Formsprag ball bearing clutches are able to carry both radial and thrust loads. Often it is necessary to check the radial loading of the bearings for an application where the clutch is subjected to radial loads imposed by drive chains, gears, sprockets or V- belts. The radial loads imposed by high tension, multi-V belts are particularly high.

The load that can be applied to a ball bearing clutch is dependent upon the bearings used in the clutch and the recommended bearing load rating as specified by the bearing manufacturer. Table 1 gives the Maximum Permissible Load (lbs.) for radial and thrust conditions for Formsprag ball bearing clutches sizes 300 through 1027. These loads are based upon a calculated L-10 bearing life of 10,000 hours (50,000 hrs. avg. bearing life). Higher loads are possible at lower speeds.

Condition #1 (A) is the Maximum Permissible Load (lbs.) for radial loads centered between the bearings.

Condition #2 (B) is the Maximum Permissible Load (lbs.) radially applied above the end face of the clutch.

Condition #3 (C) is the Maximum Permissible Load (lbs.) radially applied which can be offset or overhung from the end of the clutch.

Example: Determine the Maximum permissible load (C) that can be radially applied to a stub shaft adapter 10 inches from the end of a FSO-700 clutch.

Using the formula:

$$\text{Load (C)} = \frac{(A)\ (L)}{2\ (d + D + L)}$$

$$\text{Load (C)} = \frac{2520\ \text{x}\ 3.060}{2\ (10 + .925 + 3.060)}$$

Load (C) = 276 lbs.

L-10 bearing lives for loads and speeds other than those listed in Table 1 for each clutch may be calculated by using the following formula:

$$(\text{L-10})_0 = \left(\frac{A}{X_0}\right)^3 \text{x} \left(\frac{N}{N_0}\right) \text{x}\ 10{,}000$$

where: (L-10) is the new L-10 life in hrs.

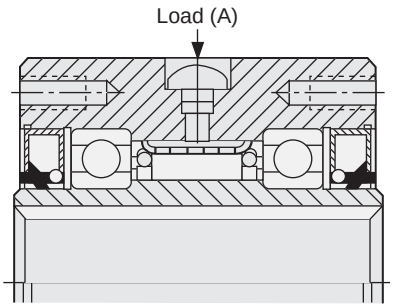
X_0 is new load in lbs.

A is load from Table 1 in lbs. (note: B and C can be used in place of A for Conditions #2 and #3 as required)

N is overrunning (O/R) speed from Table 1.

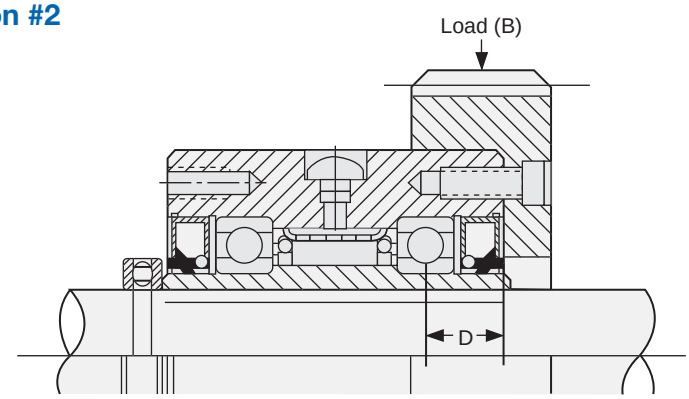
N_0 is new O/R speed.

Condition #1



Condition #1 has force or Load (A) in center of clutch between the two ball bearings. (See Table 1.)

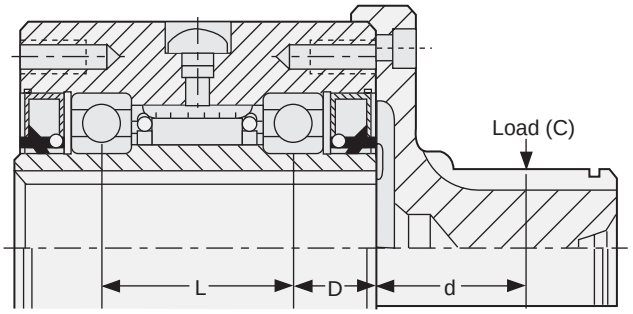
Condition #2



Condition #2 has force or Load (B) exerted on clutch bearings at end of clutch. Distance “D” is the distance from the centerline of the ball bearing nearest the load to end of clutch.

