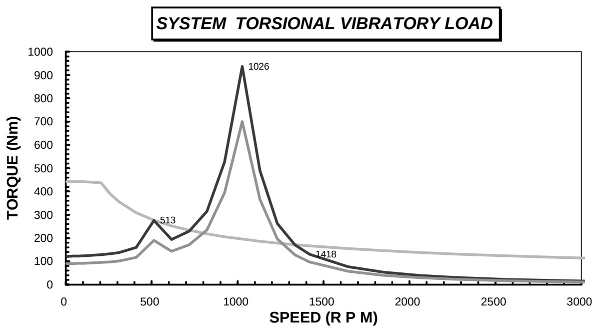
Torsional Couplings

Lovejoy Torsional Couplings solve torsional vibration problems typical of those found in diesel engine applications. The torsional coupling dampens torsional vibrations and tunes the system to have critical speeds outside the operating range. Lovejoy application engineers can analyze the application with their computer program and determine the exact coupling needed for most any application.

The LF family is a rubber-in-compression coupling designed for a wide variety of applications such as generators, pumps, compressors, front power take-off, etc. The largest size, the LF400, can carry up to 8000 Nm of torque. A range of stiffnesses are available to provide tuning capability for most any application. The inertia of the driver and the driven will determine the required stiffness. The LF is one of the most versatile couplings available in that it can be adapted to many configurations such as shaft-to-shaft, engine flywheel mounts, or floating shaft. It not only provides torsional protection but also absorbs shock loads and can tolerate misalignment.

For direct-mounted, diesel-driven hydraulic pumps, the LF coupling in Hytrel® and a LK coupling are available. These are very stiff couplings designed to shift critical speeds well above the operating range. When the inertia of the driven (hydraulic pump or pumps) is small compared to that of the driver (the diesel engine), a stiff coupling such as the LF Hytrel or LK is required. Hydraulic pump drives are a fast-growing segment of the market, particularly in smaller diesel engine drives. Applications include crawler tractors, manlifts, compactors, skid steer loaders, excavators, and lift trucks. Both the LF Hytrel and the LK have many thousands of hours of successful service in a wide variety of applications around the world.



Torsional couplings are designed primarily to fit standard installations such as those specified by SAE. Lovejoy has design and application engineers with many years of experience to custom design a Torsional coupling to fit special applications. We can solve torsional vibration problems. Also, if necessary, our engineers can analyze coupling failures. **Fax application data to Lovejoy Engineering at +1 (630) 446-0878 or send e-mail to appleng@lovejoy-inc.com**.

Table of Contents

Lovejoy LF Torsional Coupling System Overview

The Lovejoy LF Torsional coupling system consists of six basic models or configurations. Each model is designed to satisfy user requirements in a particular area of application and is available in a wide range of torque sizes (10-5000 Nm.). Flexible elements of various materials and durometer hardness may be substituted for each other in each size without complicated and uneconomical changes in coupling hardware or design. No other coupling design has achieved this versatility and economy from common components.

The LF Torsional coupling system has readily available solutions for user requirements of misalignment, installation environmental conditions (corrosives, temperature, etc.), torsional vibration dampening, noise reduction, reliability, reaction force reduction and more.

LF Torsional couplings recognize the three essential requirements that a coupling must fulfill:

1. Reliable transmission of power
2. Quick and economical installation
3. Protection of the coupled equipment from dangerous torsional vibrations, reaction forces and misalignment

Application engineering and experienced customer service support the Lovejoy line of LF Torsional couplings. Lovejoy application engineers routinely administer computer analysis of potential torsional problems in drive systems. The considerable advantages of the LF Torsional coupling, as well as the service offered by our application engineers, has led to wide use of this coupling.

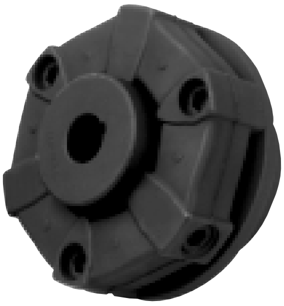
The L-Loc spline-clamping hub described in more detail in this catalog virtually eliminates spline shaft profile wear and "fretting."

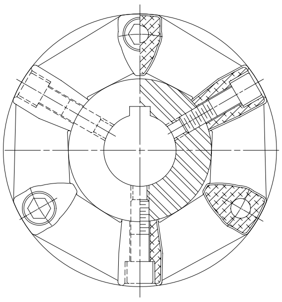
The LF Torsional coupling is one of the leading couplings in the field of hydrostatic drives in rugged off-road construction equipment.

LF Torsional couplings provide:

- Extensive experience in tough power transmission applications
- Wide range of standard designs and materials
- Application engineering
- Reliable and cost effective solutions
- Worldwide service and distribution network

LF Torsional Coupling System



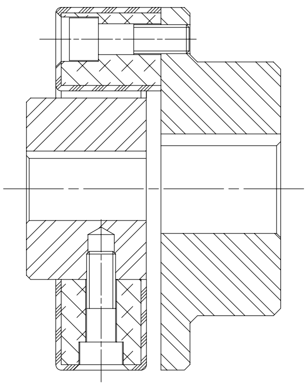


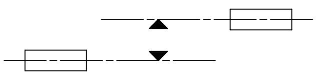
Characteristics and Benefits of LF Torsional Couplings

The basic component of the LF Torsional coupling is the unique and highly versatile elastomeric element. This element can be easily mounted in a number of different ways according to the application, and without special design changes or complex hardware modifications. The element, which is available in different materials for optimum performance, is connected to a cylindrical hub with radial screws and then to a flanged hub by axial screws. This unique coupling design is remarkably simple, highly effective, and gives the LF Torsional coupling unmatched performance capabilities.

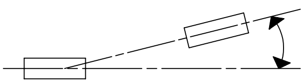
Unique Features:

- Free end float (Type S)
- Substantial shock, vibration, and misalignment capabilities
- Fail-safe operation
- Coupling allows "blind" connection of equipment
- High-speed capabilities
- Economic design
- Application versatility
- Low weight, low moment of inertia
- Free from noise and electrically insulating
- No lubrication, maintenance free
- Oil, heat, and corrosion resistant elements (Hytrel®, Zytel®)
- Easy to disconnect driver and driven without moving equipment or coupling hubs
- Unique "air flow" design assists in keeping components cool during operation
- Short profile for tight engine housing, or shaft-to-shaft requirements
- Easily assembled, no special bands, tools or time consuming assembly procedures
- Professional application assistance and expertise worldwide
- Torque transmission does not exert harmful reaction loads on equipment
- Various element materials for variation in torsional stiffness and environmental resistance

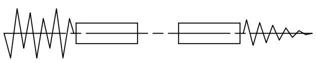




Parallel Misalignment



Angular Misalignment



Torsional Misalignment

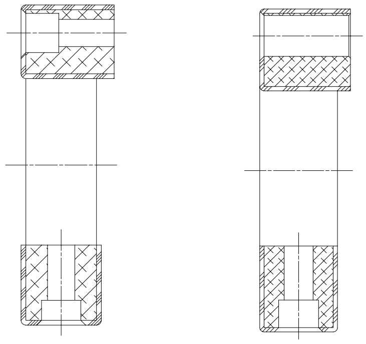
Axial Misalignment

LF Torsional Coupling System

Shown on this and the next page are the standard LF Torsional coupling models. The simple, unique design of the LF Torsional coupling permits this wide range of models, from common components, to meet each application requirement. From engine flywheel housing or the long corrosive span of a cooling tower, Lovejoy has the optimum LF Torsional coupling model available for your application.

Model O and O/S

The heart of the LF Torsional coupling is the flexible element. This model is easily mounted to the customer's application designs or customer provided shaft hubs. No bands, special tools, or contoured element clamping flanges are necessary. This model allows the customer to make his own shaft hubs from readily available steel bar stock. Ideal for quick prototype testing, retrofit and high volume applications. Model O/S permits the driver and driven equipment to be quickly "blind" assembled and allows for free end float. Available in various materials: High-Temperature Rubber (HTR), Neoprene (CR) and durometers: 50, 60, 70, and 75 Shore A.

