4.3 Product Feed and Discharge Requirements

Introduction

This section describes auxiliary process equipment and connection recommendations.

Strainer

A strainer is recommended for the suction line of each pump to protect the pump and contactor from foreign particles. Perforations should not be larger than 0.10 cm (0.045 inch) in diameter (20 mesh).

Pumps

Pumps should provide design volume at pressures developed in Section 3.4.

Valves

Manual or automatic flow control valves are required, in addition to a pressure control valve on the light liquid out (LLO) port.

Pipes and Connections

The contactor and any accessories should be connected in accordance with good pipe-fitting practices. Considerations include:

- Pipe sizes should be based on reasonable pressure-drop considerations rather than on the size of connections on the equipment.
- For chemical service, flanged or welded connections are recommended, although threaded connections may be satisfactory for some applications.
- Pipes must be rigidly anchored where connected to flexible connectors. Do not anchor pipes to the contactor foundation or to concrete adjoining foundation. Greater vibration stresses will be transferred to the flexible connectors and piping.
- Provide axial and lateral pipe adjustment to align connectors.
- Install connectors in a straight line without offset, tension, compression, or torsion (especially Teflon-lined connectors).
- Discharge HLO piping into a tank vented to the atmosphere (HLO pressure will be essentially zero gauge pressure). If HLO line runs for an appreciable distance or into a tank under pressure, operation will be satisfactory if the pressure into which the line discharges is constant. However, all other operating pressures will increase by the same amount.

Disconnecting Piping

If disconnects are made frequently:

- Attach Teflon-faced protective spacers on flanges to protect Teflon flares.
- Place Teflon gaskets between Teflon faces and metal mating flanges.
- Arrange piping for easy access to all mechanical seals.

Piping must not interfere with lifting the upper contactor enclosure or allow air to be trapped in the rotor or seal housings.

Flexible Connectors

Flexible connectors tolerate little axial deflection and should be mounted with the axis of the connector at right angles to the contactor motion at the point of connection. Contactor motion is normally greatest in the vertical plane, calling for *horizontal* mounting of connectors. If periods of heavy vibration are anticipated, an additional *vertical* connector is suggested.

Install and support piping so as not to exert a strain or twist on pumps or other equipment. Flexible connectors are suggested to reduce strain on pumps and other equipment.

Model B-10 contactors rarely experience sufficient vibration amplitude to cause failure regardless of direction of connector mounting.

Model E-48 contactor, which can contain large volumes of liquids, can attain sufficient vibration amplitude to result in rapid failure of improperly installed connectors.

Torque on Flexible Connectors

- Tighten bolts in criss-cross pattern.
- Retorque flange bolts after one temperature cycle or 24 to 30 hours after installation.
- Greater torque will result in excessive cold-flow in Teflon-faced gaskets.
- Do not disconnect Teflon-lined connectors while hot; Teflon flares could distort.
- Torque flange bolts on flexible connectors to the values shown below.

Connector	Torque	
Nominal size in inches	N-m	lb-ft
1	0.40–0.50	9–12
2	0.63–84	15–20
3	1.13–1.51	27–36

Flush piping assembly and all accessories before connecting piping to the contactor. Check accessories for operation. Check piping assembly for leaks.

Section 5: Operation

5.1 Preoperational Checks

Before You Start Before starting the equipment ...

Step	Action
1	Flush piping, contactor, and accessories (page 5–2).
2	Sterilize contactor (page 5–2) if processing food or medicine.
3	Inspect belts for signs of wear.
4	Inspect seals for leaks.
5	Inspect pipes and flexible connections for leaks or damage.
6	Inspect anchor bolts and pads for looseness or damage.
	**Do not operate contactor if anchor bolts or pads are damaged. Contactor could break loose and cause injury.**
7	Inspect electrical connections, switches, and operating and warning lights for proper function.
8	Ensure all guards and safety devices are in place and secured.
	**Do not operate contactor if guards or safety devices are missing, damaged, or disabled.**

5.2 Rotor Flushing

Normal Flushing

Procedure for normal flushing:

Step	Action
1	Ensure connections are tight.
2	Remove ASCO plugs from rotor with supplied tool.
3 	Turn on bearing oilers; adjust to 8–10 drops/min. ***or*** Start recirculation lubricating system and adjust flow according to installation drawing.
4	Start rotor and adjust speed to 10–20 rpm.
5	Flush water through the HLI port, rotor, and drain port.
6	Turn off water supply.
7	Allow rotor to spin at low speed until drained.
8	Stop rotor.
9	Inspect plug gaskets; replace if damaged.
10	Reinstall ASCO plugs and tighten with supplied tool.
11	Wash 0.5 L (8 oz) of oil rapidly through each bearing to remove moisture.

