KĀDANT

FLUID HANDLING

Thermal Oil Rotary Joints

General Usage Guidelines

Guidelines for handling, installing, and operating thermal oil rotary joints

General Guidelines

Please follow your company's safety procedures when working on Kadant Johnson rotary joints and read all instructions before proceeding.

Refer to the assembly drawings supplied with your Kadant Johnson rotary joint for part identification. Assembly drawings are available upon request. If you have any questions, please contact Kadant Johnson.

The SX® and ELSX™ rotary joints should be run dry for a minimum of five minutes after installation, before introducing thermal oil into the rotary joint.

It is recommended that any thermal oil (hot oil) rotary joint that is leaking due to material deposits or has worn seal rings be sent to Kadant Johnson for repair and rebuild. This will ensure leak-free operation when installed properly.

Handling Thermal Oil Rotary Joints

Thermal oil rotary joints should be handled with care. The rotary joint must not be bumped, dropped, or otherwise subjected to any shock that may cause internal damage or separate the sealing surfaces.

Rotary joint assemblies must be stored inside a clean environment. All inlet and outlet connections, including the nipple, must be sealed off against contaminants while in storage. This will prevent debris from building up inside the rotary joint which could cause a leak at startup.

Rotary joint assemblies should never be positioned upright on the end of the nipple. Instead, store the rotary joint assembly on its side or on the inlet connection, as shown in Figure 1 below.

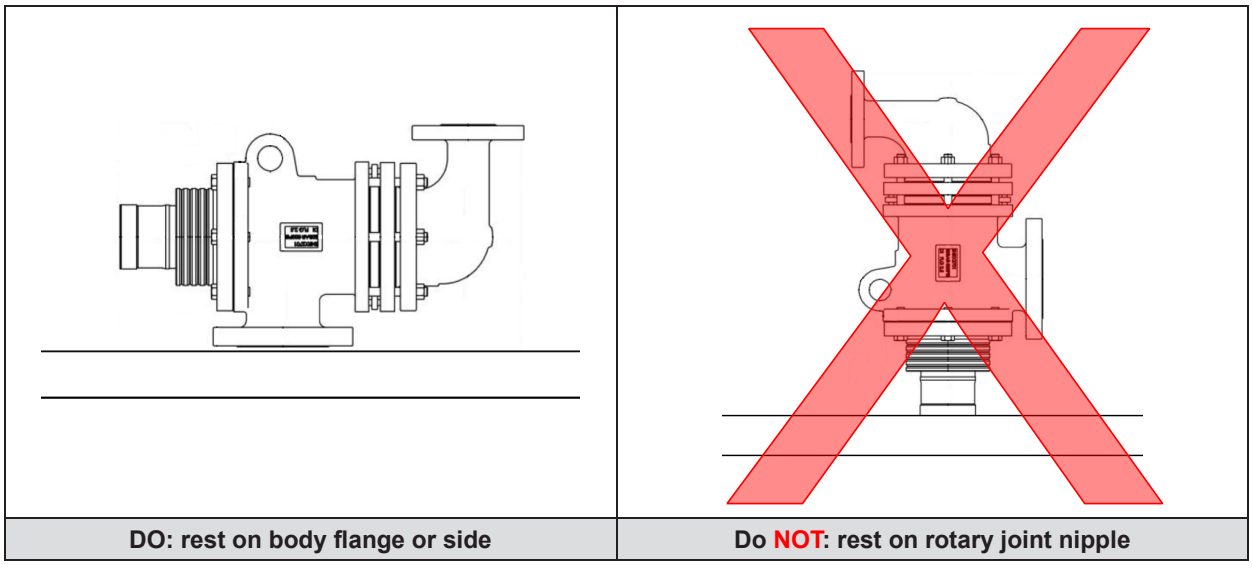


Figure 1 – Proper positioning of a rotary joint for storage

Sealing Technology

Pressure and temperature are the two main operating conditions that will dictate the type of mechanical seal used. Balanced seals excel at all pressures, while pressure-type seals have a minimum pressure that must be maintained to provide adequate sealing. More information about balance and pressure seals is provided below.

Balanced Seals

Balanced seals, like those found in the RX® rotary joint perform well at all pressures because the seal pressure does not change significantly with changes in fluid pressure. They require precise alignment, which is controlled using rolling elemental bearings. Because the balanced seals use rolling elemental bearings, they cannot operate at as high of a temperature as the pressure-type rotary joints. It is recommended to run these in a reverse flow configuration and limit dry-running at high-speed. Grease lubrication schedules must be followed while ensuring the appropriate grease is used.

