



FHD Gear Coupling Installation Guide

INTRODUCTION:

The following document is intended for the explicit use of Lovejoy customers to aid in the installation of Lovejoy power transmission products. The information may be considered privileged and should only be disseminated as an active part of conducting business with Lovejoy, Inc.

Although the coupling may have been properly specified during the design and selection process before the coupling was ordered, operational conditions could possibly have changed prior to installation. Lovejoy, Inc. provides the information and technical support necessary to ensure the appropriate heavy duty gear coupling selection was made relative to the product specifications and limitations of Lovejoy's power transmission products. The end user is ultimately responsible for verifying the suitability of the final coupling selection based on the actual service conditions at the time of the coupling installation.

Correct installation and alignment practices will ensure longer coupling life, trouble free operation, and a safer operating environment for the coupling. Please thoroughly review all of the following instructions prior to installing this coupling and placing it in operation. Proper safety guidelines and practices should always be followed during every phase of the installation.

This installation document is considered part of the purchased product and should be retained for future reference.

SAFETY:

Accidents involving rotating equipment may result in property damage, serious bodily harm, or loss of life. The purchaser of this equipment must assure that the equipment is properly assembled, installed, safeguarded, operated, and maintained. This equipment should never be operated at or subjected to conditions that exceed manufacturer's specifications.

Consult all applicable Federal, State and local laws and regulations covering the safe operation and maintenance of equipment, including, without limitation, the USDOL-OSHA "Lockout / Tag-out" procedure set forth in 29 CFR 1910.147.

Because of the possible danger to persons or property from accidents which may result from the improper use or unapproved modifications of the product, this product must be installed, maintained and operated in accordance with the procedures, standards, and engineering specifications specified in the product literature. To assure safe operation, this product should be inspected in accordance with the instructions described in this document. Proper guards and any suitable safety equipment or procedures as may be necessary, or as may be specified in safety codes, should be installed by the user. Safety equipment, coupling guards, and shields are not provided by, nor are they the responsibility of Lovejoy, Inc.

Symbols and text format used in this document may contain safety information and will appear similar to the following:



PRODUCT INSPECTION:

Prior to installation, the coupling should be examined for signs of damage that may have occurred as a result of shipping or handling. Refer to the following chart to ensure all the ordered parts are present.

FHD Coupling Components	QTY
Hubs	2
Sleeves	2
Flange Gasket	1
Seal End Ring with O-ring	2
End Ring Gasket	2
Refer to Table 1 and Table 3 for bolt types and quantity	


For maximum protection, the coupling and all components should be stored in the original packaging. All parts should be measured prior to installation to ensure correctness of parts to meet the application requirements; such as the hub bore diameter, shaft diameter, shaft separation, bolt lengths, key sizes, etc. The BSE (shaft separation) dimension should be measured from the end of one shaft to the end of the other shaft, not to hub faces or pilots.

Note: Although some gear coupling series may be shipped with the hub inside the sleeve, the complete couplings are typically shipped unassembled.

Caution! Lovejoy manufactures couplings based on the shaft data provided by the purchaser. Lovejoy will not be responsible for inaccurate or incomplete information supplied by the purchaser. Check all shaft dimensions.

It is the responsibility of the purchaser to assure the interface connections (flanges, bolts, keys, hydraulic fits, etc.) between the coupling and connected equipment is capable of handling the anticipated loads.

Warning! Before beginning the coupling installation, make sure the machinery is made safe. Disconnect and lock out all power to the equipment. No part of the installation should be performed on moving or unstable equipment.

 **Warning!** This symbol indicates safety measures which must be observed to avoid personal injury.

Caution! This symbol indicates safety measures which must be observed to avoid damage to coupling.

REQUIRED TOOLS:

- Calipers
- Calibrated Torque Wrench
- Sockets and appropriate open end wrenches
- Alignment Equipment
- Appropriate hoist or lifting equipment

COUPLING AND COMPONENT PREPARATION:

It is necessary to clean the exposed surfaces of all the coupling components including the hubs, sleeves, spacers, and any subassemblies. This is required to remove any protective coatings applied at the factory. All coupling parts and equipment components must be clean and free of any foreign materials prior to attempting assembly or installation. A clean cloth dampened with a nonflammable solvent should be sufficient for this cleaning.