Sterilization

If contactor is processing food or medical products, it must be sterilized before and after each product. Bacteria from residual materials could contaminate product. Follow cleaning practices specified by your company.

5.3 Start Up

Introduction

These instructions refer to the operation of a known system where water is the heavy liquid and kerosene the light liquid. Hexane, heptane, or similar solvents can be used instead of kerosene. Using the kerosene/water system helps the operator:

- Become familiar with the equipment
- Gain experience
- Check the extraction system for leaks
- Verify that feed systems are operating properly

Operator must follow standard operating procedures and observe safety standards for protective clothing and equipment operation.

Stop all equipment before servicing.

Refer to your company's process data sheet for speed, pressure, temperature, and feed requirements.

Starting

Refer to Figure 3-1 and instructions below.

Step	Action
1	Open rotor cover. Check that cleanout and drain plugs are tight. Spin the rotor by hand; it should turn freely.
2	Remove one ASCO tube from rotor rim and position the opening at the top of the rotor.
3	Close LLI and LLO lines.
	**The rotor must be filled with a uniform-density fluid at start-up. If it is half-filled with air or a fluid of nonuniform density, the drive could overload or excessive vibration could result from the imbalance.**
4	Fill rotor with heavy liquid to displace the air.
5	Securely replace ASCO tube. Heavy liquid will now discharge through the open HLO line.
	**Do not start rotor without fluid flow lubricating the seals.**
6	Close and securely lock rotor cover.
7	Set heavy liquid flow at about 20 L/min (5 gpm).
8	Turn on cooling water to fluid drive. Adjust flow as shown below.

Model	Start Up Flow	
	L/min	gpm
B-10	20	5
D-18, D-36	60	15
E-48	80	20

9	Ensure that the speed control dip tube of the fluid drive is in the "no-load" or zero-speed position.
10 	Turn on bearing oilers; adjust to 8–10 drops/min. ***or*** Start recirculation lubricating system and adjust flow according to installation drawing.
11	Start drive motor and gradually increase speed by raising dip tube. Do not exceed maximum current specified on the drive motor nameplate. A 10% overload is allowed during start up. The rotor will begin to turn slowly as full current is applied. As the rotor accelerates, current will drop. Continue accelerating the rotor by raising the dip tube to maintain maximum current until the contactor reaches the operating speed requested on the plant engineering process sheet. At normal operating speed, the current will drop significantly.
12	Reduce cooling water flow to fluid drive to approximately 2 L/min (0.5 gpm) to keep oil temperature below 75°C (160°F).
13	Open LLI and LLO lines. Start light liquid flowing at approximately 20 L/min (5 gpm). LLI pressure will rise, and flow of heavy liquid effluent will increase as the rotor contents are displaced by light liquid.
	Note the increase in LLO pressure compared to LLI pressure. During start up, maintain LLO pressure at 50% of LLI pressure. Light liquid might be entrained with heavy liquid or heavy liquid entrained with light liquid during start up. This problem should disappear as operation continues; the time will vary with the type of materials being processed. If the problem does not disappear, it must be corrected. ◦ To eliminate heavy liquid from LLO, increase LLO pressure. ◦ To eliminate light liquid in HLO, reduce LLO pressure.
14	When both streams are clear and LLI and LLO pressures have stabilized, gradually increase flow rates of both streams to the values shown on the process data sheet.

5.4 Shutdown

Normal Shutdown Procedure for normal shutdown:

Step	Action
1	Stop LLI flow but keep HLI flowing.
2	Reduce LLO pressure and rotor speed to displace light liquid from rotor. Clear, heavy liquid will flow from the LLO port when displacement is complete.
3	Reduce rotor speed after the light liquid has been displaced by moving drive speed control to minimum.
4	Stop the drive motor.
5	Turn off cooling water.
6	Turn off bearing oilers and HLI flow when rotor stops.
7	Stop all other operations directly associated with the system.

