RADIAL ALIGNMENT: {FRICK SCREW COMPRESSOR AS APPLICABLE}

It is very important that both an axial and a radial alignment of the driveline components be accomplished prior to operating the system. The general procedure for aligning the compressor is given in the attachment to this text.

CAUTION: Vibracon adjustable supports may have been used. These supports cannot be used as vertical jacks. Refer to the manufacturer's instructions in Section 19.

NOTE: The initial misalignment values provided in this IOM are subject to review by the qualified YORK/JCI Start-up Technician.

ADDITIONAL ALIGNMENT REQUIREMENTS

When reassembling the coupling, follow the coupling manufacturer's instructions when provided. Refer to any special instructions provided on the Instructions to Erecting Engineer drawing or the General arrangement drawing. Reassemble coupling according to match marks for balanced couplings. When no other criteria exists, it is good practice to assemble coupling so the driver and driven keys are on opposite sides.

After alignment has been completed, but before the unit is started, a check must be made for softfoot (foot plane) and piping strain. The softfoot check is described below. The piping strain check is as described in a separate document in this section.

If high vibration is experienced when the system is operated, then the unit should be immediately stopped and the alignment should be rechecked.

After at least 24 hours of successful operation of the unit, the shaft hot alignment should be verified.

NOTE: The equipment required to measure shaft alignment is not provided as part of this equipment order. This equipment is considered to be specific and common to millwright trade, and to those persons qualified to perform alignment of rotating equipment. Some special fixtures may be required in order to mount instruments to perform the final hot alignment check. It may be necessary to manufacture such fixtures at the jobsite during the alignment phase.

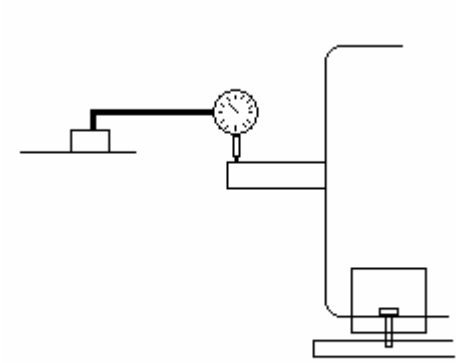
It is very important to keep a record of the current alignment offsets. Forms for these records have been provided in the front of this manual.

CAUTION: NEVER RUN THE DRIVER/GEAR WITH PARTIALLY ASSEMBLED COUPLING(S) OR COUPLINGS WITH LOOSE FASTENERS. DAMAGE AND/OR HAZARD TO PERSONNEL MAY RESULT.

METHODS TO DETERMINE SOFTFOOT

Two methods are generally used to determine soft foot, foot measurement or shaft measurement.

In the shaft method a dial indicator is mounted to the base or some other rigid support and the indicator is placed on the end of the shaft. All four motor bolts are tightened and the indicator is zeroed out. Each foot bolt is loosened one at a time and the deflection of the shaft is measured by the indicator. Generally .002 deflection (.001" for screw compressors) is the maximum deflection allowed. While the shaft deflection approach has merit, measuring soft foot at each foot provides a more accurate reading. If foot readings are taken in preparation for alignment and any observable soft foot corrected at that time, a shaft soft foot check should simply service as a confirmation. For details on performing a shaft softfoot check on centrifugal drivelines refer to drawing 560D0132, “Fabrication Notes for Refrigeration Systems using Centrifugal Compressors for PRS”, Section 4.6 and 4.7.



CHECKING FOR SOFTFOOT
USING THE SHAFT METHOD

SHIMMING TO CORRECT FOR SOFT FOOT

On four footed components with feet on separate housings a soft foot condition can occur on a machined flat base front-to-back, side-to-side, or corner to corner. Shim area may be less than the foot area when the component has full length or width feet and/or when shims were provided by the component manufacturer or the foot area is excessively large.

NOTE: If adjustable supports are used for the driveline components, refer to the manufacturer’s instructions in Section 19.

SCREW COMPRESSOR COUPLING ALIGNMENT

MOTOR MOUNTING

The following procedure is required only when the motor is mounted at the job site.

1. Thoroughly clean the motor feet and mounting pads of grease, burrs, and other foreign matter to ensure firm seating of the motor.

