

Clutch Couplings

FW/FWW

Overrunning Ball Bearing Supported, Sprag Clutch Couplings

FW Series



For in-line shaft applications

Outer race overrunning—
intermediate speed

Inner race overrunning—
high speed

FW clutch couplings are comprised of an FSO clutch with a disc coupling. The Model FSO clutch can not accommodate any misalignment, so a coupling is always required for shaft to shaft in-line mounting. The FW clutch couplings are designed for high speed inner race overrunning

and intermediate speed outer race overrunning. They are usually selected for inner race overrunning. Where outer race overrunning is necessary, use the AL.. KMSD2 clutch coupling.

FW clutch couplings accommodate angular and parallel misalignment, are torsionally stiff and can couple shafts of different sizes.

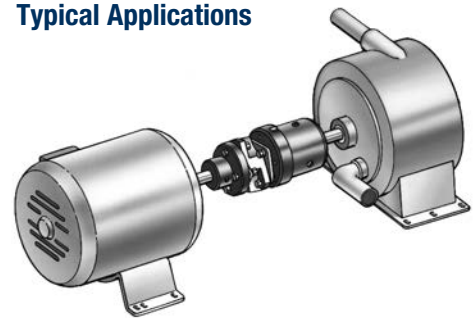
Increased clutch-coupling speeds are possible with FSO clutches having steel labyrinth grease seals.

C/T is ideal for applications with high speed outer race overrunning and slow drive speed.

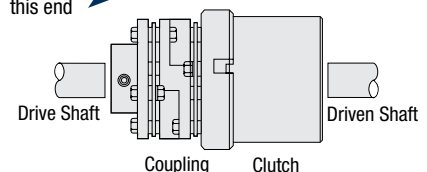
Models 403 through 712 are equipped with PCE sprags and are shipped from the factory with Mobil DTE Heavy Medium Oil or Low-Temp Grease.

FW-752 through 812 clutches are shipped from the factory with Fiske Brothers AERO-Lubriplate Low-Temp Grease or Mobile DTE Heavy Medium Oil.

Typical Applications



View from
this end



The FW Series clutch coupling is designed for **inner race overrunning**. Mount the clutch half of the unit on the driven shaft.

FWW Series



For in-line shaft applications
requiring low torque

FWW clutch couplings are designed for applications where the torque requirement is low in comparison to the shaft diameters. Both bore diameters in coupling hubs are larger than clutch bores in FW and FWW series.

C/T sprags are available in FWW series.

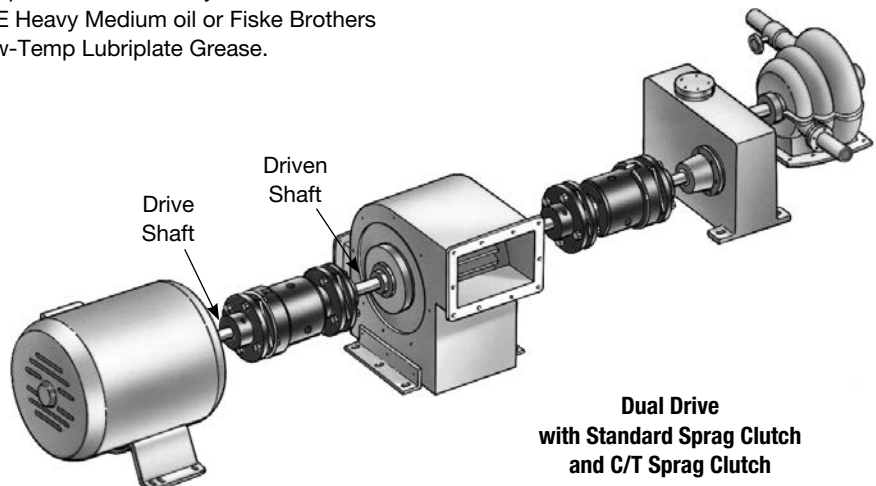
Increased clutch-coupling speeds are possible with FSO clutches having steel labyrinth seals.

Check key and shaft stress before making final clutch or coupling selection since this may determine maximum allowable drive torque capacity.

FWW-420 through 640 clutches are shipped from the factory with Mobil DTE Heavy Medium oil or Fiske Brothers Low-Temp Lubriplate Grease.