Pressure Seals

Pressure seals, like those found in the SX™ and ELSX™ rotary joint, are not well suited for pressure applications below 30 psi because they rely on the fluid pressure to generate pressure on the seal face. It is recommended to dry-run the rotary joints for a minimum of five minutes before introducing the flow of thermal transfer oil. For applications above 500°F, a nitrogen blanket is recommended to prevent coke from building up around the dry guide. If left unattended for long enough, this coke buildup may cause the rotary joint to lock, which can cause severe damage to equipment.

Note: Do NOT pressurize the system while dry-running rotary joints.

Shut-down Considerations

When the system is shut down and/or allowed to cool, special care must be taken to not allow a vacuum to form in the system. A vacuum in the system could allow the sealing interface to separate, creating a leak path. Once oil is present between the seal faces, it will not successfully re-seal itself. Vacuum conditions can be the result of valving off the inlet and outlet of the rotary joint before the system is allowed to cool.

Oil Quality

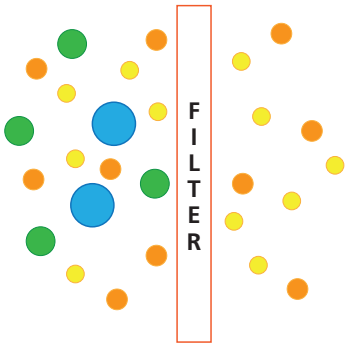
Oil systems design, filtration, and oil life are the main focus areas to maintain optimal oil quality.

Oil System

A common oversight in oil systems is not having an appropriate expansion tank, either with an isolation leg or a nitrogen pad. The isolation leg should allow the expansion tank to stay at a temperature below 140°F. If an inert gas such as nitrogen is used, the expansion tank can be kept closer to the system and at operating temperature. Additionally, it is important that the oil is rated for the maximum temperature that it is exposed to in the heater and not just the system set point. For a comprehensive review of the oil system, it is recommended to consult your oil supplier.

Filtration

Filtration during operation is just as important as filtration before a new installation or system modification. Over time, thermal transfer oils degrade by thermal cracking and oxidation. The by-product of this degradation is carbon build-up in the form of sludge and coke. These products will collect in areas inside the rotary joint and migrate to the sealing interface, causing premature failure. In addition, these products can degrade the performance of the entire system, resulting in lower heat transfer efficiency. Kadant Johnson recommends that oil be filtered to 60 microns or smaller with dual parallel filtration as close to the inlet of the rotary joint as possible. It is recommended to monitor the filters by monitoring the pressure drop across the element.



60 Micron Max.
Figure 6

In a new system, or after a new modification, it is recommended to circulate the thermal oil system. Preferably by flushing fluid through a filter (Figure 6) while bypassing the rotary joint to remove contaminants before start-up.

Oil Life

There are several items, in addition to filtration, that can prolong the service of a thermal oil system. Consult your thermal transfer oil supplier for the proper recommendations. A good way to monitor the system is by sending routine samples of the thermal transfer oil for analysis.

Temperature		Cleaning and Inspection Interval
°F	°C	
100° - 300°	38° - 149°	Every 12 months
301° - 450°	150° - 232°	Every 6 months
451° - 650°	233° - 343°	Every 3 months

Table 3, Proper cleaning and inspection intervals

If routine analysis of the oil is not performed, Kadant Johnson recommends the thermal oil system be cleaned and evaluated periodically, depending on operating conditions. Even well-filtered and maintained systems will require inspection and cleaning. See Table 3 for a recommended cleaning schedule based on operating temperature. A nitrogen pad on the front of the rotary joint can help prevent excessive coke buildup externally due to small amounts of leakage.

Installation

Piping

Self-supported rotary joints will always have some amount of movement during operation. The piping must be flexible and allow the movement to occur without creating excessive loads on the rotary joint which can lead to leakage and premature failure (Figure 2, below). The best way to minimize excessive pipe loading is to use a recommended flex hose configuration. The preferred flex hose installation consists of two flex hoses installed perpendicular (90°) to each other. Other flex hose configurations that may be used consist of a single long flex hose installed with a bend. Care must be taken not to bend the flex hose tighter than the recommended bend radius.