All sleeves, seals, hub bores, shafts, keys, and keyways must be checked for raised metal, nicks, burrs, dents, gouges, etc., and should be dressed or repaired accordingly prior to installation.

HUB INSTALLATION:

1. **For all Lovejoy Gear Style Couplings**, Lovejoy supplies 'inch' dimensioned straight hub bores with a keyway machined to the industry accepted ANSI/AGMA 9002-B04 Standards' tolerance for interference fit unless otherwise specified. Tapered and spline bores may require special manufacturing and installation consideration.

2. **For all Lovejoy Gear Style Couplings**, Lovejoy supplies 'metric' dimensioned straight hub bores with a keyway machined to the industry accepted ANSI/AGMA 9112-A04 Standards' tolerance for interference fit unless otherwise specified. Tapered and spline bores may require special manufacturing and installation consideration.

3. **Install the seals in the end rings**, (seal carriers) and slide the end rings and end ring gaskets on the shafts as far back against the equipment as possible to prevent damage while installing the hubs. Ensure the ring is oriented facing the correct direction. The end ring seal and gasket should be insulated against the heat of the hubs which will still be hot when mounting with interference fits.

4. **Straight Bore (Clearance Fit - usually not available in FHD)**: Install the key in the shaft. The key should have a snug side-to-side fit with a small clearance over the top of the key. To maintain dynamic balance, the key(s) should fit exactly lengthwise and should never be shorter than the length thru bore (LTB) dimension of the hub. The key should be flush with the end of the shaft prior to continuing.


5. **Straight Bore (Interference Fit)**: This is the default type of bore supplied by Lovejoy for gear coupling hubs. This installation is similar to Clearance Fit hubs except that these hubs need to be heated prior to sliding the hub onto the shaft. It is important when installing Interference Fit hubs, to make sure clearance exists over the top of the key(s); otherwise, when the hub cools, the hub keyway will rest on the key and produce high stresses in the keyway that could cause the coupling to fail. To maintain dynamic balance, the key(s) should fit exactly lengthwise and should never be shorter than the length thru bore (LTB) dimension of the hub. The key(s) should be flush with the end of the shaft(s) prior to continuing.

CAUTION! Hubs, sleeves, and end rings (seal carriers) must be supported during installation to avoid accidental damage should they slip.

HUB INSTALLATION (CONT'D):

6. **Heat the hubs** to prepare them for installation. Make sure the hub is heated uniformly to a temperature of at least 350°. The following are instructions to use when heating hubs for mounting with interference fits.


Oil Bath Heating is usually limited to 350° F. (177° C), or some temperature that is less than the flash point of the oil used. Special handling devices are required to support the hub in the oil bath such as tongs, threaded rods or eye-bolts placed in puller holes, etc. The hubs should not rest on the bottom of the oil bath container and need to remain in the bath for a period of time ample to heat the hub all the way through.

 **Warning!** *If an oil bath is used, the couplings will need to be heated to approximately 350° F (177° C) or more, so the oil must have a flash point above 350° F (177° C).*

Oven Heating offers some advantages over oil bath heating. Parts can be heated to higher temperatures, usually not to exceed 450° F (232° C). This is roughly the maximum temperature where the metal does not go through an annealing process and yet can still be handled with heat resistant gloves. When heating the hubs in an oven, place them on a rack and do not rest the hubs on the oven surface. The hubs should remain in the oven for a period of time ample to heat the hub all the way through.

Induction Heating can be used as long as the temperature rise in the hub is uniform and controlled.


Open Flame Heating is typically not recommended. If the hub is being heated with an oxyacetylene, or blow torch, use an excess acetylene mixture. Mark the hub body at the top, center, and bottom along the length of the hub with heat resistant crayons, one with a 350° F (177° C) melt temperature and another with a 450° F (232° C) melt temperature. The hub should be sitting elevated on refractory bricks oriented to allow the flame to flow through the hub. With a "Blue Flame" or "Rosebud" torch, direct the flame towards the hub bore and O.D. using constant motion to avoid overheating any single area. Once the heat sensitive crayon marks melt, the hub should be ready for mounting.

 **Warning!** *Do not use an open flame in a combustible atmosphere or near combustible materials.*

CAUTION! Do not "spot" heat the hub in single areas or distortion of the hub could occur.

CAUTION! Do not exceed 450° F (232° C) during the heating process. Excessive heat can soften the hub, reducing the strength of the steel affecting the performance characteristics of the hub.

