injury or death.

CAUTION
Indicates hazards or unsafe practices which could result in minor personal injury or product or property damage.

If you have any safety concerns that are not addressed within this manual, please notify your supervisor and/or your local Alfa Laval Inc. representative.

INSTALLATION AND DISASSEMBLY

Refer to INSTALLATION for additional safety information.

Have the Contherm™ electrically connected by authorized personnel.

OPERATION

System Pressure Relief: To ensure safe operation, it is the end users responsibility to install pressure relief equipment to ensure over pressurization of the Contherm™ will not occur within the product and media pipework.

MAINTENANCE

Always use OEM Parts: OEM parts are to be used to maintain safe function of the equipment. Alfa Laval is not responsible for any adverse effects to operator, equipment or product (being processed) safety that is created from the use of non-OEM components.

Always de-energize and lockout-tagout electrical circuits before working on the equipment.

TRANSPORTATION

Never lift the Contherm™ equipment in a way other than described in this manual.

Always drain fluids from all chambers and ensure no leakage of fluids or lubricants.

Use original packing or similar and ensure the unit is securely fixed in its container.

2.3 Safety and Inspection Symbols

Below table 2-1 is a listing of all safety warning symbols and their meanings.

Danger		Cold Surface	
High Pressure		Slip Hazard	
Hand Crush / Pinch Hazard		Rotating Shaft	
Sharp Edges		Potentially Corrosive Materials	
Burn Hazard		Inspection Point	
Leaking Hazard		Consult Manual	
Hoist Needed		Checklist is Recommended	
Heavy Weight		Positive Pressure May Be Present	
Electric Hazard		Extreme Temperatures May Exist	
Automatic Start		Lock Out Equipment for Safety	
Crush Foot		Maintenance / Service Required	
Watch Head		Inspect / Check Measurements	

2.4 Safety and Potential Hazards Drawing

Figures 2-1A and 2-1B list all safety warning signs and their meanings and highlights safety concerns.

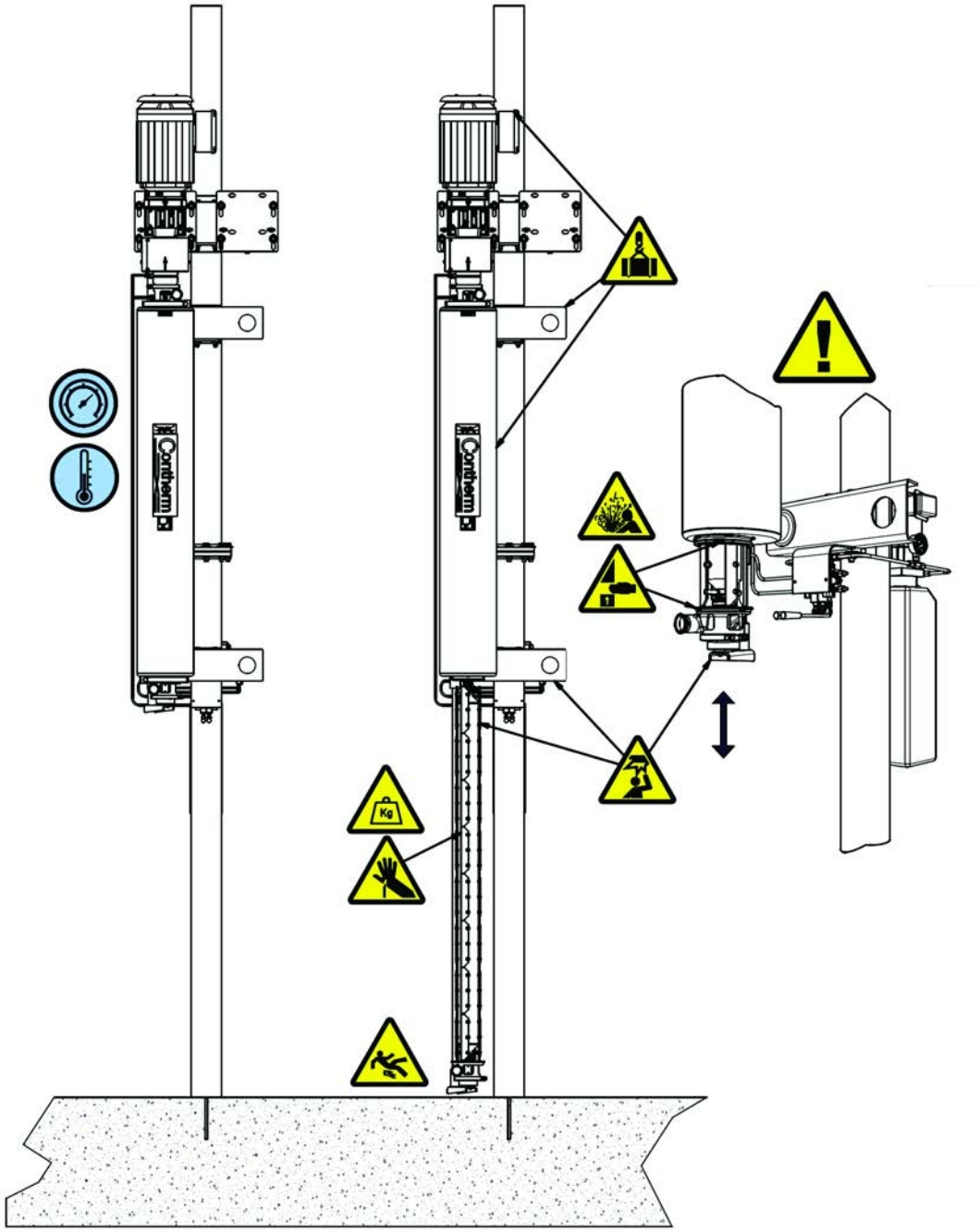


Figure 2-1A Safety Warnings
(Refer to section 2.3 for safety and inspection symbols)

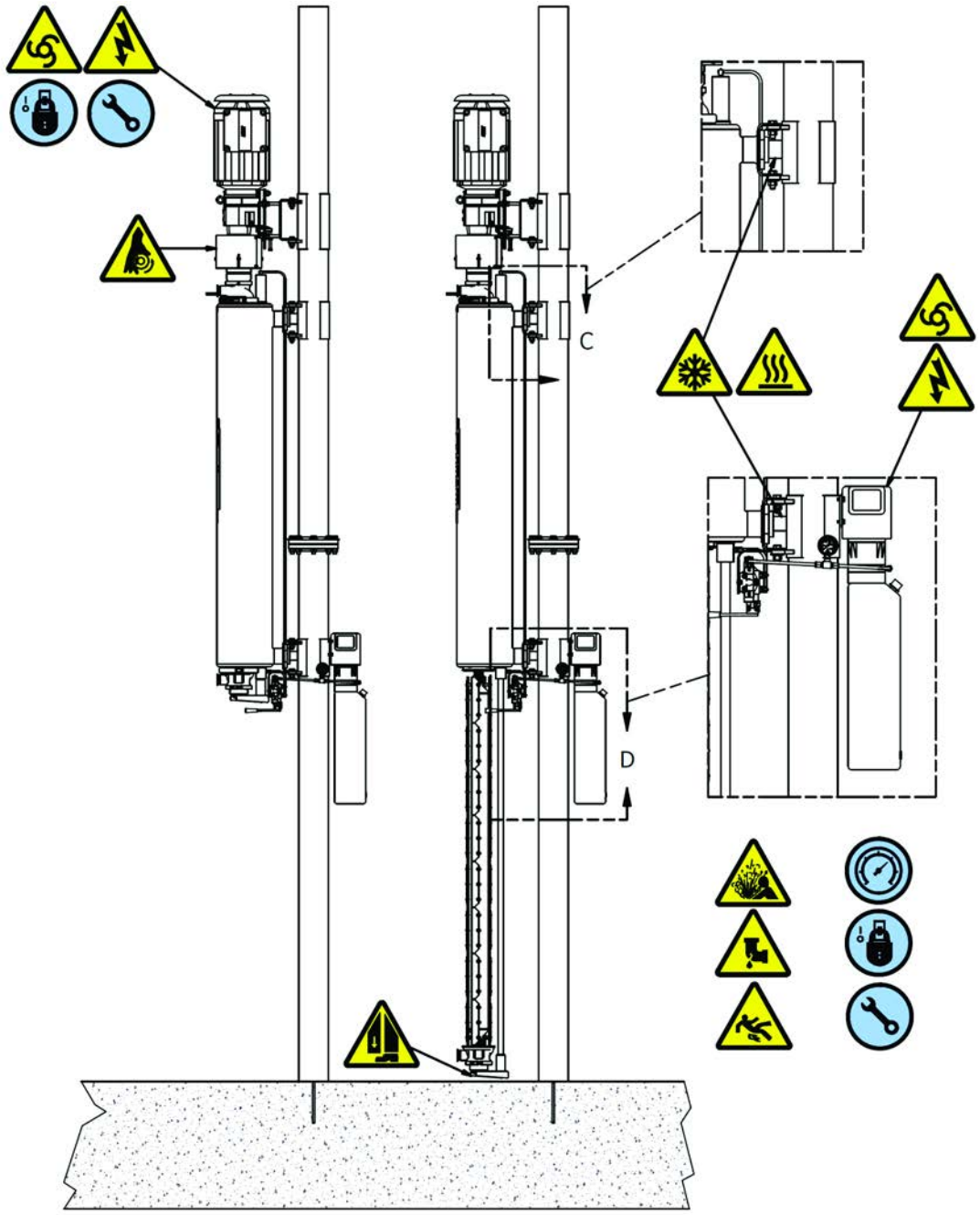


Figure 2-1B Safety Warnings
(Refer to section 2.3 for safety and inspection symbols)

3.1 Contherm™ Scraped Surface Heat Exchanger Warranty

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

1. Alfa Laval Inc. warrants to the original purchaser that all equipment manufactured by Alfa Laval Inc. Is free from defects in material and workmanship.
2. A defect in a part should not condemn the entire machine.
3. Alfa Laval 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 Inc. within 90 days from the date of shipment
4. The warranties set forth above are inapplicable to and exclude (i) any product, components or parts not manufactured by us or covered by the warranty of another manufacturer, (ii) damage caused by accident or the negligence of you or any third party, normal wear and tear, erosion, corrosion or by disasters such as fire, flood, wind and lightning, (iii) damage caused by user failure to follow all installation and operation instructions or manuals or to provide normal maintenance, (iv) damage caused by unauthorized or improper installation of attachments, repairs or modifications, (v) damage caused by a product or component part which we did not design, manufacture, supply or repair, or (vi) any other abuse or misuse by you or any third party.

3.1.1 Additional Warranties

Alfa Laval Inc. makes no additional warranties, expressed or implied, whether of merchantability or otherwise, other than that stated in Section 3.1, 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 3.1, Contherm™ SSHE WARRANTY.

Warranty excludes all on-site unapproved equipment modifications, equipment supplied by others or failure to properly integrate the Contherm into overall system related to external thermal expansion issues, pipe stresses, or other.

3.2 Product Support Services

Alfa Laval Inc. offers technical support through a worldwide network of personnel. These 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
- Training of customer staff

Within your equipment's warranty period, all charges for service and parts attributed to defective material or workmanship will be paid by Alfa Laval 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.

3.2.1 Returned Materials

Do not return any material or equipment until you have obtained a "returned material authorization" number from Alfa Laval 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. RMA items must be dealt with within 30 days of inspection report. Customer inactivity beyond 30 days may result in items being scrapped or storage fees being charged.

3.2.2 Damaged Shipments

Alfa Laval 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 Inc., Newburyport, Massachusetts, USA facility.

3.2.3 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).

3.2.4 Office and Service Locations

For your convenience, we encourage you to work with our local representatives in your area. If you cannot locate an Alfa Laval Inc. representative in your area, please contact us directly at the following location:

Alfa Laval Inc.
111 Parker Street
Newburyport, MA 01950, USA
Telephone: +978-465-5777
Fax: +978-465-6006
Email: USContherm.support@alfalaval.com

4.1 General Description

NOTE: This section describes the Contherm™ in a general sense and information in this section may or may not be applicable to your order. Please refer to Chapter 1 for specific information corresponding to your Contherm™ order.

Working Principle and Use Limits

Product enters the (7) insulated Contherm™ cylinder through the lower product head (1) and flows upwards through the cylinder. At the same time, the heating/cooling media (3) enters the Contherm™ and travels in a counter-current flow through the narrow annular channel (5) before exiting (4).

Rotating blades (6) attached to the Contherm™ rotor (8) continuously remove product from the cylinder wall (9) to ensure uniform transfer of heat from the media to the product. An optional coil in the annulus (5) increases media velocity, adding to the heat transfer efficiency

Product exits the cylinder through the upper tangential port (2). Product flow and rotor speed can be varied to suit the properties of the product flowing through the cylinder.

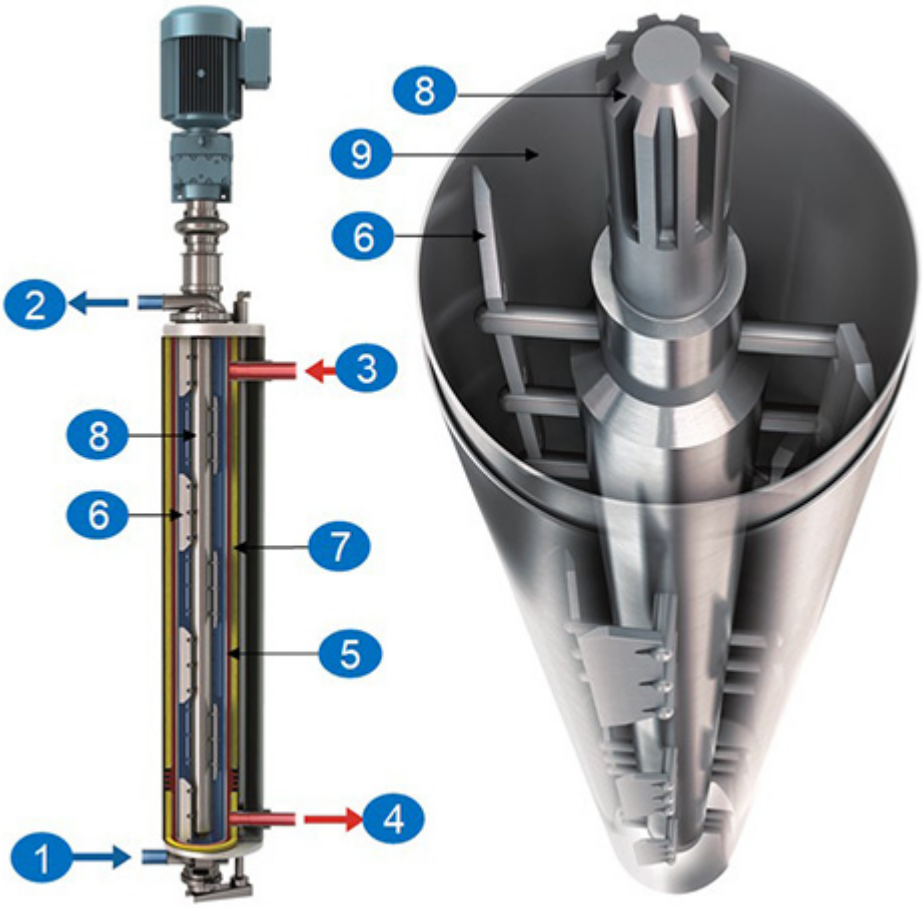


Figure 4.1 Contherm™ General Description

Tailored to specific needs

With a wide selection of components, now also including the low shear rotor for large particulates, numerous Contherm™ configurations are available.

Trained, knowledgeable Alfa Laval staff can customize each Contherm™ unit by selecting the appropriate materials, features and options to meet each customer's exact requirements.

4.2 Limits of Machinery

Use Limits:
- Refer to chapter 1 order documentation for equipment design and use limitations specific to this equipment as sold.
- Refer to chapter 2 for safety instructions including the safety and potential hazards drawing.
- Refer to below Table 4-1 for use limits for each Contherm™ product including maximum pressure and temperature limits. Over-pressure protection for both product and media piping is the responsibility of the installer of the equipment or end user.
- The Contherm™ is designed to be cleaned in place (CIP) with chemical cleaning agents commonly used such as caustic and acid solutions. While the Contherm™ manual describes general cleaning guidelines, the CIP parameters must be developed by the end user through testing and validation to achieve the highest level of cleanliness possible for the material being processed.
- Equipment users must perform routine maintenance to inspect and replace components such as seals, O-rings, scraping blades, rotor shafts, cylinder assemblies and bearings. This work is done after disconnecting the drive mechanism from power, insuring the system is empty of all fluids (product, cleaning chemicals, media) and has no residual pressure or non-ambient temperatures on equipment surfaces.
- The Contherm™ cylinder is a ASME and/or PED certified pressure vessel. The user must not alter or perform maintenance tasks on the cylinder aside from inspection and cylinder replacement. Only Alfa Laval can perform cylinder maintenance such as honing or welding to the vessel.
- Users must practice GMP (good manufacturing practices) for food plant operations when interacting with Contherm™ equipment. Users must take care to maintain the hygienic nature of the equipment such as surface finishes, materials of construction and quality of repairs, and ensure the proper functioning of the equipment to prevent product contamination or equipment failure.
- The Contherm™ is not ATEX certified.

Space Limits:
- Refer to project specific drawings when installing the equipment to ensure ample space is allowed for safe operation and maintenance of the equipment. Attention must be paid to height requirements for performing maintenance, and clear space required for rotor extraction, as well as space for various product and media piping and insulation necessary for integrating into a system.

Time Limits:
- Life limits of the machinery and/or its components are highly application and usage dependent. Varying operational parameters such as scraping speed, process temperature and pressure, product and media types, chemical compatibility and quality of maintenance will affect equipment and component life differently. It is recommended to inspect the equipment frequently (daily or weekly) in the early stages of use to identify what is appropriate and necessary for long term care and performance of the equipment. The frequency of inspection and maintenance can later be reduced based on experience gained.
- Gearmotor oils should be inspected, replenished and replaced at a frequency specified in the service manual for optimal life and reliability.

Environmental Limits:
- Temperature: The Contherm™ electrical components including drive motor and hydraulic pump motor should not be exposed to a continuous environment of extreme heat beyond what is deemed safe and allowable for end-user personnel to operate the equipment.
- Moisture & Chemicals: Protect the equipment and its electrical components from direct exposure to moisture, salt water and/or cleaning chemicals otherwise the life of this equipment will be reduced and likelihood of corrosion will increase.
- Noise:
  - Since Contherms™ are not direct-operation equipment, but are operated as part of a larger system with its own control system, they are unaffected by ambient noise.
  - The noise limits for the Contherm™ machine are dictated by the drive motor. Contherm™ standardizes on SWE-EURODRIVE motors and the noise levels of all SWE-EURODRIVE motors are well within the maximum permitted noise levels set forth in the VDI guideline 2159 for gear units and IEC/EN 60034 for motors. Electrical motors and gearmotors comply with all relevant aspects of the Machinery Directive 2006/42/EC and Low Voltage Directive 2014/35/EU.
- High Pressure Cleaning: Frequent high-pressure waterjet spray, or high-pressure spray with caustic or acidic chemicals may damage Contherm™ cylinders and electric gear motors over time and it may require replacement of all exterior safety related labels. It is the user's responsibility to maintain proper safety labelling on the Contherm™ at all times.

Interface Limits:

The Contherm™ scraped surface heat exchanger is designed to be integrated with other equipment as part of a process line. Typical equipment before and after the Contherm™ are pumps, valves, instrumentation, strainers, mixers, holding tubes and tanks. It is the user's responsibility to ensure proper compatibility of any other equipment, fluid, power or chemicals used with the Contherm™ assembly.

- It is the user's responsibility to ensure proper installation according to local or country guidelines where the Contherm™ assembly will be installed. Users must take into consideration any structural, mechanical, thermal, seismic or other considerations which may affect the Contherm™, and ensure the Contherm™ is installed in a safe manner.
- Contherm™ equipment must not be subjected to detrimental external forces from other equipment or personnel climbing on equipment.

Table 4-1 Contherm Limits of Machinery

Product Features		Contherm™ Core	Contherm™	Contherm™ HP	Convap
Model	6X3 (3 ft^2, 0.28 m^2)		•	•	•
	6X6 (6 ft^2, 0.56 m^2)		•	•	•
	6X9 (9 ft^2, 0.84 m^2)	•	•	•	•
	6X11 (11 ft^2, 1.0 m^2)	•	•	•	
	Max 48 (48 ft^2, 4.5 m^2)				
Certifications	ASME, PED	•	•	•	•
	3A Hygienic		•	•	
	Cryogenic		•	•	
Mounting	Horizontal	• (not optional)	•	•	•
	Vertical		•	•	•
Materials	316L Stainless Steel	•	•	•	•
	Duplex Stainless Steel	•	•	•	•
	HIPEX 316L Stainless Steel		•	•	•
	Nickel		•	•	•
Cylinder Coatings	Chrome	• (abrasive)	•	•	•
	Alfaloy		•	•	•
	Triple Chrome		•	•	•
Rotors	2-inch, 51 mm		•	•	
	3-inch, 76 mm	•	•	•	•
	4-inch, 76 mm		•	•	•
	4.5-inch, 114 mm	•	•	•	•
	5-inch, 127 mm		•	•	•
	Heavy Duty Spline		•	•	•
Motor RPM Range	RPM	125-340	25-1,000	25-1,000	300-450
Product	220 psi, 15 Bar				
	300 psi, 21 Bar	•	•		•
	396 psi, 27 Bar		•		
	600 psi, 41.4 Bar			•	
	-30°F to +338°F, -35°C to +170°C	•	•	•	•
	-4°F to +300°F, -20°C to +150°C				
Media	115 psi, 8 Bar				
	250 psi, 17 Bar	•	•	•	•
	700 psi, 48 Bar		•	•	
	-30°F to +338°F, -35°C to +170°C	•	•	•	•
	-4°F to +300°F, -20°C to +150°C				

Application Limits

		Contherm™ Core	Contherm™	Contherm™ HP	Convap
Viscosity	Up to 25,000 cps	•	•	•	•
	Up to 50,000 cps	•	•	•	•
	Up to 200,000 cps		•	•	•
	Up to and > 200,000 cps		•	•	•
Particulate Size	Up to 1 inch, 25 mm	•	•	•	•
	Up to 1.3-inch, 33 mm		•	•	
Gentle / Low Shear			•	•	
High Shear/Mixing/Aeration	Slotted Blades		•	•	
	High rpm (> 600 rpm)		•	•	
Aseptic Processing		•	•	•	•
Crystallization	with Ammonia/Freon		•	•	
	with Propylene Glycol	‡ Not < 50k cps	•	•	
Highly Abrasive	(use of hard cylinder coating)	•	•	•	•
Corrosive	High temperature/High salt	•	•	•	•
	pH < 2 or > 6		Contact Contherm™ Product Center		
	Non-Food, Chemical		Contact Contherm™ Product Center		

5.1 Serial Number Information

Alfa Laval Inc. assigns a unique serial number to each Contherm™.

Figurer 5.1 An example of a serial number for a standard Contherm™

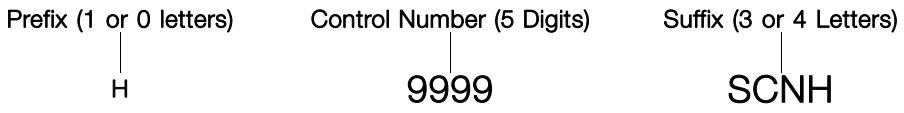


Table 5.1 Contherm™ Material, Serial Number Prefix, Suffix and Digit Description

Prefix	Suffix			
Letter	1st Letter	2nd Letter	3rd Letter	4th Letter
Hydraulic Lift Device for Ease of Maintenance	Cylinder Material	Media Chamber	Coating	HIPEX
H Hyd. Lift Included (Vertical installation)	S Stainless Steel	C Coiled	N No Coating	H HIPEX Thin Wall Stainless Steel
Not Included (horizontal installation)	D Duplex 2205	P Plain	A Alfaloy	
	N Nickel		C Chrome	No HIPEX
			T Triple-Chrome	

The information provided by your Contherms™ serial number should be referenced whenever you correspond with Alfa Laval Contherm™ Inc. or order spare parts.

The nameplate is in two locations. One is located on the heat exchanger pressure vessel itself enclosed within the trim sheet cover and the duplicate nameplate is located on the exterior stainless steel outer trim sheet both as shown below in Figure 5-1. This is where the serial number can be found for the specific Contherm(s)™ corresponding to this order and manual.

5.2 Contherm™ Name Plate

The serial number is inscribed on the inspection plate mounted on the exterior of the Contherm™ and on the pressure vessel heat exchanger cylinder.

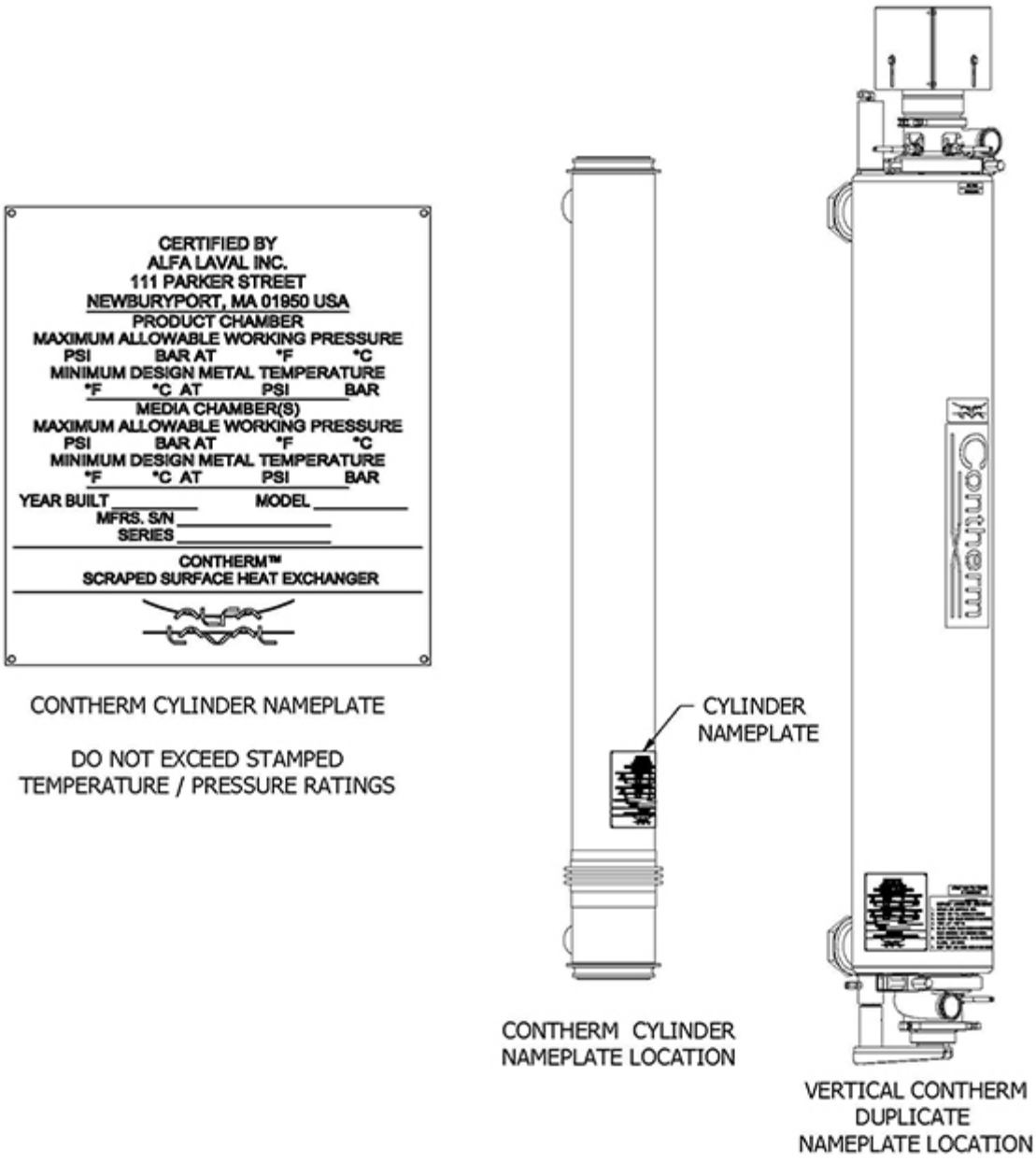


Figure 5-1 Contherm™ Nameplate

6.1 Introduction

Refer to mechanical drawings and order acknowledgement details. Installing in orientation described in the general arrangement drawing will ensure optimum use and drainability of the equipment.

Before performing any installation procedure, please review the safety precautions provided in Chapter 2, 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.

WARNING

Refer to general arrangement drawings provided with the equipment and ensure when installing to leave adequate space for safe operation and maintenance.

WARNING

Only qualified Electricians should be allowed to connect power to Contherm™ drive motors and hydraulic lift pump.

WARNING

Only qualified personnel should be allowed to move crates, uncrate, hoist, install equipment as items are large, heavy and bulky and can easily become unstable upon transporting for installation. Use appropriate lifting equipment based on table 6-1 below which provides weight limits of various equipment.

WARNING

To ensure safe operation, only properly trained resources should be used to install product and utility connections using proper gasket and/or sealant materials.

WARNING

Any modifications to the equipment can likely void the equipment warranty and can possibly create a safety risk. Contact Alfa Laval before modifying the equipment.

CAUTION

Apply anti-seize compound to non-product contact threaded connections to enhance the maintenance process.

6.2 Uncrating and Unpacking the Equipment

It is the user's responsibility to report equipment damage during freight to the freight company responsible for the shipment. In addition, contact Alfa Laval to receive any needed support.

	NOTE: Scraping blades are not installed in the Contherm™ to protect them during shipment. Locate the scraping blades in the crate and store in a safe location until the Contherm™ is ready for operation. Refer to Chapter 8, Section 8.5.1 for instructions on installing the scraping blades.

Identifying typical crate contents

Ttake note of all contents of every crate upon arrival. Seek out crates that hold spare parts and important documentation (including thumb drive with electronic files) and ensure proper personnel promptly receives this information. Alfa Laval is not responsible for lost items.

Table 6-1. Typical Contents of a Contherm™ Crate

1	Drive motor(s). See lifting instructions below
2	Hydraulic lift pump (for vertical installations only)
3	Contherm™ mounting cross arm (see mounting installation drawings)
4	Drive motor coupling components
5	Drive motor mounting plates (see mounting installation drawings)
6	Small parts box containing mounting hardware
7	Small parts box containing Contherm™ start-up spare parts
8	Scraping blades shipped separately to protect during shipment. **IMPORTANT:** Blades must be installed prior to operation
9	Documentation (manual, drawings, certifications, packing list, etc)
10	Hydraulic tubing (for vertical installations only)

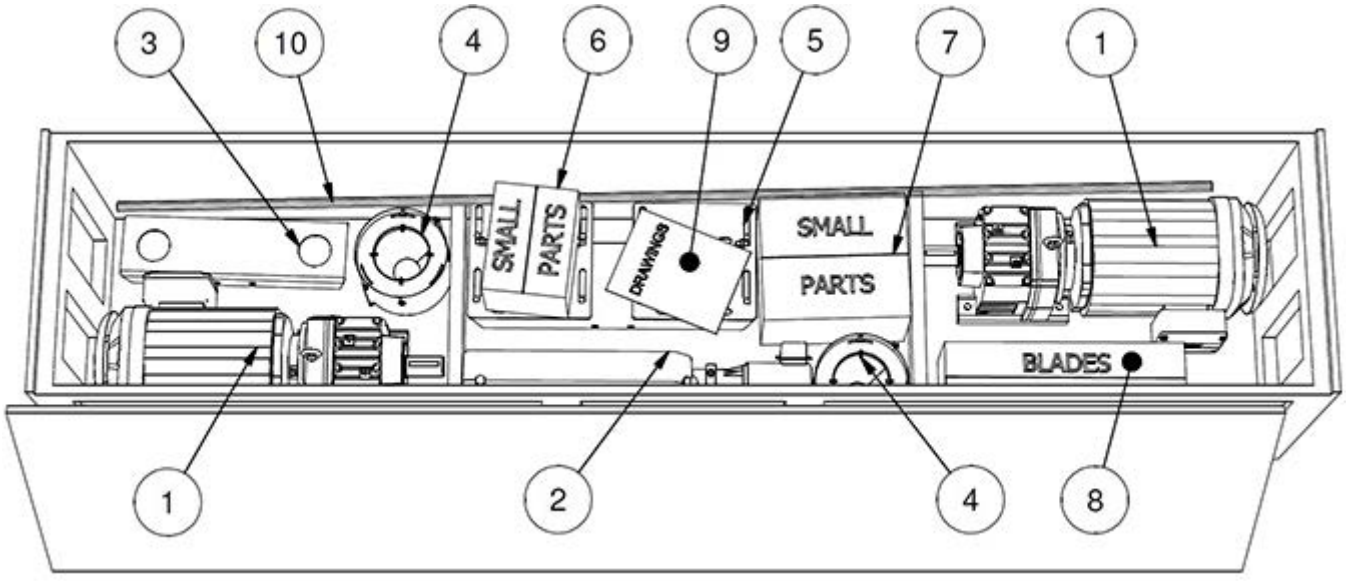


Figure 6-1. Typical Contents of a Crate
NOTE: Crates containing Contherm heat exchangers primarily contain just the Contherm. Refer to section 6.2 and related images.

6.2.1 Shipping Weights

The net weight and shipping weight for each Contherm™ Model is provided Table 6-2.

Table 6-2. Net Weight and Shipping Weight of The Contherm™

Model	Net Weight (Pounds/Kilograms)	Shipping Weight (Pounds/Kilograms)
6 x 3 Contherm™	350 lb/159 kg	455 lb/206 kg
6 x 6 Contherm™	515 lb/234 kg	630 lb/236 kg
6 x 9 Contherm™	605 lb/274 kg	720 lb/326 kg
6 x 11 Contherm™	685 lb/311 kg	800 lb/363 kg
6 x 9 Contherm™ Core	750 lb/340 kg	1130 lb/515 kg
6 x 11 Contherm™ Core	845 lb/383 kg	1225 lb/555 kg

Perform all steps of the procedure described in table 6-3 upon receipt of shipment of your Contherm™.

Table 6-3. Unpacking and Uncrating the Contherm™

Step	Action
1	Carefully open all containers. Try not to scratch or mark the items when unpacking them. Identify all small boxes of parts and put into a safe location so items do not get lost.
2	Locate the product documentation, manual and pressure vessel certifications. **Do not lose the certifications!**
3	Use the packing list and this Instruction Manual to verify that all equipment has been received.
4	If any part of the shipment is missing, notify your local Alfa Laval Inc. representative as soon as possible.
5	Leave all components in their crates and containers in a safe environment until you are ready to install them.
6	**IMPORTANT: Scraping blades are not installed in the Contherm™ to protect them during shipment.** Locate the scraping blades in the crate and store in a safe location until the Contherm™ is ready for operation. The equipment will not perform properly if the blades are not installed in the machine. Refer to Chapter 8, Section 8.5.1 for instructions on installing the scraping blades.