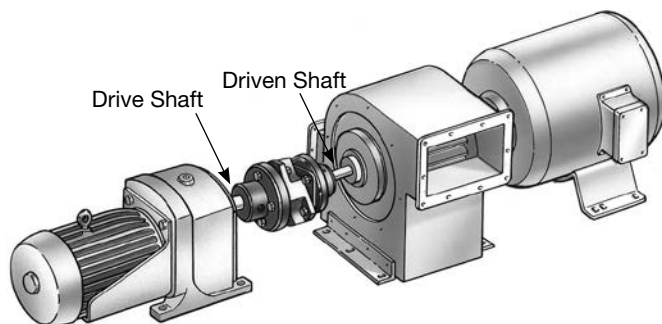
The FWW Series clutch coupling is designed for **inner race overrunning**. Mount the drive coupling on the drive shaft and the driven coupling on the driven shaft.

Note: Mounting is reversed for C/T Series.

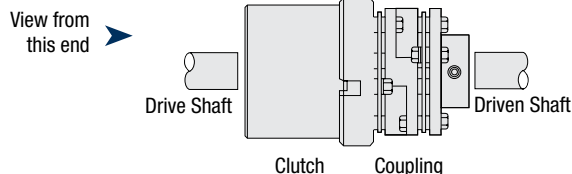


**Dual Drive
with Standard Sprag Clutch
and C/T Sprag Clutch**

Turning Gear Drive with C/T Sprag Clutch

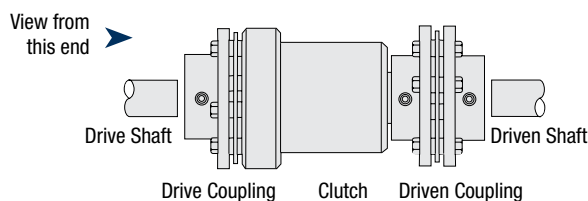


With C/T Sprags



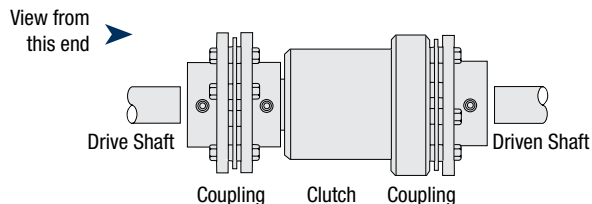
The model FW (C/T) clutch coupling is designed for outer race overrunning. Mount the clutch half of the unit on the drive shaft.

FWW



The model FWW clutch coupling is designed for **inner race overrunning**. Mount the drive coupling on the drive shaft and the driven coupling on the driven shaft.

With C/T Sprags



Note: Mounting is reversed for C/T Series.

Bore and keyseat tolerances for couplings

Couplings will be bored to AGMA Standard 511.02 for Flexible Couplings. Bore fit normally supplied is listed to the right.

For tolerances not listed, please consult Formsprag.

Standard bore tolerances inches (mm)

Nominal Shaft Dia.	Clearance Fit Class 1 Nominal	Interference* Fit Nominal
1/2" through 1 1/2" (12.7 through 38.1)	+ .001 / - .000 (+ .025 / - .000)	Less .001 + .0005 / - .000 (Less .025 + .013 / - .000)
Over 1 1/2" through 2" (Over 38.1 through 50.8)	+ .001 / - .000 (+ .025 / - .000)	Less .002 + .001 / - .000 (Less .051 + .025 / - .000)
Over 2" through 3" (Over 50.8 through 76.2)	+ .0015 / - .000 (+ .038 / - .000)	Less .003 + .0015 / - .000" (Less .076 + .038 / - .000)
Over 3" through 4" (Over 76.2 through 101.6)	+ .0015 / - .000 (+ .038 / - .000)	Less .003 + .0015 / - .000" (Less .076 + .038 / - .000)
Over 4" through 7" (Over 101.6 through 177.8)	+ .002 / - .000 (+ .051 / - .000)	Less .003 + .0015 / - .000" (Less .076 + .038 / - .000)

* Available at extra charge. Sizes are standard unless otherwise specified.

