FARR Gear Coupling
Installation Instructions

1. Introduction
Although a coupling may have been correctly specified at time of order, operational conditions can sometimes change before the coupling is installed. Lovejoy, Inc. has information available to advise on the selection and limitations of their power transmission products, but the purchaser is ultimately responsible for verifying the suitability of their choice of product for the actual service conditions.

Correct installation and alignment will insure long life and trouble free operation of your coupling. Please read through these instructions carefully before you set the coupling into operation. Make sure you follow all safety guidelines during the installation. These Instructions are part of your product, and should be retained for future reference.

2. Safety
Accidents involving rotating equipment may result in loss of life, serious bodily harm or property damage. The purchaser of this equipment must assure that the equipment is properly assembled, installed, safeguarded, operated and maintained. This equipment must not be operated at 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 / Tagout" 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 modification 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 and shields are not provided, nor are they the responsibility of Lovejoy, Inc.

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.**

3. Check Product
Before beginning installation, the coupling should be examined for any signs of damage that may have occurred during shipping and handling. Confirm that all components ordered are there, see Table 1.

For maximum protection, the coupling and components should be stored in the original packaging.

Measurements should be made to verify correctness of parts to meet application requirements, such as; hub bore diameter, shaft diameter, shaft separation, etc.

Note: FARR series Gear Couplings are shipped unassembled.

Table 1

FARR Size	Hubs	Keeper Plates	Bolts/Nuts
1	2	2	6
1.5	2	2	8
2	2	2	6
2.5	2	2	6
3	2	2	8
3.5	2	2	8
4	2	2	8
4.5	2	2	10
5	2	2	8
5.5	2	2	14
6	2	2	16
7	2	2	16
8	2	2	18
9	2	2	18
10	2	2	18
11	2	2	18

4. Tools Required
- Calipers
- Sockets
- Torque Wrench
- Open End Wrenches
- Alignment Equipment

Warning!
Before beginning coupling installation make sure the machinery is made safe. Discount all power.

5. Component Preparation

Clean the exposed surfaces of all components, hubs, sub-assemblies, spacers, etc., to remove any protective coating applied at the factory. All parts must be clean and free of any foreign materials before attempting installation or assembly, use a clean cloth dampened with a nonflammable solvent.

Check Hub Bores, Keyways and Shafts for any raised metal, nicks, burrs, dents, gouges, etc., dress if necessary.

6. Hub Installation

a. Lovejoy supplies inch dimensioned straight gear hub bores with keyway to ANSI/AGMA 9002-B04 standard for interference fit unless otherwise specified.

b. Lovejoy supplies metric dimensioned straight gear hub bores with keyway to ANSI/AGMA 9112-A04 standard for interference fit unless otherwise specified.

Caution!
Hubs must be supported during installation to avoid accidental damage should they slip.

c. **Straight Bore Interference Fit:** This type of installation is for straight shafts, with the exception that the hubs must be heated before they are installed on the shaft.

It is important when mounting inference hubs to make sure that clearance exists over the top of keys: otherwise, when the hub cools, it will rest on the key and produce high stresses in the hub that could cause it to fail.

Expand the hub bore with a uniform heat source, Oil, Oven or Induction.

Warning!
If an oil bath is used, the oil must have a flash point of 350° F (177°C) or greater. Do not rest hubs on the bottom of the container.

Oil bath heating is usually limited to approximately 350˚F (177°C), or less than the flash point of the oil used. Special handling devices are required such as tongs, threaded rods placed in puller holes in the hub, etc.

Oven heating offers some advantages over oil. Parts can be heated to higher temperatures, usually not exceeding 600˚F (315˚C) and the parts can be handled with heat-resistant gloves. Do not rest hubs on oven; place them on a rack.

An Induction heater can be used as long as the temperature rise is controlled

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

Open Flame Heating is **not** recommended. If an oxy-acetylene is used, use an excess acetylene mixture. Mark the hub body at the top, center and bottom of their length in several places with heat sensitive crayon, 350˚F (177°C) melt temperature.

Elevate the hub with refractory bricks to allow the flame to flow through the hub. With a “Blue flame” or “Rose bud torch” direct the flame towards the hub bore using constant motion to avoid overheating an area. Once the heat sensitive crayon melts the hub is ready for mounting.

Caution!
Do Not Spot Heat the Hub or Distortion May Occur.

Regardless of method used, heat **MUST** be applied evenly to avoid distortion. This is especially important when using open flame heating. In any event, extreme care must be exercised when handling heated hubs to avoid Injury to personnel.

Caution!
Do Not Exceed 600˚F (315˚C) During the Heating of the Hub. Excessive Heat may soften the Hub, Reducing the Strength of the Steel and may affect the Performance Characteristics of the Hub.

The following equations may help you determine the temperature required to expand the bore to install the hub on the shaft.

Bore Expansion

E = Bore Expansion
B = Bore Diameter (in)
T = Temperature rise above Ambient (°F)

$$T = \frac{E}{B \times .0000064}$$

e = Bore Expansion (mm)
b = Bore Diameter (mm)
t = Temperature rise above Ambient (°C)

$$t = \frac{e}{b \times .0000125}$$

Caution!
Lovejoy manufactured the coupling interfaced based on the shaft data supplied by the purchaser. Lovejoy is not responsible for inaccurate or incomplete information supplied by the purchaser.