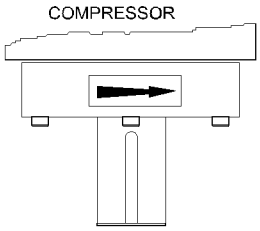
2. Attach the motor to the base using the bolts and motor-raising blocks, if required. Bolt snugly through the base.

3. Weld the four kick bolts into place so that they are positioned to allow movement of the motor feet.

4. Now that the motor has been set, check to see that the shafts are properly spaced for the coupling being used. Refer to the coupling data tables on these pages for the applicable dimension.

CHECKING MOTOR/COMPRESSOR ROTATION

⚠WARNING **Make sure coupling hubs are tightened to the shaft before rotating the motor to prevent them from flying off and possibly causing serious injury or death.**



COMPRESSOR ROTATION IS CLOCKWISE WHEN FACING THE END OF THE COMPRESSOR SHAFT. Under **NO** conditions should the motor rotation be checked with the coupling center installed as damage to the compressor may result. Bump the motor to check for correct compressor rotation. After verification, install gear or disk drive spacer, as applicable.

COMPRESSOR/MOTOR COUPLINGS INSTALLATION

RWB II units are arranged for direct motor drive and require a flexible drive coupling to connect the compressor to the motor. Before installing, perform the following:

1. Inspect the shaft of the motor and compressor to ensure that no nicks, grease, or foreign matter is present.

2. Inspect the bores in the coupling hubs to make sure that they are free of burrs, dirt, and grit.

3. Check that the keys fit the hubs and shafts properly. **NOTE: Coupling keyways must be 180° opposed.**

DBZ-B COUPLING – The Thomas DBZ-B coupling is used on applications above 600 HP and with sleeve bearing motors that do not have axial end float constraint. The DBZ-B coupling consists of two drive hubs and a flexible metal disc drive spacer that is bolted to both hubs. A flexible steel disc pack serves as the drive element. This disc pack is bolted to the coupling hubs and prevents axial end float between the compressor and motor shafts which may occur with sleeve bearing motors. On sleeve bearing motors, the magnetic center must be determined and maintained by securing the coupling to the motor shaft with the shaft properly located.

⚠CAUTION **Injury may occur if loose clothing, etc. becomes entangled on the spinning motor shaft.**

If the motor is coupled to the compressor using a fixed-end-play coupling, such as a DBZ-B coupling, and the motor is not properly centered, additional thrust loads will be transmitted to the compressor bearings that could result in premature bearing failure. Install as follows:

1. Remove the eight locknuts and long bolts attaching the center member to the disc pack.

2. Slide the disc pack and coupling hub assemblies on their respective shafts.

3. Adjust the distance between hub faces as specified in the DBZ-B Data Table by sliding the hubs. Key and secure hubs to the shafts by tightening setscrews.

4. Reinstall the eight previously removed bolts and locknuts. Alternately tighten each locknut as you would the lug nuts on an automobile. **NOTE: ALWAYS TURN THE NUT. NEVER TURN THE BOLT.**

5. Torque the locknuts to the value shown in the DBZ-B Data Table for the size coupling being installed.

⚠CAUTION **Lubricated and/or plated bolts and locknuts develop higher bolt tension with less tightening than those that are dry and not plated.**

Torques for lubricated and/or plated bolts and locknuts will generally fall in the lower range; while those that are dry or as received from the factory fall into the upper range. Torque readings should be observed while locknut is being turned.

6. Proceed to coupling alignment.

DBZ-B COUPLING DATA TABLE

DBZ-B COUPLING SIZE	HUB FACE SPACING		HUB FACE +/-		MAXIMUM TOTAL INDICATOR READING		CLAMP BOLT TORQUE ft-lb		CLAMP BOLT TORQUE Nm	
	in.	mm	in.	mm	in.	mm	LUB	DRY	LUB	DRY
226	3-13/16	96.8	1/64	.40	.003	.076	22	43	29.8	58.3
263	4-5/16	109.5	1/32	.79	.004	.102	33	63	44.7	85.4
301	4-7/8	123.8	1/32	.79	.004	.102	50	95	67.8	128.8
351	5-7/8	149.2	1/32	.79	.004	.102	95	175	128.8	237.3
401	6-11/16	169.9	1/32	.79	.004	.102	120	200	162.7	271.2