Standard keyseats inches (mm)

Nominal Shaft Diameter		Keyseat	
Over	Through	Width + .002 / - .000 (+ .051 / - .00)	Length + .010 / - .000 (+ .254 / - .000)
3/8 (9.525)	7/16 (11.100)	3/32 (2.362)	1/16 (1.168)
7/16 (11.100)	9/16 (14.275)	1/8 (3.175)	1/16 (1.575)
9/16 (14.275)	7/8 (22.225)	3/16 (4.750)	3/32 (2.362)
7/8 (22.225)	1 1/4 (31.750)	1/4 (6.350)	1/8 (3.175)
1 1/4 (31.750)	1 3/8 (34.925)	5/16 (7.925)	5/32 (3.962)
1 3/8 (34.925)	1 3/4 (44.450)	3/8 (9.525)	3/16 (4.750)
1 3/4 (44.450)	2 1/4 (57.150)	1/2 (12.700)	1/4 (6.350)
2 1/4 (57.150)	2 3/4 (69.850)	5/8 (15.875)	5/16 (7.925)
2 3/4 (69.850)	3 1/4 (82.550)	3/4 (19.050)	3/8 (9.525)
3 1/4 (82.550)	3 3/4 (95.250)	7/8 (22.225)	7/16 (11.100)
3 3/4 (95.250)	4 1/2 (114.300)	1 (25.400)	1/2 (12.700)
4 1/2 (114.300)	5 1/2 (139.700)	1 1/4 (31.750)	5/8 (15.875)
5 1/2 (139.700)	7 (177.800)	1 1/2 (38.100)	3/4 (19.050)

Clutch Couplings

FW/FWW

FW

Specifications

FW Size	Torque Capacity lb.ft. (Nm)	HP Rating/ 100 RPM HP (kw)	Maximum Overrunning Speed (RPM)								Clutch Size*	Coupling Size	Shipping Weight lb. (kg)
			Standard Sprag			C/T Sprag							
			Outer Race	Inner† Race	Drive Speed	Outer Race	Inner Race	Sprag Lift-off	Drive Speed				
403	65 (88)	1.2 (.90)	850	2,800	6,000	5,000	2,800	1,300	1,100	FSO-400	AP10W	11 (5)	
406	180 (244)	3.5 (2.6)	850	2,800	6,000	5,000	2,800	1,300	1,100	FSO-400	AP20W	13 (6)	
504	180 (244)	3.5 (2.6)	800	2,500	6,000	4,000	2,500	1,200	1,000	FSO-500	AP20W	19 (9)	
508	575 (778)	11.0 (8.2)	800	2,500	5,000	4,000	2,500	1,200	1,000	FSO-500	AP30W	29 (13)	
607	325 (440)	6.2 (4.6)	750	2,200	5,000	3,600	2,200	1,200	1,000	FSO-600	AP25W	31 (14)	
610	1503 (2033)	29.0 (21.6)	750	2,200	3,750	3,600	2,200	1,200	1,000	FSO-600	AP40W	54 (25)	
708	945 (1281)	18.0 (13.4)	450	1,600	3,000	2,500	1,600	1,000	800	FSO-700	AP35W	68 (31)	
712	2520 (3416)	48.0 (35.8)	450	1,600	3,000	2,500	1,600	1,000	800	FSO-700	AP45W	86 (30)	
752	2520 (3416)	48.0 (35.8)	650	1,000	3,000	1,800	1,000	800	650	FSO-750	AP45W	127 (58)	
812	2520 (3416)	48.0 (35.8)	525	850	3,000	1,500	850	675	525	FSO-800	AP45W	146 (66)	

* For clutch dimensions and bore/keyseat sizes, see pages 15 and 17.

† Labyrinth grease seals permit higher inner race overrunning speed; see pages 14 and 16.

