F Gear Coupling Sizes 1 - 9
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 phase 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 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 instructions in this document prior to installing this coupling and placing it in operation. Proper safety guidelines and practices should always be followed during every phase of installation and operation.

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 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 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.

F (flex-flex) FFR (flex-rigid)

Figure 1

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

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.**

PRODUCT INSPECTION:

Prior to installation, the coupling, components, and all hardware should be examined for damage that may have occurred as a result of shipping or handling. Refer to the chart below (Table 1) and the exploded view on the following page (Figure 2) to ensure all the parts as ordered are present.

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 (see Tables 2 and 3).

Table 1 - Product Inspection (Component Quantities)

	Size: >>>	F 1	F 1.5	F 2	F 2.5	F 3	F 3.5	F 4	F 4.5	F 5	F 5.5	F 6	F 7	F 8	F 9
Quantities	Hubs	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Sleeves with O-Ring Seal and Pipe Plug	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Gasket	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Exposed Bolts and Lock Nuts per Hub	6	8	6	6	8	8	8	10	8	14	14	16	16	18
	Shrouded Bolts and Lock Nuts per Hub	6	8	10	10	12	12	14	14	14	16	-	-	-	-

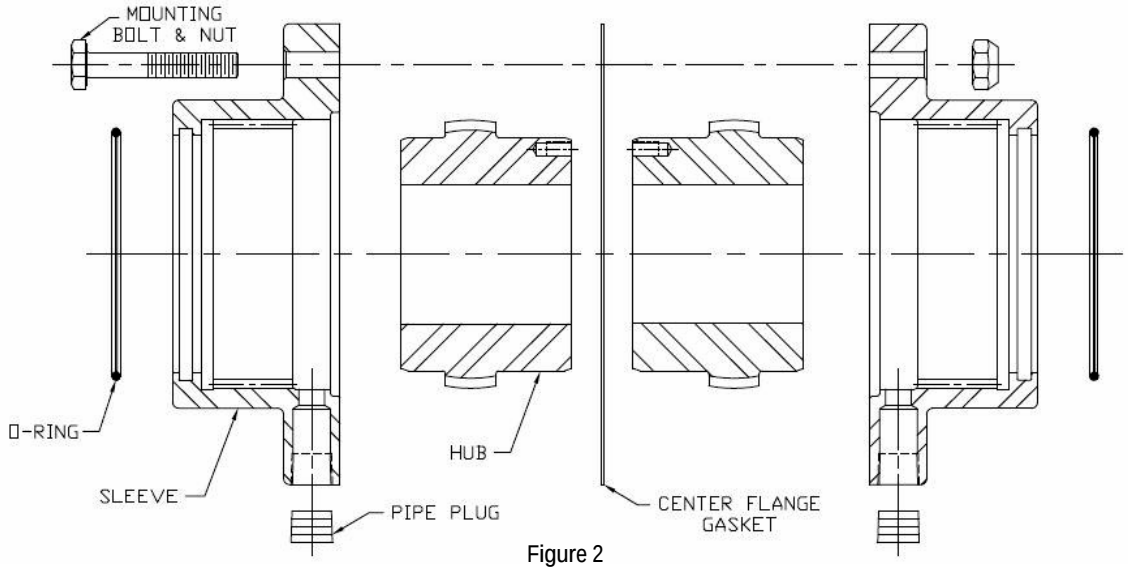


Figure 2

PRODUCT INSPECTION (continued):

Note: Although F-Series gear couplings may be shipped with the hub inside the sleeve, the complete couplings are normally shipped unassembled. The O-Ring seals are typically packaged with the accessory kit.

Caution! Lovejoy manufactures couplings based on the shaft details provided by the purchaser. Lovejoy will not be responsible for inaccurate or incomplete information supplied by the purchaser. Lovejoy recommends that customers re-check all shaft dimensions.

It is the responsibility of the purchaser to assure the interface connection (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.*

REQUIRED TOOLS:

- Calipers
- Calibrated Torque Wrench
- Sockets and appropriate open end wrenches
- Alignment Equipment
- Oven or heating device for interference fit hubs

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 suffice 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.

