Selection Guide

Formsprag and Stieber facilities design and manufacture the largest variety of overrunning, indexing and backstopping clutches in the world. To select the model that would best meet your application requirements, you will need to determine the following:

- Function — Overrunning, Indexing, Backstopping
- Torque Required
- Shaft Size or Required Clutch Bore
- Maximum Inner Race Overrunning Speed
- Maximum Outer Race Overrunning Speed
- Lubrication Preferences or Limitations

With this information use the chart on the adjacent page to select models that meet your requirements. The models are grouped by type of bearing support and mounting requirements. To make the final selection, use the Selection Procedure listed on page 10.

General Purpose Clutches

- **Ball Bearing Supported**
  - **FSO**
  - **HPI**
  - **FRB**
  - **FSA**
- **Sleeve Bearing Supported**
  - **FS-02**
  - **FSR**
- **Bearing Envelope Design**
  - **CSK**
  - **CSK..P**
  - **CSK..PP**
  - **ASK**
  - **GFK**
- **Not Self-supporting**
  - **ASNU**
  - **FS-20 and 50**
  - **DC**
  - **RSCI**
  - **AS**

Special Purpose Clutches

- **FS-100, FS-200, FS-300**
- **HPO**
- **SB/SBI**
- **FSD/HBG**
- **CDU**
- **RL**

Backstopping Clutches

- **RSBW**
- **HSB**
- **LLH**
- **LCB**
- **FHB**
- **HFB/VFB**

Modular “Building Block” Clutches

- **AL**
- **GFR**
- **RIZ**

Clutch Couplings

- **AL/ALM..KEED2**
- **FW, FW (C/T)**
- **FWW, FWW (C/T)**
- **RIZ/RAZ..ELG2**

Accessories

Application						Overrunning Speed (RPM)		Lubrication	
Model	Overrunning	Indexing	Backstopping	Torque Range (lb. ft.)	Bore Range (in.)	Inner Race	Outer Race	Oil/Grease	Page
FSO C/T	X		X	275 – 27,000	0.5 – 7.0	3,000 – 500	6,000 – 1,100	Oil	14
FSO	X	X	X	275 – 27,000	0.4 – 7.0	3,600 – 1,100	900 – 375	Oil/Grease	14
HPI		X		275 – 27,000	0.5 – 7.0	N/A	N/A	Oil	14
FRB	X		X	89 – 11,800	0.4 – 4.4	5,000 – 1,800	340 – 145	Grease	18
FSA	X	X	X	38,000 – 500,000	4.93 – 20.0	400 – 75	50 – 20	Oil/Grease	20
FS-02,04,05	X	X	X	4.5 – 30	0.25 – 0.63	3,450 – 1,800	2,400 – 900	Grease	22
FSR	X	X	X	40 – 1,800	0.37 – 2.19	1,950 – 950	900 – 250	Oil/Grease	24
CSK*	X	X	X	3 – 284	0.3 – 1.57	15,000 – 3,000	15,000 – 3,000	Grease	26
ASK*	X	X	X	53 – 185	1.57 – 2.36	3,500 – 2,500	3,500 – 2,500	Grease	30
GFK*	X	X	X	38 – 339	0.7 – 1.96	5,500 – 3,400	4,000 – 2,200	Grease	32
AS*	X	X	X	1.5 – 784	0.2 – 3.14	5,000 – 600	7,500 – 900	Oil	34
ASNU*	X	X	X	9 – 32,841	0.3 – 7.87	3,300 – 230	5,000 – 350	Oil	36
FS-20 and 50		X	X	39– 1,250	N/A	2,500 – 1,750	N/A	Oil	38
DC	X	X	X	46 – 3,598	—	—	—	Oil	40
RSCI*	X		X	156 – 70,849	0.7 – 9.4	14,500 – 3,100	0 – 0	Oil	42
FS-100, 200	X	X	X	70 – 440	0.5 – 2.0	1,800 – 1,200	450 – 300	Oil	46
HPO	X		X	3,200 – 18,000	1.9 – 7.0	600 – 300	3,000 – 1,500	Grease	48
SB/SBI	X	X	X	875 – 22,300	0.75 – 7.00	2,500 – 500	800 – 375	Oil/Grease	50
FSD/HBG	X			27,000 – 300,000	6.0 – 8.98	N/A	N/A	Oil	52
CDU	X			1,175 – 45,000	N/A	3,600 – 1,100	3,600 – 1,100	Oil	54
RL				8 – 2,208	0.49 – 2.49	1,800 – 900	N/A	Oil/Grease	58
RSBW*			X	277 – 3,598	1.0 – 3.5	400 – 200	0 – 0	Grease	62
HSB			X	275 – 27,000	0.5 –7.0	2,900 – 1,050	0 – 0	Oil	64
LLH			X	4,000 – 700,000	1.87 – 20.0	400 – 75	N/A	Oil/Grease	68
FHB			X	1,734 – 4,130	1.1 – 3.7	2,400 – 400	0	Grease	84
HFB/VFB			X	284 – 483	1.0 – 6.0	2,000 – 1,800	0	Grease	88
LCB			X	150 – 850	1.85 – 5.00	0	1800-3600	Grease	86
AL*	X	X	X	41 – 212,175	0.47 – 9.84	2,500 – 100	7,200 – 620	Oil	92
GFR*	X	X	X	41 – 51,660	0.47 – 5.9	4,000 – 200	5,600 – 800	Oil	98
RIZ*	X		X	231 – 12,546	1.1 – 5.1	9,000 – 2,400	0 – 0	Grease	104
AL..KEED2*	X			41 – 184,500	0.47 – 9.8	2,500 – 100	6,000 – 620	Oil	110
FW	X			107 – 27,000	0.37 – 6.5	2,800 – 500	850 – 375	Oil/Grease	114
FW (C/T)	X			107 – 27,000	0.37 – 6.5	2,800 – 500	5,000 – 1,100	Oil	114
FWW	X			276 – 7,000	0.37 – 5.75	2,800 – 1,000	850 – 650	Oil/Grease	114
FWW (C/T)	X			276 – 7,000	0.37 – 5.75	2,800 – 1,000	5,000 – 1,800	Oil	114
RIZ..ELG2*	X			231 – 12,454	1.1 – 5.1	9,000 – 2,400	—	Grease	112