CAUTION! Use extreme care when handling heated hubs to avoid injury to personnel.

 **Warning!** *When installing the hub, consult with all applicable Federal, State, and local laws and regulations covering the safe operation and maintenance of equipment, including, without limitation, the USDOL-OSHA "Lockout/Tag-out" procedure set forth in 29 CFR 1910.147.*

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CAUTION! Position the Seal Carriers on the shafts prior to installing Hubs.


7. **The seal carrier rings, seals or o-rings and gaskets** should already be on the shafts as far back as possible to ensure they don't get distorted from the heat radiating off the hubs (per Step 3).

8. **Install the hubs** on the proper shafts and ensure the face of the hub is even with the end of the shaft. The hub should be oriented with the proper end of the hub facing the end of the shaft. The key(s) should also be lined up with the end of the shaft and face of the hub.

9. **Do not try to install the sleeve until the hub has completely cooled to room temperature.** Do not continue until the hub has completely cooled to a reasonable ambient surrounding temperature. See step 10 prior to proceeding with the installation of the sleeves.

10. **Hand pack an ample amount of grease** around all of the gear teeth on both the hub and sleeve prior to sliding the sleeve into position over the hub.

CAUTION! Hand pack an ample amount of Coupling Grease around the hub and sleeve gear teeth prior to sliding the sleeve over the hub.

 **Warning!** Use only approved Coupling Grease when installing gear couplings. Coupling grease is manufactured using a technique that prevents the materials/chemicals in the grease from separating thru the centrifuge process when the coupling is rotating during operation. See documentation in <http://www.lovejoy-inc.com> regarding grease specifications (found in "Technical Resources").

11. **Carefully position the sleeve over the end of the hub** and line up the gear teeth. The sleeve should be securely supported to prevent the sleeve from dropping or moving while mounting. Ensure the sleeve is properly oriented with the flange facing the mating flange on the other half of the coupling. The grease fittings on each sleeve should be as close to in-line as possible. When positioning the sleeve, use caution to ensure the gear teeth do not impact or bang against each other causing damage to the teeth. Once aligned, carefully slide the sleeve over the hub. If the gear teeth are binding, check hub and sleeve alignment to ensure the sleeve is not at a slight angle relative to the hub.

12. **Slide the sleeve far enough onto the hub** so that the hub extends out slightly further than the flange on the sleeve. This will allow for access to the end of the hub for checking the alignment once the equipment is moved into place.

13. **Move the equipment into place** and check the shaft and hub alignment. Realign equipment as necessary.

14. **Continue supporting the sleeve and install the seal and seal carrier** on the end of the sleeve. The seal and gear teeth should be able to support the weight of the sleeve. The main sleeve flange should be slid completely into place and the face of the flange should be oriented with the end of the hub. Each sleeve of an FHD coupling has two lubrication filler holes located 180° apart (only one pair on the flex hub side of an FHDFR coupling). The bolt holes on the sleeve flange should be lined up with the bolt holes on the opposing flange (FHD flex-flex) so that the lube filler holes as close to in-line as possible.

CAUTION! When positioning the two coupling halves together and aligning the bolts holes in the flanges, ensure the lubrication holes are as close to in-line as possible.

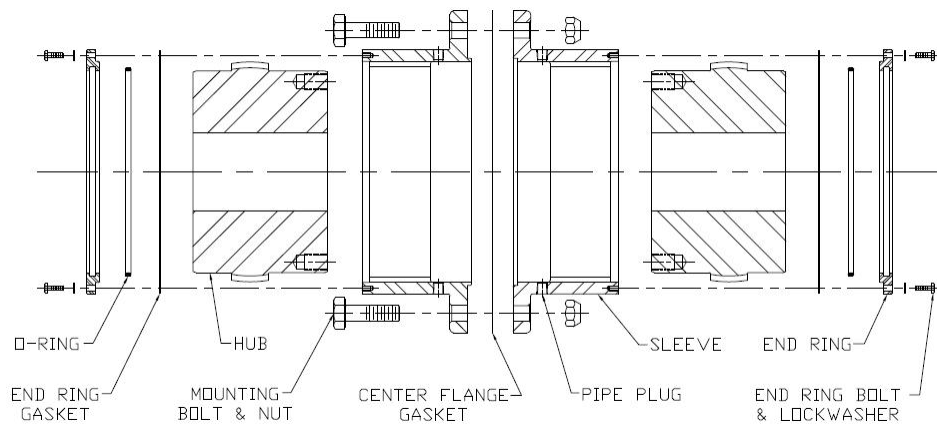
15. **Once the bolt holes and lube holes are lined up**, insert the main bolts and tighten the nuts with a calibrated torque wrench using the bolt torque values defined in Table 3.