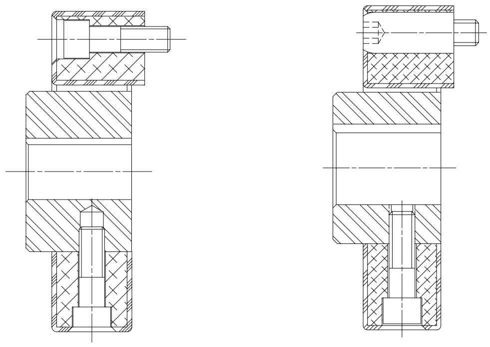


Model O and O/S

Model 1 and 1/S

Consists of the standard flexible element (Model 0) with a simple steel cylindrical hub. This satisfies the application requirements for mounting directly to engine flywheels, pulleys, brake discs, friction clutches, universal joints and gears. The cylindrical hub is available in a range of bores (Standard ANSI, DIN, JIS) inch, metric, spline and custom.

Model 1/S is shown with the S-style axial screw (similar to a dowel) for quick blind assembly of the drive package. The same element combinations available in Model 1 are also available in the Model 1/S.

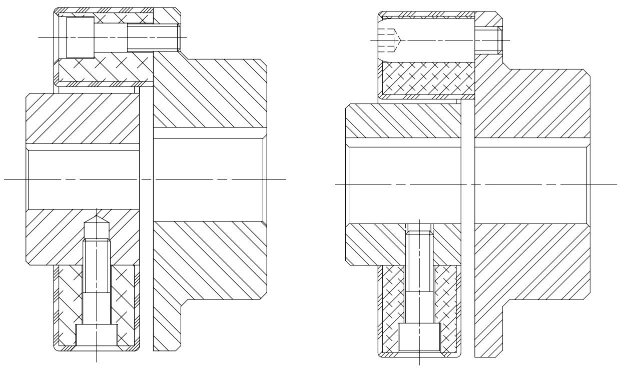


Model 1 and 1/S

Model 2 and 2/S

Provides a complete shaft-to-shaft coupling in a range of sizes for all industrial power transmission applications. It is similar to Model 1 shown above, except a flanged hub is added to make the shaft to shaft connection.

Model 2/S allows the drive package to be "blind" connected. As with all S-style models, free axial end float of equipment shafts is accomplished without harmful push-pull force.

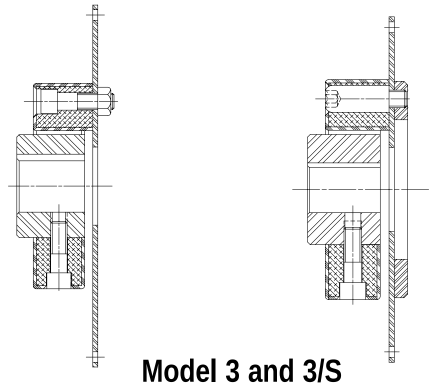


Model 2 and 2/S

LF Torsional Coupling System

Model 3 and 3/S

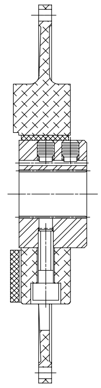
A Model 1 or 1/S, with the addition of an engine flywheel mounting plate, becomes a Model 3 or 3/S. It is available in many standard SAE flywheel sizes (see page 18) as well as made-to-order sizes. Special mounting requirements are easily and economically accomplished. The standard cylindrical hub is available in a variety of ANSI (SAE), DIN, JIS spline bores as well as straight bores. As with the previous models, various standard flexible element materials are available for specific torsional, misalignment and environmental requirements.



Model 3 and 3/S

Model 4

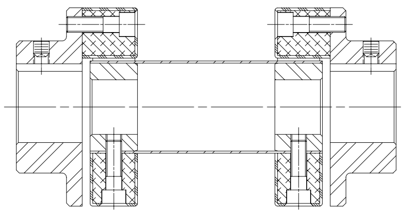
Similar to Model 3/S, this model consists of a cylindrical hub for shaft mounting and a high performance Hytrel® element, which is pilot-mounted to a cast alloy SAE flywheel adapter plate machined to SAE J620 specifications. Model 4 features a thin coupling profile for tight engine housing/pump application requirements. This is a reliable solution for problems of torsional resonance and performance in hot, oily environments.



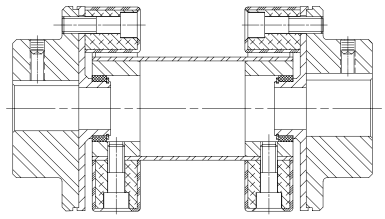
Model 4

Model 6, 6/S, 6B

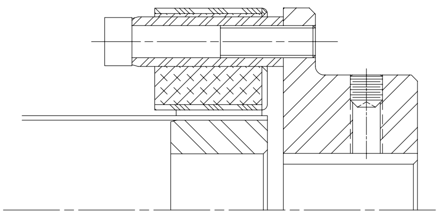
Floating shafts are available in customer specified assembly length, with special corrosion and heat resistant elements and materials. This model surpasses all other floating shaft designs in assembly, simplicity and reliability. Model 6/S accommodates free endplay without harmful push-pull reaction forces. Model 6B is a highly elastic floating shaft coupling with accurate, maintenance- free centering flanges for applications with long spans and high misalignment and/or speed requirements.



Model 6



Model 6B



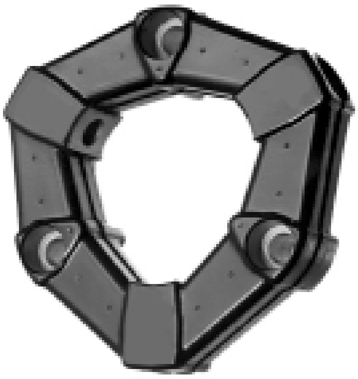
Model 6S

LF Torsional Flexible Elements

The focus of any coupling is the flexible elements; the "working component." This is the part that must effectively absorb the shock loads, misalignment forces, torsional vibrations and the abuse of environmental conditions. It must be reliable, economical and not harmful to the connected equipment. It is virtually impossible for one single element material, or coupling configuration, to satisfy all these user requirements. That's why we use different materials for our flexible elements. Optimum and reliable performance is the result of the unique LF Torsional coupling design, which permits easy adaptation and assembly to any application.

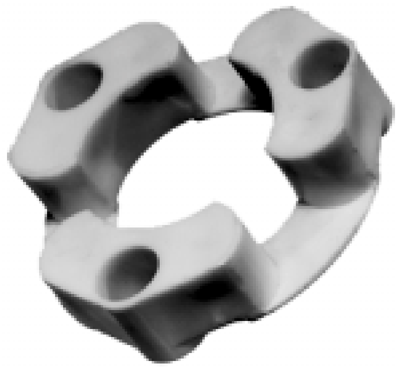
Rubber (HTR and CR)

There are two different element materials available. Both are classified under the heading of rubber elements: Natural rubber (HTR) and one synthetic rubber element of Neoprene (CR). Both rubber elements are torsionally soft and are placed into compression during assembly. Rubber in compression can carry up to five times the amount of torque, as compared to non-compressed elements. The rubber LF Torsional elements effectively accommodate shock, misalignment, and vibration and do not exert harmful radial and axial forces on the connected equipment. Each rubber element material is available in various durometer hardness (Shore A Scale) of 50, 60, 70 and 75 for particular torsional vibration requirements. The synthetic rubber elements are primarily used in environments that are hostile to natural rubber and can operate in a temperature range of -40°C to 80°C. Natural rubber (HTR) elements have an operating range of -40°C to 90°C. Consult Lovejoy Engineering for higher temperature requirements.



Hytrel® Elements (HY)

LF Torsional elements are made of a Hytrel® elastomer compound from DuPont™. These elements are torsionally much stiffer than natural rubber--about 20 times stiffer--and were developed for use primarily in combustion engine/hydraulic pump applications. These applications usually require reliable coupling performance in hot, oily environments. Hytrel elements have 20% greater torque capacity compared to rubber elements and operate efficiently in the temperature range of -50°C to 120°C. The Torsional coupling with the Hytrel element places the harmful vibration resonance frequency above the operating speed range of the power package. The unique element design also reduces harmful axial reactionary forces.



Zytel® Elements (X)

This element is extremely rugged and made of Dupont's highly stressable Zytel® elastomeric compound. Zytel has excellent resistance to most chemical attacks and corrosion. Operational temperature range is -40°C to 150°C without derating. This element composition is torsionally about three times stiffer than the Hytrel elements. Maximum angular misalignment is 1°. Zytel (X) elements exhibit less than 1° wind up at nominal torque and zero backlash. With more torque carrying capacity, compared to Hytrel, this element is particularly suited for applications where heat, moisture, high torque/high speed and corrosion resistance are important factors in coupling selection.