Recommended Lifting Procedures

Removing the Contherm™ heat exchanger should involve strapping around the media connections of the outer jacket as shown to the below right.

Proper lifting of a Contherm™ from its Crate

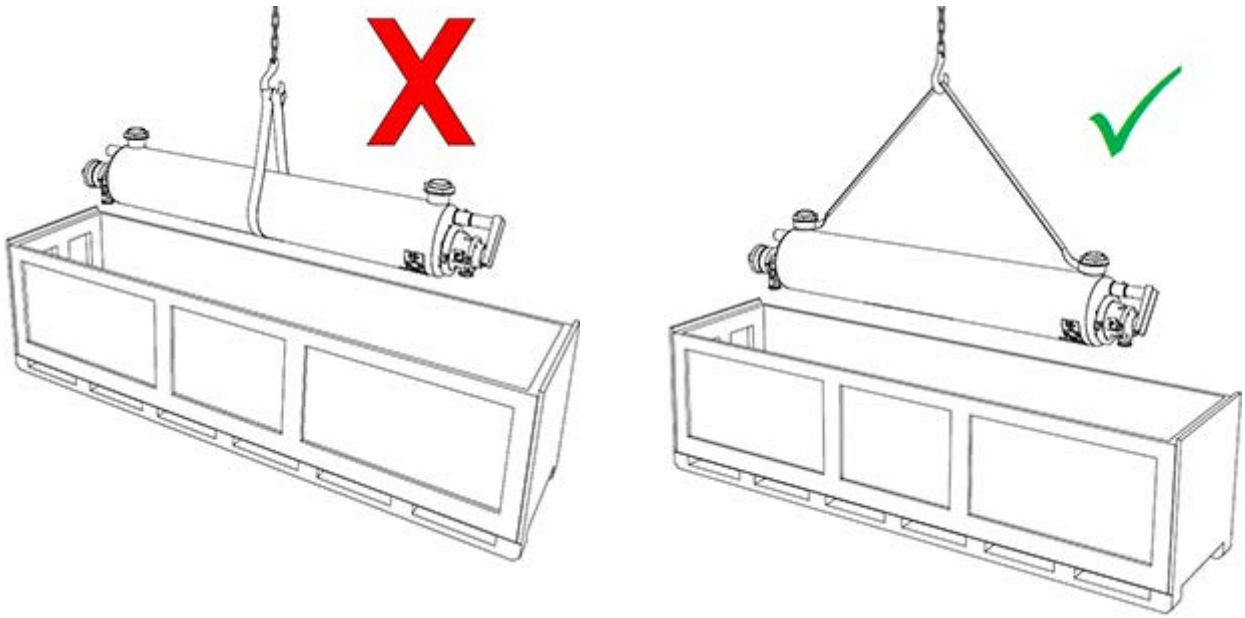


Figure 6-2. Proper Lifting of a Contherm™ from its Crate

For vertical mounting columns, strap column at center of gravity location.
For motors, use manufacturers lifting eye bolts.

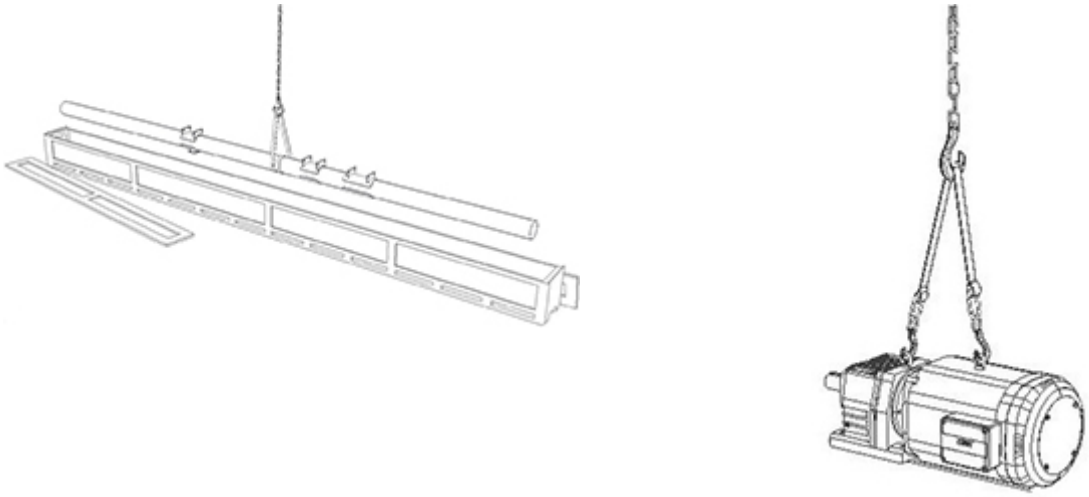
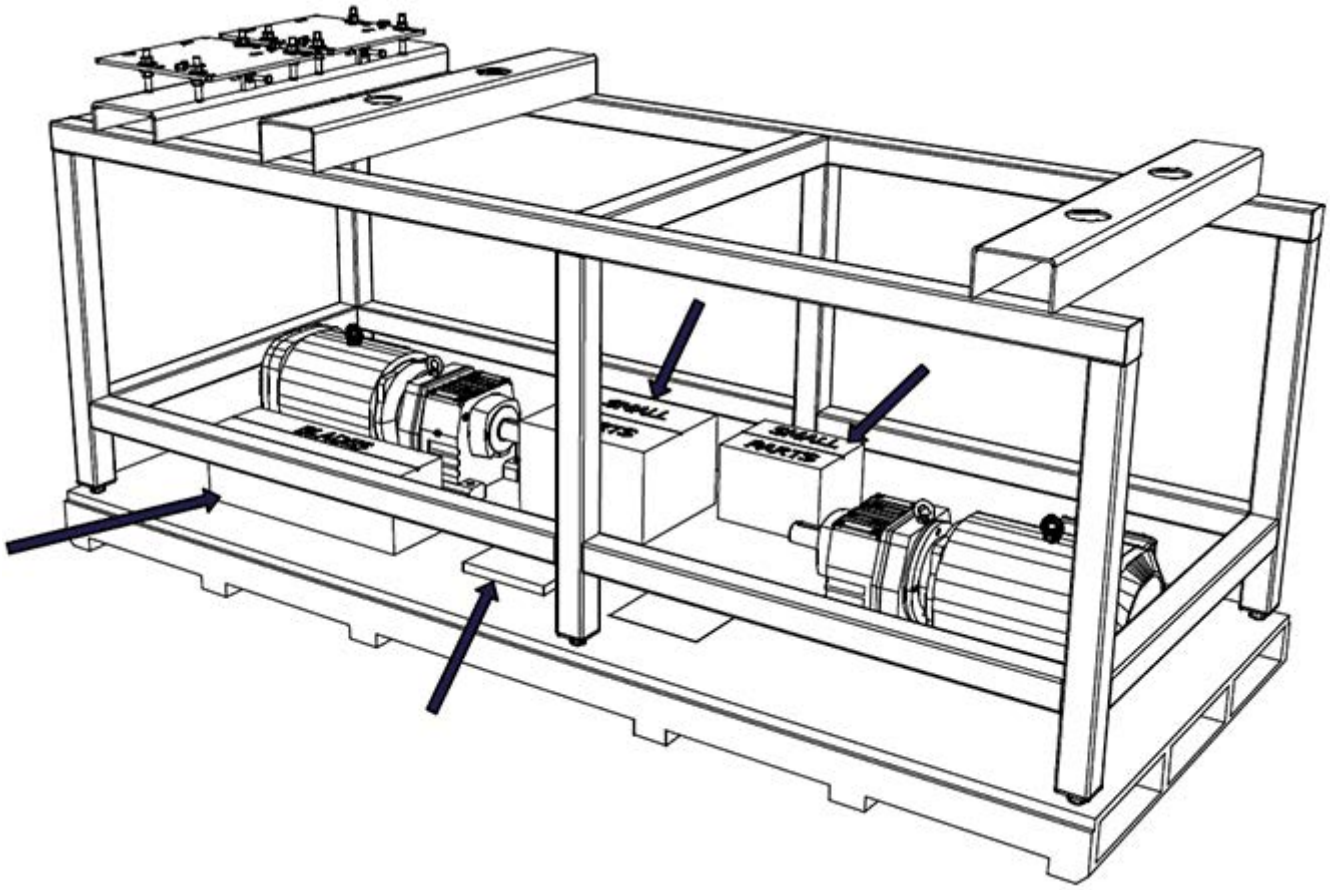


Figure 6-3. Take caution to properly and safely lift Contherm™ from Crate

Typical Contents of Crate Containing Horizontal Contherm Mount



Note: Motor and other important items such as spare parts, blades and documentation will likely be in the crate with the horizontal frame as shown.

Figure 6-4. Typical Contents of a Crate Containing Horizontal Contherm™ Mount

6.3 Installing the Vertical Mount

Refer to Appendix A for additional images demonstrating the proper installation sequence for vertical installations.

If the mount has been supplied by others, use the procedure they have provided.

Two methods are recommended for installing the vertical mount, either bolting the mount to the wall or bolting to the ceiling. Refer to Table 6-5 for installation instructions.

Both mounting methods are shown in Figure 6-5. 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 Inc. The end user is responsible for these structural mounting items.

Select the mounting method most appropriate for your facility. Refer to both Figure 6-5 and the mounting drawing supplied with your equipment while performing the following vertical mount erection procedure.

Wall Mounting

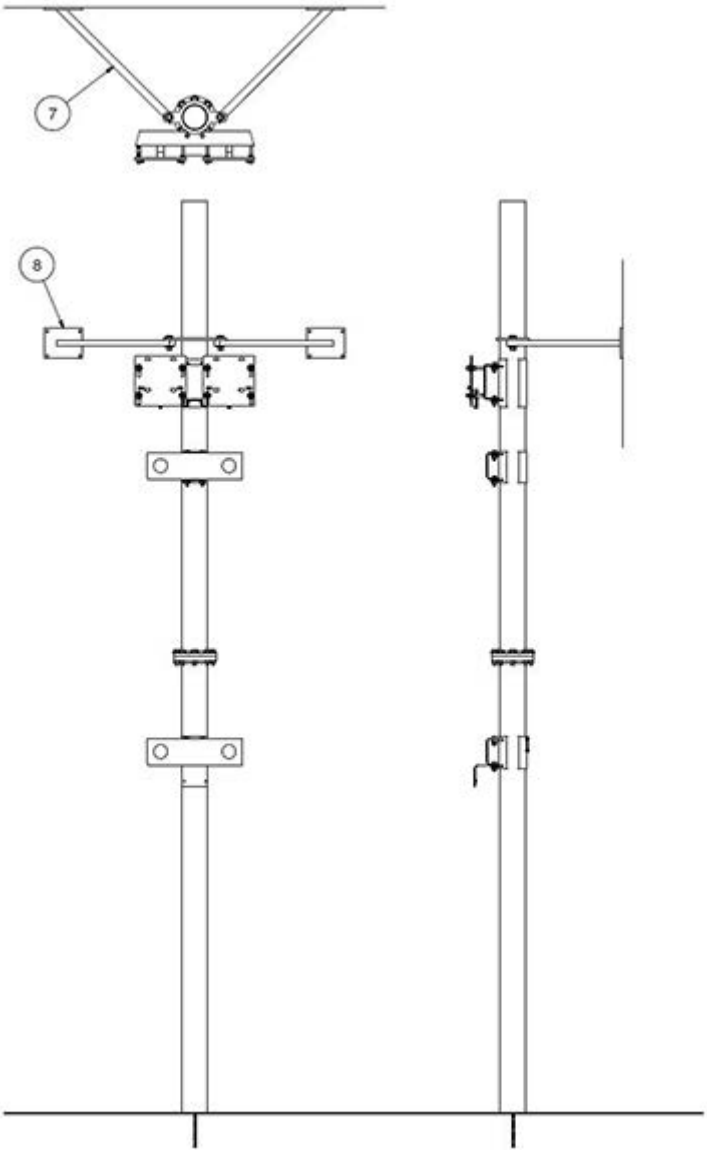


Figure 6-5A Wall Mount

Ceiling Mounting

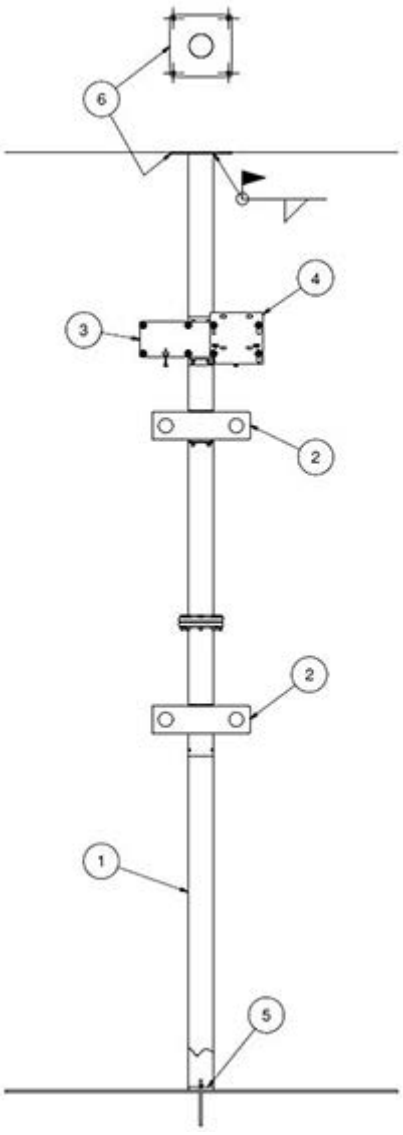


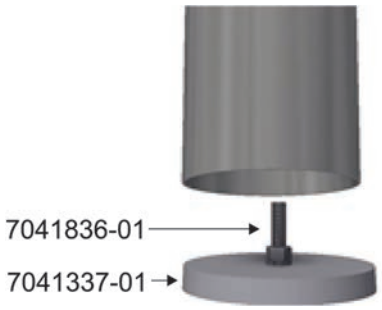
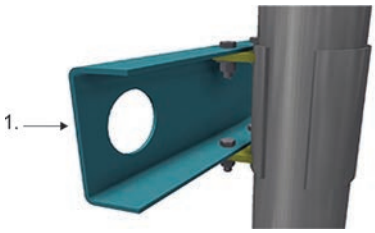
Figure 6-5B Ceiling Mount

Table 6-4. Wall and Ceiling Mounting

1	Mounting column
2	Contherm cross-arm
3	Motor cross-arm
4	Motor mounting plate
5	Mount floor plate and tie-down bolt
6	Ceiling plate (bolted to ceiling by installer)
7	“A” Frame (bolted to wall by installer)
8	Wall mounting plates (bolted to wall by others)

Perform all steps of the procedure described in Table 6-5 upon receipt of shipment of your Contherm™

Table 6-5. 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). Refer to the mounting drawings provided and repeat the drilling for the additional floor plates as needed. 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 securing cross-arms to the column, ensure the cross-arm components sit on top of the support brackets and not below the support brackets. 1. Cross-arm installed on top of mounting column brackets.  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) as described in step 1. It is the responsibility of the customer to use a properly rated rope or chain sling to safely raise and lower each column. 1. Bottom 2. Top 
4	Secure the top of the mount using one of the methods shown in "Installing The Vertical Mount" section above..
5	When the mount has been assembled and each column is securely supported in the vertical orientation, the Contherm can now be installed onto the vertical mount. See following section (6-4, Mounting and Installing the Contherm™ In a Vertical Configuration).

6.4 Mounting and Installing the Contherm™ In a Vertical Configuration

After installing the mount, you can then mount and install the Contherm™ heat exchanger. Before starting this procedure, review the safety warnings in section 6.1 and obtain the lifting equipment required for the safe installation of this equipment.

When you are ready to install the Contherm™, proceed to Table 6-6 and perform each step of the procedure in the sequence in which it is presented.

Table 6.6 Mounting and Installing the Contherm™ In a Vertical Configuration

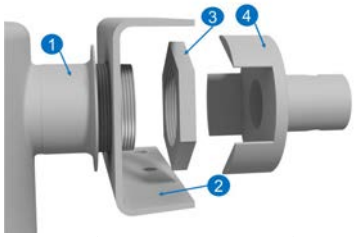
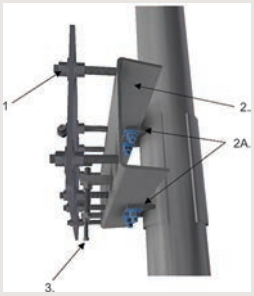
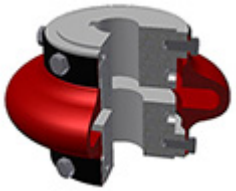
Step	Action
1	Use a properly rated rope or chain sling (necessary to handle the weights shown in Table 6-2) to safely raise and remove the Contherm™ from its crate. Refer to recommended lifting procedures above. If a chain sling is used to raise the Contherm™ vertically, wrap the slots in the product head with cloth to protect their polished surfaces.
2	Remove locknut, item 3 in figure 6-6 (P/N 7401266-01). 1. Contherm™ trim sheet (outer jacket) with 3 inch (76 mm) threaded connection. 2. Mount cross-arm 3. 3-inch (76 mm) Locknut (7401266-01) 4. 3-inch (76 mm) Hex wrench tool (7403126-01)  Figure 6-6 Side View of Contherm™ Trim Sheet and Mounting Arm
3	Figure 6-7 demonstrates the proper installation of the media pipe. 1. Media pipe extending through the trim sheet 2. **DO NOT WELD to 3-inch (76mm) threaded connection.** 3. Media pipe connecting directly to Contherm™ heat exchanger cylinder located inside the Contherm™ trim sheet.  Figure 6-7 Media Pipe Extending Through Cross-Arm and Contherm™ Outer Trim Sheet
4	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 cross arm. Refer to Figure 6-6. 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 cross arm.
5	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. Refer to Figure 6-6. Use the supplied tightening tool (P/N 7403126-01) to tighten each locknut.

Table 6-7. Mounting and Installing the Motor Plates and Coupling for Electric Direct-Coupled Drive System

Step	Action
1	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 6-8. The location of the motor plate on the vertical mount is preset by Alfa Laval Inc. at the factory to minimize the need for adjustments. Final adjustments must be made on side to insure proper alignment. 1. Motor plate horizontal adjustment hex nuts (P/N 7401248-02) 2. Cross-Arm positioned on top of (2A) mount support brackets 3. Mounting plate vertical adjustment bolt (P/N 7401241-16)
	 Figure 6-8. Motor Plant Assembly
2	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 6-9 below. **NOTE: Place the coupling guard ring over the bearing housing before installing the drive motor. Refer to section 6.5 for more details.**
	 Figure 6-9. Both Hubs Mounted Inward
3	Inspect both driving (motor) and driven (Contherm™) shafts and hub bores. 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.
4	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 8. 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 close to touching but not in contact.
5	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 hubs with a straight edge (or laser alignment tool) along the front edge and at a 90° 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.
6	Use the vertical adjustment bolt to raise the motor plate assembly if required.
7	Check the alignment of the hubs again and make any required adjustments. Before tightening nuts and bolts, ensure that the distance of the bolt holes of the hubs are equal to that of the bolt holes of the elastomer elements. Once proper distance is obtained, firmly tighten all nuts and bolts.
8	Place half of the flexible coupling's elastomer element around the hubs and secure with the self-locking cap screws. The elastomer element will space the other hub. It is important to have the cap screw locking the first hub to the shaft and ensure that it is properly tightened. Now secure the other hub to the shaft.
9	Mount the other half of the elastomer element to the hub and tighten all screws.

6.5 Installing the Coupling Guard

After installing the drive coupling, be sure to install the safety guard. Refer to table and figures below for the installation procedure.

Table 6-8 Describes the list of components for the coupling guard.

Item	Quantity	Part Number	Description
1	1	7404622-01	Guard Ring
2	2	7401242-10	Socket Head Screw 10-32
3	3	7401244-22	Lock Washer # 10
4	4	7404623-02	Guard Halves
5	5	7401241-01	Hex Head Bolt 1/4-20
6	6	7401244-10	Flat Washer 1/4
7	7	7401242-15	Socket Head Screw 10-24

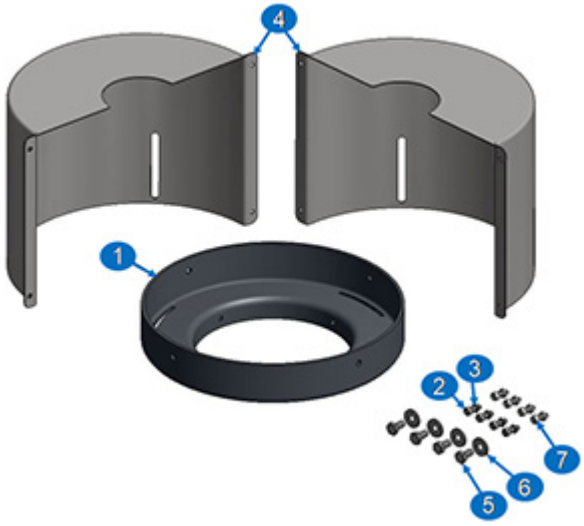


Figure 6-10.

WARNING For equipment and operator safety, the drive motor power must be off before attempting this step.

Place the coupling guard ring over the bearing housing **before installing the coupling hub**.

Verify the couplings are installed correctly and properly aligned before installing the coupling guard. (see section 6-4 for instructions).

Connect the coupling ring to the bearing housing cover plate using the 7401242-10 socket head screws and 7401244-22 lock washers.

Next, use hex bolts 7401241-01 and flat washers 7401244-10 to mount the guard halves to the guard ring. Do not tighten these until the socket head screws, PN 7401242-15 (10-24) are located and have been started in the guard halves.

Tighten socket head screws 7401242-15 (10-24) and then check clearance of the drive coupling. If it is clear of the cover, then tighten the 7401242-10 socket head screws.

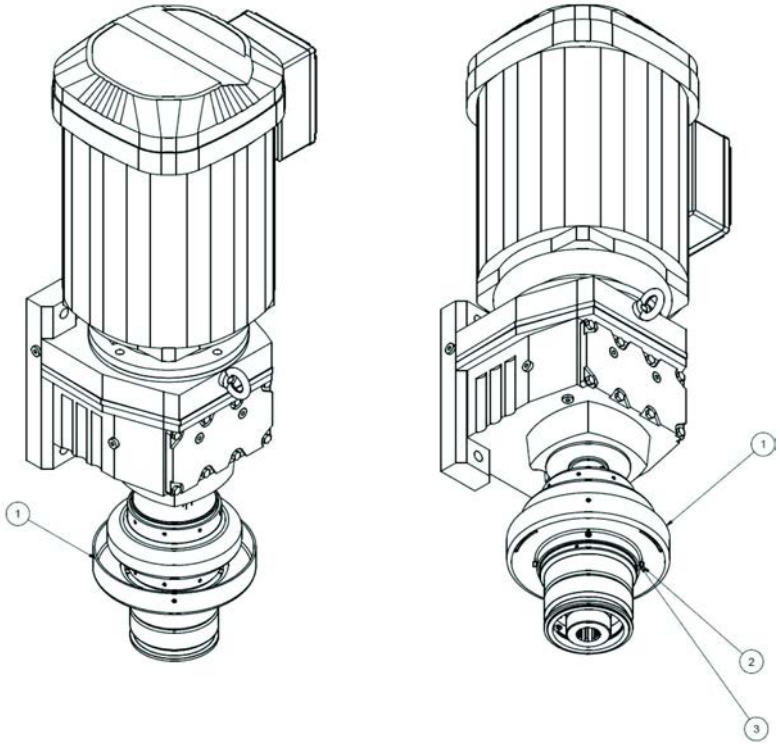


Figure 6-11A Installing the coupling guard.

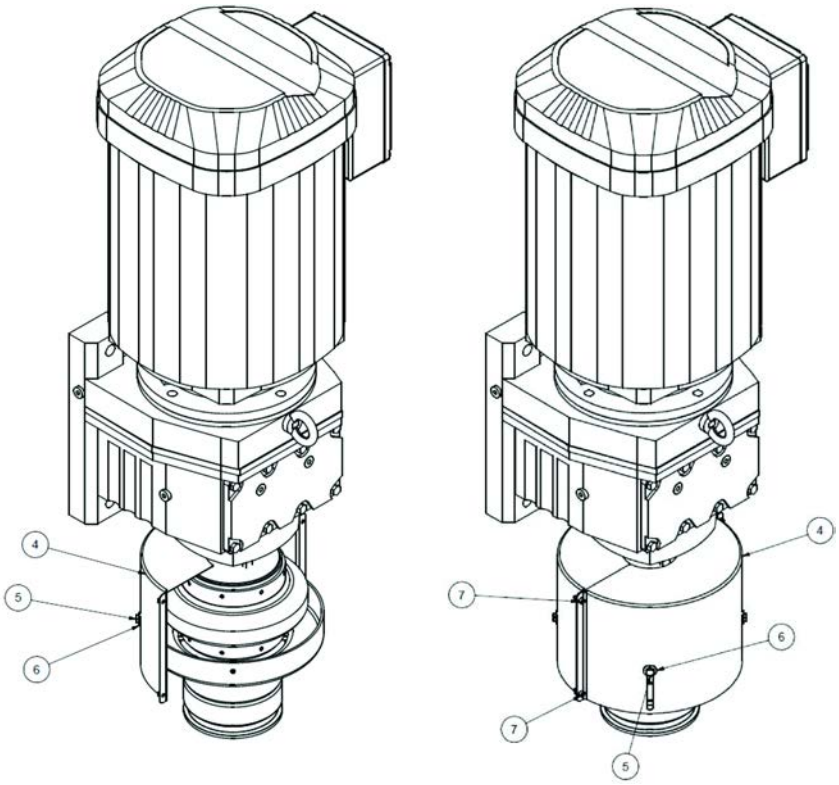


Figure 6-11B Installing the coupling guard continued

6.6 Installing the Components of the Rotor Lifting Device

Each vertically mounted Contherm™ is provided with a hydraulically controlled rotor lifting system. This system permits the Contherms™ rotor and blade assembly to be raised or lowered safely and easily for inspection, maintenance or manual cleaning. Refer to Figure 6-13 for detailed description.

Safety:

1. Hydraulic lift and stack valve handle are meant for "One Person Operation" only to ensure safety during operation.
2. Locate the pump within 30-feet (9.14 M) of the Stack Valve Assembly.
3. As many customers choose to customize the hydraulic tubing, multiple lengths of tubing are provided with the equipment and it is to be cut and configured on site at time of installation.
4. Do not use more than two center sections in any Stack Valve Assembly and do not attempt to raise and lower two hydraulic lift cylinders at the same time.

DANGER

1. More than one operator of the hydraulics and equipment alignment increases the risk of creating a pinch point and injury between the lower product head and the cylinder.
2. 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 PSIG (31 Bar).
3. 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: 7403038-01) or the Bearing Cap Clamps (P/N 7401579-01).

Figure 6-13. The major components of the rotor lifting device include the following:
The hydraulic lift equipment is to be arranged, fabricated, assembled, wired, and installed on site by competent personnel.

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	Hydraulic interconnecting fittings and tubing with pressure gauge.

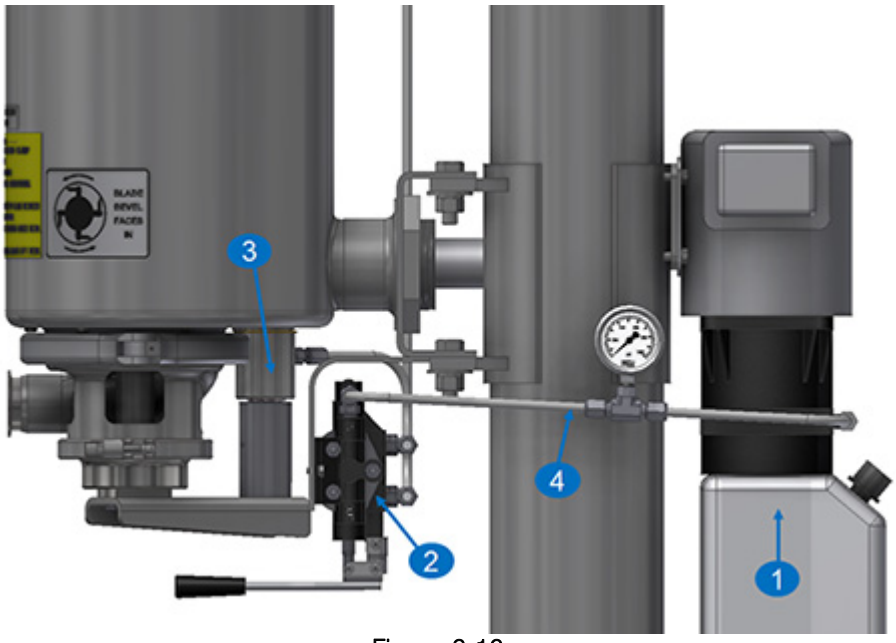


Figure 6-16.

For safety, it is essential that a single operator safely adjust and align the lower product head with one hand while manipulating the stack valve assembly handle with the other hand.

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

Figure 6-14. Single and Dual Center Section Stack Valve Assembly

Single Center Section

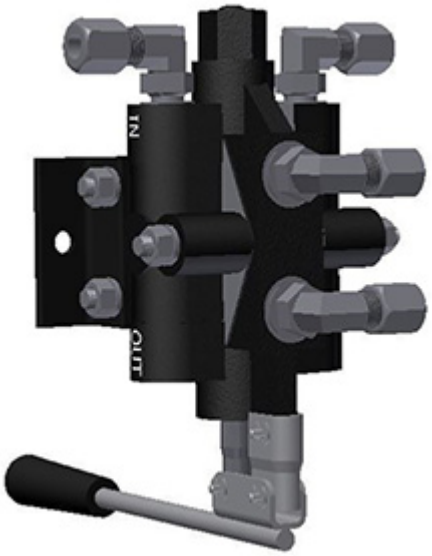


Figure 6-17. Single Center Section

Dual Center Sections

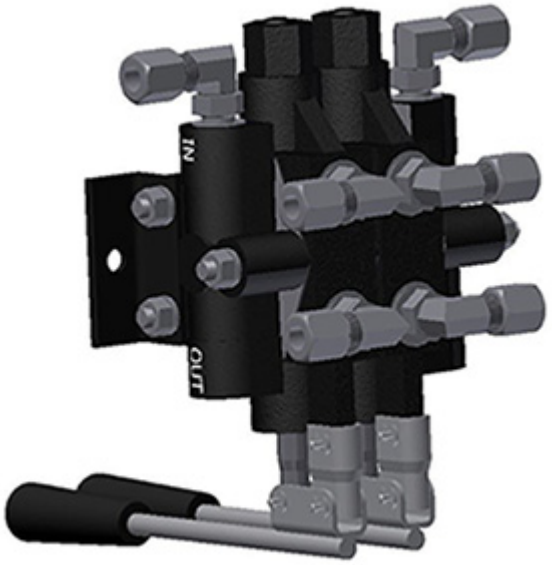


Figure 6-17. Dual Center Section

Figure 6-15 below demonstrates a dual rotor lifting system configuration. This configuration utilizes a Stack Valve Assembly with two center sections also known as a Dual Stack Valve Assembly.

Figure 6-15. The major components of the rotor lifting device:

1	Supply from the hydraulic pump.
2	Supply from right top stack valve to bottom of hydraulic lift pistons.
3	Return from top of lift pistons to bottom right stack valve.
4	Return from stack valves to hydraulic pump

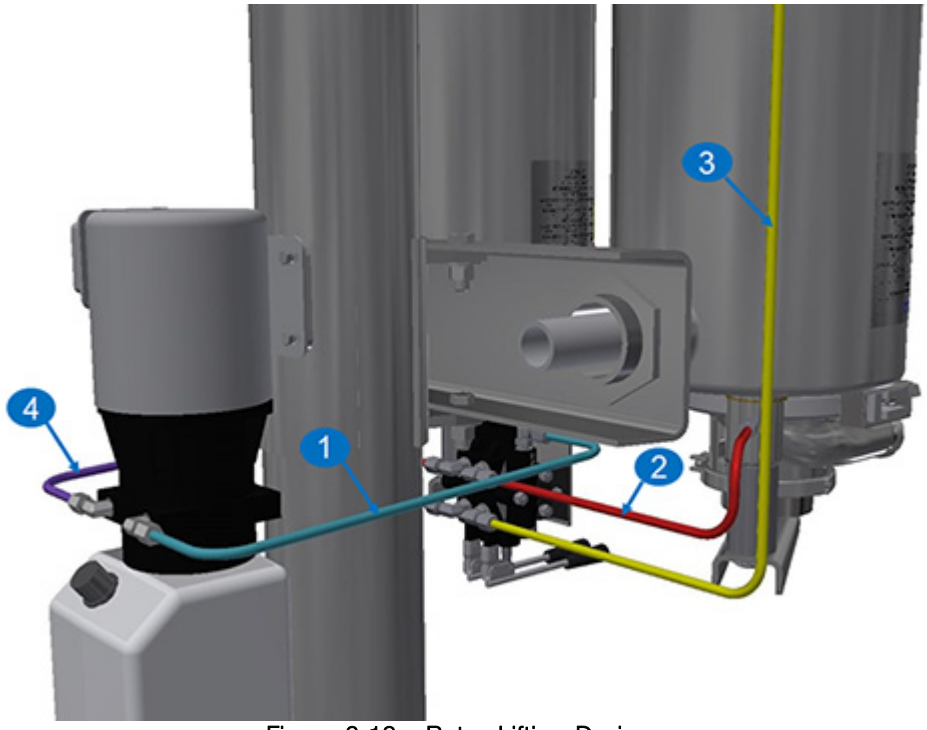


Figure 6-18. Rotor Lifting Device

Below demonstrates a dual rotor lifting system configuration and how to connect stack valve assemblies as shown in Figure 21, item 1. Hydraulic tubing is configured, bent and connected on site.