SCREW COMPRESSOR COUPLING ALIGNMENT

SERIES 52 COUPLING – The Thomas Series 52 coupling is also used on applications above 600 HP. It has two drive hubs, a center spool, and disc packs which are bolted between the center spool and each drive hub. A center spool and two flexible steel disc packs serve as the drive element. These three parts, situated between the motor and compressor hubs, prevent axial end float between the motor and compressor shafts. End float tends to occur with sleeve bearing motors. The magnetic center of the sleeve bearing motors must be determined and maintained by securing the coupling hub to the motor shaft with the shaft properly located.

⚠ CAUTION **Injury may occur if loose clothing, etc. becomes entangled on the spinning motor shaft.**

If the motor is coupled to the compressor using a fixed-end-play coupling such as the Series 52 coupling and the motor is not properly centered, the additional thrust loads will be transmitted to the compressor bearings. This additional thrust could result in premature bearing failure. Install as follows:

1. Before proceeding with the alignment process, following this section, disassemble the Series 52 coupling **noting the arrangement of bolts, washers, and nuts as THEY MUST BE REPLACED IN THE SAME ORDER.** Mark the adjoining bolt holes of each part, the two hubs, the two disc packs, and the center spool, so they are put back together in the same position.

2. Mount the coupling hubs on their respective shafts. The hub is bored for an interference fit on the shaft. Heating of the coupling hub may be necessary for assembly. **DO NOT SPOT HEAT THE HUB** as it may cause distortion. Heat in water, oil, or use a SOFT open flame and quickly position on the shaft.

3. Adjust the distance between hub faces, as specified in the Series 52 Coupling Data Table, by sliding the hubs. Key and secure the hubs to the shafts by tightening the set screws.

4. Reassemble the coupling with the disc packs and the center spool. Ensure that they are reassembled exactly as they were disassembled.

WOODS BP SERIES COUPLING – is also used on applications above 600 HP. It utilizes a center spool and two flexible steel disc packs as the drive element. These three parts, situated between the motor and compressor hubs, prevent axial end float between the motor and compressor shafts. End float tends to occur with sleeve bearing motors.

⚠ CAUTION **Injury may occur if loose clothing, etc. becomes entangled on the spinning motor shaft.**

If the motor is coupled to the compressor using a fixed-end-play coupling and the motor is not properly centered, the additional thrust loads will be transmitted to the compressor bearings. This additional thrust could result in premature bearing failure. Install the BP Series coupling using the following instructions:

1. Before proceeding with the alignment process, following this section, disassemble the BP Series coupling **noting the arrangement of bolts, washers, and nuts as THEY MUST BE REPLACED IN THE SAME ORDER.** Mark the adjoining bolt holes of each part, the two hubs, the two disc packs, and the center spool, so they are put back together in the same position.

2. Slide the coupling hubs on their respective shafts.

3. Reassemble the coupling with the disc packs and the center spool. Ensure that they are reassembled exactly as they were disassembled. Torque disc pack hardware to specification in BP Series Coupling Data Table.

4. Key and secure the hubs to the shafts by tightening the clamping bolts. Make sure that the keyways are offset 180° to maintain balance.

5. Torque the clamping bolts of both hubs to the torque value given in the Data Table. **DO NOT USE ANY LUBRICANT ON THESE BOLTS.**

6. Proceed to Coupling Alignment.

BP SERIES COUPLING DATA TABLE

BP SERIES SIZE	HUB FACE * SPACING		DISC PACK BOLT TORQUE		CLAMP BOLT TORQUE DRY	
	in.	mm	ft-lb	Nm	ft-lb	Nm
BP48	4.88	124	40	54	41	56
BP53	5.88	150	60	81	65	88
BP58	6.00	152	120	163	100	136
BP58	6.69	170	120	163	100	136
BP63	7.00	179	120	163	100	136

* Max total indicator reading .003 in. or .076 mm for all sizes.