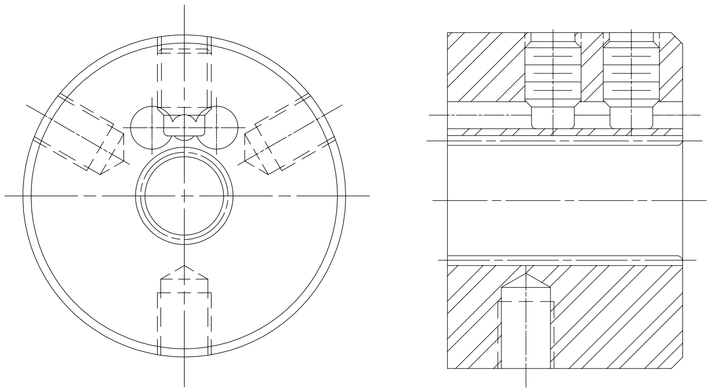
L-Loc Spline Shaft Clamping Feature

For years, spline shaft profile distortion and fretting were a major problem for hydraulic pump manufacturers. Now Lovejoy offers a simple solution: L-Loc.

It is well known that normal manufacturing tolerances between the spline shaft and its mating spline coupling hub create unavoidable play. This play permits minor movements between the components. Compounding this tolerance related movement is misalignment and the hammering forces during power transmission. Eventually, spline profile distortion occurs, even with shafts and hubs of high quality hardened steel. When spline distortion and wear occur, a decrease in pump efficiency results, and abnormal stresses are placed on seals, bearings and other engine/pump components. Equipment operation may become sluggish; horsepower and fuel are wasted. Premature maintenance or even failure of the shaft or other components may result.

It appeared that the only way to eliminate spline distortion and wear was to eliminate the backlash and clearance related to mating tolerances and assembly misalignment, however, this became expensive, time consuming, and was for the most part unsuccessful. The solution is the L-Loc.

The Torsional coupling with the L-Loc spline-clamping hub can dampen harmful torsional vibrations, compensate for assembly misalignments and dramatically inhibit spline profile distortion.

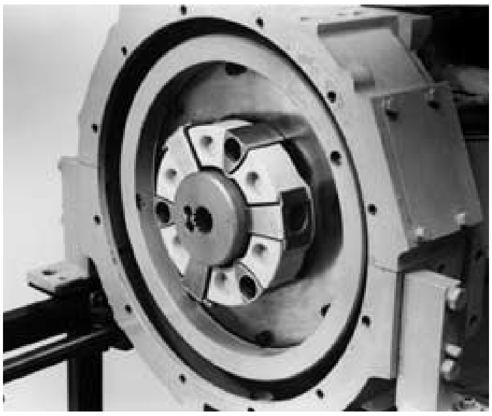


This unique design is remarkably simple and effective. The design of L-Loc consists of a unique slot that is placed slightly above and parallel to the spline bore. Two set screws are fitted perpendicularly into this slot. As the set screws are torqued, this spline shaft is "wrapped" with a clamping force around its entire profile.

The hub becomes firmly locked around the spline shaft, and the set screws never touch the spline profile. No dents, no gouges, no burrs, no hammering on and off "shrink fits" occur. The hub and shaft are absolutely free from play; a single assembly. By loosening the set screw, the clamping force is removed.

L-Loc Benefits

- Eliminates premature spline shaft maintenance or replacement
- Reduces stress on equipment components
- Quick assembly and removal
- Maintains equipment efficiency
- Reduces equipment noise



Torsional Coupling Selection for Internal Combustion Engine Applications

When correctly sized and selected, the Lovejoy Torsional coupling will effectively dampen vibration and tune critical frequencies out of the operating range of systems driven by diesel, gasoline or natural gas reciprocating engines. But to make sure the coupling will do its job as intended, the selection should be verified with a torsional vibration analysis of the system.

Misapplication of the coupling in an engine application frequently leads to coupling failure or system damage. For these applications, we strongly urge that you let Lovejoy make the coupling selection for you.

We will insure that the correct coupling size and stiffness is selected not only for proper nominal and maximum torque, but also for the elusive factor of continuous vibratory torque which can otherwise melt or rupture an elastomeric coupling or damage other system components.

Please complete the information worksheet on page 10 and fax it to Lovejoy for selection. Or you may e-mail us by filling out the version of this worksheet found on Lovejoy's web site at www.lovejoy-inc.com. For those confident in their technical abilities and understanding of system torsional analysis who prefer to make their own coupling selection, we provide the following essential guidelines.

1. **Choose a model** that suits your drive arrangement using the descriptions of basic models given previously on pages 4 and 5.

   - **Model 3 , 3/S or 4** - For mounting directly to standard SAE flywheels.
   - **Model 2 or 2/S** - For shaft-to -shaft applications such as PTOs. Also, the flanged hub can be modified to adapt to front damper pulleys.
   - **Model 1 or 1/S** - For connecting a shaft to a flange or non-standard flywheel.
   - **Model 6** - Various different universal floating shaft arrangements available (see page 20)

2. **Nominal torque**

   The nominal torque transmitted though the coupling (T_{LN}) *must be no more than the nominal torque rating for the coupling* (T_{KN}) *at any given operating temperature:*

   $$T_{KN} \geq T_{LN} \bullet S_t$$

   where S_t is the temperature factor (Fig.1, p.14), and

   $$T_{LN}(\text{Nm.}) = (\text{kW} \bullet 9555)/\text{RPM}$$

3. **Peak torque pulses**

   The magnitude of the maximum torque pulses that occur during operation (T_{max}) *at all operating temperatures must not exceed the maximum torque rating of the coupling* (T_{Kmax}). These are short-duration transient pulses that would result from **start-up, shock, or acceleration through a system resonance to reach operating speed.** By definition, these pulses may occur over the life of the coupling 10^5 times in one direction of rotation, or 5×10^4 times reversing.

   $$T_{Kmax} \geq T_{max} \bullet S_t$$

4. **Determine critical speeds due to resonance**

   Select coupling stiffness so that the system does not run at high resonance, or in other words, make sure normal running and idle speeds are not at or near critical speeds.

   Critical speeds are related to the system natural frequency and the number of pulses or excitations generated per revolution **i** (order). For analysis, if possible, reduce the application to a 2-mass system and apply the following equation on next page.

Torsional Selection for Internal Combustion Engine Applications

$$n_R = \frac{60}{2\pi \bullet i} \sqrt{C_{Tdyn} \bullet \frac{J_A + J_L}{J_A \bullet J_L}}$$

where

n_R = the critical resonance speed of the system (RPM),

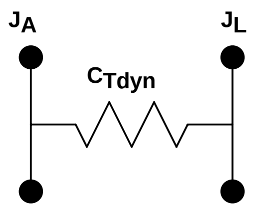
C_{Tdyn} = the dynamic torsional stiffness of the coupling (Nm/rad),

J_A = the mass moment of inertia for the drive side (kg-m^2),

and

J_L = the mass moment of inertia for the load side (kg-m^2).

The coupling would be modeled as the spring controlling torsional oscillations of the engine and flywheel on one side and the driven equipment on the other:



Use the dynamic torsional stiffness values from the Performance Data table (p. 12). Mass moment of inertia values may be obtained from the respective engine and equipment manufacturers.

Generally, system steady-state operating speeds should be 1.5 to 2 times the major critical speed for safe, low-resonance operation.

5. **Allowable continuous vibratory torque**

The amplitude of the continuously oscillating (vibratory) torque generated in the system **(T_W)** *must not exceed the coupling's rating* **(T_{KW})** *at a particular steady-state frequency (RPM) and temperature.* This torque is superimposed on (co-exists with) the basic load **(T_{LN})**.

$$T_{KW} \geq T_W \bullet S_t \bullet S_f$$

where

T_{KW} = coupling rating for continuously oscillating torque at 10Hz

and

S_f = the frequency factor that relates the operating frequency to the coupling's 10Hz rating (see Fig. 3, p.14).

The magnitude of the continuously oscillating torque **(TW)** is dependent on an amplifying factor **(V)** based on the distance of the system steady-state operating speed **n** from the resonance speed n_R **:**

$$V \approx \frac{1}{\left|1-(n/n_R)^2\right|}$$ (see Fig. 4, p.14).

6. **Other considerations**

Refer to the Performance Data tables, figures, and dimension tables to make certain final coupling selection meets application constraints for envelope (O.D., length, bore dimensions, etc.), maximum speed limitations and allowable misalignment

Lovejoy

Coupling Selection Worksheet for Engine Applications

For systems driven by an internal combustion engine, complete this worksheet and fax it to the Lovejoy engineering department. We will respond with the proper coupling selection.