FWW

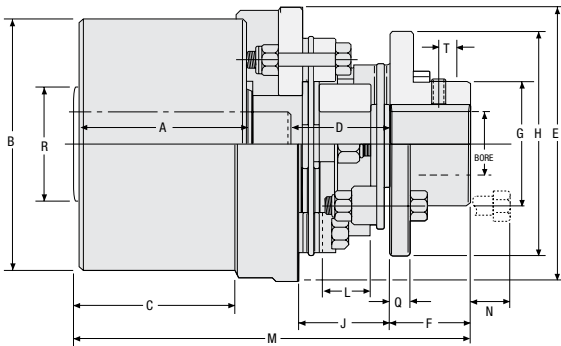
Specifications

FWW Size	Torque Capacity lb.ft. (Nm)	HP Rating/ 100 RPM HP (kw)	Maximum RPM Overrunning Speed								Clutch Size*	Coupling Size	Shipping Weight lb. (kg)
			Standard Sprag			C/T Sprag							
			Outer Race	Inner† Race	Drive Speed	Outer Race	Inner Race	Sprag Lift-off	Drive Speed				
420	183 (248)	3.5 (2.6)	850	2,800	6,200	5,000	2,800	1,300	1,100	FSO-400	AR20	20 (9)	
530	575 (774)	11.0 (8.2)	800	2,500	5,000	4,000	2,500	1,200	1,000	FSO-500	AR30	42 (19)	
640	1500 (2033)	29.0 (21.6)	750	2,200	3,750	3,600	2,200	1,200	1,000	FSO-600	AR40	91 (41)	

* For clutch dimensions and bore/keyseat sizes, see pages 15 and 17.

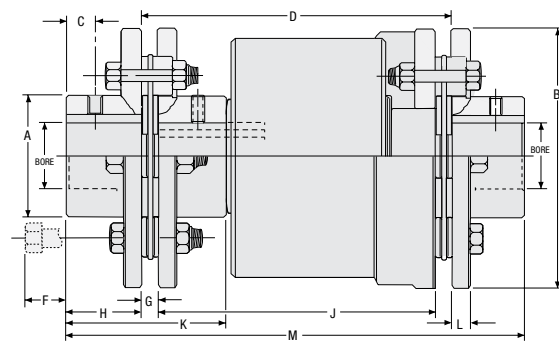
† Labyrinth grease seals permit higher inner race overrunning speeds, see pages 14 and 16.

FW



Coupling sizes 403 through 712 have PCE sprags. C/T sprags are available for all sizes.

FWW



Coupling sizes 420 through 640 have PCE sprags. C/T sprags are available for all sizes.

FW

Dimensions inches (mm)

Size	A	B	C	D	E	F	G	H	J	L	M	N	Q	R	T
403	2.75 (69.85)	3.500/3.498 (88.90/88.85)	2.53 (64.26)	2.39/1.72 (60.71/43.69)	4.00 (101.60)	1.00 (25.40)	1.80 (45.72)	3.19 (81.03)	1.72 (43.69)	1.18 (29.97)	6.167 (156.64)	0.62 (15.75)	0.30 (7.62)	1.187 (30.15)	.375 (9.53)
406	2.75 (69.85)	3.500/3.498 (88.90/88.85)	2.53 (64.26)	2.67/1.74 (67.82/44.20)	4.08 (103.63)	1.38 (35.05)	2.40 (60.96)	4.08 (103.63)	1.83 (46.48)	1.14 (29)	6.740 (171.20)	0.57 (14.5)	0.35 (8.89)	1.187 (30.15)	.500 (12.70)
504	3.50 (88.90)	4.250/4.248 (107.95/107.90)	3.25 (82.55)	2.64/1.74 (67.06/44.20)	4.75 (120.65)	1.38 (35.05)	2.40 (60.96)	4.08 (103.63)	1.83 (46.48)	1.14 (29)	7.460 (189.48)	0.57 (14.5)	0.35 (8.89)	1.770 (45.0)	.500 (12.70)
508	3.50 (88.90)	4.250/4.248 (107.95/107.90)	3.25 (82.55)	3.70/2.48 (93.98/62.99)	5.63 (143.00)	1.88 (47.75)	3.30 (83.82)	5.63 (ø143)	2.77 (70.28)	1.87 (47.72)	9.085 (230.76)	.55 (14)	0.55 (13.97)	1.770 (45.0)	.687 (17.45)
607	3.75 (95.25)	5.375/5.373 (136.53/136.47)	3.50 (88.90)	3.30/2.63 (83.82/66.80)	5.86 (148.84)	1.62 (41.15)	3.14 (79.76)	ø4.84 (ø123)	2.46 (62.44)	1.61 (41)	8.47 (215.05)	.34 (8.5)	0.35 (8.89)	2.750 (69.85)	.625 (15.88)
610	3.75 (95.25)	5.375/5.373 (136.53/136.47)	3.50 (88.90)	5.35/4.17 (135.89/105.92)	7.79 (197.87)	2.50 (63.50)	5.21 (132.45)	7.99 (ø203)	3.99 (101.4)	2.49 (63.2)	11.34 (288.11)	1.12 (28.5)	0.55 (13.97)	2.750 (69.85)	1.20 (30.48)
708	5.00 (127.00)	7.125/7.123 (180.98/180.92)	4.94 (125.48)	4.60/3.58 (116.84/90.93)	7.12 (180.85)	2.25 (57.15)	3.17 (113.00)	6.65 (ø169)	3.62 (92)	2.44 (62)	11.91 (302.48)	0.63 (16)	0.45 (11.43)	4.000 (101.60)	.875 (22.23)
712	5.00 (127.00)	7.125/7.123 (180.98/180.92)	4.94 (125.48)	4.69/3.26 (119.13/82.80)	7.79 (197.87)	3.00 (76.20)	5.21 (132.45)	7.99 (ø203)	3.99 (101.4)	2.49 (63.2)	13.55 (344.19)	0.63 (16)	0.55 (13.97)	4.000 (101.60)	1.203 (30.56)
752	6.00 (152.40)	8.750/8.748 (222.25/222.20)	5.94 (150.88)	4.69/3.26 (119.13/82.80)	8.75 (222.25)	3.00 (76.20)	5.21 (132.45)	ø7.99 (ø203)	3.99 (101.4)	2.49 (63.2)	14.10 (358.19)	0.63 (16)	0.55 (13.97)	4.250 (107.95)	1.203 (30.56)
812	6.00 (152.40)	10.000/9.998 (254.00/253.95)	5.94 (150.88)	4.69/3.26 (119.13/82.80)	10.00 (254.00)	3.00 (76.20)	5.21 (132.45)	ø7.99 (ø203)	3.99 (101.4)	2.49 (63.2)	14.29 (362.99)	0.63 (16)	.55 (13.97)	5.500 (139.70)	1.203 (30.56)