SERIES 52 COUPLING DATA TABLE

COUPLING SIZE	HUB FACE SPACING		HUB FACE +/-		MAX TOTAL INDICATOR READING ANGULAR		MAX TOTAL INDICATOR READING PARALLEL		CLAMP BOLT TORQUE (LUBE)	
	in.	mm	in.	mm	in.	mm	in.	mm	ft-lb	Nm
225	5	127.0	1/32	.914	.004	.102	.004	.102	25	34.0
262	5	127.0	1/32	.914	.004	.102	.004	.102	30	40.7
312	5-1/2	139.7	3/64	1.295	.004	.102	.004	.102	40	54.2
350	6	152.4	3/64	1.295	.004	.102	.004	.102	95	128.8
375	7	177.8	1/16	1.574	.004	.102	.004	.102	130	176.3
425	7	177.8	1/16	1.574	.004	.102	.004	.102	175	237.3
450	8	203.2	1/16	1.574	.004	.102	.004	.102	200	271.2
500	9	228.6	5/64	2.083	.004	.102	.004	.102	260	352.5

⚠ WARNING **All rotating power transmission equipment is potentially dangerous. Ensure that the couplings are properly guarded prior to turning on the power. Coupling guards are provided with the equipment and must be in place and secured properly while the equipment is in operation.**

COUPLING ALIGNMENT PROCEDURE

The life of the compressor shaft seal and bearings, as well as the life of the motor bearings, is dependent upon proper coupling alignment. Couplings may be aligned at the factory but realignment **MUST ALWAYS** be done on the job site after the unit is securely mounted on its foundation. Initial alignment must be made prior to start-up and rechecked after a few hours of operation. Final (HOT) field alignment can only be made when the unit is at operating temperature. After final (HOT) alignment has been made and found to be satisfactory for approximately one week, the motor may be dowelled to maintain alignment.

NOTE: Frick recommends cold aligning the motor .005" high. This cold misalignment compensates for thermal growth when the unit is at operating temperature.

The following procedure is applicable to both the CH and DBZ-B couplings. Dial indicators are to be used to measure the angular and parallel shaft misalignment. Coupling alignment is attained by alternately measuring angular and parallel misalignment and repositioning the motor until the misalignment is within specified tolerances.

⚠WARNING **ALWAYS LOCK OUT MAIN MOTOR DISCONNECT BEFORE TOUCHING MOTOR SHAFT. MISALIGNMENT MUST NOT EXCEED .004" FOR ALL CH, DBZ-B AND SERIES 52 COUPLINGS EXCEPT DBZ-B 226 WHICH SHALL NOT EXCEED .003".**

ANGULAR ALIGNMENT

1. To check angular alignment, as shown in Figure 1, attach dial indicator rigidly to the motor hub. Move indicator stem so it is in contact with the outside face of compressor hub, as shown in Figure 2.

NOTE: When DBZ-B couplings are used on motors with sleeve bearings, it is necessary to secure the two coupling hubs with a bolt to prevent them from drifting apart when rotating.

2. Rotate both coupling hubs several revolutions until they seek their normal axial positions.

Check the dial indicator to be sure that the indicator stem is slightly loaded so as to allow movement in both directions.

3. Set the dial indicator at zero when viewed at the 12 o'clock position, as shown in Figure 2.

4. Rotate both coupling hubs together 180° (6 o'clock position), as shown in Figure 3. At this position the dial indicator will show TOTAL angular misalignment.

NOTE: The use of a mirror is helpful in reading the indicator dial as coupling hubs are rotated.

5. Loosen motor anchor bolts and move or shim motor to correct the angular misalignment.

After adjustments have been made for angular misalignment retighten anchor bolts to prevent inaccurate readings. Repeat Steps 3 through 5 to check corrections. Further adjustments and checks shall be made for angular misalignment until the total indicator reading is within the specified tolerance.