Figure 6-19. How to Connect Two Stack Valve Assemblies:

1 Stack valve hydraulic tubing connection. Refer to table 6-10 below for step-by-step instructions.

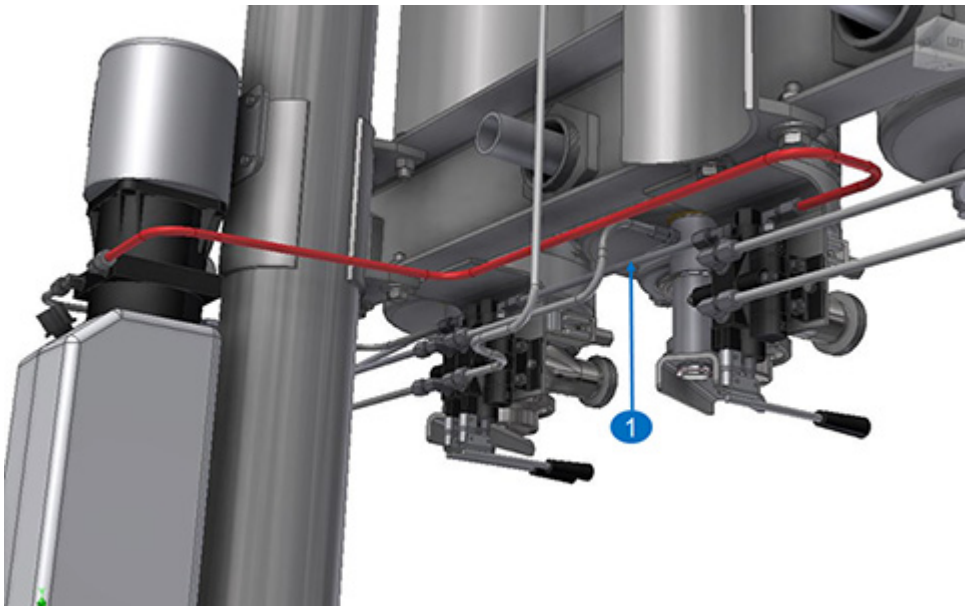


Figure 6-19. Connect Two Stack Valve Assemblies

If the Contherm™ mounting assembly has been provided by Alfa Laval 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.

The procedure for installing the components of the Rotor Lifting Device is provided below. Refer to Figure 6-17 while performing this installation.

Table 6-10. 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™ hydraulic lift piston assembly. Avoid crimping the tubing and ensure that the tubing is not resting against 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 Figure 6-16 above. The red line indicates the hydraulic system feed line. Item 1 below indicated in blue demonstrates how to connect the piping of each stack valve in series.
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.
4	Add the initial charge of hydraulic oil to the reservoir. Volume required is 4.0 U.S. gallons (15.2 liters). Use a high-quality SAE 10 Grade Hydraulic Oil for applications operated in a temperature range of 0° F (-18° C) minimum to 160° F (71° C) maximum. Use a high-quality SAE 20 Grade Hydraulic Oil for applications operated in a temperature range of 32° F (0° C) minimum to 200° F (93° C) maximum. Operate the hydraulic fluid at temperatures below 160° F (71° C) for optimal performance of both the pump and hydraulic oil. (Ex. Mobile Hydraulic Oil AW 32, ISO VG 32 or Exxon NUTO FG 32)
5	After adding the initial charge of hydraulic oil to the hydraulic pump assembly's reservoir, purge the air from the Contherms™ 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.
6	Be sure head and bearing clamps are secured to the components. Operate the stack valve to ensure the lift beam has snugged up to the bearing housing.
7	Non-Rotor Hold Down: 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. Rotor Hold Down Design: 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.
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 - 9 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 just below the Breather Cap connection.
12	Reattach the shoulder bolt to the bearing housing and operate the lift device according to the label on the Contherm™. Lower head and rotor as final test. Attach using clamp.
13	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.

Figure 6-20. Additional Dual Stack Valve Assembly Details

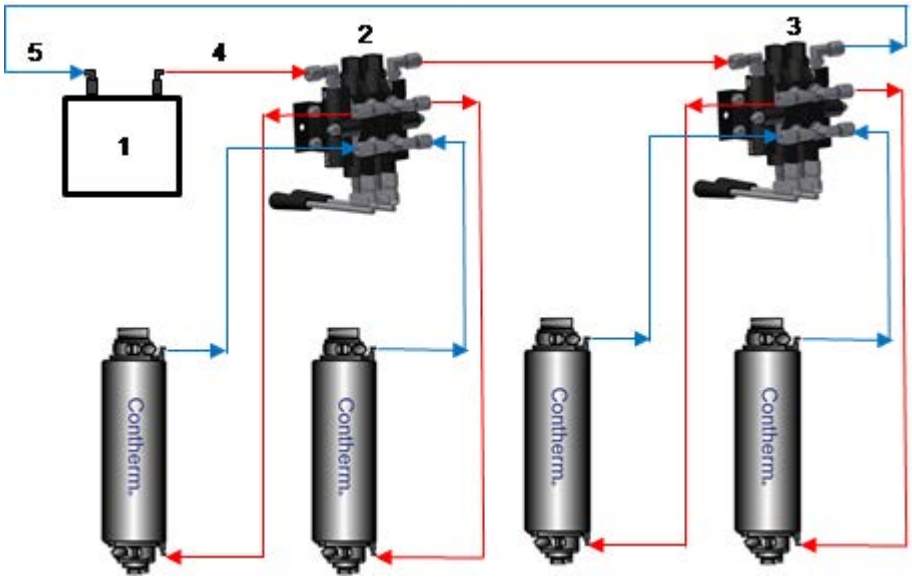


Figure 6-20. Additional Dual Stack Valve Assembly Details

1. Hydraulic pump
2. Dual stack valve
3. Second dual stack valve piped in series
4. Hydraulic pump fluid supply
5. Hydraulic pump fluid return

6.7 Mounting and Installing the Standard Contherm™ or a Contherm™ Core in a Horizontal Configuration

Refer to Chapter 1 for the detailed general arrangement drawing provided with the horizontal mount's hardware package for assembly and set-up instructions and to determine the required floor space. There must be adequate space on the non-driven end to remove the Contherm™ rotor. The following sections describe how to assemble and set-up the horizontal mount and then how to install the Contherm™ on the mount.

6.6.1. Mounting and Installing the Contherm™ On a Horizontal Mount

Refer to table 6-6 above as affixing the Contherm™ to a preassembled mounting structure is identical for both vertical and horizontal mounting frames.

6.6.2. Installing the Horizontal Mount

Figure 6-10 is a general drawing showing the rotor removal trough, item 1 (P/N 7402714) that is provided to protect the cylinder and rotor blade pins from coming into contact upon removal of the rotor. After assembling the mount, ensure that the mount is level by using the adjustable feet on the legs of the mount. It is recommended to install with a 0.5-degree pitch for product and CIP drainage.

Alfa Laval Contherm™ Product Center is not responsible for equipment failures due to improper mount designs by others. If the mount has been supplied by your local Alfa Laval Company or another company, use the procedure they have provided.

Contherm™ HEAD ORIENTATION and Equipment Drainability in Horizontal Installations

To maintain a dry bearing area, the Contherm™ head and port orientation should be kept in the configuration as demonstrated in your project specific general arrangement drawing otherwise pooling of product, CIP solution or moisture can occur causing premature bearing failure.

Figure 6-11. Head Port Location

1	Drive end (see below image of head orientation at outlet of Contherm™).
2	Outboard end (see below image of head orientation at inlet of Contherm™).
3	Adjustable leveling feet.
4	Pitch drive end up 0.5° toward outboard end for drainage using leveling feet.

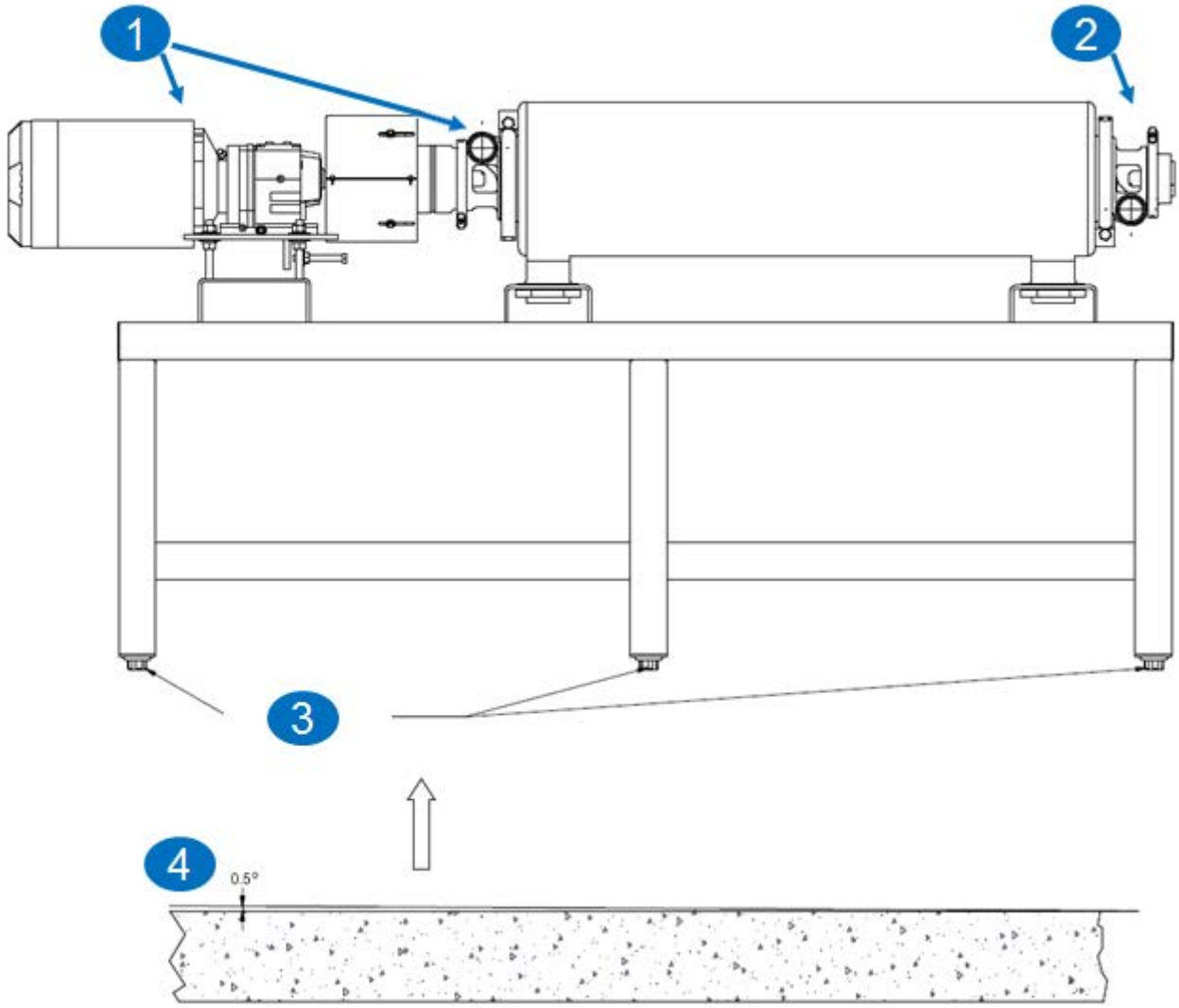


Figure 6-13. Head Port Location

Figure 6-12. Inlet / Outlet Head Orientation

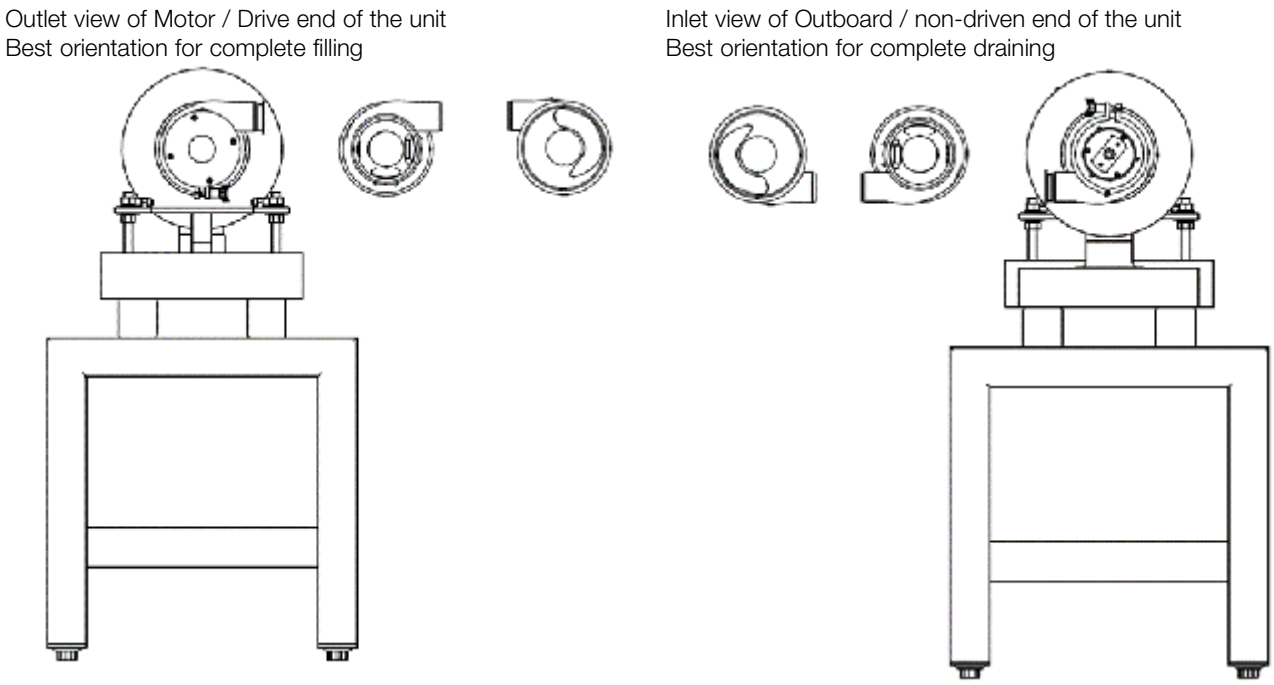


Figure 6-14. Inlet / Outlet Head Orientation

6.6.3. Rotor Removal Trough

As shown in Figure 6-15, the horizontal mount provided by Alfa Laval Inc. includes a rotor removal trough (P/N 7402714). This device will help you manually remove the rotor from the Contherm™.

To remove the rotor from the Contherm™, perform the procedure provided in Table 6-9.

WARNING

1. Refer to chapter 2, Safety, before proceeding to maintain the Contherm™ equipment.
2. Refer to WARNING comments in Introduction section of chapter 8, Inspection & Maintenance before using the rotor trough.

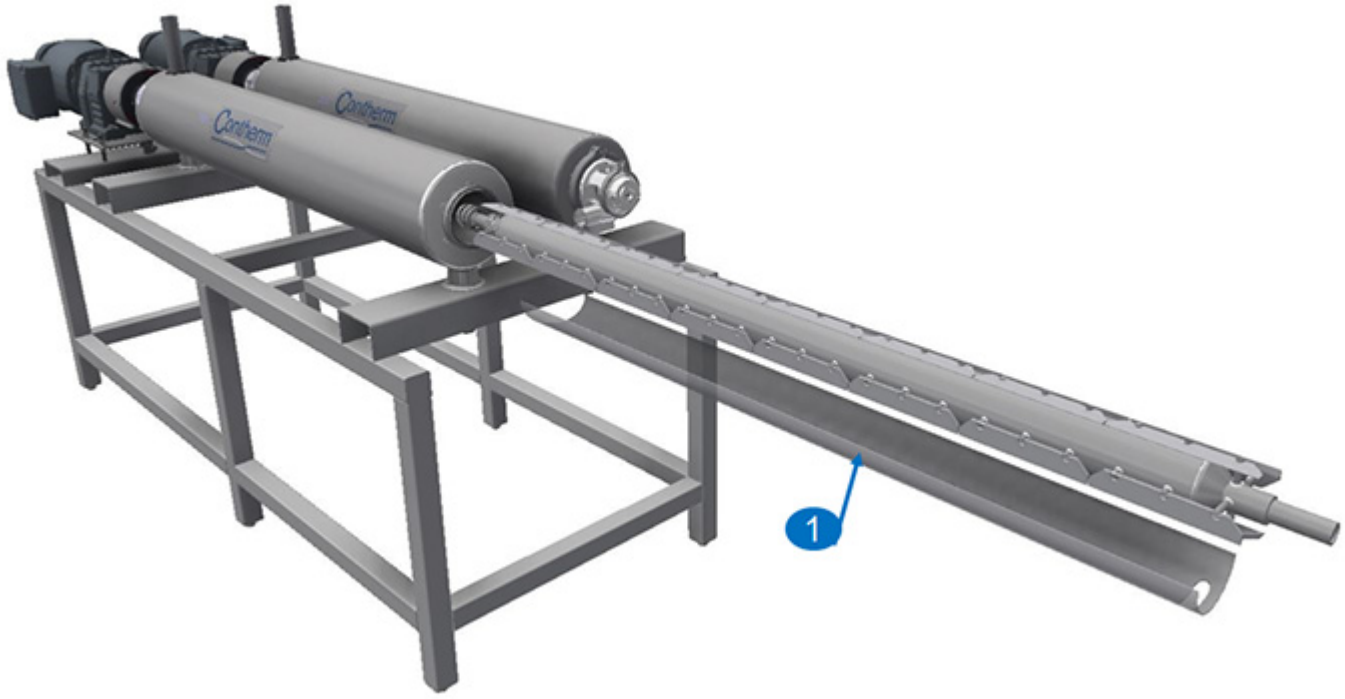


Figure 6-15. Horizontal mounting frame with rotor and rotor removal trough.

Table 6-9. Removing the Rotor from The Contherm™ With the Rotor Removal Trough

Step	Action
1	First Step for all maintenance procedures is to always verify there is no pressure in system, system is drained of all fluids, and temperatures are suitable for handling.
2	Remove the non-driven side head assembly from the Contherm.
3	Lift the rotor slightly to permit the rotor removal trough (P/N 7402714) to be slid into the bottom of the heat exchanger cylinder below the rotor and scraping blades to protect cylinder and rotor from coming into contact upon removal of the assembly.
4	Use the rotor removal trough to pull out/slide the rotor from the heat exchanger. Use precautions to protect blades from falling off rotor and have safe location to store rotor to protect it from damage. Do not put rotor on floor as this may damage / scrape blade pins.

6.8 Installing Ancillary Equipment or Piping to Support Heating or Cooling in the Contherm™

DANGER

1. Do not allow liquid to be isolated in the Contherm™ (product or media side) without pressure relief protection. Thermal expansion or contraction can seriously damage the equipment or create an extreme pressure situation causing injury or death.
2. Safety relief valves should be installed on all positive pressure lines for operator safety and equipment protection.
3. Refrigeration piping must be installed by fully trained and qualified personnel.

6.9 Installing a Steam Heating System

Figure 6-18 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.

The pressure and temperature gauges are important tools that should be incorporated within your Contherm™ steam heating system to monitor system performance and help aid in troubleshooting activities.

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.

6.9.1 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™.

NOTE: Safety / purge valve is the responsibility of the end-user.

It is the end-user's responsibility to consult a trained expert in the design of a steam heating systems for your specific application and installation needs.

Remote or Self-Actuating Control Valve

The steam valve is pneumatically or electronically controlled by the controller. To maintain a constant pressure, the steam valve will open a proportional amount to the difference between the set point temperature and the actual temperature sensed at the product outlet port.

Solenoid Valve

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

Bypass and Shut Off Valve

Used to isolate the control valve when it needs service

Purge Valve

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

Figure 6-21.

1	Contherm™ Product inlet
2	Contherm™ Product outlet
3	Steam supply / Inlet
4	Steam return / Outlet
5	Steam control valve
6	Temperature or pressure gauge
7	Process control
8	Temperature signal to controller
9	Steam trap
10	Condensate leg

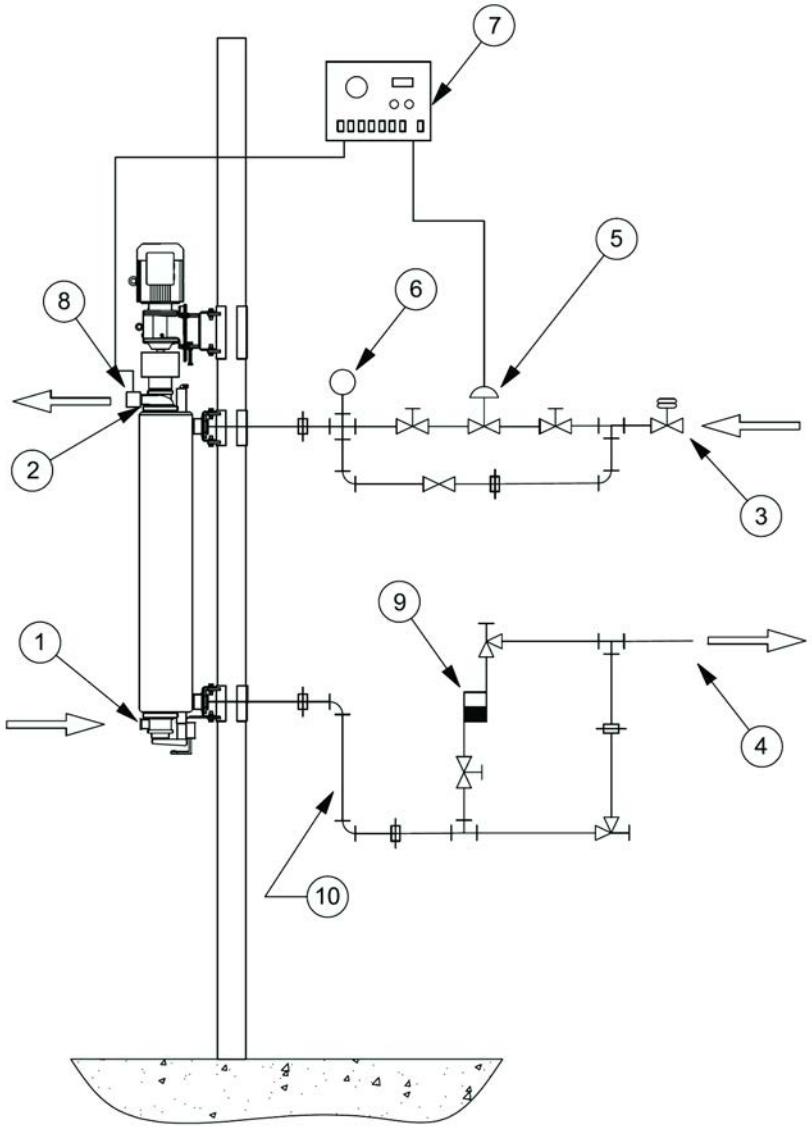


Figure 6-21.

6.10 Installing an Ammonia for Freon: Full-Flooded Refrigeration System

The refrigeration system and related pipework should only be installed and tested by a qualified refrigeration technician. Ensure that debris and contaminants associated with installing the refrigeration pipework are removed from piping and do not foul the Contherm™ or related components. Refer to Chapter 1 for any drawings and instructions specific to your order.

A typical refrigeration system configuration for a Contherm™ is shown in Figure 6-19. Your installation may vary from what is shown.

It is the end-user responsibility to ensure adequate refrigeration capacity to the Contherm™ heat exchangers at all times. 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 at all times.

An important optional feature available with Contherm™ refrigeration systems using ammonia or Freon is the Maintain Status feature. With proper system control, this feature will prevent complete freezing of the product in the Contherm™. If 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 refrigerant to a higher level than the normal operating pressures. This higher pressure will in turn raise the boiling 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.

6.10.1 Component Description

The following components are typical of those used in standard Contherm™ refrigeration (ammonia and Freon) media packages.

Components in a Standard Ammonia Refrigeration Package include:

1	Ammonia accumulator.
2	Dual back pressure regulator.
3	Liquid feed line and Hand expansion valve.
4	Liquid level control.
5	Safety relief valve.
6	Purge valve.
7	Support 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.

Dual Back Pressure Regulator

The primary back pressure regulator valve controls the flow of refrigerant gas 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

The primary control for maintaining the liquid 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.

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.

Hot Gas Defrost
The hot gas defrost consists of the following valves:

1. 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 into the Contherms™ media annulus and accumulator to prevent product freeze-up.
2. The hand valve is used to control the flow of hot gas into the refrigeration system.
3. The check valve prevents liquid from flowing back into the hot gas line.

Suction Line Installation
1. Do not connect the suction line header to a pre-existing header already in use as this could produce varying refrigeration loads to the Contherm™.
2. Size the header for 50% or more above the rated capacity of the Contherm(s™).
3. Keep suction pressure at compressor as low as possible to allow for greatest cooling capacity at the Contherm™.

Sniffer Line
A sniffer line is used with Freon refrigeration systems to purge oil from the accumulator.

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

1. Pipe lengths to be kept to a minimum to not create restriction of liquid to Contherm™.
2. Install a hand expansion valve in the liquid feed line between the solenoid and accumulator to control the flow of liquid refrigerant. This valve should be adjusted so that the solenoid remains open roughly 70% of the time during operation.
3. Install an indicator lamp to show when the liquid line solenoid is open.
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 6-19. 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.

Figure 6-22

1	Contherm™ Product inlet
2	Contherm™ Product outlet
3	Liquid feed line
4	Suction line
5	Accumulator vessel
6	Dual back pressure regulator
7	Pressure relief valve
8	Hand expansion valve
9	Level sensing float switch
10	Sniffer line (Freon only)
11	Hot gas line
12	Down leg purge valve/drain
13	Down leg
14	Accumulator assembly support
15	Process controls
16	Temperature signal to controller

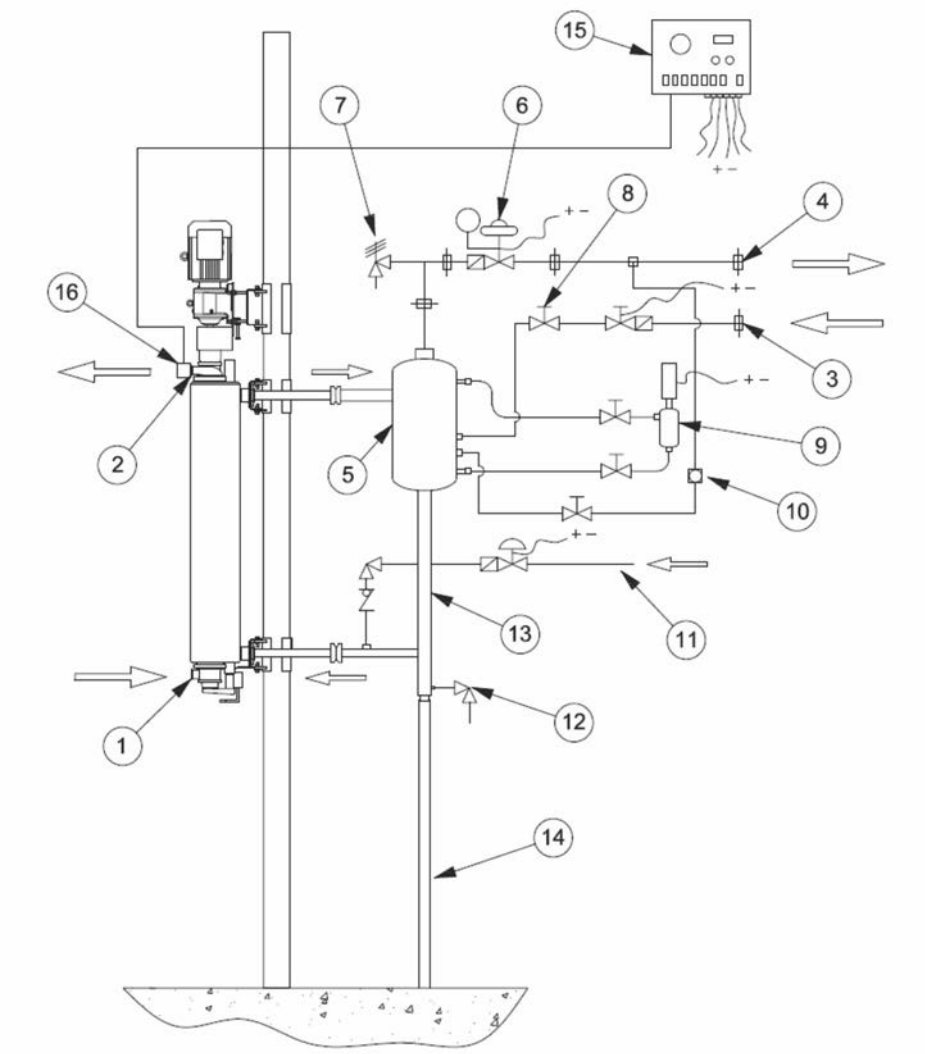


Figure 6-22

6.11 Installing a Liquid Heating or Cooling Media System

The Contherm™ operates most efficiently with counter-current flow between the product and the media. Product enters the cylinder at the bottom or non-driven end while liquid media enters the top or drive end. 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. Water media must achieve a minimum of 50 gpm (190 liter/min) and non-water media (i.e. propylene glycol) must achieve a minimum of 65 gpm (250 liter/min).

Your installation may vary from what is shown in Figure 6-20. If more than one Contherm™ is utilized, liquid media can be piped in parallel where each Contherm™ is receiving its own media stream or in series flow as shown. Parallel flow must be sufficient to maintain the above stated media flow rates in each Contherm™. Temperature sensors are important tools that should be incorporated within your Contherm™ cooling system to monitor system performance and aid in troubleshooting activities.

Figure 6-23. Component Description
The following components are typical of those used in standard Contherm™ Liquid media heating or cooling 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.

1	Contherm™ Product inlet
2	Contherm™ Product outlet
3	Heating or cooling liquid inlet
4	Heating or cooling liquid outlet
5	Supply line on/off solenoid
6	Centrifugal pump
7	Flow metering valve
8	Check valve
9	Return line remote actuated control valve

It is the end-user's responsibility to consult a trained expert in the design of a liquid heating or cooling system for your specific application and installation needs

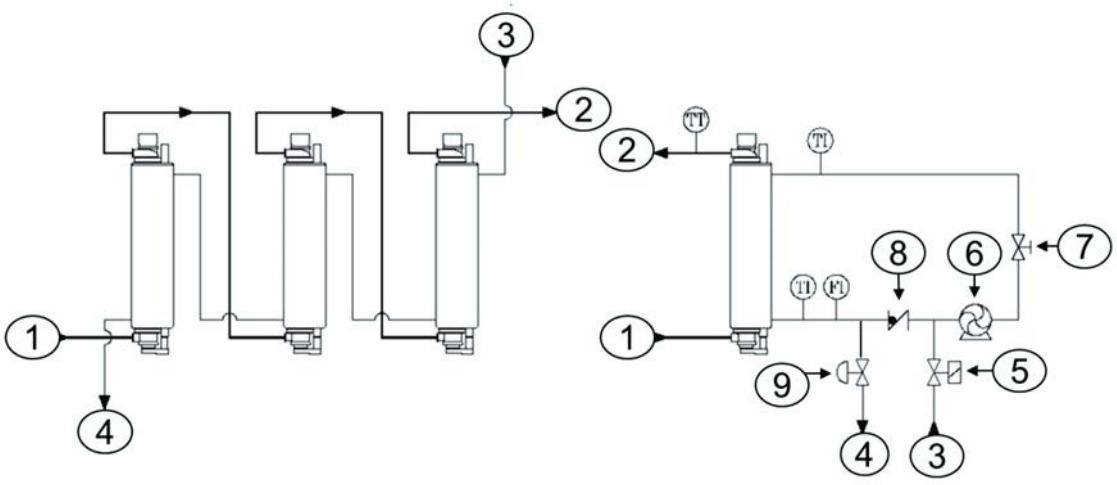


Figure 6-23

6.12 Uninstalling the Contherm™

Prior to disassembly, the equipment must be relieved of pressure and all fluids must be safely drained including product and media within the Contherm™ and hydraulic fluid from the hydraulic lifting system and interconnecting piping. These fluids can create a slip hazard.

Fully CIP the Contherm™ product side prior to disassembly to ensure the internal equipment such as rotor, blades and seal components are clean and free of any material that will make disassembly unsafe or result in contamination or handling issues.

Utilize the above installation guidelines in reverse order to properly disassemble the Contherm™ equipment. Refer to all safety instructions provided in this chapter and in chapter 2.

6.12.1. Scrapping the Contherm™

1	Drain equipment of all fluids.
2	All metallic materials are recyclable
3	Consult with local laws on recycling
4	Alternately, return equipment to Alfa Laval for proper recycling.

7 Operations

7.1 Introduction

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 2 and have installed the Contherm™ and all related equipment in accordance with the procedures provided in Chapter Six, Installation.

WARNING

1. Do not operate the Contherm™ or handle equipment and parts until you have read this manual, have installed the Contherm™, motors and the hydraulic lift system (if applicable) in accordance with the procedures provided in Chapter 6, Installation. Ensure operators are knowledgeable of all related equipment and safety precautions.

2. If hydraulic lift system is not operating properly, go directly to the troubleshooting guide to correct the problem. This is a safety issue.

3. Contact Alfa Laval if on-site operation and maintenance training is desired

4. Before attempting to operate the Contherm™ beyond what is specified in your order documentation, contact Alfa Laval to ensure you do not exceed the equipment's limitations.

WARNING

1. It is the user's responsibility to inspect the machinery and continuously monitor during operation for mechanical malfunctions or hazards as well as product contamination. Ensure no external contaminants are allowed to come in contact with the product. Ensure rotating equipment is spinning concentrically with little to no vibration, that all equipment is properly and tightly fastened and guarded. If any of these conditions are compromised, the user should postpone production until issues can be properly addressed for safety to both users and product being processed. Consult with the factory service technicians if something seems wrong.

2. Never attempt to remove any clamp connections or Contherm™ product head clamp while unit is in operation, while the unit is pressurized, or while the unit contains fluid.

7.2 Operating the Hydraulic Rotor Lifting System

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

WARNING

1. Only one operator must safely adjust and align the lower product head with one hand while manipulating the stack valve handle with his or her other hand. More than one operator of the hydraulics and equipment alignment increases the risk of creating a pinch point and injury between the lower product head and the cylinder.

CAUTION

2. The hydraulic lift pump should not be energized when not in use to ensure the longest life of the electric pump.

To operate the Rotor Lifting System, perform the procedure provided in Table 7-4. The major components of the Rotor Lifting System are identified and shown in Figure 7-1. Refer to this figure for component location information while performing the following procedure.

Table 7-4. Operating the Hydraulic Rotor Lifting System

Step	Action
1	Turn off the Contherms™ Rotor Drive System.
2	Clean the system with CIP, then flush the Contherm™ with cold water and then drain before disassembling unit.
3	Remove the product piping from the lower product head 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 body, hands and feet clear of the area directly below the Contherm™, remove the lower head clamp (P/N 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	Install the blade funnel before raising the rotor into the Contherm. Refer to section 8.5.2 Inspecting the Scraping Blades and figure 8-8 for a detailed description on use of the blade funnel.
10	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 on the small pin.
11	Guide the lower head assembly into the cylinder with your free hand.
12	Pull the handle on the Stack Valve Assembly up and raise the rotor, using one hand to guide it up keeping blades from binding. Pause raising the rotor once the tips of the last set of blades have entered the cylinder and remove the blade funnel making sure to keep hands and fingers clear of the cylinder and head as they close.
13	While keeping your hands and feet clear of the area directly below the Contherm™, reattach the lower head clamp (P/N 7403038-01). **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.
14	Turn off the hydraulic Rotor Lift Pump when not in use to extend the life of the pump (P/N 7402078).
15	Verify that the Contherm™ has been reassembled correctly.
16	The Contherm™ is now ready to go back into service.