16. **Insert a grease fitting** in one of the lubrication holes and leave the second hole at 180° unplugged. Rotate the coupling until the lubrication holes are oriented in a near horizontal position. The open hole might be oriented slightly higher than the grease fitting hole. Inject grease through the grease fitting until the recommended amount (see Table 4) has been loaded into the coupling. Grease may come out of the opposite hole when the recommended amount has been loaded. Replace the lubrication plugs in both fitting holes prior to placing the coupling in service.

17. **Bring the coupling up to the recommended operating speed** and check for binding, vibration, or any abnormal operation. If issues are encountered in the initial operation, check alignment prior to any disassembly of the coupling.

18. **After the initial startup test**, place the coupling in operation for one month, or less, and inspect for any abnormal operation or wear. Ideally, the coupling should be opened and the gear teeth inspected for galling or other wear issues.

19. **Following the initial inspection**, the coupling should be inspected and serviced on an annual basis and the grease completely replaced using a qualified coupling grease. Specifications for coupling grease can be found in the Lovejoy website at: <http://www.lovejoy-inc.com/resources/installation-instructions.aspx> under the Technical Data heading.



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Table 1: FHD Heavy Duty Coupling Dimensional Data ¹

Size ¹	OAL in	ID1 - ID2		LTB in	BSE in	FD in	D in	HD in	Bolts **	
		Maximum Bore ² Standard Keyways							Number of	
		in	mm						Main ⁴ Flange Bolts	Seal ⁵ Carrier Bolts
7	17.25	9.50	255	8.69	0.38	20.75	15.75	13.00	16	20
8	22.38	11.50	310	11.00	0.38	23.25	18.34	15.50	16	24
9	23.50	12.50	340	11.50	0.50	26.00	20.38	17.00	18	24
10	24.50	13.75	355	12.00	0.50	28.00	22.31	18.50	18	28
11	26.75	15.50	410	13.13	0.50	30.50	24.36	21.00	18	24
12	28.25	17.00	435	13.88	0.50	33.00	26.63	22.75	18	24
13	30.00	18.25	480	14.63	0.75	33.75	28.88	24.75	18	24
14	31.75	19.50	510 ³	15.50	0.75	38.00	31.00	26.50	18	20
15	33.75	21.00	550 ³	16.50	0.75	40.50	32.97	28.50	20	24

- Notes:**
- All FHD coupling hubs come standard with Puller Holes.
All FHD coupling sleeves come standard with the exposed bolt design.
For installation support on sizes F 16E thru F 30E, please contact Lovejoy Technical Support.
 - Interference Bores with no Set Screws are standard unless otherwise specified.
Inch Bore and Keyway Tolerances conform to the ANSI / AGMA 9002-B04 Standard (ANSI B17.1 for bores above 18").
Metric Bore and Keyway Tolerances conform to the ISO 286-2 and ANSI / AGMA 9112-A04 Standard.
 - The ANSI Standard does not provide dimensional data for metric keys/keyways above 500mm bores.
Please contact Lovejoy Technical Support to confirm maximum bore and keyway sizes for bores over 500mm.
 - The number of main flange bolts and nuts should match the number of holes in one sleeve flange. **
 - The number of Seal Carrier bolts and nuts should match the number of holes in both sleeves. **
- ** The number of bolts may vary based on specific product designs.