FWW

Dimensions inches (mm)

Size	A	B	C	D	F	G	H	J	K	L	M
420	2.40 (60.96)	4.08 (103.63)	0.50 (12.70)	5.56 (141.23)	0.57 (14.5)	0.34 (8.74)	1.38 (35.05)	4.87 (123.75)	2.98 (75.69)	0.35 (8.89)	8.32 (211.33)
530	3.30 (83.82)	5.63 (143)	0.69 (17.53)	7.55 (191.77)	1.14 (29)	0.45 (11.43)	1.88 (47.75)	6.65 (168.91)	4.23 (107.44)	0.55 (13.97)	11.31 (287.27)
640	4.45 (112.99)	6.65 (169)	0.87 (22.10)	8.98 (228.09)	1.00 (25.40)	0.57 (14.53)	2.50 (63.5)	7.84 (199.03)	5.60 (142.24)	0.35 (8.89)	13.98 (355.09)

Clutch Couplings

FW/FWW

Coupling standard bore sizes and keyseats inches (mm)

Coupling Size	Bore Size	Keyseat	Bore Range	
			Min.	Max.
AP10W	500	1/8 × 1/16 (3.18 × 1.59)	.375 (9.53)	1.625 (41.28)
	750	3/16 × 3/32 (4.76 × 2.36)		
	1.000 1.250	1/4 × 1/8 (6.35 × 3.18)		
AP20W	1.000 1.125 1.250	1/4 × 1/8 (6.35 × 3.18)	.375 (9.53)	2.125 (53.98)
	1.375	5/16 × 5/32 (7.93 × 3.96)		
	1.500 1.525	3/8 × 3/16 (9.52 × 4.75)		
AP25W	1.375	5/16 × 5/32 (7.93 × 3.96)	.500 (12.70)	2.375 (60.33)
	1.625	3/8 × 3/16 (9.52 × 4.75)		
	1.875 2.000	1/2 × 1/4 (12.70 × 6.35)		
AP30W	1.875 2.000 2.125	1/2 × 1/4 (12.70 × 6.35)	.625 (15.88)	2.875 (73.03)
	2.375	5/8 × 5/16 (15.87 × 7.93)		
AP35W	2.125	1/2 × 1/4 (12.70 × 6.35)	.625 (15.88)	3.750 (95.25)
	2.375 2.625	5/8 × 5/16 (15.87 × 7.93)		
	2.875	3/4 × 3/8 (19.05 × 9.52)		
AP40W	2.375	5/8 × 5/16 (15.87 × 7.93)	.750 (19.05)	3.75 (95.25)
	2.875	3/4 × 3/8 (19.05 × 9.52)		
AP45W	Any Coupling Bore is Standard Between Minimum and Maximum Shown with Standard Tolerances		1.375 (34.93)	4.625 (117.48)