COUPLING INSTALLATION:

SLEEVE POSITIONING (prior to hub installation):

The sleeve will need to be slid onto the shaft with the O-ring installed prior to installing the hub allowing adequate room to mount the hub. Care should be taken to support the sleeve and prevent accidental damage if the sleeve were to slip while placing it on the shaft. Once the sleeve is on the shaft, allow room to install the hub. The sleeve will need to be supported to prevent damaging the seal. The flange face should be oriented toward the end of the shaft.

HUB INSTALLATION:

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

1. Lovejoy supplies '**inch**' dimensioned 'F' hub straight bores with bore and keyway tolerances conforming to ANSI/AGMA 9002-B04 standards for interference fit unless otherwise specified.

2. Lovejoy supplies '**metric**' dimensioned 'F' hub straight bores with bore and keyway tolerances conforming to the ISO 286-2 standards for a P7 interference fit unless otherwise specified.

3. **Straight Bore (Clearance Fit)**: Install the keys in the shaft. The key(s) 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, or LTB dimension of the hub (see Table-2). Align the key(s) in the shaft, and then slide the hub onto the shaft. The key(s) should be flush with the end of the shaft and face of the hub. The long end of the hub should face the end of the shaft.

HUB INSTALLATION (continued):

4. **Straight Bore (Interference Fit)**: This is the default bore supplied by Lovejoy for gear coupling hubs. The installation is similar to Clearance Fit hubs except that these hubs need to be heated prior to installing the hub onto the shaft. It is important when installing a hub with an interference fit that some clearance exists over the top of the key. Otherwise, when the hub cools, the top of the hub keyway will rest on the key and produce high stresses in the keyway that could cause the coupling to fail. Orient the hub with the long end of the hub facing the end of the shaft. Align the keyway(s) and key in the shaft, then slide the hub onto the shaft. The key(s) should be flush with the end of the shaft and face of the hub.

5. **Heating Recommendations for Interference Fit Hubs**: Expand the hub using a uniform heat source described in the following steps.

Oil Bath Heating is usually limited to 350º F. (177º C), or 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 at any time.

Oven Heating offers some advantages over oil bath heating. Parts can be heated to higher temperatures, usually not to exceed 600º F (315º C). This is roughly the maximum temperature where the metal does not go though 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.

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

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. When heating the hub with an oxyacetylene torch, 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 350º F (177º C) melt temperature and another with a 450º F (232º 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 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.*

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

When installing coupling hubs, always consult with all applicable Federal, State, and local laws and regulations covering the safe operation and maintenance of equipment. This includes, without limitation, the USDOL-OSHA "Lockout/Tag-out" procedure set forth in 29 CFR 1910.147.

Caution! The coupling sleeves must be slid onto the equipment shaft prior to mounting the hubs.

6. Mount 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 long end of the hub facing the end of the shaft unless this is a "Slide – FSL" style coupling (Contact Lovejoy Technical Support with questions). The key should be lined up with the end of the shaft and face of the hub. Once mounted on the shaft, **allow the hubs to cool completely before continuing.**

F GEAR COUPLING ALIGNMENT:

1. Although the shafts may be accurately aligned at installation, they will need to be realigned after the coupling hubs have been mounted. Position the equipment in approximate alignment with the appropriate and specified hub separation (BSE) dimension per Table-2 at the end of this document. Allowable angular and parallel misalignment values are shown in Table-4. Methods for performing an industry accepted coupling alignment will be covered in the next two steps.

2. **Angular Alignment** – Attach a dial indicator base to one of the hubs and position the indicator needle against the face of the other hub. Ensure the needle is placed on a clean smooth surface as close to the outside diameter of the hub face as possible. Rotate the hub 360º and record indicator readings at **four points, 90º apart**. Adjust the equipment until all four readings are identical. The difference between the maximum and minimum measurements must not exceed the **Installation Limits for "Angular Max"** as found in Table-4. Relocate the indicator to the opposite hub and repeat this procedure.