Alternate Shutdown If properly set up, the fluid drive can brake the rotor using the procedure below:

Step	Action
1	Increase water flow to the oil cooler to keep the oil temperature below 75°C (160°F).
2	Move speed control to zero. Turn off the drive motor.
3	Allow the motor to slow down. (It will not stop immediately because of drag in the fluid drive.)
4	Restart motor in the reverse direction.
5	Increase drive speed until full-load current is reached (by raising the dip tube) to the high-speed position.
6	Adjust speed control to maintain full-load current.
	The current could increase as the rotor slows. If so, turn the speed control toward the minimum position.
7	Turn off the motor and cooling water to the fluid drive when rotor stops.
8	Turn off bearing oilers and the HLI flow to the contactor.
9	Stop all other operations directly associated with the system.

Section 6: Maintenance

6.1 General Information

Introduction

Important aspects of preventive maintenance include:

- Proper lubrication
- Regular inspection

This section covers lubrication, regular maintenance, and cleaning and storage procedures.

Regular Maintenance

Perform maintenance as indicated.

Frequency	Action
Daily	Check poly-V-belt tension and condition.
Quarterly	Change oil filter on Model E contactors.
Annually	Change oil on Model E contactors.

6.2 Lubrication

Introduction

Lubrication procedures depend on the model, as outlined below.

Model B and D Series

Model B and D contactors have drip-type oilers with a valve to adjust oil flow. Oil enters at the top outboard side of each bearing and exits the bottom inboard side. This transverse flow of oil provides excellent lubrication.

Lubrication oil recommendations:

- High-grade
- Rust- and oxidation-inhibiting
- Viscosity range of 300–315 SSU at 38°C (100°F)
- Minimum viscosity of 60–70 SSU at
- When operating above 100°C (210°F), viscosity of at least 60 SSU at operating temperature
- Never reuse oil; clean, uncontaminated oil is essential

Special operating conditions (low ambient temperature, high process temperature, mist lubrication, etc.) might require lubricant with a different viscosity range. Consult local suppliers or B&P for specific recommendations.

B&P recommends drip lubrication for these models but can furnish an oil-mist system on request. Recommendations for oiler operation:

- Adjust drip rate to 8 to 10 drops per minute using the knob and lever
- Move lever to horizontal position to turn on oil after adjusting rate
- Confirm oil flow at sight glass at bottom of oiler
- Verify oil flow regularly

If equipment has been shut down for awhile, turn the rotor after the oilers are turned on and before starting the equipment. This ensures bearings are covered with an oil film and prevents flat spots on the bearing races.

Model E Series

This series provides a recirculating lubrication system complete with explosion-proof motor. Oil is supplied to the bearings through holes in the top center of the outer race. Oil flows outwards in both directions—providing thorough lubrication to the contact areas—and returns to the sump.

Lubrication oil recommendations:

- Heavy-duty, industrial grade oil
- Rust- and oxidation-inhibiting
- Viscosity should be 570 SSU at 38°C (100°F) and 66 SSU at 100°C (210°F)
- For operating above 100°C (210°F), viscosity of at least 60 SSU at operating temperature

Special operating conditions (low ambient or high process temperature) might require lubricant with different viscosity range.

Refer to lubrication system drawing for recommended oil flows to each bearing. Other operating recommendations for operation include:

- Verify oil flow regularly using sight glass on return line
- Inspect oil filter 1 to 2 weeks after start up, then every 3 to 6 months, based on experience
- Examine or analyze oil for contaminants and impurities periodically

If equipment has been shut down for awhile, turn the rotor after the lubrication system is turned on. This ensures bearings are covered with an oil film and prevents flat spots on the bearing races.

6.3 Poly-V-Belt Adjustment

Introduction

Proper installation and adjustment of the poly-V-belt connecting the fluid drive and contactor is essential.

Installation

Do not force poly-V-belt over the sheave. Slack off drive to install belt.

Be sure fluid drive and contactor shafts are parallel and sheaves are aligned. When operating, both the tight and slack side of the belt should be in a straight line from sheave to sheave, with no sag or bow. Recheck after 8 hours of operation.