Figure 7-1. Hydraulic Rotor Lift System Component List

1	Stack valve handle
2	Hydraulic tubing
3	Blades
4	Rotor hold down feature
5	Helper plate
6	Helper plate / Contherm™ cylinder clamp

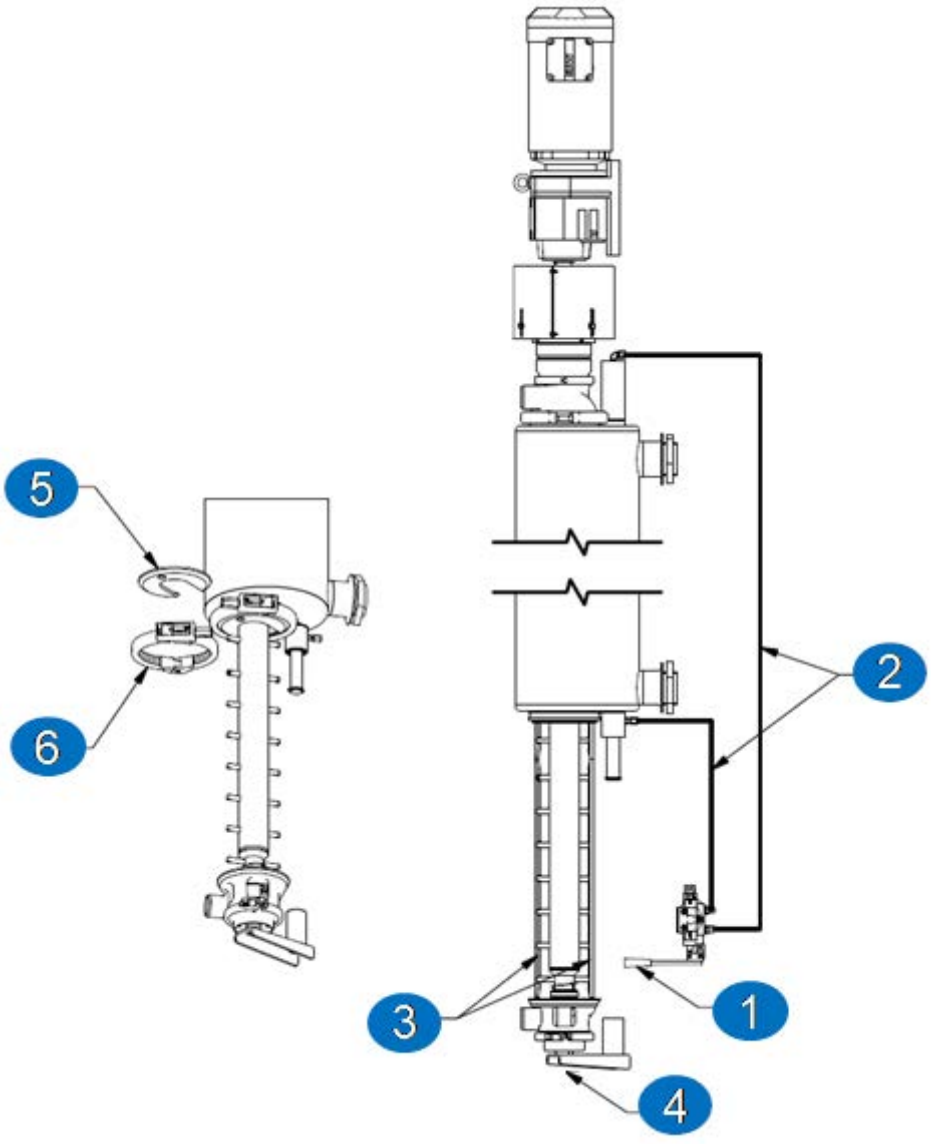


Figure 7-1. Hydraulic Rotor Lift System

7.3 Rotor Lift Helper Plate to Aid in Serving Lower Components

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 Contherms™ Rotor Lift Helper Plate is provided in Table 7-5. Refer to Figure 7-1 for component identification and location information.

Table 7-5. Operating the Rotor Lift Helper Plate

Step	Action
1	Pull the handle on the Stack Valve Assembly down and lower the rotor until at least one full blade length of blade pins are exposed.
2	Carefully remove the exposed blades.
3	Insert Rotor Lift Helper Plate around rotor and into same position product head assembly would normally be located. The plate has same mating geometry as the product head. Refer to Figure 26.
4	Pull the handle on the Stack Valve Assembly up and slowly and gently raise rotor until next set of blade pins contacts bottom of Rotor Lift Helper Plate and secures it into place.
5	Securely clamp the Rotor Lift Helper Plate in place as shown in Figure 7-2A. NOTE: Before proceeding to the next step, if your Contherm™ has a Rotor Hold Down feature, you must remove the blue socket head cap screw (P/N 7401242-03) which is located at the bottom and inside the lower bearing assembly.
6	Slowly and gently lower the rotor assembly until the next set of blade pins inside the cylinder rest against the top of the Rotor Lift Helper Plate. Ensure that the pins are resting securely on the plate and that the plate is securely in place.
7	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 to gain easy access to lower seals and bearings.
Raising the Rotor	
8	Before raising the rotor, reattach bottom head assembly to rotor, unclamp Rotor Lift Helper Plate, and then reattach any rotor blades that were removed to their rotor pins.
9	To raise the rotor, reverse the steps above.

Figure 7-2A. Installing the Rotor Helper Plate

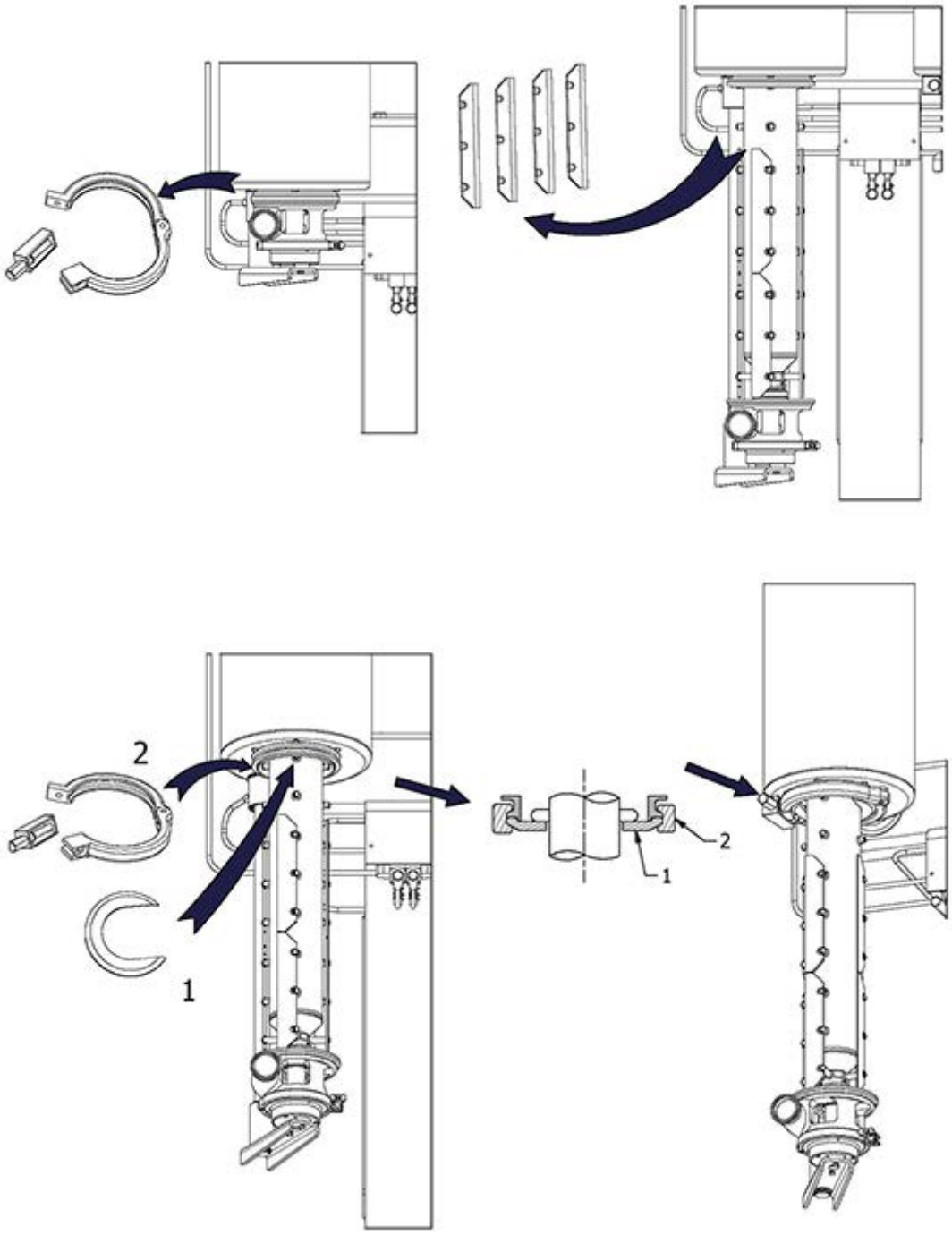


Figure 7-2A. Installing the Rotor Helper Plate

Figure 7-2B. Using Helper Plate to Access Lower Head & Seal Components

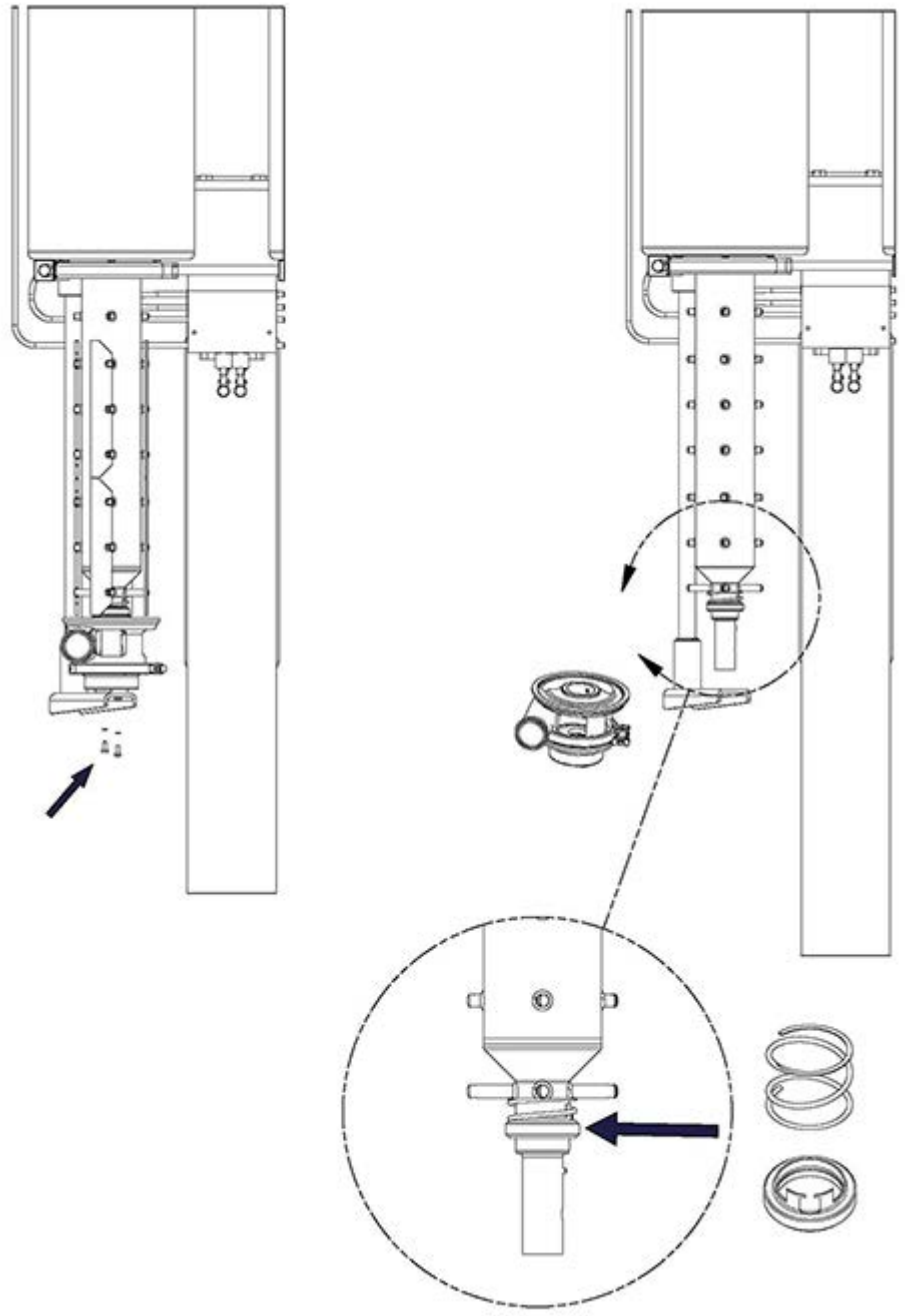


Figure 7-2B. Using Helper Plate to Access Lower Head & Seal Components

7.4 Contherm™ Pre-Test

Perform the pretest procedure below to verify its operational status.

Contherm™ Pre-Test Procedure

Step	Action
1	To ensure that your Contherm™ is ready to begin operation, perform the following steps:
2	Ensure that the flexible couplings of the drive motor and the Contherm™ are aligned properly. Adjust if necessary as misalignment can cause damage to the Contherm™ components. Refer to table 6-5 in Chapter 6, Installation, for the procedure on how to align these couplings.
3	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.

7.5 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 7.6 through 7.9 of this manual describe the start-up and initial testing procedures for Contherms™ configured for use in the following systems:

- Steam or liquid heating or cooling.
- Refrigerated (Ammonia or Freon Full-Flooded)

After reading and reviewing the precautions provided in Table 7-7, proceed to the appropriate section for your Contherms™ detailed start-up and initial testing procedures. If you follow and understand the guidelines and precautions provided in Table 7-7, 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 Contherm™ media connections. The piping should only be installed and tested by qualified personnel.

Table 7-7. 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 and direction of rotor.
5	Verify the settings of the air supply to any pneumatic components 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 temperature probes or sensors and pressure gauges in both the product and media lines, as these gauges will be useful when troubleshooting system problems.

7.6 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 Six, Section 6.9 Installing A Steam Heating System. Please refer to these portions of Chapter Five as necessary while performing the initial start-up and operating procedure that is provided below.

Table 7-8. Start-Up and Operation of Steam Heating Contherm™

Step	Action
1	Using water as the test “product,” start flowing the water through the Contherm™ via the product inlet. When water exits the product outlet, start the rotor. For installations using flushed seals, turn on the seal flush water or steam. Do not exceed 15 psi (1 Bar) of pressure for flush fluid.. **Note: For best results, adjust the flow rate and temperature of the test 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	When you are satisfied that the Contherm™ is operating properly with water as the product, drain and flush the water “product” from the system.
5	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 media is turned on. Divert the product back to the source until the product is at the desired temperature, then begin the forward (process) flow. The rotor must be turned on before steam is introduced. 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 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

7.8 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 Six, Section 6.10 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 below.

7.8.1 Maintain Status Feature

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 Contherms™ drive system. With the Maintain Status feature, the load on the Contherms™ drive system is monitored. An ammeter is used with Contherms™ equipped with electric 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 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 Contherms™ 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 set point is reached, the liquid line solenoid valve will close and the Contherms™ rotor will stop. Hot gas will automatically be introduced to the annulus for one to three minutes.When 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 shutdown of the Contherms™ rotor, and the input of hot gas) must be performed manually.

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

Table 7-10. 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 exits the product outlet, start the rotor. Note: For best results, adjust the water inlet flow rate and temperature 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 show the desired temperature within several minutes. Set the controller or adjust the back-pressure regulator for several other temperatures setting 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. 1. Note: 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.

7.9 Operating a Water Heating or Cooling Contherm™ or Brine Cooling 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 those portions of Chapter Five as necessary while performing the initial start-up and operating procedure that is provided in Table 7-11.

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 Contherms™ 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 7-11. 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
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.

7.10 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 through the Contherm™ system with rinse water. NOTE: Some product applications are not compatible with water in which case it is up to the customer to determine what type of fluid should be used to clear the system of product. As there is very little mixing of water and product 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) and allow the system to come to a moderate temperature range where freezing or burning of the fluid being used to void the system of product.

CAUTION

DO NOT use pressurized air to clear your Contherm™ system of product as this will damage the Contherm™ and may produce a dangerous high-pressure situation will damage the Contherm, and may cause injury or death.

At this point, the Contherm™ may be cleaned in accordance with the information provided in the following section, Section 7.11 Cleaning the Contherm™. After you have completed the cleaning process, you can shut off the Contherms™ drive motors.

7.11 Cleaning the Contherm™

The Contherm™ is designed to be cleaned in place (CIP). The selection of the appropriate cleaning solutions and the proper time/temperature relationship is critical to the integrity of the equipment. Specific product soils can cause variations in the cleaning chemicals and procedure selections.

For additional recommendations on cleaning and sanitizing your Contherm™, contact your local chemical supplier representative.

To protect your equipment and your warranty, clean the Contherm™ in accordance with the following guidelines and the recommended cleaning program provided in Table 7-12.

7.11.1 Recommended Cleaning Guidelines

The following list provides recommended guidelines to follow when cleaning your Contherm™ 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 or Duplex 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 7-12.
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.

CAUTION

If you use cleaning agents that are not recommended and approved by Alfa Laval Inc. or if cleaning agents are used improperly, you may void your equipment warranty.

Table 7-12 identifies the recommended steps in the cleaning program that are suitable for your Contherm™. If you have a question about any of the steps in the cleaning program, contact your local Alfa Laval Inc., local chemical supplier representative.

The following cleaning program steps are identified in Table 7-12:

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

Table 7-12. Recommended Cleaning Program for The Contherm™

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 (Phosphoric)	135-145° F; max. 165° F 57-6°3 C; max. 74° C	10 - 20 minutes	Up to 1%	3.5 - 4	Remove protein deposits & any remaining Alkaline & Minerals
Water Rinse	68° F max. 20° C	Until discharge indicates pH of 7.0	Not Applicable	Available Water Supply	Neutralize acid cleaner
Sanitize	68° F 20° C	0.5 - 2 minutes	Depends on sanitizer used	Depends on sanitizer used	Sanitize surface

Notes:

1. The recommended CIP flow rate range is 120 – 150 gpm (27 – 34 m3/hr). Optimal CIP flow rate will vary depending upon the product solids and degree of fouling. The above flow rate range is a recommendation that should be suitable for most products. The flow rate should be increased or decreased through trial and error to optimize cleaning flow rate, cleaning time and chemical concentration.

2. Certain soils of products with a pH range of 3 - 4 may require less cleaning time or lower cleaning temperatures.

3. Soils of products with pH values higher than the 3 - 4 range, and which precipitate out because of high temperatures encountered during processing, will require maximum cleaning time and temperatures.

4. You can improve the cleaning for stringy or particulate products by periodically pulsing the Contherm™ rotor, reversing the rotation of the rotor during the cleaning cycle and reversing the CIP flow direction for very difficult to clean products.

8 Inspection & Maintenance

8.1 Introduction

This chapter provides a recommended schedule for performing maintenance. You must perform periodic maintenance on the equipment and components of your Contherm™ to ensure its safe and efficient operation. Alfa Laval Service personnel are also available to assist with equipment service. Assistance can be requested via e-mail (USContherm.support@alfalaval.com).

As each application and use of the Contherm™ will create varying degrees of mechanical performance. It is highly recommended to inspect the equipment frequently in the early stages of use and to document wear patterns of all components to identify what is appropriate and necessary for long term care and performance of the equipment. The frequency of inspection and maintenance can later be reduced based on experiences gained.

Items that require frequent inspection whenever the heat exchanger is opened are as follows:

1. Scraping blades
2. Mechanical seal components and O-rings
3. Heat transfer cylinder
4. Rotor blade pins

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.

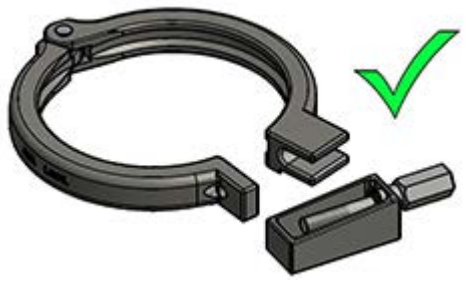
WARNING Refer to chapter 2, Safety, before proceeding to maintain the Contherm™ equipment.

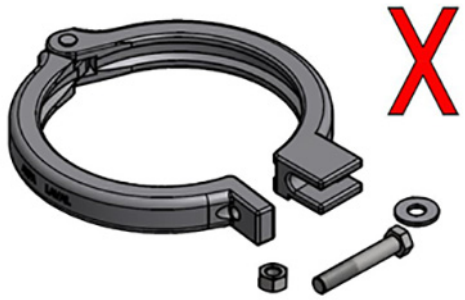
WARNING Do not perform maintenance on the Contherm™ or its equipment and parts until you have read this manual and are knowledgeable of the equipment and all applicable safety precautions. Handle all items with care as some items may be slippery due to lubrication, fragile and/or may have sharp edges.

WARNING When lifting or transporting large components such as the heat transfer cylinder or the rotor, take proper precautions and use proper lifting devices as these components can weigh up to 200 lb/91 kg

WARNING Before attempting service of media pipework or refrigeration equipment, ensure the system is not pressurized, is at ambient temperature and is fully drained of fluid or refrigerant as some refrigerants are extremely harmful to user safety.

WARNING Many maintenance procedures require opening of the Contherm™ heat exchanger via use of the product head clamp (Part Number 7403038-01). Only use OEM clamp components as this is a pressure vessel code component made from special materials.





WARNING

1. Do not disassemble the Contherm™ before safely isolating and turning off all energy sources including drive motor, product and media.
2. Hot product or CIP (Clean in Place) solutions may still be present in the Contherms™ product chamber. Drain all product and CIP solutions from the unit before removing any of the Contherms™ 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.

WARNING

Only Alfa Laval OEM parts are to be used to maintain safe function of the equipment. Alfa Laval is not responsible for any adverse effects to operator, equipment or product (being processed) safety that is created from the use of non-OEM components.

All Contherm™ equipment field repairs should be considered only if all required tools and work conditions can be met. Alfa Laval can perform all equipment repairs highlighted in this chapter at one of our closest Service Centers. Please contact your local Alfa Laval representatives or contact USContherm.support@alfalaval.com for more information regarding our Service offerings.

8.2 Recommended Inspection

Tables 8-1A, 8-1B and Figures 8-1A, 8-1B describe suggested inspection points.

Table 8-1A Recommended Inspection Points (refer to section 2.3 for symbol references)

1A, 1B	-	Ensure clamps/bolts are properly tightened - Check for product leaks at clamp connections and seal components - Determine if excessive vibration or heat of bearings	5	- Inspect all blade pins for wear - Inspect lower mechanical seal for cleanliness. - For detailed inspection, refer to section 7.3, Operating the Rotor Lift Helper Plate for detailed operating procedure for full inspection of lower seal assembly.
2A, 2B	-	Check cylinder end for damage - Check inside cylinder for wear or failing chrome	6	- Check upper hydraulic connections for leaks - Check integrity of retaining rings for safety
3	-	Inspect guard and coupling components and/or spline and bearing components for concentricity and alignment, vibration, loose bolts and obvious signs of abnormal wear and tear.	7	- Inspect lower bolts that secure the hydraulic lift foot to the lower non-driven head for tightness. This is a weight bearing item.
4	-	Inspect all blades for wear, cracking, chemical attack, blade life and cleanliness - Inspect rotor blade pins and rotor ends for excessive wear	8	- Check Lower hydraulic connections for leaks - Check integrity of retaining rings for safety.

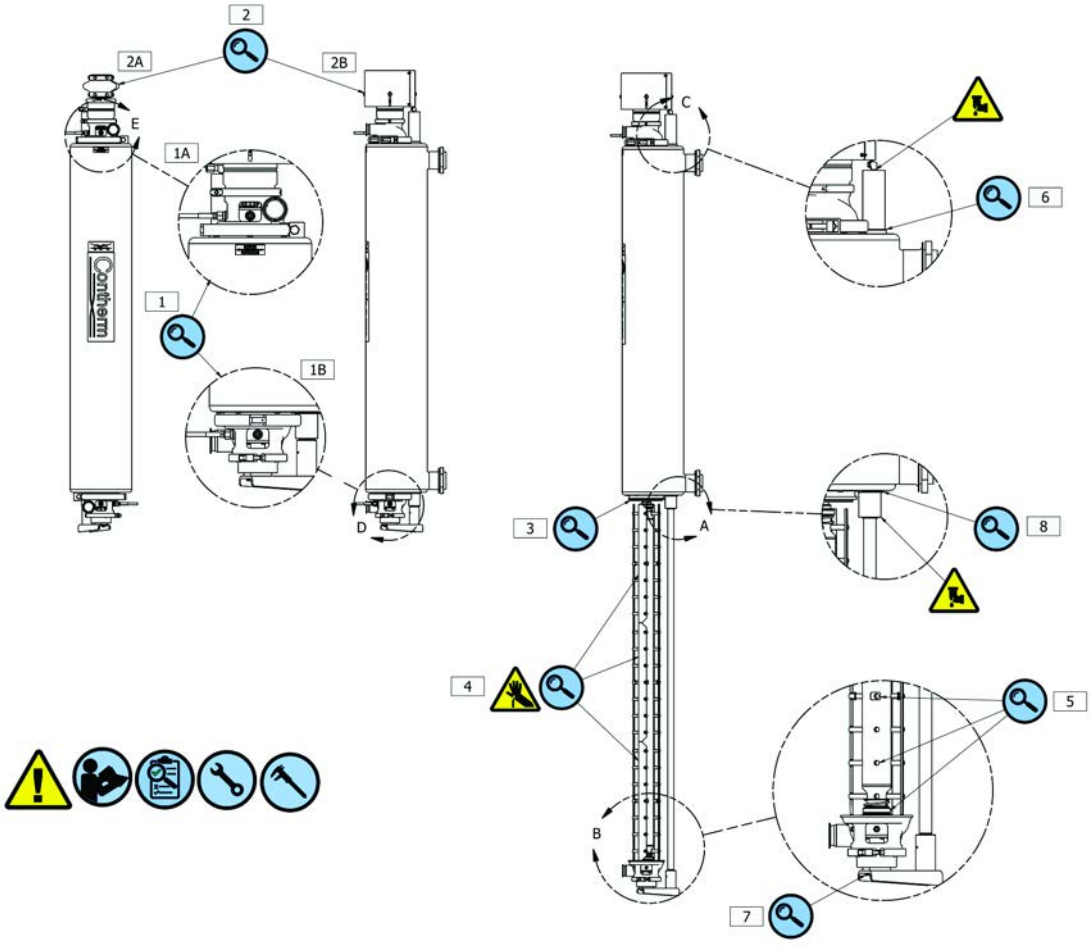


Figure 8-1A Recommended Inspection Points

Table 8-1B Recommended Inspection Points continued (refer to section 2.3 for symbol references)

9	-	Ensure coupling guard components are all in place for proper safety and bolts are tight.	13	-	Insure 3-inch (76 mm) locking nuts securing the Contherm™ to the mount are tight.
10	-	Adjust bolts to obtain complete alignment of motor gear to Contherm™ via the coupling components and no excessive vibration - Ensure motor adjustment bolts are tight	14, 15	-	Inspect all upper mounting hardware and ensure all connections are tight and secure.
11	-	Inspect for product or leaking material that may cause a slip hazard.	16	-	If applicable, ensure mounting flange bolts are tight as this is a weight bearing component
12	-	Inspect both top and bottom Contherm™ trim sheet connection points to the mounting cross arms for any cracks, damage or corrosion.	17	-	Inspect hydraulic pump and related components for leaks and ensure all connections are tight. - Ensure hydraulic pressure is 450 psi (31 Bar or less).

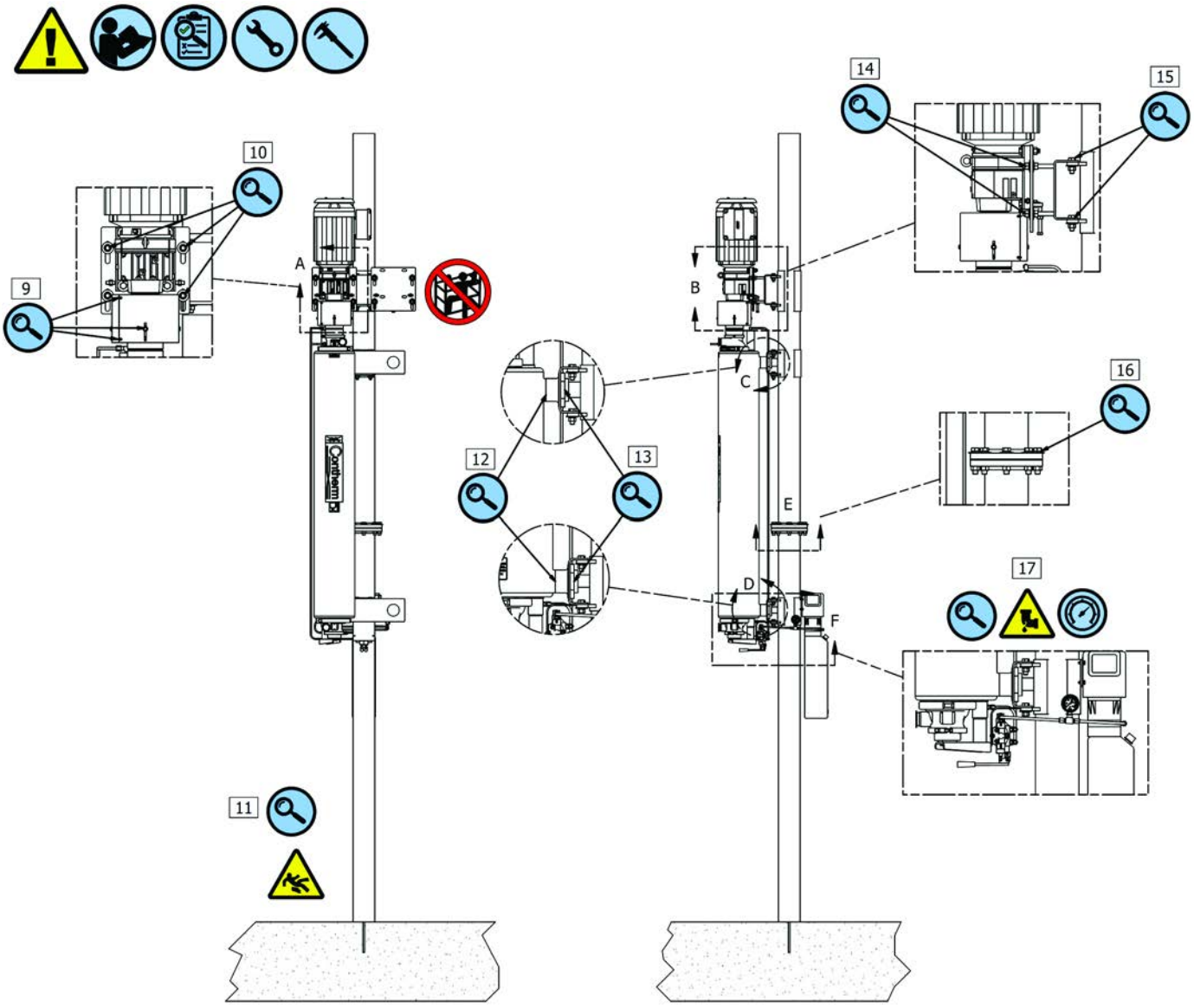


Figure 8-1B. Recommended Inspection Points

NOTE: ALFA LAVAL recommends the customer create a physical inspection checklist to be used regularly by staff to ensure proper equipment function. Store inspection records for later use.

8.3 Scheduled Maintenance

As each application and use of the Contherm™ will create varying degrees of mechanical performance. **It is highly recommended to inspect the equipment frequently** in the early stages of use and to **document wear patterns of all components** to identify what is appropriate and necessary for long term care and performance of the equipment. **The frequency of inspection and maintenance can later be reduced to levels that best suit the application and equipment usage based on experiences gained.**

Table 8-2 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 Inc. as a suggested maintenance guideline.

Table 8-2. Initial Inspection and Maintenance for The Contherm™

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

8.4 Seals

This section describes how to inspect, replace, and test the Contherms™ rotary seals.

The fluid seal is created between two flat surfaces, one on the rotor (the rotary seal face) and the other installed into the product head (stationary seal bushing). It is the integrity of the contact between these surfaces that ensures an effective sealing.

NOTE: Refer to Chapter 10 Spare Part Information, for details regarding your equipment's mechanical seal type and part numbers.

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

1. Rotary Seals
   - Standard and Hard Face Rotary Seal
   - Flushed Standard and Flushed Hard Face Rotary Seal

Table 8-3 shows how the information in this section is organized.

Table 8-3. Contherm™ Seal Maintenance Information

Section	Description
8.4.1	Standard and Hard Face Rotary Seals
8.4.2	Flushed Standard and Flushed Hard Face Rotary Seals
8.4.3	Seal Inspection and Replacement
8.4.3.1	Replacing a Seal Bushing
8.4.3.2	Replacing a Seal Face
8.4.3.3	Lapping a Seal Face
8.4.3.4	Testing Integrity of Replacement Seal
8.4.3.5	Replacing a Seal Locking Pin

WARNING Refer to Section 8.1 Introduction and safety recommendations before performing the following procedures.

8.4.1 Standard and Hard Face Rotary Seals

The actual lifecycle of the rotary seal will be determined by the following combination of factors:

1. The product being processed.
2. Hours of usage per week.
3. The temperature at which the Contherm™ is operated.
4. The degree of preventative maintenance performed including cleaning frequency.

The seal in the Hard Face Seal Assembly is a single seal assembly that functions just like the 2-inch (51 mm) Standard Carbon Seal Assembly, but in this case the rotating seal face is a harder and more durable material such as Silicon Carbide or Tungsten Carbide material.

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 as indicated in Table 8-1.

Figure 8-2 identifies the assemblies and components of the Standard and/or Hard Face Rotary Seals.

Table 8-4 identifies the components of the Standard and Hard Face Rotary Seals.

Table 8-4. Assemblies and Components of the Standard and Hard Face Rotary Seals

Item	Assembly/Component	Quantity
1	Seal Bushing O-Ring	2
2	Seal Bushing	2
3	Set Screw	2
4	Seal Face	6
5	Seal Shell O-Ring	2
6	2 inch Seal Shell	2
7	Seal Spring	2

As shown in Figure 8-2, the Standard and Hard Face Rotary Seals utilize the same assemblies and components for both the upper and lower product heads of the Contherm™.