3. **Parallel Offset Alignment** – Although laser alignment equipment is available in the market today, it is not always readily available. For that reason, the dial indicator method can be used for measuring and correcting parallel misalignment. Attach the dial indicator base to one of the hubs and set the dial indicator needle in contact with the outside diameter of the opposite hub. Rotate the hub that the indicator needle is resting against 360º and record indicator readings at **four points, 90º apart**. Adjust the equipment until all four readings are identical. The difference between the maximum and minimum measurements must not exceed the **Installation Limits for "Offset Max"** as found in Table-4. Relocate the indicator to the opposite hub and repeat this procedure.

4. Tighten all equipment mounting and foundation bolts; then repeat steps 2 and 3 to ensure the coupling hubs are still in proper alignment. The BSE should not have changed and should match the specified value for the coupling as purchased (see Table-2).

COUPLING ASSEMBLY:

1. Per instructions earlier in this document, the sleeves should already be mounted on the shafts with the O-rings in place prior to mounting the hubs.

2. Hand apply an ample amount of coupling grease around the gear teeth on one hub and the gear teeth inside the mating sleeve. Then carefully slide the sleeve over the hub. Maintain careful support for the sleeve to protect the O-Ring seal and ensure the sleeve does not impact against the hub causing damage. The gear teeth in the sleeve should mesh with the gear teeth on the hub. Slide the sleeve over the hub until the hub protrudes through the O-Ring seal. The teeth and seal should support the weight of the sleeve at this time. Repeat this process for the opposite hub and sleeve.

3. Prior to sliding the sleeves together, remove the flange gasket from the accessory kit and position the gasket between the two flanges then slide two or more of the bolts from the accessory kit through the top bolt holes to hold the gasket in place.

Caution! Use care not to crimp or damage the gasket.

COUPLING ASSEMBLY (continued):

4. Slide the two flanges together with the gasket between them. Be careful not to crimp or damage the gasket. Then insert the remainder of the bolts from the accessory kit. The grease fitting holes should be located 180º apart. Insert the remainder of the bolts and hand tighten the nuts on each bolt.

5. Partially tighten each of the nuts in a star, or criss-cross, pattern, again using care to ensure the gasket is not being crimped or damaged.

6. Use a calibrated torque wrench to tighten the bolts and nuts following a star, or criss-cross, pattern until each bolt has been tightened to the specified torque value as defined in Table-3.

7. Insert a grease fitting in one of the grease fitting ports and leave the second hole unplugged. Rotate the coupling until the grease fittings are horizontal. Use only coupling grease and inject the grease through the fitting until the recommended amount specified in Table-4 has been loaded into the coupling. Place the grease plugs in both fitting holes prior to placing the coupling in service.

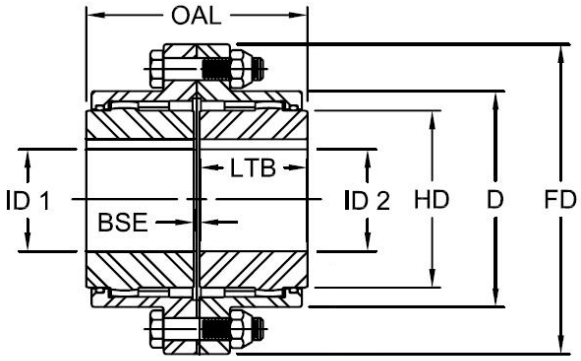
MAINTANENCE:

1. It is typical to inspect the coupling after running a few hours or less to ensure there are no issues with alignment, heat, or other concerns that could be detrimental to the operation of the coupling.

2. After roughly one month of operation, the coupling should be disassembled and inspected for abnormal wear, problems with grease, and possible issues with equipment alignment.

3. Periodic inspections should take place at least on an annual basis to ensure the coupling is performing as designed and the grease is not breaking down. Specifications for coupling grease can be found at http://www.lovejoy-inc.com under Technical Resources.