Lovejoy Engineering Fax: +1 (630) 852-2120

Customer Information

DATE:______________________________

NAME:____ COMPANY:____

PHONE:____ FAX:____

E-MAIL ADDRESS:____

ANTICIPATED ORDER QUANTITY/ ANNUAL USAGE:____

BRIEF DESCRIPTION OF APPLICATION/PROBLEM:____

____

____

____

____

ENGINE INFORMATION

Engine Manufacturer:________________________

Model Number:______________________________

Displacement:_______________________________

Rated Horsepower:___________________________

@ Rated Speed:_____________________________

Operating Speed or Range:___________________

Idle Speed:____________________

- ☐ Diesel
- ☐ Gasoline
- ☐ Natural Gas
- ☐ Other _____________
- ☐ 2-Stroke
- ☐ 4-Stroke

Number of Cylinders:_____

Piston Configuration:

- ☐ In-Line
- ☐ Vee   Vee Angle:____

SAE Flywheel Size (J620D):____
(Attach drawing if non-standard)

SAE Flywheel Housing Size(J617C):___

DRIVEN EQUIPMENT

- ☐ Compressor
- ☐ Water Pump
- ☐ Hydraulic Pump
- ☐ Generator/Alternator
- ☐ Other ____________________

Shaft Diameter or Spline Information:

____

____

Type of Equipment Mounting:

- ☐ Flange-Mounted to Engine Pilot
- ☐ Independent of Engine

Driven From:

- ☐ Flywheel
- ☐ Front PTO
- ☐ Other (Explain)________________

Ambient Operating Temperature:____°C

Mass Moment Of Inertia (J or WR^2)

Provide mass-elastic diagram if available
(Please Include Units)

Engine:____________________

Flywheel:___________________

Driven Equipment:
1. ____________________
2. ____________________
3. ____________________
4. ____________________

Sketch or Remarks (Attach Additional Sheets if Necessary):

Torsional Coupling Selection for General Industrial Applications

While the LF Torsional coupling was developed to solve the unique problems associated with torsional vibration in equipment driven by internal combustion engines, the coupling works equally well in general industrial applications. For these **electric motor-powered and other non-engine applications**, use the following simple selection procedure (Refer to page 8 for engine-driven applications).

1. **Choose a model** that suits your drive arrangement using the descriptions of basic models given previously on pages 4 and 5:

   - **Model 2** - Most common for shaft-to-shaft applications.
   - **Model 2/S** - For shaft to shaft applications that require free end-float or quick, blind "plug-in" assembly.
   - **Model 1 or 1/S** - For connecting a shaft to a flange or flywheel.
   - (see page 20 for Model 6 floating shaft applications)

2. **Choose element material** consistent with application requirements. Most commonly, the HTR (high-temperature rubber) element is used for virtue of its high flexibility. This feature provides the previously mentioned benefits of vibration and shock damping, noise silencing, and a high tolerance for misalignment.

   When required, the Zytel® element provides a torsionally rigid connection yet is still flexible in terms of accommodating small angular misalignments. Use of the floating-shaft Model 6 version will allow for parallel misalignment as well. The Zytel® material is also very chemical resistant.

   Please note that the optional Hytrel® element requires almost perfect alignment which is unlikely in most applications and is not recommended, except when used as intended on a flange-mounted hydraulic pump to an engine flywheel.

3. **Choose a service factor** from the chart on page 14 for your application.

   Example: Centrifugal pump ⇒ SF=1.0

4. **Determine nominal torque requirement** for coupling from application horsepower and speed. Use the actual torque or horsepower requirement for the driven equipment if known. Otherwise, use the rated motor horsepower.

   Now, using the Performance Data table, select a coupling size with a rating equal to or greater than the application torque multiplied by the service factor:

$$T_{KN}\ (\mathrm{Nm}) \geq \frac{\mathrm{kW \times SF \times 9550}}{\mathrm{SPEED(rpm)}}$$

   Example:
   Centrifugal pump using 10 kw at 1500 RPM

   (10kW x 1.0 x 9555)/1500RPM = 64Nm

   ⇒ use LT Torsional size LF8

5. **Other considerations**
   Refer to the Performance Data tables, figures, and dimension tables to make certain final coupling selection meets application constraints for envelope (O.D., length, bore dimensions, etc.), and maximum speed limitations.

LF Torsional Performance Data

CPLG Size	Element Material*	Nominal Torque T_{KN}	Maximum Torque $T_{K\,max}$	Max Speed (RPM) n_{max}	Allowable Continuous Vibratory Torque T_{KW}	Dynamic Torsional Stiffness C_{Tdyn}			
						Rubber 60 Shore A (STANDARD)	Rubber 50 Shore A (OPTIONAL)	HYTREL®	ZYTEL®
LF1	HTR	10Nm	25Nm	10,000	5Nm	140Nm/rad	90Nm/rad	—	—
LF2	HTR	20Nm	60Nm	8000	10Nm	290Nm/rad	180Nm/rad	—	—
	ZYTEL	30Nm	60Nm	10,000	n/a	—	—	—	6230Nm/rad
LF4	HTR	50Nm	125Nm	7000	20Nm	850Nm/rad	550Nm/rad	—	—
	ZYTEL	60Nm	120Nm	8000	n/a	—	—	—	1650Nm/rad
LF8	HTR	100Nm	280Nm	6500	40Nm	1500Nm/rad	900Nm/rad	—	—
	HYTREL	100Nm	280Nm	6500	n/a	—	—	23,000Nm/rad	—
	ZYTEL	120Nm	280Nm	7000	n/a	—	—	—	46,820Nm/rad
LF12	HTR	140Nm	360Nm	6500	50Nm	4400Nm/rad	2700Nm/rad	—	—
LF16	HTR	200Nm	560Nm	6000	80Nm	3400Nm/rad	2000Nm/rad	—	—
	HYTREL	200Nm	560Nm	5500	n/a	—	—	36,000Nm/rad	—
	ZYTEL	240Nm	560Nm	6000	n/a	—	—	—	74,000Nm/rad
LF22	HTR	275Nm	750Nm	6000	100Nm	9000Nm/rad	6100Nm/rad	—	—
LF25	HTR	315Nm	875Nm	5000	125Nm	4500Nm/rad	2800Nm/rad	—	—
	HYTREL	350Nm	875Nm	5000	n/a	—	—	120,000Nm/rad	—
	ZYTEL	370Nm	800Nm	5000	n/a	—	—	—	111,600Nm/rad
LF28	HTR	420Nm	1200Nm	5000	150Nm	12,000Nm/rad	7500Nm/rad	—	—
LF30	HTR	500Nm	1400Nm	4000	200Nm	7800Nm/rad	4800Nm/rad	—	—
	HYTREL	500Nm	1400Nm	4000	n/a	—	—	88,000Nm/rad	—
	ZYTEL	550Nm	1400Nm	4500	n/a	—	—	—	134,100Nm/rad
LF50	HTR	700Nm	2100Nm	4000	300Nm	19,000Nm/rad	12,000Nm/rad	—	—
	HYTREL	800Nm	2000Nm	4000	n/a	—	—	262,000Nm/rad	—
LF80	HTR	900Nm	2100Nm	4000	320Nm	25,000Nm/rad	16,000Nm/rad	—	—
LF90	HTR	1100Nm	3150Nm	3600	450Nm	16,000Nm/rad	10,500Nm/rad	—	—
LF140	HTR	1700Nm	4900Nm	3600	700Nm	40,000Nm/rad	26,500Nm/rad	—	—
	HYTREL	1600Nm	4000Nm	3600	n/a	—	—	440,000Nm/rad	—
LF250	HTR	3000Nm	8750Nm	3000	1250Nm	67,000Nm/rad	43,000Nm/rad	—	—
LF400	HTR	5000Nm	12,500Nm	2500	2000Nm	120,000Nm/rad	75,000Nm/rad	—	—

* HTR = High Temperature Natural Rubber

^ For Hytrel, dynamic torsional stiffness values are non-linear with respect to torque. Value given is for 100% of nominal torque. Please Call Lovejoy for stiffness at lower torques.