Figure 8-2 Component List

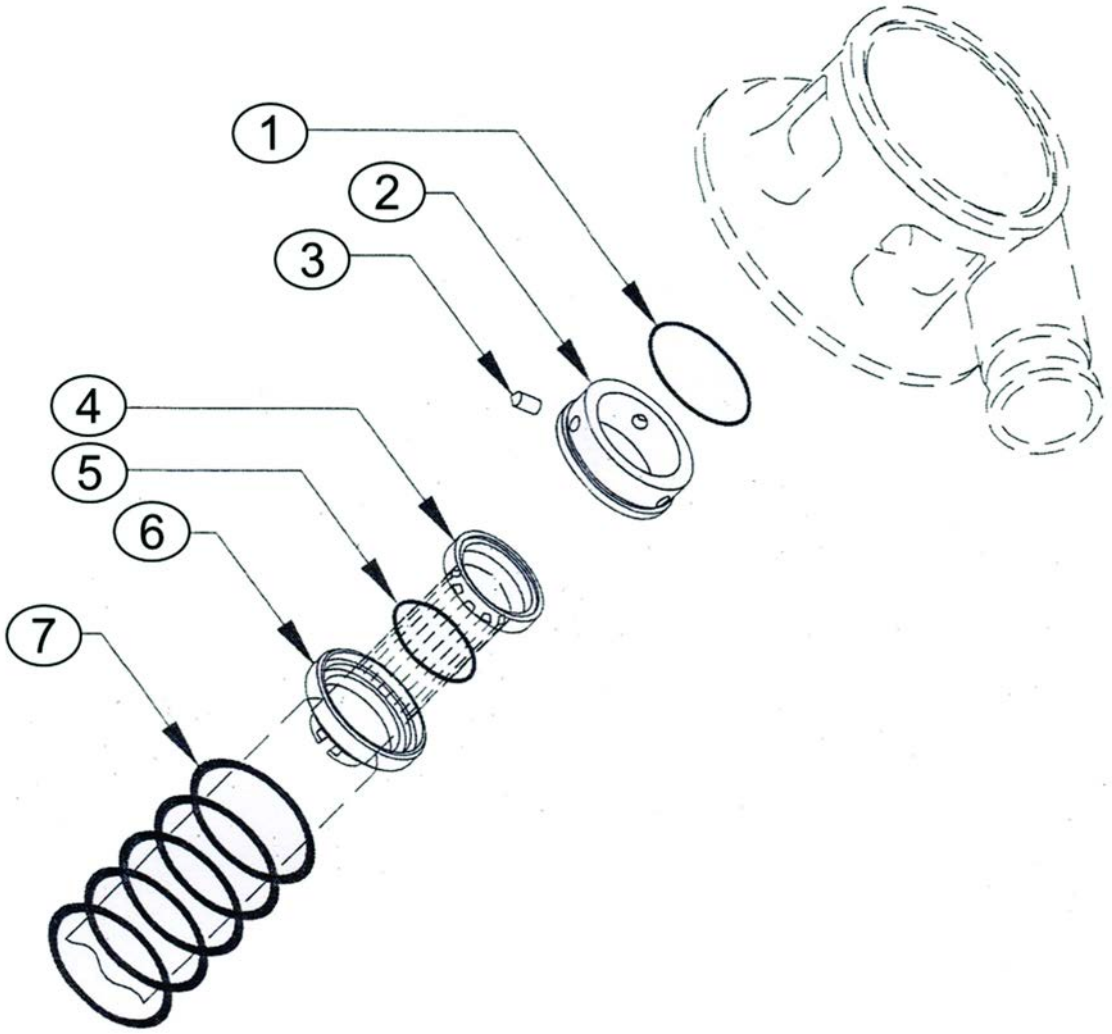


Figure 8-2.

8.4.2 Flushed Standard and Flushed Hard Face Rotary Seals

The Flushed Rotary Seal is used for applications that require additional lubrication or aseptic sealing. It provides the same rotary sealing action as the standard rotary seal, but with one additional feature -- it lubricates, cleans or sterilizes the non-product side of the seal. Flexible hoses are provided for flushing media. Supply each seal with either potable water (lubrication) or steam (aseptic sterilization) at approximately 15 PSIG (1 Bar). Do not exceed 1 Bar. The product pressure in the Contherm™ must always remain higher than the pressure of the seal flushing media so seal flush fluid will not enter the product zone.

The Flushed Hard Face Seal Assembly uses the Hard Face Seal Assembly in combination with a second seal. The secondary seal face can be of the standard carbon or hard face material.

The inspection, maintenance, testing and 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.

Figure 8-3 identify the assemblies and components of the Flushed Standard and Flushed Hard Face Seal Assemblies.

Table 8-5 components of the Flushed Standard and Flushed Hard Face Seal Assemblies in Contherms™ equipped with tangential product heads.

Table 8-5. Assemblies and Components of Flushed Standard and Flushed Hard Face Seal Assemblies

Item	Assembly/Component
1	Cap Screws
2	Outer Stationary Seal Face
3	Bushing Cap O-Ring
4	Flushed Seal Bushing
5	Quick Disconnect Nipple
6	Seal Bushing O-Ring
7	Set Screw
8	1.5 inch Seal Face
9	1.5 inch Seal Shell O-Ring
10	1.5 inch Seal Shell
11	1.5 inch Seal Spring
12	2 inch Seal Face
13	2 inch Seal Shell O-Ring
14	2 inch Seal Shell
15	2 inch Seal Spring
16	Quick Disconnect
17	Seal Flush Hose

As shown in Figure 8-3, 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™.

Figure 8-3 Component List
Refer to above Table

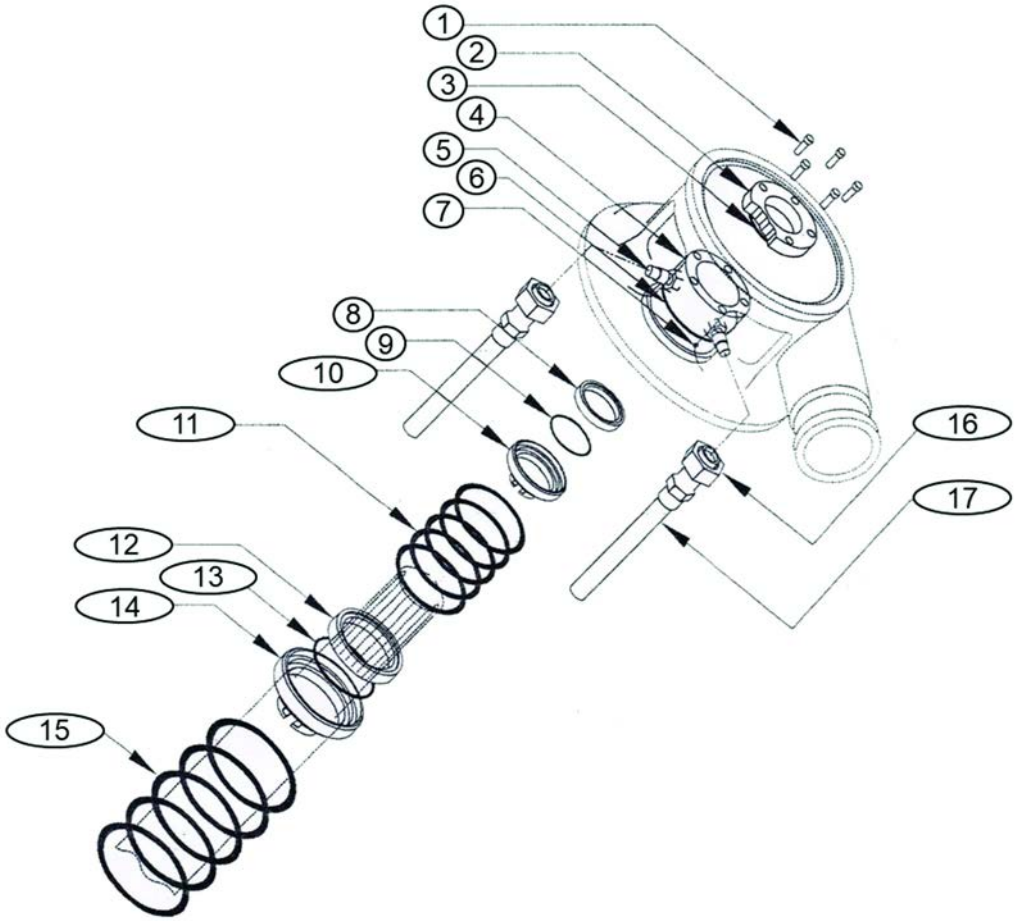


Figure 8-3.

8.4.3. Seal Inspection and Replacement

This section describes how to inspect and replace the Contherms seal components. Seal inspection and replacement are easy tasks that can be performed by one individual. The seal inspection process consists of looking for signs of visual mechanical wear such as seal face chipping, metal scoring, seal pin notching, evidence of leaks, worn or failed O-rings, or worn seal faces. A detailed Seal Inspection and Replacement procedure is provided in Table 8-6.

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 550ºF (290ºC)
- 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.

Refer to safety considerations as stated in the beginning of this chapter.

Table 8-6. Seal Inspection and Replacement

Step	Action
1	Using the rotor lift helper plate, prepare the Contherm™ for inspection of the lower seal assembly. **Note:** You must use the Rotor Lift Helper Plate to inspect the lower seals. Refer to section 7.3, Operating the Rotor Lift Helper Plate in Chapter Seven for 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. Do so by compressing the seal spring and rotate the shell to disengage the locking pin. Remove the seal bushing from the product head by loosening the three set screws (Refer to the following section 8.4.3.1, 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 head to 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 Contherms™ upper seal components by lowering the rotor until the upper product rotary assembly is completely lowered and 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. As described in step 2 above.
8	After completing the inspection and/or component replacement for the upper rotary 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.

8.4.3.1 Replacing the Stationary Seal Bushing

Table 8-7 provides a detailed procedure for replacing the upper and lower seal bushing.

Table 8-7. Replacing the Seal Bushing

Step	Action
1	If the seal bushing shows wear or is cracked or chipped, it must be replaced.
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 sealant.
5	Install the new seal bushing into the product head. Verify that the bushing is positioned 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.

8.4.3.2 Replacing the Rotary 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 Inc. recommends that you always have adequate spare seal face assemblies available so that replacement may be performed quickly.

Replacing the seal face must be done correctly to ensure that the seal will function properly. Table 8-8 provides a detailed procedure for replacing the seal face.

Table 8-8. 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 pieces of the seal face. Rinse thoroughly.
3	Place seal shell (without O-Ring) in an oven or other heat source such as a heating plate that will provide uniform heating and expansion across the entire shell. Ensure precautions are taken as non-uniform or inconsistent heating of the shell can either distort or damage the seal. If possible, seek to achieve 550°F (290°C) for 30 minutes.
4	Place new seal face on a lapping plate, with the relieved side down.  Relieved Side
5	Use heat protective gloves to remove the shell from the oven or heat source and place it over the seal face. Press the seal shell down evenly over the seal face and rotate it to ensure proper flat seating. The thermal expansion of the shell should allow for easy assembly. If the assembly procedure requires a high degree of pressing force, stop and repeat above heating step with increased temperature to achieve easy assembly with little force required.
6	Allow the assembly to cool to room temperature. **Note:** Do not use water to cool the assembly as this will crack the seal face.
7	Clean the lapping seal face. Lap the seal face in accordance with the procedure provided in Table 8-9 of the following section, Section 8.4.3.3, Lapping A Seal Face.
8	Lubricate the new O-ring with food grade lubricant. Install the O-ring into the seal. Install the seal onto the rotor. **Do not to touch the seal face!** Install a new O-ring, first apply a food grade lubricant to the O-ring. Install the seal assembly onto the rotor.
9	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.

8.4.3.3 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 8-9 provides a detailed procedure for lapping a seal face.

Table 8-9. 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, even 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. **Do not touch the seal face!** After installation, clean the seal face with alcohol or solvent.

8.4.3.4 Replacing the Seal Locking Pin

When a seal leak is detected, visually inspect the Contherms™ rotor and verify that the seal locking pin (Part Number 7403558-07) is not broken, notched or damaged. If it is broken or damaged, follow the directions provided in Table 8-10 to replace it.

The seal pin locations for rotors with external bearings are identified and shown in Figure 8-4 and Table 8-11. These demonstrate seal pins on both ends of the rotors. Figure 8-5 and Table 8-12 identify the seal pin locations for rotors with internal bearings. These figures demonstrate only one seal pin on the drive end of the rotor.
Note: The procedure in Table 8-10 assumes that you have been referenced here from the procedure provided in Table 8-8, Inspecting and Replacing a Seal. Please review all Safety Precautions included in Section 8.3.4, Seal Inspection and Replacement, before continuing.

Materials:

- Hand drill. A drill that can rotate at 2000 RPM and has a head runout of no more than .0005” is acceptable.
- Hammer
- Seal pin installation kit, P/N 7404208-01
- Pliers
- (Optional) Seal pin jig 7404621-02

Table 8-10. Replacing the Seal Locking Pin

Step	Action
1	Grind off the top of the damaged pin. Be sure that the pin is flush with the shaft surface and is of a sanitary finish (32 µin / 1.6 µm).
2	Mark the location of the new drill hole, to the dimensions specified below. Center punch the hole location. Pre-drilling the hole with a smaller pilot drill will help in attaining an accurate diameter. Be sure that the shaft is on a level surface, for drilling and that the drill is held perpendicular to the rotor surface..
3	Use the drill (# 17) included with the kit and drill a hole, to a depth of .375” (9.525 mm).
4	Using slow rotation (30 - 50 RPM). Next, use the reamer at 30 - 50 rpm. Take caution as higher rotational speeds could yield an oversized diameter.
5	Clean out the hole thoroughly.
6	Hold the pin over the hole. Using a hammer tap the pin into place.
7	The top of the pin should protrude from the shaft, only .125” (3.175 mm).

Please call the Technical Services Department at Alfa Laval Inc. Contherm™ Product Center if you have any questions: 978-465-5777 or e-mail to UScontherm.support@alfalaval.com

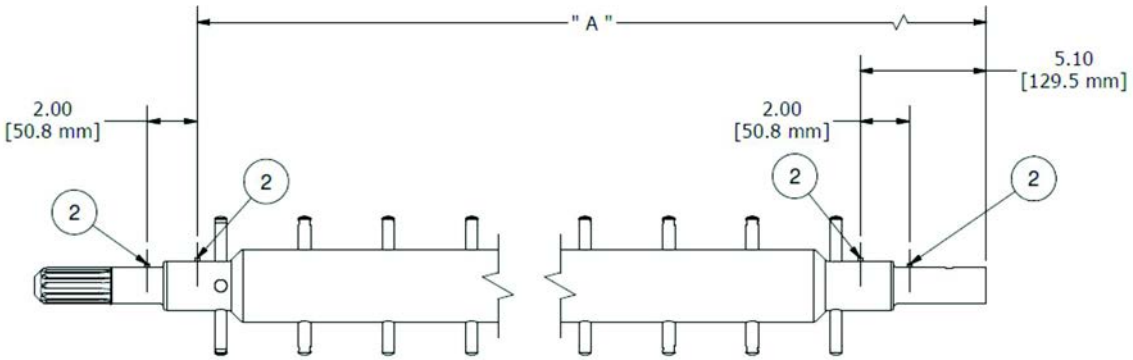


Figure 8-4. Seal Pin Locations for Rotors with External Lower Bearings

Table 8-11. Seal Pin Locations for Rotors with Internal Bearings

Rotor Type	Contherm™ Dimension "A"			
	6 x 3	6 x 6	6 x 9	6 x 11
Standard Rotor	27.28 inches (692.9 mm)	51.28 inches (1302.5 mm)	75.28 inches (1912.1 mm)	85.81 inches (2179.5 mm)
Standard Rotor (Extended Top & Bottom Head Extensions)	38.14 inches (968.8 mm)	62.14 inches (1578.4 mm)	86.14 inches (2188.0 mm)	N/A
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)	N/A
Standard Rotor (Extended for Convap Vapor Dome)	37.52 inches (953.0 mm)	61.52 inches (1562.6 mm)	85.52 inches (2172.2 mm)	N/A

NOTE: Dimensions provided for the external bearing style are from the end of the rotor with the rotor end (Part number 7402747-01) removed. The dimensions provided in Table 8-11 are for the "A" dimension shown in Figure 8-4.

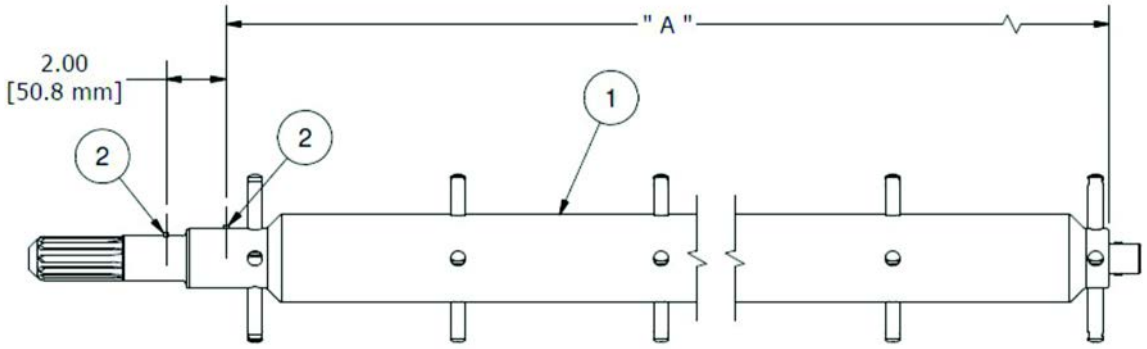


Figure 8-5. Seal Pin Locations for Rotors with Internal Bearings

Table 8-12. 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 8-12 are for the "B" dimension that is shown in Figure 8-5.

8.3.4.5 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.

8.5 Scraping Blades

The following sections describe how to install, inspect, and maintain the blades used with your Contherm™. Table 8-13 shows how the information in this section is organized.

Table 8-13. Installation and Maintenance Procedures for The Scraping Blades

Section	Description
8.4.1	Installing the Scraping Blades
8.4.2	Inspecting the Scraping Blades
8.4.3	Maintenance of The Scraping Blades
8.4.4	Maintenance of The Blade Pins

WARNING Refer to Section 8.1 Introduction and safety recommendations before performing the following procedures.

WARNING Stainless Steel Scraping Blades can become sharp when heavily worn. Wearing protective gloves when handling blades is recommended.

CAUTION Stainless Steel Scraping Blades can only be used in Contherms™ that have plated or coated heat exchange cylinders.
Stainless steel blades to be used on chrome plated cylinder only!

8.5.1 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. metal insert fits into the blade pin slot.

The procedure for installing the Contherms™ plastic or stainless-steel blades is provided in Table 8-14.

Figure 8-6 shows the blade pin orientation. The lead pin is reverse acting as a locking mechanism so the blade does not easily fall from the pins when the rotor is lowered for inspection.

Table 8-14. Installing the Blades

Step	Action
1	Place the plastic blade's insert rod or the stainless-steel blade's back edge into the lead pin slot for the top (uppermost) blade pin. The beveled side of the blade should be facing toward the rotor as shown in Figure 8-7.
2	Rotate the blade, beveled side first, until the rest of the blade can be inserted into the remaining pins. The bevel should face the rotor surface as shown in Figure 8-7.

CAUTION make sure to follow the direction of rotation of the Contherm™ rotor when installing the blades. See the label on the trim sheet or (insert label image in this manual).

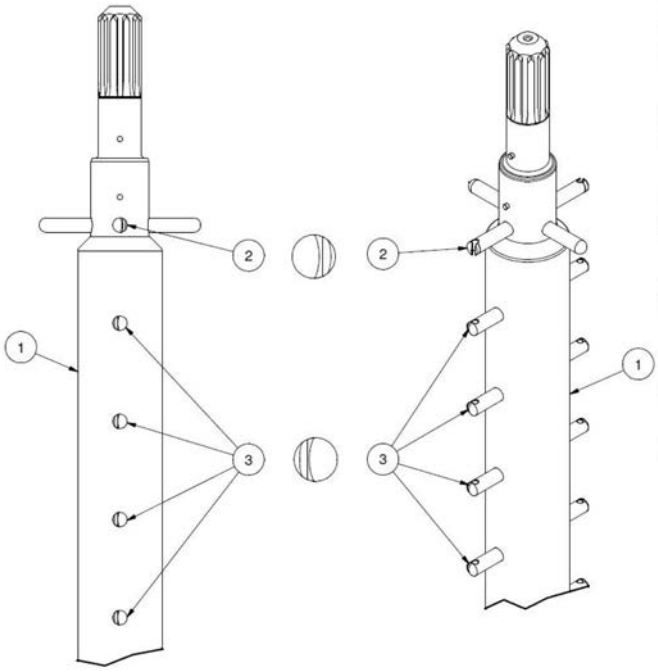


Figure 8-6. Blade Pin Orientation

1. Contherm rotor
2. Lead blade pin slot (reverse)
3. Blade pins

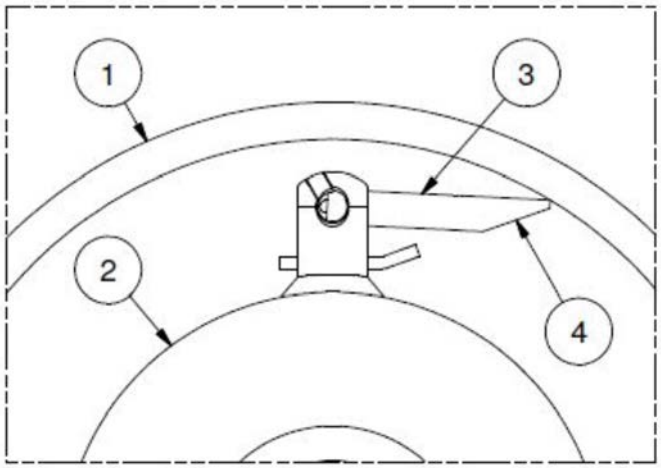


Figure 8-7. Blade Orientation of Beveled Edge

1. Contherm cylinder
2. Rotor
3. Blade
4. Blade bevel orientation

8.5.2 Inspecting the Scraping Blades

Contherm™ blades should be inspected regularly to ensure operational efficiency of the unit and to protect the product cylinder. Blade inspection should be performed in accordance with the schedule recommended in Table 8-1, Scheduled Maintenance for The Contherm™.

Use the procedure provided in Table 8-15 to inspect your Contherms™ plastic or stainless-steel blades.

Table 8-15. Inspecting the Blades

Step	Action
1	First step is always to make sure there is no pressure, no fluid and no extreme temperatures present.
2	Remove the Contherms™ lower head clamp (P/N 7403038- 01) and lower the rotor, using the hydraulic rotor lifting device. **Note:** Refer to Table 7-4, Operating the Hydraulic Rotor Lift System, and Table 7-5, Operating the Rotor Lift Helper Plate in Chapter 7.
3	With rotor lowered, visually inspect blades to determine if there is wear in the form of a rough or razor-sharp edge along the blade's scraping surface. **Note:** The parting edge of the blade should not be sharp.. If the blades are worn, dress the blade's edge as described in Table 8-16, Dressing the Contherms™ Scraping Blades, Section 8.5.3, Maintenance of The Scraping Blades.
4	Visually inspect the metal inserts of the plastic blades, or stainless-steel blade slots for wear or breakage. If wear or breakage is found, replace the blade.
5	Install the new blades with the beveled surface facing pointing toward the center of the cylinder as shown in Figure 8-7. Inspect the blades and verify that they are installed properly and are secured to the rotor.

6	Before raising the rotor with blades installed, insert the blade funnel by wrapping the funnel around the rotor. Insert the collar into the Contherm™ cylinder as shown in Figure 8-8 A, B & C. The blade funnel will assist in guiding the blades as they enter the cylinder and ensure they do not come into contact with the cylinder edge causing damage to both the blade and cylinder edge.
7	Remove blade funnel when tips of the last set of blades are within the cylinder. Raise rotor to engage head to cylinder. Keep fingers and hands clear of the rotor, head and cylinder. Properly Install lower head clamp and tighten bolt accordingly.

CAUTION

If the rotor will not insert properly, it must be rotated slightly to align the drive end spline teeth. Keep fingers and hands clear when raising the rotor.

Figure 8-8A. Purpose of the Blade Funnel
When raising the rotor using the hydraulic lift, blade pins can contact the cylinder end and damage this area which can cause the Contherm™ to leak due to an un-flat surface.

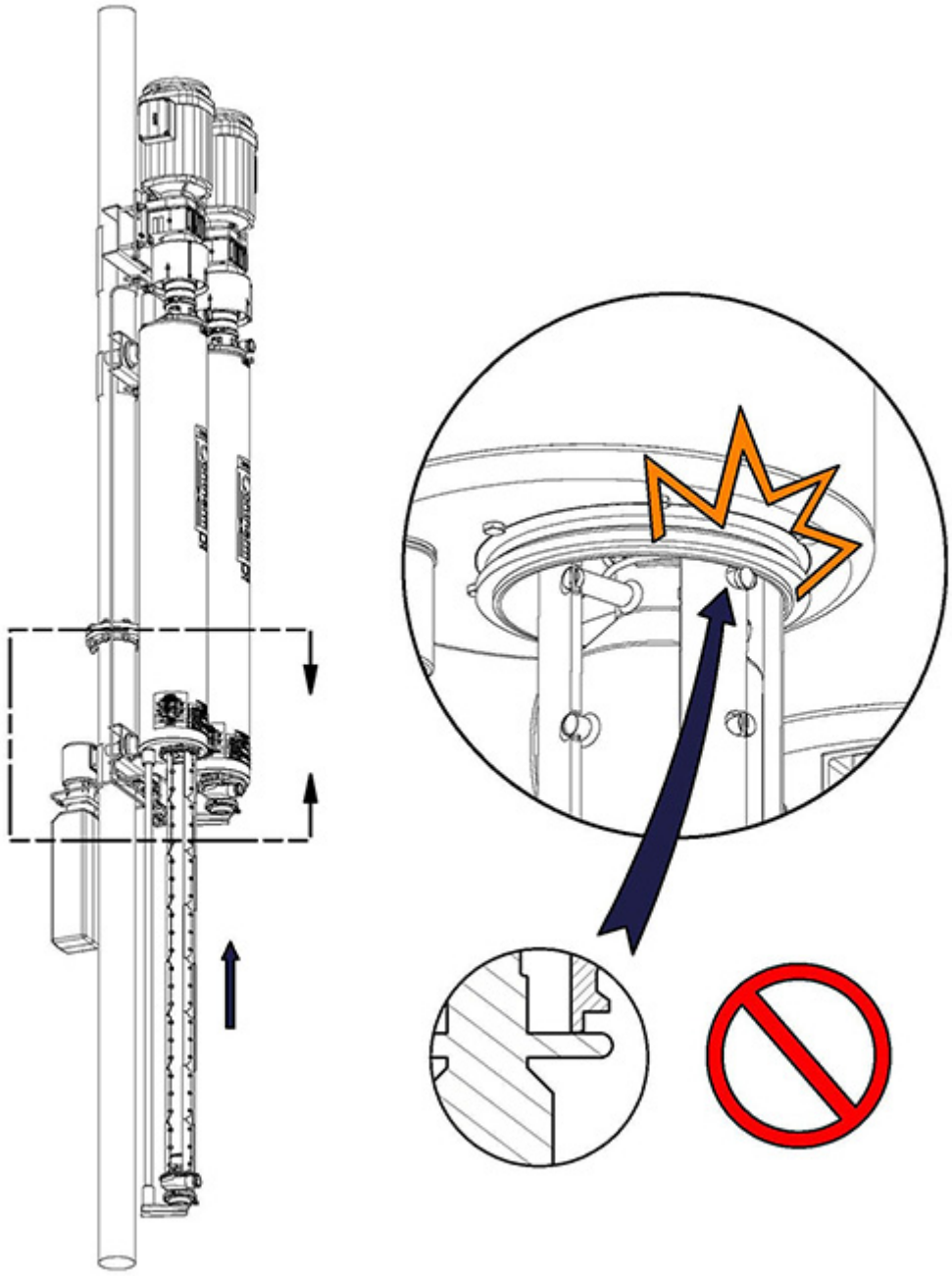


Figure 8-8A. Purpose of the Blade Funnel

Figure 8-8B. Inst the Blade Funnel
Follow the below sequence of installing the funnel and raising of the rotor.

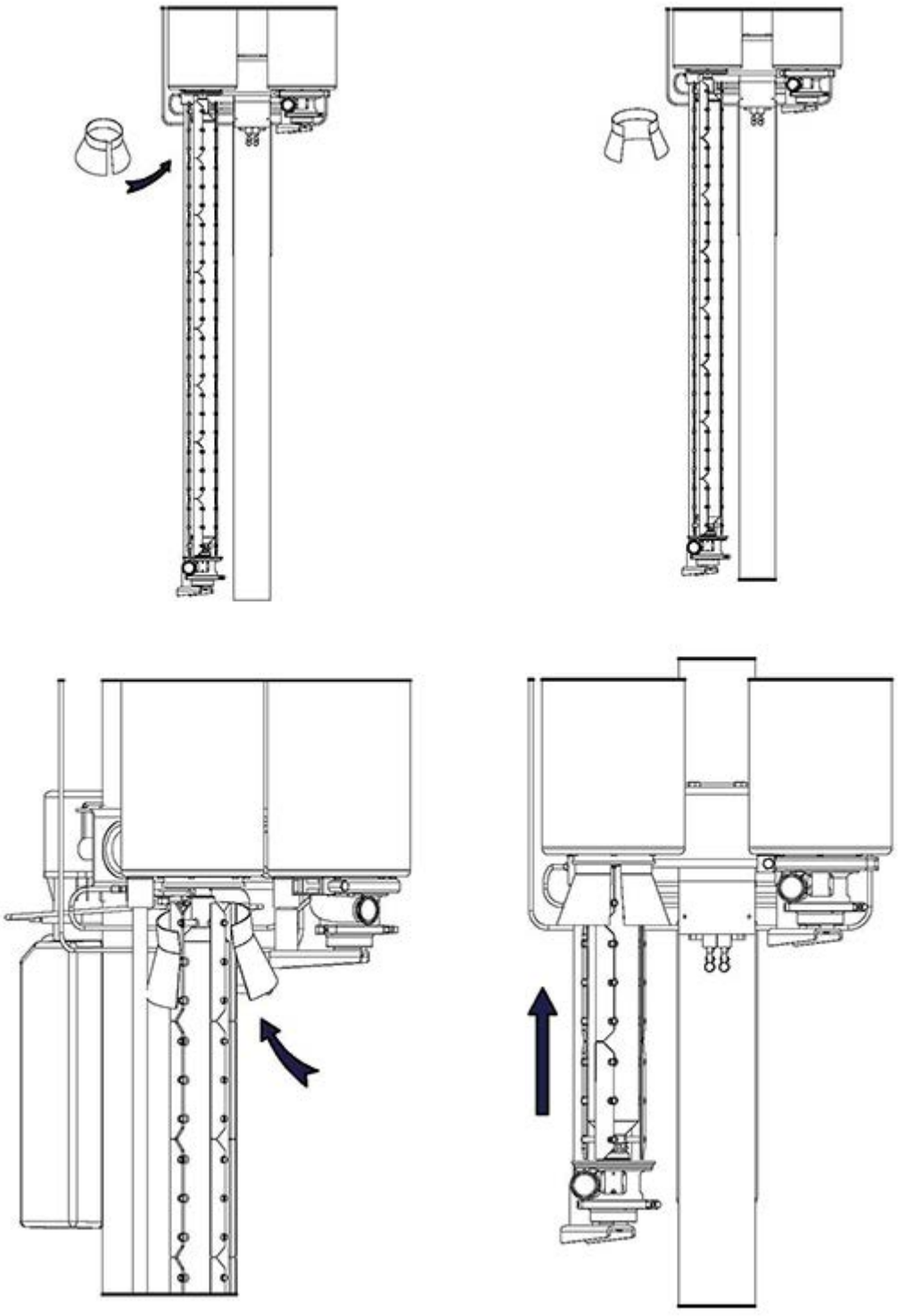


Figure 8-8B. Inst the Blade Funnel

Figure 8-8C. Removing the Blade Funnel
Remove the funnel once the last set of blades is within the Contherm cylinder

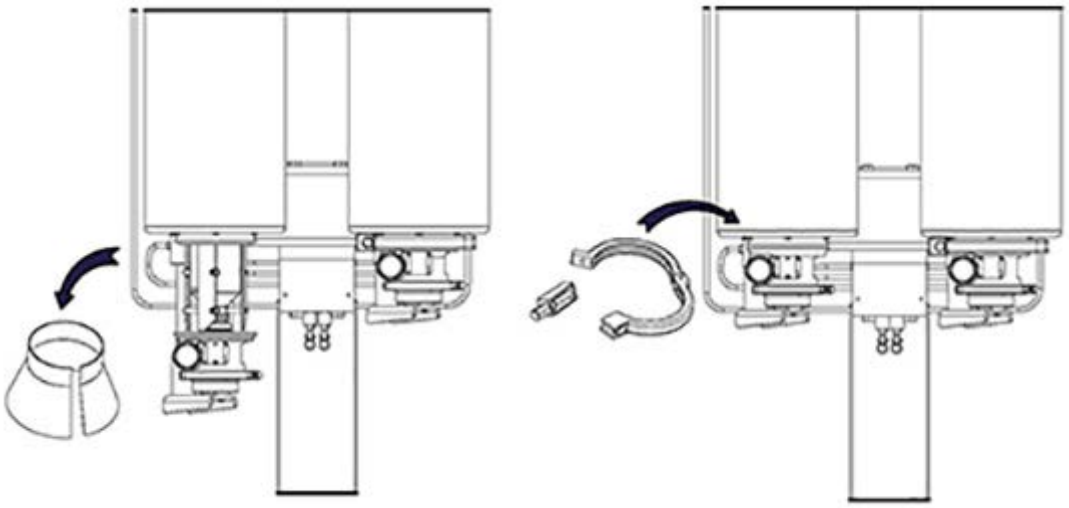


Figure 8-8C. Removing the Blade Funnel

8.5.3 Maintenance of the Scraping Blades

If a jagged or razor-sharp edge is found, remove it by dressing the blade as shown in Figure 8-9 and described in Table 8-16.

Table 8-16. Maintenance of the 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 8-9. **The blade may be dressed until its width is 1.25" (31.8 mm).**
Figure 8-9. Dressing the Contherms™ Scraping Blades	1. Flat mill file. 2. Vise jaws 3. Scraping blade 4. Soft material to protect blade surfaces 5. Top view and angle of file and scraping edge 6. Slight flat edge smooth and free of burrs 7. End of life distance for blade wear
3	Clean the scraping blade thoroughly after dressing the edge, and then reattach the blade to the rotor.
4	Repeat Steps 1 through 3 for any other blades needing to be dressed.