Note: During maintenance, when the coupling is not being disassembled or the bolts are not removed, insert a grease fitting in one of the grease fitting ports and leave the second hole unplugged. Rotate the coupling until the grease fittings are horizontal. Inject grease through the fitting until clean grease oozes out of the other port. Again, Place the grease plugs in both fitting holes prior to placing the coupling back in service.



F Flex-Flex Coupling

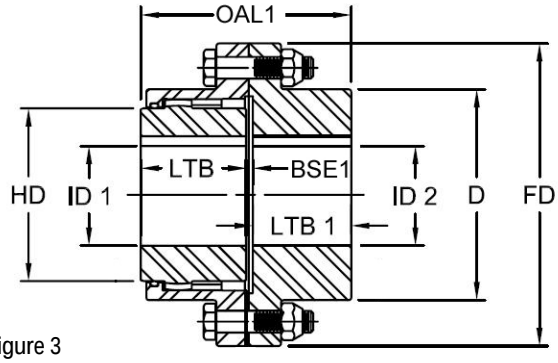


Figure 3

FFR Flex-Rigid Coupling

Table 2 - Dimensional Data [1]

F Size	OAL in	OAL 1 in	FD in	D in	HD in	BSE in	BSE 1 in	LTB in	LTB 1 in
1	3.5	3.41	4.56	3.06	2.31	0.13	0.16	1.69	1.56
1.5	4.00	3.94	6.00	3.97	3.00	0.13	0.16	1.94	1.84
2	5.00	4.88	7.00	4.86	4.00	0.13	0.16	2.44	2.28
2.5	6.25	6.13	8.38	5.84	4.63	0.19	0.19	3.03	2.91
3	7.38	7.19	9.44	6.84	5.63	0.19	0.19	3.59	3.41
3.5	8.63	8.38	11.00	7.91	6.50	0.25	0.22	4.19	3.97
4	9.75	9.50	12.50	9.25	7.50	0.25	0.31	4.75	4.44
4.5	10.94	10.69	13.63	10.38	8.50	0.31	0.34	5.31	5.03
5	12.38	12.06	15.31	11.56	9.50	0.31	0.34	6.03	5.69
5.5	14.13	13.41	16.75	12.72	10.50	0.31	0.34	6.91	6.16
6	15.13	15.22	18.00	14.00	11.50	0.31	0.41	7.41	7.41
7	17.75	17.88	20.75	15.75	13.00	0.38	0.50	8.69	8.69
8	22.38	22.50	23.25	18.34	15.50	0.38	0.50	11.00	11.00
9	23.50	23.56	26.00	20.38	17.00	0.50	0.56	11.50	11.50

Notes: 1. For OAL, BSE and LTB, standard options are for flex-flex.
OAL 1, BSE 1, and LTB 1 options are for flex-rigid

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Revision Date: 26-May-2011

Table 3 - Performance Data

F Size	Torque Nominal in-lbs	Torque Nominal Nm	Maximum Bore Size Flex-Hubs in [2]	Flex-Hubs mm [3]	Rigid Hubs in [2]	Rigid Hubs mm [3]	Approx Weight (based on RSB) lbs	kg	WR^2 x 10^-6	Flange Bolts [1] Qty	Size	Tightening Torque
1	7,600	850	1.625	42	2.125	56	9	4	19	6	1/4-28	130 in-lbs
1.5	18,900	2 140	2.125	56	2.813	76	19	9	65	8	3/8-24	425 in-lbs
2	31,500	3 560	2.750	73	3.500	95	34	15	150	6	1/2-20	940 in-lbs
2.5	56,700	6 410	3.250	85	4.250	114	54	25	340	6	5/8-18	1750 in-lbs
3	94,500	10 700	4.000	107	4.875	134	80	36	655	8	5/8-18	1750 in-lbs
3.5	151,200	17 100	4.625	125	5.625	150	130	59	1,485	8	3/4-16	2650 in-lbs
4	220,500	24 900	5.375	145	6.500	176	190	86	2,725	8	3/4-16	2650 in-lbs
4.5	302,400	34 200	6.000	165	7.625	202	250	114	4,280	10	3/4-16	2650 in-lbs
5	434,700	49 100	6.500	180	8.750	230	380	173	8,280	8	7/8-14	3650 in-lbs
5.5	573,300	64 800	7.500	200	9.500	260	520	236	12,795	14	7/8-14	3650 in-lbs
6	749,700	84 700	8.250	225	10.500	285	650	295	17,290	14	7/8-14	3650 in-lbs
7	1,008,000	113 900	9.500	255	12.000	320	950	431	32,180	16	1-14	4850 in-lbs
8	1,323,000	149 500	11.500	310	14.000	375	1,560	708	64,610	16	1-1/8 - 12	6300 in-lbs
9	1,827,000	206 400	12.500	340	15.500	415	2,015	915	110,940	18	1-1/4 - 12	8300 in-lbs