Belt Tension

Belt tension is very important. To check tension:

Step	Action
1	Put straightedge on belt above both sheaves, parallel to the direction the belt runs.
2	Using a belt tension gauge, press on belt halfway between the sheaves with the listed amount of force.
3	Measure the deflection from the straightedge.
4	Recheck tension after 8 hours of operation. Recheck periodically for slippage and proper tension.

Tension Specifications

Specifications are shown below:

Model	Force		Deflection	
	Newtons	Pounds	Centimeters	Inches
B-10	2.1–3.5	15–25	1.27	0.5
D-18 and D-36	2.1–3.5	15–25	1.91	0.75
E-48	6.9–10.4	50–75	2.54	1.0

Belt Condition

- Do not use a belt dressing.
- Do not allow oil or grease to accumulate on the belt.
- Clean belt as necessary with a cloth dampened with an appropriate solvent.

6.4 Storage

Introduction

It is impossible to guarantee contactors and drive motors protection against rust damage in storage. However, few problems have been reported when equipment is maintained as described below, and compliance with these procedures will preserve the warranty.

Storage

Unpack and store contactors and drive motors in heated surroundings.

Contactors

At a minimum:

Step	Action
1	Plug bearing drain lines (or tie tubing above bearing level) and flood bearings with a viscous rust-inhibiting oil.
2	Turn rotors 1½ or 2½ turns at least monthly (more often in humid climates). Rust-inhibiting oil should be replaced periodically.
3	Flush oil from bearings before returning to operation by passing copious amounts of normal lubricant through the bearings (with drain lines open) while slowly turning the rotor.

Drives

To protect drive motors:

Step	Action
1	Liberally grease outer bearings and fill casing with proper oil up to the shaft level. ***or*** Connect to the electrical supply and return to operation in the normal way. If the first method is used, special attention must be given when equipment is returned to operation.
2	Drain oil, clean reservoir, and add proper oil to the level specified in the drive manual.
3	Remove grease plugs temporarily when first operating the drive to allow excess grease to flow out.

6.5 Major Cleaning

Introduction

Several cleaning methods are available depending on the degree of solids accumulation. Determine the best cleaning procedure for a specific system by experimentation.

- For routine water cleaning see Section 5.2.
- For sterilization see Section 5.2.

Typical Cleaning

For normal cleaning:

Step	Action
1	Pump a large volume of water through the rotor, turning the rotor by hand periodically.
2	Flush for 5 to 10 minutes.
3	Stop water flow and remove ASCO tubes from rotor circumference.
4	Inspect contactor interior.
5	If solids are still present, close rotor enclosure and secure (do not replace the ASCO tubes).
6	Restart water flow through HLI port (or LLO if possible) at the highest rate possible (water will flow out ASCO tube openings).
7	Allow drive to turn rotor slowly (approximately 10 rpm). Water will scrub the surfaces of the elements.
8	Allow 0.1 to 0.2 liters (2 to 4 oz) of oil to flow through the bearings after flushing is complete to remove moisture accumulated during cleaning.

Solvent Cleaning

If solids remain in the rotor after water flushing, clean with a suitable organic solvent. Suitable solvents must be known through experience or determined by experiment. A suitable solvent must dissolve the solids, but be compatible with O-rings in the system.

If a suitable solvent is found, schedule periodic cleaning by recirculation in a closed system.

Acid Cleaning

If organic solvents are ineffective, consider using an inhibited sulfuric or nitric acid wash (laboratory work will indicate suitability).

Step	Action
1	Pour acid or cleaning solution into the rotor (⅛ to ¼ of the rotor volume) through one of the ASCO tubes.
2	Remove a second ASCO tube as an air vent.
3	Close all liquid inlets and outlets.
4	After acid or cleaning solution has been added to the rotor, replace ASCO tubes and turn the rotor slowly (10 to 20 rpm).
5	When solids are loosened or dissolved, drain acid completely, neutralize, and wash with water to remove last traces of acid and solids.
6	Check periodically to determine the effectiveness and extent of cleaning.

High-Pressure Cleaning

If deposits remain despite the methods above, try a high-pressure cleaning lance.