Coupling standard bore sizes and keyseats inches (mm)

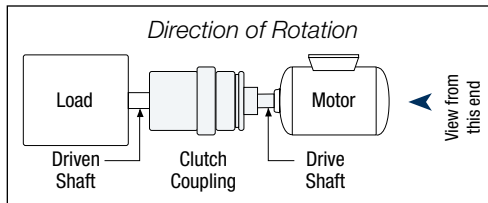
Coupling Size	Bore Size	Keyseat	Bore Range	
			Min.	Max.
AR20	1.000 1.125	1/4 × 1/8 (6.35 × 3.18)	.375 (9.53)	2.125 (53.90)
	1.250 1.375	5/16 × 5/32 (7.93 × 3.96)		
	1.500 1.625	3/8 × 3/16 (9.52 × 4.75)		
AR30	1.875 2.000	1/2 × 1/4 (12.70 × 6.35)	.625 (15.88)	2.875 (73.03)
	2.125 2.375	5/8 × 5/16 (15.87 × 7.93)		
AR40	2.375	5/8 × 5/16 (15.87 × 7.93)	.750 (19.05)	3.75 (95.25)
	2.875	3/4 × 3/8 (19.05 × 9.52)		

Selection Procedure

- Calculate the drive torque to be transmitted by the clutch coupling:

$$\text{Drive Torque (lbs.-ft.)} = \frac{5250 \times \text{HP}}{\text{RPM}}$$
- Select proper Service Factor from the table below.
- Determine Design Torque:

$$\text{Design Torque (lbs.-ft.)} = \text{Service Factor} \times \text{Drive Torque}.$$
- Determine shaft size and bore requirements of clutch and coupling. Check key and shaft stress before making final selection since this may determine maximum allowable drive torque capacity. Metric bore and keyseats available on request.
- Determine overrunning speed and the type of clutch coupling required (FW or FWW). Standard FW and FWW Clutch Couplings (Form-Flex coupling combined with a FSO clutch) are designed for high speed inner race overrunning and intermediate speed outer race overrunning.
 - FW C/T or FWW C/T models may be used in applications where the drive RPM is lower than the listed C/T maximum drive RPM and the outer race overrunning RPM is higher than the listed lift-off RPM.
 - FW C/T or FWW C/T models may not be used in applications where the drive RPM is higher than the listed maximum drive RPM.
- Determine the direction of rotation required. These units are not symmetrical, rotational direction must be specified.
- Select a clutch coupling from the catalog based on Design Torque, Bore Size and overrunning speed to meet the application requirements.
- Check the maximum drive speed rating of the clutch coupling selected. If the application speed requirement is greater than the maximum drive speed rating consult Formsprag.
- Check space limitations to allow axial space for assembly and disassembly of clutch coupling.
- Do not exceed angular or parallel alignment shown on page 120.
- Check lubrication requirements (refer to page 134). Grease is not recommended where ambient temperatures are below +20°F.






Service Factors

Formsprag Overrunning Clutch

Couplings are suitable for many different power transmission applications. Please refer to this table for proper service factor for your application.

Typical Prime movers are listed below, types of loads across the top, and your service factor opposite the typical prime movers.

Driven Equipment Load Classifications					
Light Steady Loads		Moderate Loads		Medium Loads	
Starting torque is equal to or slightly greater than running torque.		High starting torque or above average running torque.		Starting torque is approximately double running torque.	
					
Centrifugal pumps, uniformly loaded conveyors, light-duty fans and blowers, liquid mixers and agitators, centrifugal compressors, lobe and vane type blowers, gear pumps, textile machinery, woodworking machinery.		Hot oil pumps, heavy-duty centrifugal pumps, cooling towers, slurry agitators, boiler feed pumps, hoists, conveyors.		Dredge pumps, dynamometer drives, light-duty hammermills, lineshafts, paper-converting machinery, rotary kilns, rotary or screw-type pumps for high viscosity fluids.	
				Mine ventilating fans, reciprocating pumps or compressors, papermaking machinery, heavy-duty hammermills, ore crushers, pulverizing mills.	
Prime Mover	Steam, gas or air turbine	1.00	1.50	1.50	2.50
	AC electric motor	1.25	1.50	1.50	2.50
	DC electric motor with DOL start AC electric motor	1.25	1.50	1.75	3.00
	Gasoline, natural gas, propane or other spark ignition engine	1.75	1.75	Consult Formsprag	Consult Formsprag
	Diesel	Consult Formsprag	Consult Formsprag	Consult Formsprag	Consult Formsprag

DOL = Direct on Line

Clutch Couplings

FW/FWW

Installation and Alignment Procedure

Mounting and Preliminary Alignment

Reasonable care in initial assembly and aligning will permit clutch-coupling to operate to full capacity, compensate for misalignment, and provide long service life.