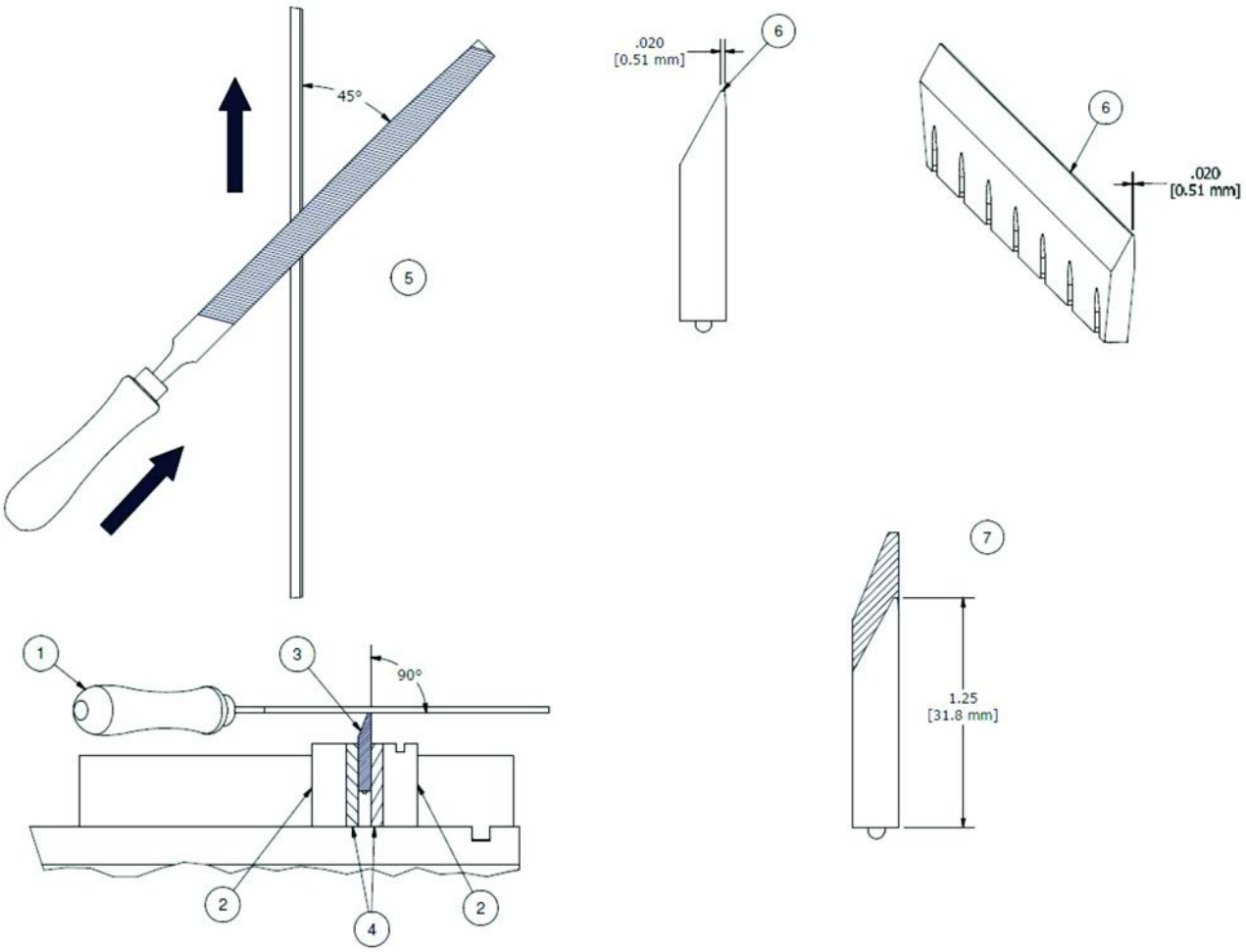


Figure 8-9. Dressing the Contherm™ Scraping Blades

8.5.4 Maintenance of The Blade Pins

If your Contherms™ 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 or burning of the product on the cylinder's inner diameter wall.
3. Excessive force on the blade caused by continuous starting the rotation of the rotor when the product viscosity is extremely high.
4. Damage caused by the blade pin hitting the cylinder end as in Figure 8-8A

If the slot has been worn or damaged, 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 8-17. Refer to Figure 8-10 while performing this procedure.

In some cases, it may be necessary to replace the blade pin(s), especially if they are bent or severely worn. The nearest Alfa Laval Service Center can perform this repair, or the rotor can be returned to Contherm™ for evaluation, rework, or replacement.

Table 8-17. Repairing 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.

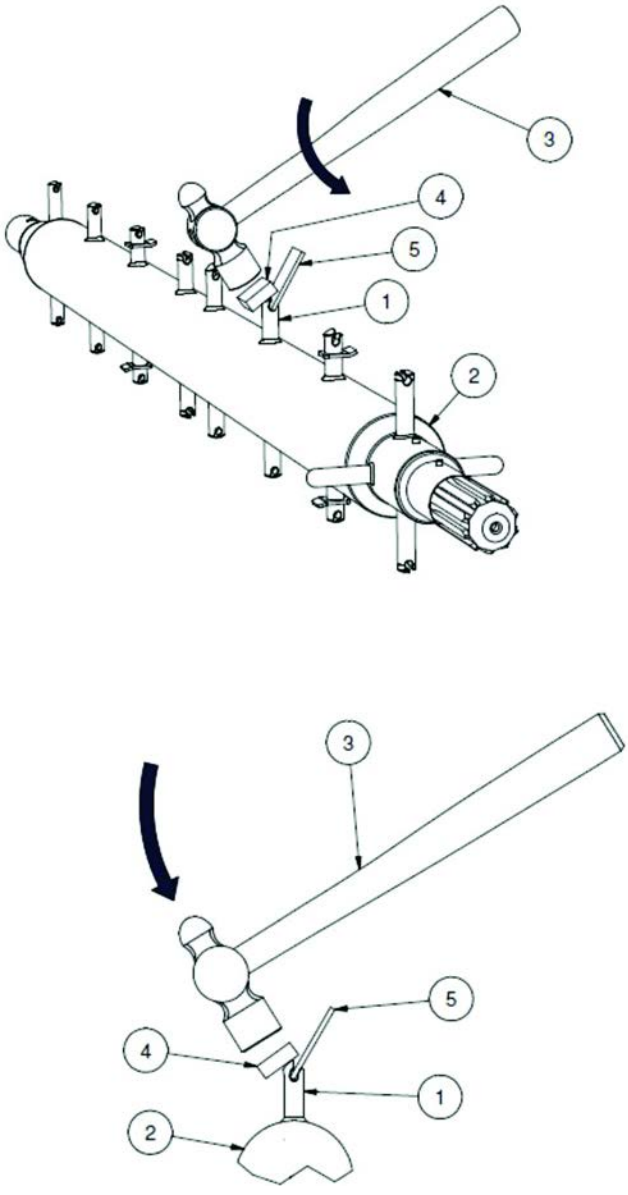


Figure 8-10. Repairing a Damaged Blade Pin
1. Blade pin
2. Rotor
3. Hammer
4. Protective striking pad
5. 0.125 Feeler gauge

8.6 Bearings

Each Contherm™ has three bearings:

1. One Lower Non-Driven End Bearing
2. Two Upper (Drive end) Bearing.

This section describes how to inspect and replace the Contherms™ bearings. The procedures in this section are organized as shown in Table 8-18.

Table 8-18. Contherm™ Bearing Related Maintenance Procedures

Section	Description
8.5.1	Inspecting the Bearings
8.5.2	Replacing the Lower Bearings (Non- Hold Down Style)
8.5.3	Replacing the Lower Bearings (Hold Down Style)
8.5.4	Replacing the Upper Bearings on Electric Motor Drive Systems (Direct Coupled)

WARNING Refer to Section 8.1 Introduction and safety recommendations before performing the following procedures.

8.6.1 Inspecting the Bearings

Failed bearings can be the root cause of catastrophic equipment failure. You should initially inspect the Contherms™ lower (non-driven end) and upper (drive head) bearings once per month and based on experience, extend the inspection time to what is deemed to be a practical and safe frequency. 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. The most common cause of bearing failure is breach of the seal and contamination of the internal grease. Ensure proper use of the slinger ring (P/N 7401964-01) on the lower non-drive end bearing and minimize high pressure washdown of the bearing areas.

To inspect a bearing, rotate its inner race with your hand. If it turns smoothly, the bearing is good. Indicators of a failed bearing can be a grinding noise when rotating the drive shaft, or when "ticks" or "clicks" are felt from normal operation or external inspection. Note that bearings in need of replacing will tend to be loose and allow the rotor to slide side-to-side.

The Contherms™ lower bearing, when used in normal operating conditions, is good for 1000 to 2000 hours. Its actual operational life will be determined by the Contherms™ hours of use and operating speed, and by how long the bearing shield remains intact. The Contherms™ upper bearings, when operated under normal conditions, have an operational life of 2000 to 3000 hours.

8.6.2 Replacing the Lower Bearings (Non- Hold Down Style)

The procedure for replacing the Contherms™ lower bearing is provided in Table 8-19. Refer to Figure 8-11 while performing this procedure. Figure 8-11 shows the location and identifies the parts of the lower bearing.

Table 8-19. Replacing the Lower Bearings (Non- Hold Down Style)

Step	Action
1	First step is always to make sure there is no pressure, no fluid and no extreme temperatures present.
2	Remove the Contherms™ lower head clamp (part number 7403038- 01) and lower the rotor, using the hydraulic rotor lifting device. **Note:** Refer to Table 7-4, Operating the Hydraulic Rotor Lift System, and Table 7-5, Operating the Rotor Lift Helper Plate in Chapter 7.
3	Release the Bearing Cap Clamp (part number 7401579-01) and move the lower product head aside. Refer to Figure 8-11 for parts identification and parts location information.
4	Remove the shoulder bolt (part number 7401286-01) and the sleeve (part number 7401289- 01) from underneath the Lift Beam Assembly (part number 7401283-01) to detach the bearing cap (part number 7401618-01).
5	Use a bearing puller tool to remove the lower bearing (part number 7401391-01) from the bearing cap.
6	Press a new bearing into the bearing cap. Verify that it is seated completely and squarely into the bearing cap.
7	Secure the bearing cap to the lift beam assembly with the sleeve and shoulder bolt.
8	Place the lower product head onto the bearing cap, and attach with the bearing cap clamp.
9	Raise the hydraulic rotor lifting system to engage the rotor into the bearing cap.
10	Release the rotor lift helper plate.
11	Lower the rotor and replace the row of blades.
12	Use the hydraulic lift system to raise the lower product head and engage it with the end hub of the Contherms™ heat exchange cylinder. Secure the product head and the cylinder with the lower product head clamp (part number 7403038-01).

Figure 8-11 Component List

1	Product Head
2	Bearing Clamp (7401579-01)
3	Slinger Ring (7401964-01)
4	Bearing Cap (7401618-01)
5	Spacer (7402979-02)
6	Bearing (7401391-01)
7	Rotor End (7402982-02)
8	Bearing Cap Cover (7402993-01)
9	Socket Head Cap Screw (7401242-10)
10	Lock Washer (7401244-06)
11	Hex Head Cap Screw (7401241-21)
12	Socket Head Cap Screw (7401242-03)
13	Retaining Ring (7401243-08)
14	Lift Beam Assembly (7401283-02)
15	Tapered Pin (7401749-01)
16	Piston Rod (7401173)

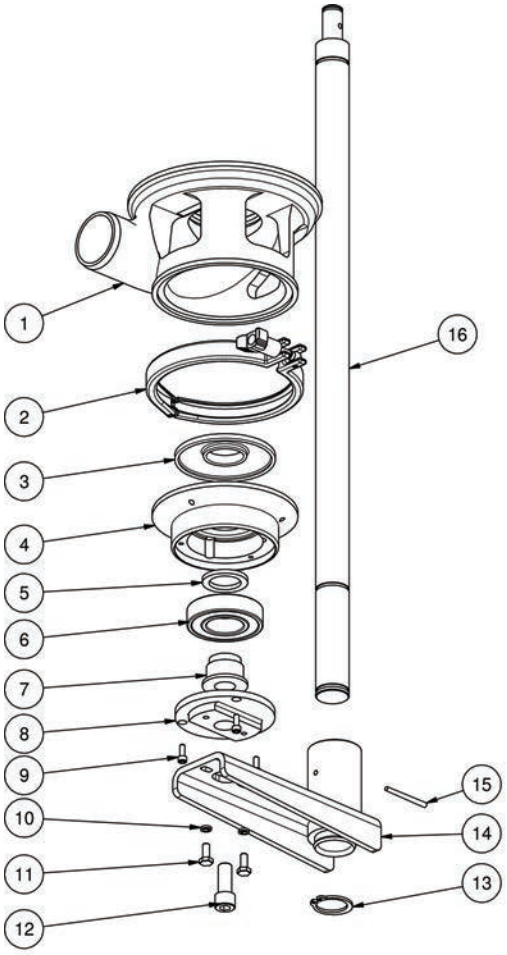


Figure 8-11. Lower Bearings. Non-Hold Down Style

8.6.3 Replacing the Lower Bearing (Rotor Hold Down Style)

The procedure for replacing the Contherms lower bearing (Rotor Hold Down Style) is provided in Table 8-20. Refer to Figure 8-12 while performing this procedure. The drawing provided in Figure 8-12 shows the location and identifies the parts of the lower bearing.

Table 8-20. Replacing the Lower Bearing (Hold Down Style)

Step	Action
1	First step is always to make sure there is no pressure, no fluid and no extreme temperatures present. Adjust following numbers accordingly.
2	Remove the Blue Socket Head Cap Screw (Part Number 7401242-03) underneath the bearing cap cover to release the rotor assembly from the lower product head assembly.
3	Using the rotor lift helper plate, prepare the Contherm™ for inspection of the lower bearings. Note: Refer to Table 7-4, Operating the Hydraulic Rotor Lift System, and Table 7-5, Operating the Rotor Lift Helper Plate in Chapter 7.
4	Release the Bearing Cap Clamp (Part Number 7401579-01) and move the lower product head aside. Refer to Figure 8-19 for parts identification and parts location information.
5	Remove the two (2) hex head bolts (Part Number 7401241-21) which secure the Lift Beam Assembly (P/N 7401283-02) to the bearing cap cover (P/N 7402993- 01).
6	Remove the three (3) socket head cap screws (Part Number 7401242-10) from the bearing cap cover. Note: There is a press fit between the bearing and both the rotor end (Part Number 7402982-02) and the bearing cap (Part Number 7402992-01).
7	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. Discard the bearing.
8	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 (Part Number 7402979-02) is in place before you press the new bearing back into the bearing cap.
9	Replace the bearing cap cover plate and tighten the three (3) socket head cap screws.
10	Secure the bearing cap to the lift beam with the two (2) hex head bolts.
11	Place the lower product head onto the bearing cap and attach with the bearing cap clamp.
12	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.
13	Continue to raise the hydraulic lifting system to release the rotor lift helper plate.
14	Lower the rotor and reattach the row of blades.
15	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 (Part Number 7403038-01).

Figure 8-12 Component List

1	Product Head
2	Slinger Ring (7401964-01)
3	Bearing seal (7401621-01)
4	Bearing (7401391-01)
5	Bearing Clamp (7401579-01)
6	Bearing Cap (7401618-01)
7	Bolt Sleeve (7401289-01)
8	Hex Head Cap Screw (7401286-01)
9	Retaining Ring (7401243-08)
10	Lift Beam Assembly (7401283-01)
11	Tapered Pin (7401749-01)
12	Piston Rod (7401173)

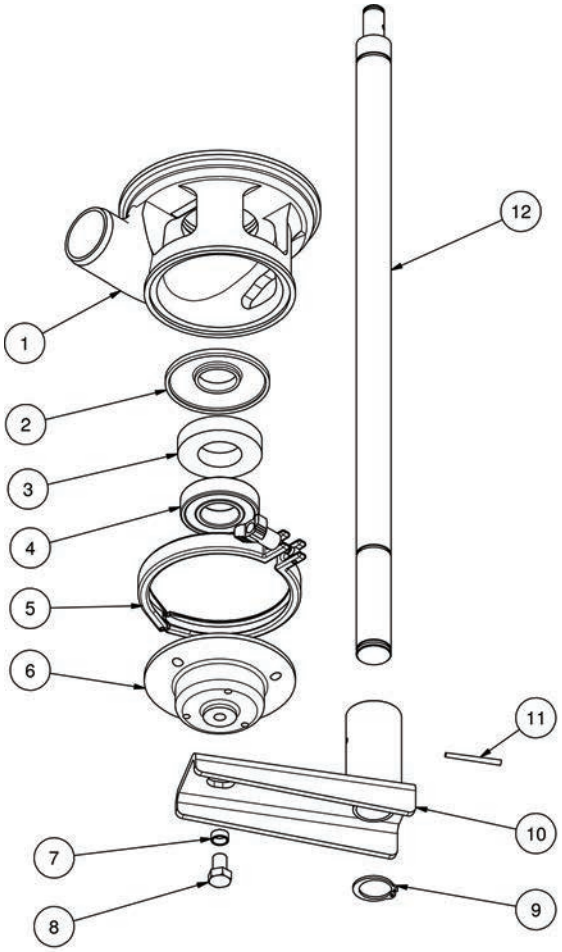


Figure 8-12. Lower bearings, Hold Down Style

8.6.4 Replacing Upper Bearings, Direct Coupled Motor Drive Systems

The procedure for replacing the upper bearing on Contherms™ equipped with a direct coupled, electric motor drive system is provided in Table 8-21. Refer to Figure 8-13 while performing this procedure. The drawing shows the location and the identification of the parts of the upper bearing.

Table 8-21. Replacing Upper Bearings on A Direct Coupled, Electric Motor Drive System

Step	Action
1	Turn off the power to the motor.Lock out the motor power circuit if necessary to prevent accidental start-up.
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 flexible element (direct drive configurations only). You should not have to move the motor. The flexible elements remove from the side after removing the hex bolts that secure them to the hubs.
4	Release and remove the clamp (Part Number 7401579-01) remove the bearing housing from the product head.
5	Remove the cover plate (Part Number 7402763-01).
6	Turn the bearing housing (Part Number 7401620-02) upside down. While applying pressure to the inner race of the bearing (Part Number 7401361-01), press out the drive coupling (Part Number 7401203-02 for hydraulic drives and Part Number 7403769-01 for direct drives) and the bearings from the bearing housing. Discard the bearings.
7	Use a gear bearing puller tool to remove the two (2) worn bearings (Part Number 7401361-01) from the drive coupling.
8	Install two (2) new bearings (Part Number 7401361-01) onto the drive coupling, 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 (Part Number 7401620-02) from the non-clamped end. Orient the drive coupling so that the female spline end enters first.
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.

One should not have to raise the motor to service the upper bearings. There should be a gap between the motor shaft and the extended spline coupling shaft that gives you space to pick up the head / bearing housing and remove it whole from the unit.

Figure 8-13 Component List

1	Electric motor (Gearbox likely included but not shown)
2	Flex Coupling (example)
3	Cap Screw (7401242-02)
4	Cover Plate (7402763-01)
5	Bearing (7401361-01)
6	Coupling (7402768-##)
7	Bearing (7401361-01)
8	Retaining Ring (7401243-09)
9	Bearing Housing (7401620-02)
10	Clamp (7401579-01)
11	Product Head

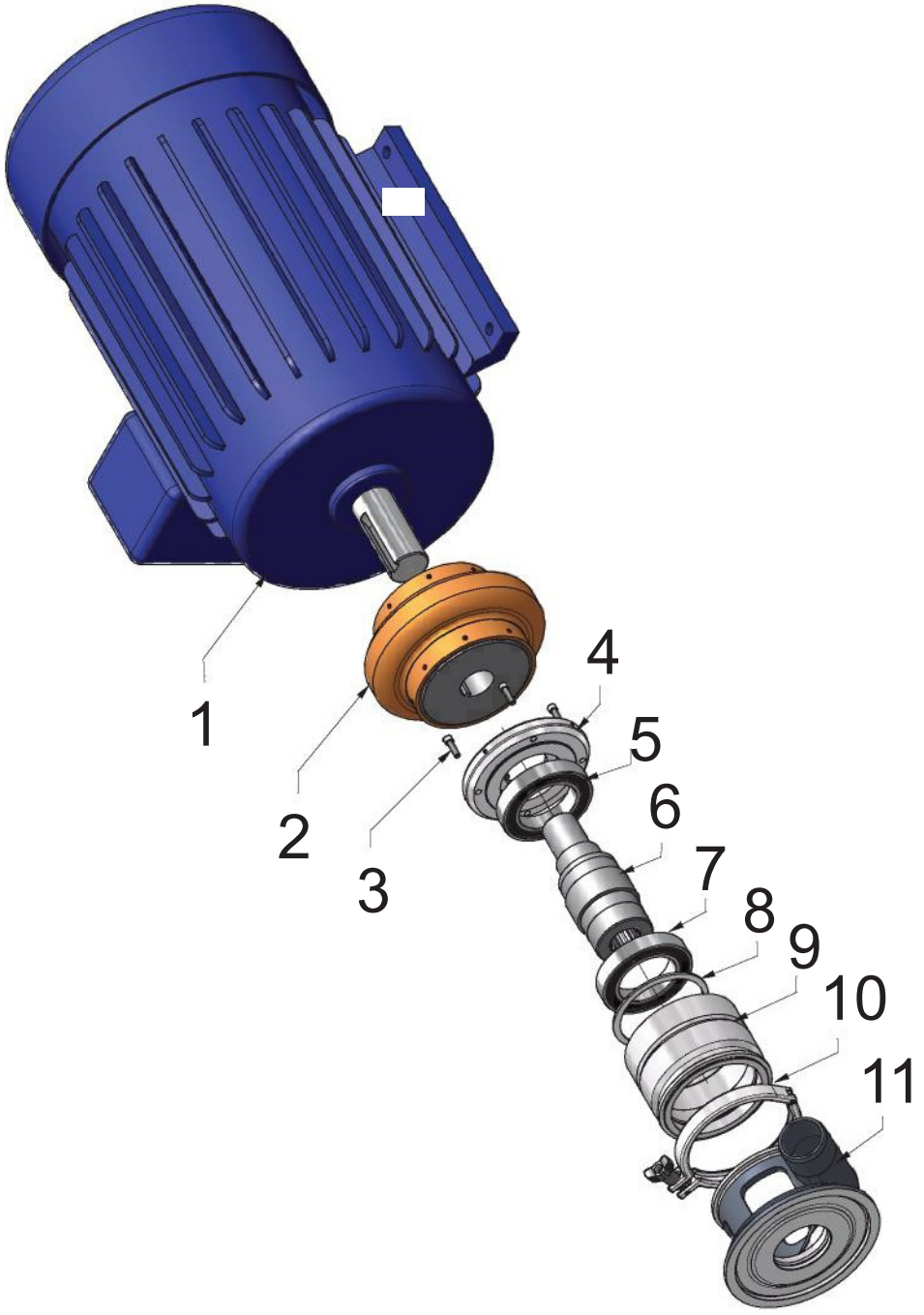


Figure 8-13. Upper Bearings, Direct Coupled, Electric Drive Motor

8.7 Heat Exchanger Cylinder

The inside surface of the Contherms™ heat exchange cylinder should be cleaned in place (CIP) as recommended in chapter 7, section 7.11.1, Recommended Cleaning Guidelines. 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 Contherms™ heat exchange cylinder.

8.7.1 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 8-22 to inspect your Contherms™ heat exchange cylinder.

Table 8-22. Inspecting the Heat Exchange Cylinder

Step	Action
1	First step is always to make sure there is no pressure, no fluid and no extreme temperatures present.
2	Remove the Contherms™ lower head clamp (Part Number 7403038- 01) and lower the rotor, using the hydraulic rotor lifting device. Note: Refer to Table 7-4, Operating the Hydraulic Rotor Lift System, and Table 7-5, Operating the Rotor Lift Helper Plate in Chapter 7.
3	After lowering the rotor from the Contherm™, inspect the walls of the cylinder for the presence of any unusual pitting or scoring conditions.
4	Inspect the cylinder end that mates with the product head for any damage that may have been caused by raising the rotor with the hydraulic lift system and a blade pin coming into contact with the cylinder end. **(there should be a series of photographs of various states of cylinder wear, showing what is normal and expected, and then showing pitting, scoring, flaking, and scalloping.)**
5	If any of the above conditions exist, please contact your local Alfa Laval Inc. representative for additional assistance.

8.7.2 Replacing the Cylinder

If your inspection shows the need to replace the Contherms™ heat exchange cylinder, refer to the disassembly procedure for the Contherm™ that is provided in Section 8.9, Disassembly and Re-assembly of the Contherm™.

Each replacement heat exchange cylinder 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 off 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 Contherms™ outside surface (trim sheet) using the four, new drive screws that were supplied with the replacement cylinder.

8.7.3 Cleaning the Media Annulus

Due to contaminants that may exist in some water and steam supplies, fouling of the Contherms™ media annulus may gradually occur over time. At some point, this fouling, if it occurs, could begin to affect the Contherms 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.

Fouling can also be caused by oils in refrigerants.

To remove this fouling layer of mineral deposits, circulate a standard demineralizing agent throughout the annulus until the fouling layer is removed. Table 8-23 identifies typical demineralizing procedures recommended by Alfa Laval Inc. for removing mineral deposits from the outer surface of the cylinder.

Table 8-23. Recommended Demineralizing Procedures

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

8.8 Hydraulic Pump and Stack Valve Assembly

Hydraulic pump fluid should be inspected, replenished and replaced at a frequency specified in the service manual (found in appendix) for optimal life and reliability.

This remaining section provides the procedure for disassembling and reassembling the Contherms™ 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 Contherms™ rotor assembly. Compression fittings for both supply and return lines, along with fittings for connections to the Contherms™ 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 8-14 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 Contherms™ Stack Valve Assembly is provided in Table 8-24. Refer to Figure 8-14 for parts location and identification information while performing this procedure.

Figure 8-14 Component List

1	Inlet Body Kit with check balls and seats	7402083-02
2	Outlet Body Kit with O-rings & Shims	7402083-04
3	Valve Section with O-rings & Shims	7402083-03
4	Handle Kit with Linkage Pins & Retaining Rings	7402083-01
5	Mounting Bracket	7401781-01
6	Tube Fitting, Elbow	7402076-22
7	Tube Fitting, Straight	7402076-21
8	Tie Rod (One Section / Two Section)	7402083-06, -07
9	Shim	7402083-05
10	O-Ring	7401137-24
11	Hex Nut	7401248-03
12	Lock Washer	7401244-05
13	Plug	7402102-01

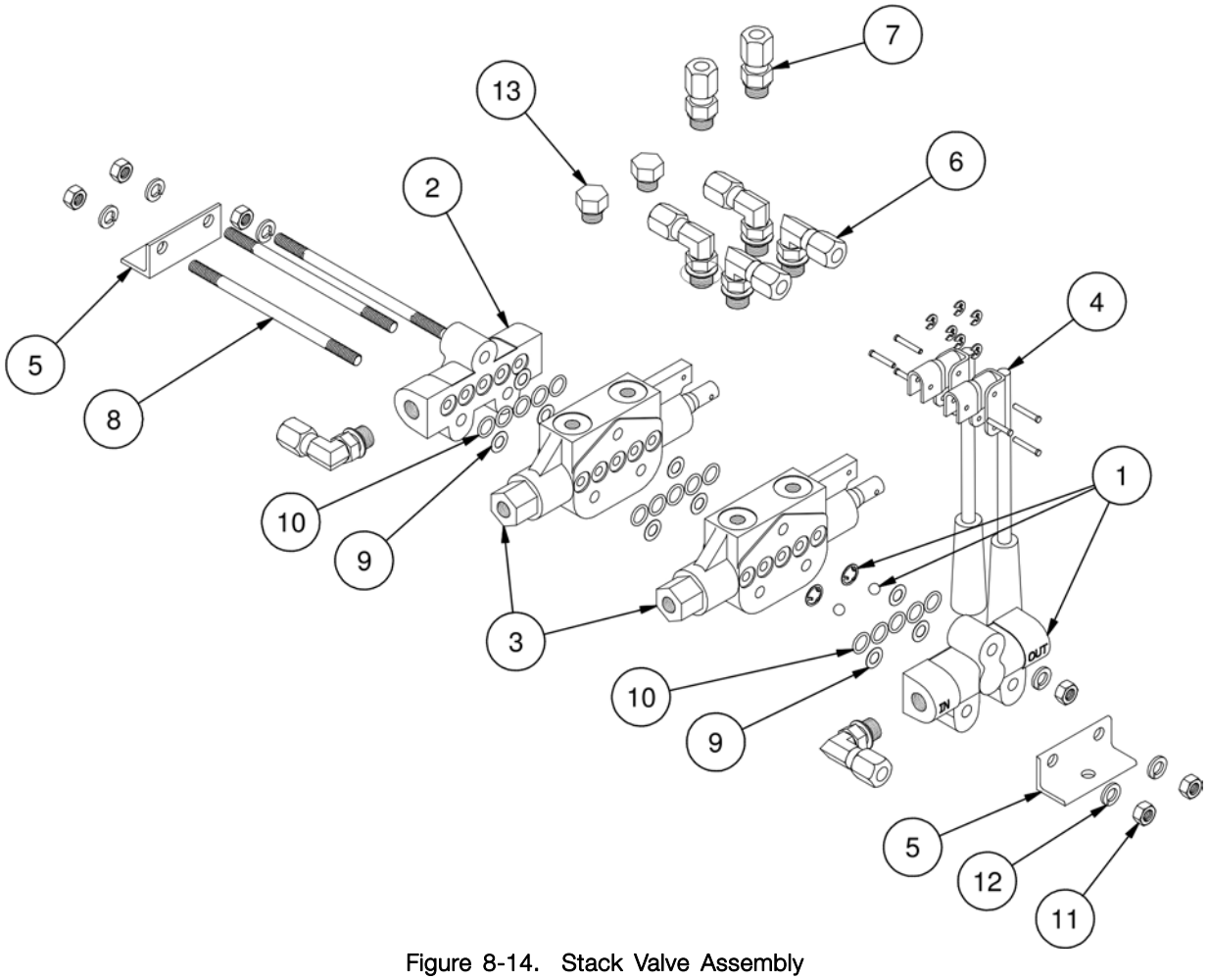


Figure 8-14. Stack Valve Assembly

8.8.1 Replacing O-Rings in The Stack Valve Assembly

Table 8-24. Replacing O-Rings in The Stack Valve Assembly

Steps	Action
1	Drain the hydraulic fluid from the Contherms™ Rotor Lift System and disconnect all hydraulic lines (tubing) from the Stack Valve Assembly's center section. **WARNING:** Ensure that all the Contherms™ 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 8-14.
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 8-14.
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.

8.9 Disassembly and Reassembly of the Contherm™

This section provides the detailed procedures for disassembling and reassembling a vertically mounted Contherm™. Table 8-25 identifies the disassembly/reassembly procedures that are contained in this section.

Table 8-25. Contherm™ Disassembly and Reassembly Procedures

Section	Description
8.9.1	Disassembly of the Contherm™
8.9.2	Reassembly of the Contherm™
8.9.3	Disassembly of the Contherms™ 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.

WARNING Refer to chapter 2, Safety, and section 8.1 Introduction and safety before proceeding to disassemble the Contherm™ equipment.

8.9.1 Disassembly of the Contherm™

The procedure for the disassembly of the Contherm™ is provided in Table 8-26.

Table 8-26. Disassembly of The Contherm™

Steps	Action
1	Disconnect the Contherms™ power supply to the drive motor and disengage any related drive couplings.
2	Drain the heat exchange cylinder. Ensure there are no remaining fluids or pressure within the pipework.
3	Remove any connecting product piping from the unit.
4	Shut off and disconnect all the media supply and return lines from the Contherm™. Ensure there are no remaining fluids or pressure within the pipework before dismantling.
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 7-4, Operating the Hydraulic Rotor Lift System, for its detailed operating procedure.
6	Return the hydraulic rotor lift beam to its operating position. Secure the lower head in position with clamp.
7	Disconnect the lower hydraulic tube from the lift cylinder, and drain the fluid. Manually extend the piston rod to drain the remaining 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. With all clamps securely in place, 7" clamps P/N 7403038-01, pass a sling through the slots on the Contherms™ upper product head. Refer to figure 8-15
9	Remove both locknuts (Part Number 7401266-01) maneuver the Contherm™ out and away from the mount, 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 end bearing housing by removing the clamp (P/N 7401579-01) at drive end from between the bearing housing and the product head.
11	Loosen and remove the clamp (P/N 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.
12	On the lower end of the unit, 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 Contherms™ 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 8-16 for parts location and identification information.
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.
18	Inspect the insulation for signs of damage. Replace as needed.

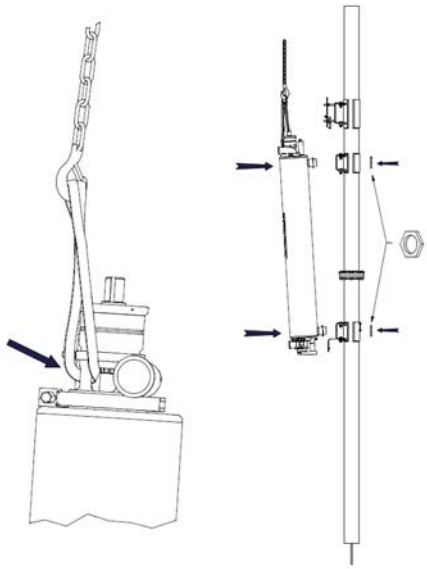


Figure 8-16 Component List
1. Trim sheet assembly
2. Cylinder head trim assembly
3. Hex head bolt
4. Mounting locknut

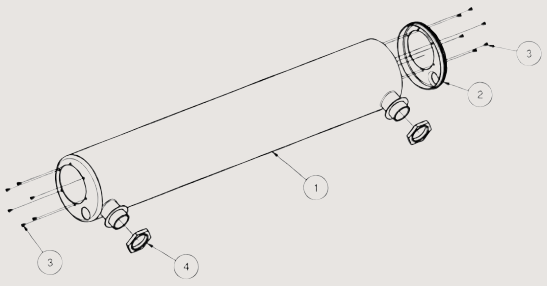


Figure 8-16. Contherms™ Exterior Trim Sheet

8.9.3 Reassembly of the Contherm™

Table 8-27. Reassembly of the Contherm™

Steps	Action
1	This procedure assumes that you have disassembled the Contherm™ in accordance with all directions provided in Table 8-26.
2	Place the cylinder assembly into 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. Refer to figure 8-16.
4	Return the cylinder head trim assembly (Part Number 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 (Part Number 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 (Part Number 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 (Part Number 7401266-01). Refer to Chapter 6, section 6.4, Figure 6-3. Do not touch seal faces. Clean seal faces with alcohol or solvent before inserting into the cylinder.
9	Connect the lift cylinder hydraulic connections. Purge the air from the hydraulic lines. (Refer to Chapter Six, section 6.7, Installation.)
10	Using the hydraulic rotor lift system, lower the bottom head assembly and install the rotor, top spline end first, with the seals properly attached, into the Contherm™. Carefully insert the lower end of the rotor into the lower head assembly to avoid damage to the seal bushing and the lower bearing.
11	Install the scraping blades onto the rotor. Refer to Chapter 8, Section 8.5, Scraping Blades. Use blade funnel tool to protect equipment.
12	Raise the lower product head assembly and rotor, guiding the scraping blades, into the cylinder and secure with clamp. If the top spline end binds, carefully rotate the rotor slightly to better engage the spline teeth, and try raising the rotor again. Be careful not to dislodge the seal at the drive end.
13	Connect all media supply and return lines to the Contherm™.
14	Attach any product piping to both product heads.