Table 2: FHD Heavy Duty Coupling Performance Data

Cplg Size	Nominal Torque		Maximum Speed		ID1 - ID2 Maximum Bore Standard Keyway		Weight		Parallel Misalignment		Max Angular Misalignment Degrees
	in-lb	Nm	rpm Unbal	rpm Bal	in	mm	lbs	kg	in	mm	
7	1,008,000	110 000	2,000	3,000	9.50	255	950	431	0.135	3.429	3/4 ° Per Gear Mesh
8	1,323,500	150 000	1,900	2,850	11.50	310	1,560	708	0.160	4.064	
9	1,827,700	210 000	1,750	2,625	12.50	340	2,015	915	0.165	4.191	
10	2,521,000	280 000	1,550	2,325	13.75	355	2,500	1 135	0.180	4.572	
11	3,466,000	390 000	1,400	2,100	15.50	410	3,380	1 535	0.205	5.207	
12	4,412,000	500 000	1,300	1,950	17.00	435	4,165	1 891	0.210	5.334	
13	5,249,000	600 000	1,150	1,725	18.25	480	5,215	2 368	0.230	5.842	
14	6,429,000	730 000	1,050	1,575	19.50	510 *	6,400	2 906	0.255	6.477	
15	7,752,000	880 000	900	1,350	21.00	550 *	7,710	3 500	0.280	7.112	

- Notes:** * AGMA does not define Keyways for bore sizes over 500mm.

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Table 3: FHD Heavy Duty Coupling Bolt Torque - Main Flange and Seal Carrier Bolts

Cplg Size	Main Flange Bolts (Exposed)				Seal Carrier Bolts			
	Details ¹		Tightening Torque		Details ¹		Tightening Torque	
	Qty	Size	Eng	Met	Qty	Size	Eng	Met
7	16	1 - 14	400 ft-lbs	542 Nm	20	5/16-18	10 ft-lbs	13.5 Nm
8	16	1-1/8 - 12	550 ft-lbs	746 Nm	24	5/16-18	10 ft-lbs	13.5 Nm
9	18	1-1/4 - 12	750 ft-lbs	1017 Nm	24	3/8-16	15 ft-lbs	20.3 Nm
10	18	1-3/8 - 12	1000 ft-lbs	1356 Nm	28	3/8-16	15 ft-lbs	20.3 Nm
11	18	1-1/2 - 12	1500 ft-lbs	2034 Nm	24	1/2-13	30 ft-lbs	40.7 Nm
12	18	1-1/2 - 12	1500 ft-lbs	2034 Nm	24	1/2-13	30 ft-lbs	40.7 Nm
13	18	1-1/2 - 12	1500 ft-lbs	2034 Nm	24	1/2-13	30 ft-lbs	40.7 Nm
14	18	1-3/4 - 12	1900 ft-lbs	2576 Nm	20	1/2-13	30 ft-lbs	40.7 Nm
15	20	1-3/4 - 12	1900 ft-lbs	2576 Nm	24	1/2-13	30 ft-lbs	40.7 Nm

Notes: 1. The actual number of bolts may vary based on custom hub/sleeve designs

Table 4: FHD Heavy Duty Coupling Grease Capacity ¹

Cplg Size	FHD Gear Grease Capacity				FHDFR Gear Grease Capacity			
	Volume		Weight		Volume		Weight	
	(Eng)	(Metric)	(Eng)	(Metric)	(Eng)	(Metric)	(Eng)	(Metric)
7	3.75 qt	3.54 L	7.1 lb	3.23 kg	2.7 qt	2.54 L	5.1 lb	2.32 kg
8	1.7 gal	6.34 L	12.75 lb	5.78 kg	1.15 gal	4.30 L	8.65 lb	3.92 kg
9	2.0 gal	7.66 L	15.4 lb	6.98 kg	1.35 gal	5.13 L	10.3 lb	4.67 kg
10	3.1 gal	11.82 L	23.75 lb	10.76 kg	2.05 gal	7.81 L	15.7 lb	7.11 kg
11	3.2 gal	12.20 L	24.5 lb	11.11 kg	2.3 gal	8.64 L	17.35 lb	7.87 kg
12	4.15 gal	15.64 L	31.4 lb	14.24 kg	2.85 gal	10.80 L	21.7 lb	9.83 kg
13	6.15 gal	23.32 L	46.8 lb	21.23 kg	4.0 gal	15.07 L	30.25 lb	13.73 kg
14	8.15 gal	30.78 L	61.8 lb	28.31 kg	5.1 gal	19.31 L	38.75 lb	17.59 kg
15	8.75 gal	33.19 L	66.65 lb	30.22 kg	5.55 gal	21.06 L	42.25 lb	19.17 kg

Notes: 1. Brand names and specifications for acceptable coupling grease can be found in the Lovejoy website at:
http://www.lovejoy-inc.com/uploadedFiles/Technical_Resources/LovejoyGearLubrication05Jan07.pdf

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