LF Torsional Performance Data (continued)

CLPG Size	Element Material*	MAX. Allowable Misalignment**				Wind Up (Angle of Twist)		Static Stiffness		
		Angular (Degrees) ΔKw	Parallel ΔKr	Axial (End Float) Standard ΔKa	Axial (End Float) S-Style***	@ NOM Torque (Degrees)	@ MAX Torque (Degrees)	Axial Ca	Radial Cr	Angular Cw
LF1	HTR	3	1.5mm	+/-2mm	+4.6mm/-2mm	6	17	38N/mm	150N/mm	.3Nm/deg
LF2	HTR	3	1.5mm	+/-3mm	+3mm/-3mm	6	17	22N/mm	150N/mm	.3Nm/deg
	ZYTEL	1	.1mm	+/- .5mm	+3mm/-.5mm	—	—			
LF4	HTR	3	1.5mm	+/-3mm	+4.3mm/-3mm	5	12	75N/mm	500N/mm	2.4Nm/deg
	ZYTEL	1	.1mm	+/- .5mm	+4.3mm/-.5mm	—	—			
LF8	HTR	3	2mm	+/-4mm	+5mm/-4mm	5	14	75N/mm	500N/mm	3.6Nm/deg
	HYTREL	0	0mm	+3mm/-2mm		—	—			
	ZYTEL	1	.1mm	+/- .5mm	+5mm/-.5mm	—	—			
LF12	HTR	2	2mm	+/-3mm	+5mm/-4mm	3	7.5	250N/mm	1000N/mm	9.0Nm/deg
LF16	HTR	3	2mm	+/-5mm	+5.8mm/-5mm	5	14	100N/mm	500N/mm	5.0Nm/deg
	HYTREL	0	0mm	+3mm/-2mm		—	—			
	ZYTEL	1	.1mm	+/- .5mm	+5.8mm/-.5mm	—	—			
LF22	HTR	2	2mm	+/-3mm	+5.8mm/-5mm	3	7.5	500N/mm	1300N/mm	12.0Nm/deg
LF25	HTR	3	2mm	+/-5mm	+6.6mm/-5mm	5	14	140N/mm	600N/mm	7.0Nm/deg
	HYTREL	0	0mm	+3mm/-2mm		—	—			
	ZYTEL	1	.1mm	+/- .5mm	+6.6mm/-.5mm	—	—			
LF28	HTR	2	2mm	+/-3mm	+6.6mm/-5mm	3	7.5	550N/mm	1400N/mm	17.0Nm/deg
LF30	HTR	3	2mm	+/-5mm	+6.6mm/-5mm	5	14	190N/mm	750N/mm	9.0Nm/deg
	HYTREL	0	0mm	+3mm/-2mm		—	—			
	ZYTEL	1	.1mm	+/- .5mm	+6.6mm/-.5mm	—	—			
LF50	HTR	3	2mm	+/-5mm	+6.6mm/-5mm	3	7.5	650N/mm	2200N/mm	26.0Nm/deg
	HYTREL	0	0mm	+3mm/-2mm		—	—			
LF80	HTR	2	1.5mm	+/-5mm	+6.6mm/-3mm	3	7.5	850N/mm	2900N/mm	34.0Nm/deg
LF90	HTR	3	2mm	+/-5mm	+8.6mm/-5mm	5	14	220N/mm	1000N/mm	17.0Nm/deg
LF140	HTR	2	2mm	+/-5mm	+8.6mm/-5mm	3	7.5	650N/mm	2300N/mm	38.0Nm/deg
	HYTREL	0	0mm	+3mm/-2mm		—	—			
LF250	HTR	2	2mm	+/-5mm	+10mm/-5mm	3	7.5	1150N/mm	4100N/mm	68.0Nm/deg
LF400	HTR	2	2mm	+/-3mm		3	7.5	1300N/mm	6000N/mm	88.0Nm/deg

* HTR = High Temperature Rubber

** Angular and parallel misalignment values are dependent on speed, and for rubber elements, they should be adjusted according to figure 2.
Hytrel elements are only for applications where the driven component is piloted to the driver for essentially perfect alignment (i.e. hydraulic pump flange-mounted to engine flywheel housing)

*** The “S-Style” design is not constrained axially and thus allows the hubs to move apart without creating axial force on the connected equipment.
Special length S-Style fastener sleeves can further increase the allowable end float.

LF Torsional Technical Selection Data

Service Factor Guide

Agitators 1.0
Beaters 1.5
Blowers 1.0-1.25
Can Filling Machinery 1.0
Car Dumpers 2.5
Car Pullers 1.5
Compressors (Screws) 1.0-1.25
Compressors (Reciprocating) . . . .consult Lovejoy
Conveyors 1.0-1.25
Live Roll, shaker & Reciprocating 3.0
Conveyors (Heavy Duty) 1.25-2.5
Cranes & Hoists 2.0
Crushers 3.0
Dredges 1.5-2.0
Elevators 1.5-2.0
Evaporators 1.0
Fans 1.0-1.5
Feeders 1.0
Reciprocating 2.5
Generators
Not Welding 1.0
Welding 2.0
Hoist 1.5
Hammer Mills 2.0
Kilns 1.5
Laundry Washers
Reversing 2.0
Line Shafting 1.5
Lumber Machinery .2.0
Machine Tools 1.5-2.0
Metal Forming Machines 1.5-2.5
Mills, Rotary Type 2.0
Mixers 1.5-1.8
Paper Mills Equipment 1.2-2.0
Pumps
Centrifugal 1.0
Gear, Rotary or Vane 1.25
Reciprocating 1 Cyl. single 2.0
or double acting
2 Cyl. single acting 2.0
2 Cyl. double acting 1.75
3 or more Cyl. 1.5
Rubber Machinery .2.0-2.5
Stokers 1.0
Textile Machinery 1.2
Windlass 2.0
Woodworking Machinery 1.0

Fig. 1 – Temperature Factor

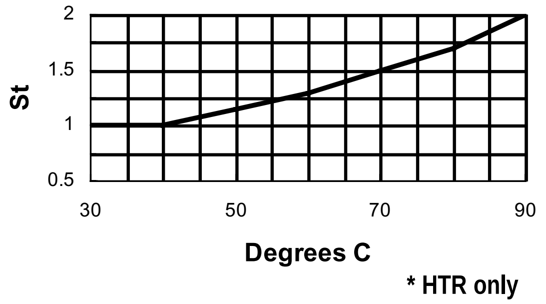


Fig. 2 – Permissible Misalignment vs. Speed

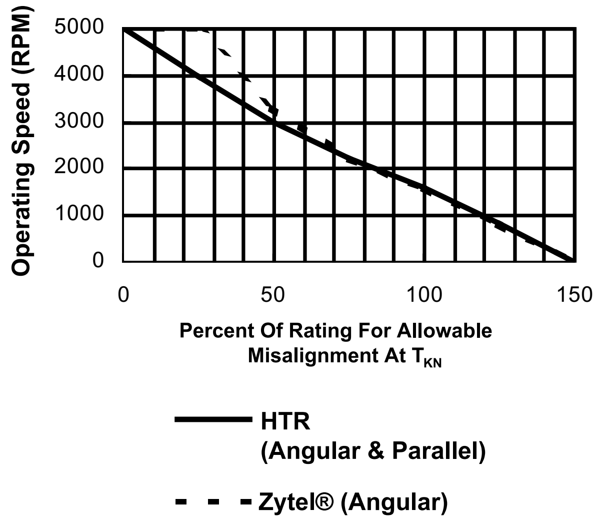


Fig. 3 – Frequency Factor

Operating Frequency **f (Hz)**	≤10	>10
Frequency Factor S_f	1	$\sqrt{f/10}$

Fig. 4 – Resonance Factor Vr and Relative Damping Factor Ψ

Coupling Element	Vr	Ψ
HTR 50 Shore A	10	0.6
HTR 60 Shore A	8	0.78
Hytrel®	—	0.5
Zytel®	—	0.4

Chemical Resistance Chart

Oils & Hydraulic Fluids	Hytrel®	Zytel®	Solvents & Fuels	Hytrel®	Zytel®	Acids & Bases	Hytrel®	Zytel®	Miscellaneous	Hytrel®	Zytel®
Automatic Transmissions	A	A	Gasoline	A	A	Sulfuric Acid (20%)	A	C	Ethylene Glycol *	A	A,B
Fluid Type A & F	A	A	Nujol, JP4 Kerosene	A	A	Hydrochloric Acid(20%)	B	C	Steam	B	B
Hydraulic Fluid	A	A	Halocarbons, Freon	A	A	Potassium or Sodium			Liquid Ammonia		A
Phosphate Ester	A	A	Trichlorethylene	C	C	Hydroxide (20%)	A	B			
Lube Oil	A	A	Carbon Tetrachloride	B	A						

Code: A= Little or No Effect; B=Moderate Effect; C=Severe Effect

* Additives in antifreeze may attack these elastomers severely.