It is the purchasers responsibility to assure that the interface connections (Flanges, Bolts, Keys, Hydraulic Fits. between the coupling and the connected equipment are capable of handling the anticipated loads.

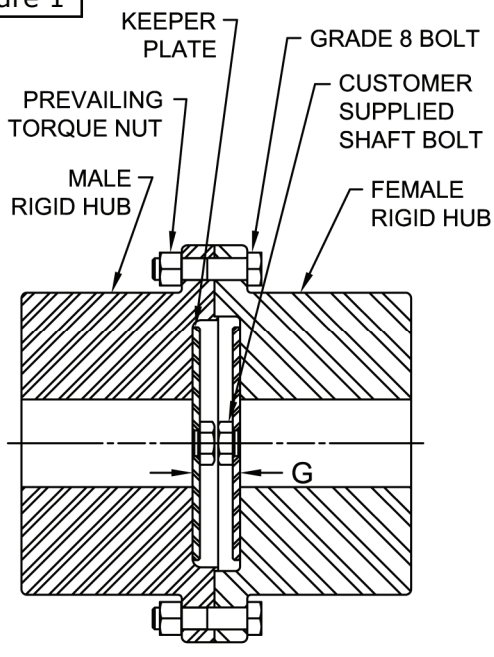
7. Coupling Assembly

a. Once the hub is mounted and cooled, place the keeper plate (figure 1) into the counter bore and attach it to the shaft with the bolt (figure 1) supplied by the customer. Torque bolts to equipment manufactures specification.

b. The customer supplied bolt should not be used with a lock washer as this may create an interference. Loctite may be used..

c. With the appropriate flexible support lifting equipment, move the Drive equipment into place, approximately parallel and in line with the driven shaft.

Figure 1



d. Rotate one hub so that the hub bolt holes line up with the other hub and insert the bolts through the hub, add the locknuts and hand tighten. All the locknuts can be snugged up at this time**. Do Not Torque the Locknuts** at this time.

e. Using a precision torque wrench, while allowing the drive assembly to move as required to draw the flanges together, tighten the fasteners as described in the torqueing procedure (Section 8).

8. Torqueing Procedure

Note: If room permits, always tighten the nut, not the bolt since part of the tightening torque is needed to overcome friction. As there is additional friction when turning the bolt, more of the effort goes into friction than in to stretching the bolt.

a. Always remember to **properly seat the bolt** before tightening the nut. Drawing the bolt through the flange by tightening the nut could result in insufficient preloading of the bolt.

b. Bolts should be tightened to the recommended torque specification in the following steps:

1. All bolts should be **tightened to one half** of the torque tightening values in a crisscross fashion as shown in Table 2.

2. Once all bolts have been tightened to half of the torque tightening value, follow the same crisscross pattern and **torque to the final torque value** as shown in Table 2.

3. Finally, **check the first bolt tightened to assure it has maintained its torque value** after all bolts have been tightened, if it does not meet the torque value in Table 2 follow the same crisscross pattern and torque all bolts again.

Lovejoy has calculated the bolt stress and their tightening recommendations, which should always be followed.

There are numerous reasons why the bolts should be properly torqued:

- Couplings resist misalignment and the resulting “force and moments” put a strain on the equipment and connecting fasteners

- If fasteners are loose, they are subject to alternating forces and may fail through fatigue

- A bolt that is not properly preloaded, may become loose after a short period of operation
- The Lovejoy gear coupling design requires 100% of the torque to be transmitted through friction
- If the bolts are not tightened properly, there is less clamping force, less friction and the torque will be transmitted through shear

Because of the combined shear and tensile stresses in the bolts, recommendations for bolt tightening vary from coupling to coupling.

9. Machinery Alignment

a. Optical methods of alignment (such as Laser) are recommended

b. With the machinery in place and the gear coupling assembled, align the units. The useful life of any gear coupling is directly influenced by the operating misalignment; the better the alignment, the longer the coupling life. The coupling alignment should be check periodically. Even when a coupling is well aligned at installation, subsequent settling of foundations, shifting of equipment, etc., may cause the alignment to deteriorate.

Table 2

FARR Size		1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	7	8	9	10	11
"G" Hub Separation	Figure 1	1.12	1.64	1.64	1.51	1.63	1.63	1.63	1.63	1.63	1.63	1.63	2.88	2.88	2.88	2.88	3.75
Installation	Offset MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limits	Angular MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating	Offset MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Limits	Angular MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Speed	RPM	6,000	5,500	5,000	4,400	4,000	3,500	3,000	2,700	2,500	2,200	2,100	2,000	1,900	1,800	1,550	1,400
Tightening Torque	N-m	15	48	106	198	198	299	299	299	412	412	412	548	712	938	1,485	2,055
Tightening Torque	ft-lbs	11	35	78	146	146	221	221	221	304	304	304	404	525	692	1,095	1,516

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