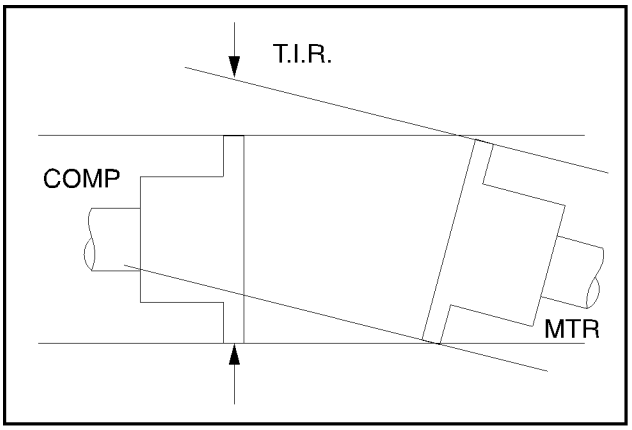


Figure 1 - Angular Misalignment

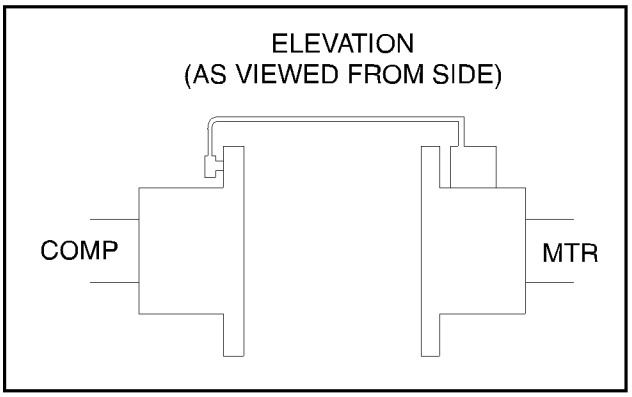


Figure 2 - Dial Indicator Attached (At 12 O'clock)

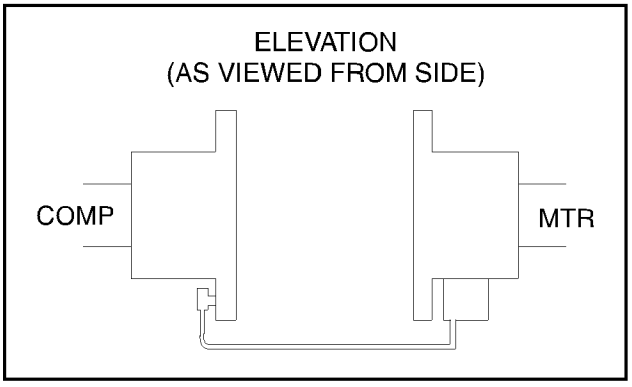


Figure 3 - Dial Indicator At 6 O'clock

PARALLEL ALIGNMENT

6. To check parallel alignment, as shown in Figure 4, reposition dial indicator so the stem is in contact with the rim of the compressor hub, as shown in Figure 5.

Check the dial indicator to be sure that the indicator stem is slightly loaded so as to allow movement in both directions.

7. Check parallel height misalignment by setting dial indicator at zero when viewed at the 12 o'clock position. Rotate both coupling hubs together 180° (6 o'clock position). At this position the dial indicator will show TWICE the amount of parallel height misalignment.

8. Loosen motor anchor bolts and add or remove shims under the four motor feet until parallel height misalignment is within specified tolerance when anchor bolts are retightened.

⚠ CAUTION **CARE MUST BE USED WHEN CORRECTING FOR PARALLEL MISALIGNMENT TO ENSURE THAT THE AXIAL SPACING AND ANGULAR MISALIGNMENT IS NOT SIGNIFICANTLY DISTURBED.**

9. After the parallel height misalignment is within tolerance, repeat Steps 1 through 5 until angular misalignment is within specified tolerance.

10. Check parallel lateral misalignment by positioning dial indicator so the stem is in contact with the rim of the compressor hub at 3 o'clock, as shown in Figure 6.

Set indicator at zero and rotate both coupling hubs together 180° (9 o'clock position), as shown in Figure 5.

Adjust parallel lateral misalignment using the motor adjusting screws until reading is within specified tolerance.

11. Recheck angular misalignment and realign if necessary.

12. Tighten motor anchor bolts and rotate both coupling hubs together, checking the angular and parallel misalignment through the full 360° travel at 90° increments. If dial readings are in excess of specified tolerance realign as required.