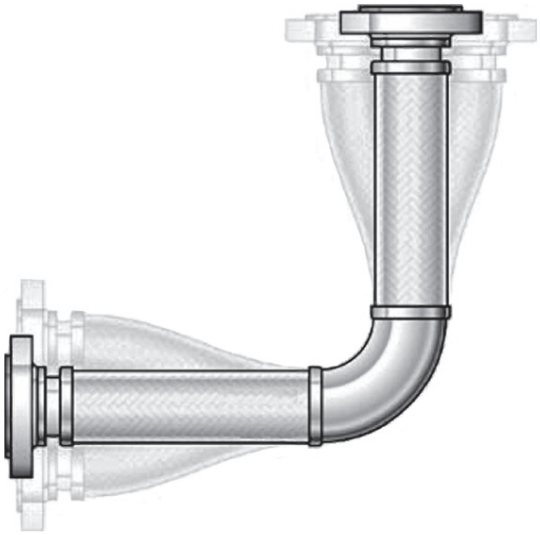


Figure 2 - Compound hose piping movement

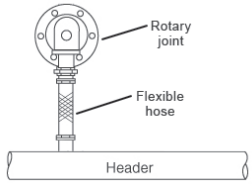
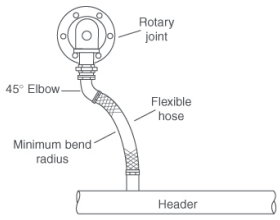
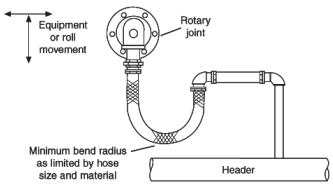
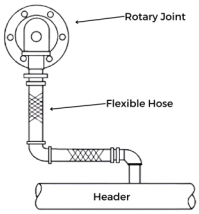
			
Not Recommended	**Good**	**Better**	**Best**

Table 1 - Piping recommendations

Installation

Anti-Rotation Rods

All self-supported rotary joints require an anti-rotation rod. The three main functions are to prevent the body of the rotary joint from turning, minimize stress on the flex hose piping, and allow radial and axial movement of the rotary joint body. Properly sized anti-rotation rods should be installed in the lug hole located on the body of the rotary joint. The lug hole should be in good condition and not be damaged or worn. Rotary joints that operate above 200 psi (13 bar) should use a solid bar, rather than a pipe. Kadant Johnson does not recommend using a threaded rod for an anti-rotation rod. Threaded rods act like a file and will damage the lug hole. Refer to the rotary joint drawing for anti-rotation rod size requirements or contact Kadant Johnson.

The most common method of anti-rotation is to link two adjacent rotary joints together. When using this method, the rod must be allowed to float within the lugs of the rotary joint body. This is often not possible in thermal oil applications due to the following requirements for this method:

- To link two adjacent rotary joints, they must rotate in the same direction. Never link counter-rotating rotary joints with the same anti-rotation rod
- The distance between centerlines must be a minimum of two feet (0.6 m) to minimize the reaction force

Correct		
Not Recommended		

Table 2 – Correct and incorrect anti-rotation rod placement

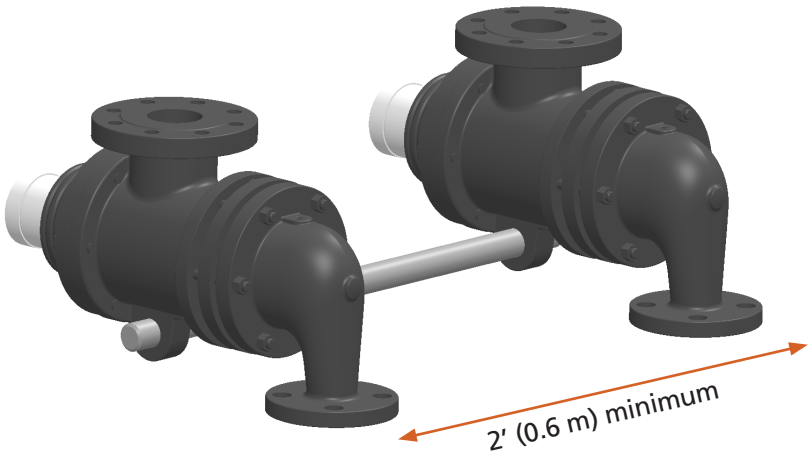


Figure 3 – Minimum anti-rotation rod placement

Installation

Kadant Johnson recommends using an individual anti-rotation rod per rotary joint. There are additional considerations when using one anti-rotation rod:

- The rod should be secured to the lug of the rotary joint while allowing the other end to float along a ridged frame
- The center of the rotary joint to the center of the frame must be a minimum of two feet (0.6 m) apart
- For clockwise rotation, install the rod to the right of the rotary joint. For counterclockwise rotation, install the rod to the left of the rotary joint. If the rotary joint rotates in both directions, the rod will need to be secured in a slot. The slot must prevent rotation while allowing axial movement to accommodate seal ring wear