LF Torsional Weights and Mass Moment of Inertia

Weights & Mass Moment Of Inertia For Couplings With Rubber (HTR) Elements

CLPG	Weight (kg)					Inertia (kg-cm^2)				
Size	Model 0	Model 1	Model 1/S	Model 2	Model 2/S	Model 0	Model 1	Model 1/S	Model 2	Model 2/S
LF1	0.06	0.21	0.24	0.47	0.49	0.35	0.75	0.86	1.60	1.70
LF2	0.15	0.46	0.49	1.06	1.09	1.25	2.5	3.3	7.3	8.1
LF4	0.21	1.31	0.70	2.31	1.70	3.3	5.0	6.5	11.3	12.8
LF8	0.32	1.35	1.44	3.45	3.54	7.0	15.0	18.6	41.0	44.6
LF12	0.35	1.45	1.56	3.55	3.66	8.4	18.2	20.0	44.2	46.1
LF16	0.65	2.28	2.33	6.16	6.21	23.4	42.5	49.1	118.8	125.4
LF22	0.70	2.52	2.62	6.42	6.62	26.6	50.4	70.2	126.5	146.3
LF25	0.84	3.59	3.77	9.31	9.49	50.2	90.7	102.7	215.0	227.0
LF28	0.95	3.79	4.05	9.51	9.76	55.6	102.4	113.2	247.8	258.5
LF30	1.43	5.66	6.02	15.21	15.57	102.0	200.0	220.4	545.5	565.9
LF50	1.60	6.04	6.50	15.60	16.05	104.0	205.0	253.4	550.5	598.9
LF80	2.10	6.85	7.25	16.60	17.00	131.8	240.3	263.9	585.5	609.1
LF90	3.30	11.55	12.23	28.67	29.35	450.0	657.5	759.2	1630.1	1731.8
LF140	3.65	12.33	13.22	29.45	30.36	572.0	770.0	873.0	1742.6	1845.6
LF250	7.10	18.98	20.01	44.42	45.44	1754.0	2404.0	2529.0	5264.0	5389.0
LF400	11.25	26.58	29.34	57.23	59.95	3380.0	4485.0	4683.0	9130.0	9329.0

Weights & Mass Moment Of Inertia
For Couplings With Hytrel® Elements

CLPG	Weight (kg)			Inertia (kg-cm^2)		
Size	Model 1	Model 2	Model 4	Model 1	Model 2	Model 4
LF8 Hytrel	1.30	3.10	-	76.9	181.0	-
LF16 Hytrel	2.30	4.80	-	206.6	512.0	-
LF30 Hytrel	5.20	13.30	6.50	800.7	2183.2	1759.4 (SAE 10)
LF50 Hytrel	5.60	13.70	7.00	942.3	2326.0	2310.8 (SAE 11.5)
LF110 Hytrel	7.80	-	-	-	-	-
LF140 Hytrel	12.00	29.00	14.50	3366.6	7257.7	-

Weights & Mass Moment of Inertia
For Couplings With Zytel® Elements

CLPG	Weight (kg)			Inertia (kg-cm^2)		
Size	Model 0/0S	Model 1/1S	Model 2/2S	Model 0/0S	Model 1/1S	Model 2/2S
LF2 Zytel	0.1	0.4	1.0	1.23	1.81	6.61
LF4 Zytel	0.1	1.3	2.3	2.63	3.63	9.95
LF8 Zytel	0.3	1.5	3.5	10.5	14.6	40.7
LF16 Zytel	0.5	2.1	5.9	27.5	36.6	113.0
LF25 Zytel	0.7	3.6	9.1	50.3	72.3	196.4
LF30 Zytel	1.1	5.4	14.9	122.0	177.9	523.5

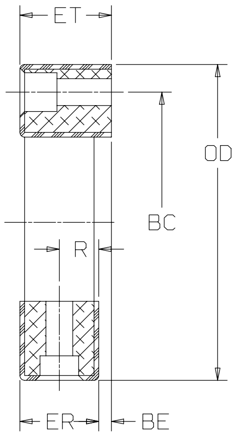
Weights & Mass Moment Of Inertia
For SAE Flywheel Adapter Plates (5mm thick)

SAE Size (J620)	Weight kg	Inertia kg-cm2
6.5	1.2	76
7.5	1.5	123
8	1.9	176
10	2.7	357
11.5	3.5	565
14	5.8	1724

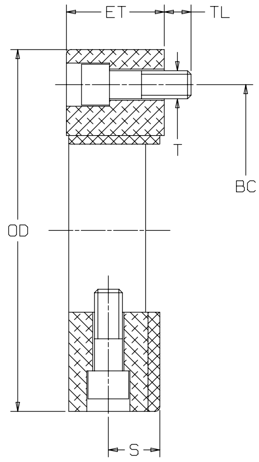
Note: To Obtain Weight of Model-3
1. Select weight of Flywheel Plate (from chart at left)
2. Select weight of Model-1 or 1/S Coupling (from chart above)
3. Add Flywheel Plate and Coupling Weight Together

Note: To Obtain Inertia of Model-3
1. Select Inertia of Flywheel Plate (from chart at left)
2. Select Inertia of Model-1 or 1/S Coupling (from chart above)
3. Add Flywheel Plate and Coupling Inertia Together

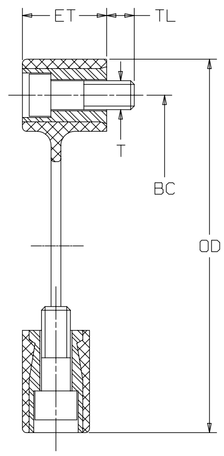
LF Torsional Dimensions



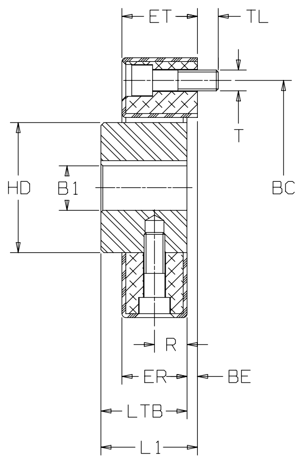
Model 0, Rubber



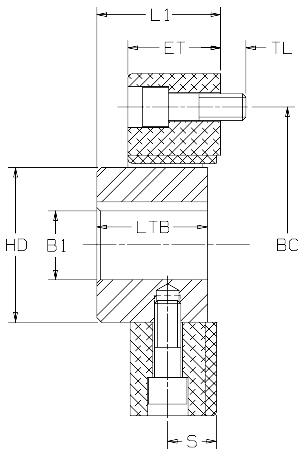
Model 0, Hytrel®



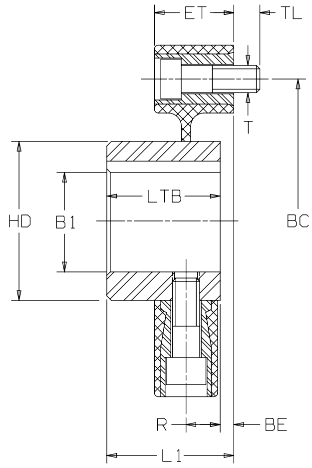
Model 0, Zytel®



Model 1, Rubber



Model 1, Hytrel®

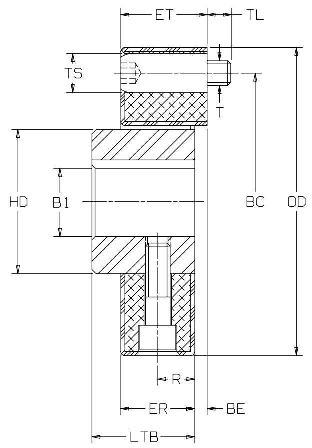


Model 1, Zytel®

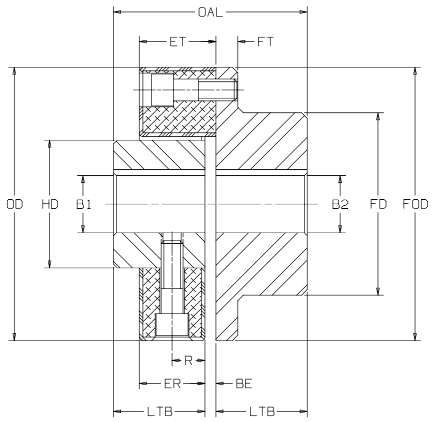
Dimensions For Basic Models (mm)