Step	Action
1	Loosen deposits with water from the right-angle spray head of the high-pressure lance.
2	Use the lance in one ASCO hole at a time. Rotate 360°, moving up from shaft to rim.
3	Clean adjacent ASCO holes until all have been cleared.
4	Flush with additional water.

For Extreme Cases

For plugging that cannot be removed by the methods above:

- Remove left-hand rotor plate to access the interior for inspection and cleaning.
- Have a B&P representative present the first time rotor is opened.

Section 7: Disassembly and Reassembly Procedures

7.1 Rotor

Introduction

It is good practice to check the rotor for possible runout with a dial indicator before removing it from the base. Machined surfaces at either end of the rotor on the periphery have been provided for this purpose. Excessive runout might call for corrective measures.

Always drain the rotor before removing it from base.

Rotor Weights

Two hoists with cables or straps are required to remove the rotor. Rotor weights for various contactor models follow:

Model	Empty Weight	
	Kilograms	Pounds
B-10	410	900
D-18	1270	2,800
D-36	1770	3,900
E-48	4660	10,250

Removal

To remove rotor:

Step	Action
1	Fabricate shaft protector (Figure 7-1) and lifting collar (Figure 7-2) or acquire from B&P. Construct pedestal from lumber (Figure 7-3). Shaft protectors are made from pipe welded to a lock nut. Ensure pipe is long enough to protect the small seal shaft from damage.
2	Remove seal housings and seal housing brackets along with V-belt. (Section 7.11).
3	Install shaft protectors on both ends of rotor shaft.
4	Raise rotor cover and secure for safety.
5	Remove cap screws securing base cap to base and remove base caps.

Removal,

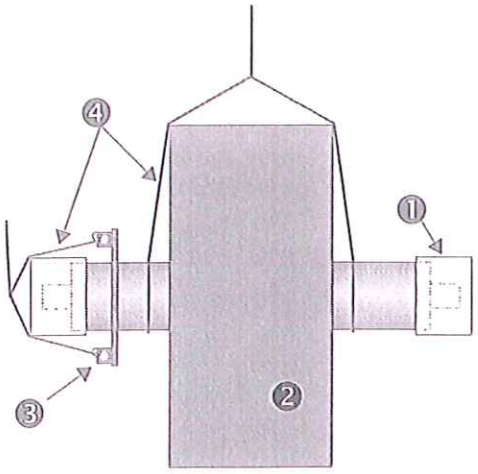


Figure 7-1 Shaft Protectors and Lifting Cables

① Shaft protectors
② Rotor assembly
③ Lifting collar
④ Lifting cable or strap

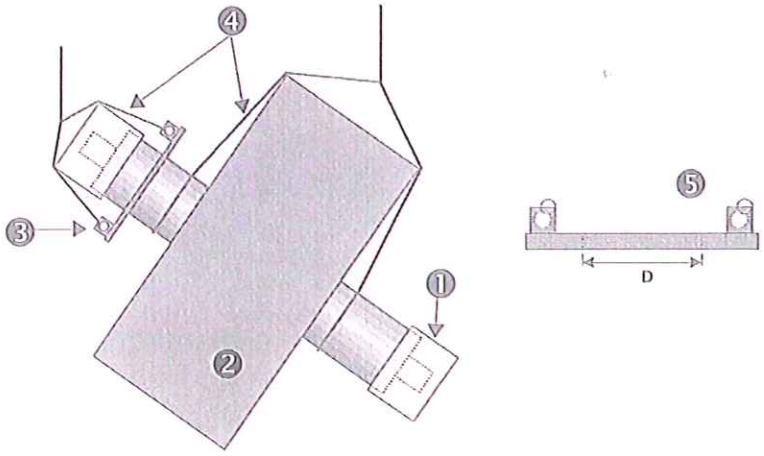
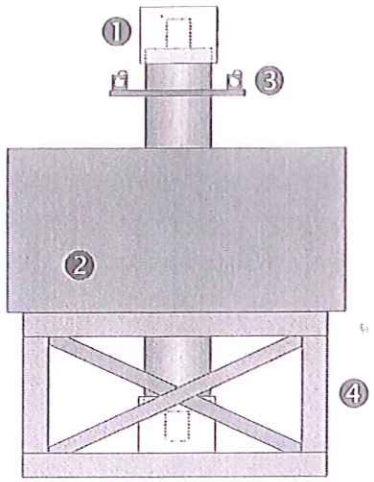