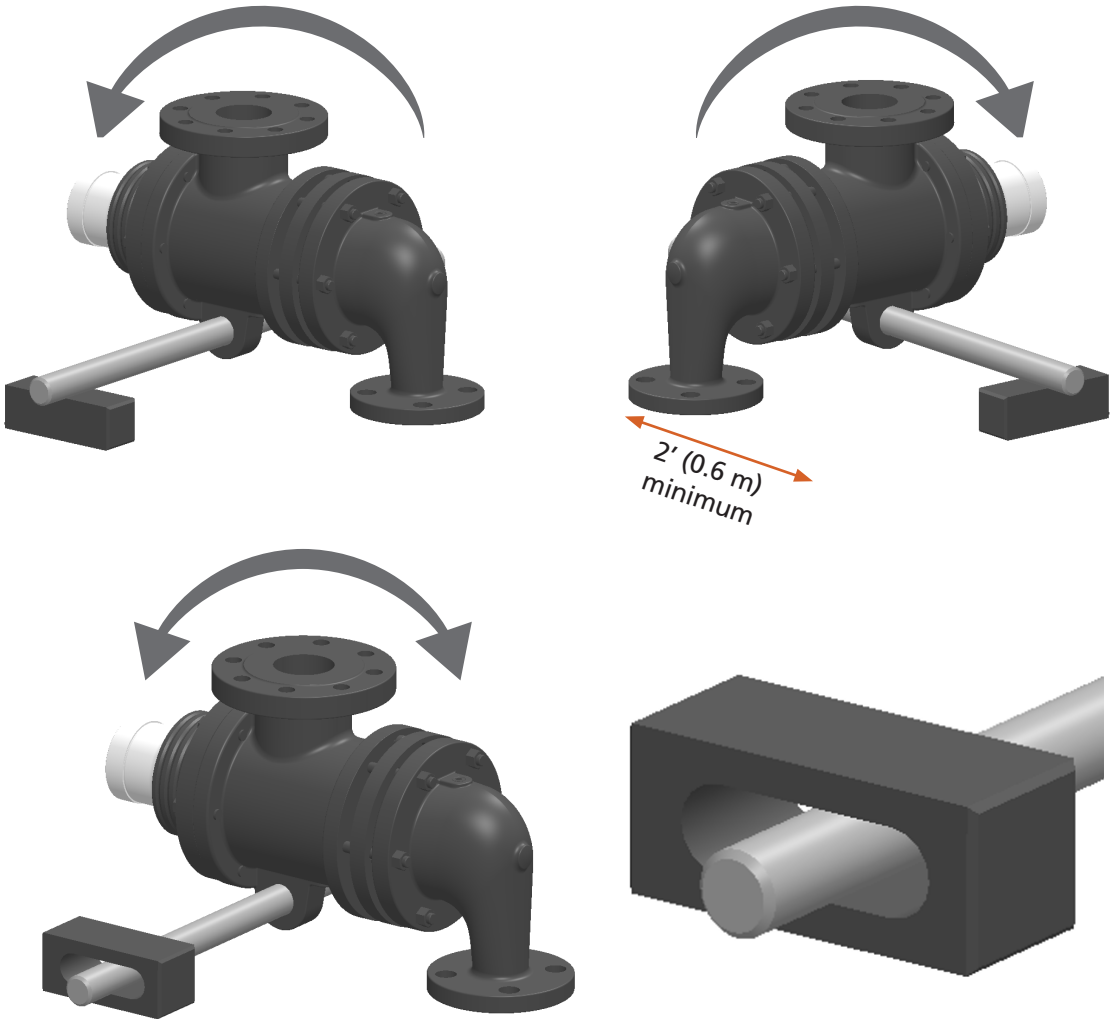


Figure 4 – Minimum distance between rotary joint and frame

Installation

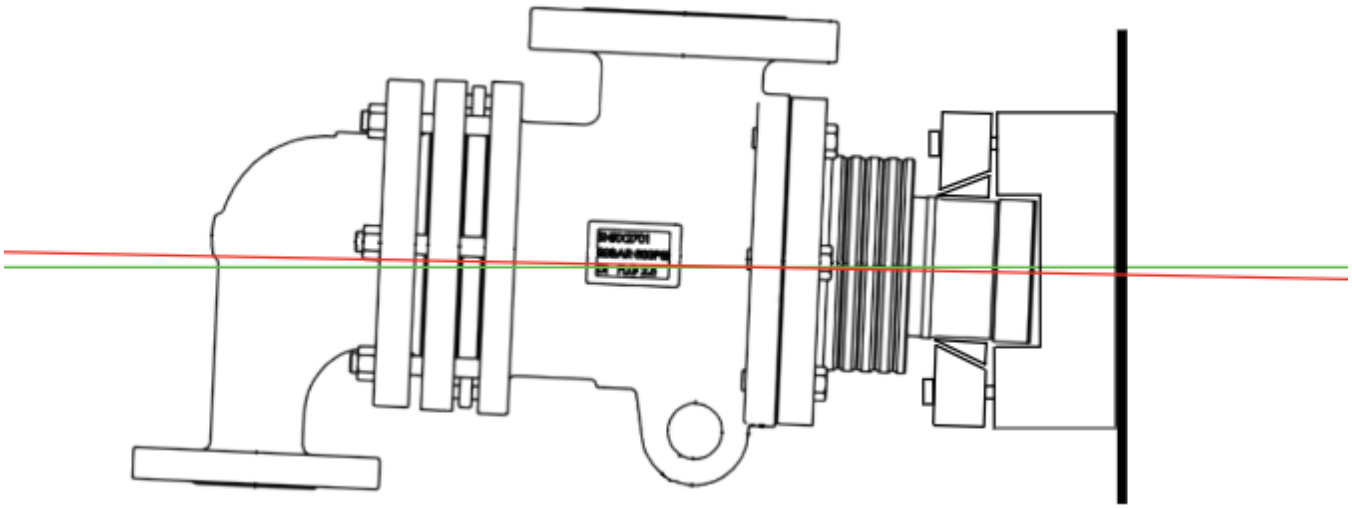


Figure 5 – Misaligned rotary joint

The operating reliability of a self-supported rotary joint depends on the quality of the rotary joint installation. It is important that the centerline of the rotary joint nipple be concentric and coaxial with the centerline of the rotating dryer journal. If there is any eccentricity, the joint will exhibit run-out when placed into service (reference Figure 5 above). This run-out puts extra stress on the internal support bushings (carbon graphite guides) or bearings as well as the flexible metal hoses and associated piping. Run-out may also unload the seal ring, causing a leak. Proper flex hoses and torque restraints minimize the detrimental effects that are caused by rotary joint run-out.

Note: Aluminum is the most suitable material for the Q-flange gasket.

Journal adapter flanges must be mounted concentric and square to the journal. All mating surfaces should be cleaned thoroughly and free of debris. Always be sure to use a star pattern when tightening fasteners and use new gaskets and O-rings. Quick release flanges are to be installed in the same manner while being sure to maintain an even gap between the quick release flange and the journal flange. For larger rotary joints, it is recommended to use overhead rigging to assist with installation. Always be sure the rotary joint is correctly aligned during installation.

Starting New Thermal Oil Systems

To ensure leak-free service at the start-up of new equipment, it is recommended that the circulating system be flushed and include a filter capable of retaining all metallic and non-metallic foreign material that may be present in the system as they can damage the seal face.