Notes:
1. Bolt Sizes for Exposed bolts only (Lovejoy standardized on exposed bolts, shrouded bolts are available)
2. Bore and keyway tolerances for inch dimensions based on the ANSI/AGMA 9002-B04 Standard
3. Bore and keyway tolerances for metric dimensions based on the ISO 286-2 Standard

Table 4 - Alignment and Lubrication

Size: >>>		F 1	F 1.5	F 2	F 2.5	F 3	F 3.5	F 4	F 4.5	F 5	F 5.5	F 6	F 7	F 8	F 9
Hub Separation Flex-Flex		0.1250	0.1250	0.1250	0.1875	0.1875	0.2500	0.2500	0.3125	0.3125	0.3125	0.3125	0.3750	0.3750	0.5000
Hub Separation Flex-Rigid		0.1563	0.1563	0.1563	0.1875	0.1875	0.2188	0.3125	0.3438	0.3438	0.3438	0.4063	0.5000	0.5000	0.5600
Installation Limits	Offset Max	0.0111	0.0121	0.0170	0.0209	0.0233	0.0262	0.0298	0.0350	0.0403	0.0442	0.0239	0.0272	0.0317	0.0334
	Angular Max	0.0070	0.0090	0.0116	0.0135	0.0164	0.0186	0.0215	0.0248	0.0272	0.0304	0.0165	0.0186	0.0223	0.0242
Operating Limits	Offset Max	0.0556	0.0603	0.0850	0.1047	0.1164	0.1312	0.1490	0.1749	0.2014	0.2210	0.1195	0.1358	0.1587	0.1669
	Angular Max	0.0348	0.0449	0.0578	0.0676	0.0818	0.0928	0.1074	0.1240	0.1360	0.1519	0.0823	0.0928	0.1114	0.1212
Tooth Center to Tooth Center		2.125	2.305	3.245	3.998	4.448	5.010	5.690	6.683	7.693	8.443	9.133	10.375	12.125	12.750
Max Speed (RPM) Unbalanced		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
Flex-Flex	Weight	2 oz	4 oz	6 oz	11 oz	1.0 lbs	1.3 lbs	2.0 lbs	3.5 lbs	4.5 lbs	6.5 lbs	7.3 lbs	9.3 lbs	18 lbs	20 lbs
Lube Capacity	Volume	2 oz	4 oz	6 oz	12 oz	18 oz	24 oz	1.1 qt	2.0 qt	2.5 qt	3.5 qt	1.0 gal	1.3 gal	2.3 gal	2.8 gal
Flex-Rigid	Weight	1 oz	2 oz	3 oz	5 oz	8 oz	10 oz	1.0 lbs	1.8 lbs	2.3 lbs	3.3 lbs	3.6 lbs	4.6 lbs	8.8 lbs	10 lbs
Lube Capacity	Volume	1 oz	2 oz	3 oz	6 oz	9 oz	12 oz	18 oz	1.0 qt	1.3 qt	1.8 qt	2.0 qt	2.4 qt	1.1 gal	1.4 gal

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Revision Date: 26-May-2011