13. When the coupling hubs have been aligned to within specified tolerance, a recording of the cold alignment must be made for unit records and usage during hot alignment.

⚠ CAUTION **Install the coupling guard before operating the compressor.**

⚠ CAUTION **When installing drive spacer, make sure that hub spacing is within limits shown on the Coupling Data Table applicable to the coupling being installed and that the clamping bolt(s) are properly torqued.**

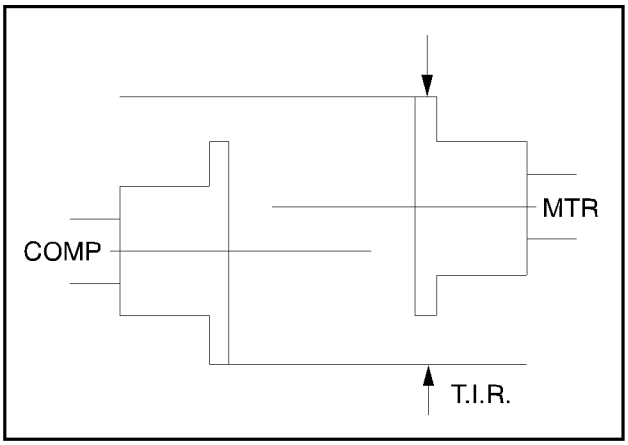


Figure 4 - Parallel Misalignment

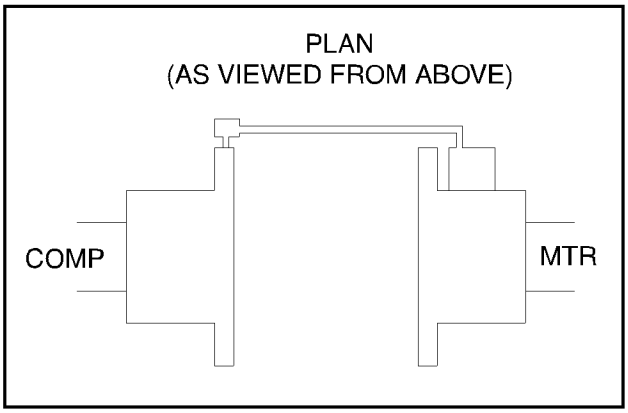


Figure 5 - Dial Indicator Attached (At 9 O'clock)

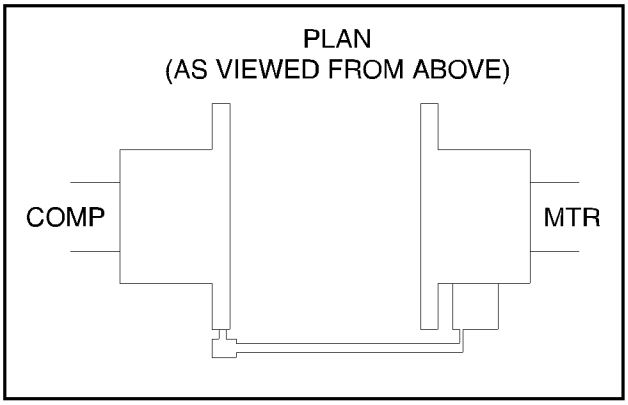


Figure 6 - Dial Indicator At 3 O'clock

HOT ALIGNMENT OF COMPRESSOR/MOTOR

⚠WARNING **Hot alignments can only be made after the unit has operated for several hours and all components are at operating temperatures.**

Shut down the unit **(proper lockout/tagout procedures should be followed)** and **QUICKLY** affix dial indicator to coupling motor hub, then take readings of both the face and rim of the compressor hub. If these readings are within tolerance, record reading, attach coupling guard and restart unit. However, if the reading is not within limits, compare the hot reading with the cold alignment and adjust for this difference; i.e. if the rim at 0° and 180° readings indicates that the motor rises .005" between its hot and cold state, .005" of shims should be removed from under the motor.

After the initial hot alignment adjustment is made, restart unit and bring to operating temperature. Shut down and recheck hot alignment. Repeat procedure unit hot alignment is within specified tolerance.

⚠CAUTION **INSTALL COUPLING GUARD BEFORE OPERATING COMPRESSOR.**