A means of filtration should be installed before each rotary joint. The filter should remove particles 40 – 60 microns or larger in size. Pressure gauges should be mounted up and down stream of the filter to monitor the condition of the filter element.

It is very important to maintain a clean system. The major cause of premature rotary joint failure is debris in the system. If an older system is being used, it is important to keep the piping, rolls, and rotary joints clean while service is being performed. Adequate filters must be installed in all systems.

Step 1
It is highly recommended to keep the system clean. All piping should be thoroughly cleaned during construction. Cover all open piping stubs and other ports so that construction debris does not contaminate the system. Make sure the system is free of welding slag, metallic particles, pipe sealers, and thread chips.

Step 2
Remove filter cartridges to accommodate the rinsing process.

Step 3
Bypass the rotary joint(s) so debris is not flushed into it.

Step 4
Flush roll(s) separately from the rest of the system.

Step 5
Fill the system with a flushing solvent recommended by the manufacturer of the heat transfer fluid.

Step 6
Force the solvent through the system either by running the pump, compressed air, or by gravity flow. If possible, heat the flushing solvent. This will expand the piping allowing some additional debris left over from the welding to break free. Do not exceed the recommended temperature range of the flushing fluid.

Step 7
Continue to rinse the system until the flushing solvent is clean.

Step 8
Drain all the flushing solvents from the system.

Step 9
Install the system filter cartridges.

Step 10
Install the Kadant Johnson rotary joint(s). If you are installing an RX or ELSX rotary joint, dry-run the rotary joint for five minutes.

Step 11
Fill the system with the heat transfer fluid.

Step 12
Run the system according to the manufacturer's recommendations.

Step 13
Check the system for leaks and repair as necessary.

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