8.9.4 Disassembly of The Contherms™ Hydraulic Lift Cylinder

The procedure for disassembling the Contherms™ hydraulic lift cylinder is provided in Table 8-28. Refer to Figures 8-18 for parts location and identification information while performing this procedure. Figure 8-18 shows the disassembly of a Contherm™ with a rotor hold down design.

WARNING

Refer to chapter 2, Safety, and section 8.1 Introduction and safety before proceeding to disassemble the Contherm™ equipment.
This operation must be performed with the hydraulic lift cylinder removed from the unit.

Table 8-28. Disassembly of The Contherms™ Hydraulic Lift Cylinder

Steps	Action
1	Remove the piston rod (Part Number 7401173), cylinder head (Part Number 7401164-01) and piston (Part Number 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 (Part Number 7401137-02). This is accomplished by releasing the retaining ring (Part Number 7401243-07) located at the top of the lift cylinder and removing the cylinder cap.
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 (Part Number 7401243-05) located at the end of the piston rod and remove the piston (Part Number 7401172-01). Replace the two (2) U-cups on the piston. Refer to Figures 8-29 and 8-30 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 (Part Number 7401137-02 and 7401137-04). Release the retaining ring (Part Number 7401243-05) from the piston rod (Part Number 7401173) and remove the piston. Replace both O-rings on the cylinder head (Part Number 7401164-01).
5	Reassemble both cylinder head (Part Number 7401164-01) and piston (Part Number 7401172-01) to the piston rod (Part Number 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 (Part Number 7401162-01) at the top end of the lift cylinder (Part Number 7401168). Secure both ends by replacing the retaining rings (Part Number 7401243-07).

Figure 8-18 Component List

Item	Qty	Part Number	Description	Item	Qty	Part Number	Description
1	2	7401109-01	U-Cup, Hydraulic Piston Seal	11	2	7401243-06	Retaining Ring, Ext., Hydraulic Lift Cylinder
2	2	7401137-02	O-Ring, Size 223, BUNA	12	2	7401243-07	Retaining Ring, Internal, 1-7/8 Bore
3	1	7401137-04	O-Ring, Size 218 BUNA N (Nitrile)	13	3	7401243-08	Retaining Ring, Hydraulic Lift Cylinder
4	2	7401137-90	O-Ring, Size 116, BUNA	14	1	7401243-01	Lift Beam Assembly, Hydraulic, Inboard Bearing
5	1	7401162-01	Cap, Hydraulic Lift Cylinder	15	1	7401283-01	Lift Beam Assembly, Hydraulic, Rotor Hold Down
6	1	7401164-01	Head, Hydraulic Lift Cylinder	16	1	7401749-01	Pin, Tapered
7	1	7401169-03	Cylinder, Hydraulic Lift	17	1	7402076-23	Fitting, Tube, Straight
8	1	7401172-01	Head, Hydraulic Lift Cylinder Piston	18	1	7402076-24	Fitting, Tube, Elbow
9	1	7401173-03	Rod, Hydraulic Lift Cylinder Piston, 6x6	19	1	7403519-01	Pin, Dowel, 3/16 diameter x 1.25” length
10	1	7401243-05	Ring, Retaining	20	2	7404028-01	Plug

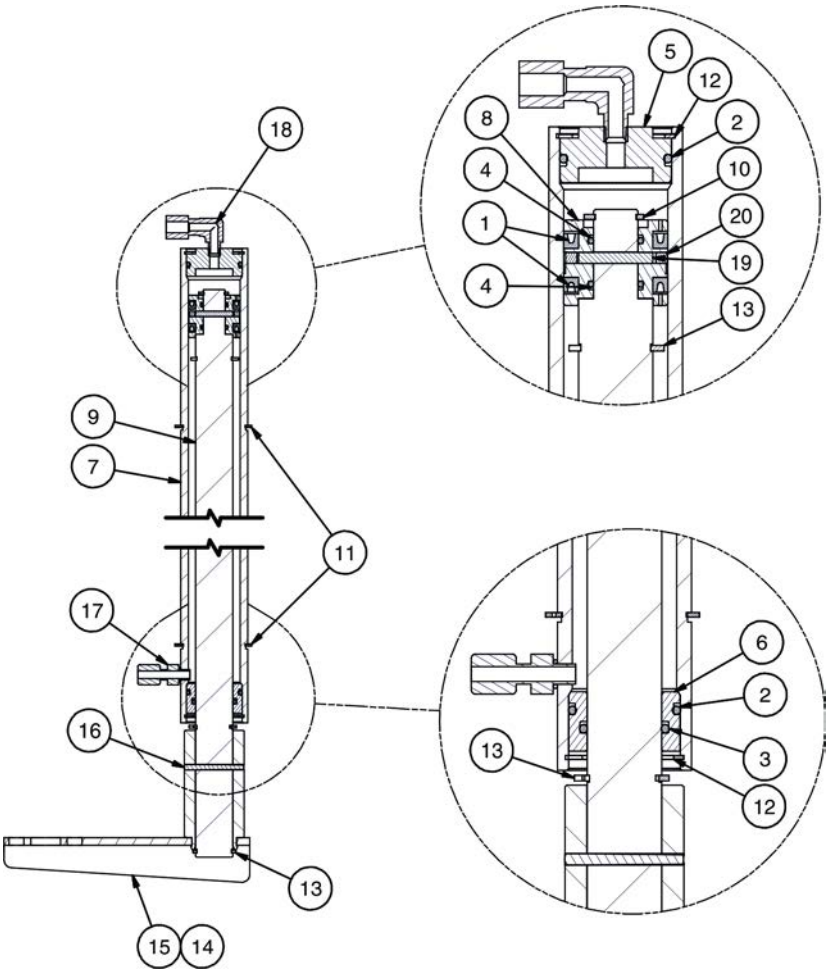


Figure 8-18A . CONTHERM™ Hydraulic Lift Assembly

Figure 8-18 Component List

Item	Qty	Part Number	Description
1	2	7401109-01	U-Cup, Hydraulic Piston Seal
2	2	7401137-02	O-Ring, Size 223, BUNA
3	1	7401137-04	O-Ring, Size 218 BUNA N (Nitrile)
4	2	7401137-90	O-Ring, Size 116, BUNA
5	1	7401162-01	Cap, Hydraulic Lift Cylinder
6	1	7401164-01	Head, Hydraulic Lift Cylinder
7	1	7401169-03	Cylinder, Hydraulic Lift
8	1	7401172-01	Head, Hydraulic Lift Cylinder Piston
9	1	7401173-03	Rod, Hydraulic Lift Cylinder Piston, 6x6
10	1	7401243-05	Ring, Retaining
11	2	7401243-06	Retaining Ring, Ext., Hydraulic Lift Cylinder
12	2	7401243-07	Retaining Ring, Internal, 1-7/8 Bore
13	3	7401243-08	Retaining Ring, Hydraulic Lift Cylinder
14	1	7401283-01	Lift Beam Assembly, Hydraulic, Inboard Bearing
15	1	7401283-02	Lift Beam Assembly, Hydraulic, Rotor Hold Down
16	1	7401749-01	Pin, Tapered
17	1	7402076-23	Fitting, Tube, Straight
18	1	7402076-24	Fitting, Tube, Elbow
19	1	7403519-01	Pin, Dowel, 3/16 diameter x 1.25” length
20	2	7404028-01	Plug
21	2	7401241-21	Bolt, Hex Head SST, .250-20UNC x .625 LG
22	2	7401244-06	Washer, Lock, 1/4”
23	1	7401286-01	Hex Cap Screw, 1/2-13 UNC x .75 LG
24	1	7401289-01	Sleeve, Shoulder Bolt
25	1	7401618-01	Cap, Bearing
26	1	7402992-01	Cap, Bearing
27	1	7402993-01	Cover, Bearing Cap

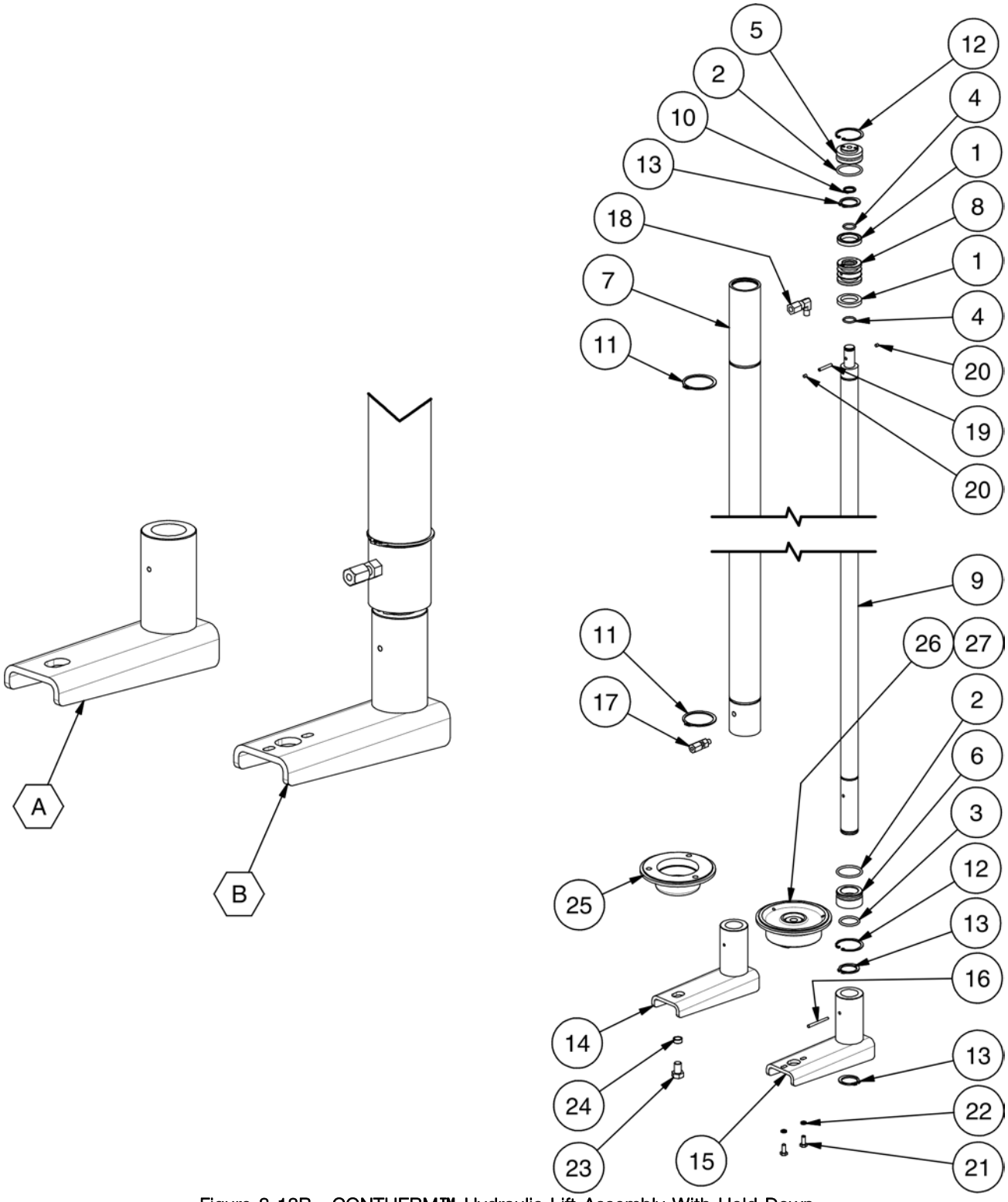


Figure 8-18B . CONTHERM™ Hydraulic Lift Assembly With Hold Down

9 Troubleshooting

9.1 Introduction

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 Inc.'s engineers as well as customers 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 Inc. representative.

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

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

Table 9-1. Contherm™ Troubleshooting Information

Section	Category	Applicable Table(s)
9.2	- Seal Leaks - Product Seals. - Flush Seals (Flushing media entering atmosphere).	Table 9-2. Product Seal Leaks Table 9-3. Flush Seal Leaks
9.3	- Lower Bearing - Lower bearing wearing out prematurely.	Table 9-4. Lower Bearing
9.4	- 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 9-5. Rotor Lift System
9.5	- Product Heating - Product not heated to specified temperature. - Product burning onto cylinder wall.	Table 9-6. Product Not Heated to Specified Temperature Table 9-7. Product Burning onto Cylinder Wall
9.6	- Product Cooling (Water/Glycol/Brine) - Product not cooling to specified temperature.	Table 9-8. Product Not Cooling to Specified Temperature
9.7	- Product Cooling (Ammonia/Freon) - Product not cooling to specified temperature. - System Freezes Up.	Table 9-9. Product Not Cooling to Specified Temperature Table 9-10. 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.

9.2 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 Eight, 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:

- Product Seal Leaks.
- Flush Seal Leaks.

Product Seal Leaks

Product seal leaks may occur with Contherms™ equipped with rotary seals. When a product seal leak occurs, the product leaks from the rotary seals via the seal face or the O-ring.

A product seal leak may be caused by any of the conditions identified in Table 9-2. 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 Eight for correcting the problem.

Table 9-2. Product Seal Leaks

Possible Cause	How To Resolve
Damaged or worn seal face.	Re-lap or replace seal face. Refer to Section 8.4.3, Seal Inspection and Replacement.
Damaged or worn seal bushing.	Replace seal bushing. Refer to Section 8.4.3, Seal Inspection and Replacement. Lubricate before installing new O-Rings.
Defective or twisted O-Rings.	Replace O-Rings. Refer to Section 8.4.3, Seal Inspection and Replacement.
Foreign matter lodged in O- Ring groove of seal shell.	Clean groove and replace O-Ring.
Product has prevented inner spring from exerting proper pressure onto seal shell.	Thoroughly clean or replace the inner spring and the seal shell.
Seal face not installed into seal shell properly or seal face not lapped flat.	Remove and replace seal face. Refer to Section 8.4.3, Seal Inspection and Replacement.
Improper O-Ring material.	Consult your local Alfa Laval Inc. representative.
Seal locking pin broken or damaged.	Replace seal pin(s). Refer to Section 8.4.3.4, Replacing A Seal Locking Pin.
Rotor stop adjustment or rotor hold down bolt not set or secured properly.	Ensure rotor travel is restricted by either securing the rotor hold down bolt or by the rotor stop mechanism in the upper splined coupling depending on your Contherm™ design.
Seal spring failure due fatigue	Inspect frequently and replace as needed based on experience.
Damaged rotor or improper repair of rotor	Wear on rotor surface not allowing for a proper seal. Contact Alfa Laval for rotor repair.
Extreme temperature differences between Product inlet and media will cause seal leaks.	Use of non-OEM seals or O-rings

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 9-3. 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 9-3. Flushed / Aseptic Seal Leaks

Possible Cause	How To Resolve
Seal flushing fluid pressure too high.	Reduce fluid pressure to equal or less than 15 psi (1 Bar).
Damaged carbon seal face of flushed seal.	Re-lap or replace seal face. Refer to Section 8.4.3, Seal Inspection and Replacement.
Improper O-Ring material	Consult your local Alfa Laval Inc. representative.
Seal locking pin broken or damaged.	Replace seal pin(s). Refer to Section 8.4.3.4, Replacing A Seal Locking Pin.
Seal spring failure due to crack / break or fatigue	Inspect both product and seal flush springs frequently and replace as needed based on experience.

9.3 Lower Bearing

If the lower bearing on your Contherm™ is wearing out prematurely, this may result in excess vibration of the equipment. The problem may be caused by one of the following conditions:

- Worn bearing seal(s) or contaminated bearing.
- A worn rotor end.
- An improperly set rotor stop.

To resolve the problem, perform the appropriate action as described in Table 9-4. When applicable, the table will direct you to the appropriate maintenance related procedure in Chapter Seven.

Table 9-4. Lower Bearing

Possible Cause	How To Resolve
Damaged or failed bearing seal(s).	Replace the bearing. Refer to Section 8.6 and its subsections, Replacing Lower Bearings.
A worn rotor end (rotor hold down version).	Replace Rotor End Assembly. Refer to Chapter Eight, Section 8.6.3, Replacing the Lower Bearings (Hold Down Style). Check your order documentation to identify if “Rotor hold down” version is included with your equipment. If not, refer to step below.
An improperly set rotor stop. **Note:** Applies only to Contherms™ with Non-Hold Down Style Rotors.	Contact Alfa Laval for more information on “Rotor stop” / Non-Hold Down designs.
Missing slinger ring.	Replace PN 7401964-01
Bearing assembly drain holes not properly draining.	Unplug the drain holes. Inspect frequently to ensure no accumulation of product or cleaning chemicals on bearing which will prematurely impact the bearing seals.

9.4 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 Contherms™ rotor and blade assembly for inspection, maintenance, or manual cleaning.

If a problem with the system should occur, the following procedures show how to identify and resolve it.

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

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

Table 9-5 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 9-5. Rotor Lift System

Problem	Possible Cause	How To Resolve
Rotor Lift System Not Operating Smoothly in Either Direction	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.
	Oil contamination due to water (oil has creamy and foamy appearance).	Drain contaminated oil from system and replace with clean oil. Refer to Table 6-8 for oil type recommendations.
Rotor Lift System Will Lower but Will Not Return	Stack valve blocked.	Disconnect lines to the stack valve and inspect for any restrictions.
	Hydraulic lift pump motor is not operating.	Check wiring and/or fuses.
	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.

9.5 Product Heating

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.

Problem: Product Not Heated to Specified Temperature

Table 9-6 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 9-6. Product Not Heated to Specified Temperature

Possible Cause	How To Resolve
Product flow rate is too high.	Decrease the product flow rate.
Product input temperature too low.	Increase the temperature of the product entering the input port or adjust the flow rate down to compensate for the lower incoming product temperature.
Steam control valve improperly sized.	Re-size and replace the valve.
Steam control valve not installed within five feet (1.5 meters) of the Contherm™.	Relocate the steam valve.
No condensate trap in the condensates return line.	Install a properly sized steam trap.
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.
Rotors turning in reverse direction.	Change the motor wiring.
Rotor speed too low.	Increase speed and frequency of scraping. This can have a dramatic effect on heat transfer. Every application has an optimum scraping speed.

Problem: Product Burning onto Cylinder Wall

Table 9-7. Product Burning onto Cylinder Wall

Possible Cause	How To Resolve
Product not flowing through Contherm™ before steam is turned on.	Start product flow through the Contherm™ before turning the steam on.
Rotor not turned on before steam turned on.	Turn on the rotor as soon as the product enters the Contherm™. Never spin rotor in a dry Contherm™.
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) to ensure fouling of product on the cylinder wall is not allowed to occur.
Steam leaking past the control valve when system is shut down.	Install a normally closed solenoid valve ahead of the steam control valve.
Rotor speed too slow.	Increase speed and frequency of scraping.
Cylinder wear / grooving is allowing fouling to occur	Inspect the cylinder frequently and address any wear that can impact the mechanical and the heat transfer performance. Contact Alfa Laval for an equipment audit.

9.6 Product Cooling (Water/Glycol/Brine)

If a product cooling problem does occur, the following procedure shows you how to identify its cause and resolve the problem.

Table 9-8 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.

Problem: Product not cooling to specified temperature.

Table 9-8. Product Not Cooling to Specified Temperature (Water/Glycol/Brine)

Possible Cause	How To Resolve
Product flow rate too high.	Reduce the product flow rate.
Product input temperature too high.	Reduce the temperature of the entering product or adjust the flow rate down to compensate for the higher incoming product temperature.
Media temperature too high.	Reduce the temperature of the media.
Media flow rate too low.	Increase the media flow rate. 50 GPM (11,000 l/hr) minimum for water media and 65 GPM (13,000 l/hr) for Glycol cooling media for proper turbulence of media.
Rotor speed too slow or too fast.	Modify speed to optimize product temperature. Every application has an optimum scraping speed.
Rotor turning in reverse direction.	Change the motor wiring or check VFD direction
Blades left off after maintenance or installed in reverse direction.	Lower rotor for inspection. Install any missing blades or re-install blades in correct orientation with bevel facing the rotor. Return rotor to operating position. Refer to figure 8-7, Installing Scraping Blades.
Brine/Glycol concentration too high.	Check the freezing points and lower the concentration (%). Heat transfer dramatically decreases at concentrations greater than 30%.

9.7 Product Cooling (Ammonia/Freon)

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.

Table 9-9 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.

Problem: Product not cooling to specified temperature.

Table 9-9. Product Not Cooling to Specified Temperature (Ammonia/Freon™)

Possible Cause	How To Resolve
Product flow rate too high.	Reduce the product flow rate.
Product input temperature too high.	Reduce the temperature of the product.
Rotor turning in reverse direction.	Change the motor wiring or check VFD direction.
Rotor speed too slow or too fast.	Modify speed to optimize product temperature.
Liquid level control on accumulator set too low or is defective.	Turn the adjustment screw until the product reaches the proper temperature. For automatic systems, check the operation of the controller and repair if necessary.
Ammonia system contaminated with oil.	Purge the oil from the system.
Back pressure valve for refrigerant not properly adjusted.	Install a correctly sized valve. Consult valve manufacturer. Install different orifice if available.
Back pressure valve not properly sized.	Re-size and replace the suction line. Consult valve manufacturer. Install different orifice if available.

Problem: Contherm™ system is freezing up

Table 9-10 identifies specific factors that may result in the system freezing up. System freeze up is a process situation where the rotors cease to spin and scrape due to freezing of product at a rate that exceeds the Contherms™ ability to remove frozen material from the heat transfer wall. 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 9-10. System Freezing Up (Ammonia/Freon)

Possible Cause	How To Resolve
Product flow too low or has stopped.	If the product flow should stop during operation, keep the rotors turning and place the refrigeration system under Maintain Status operation. Discover cause of stoppage and resume. Refer to chapter 7, section 7.8.1 Maintain Status Feature for more information.
Product supply has stopped (empty feed tank)	Adjust controls to alert when product feed tank supply is low. Do not let supply lines run dry. Monitor current draw of motor with ammeter.
Rotor has stopped.	Check motor starter and control.
Product input temperature has been lowered during processing run.	Discover cause and correct or modify controls to function under new parameters if capable.
Refrigeration system malfunction.	Check the operation of the refrigeration system.
Contherm™ drawing high amps. Set points on ammeter too high	Re-adjust the settings to properly activate the Maintain Status operation.
System power failure	Check power supply

WARNING

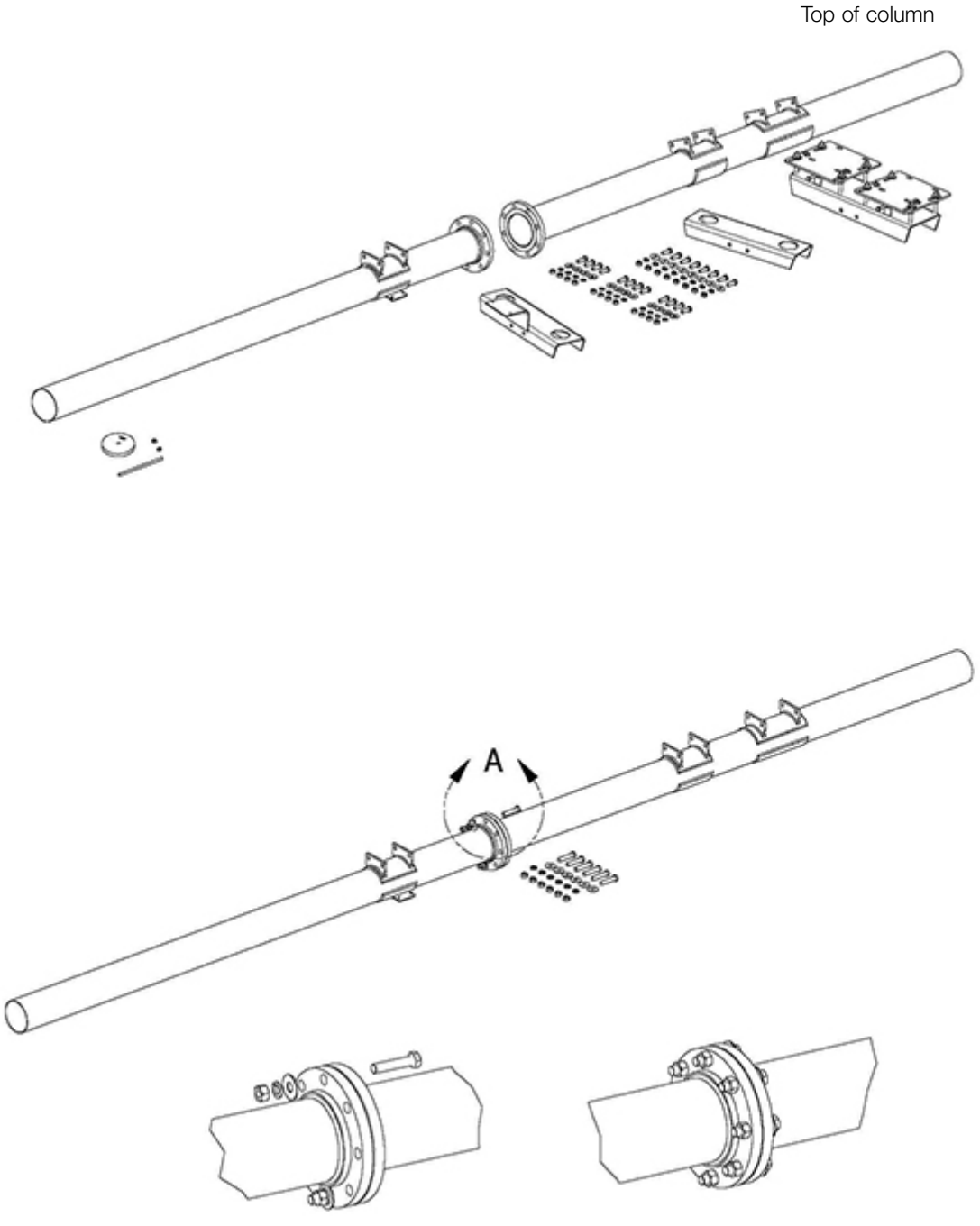
Shut down system immediately and energize Hot Gas Defrost System if system freezes up to the point where rotor will no longer turn. Resume the product run only after system has been defrosted. Before resuming the run, readjust all valves to prevent freeze up problem from recurring.
Do not jog motor to break out of freeze-up condition as this can damage rotor, blades, blade pins, and spline teeth.

10 Appendix A: Additional Installation Drawings

Additional Installation Drawings

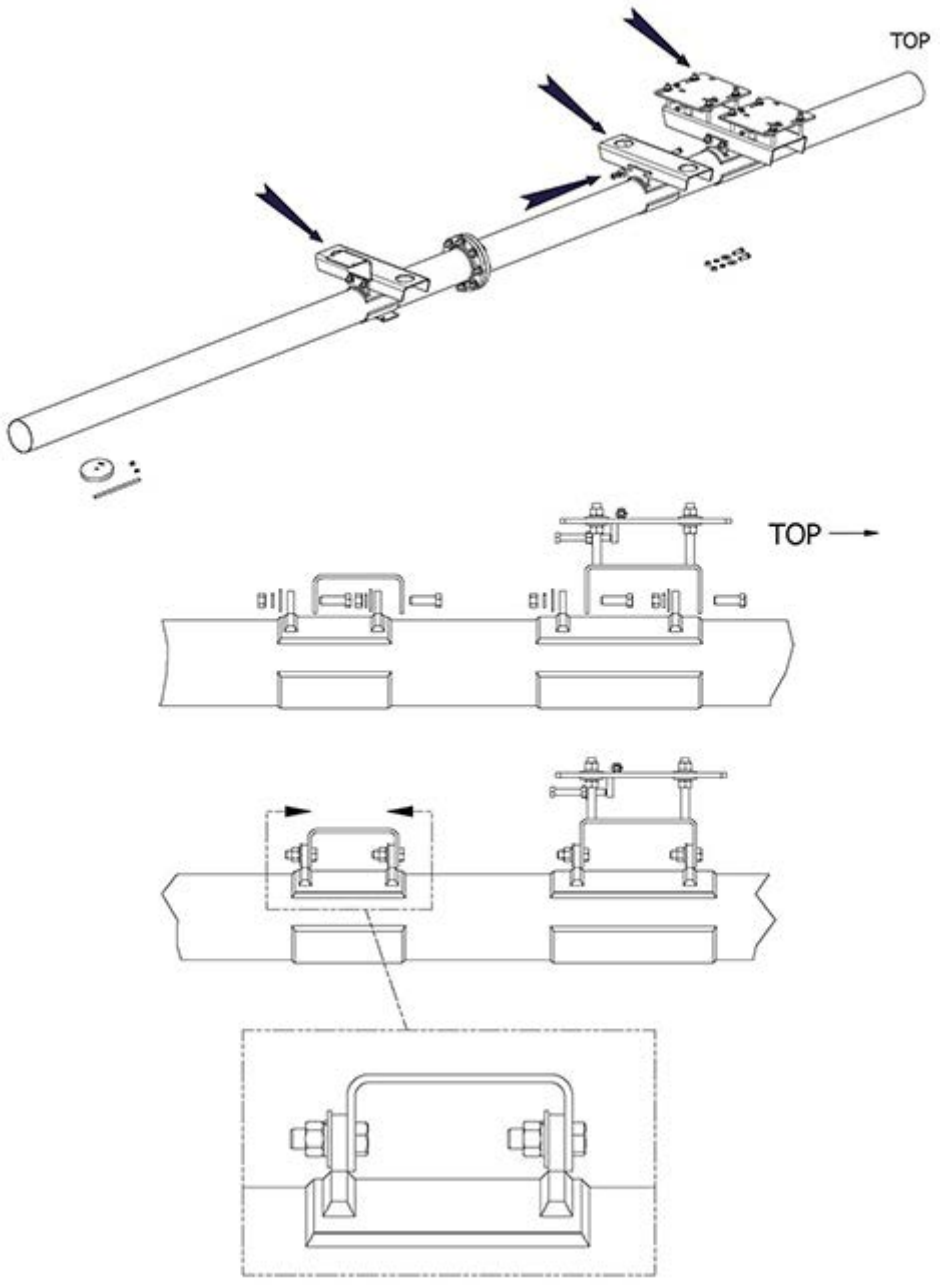
The below drawings follow a typical sequence of how to install your vertical Contherm™ scraped surface heat exchanger equipment.

1. Assemble the mounting column
   - Below demonstrates a split column. Not all columns are split and require assembly as shown below.

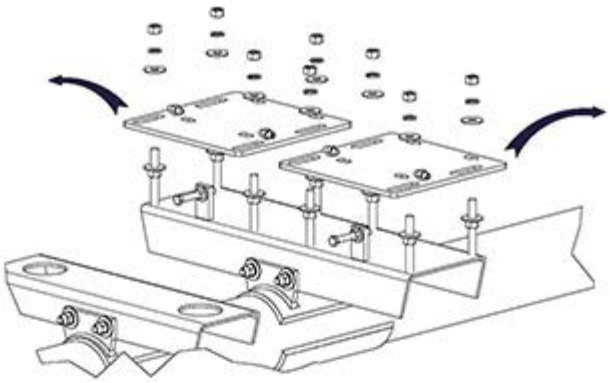


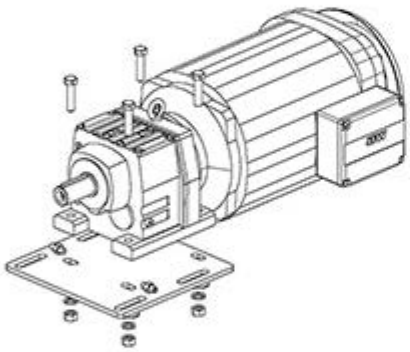
2. **Place the cross arms onto the column as shown.**
   - The cross arms must sit on top of the column brackets and be bolted as shown for a safe installation.

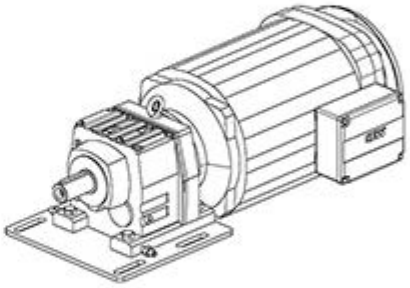
Top of column

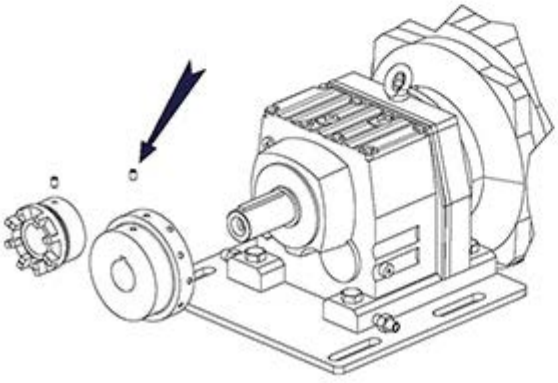


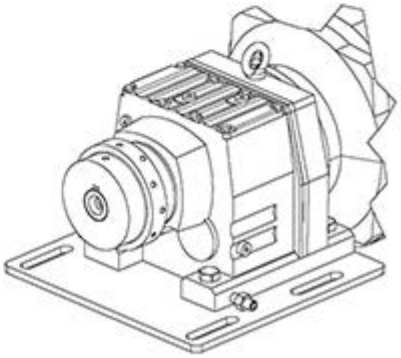
3. Install the drive motors onto the motor mounting plates.
   - Remove the motor plate from the mount.
   - Attach motor to the motor plate.
   - Attach the upper coupling hub to the motor shaft
   - Install the upper coupling component onto the motor drive shaft as shown.