1. Inspect shafts and bores and make sure they are free from burrs. Check for the proper fit of the keys to the shafts and bores.
2. Position the coupling hub so that the shaft end is flush with the machined face of the flange. Coupling hub shrink fits are not necessary with Form-Flex couplings. If the hub is bored for an interference fit, the hubs should be heated in oil at 200–250°F and then quickly positioned on the shaft. Do not spot heat as it may cause distortion.
3. Check clutch for proper rotation by overrunning (freewheeling) clutch by hand. Mount clutch and key on shaft. Mount so that clutch will stay in place in service. Use shoulders, snap rings, set collars, or locking keys. Fit the clutch/ adapter assembly so that A) the machined face of the adapter is flush with the proper shaft end or B) the dimension as specified on the installation drawing between the shaft end and the machined face of the adapter is maintained.
4. Move the equipment to be connected into position. Set the gap between hub and adapter flanges to the "Adapter to Coupling Flange Dimension" within $\pm .010$ ". For special clutch couplings, refer to the installation drawing for the proper dimension.

Angular Alignment

5. After preliminary alignment, secure a dial indicator to the adapter flange and indicate face of the coupling hub as shown in figures 1 and 2.
6. Rotate the adapter flange to which the indicator is attached to find minimum indicator reading. Set the indicator for zero reading.
7. Again, rotate the coupling half (with indicator attached) 360° to check misalignment.

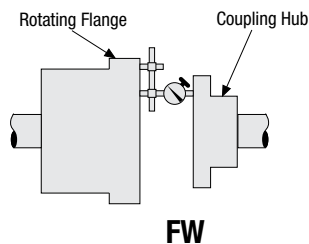


Figure 1. Angular alignment.

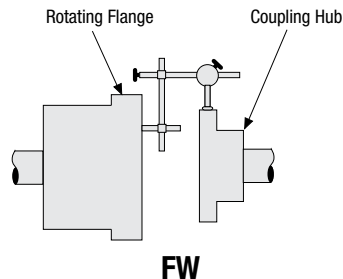


Figure 3. Parallel alignment.

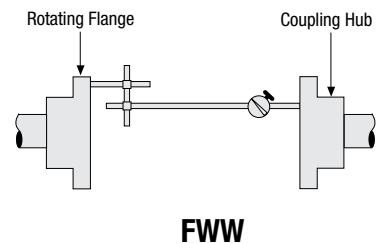


Figure 2. Angular alignment.

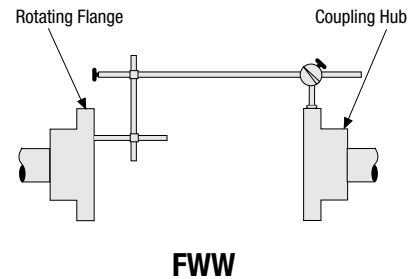


Figure 4. Parallel alignment.

Coupling Model No.	T.I.R.	
	Angular	Parallel
403	.028	.006
406	.036	.006
420	.036	.012
504	.036	.006
508	.048	.008
530	.048	.029
607	.042	.009
610	.068	.015
640	.058	.030
708	.050	.012
712	.068	.015
728	.052	.004
732	.066	.005
745	.068	.039
752	.068	.015
754	.080	.017
755	.080	.048
812	.068	.015

* Bolts should be lubricated with grease before assembling.

8. Adjust position of connected equipment until indicator reading is within the allowable variation shown in the table at right.

Parallel Alignment

9. Reposition the indicator as shown in figure 3 and/or figure 4 and check for parallel alignment. Adjust the height of connected equipment to attain minimum misalignment. The allowable parallel misalignment is indicated in the table above.
10. Recheck angular alignment to make certain the values in the table have not been exceeded.