CLPG	Bore B1		Bore B2			OD		FOD		ET		OAL		L1	
Size	Min	Max	Min	Max	HTR	HY	ZY		HTR	HY	ZY		HTR	HY	ZY
LF1	8	19	8	25	56	-	-	56	24	-	-	50	26	-	-
LF2	10	26	12	38	85	-	88	85	24	-	24	60	32	-	32
LF4	12	30	15	45	100	-	100	100	28	-	25	64	34	-	32.5
LF8	12	38	18	55	120	125	125	120	32	34	30	88	46	48	45
LF12	12	38	18	55	122	-	-	120	32	-	-	88	46	-	-
LF16	15	48	20	70	150	155	155	150	42	43	36	106	56	58	53
LF22	15	48	20	70	150	-	-	150	42	-	-	106	56	-	-
LF25	15	55	20	85	170	182	175	170	46	47	40	116	61	62	58
LF28	15	55	20	85	170	-	-	170	46	-	-	116	61	-	-
LF30	20	65	25	100	200	205	205	200	58	58	50	140	74	76	71
LF50	20	65	25	100	200	205	-	200	58	58	-	140	74	76	-
LF80	20	65	25	100	205	-	-	200	65	-	-	141.5	75.5	-	-
LF90	30	85	30	110	260	-	-	260	70	-	-	168	88	-	-
LF140	30	85	30	110	260	270	-	260	70	58	-	168	88	88	-
LF250	40	105	40	130	340	270	-	340	85	103	-	208	108	103	-
LF400	40	120	40	140	370	-	-	370	105	-	-	260	135	-	-

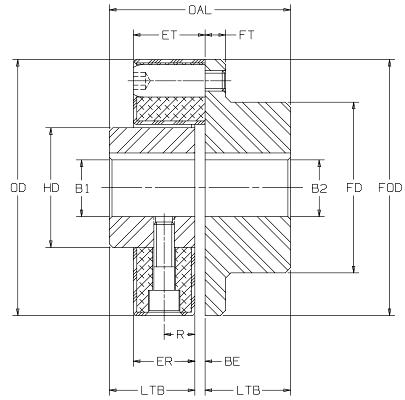
LF Torsional Dimensions



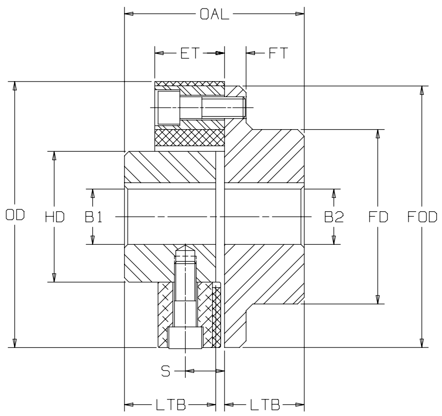
Model 1S, Rubber



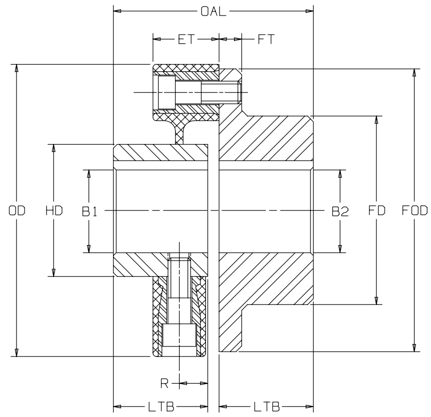
Model 2, Rubber



Model 2/S, Rubber



Model 2, Hytrel®



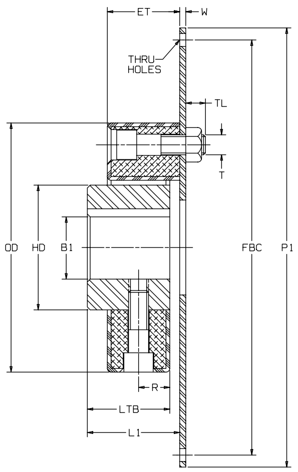
Model 2, Zytel®

Dimensions For Basic Models (mm) - Continued

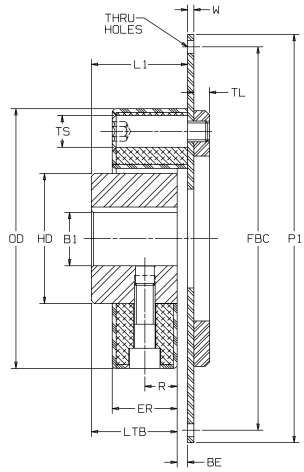
LTB	HD	FD	FT	BE (+3/-2)	S**	ER*	R	BC/Division		T	TS HTR	TS HY	TS ZY	TL	Coupling Size
24	30	36	7	2	-	22	11	44	2@180°	M6	10	-	-	7	**LF1**
28	40	55	8	4	-	20	10	68	2@180°	M8	14	-	15	8	**LF2**
30	45	65	8	4	-	24	12	80	3@120°	M8	14	-	15	8	**LF4**
42	60	80	10	4	20	28	14	100	3@120°	M10	17	-	19	10	**LF8**
42	60	80	10	4	-	28	14	100	4@90°	M11	17	-	-	10	**LF12**
50	70	100	12	6	26	36	18	125	3@120°	M12	19	-	22	12	**LF16**
50	70	100	12	6	-	36	18	125	4@90°	M12	19	-	-	12	**LF22**
55	85	115	14	6	27	40	20	140	3@120°	M14	22	-	25	14	**LF25**
55	85	115	14	6	-	40	20	140	4@90°	M14	22	-	-	14	**LF28**
66	100	140	16	8	35	50	25	165	3@120°	M16	25	-	30	16	**LF30**
66	100	140	16	8	35	50	25	165	4@90°	M16	25	-	-	16	**LF50**
66	100	140	16	4	-	61	30.5	165	4@90°	M16	25	-	-	16	**LF80**
80	125	160	19	8	-	62	31	215	3@120°	M20	32	-	-	20	**LF90**
80	125	160	19	8	33	62	31	215	4@90°	M20	32	-	-	20	**LF140**
100	160	195	19	8	-	77	22.5/54.5	280	4@90°	M20	32	-	-	20	**LF250**
125	170	200	25	10	-	95	28.5/66.5	300	4@90°	M24	45	-	-	28	**LF400**

* Dimension ER for HTR (rubber) only.
** Dimension S for Hytrel only.

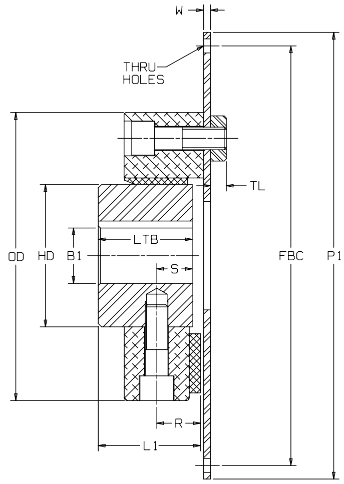
LF Torsional Flywheel Couplings



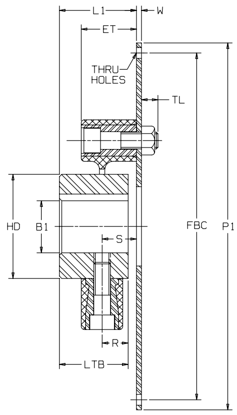
Model 3, Rubber



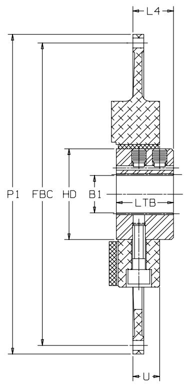
Model 3/S, Rubber



Model 3, Hytrel®



Model 3 and 3/S, Zytel®



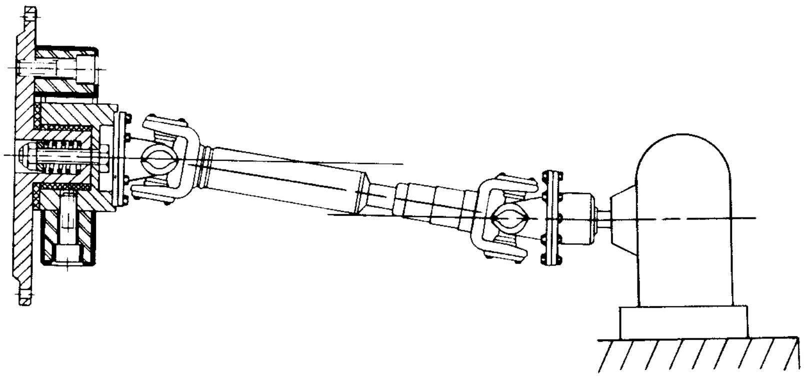
Model 4, Hytrel®

Damper Couplings

The damper coupling (sometimes referred to as the intermediate coupling) is used with U-Joint and Cardan shafts to eliminate torsional vibrations from the diesel engine being transmitted to the driven equipment.