(See Table 1)

Condition #3



Condition #3 has force or load applied “d” distance from face of the clutch. (To be determined by individual application.) To calculate the Maximum Permissible Load (C) a distance “d” from the clutch face, use the following equation:

$$\text{Load (C)} = \frac{(A)(L)}{2\ (d + D + L)}$$

(Refer to Table 1 for values of A, D and L)

Bearing Loads

Table 1

Clutch No.	Maximum Permissible Load Cond. #1 (A) lb.	Maximum Permissible Load Cond. #2 (B) lb.	D in.	L in.	Thrust Cap. @ Max. O/R Speed lb.*	Max O/R Speed RPM
FSO-300	452	165	.516	1.381	226	3,600
FSO-400	450	151	.675	1.376	225	3,600
FSO-500	755	275	.745	1.990	378	3,000
FSO-600	1,248	437	.836	1.950	624	2,400
FSO-700	2,520	968	.925	3.060	1,260	2,000
FSO-750	2,040	755	1.247	3.550	1,020	1,800
FSO-800	2,555	944	1.251	3.542	1,277	1,500
FSO-900	3,030	1,134	1.257	3.740	1,515	1,350
FSO-1027	500	51	1.446	3.355	0	1,100
HPO-720	2,196	837	.925	2.96	1,098	3,000
HPO-750	1,795	663	1.247	3.53	897	2,600
HPO-800	2,273	840	1.251	3.55	1,136	2,100
HPO-900	2,712	1,014	1.257	3.73	1,356	1,850
HPO-1027	639	230	1.446	3.72	319	1,500

* Always contact Formsprag Engineering for approval when applying axial loads to the clutch.

Table 2

Clutch No.	Bore (Ref.)	Radial Load Capacity (lb.)	Max O/R Speed Inner Race RPM
FS-02	.250	12	3,450
FS-04	.375	15	2,800
FS-04	.500	15	2,800
FS-05	.625	30	1,800
FSR-3	.375	40	1,950
FSR-3	.500	40	1,950
FSR-5	.500	45	1,950
FSR-5	.625	45	1,950
FSR-6	.750	70	1,950
FSR-8	.875	110	1,650
FSR-8	1.000	110	1,650
FSR-10	1.125	130	1,250
FSR-10	1.250	130	1,250
FSR-12	1.375	190	1,150
FSR-12	1.500	190	1,150
FSR-14	1.625	250	950
FSR-14	1.750	250	950
FSR-16	1.875	260	950
FSR-16	2.000	260	950

Example: Determine the maximum permissible load that can be radially applied between the bearings of a FSO-750 with an overrunning speed of 600 RPM that will result in a L-10 bearing life of 10,000 hours.

Since the load is applied between the bearings the value (A) for Condition #1 is used for this calculation. Also, because the bearing life is 10,000 hours, the new L-10 remains at 10,000 hrs.

Using the bearing life formula:

$$(L\text{-}10)_0 = \left(\frac{A}{X_0}\right)^3 \times \left(\frac{N}{N_0}\right) \times 10{,}000$$

Substituting values into the equation:

$$10{,}000 = \left(\frac{2{,}040}{X_0}\right)^3 \times \left(\frac{1{,}800}{600}\right) \times 10{,}000$$

$$X_0^3 = 2{,}040^3 \times \frac{1{,}800}{600} \times \frac{10{,}000}{10{,}000}$$

$$X_0 = \sqrt[3]{2{,}040^3 \times 3 \times 1}$$

$$X_0 = 2{,}942 \text{ lbs}$$

Answer: The new maximum permissible radial load that can be applied is 2,942 lbs.

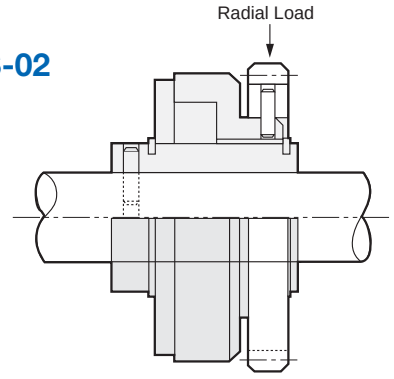
The clutch thrust capacity at Max. O/R speed given in Table 1 is the **Maximum permissible load** applied in an axial direction to the end of the clutch. The clutch thrust capacity listed in Table 1 is without any radial load applied to the clutch. For applications that have both thrust and radial loads consult Formsprag engineering.

Sleeve bearing clutches, models FS-02 through FSR-16, are equipped with oil-impregnated bronze bearings (Figure 1). The bearings are designed to provide proper support for radial loads imposed on the clutch hubs, however, they are not designed to accept axial loads.

Table 2 gives the radial load capacity for each sleeve bearing model. The bearing capacity shown is rated at the maximum overrunning (O/R) speed of the inner race for each clutch model.

Higher radial loads are possible at lower speeds. In such cases please consult Formsprag engineering.

FS-02



FSR

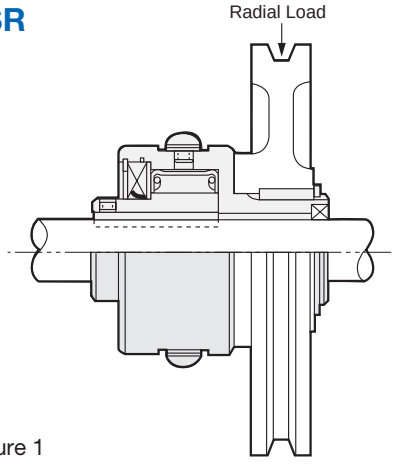


Figure 1