Figure 7-2 Lifting Collar

① Shaft protectors
② Rotor assembly
③ Lifting collar
④ Lifting cable or strap
⑤ Lifting collar (enlarged)
D Typical diameter
B-10 = 8.25 cm (3¼ in.) ID
D-8/36 = 13.35 cm (5¼ in.) ID
E-48 = 20.64 cm (8⅛ in.) ID

6	Put straps or wire cable in place on both sides of rotor between rotor side plate and bolting ring (Figure 7-1).
!	If cable is used to remove rotor from base, place a protective pad under the cable to prevent the shaft from being scored.

7	Lift rotor assembly from base assembly.
8	Lower rotor to floor. Keep cables and straps in place and connected to hoist.
9	Remove shaft protectors.
10	Remove bearings (Section 7.9 and 7.10).
11	Install lifting collar (Figure 7-2).
12	Reinstall shaft protectors.
13	Connect additional cables and hoist to lifting collar (Figure 7-2).
14	Lift rotor until shaft is vertical.
15	Put rotor on pedestal (Figure 7-3).
	 *Figure 7-3 Storage Pedestal* ① Shaft protectors ② Rotor assembly ③ Lifting collar ④ Pedestal
16	Remove cables.

Installation

To install rotor:

Step	Action
1	Clean the base and bearing caps. Repair any damage. Measure the bores to ensure correct fit with bearing capsules. Replace all worn mounting pads under the feet of the base.
2	Install lifting collar on rotor shaft (Figure 7-3).
3	Install shaft protectors on both ends of rotor shaft (Figure 7-3).
	For description and dimensions of lifting collar and shaft protectors, see the removal portion of this section.

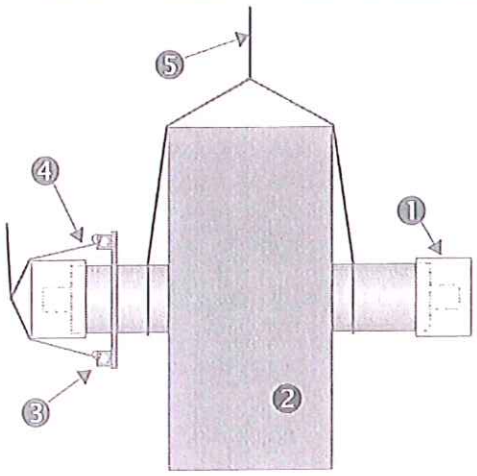
4	Attach straps or wire cables from one hoist to lifting collar (Figure 7-4).
5	Attach straps or wire cables from second hoist on both sides of the rotor between the rotor side plate and bolting ring (Figure 7-4).
!	If cable is used to remove rotor from base, place protective pad under the cable to prevent shaft from being scored.
6	Lift rotor off pedestal and place it on the floor (shaft in a horizontal position, Figure 7-4).
7	Remove shaft protectors and lifting collar.
8	Install bearings and seals (Sections 7.9 or 7.10 and 7.11).
9	Reinstall shaft protectors.
10	Lift rotor and carefully lower it into base.
!	Line up oil holes in bearing capsules with oil holes in base. Bearings will be oil-starved and fail if misaligned.
11	Install locking-end drive base cap first, tightening cap screws to 1.25 to 1.68 N-m (30 to 40 lb-ft). Draw up bolting ring before assembling floating-end base cap to properly orient rotor in base.
12	Turn rotor by hand after oiling bearings and checking that bearings run freely and are aligned properly. Again, use dial indicator to check rotor for excessive runout.
	

Figure 7-4 Lifting Rotor

① Shaft protector ② Rotor assembly ③ Lifting collar
④ Straps or cables from first hoist ⑤ Straps or cables from second hoist

13	Lower rotor cover.
14	Remove shaft protectors.

15	Install seal housings and seal brackets along with V-belt (Section 7.11).
16	Check balance. (Rotor might be balanced if all components are in original locations.) For a quick check: ◦ Turn on oilers or oil system ◦ Turn rotor several times manually; allow to coast to stop. ◦ Rebalance is needed if rotor stops in same location each time.