* Stieber Metric Designs

Selection Procedure

When a clutch is to be selected on the basis of torque calculation, follow the eleven steps below:

1. Calculate **load torque** to be transmitted by the clutch.

$$\text{Torque (lb.ft.)} = \frac{5250 \times \text{HP}}{\text{RPM}}$$

or

$$\text{Torque (Nm)} = \text{lb.ft.} \times 1.356$$

2. Select the proper service factor from the appropriate table on page 13.
3. Determine the **design torque** by multiplying the load torque by the service factor.
4. Check the key and shaft stress before making a final clutch selection since this may determine the maximum allowable drive torque capacity.
5. Determine the overrunning and drive speed along with which race will overrun.
6. Select a clutch **MODEL** and **SIZE** from the catalog based on design torque, bore size, overrunning speed and dimensions for proper fit into the available space.
7. If the **outer race** is the overrunning member, then determine if the C/T option can be used for the clutch model selected.
   a. A Centrifugal Throwout (C/T) model clutch may be used if the drive speed is less than the maximum C/T drive speed and the overrunning speed is higher than the lift-off speed.
   b. A C/T model clutch may not be used when the drive speed is higher than the maximum C/T drive speed.
   c. For overrunning speeds other than listed, contact the factory.
8. When higher speeds are required select the LABYRINTH GREASE SEAL option listed in the Specification chart for each clutch model or contact Formsprag Application Engineering Department.
9. Determine the shaft size, bore and key size requirement of the clutch from the catalog. Refer to the **BORE SIZES/ SHAFT TOLERANCES** chart on pages 128 and 129 for the **ACTUAL BORE SIZE** that will be supplied with the clutch. If the actual bore size required is other than that listed, contact the factory.
10. Select the type of **LUBRICANT**, **oil** or **grease**, for the clutch model where appropriate. It should be noted that many of the clutch model are available in either oil or grease only. If the Labyrinth grease seal option is selected in step 8 above, the clutch must be **grease** lubricated.
11. Determine the **DIRECTION OF ROTATION** for the model selected where necessary. When viewing the clutch from the end as shown in the catalog, **if the inner race is to rotate freely in the CCW direction and drive in the CW direction it is a Right Hand (RH) rotation. Left Hand (LH) is opposite.** See clutch rotation on page 12.

The torque values listed in this catalog are based upon normal use with 1 million load cycles at full catalog torque and receiving proper care and maintenance. For Models FSO, HPI, FSA and SB the torque ratings are based upon using only one end face to transmit.

Shaft and key length must be equal to the length of the inner race of the clutch for proper engagement. If the shaft to clutch bore engagement is less than 100%, contact Formsprag Engineering.

Caution: Consult factory for reciprocated type prime mover and any inclined or vertically mounted applications.

Special Designs

While the wide range of sizes and capacities covered by this catalog's line of clutches will cover substantially all industrial needs, it is sometimes necessary to design and build clutches to meet specialized requirements.

Special designs can also take advantage of a self-contained lubrication system or lubricant contained within the customer's machine. In such cases, lubrication could be introduced through the inner race or through clutches assembled without seals to permit a free flow of oil through the clutch. Since other factors may affect selection of clutches in both indexing and holdback cases, consult our Application Engineering Department for assistance.

How To Order

When placing an order always use the part number in addition to the model number if available.

The part number is marked on the clutch and listed in the price sheets. There is a unique part number for each design and bore combination and the format is as follows:

Format is CL XXXXX – XXX – XX

- CL (clutch)
- Base model no. (5 digits)
- Clutch Bore (1, 2 or 3 digits)
- Special Design of the same bore (1, 2 or 3 digits)

Example is CL42156-123-2

The model number is marked on the clutch and listed in the product catalog.