Coupling Assembly

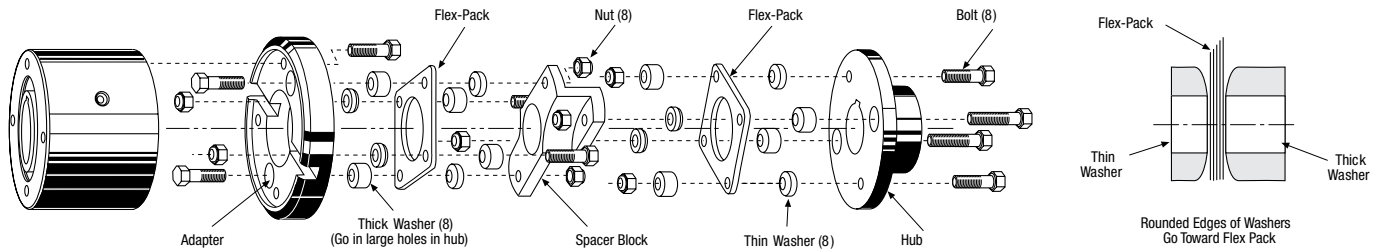
11. Assemble the clutch coupling.

Note: The curved face of the washers must be placed adjacent to the flexible element pack. Do not drive or force bolts into position. The thick washers nest in the large clearance holes in the flanges.

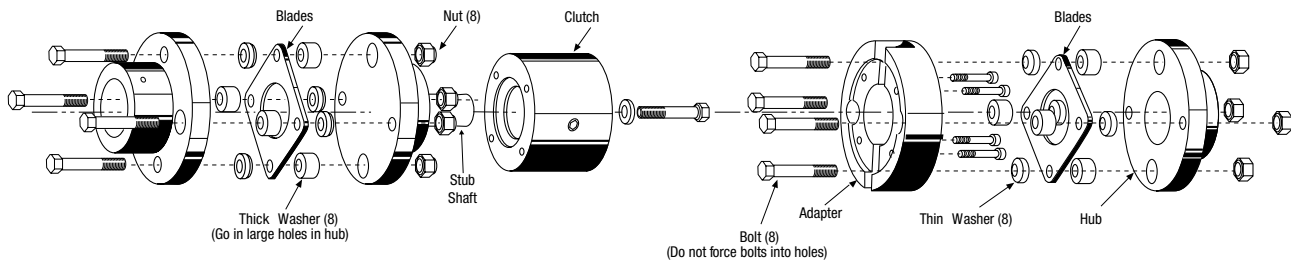
12. Torque tighten all nuts to the value shown below. Check torque on nuts after several hours of actual running. Use "Loctite" on bolts which fasten into tapped holes.

For further information see Installation and Maintenance Bulletin WRN 2332, P-222-28.

FW



FWW



Torque Values (mm)

Coupling Model No.	Tightening Torque lb.ft. (Nm.)*
403	8 (10.5)
406	19 (26)
420	19 (26)
504	19 (26)
508	66 (90)
530	66 (90)
607	37 (50)
610	236 (320)
640	110 (150)
708	110 (150)
712	236 (320)
728	58 (78.636)
732	115 (155.917)
745	115 (155.917)
752	236 (320)
754	465 (630)
755	465 (630)
812	236 (320)

* Bolts should be lubricated with grease before assembling.

How to Order

Available Modifications

Special designs are available. Contact Formsprag Engineering.

- **Custom length spacers** to accommodate greater distance between shafts.
- **Dynamic balancing** for high speed applications
- **Splined bore** for splined shafts.
- **Taperlock and Q.D. bushings** for the coupling hub.
- **Tapered bore coupling hubs** for mill motors.
- **Holding brake** to provide overrunning drag when required for turbine or motor dual drive systems.

Example

When the assembly number is known, please specify:

Series FW Model No. 504 Assembly No. 36 Direction of Rotation (see page 115) RH

When the assembly number is not known, please specify:

Item

Example

Series and Model No.....FW-752
 Clutch Bore (Driven or Driving) Clutch 2.50" Driven Shaft
 Keyseat Size (If other than listed on page 15)
 Coupling Bore (Driven or Driving) Coupling 2.75" Driving Shaft
 Keyseat Size (If other than listed on page 113)
 Direction of Rotation (see page 115)Rotation RH
 Lubricant, Oil/GR (Grease).....GR
 Labyrinth seal optional..... L