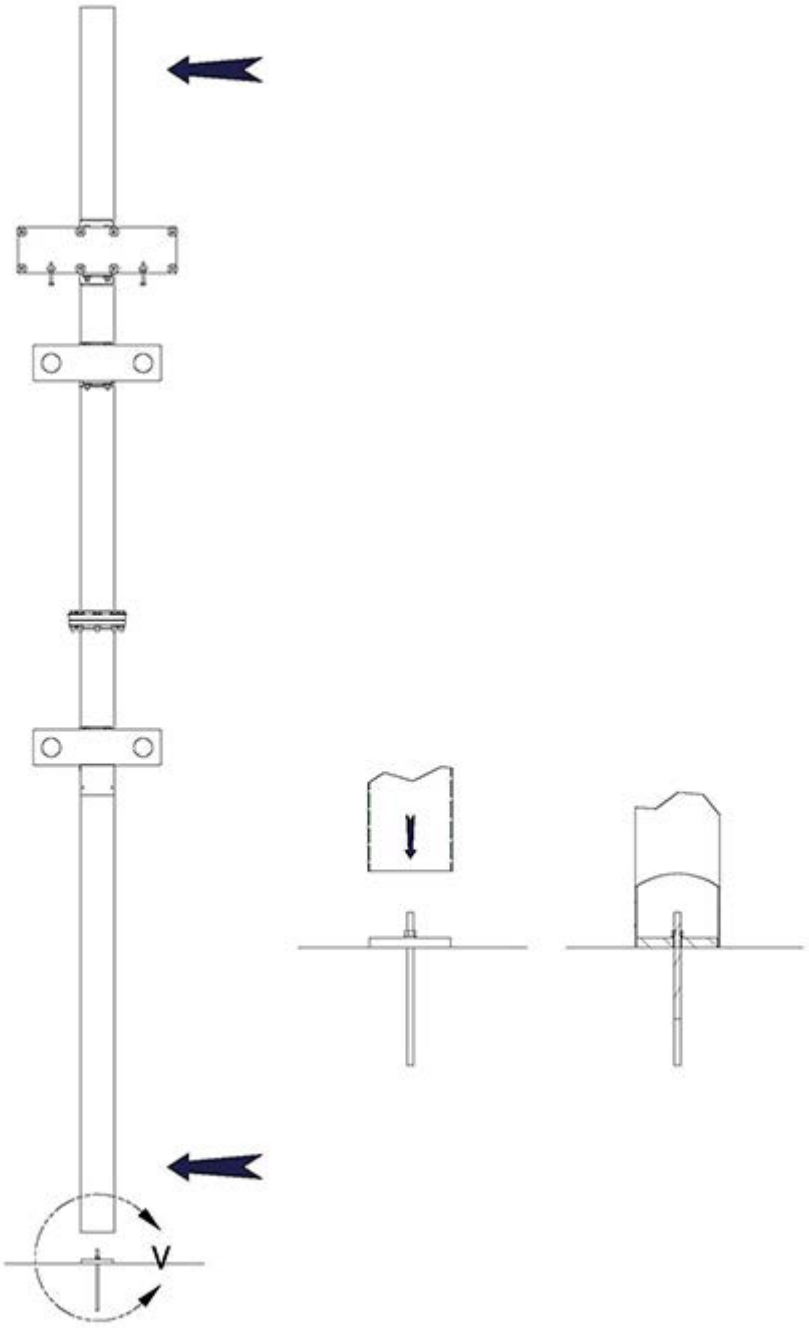




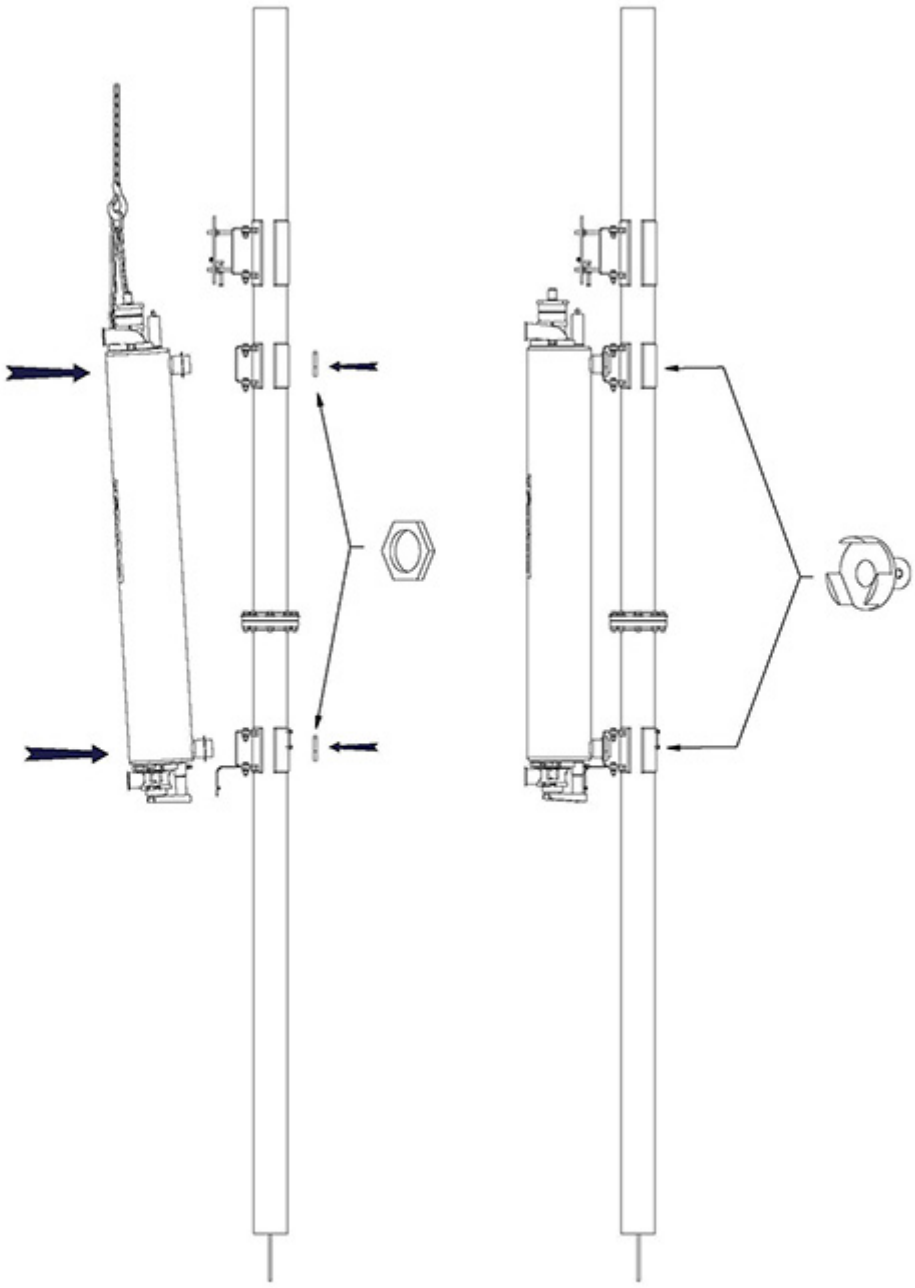




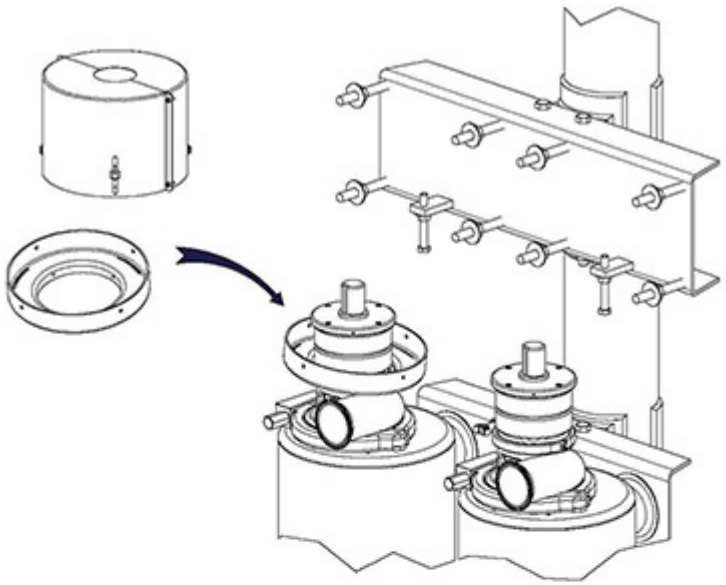
4. Installing the vertical column(s).
   - Fix the column to a ceiling brace and to the floor. The mount floor plate and the ceiling or wall bracing must be secured by others that are qualified and can ensure a safe installation of the equipment. Consult a structural engineer.

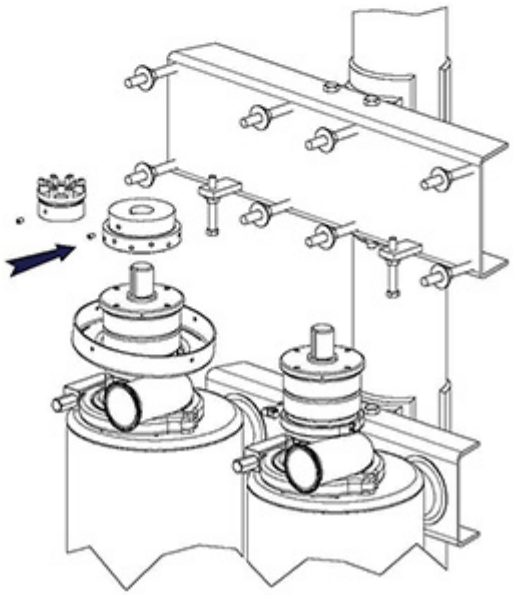


5. Installing the Contherm to the vertical column.
   - Insert the lower media port into and through the cross-arm holes then insert the upper media port through the upper crossarm hole and secure with the 3-inch mounting nuts.
   -

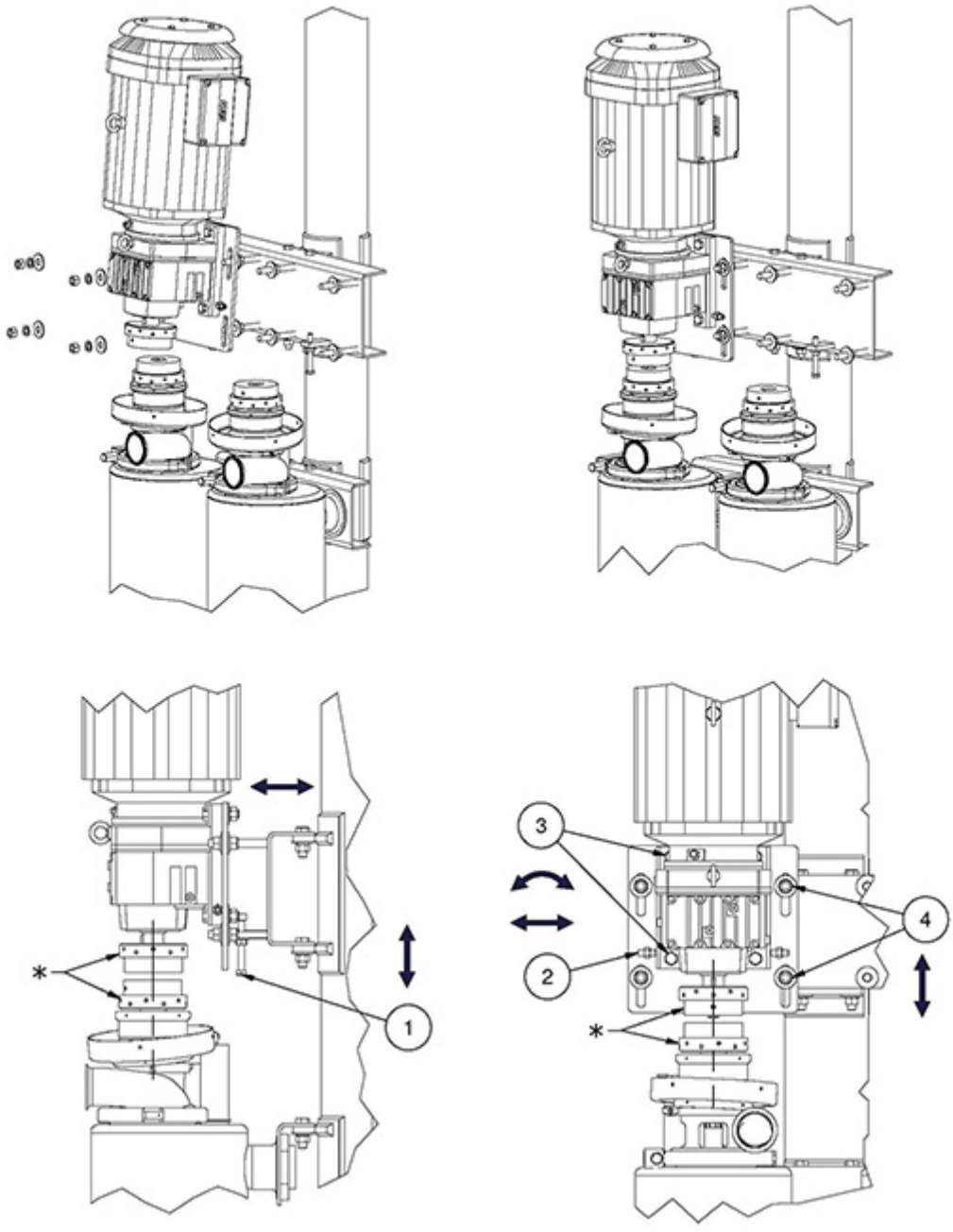


6. Install the coupling guard components
   - Place the guard ring over the Contherm bearing housing as shown below. Leave this ring loose at this step. Install the lower coupling half to the Contherm drive shaft exactly as shown with coupling facing up.

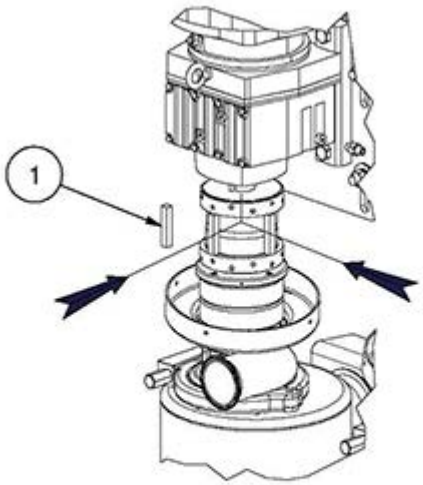


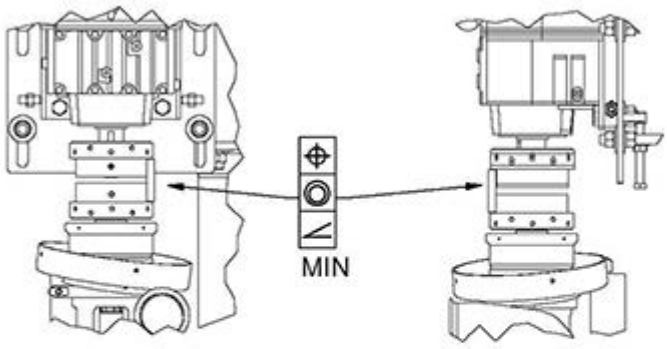


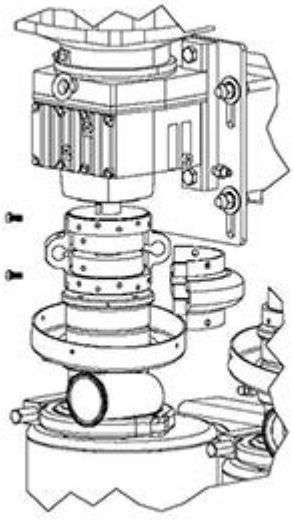
7. Install the motor onto the motor cross arm.
   - The motor and motor place should have already been preassembled.
   - Note orientation of motor couplings. Install the couplings exactly as shown below.
   - Use adjustment hardware (1,2,3,4) to position the motor so that the couplings are aligned.

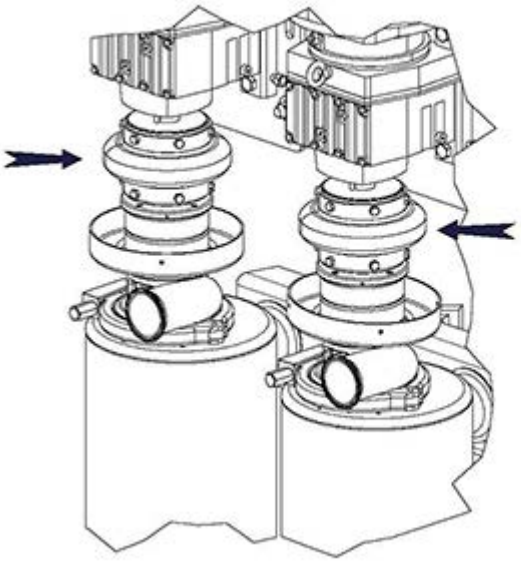


8. Align the drive motor to the Contherm shaft
   - Ensure the couplings are completely aligned via the use of a straight edge or laser shaft alignment device.
   - Use spacer provided (1) to ensure proper alignment.
   - Misalignment will cause premature wear to components. Key stock or a small combination square can be used to help align the coupling hubs.
   - Attach flexible elements with the hex bolts provided.

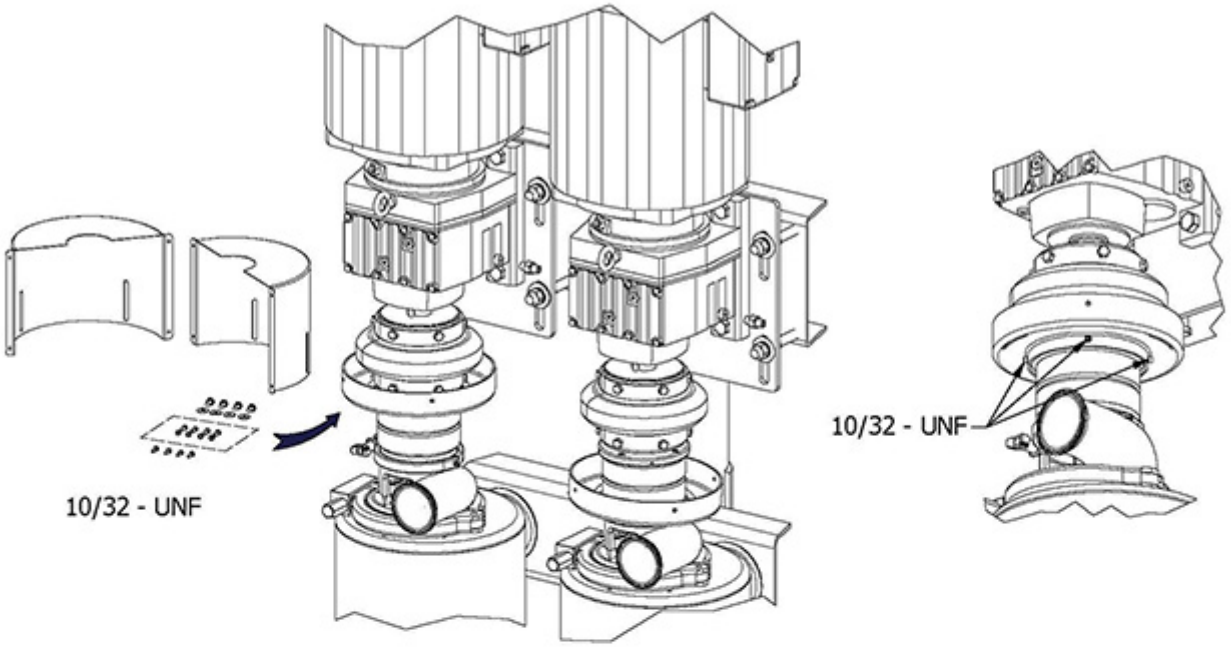


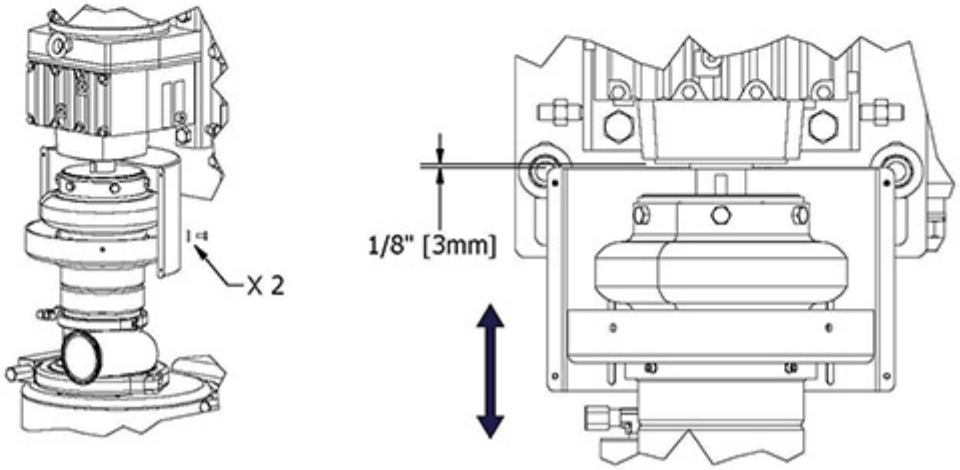


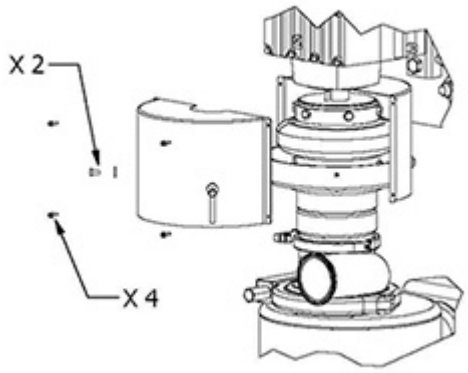


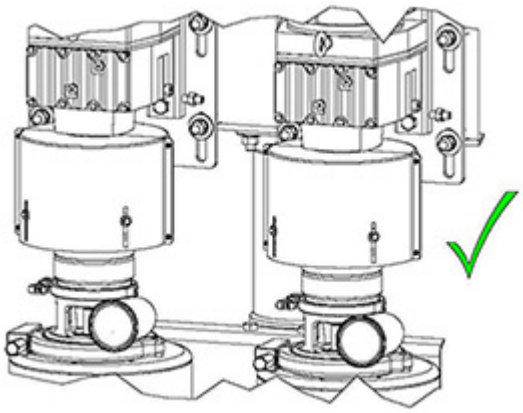


9. **Install the coupling guard components.**
   - Refer to section 6.5 for additional detail.
   - Secure the plastic ring to the bearing housing top plate with the 4 socket head cap screws.

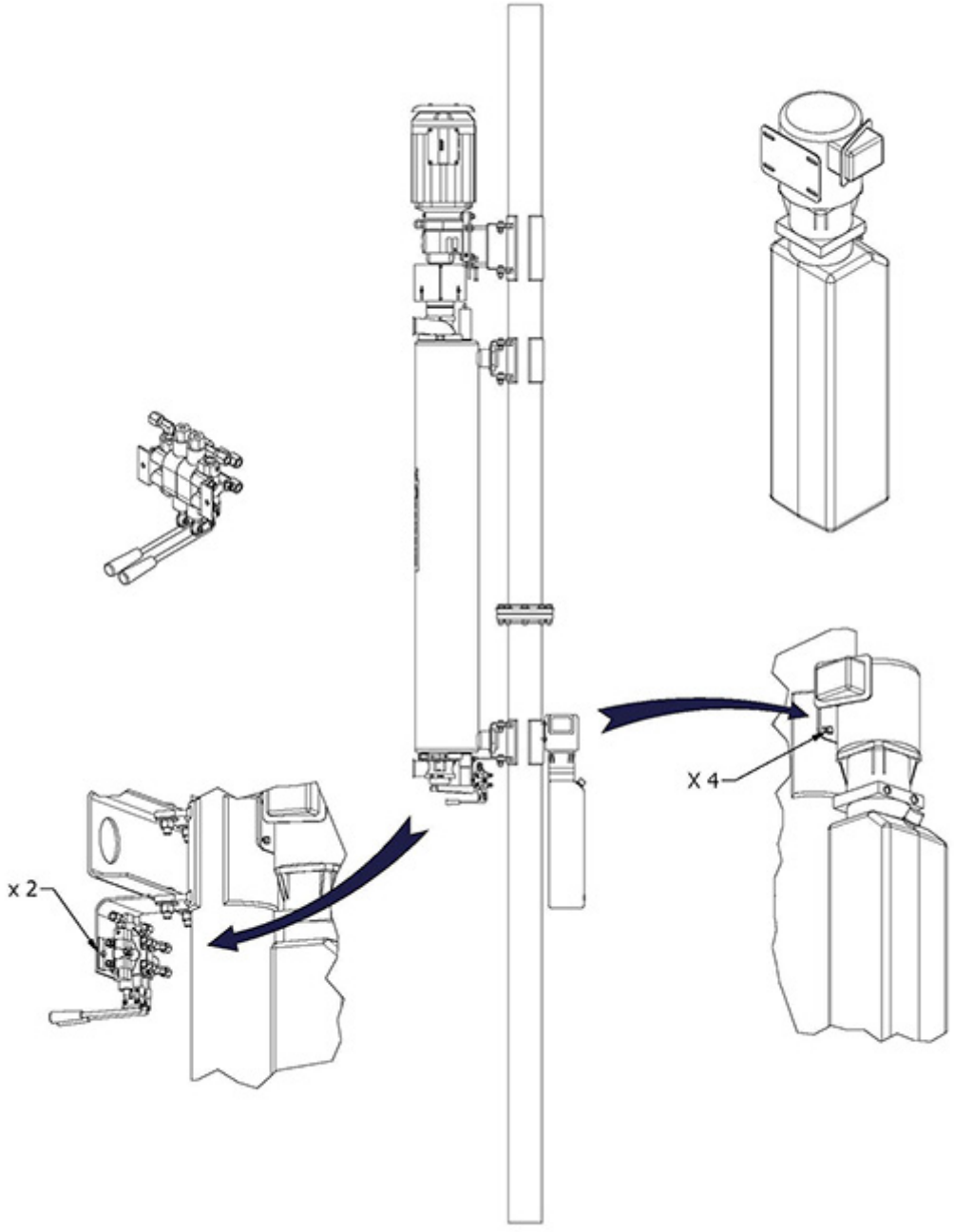





X 2
X 4

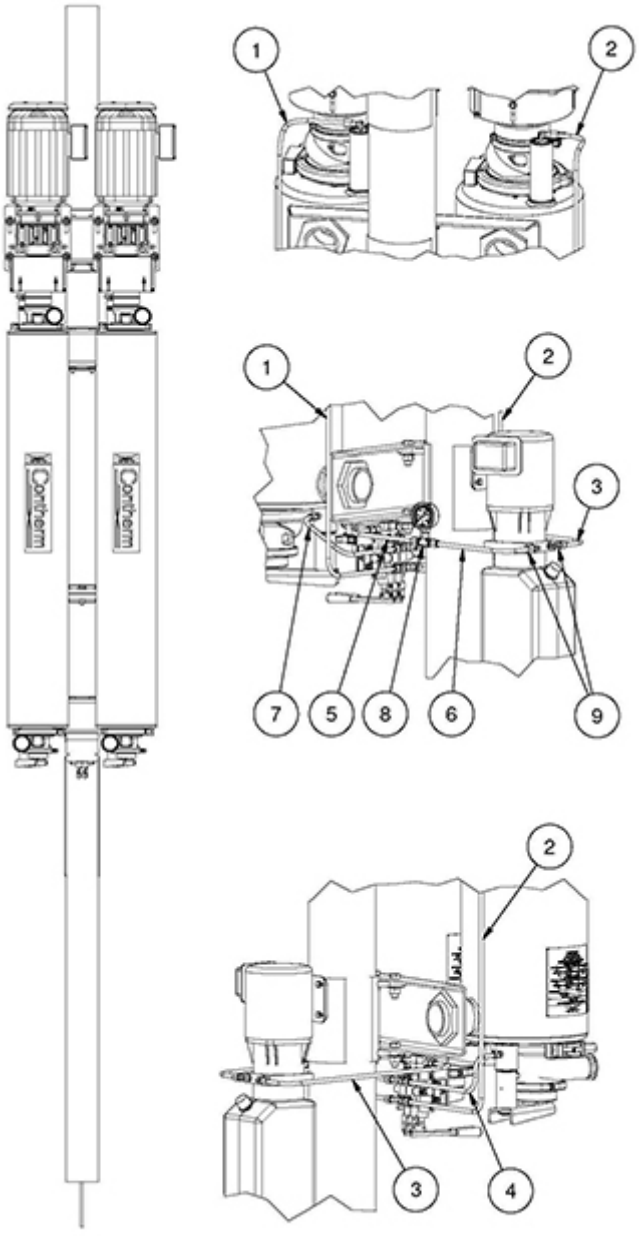


10. Install the hydraulic lift pump and stack valve components.

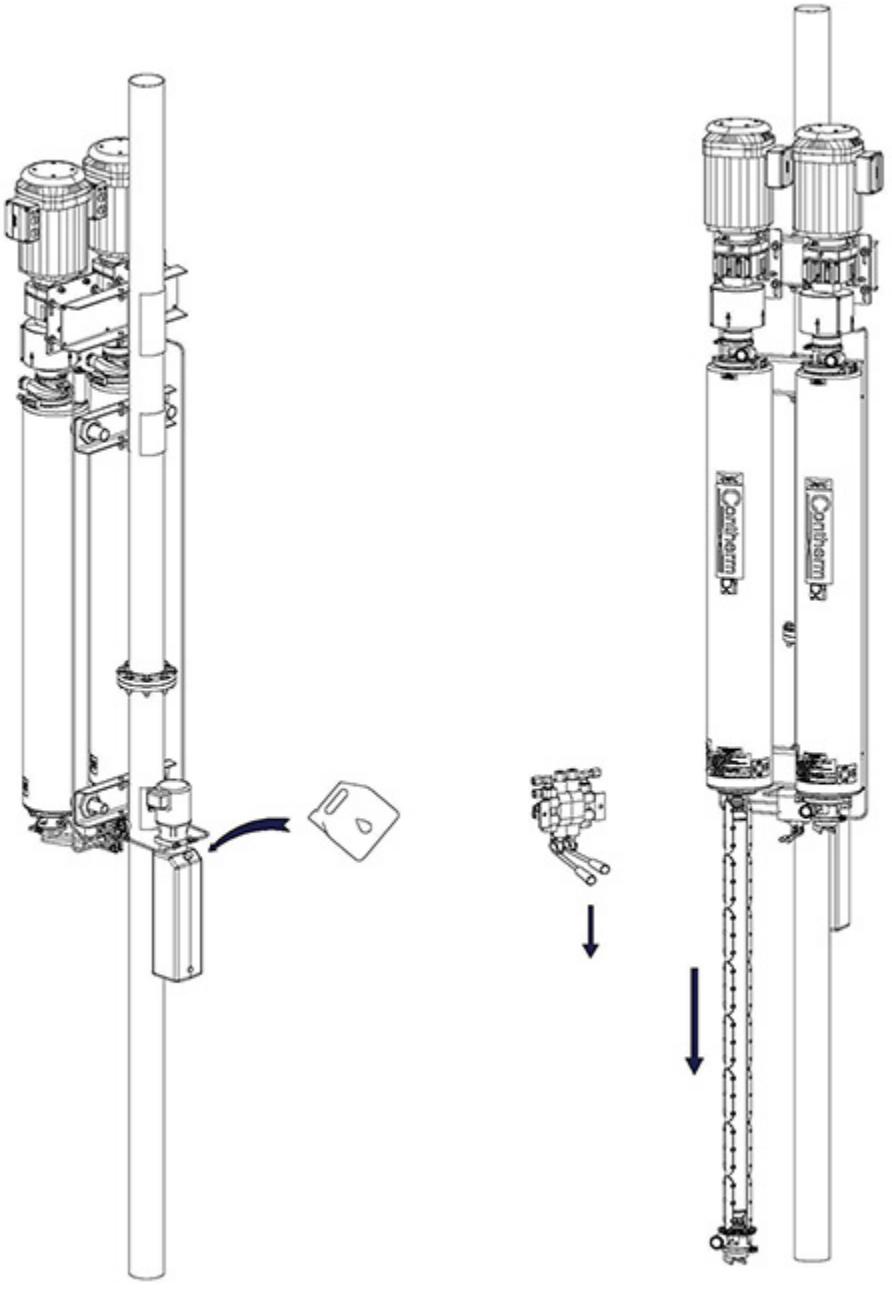


11. **Install the hydraulic tubing**
    - Refer to section 6.7 for proper installation of hydraulic lifting system components

1	Oil return from piston 2
2	Oil return from piston 1
3	Oil return to pump from stack valve
4	Oil supply to piston 1
5	Oil supply to stack valve
6	Oil supply from pump
7	Oil supply to piston 2
8	Pressure gauge



12. Fill hydraulic pump reservoir and test hydraulics
- Refer to table 6-10 for installation instructions and proper oil specification.
- You are now ready to operate your Contherm equipment.
- Make sure rotor raises and lowers in the same direction as the stack valve handle.



Tools

Text to be added/modified

Available Tools to Assist in Inspection and Maintenance

Component	Part Number (P/N)	Description
Helper Plate 	7401322-04 (5” Rotors) 7401322-03 (4.0" to 4.5" Rotors) 7401322-02 (3” Rotors) 7401322-01 (2” Rotors)	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 Contherms™ Rotor Lift Helper Plate is provided in Table 7-5.
Seal Pin Jig 	7404621-01 (2” Spline) 7404621-02 (1,5” Spline) CO6606-01 (Special seal pin Heating) CO6607-01 (Special seal pin Cooling)	Used to allow customer to perform on-site maintenance with accuracy. Allows for proper drilling of seal pin hole in rotor when previous seal pin reaches end of life.
Inboard Bearing 	CO6512-01	Simple method to gauge if the inboard bearing has reached its end of life.
Rotor Removal 	CO6488-01	Allows for more ergonomic positioning when lifting a rotor in its vertical orientation either into or out of the Contherm™ head and cylinder assembly.
Blade Thickness Gauge 	7404481-01	Allows for more instant assessment if scraping blades have reached their end of life.

13 Appendix D: Contherm Cylinder Capacity

SCN, STAGGERED, ALFALON II BLADES
2-INCH TANGENTIAL HEADS COILED CYLINDER

Model	Capacity	3-in. Rotor (76-mm)	4-in. Rotor (102-mm)	4.5-in. Rotor (114-mm)	Media Annulus Capacity
6X3	US Gallon	2.5	2.1	1.9	0.5
	Liter	9.4	7.9	7.0	2.0
6X6	US Gallon	4.8	3.8	2.3	1.0
	Liter	18.1	14.8	8.8	4.0
6X9	US Gallon	6.7	4.7	2.8	1.6
	Liter	25.3	18.0	10.7	6.0
6X11	US Gallon	7.5	5.3	4.0	1.8
	Liter	28.7	20.3	15.3	6.9

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)	Media Annulus Capacity
6X3	US Gallon	2.4	2.0	1.8	0.5
	Liter	9.1	7.6	6.7	2.0
6X6	US Gallon	4.6	3.6	2.0	1.0
	Liter	17.3	13.7	7.6	4.0
6X9	US Gallon	6.5	4.5	2.6	1.6
	Liter	24.8	17.2	9.9	6.0
6X11	US Gallon	7.4	5.2	3.8	1.8
	Liter	28.3	19.7	14.5	6.9

Note: Add 20% additional volume for HIPEX cylinder media capacity values stated above.

How to contact Alfa Laval
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