Example:

1. FSO 700 model clutch, optional C/T retainer, 2.2485/2.2500" bore, .625 x .32 keyseat, oil lubricated.
2. FSR - 16 model clutch, 1.000/1.001" bore, .50 x .25 keyseat, grease lubricated, right hand rotation.
3. HPI 900 model clutch, optional Labyrinth grease seals, 4.498/4.500" bore, 1.00 x .50 keyseat, grease lubricated.

Example:

1)	FSO – 700	C/T/	2.25	.625 x .32			
2)	FSR – 16		/ 1.00	.50 x .25	GR	RH	
3)	HPI – 900	L /	4.50	1.00 x .50	GR		

- Model
- Size
- Options (Labyrinth Seal, C/T Sprag)
- Nominal Bore
- Keyseat Size*
- Lubricant (Blank - Oil, GR - Grease)
- Direction of Rotation

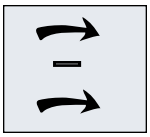
* If keyseat is not specified when ordering, the clutch will be supplied with the available standard keyseat.

Overrunning Clutches

Overrunning Speeds

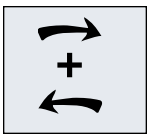
This is the maximum speed differential between the inner and outer races. When one race is stationary and the other overruns, clutch selection may be based on maximum overrunning speeds shown in the catalog.

Same direction of rotation



If both races rotate in the same direction at different speeds, the overrunning speed is the *difference* in their speeds.

Opposite direction of rotation



If the races rotate in opposite directions, the overrunning speed is the *sum* of their speeds.

Drag Torque

In an overrunning clutch the drag or resistance to freely turn is a result of the additive values of seal drag, bearing drag and sprag energizing drag. This clutch drag torque is noted as “resistance after run-in” and is listed for each model on its data page. The drag (resistance after run-in) torque values for new clutches will be higher at first and after 12 to 24 hours of overrunning at standard motor speeds will reduce to catalog-listed values. When a clutch is overrunning, the drag torque is exerted upon the lower speed race and any attached drive components.

Indexing Clutches

Dynamic Load

The torque required to accelerate the indexing mechanism and load, increases rapidly as the angle of index and number of cycles per minute increases. This torque should be calculated and added to other torque values in the system. For equation, see Overrunning Clutch Application Manual P-1052.

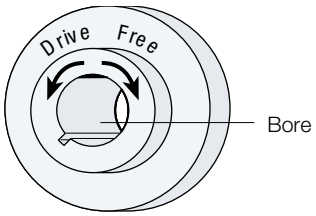
Brake Torque

If a brake is used in the indexing system, the resistance of the brake must be calculated in terms of torque and added to the other torque values in the system.

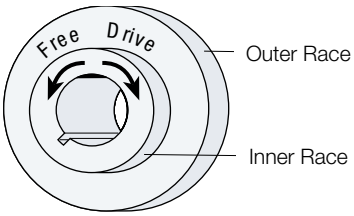
Stock Load

If, as in a punch press feed device, the indexing mechanism must pull stock from a coil, the force required to do this must be added. This load can best be determined by actual measurements.

Clutch rotation



Left Hand Rotation Shown



Right Hand Rotation Shown

If the overrunning clutch design is not symmetrical, then the clutch rotation will need to be determined, and this information (RH or LH) must be provided at time of order placement.

To establish rotation of a clutch, look at the clutch from the end specified by the arrow for each clutch series. If the inner race drives the outer race in the clockwise direction it is a right hand rotation. For Clutch Couplings see page 114.

Service Factors

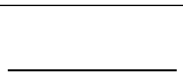
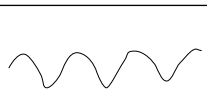
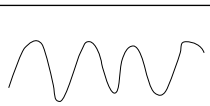
Formsprag and Stieber Overrunning Clutches

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

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

When torsional or linear vibration is present, use an FSO series clutch and increase the service factor at least 50%. For severe vibration, a greater service factor increase is necessary. To conform with couplings manufacturer's recommendations, use a minimum service factor of 1.5 on all Clutch Couplings.

Overrunning & Backstopping Applications Service Factors

		Driven Equipment Load Classifications			
		Light Steady Loads Starting torque is equal to or slightly greater than running torque.	**Moderate Loads** High starting torque or above average running torque.	**Medium Loads** Starting torque is approximately double running torque.	**Heavy-Duty Loads** High starting torque, shock loading, light torque reversals during drive.
					
		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	3.0	3.0	Consult Formsprag	Consult Formsprag
	Diesel	Consult Formsprag	Consult Formsprag	Consult Formsprag	Consult Formsprag

DOL = Direct on Line

Indexing Applications Service Factors

Type of Load	FS-02, 04, 05 FSR-3 & 5	FSR 6 to 16 HPI	FSO	Roller Design
Less than 90° or less than 150 strokes/min.	3	2	2	2
Over 150 strokes/min.	4	2	N/A	3
When angle is greater than 90° and over 200 strokes/min.	4	2	N/A	2.5

* Recommended for maximum performance and maximum life.

Note: In all cases where considerable vibration is present, a higher service factor may be needed (possibly up to 6).