The damper coupling assures that the drive systems are free of dangerous resonance speeds in the operating speed range and eliminates
damage to gears, bearings, seals, and spline fretting the driven equipment

Contact Lovejoy Engineering for assistance in applying a damper coupling.



LF Torsional Flywheel Couplings

Flywheel Couplings Model 3, 3/S, and 4 Dimensions (mm)

CLPG	Bore B1		OD			ET			TL	L1			ER*	W	R	LTB
Size	Min	Max	HTR	HY	ZY	HTR	HY	ZY		HTR	HY	ZY				
LF1	8	19	56	-	-	24	-	-	7	26	-	-	22	-	11	24
LF2	10	26	85	-	88	24	-	24	8	32	-	32	20	-	10	28
LF4	12	30	100	-	100	28	-	25	8	34	-	32.5	24	-	12	30
LF8	12	38	120	125	125	32	34	30	10	46	48	45	28	5	14	42
LF12	12	38	122	-	-	32	-	-	10	46	-	-	28	5	14	42
LF16	15	48	150	155	155	42	43	36	12	56	58	53	36	5	18	50
LF22	15	48	150	-	-	42	-	-	12	56	-	-	36	5	18	50
LF25	15	55	170	182	175	46	47	40	14	61	62	58	40	5	20	55
LF28	15	55	170	-	-	46	-	-	14	61	-	-	40	5	20	55
LF30	20	65	200	205	205	58	58	50	16	74	76	71	50	5	25	66
LF50	20	65	200	205	-	58	58	-	16	74	76	-	50	5	25	66
LF80	20	65	205	-	-	65	-	-	16	75.5	-	-	61	5	30.5	66
LF90	30	85	260	-	-	70	-	-	20	88	-	-	62	5	31	80
LF140	30	85	260	270	-	70	58	-	20	88	88	-	62	5	31	80
LF250	40	105	340	270	-	85	103	-	20	108	103	-	77	13/19	22.5/54.5	100
LF400	40	120	370	-	-	105	-	-	28	135	-	-	95	19	28.5/66.5	125

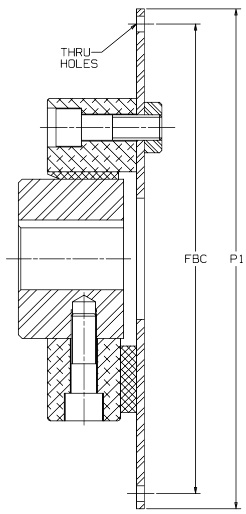
* Dimension ER for HTR (rubber) only.

Clpg	BE	S*	U*	L4*	HD	BC/Division		T	TS		
Size		(+3/-2)	(+3/-2)						HTR	HY	ZY
LF1	2	-	-	-	30	44	2@180°	M6	10	-	-
LF2	4	-	-	-	40	68	2@180°	M8	14	-	15
LF4	4	-	-	-	45	80	3@120°	M8	14	-	15
LF8	4	20	-	-	60	100	3@120°	M10	17	-	19
LF12	4	-	-	-	60	100	4@90°	M10	17	-	-
LF16	6	26	-	-	70	125	3@120°	M12	19	-	22
LF22	6	-	-	-	70	125	4@90°	M12	19	-	-
LF25	6	27	-	-	85	140	3@120°	M14	22	-	25
LF28	6	-	-	-	85	140	4@90°	M14	22	-	-
LF30	8	35	44	11	100	165	3@120°	M16	25	-	30
LF50	8	35	30	22	100	165	4@90°	M16	25	-	-
LF80	4	-	-	-	100	165	4@90°	M16	25	-	-
LF90	8	-	-	-	125	215	3@120°	M20	32	-	-
LF140	8	33	31.5	10.5	125	215	4@90°	M20	32	-	-
LF250	8	-	-	-	160	280	4@90°	M20	32	-	-
LF400	10	-	-	-	170	300	4@90°	M24	45	-	-

* Hytrel only.

SAE J620 Flywheel Dimensions For Model 3, 3S, and 4 (mm)

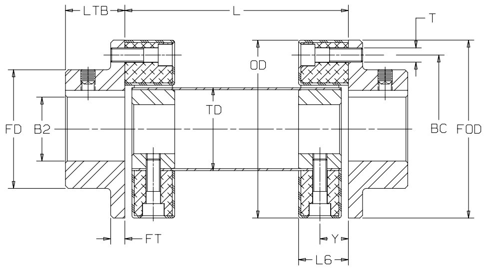
SAE Flywheel Size	Pilot P1	Bolt Circle FBC	Thru Holes NO	Thru Holes NOM DIA	Suggested Coupling Sizes for SAE Flywheel Sizes: HTR Model 3 &3S	HY Model 3	HY Model 4	ZY Model 3
6-1/2	215.9	200.02	6	9	8, 16	8, 16	N/A	8, 16
7-1/2	241.3	222.25	8	9	8, 16	8, 16	N/A	8, 16
8	263.52	244.47	6	11	16, 25	16, 30	30	16, 25, 30
10	314.32	295.27	8	11	25,30	30, 50	30	25, 30
					50,90	140		
11-1/2	352.42	333.37	8	11	30,50	50, 140	50	30
					90,140	250	110	
					250		140	
14	466.72	438.15	8	13	90,140	140	N/A	N/A
					250	250		
16	517.5	488.95	8	13	250	250	N/A	N/A



LF Torsional Model 6 & 6B Floating Shaft Couplings

Model 6, 6/S (Rubber Elements)

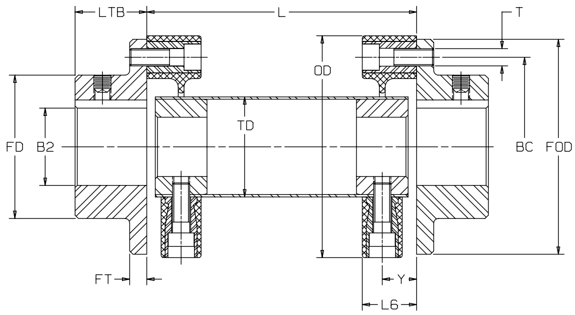
This model compensates for considerable axial, radial, and angular misalignment, and with the rubber flexible elements is torsionally very soft. Lengths are not standardized, but made according to customer requirements. S-style axial mounting screws allow the hubs to have free end float without exerting axial loads on the connected equipment, while providing quick assembly.



Model 6, Rubber

Model 6, 6/S (Zytel® Elements)

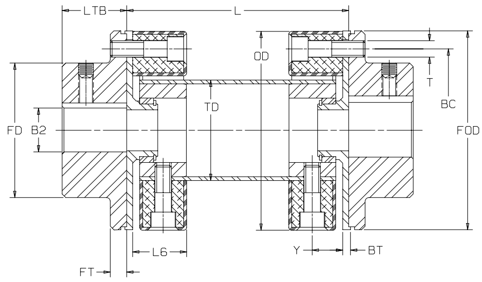
Elements made of super-tough, corrosion resistant Zytel® from DuPontTM are torsionally stiff without backlash, with less than 1° windup. Large spans, equal to all-metal couplings, can be accommodated without internal support bearings when light-weight Zytel® flexible elements are used. Hubs, hardware and tubes are also available in stainless steel or with plating and corrosion resistant coatings. S-style, axial mounting screws allow for free end-float without harmful reaction forces.



Model 6, Zytel®

Model 6B (Rubber Elements)

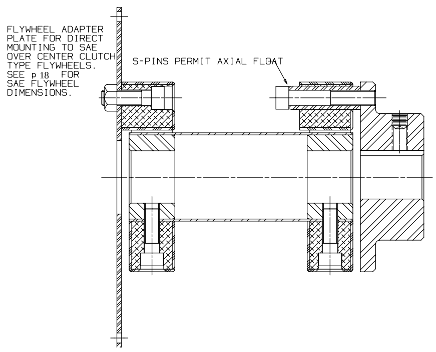
Similar to Model 6 except the center shaft is supported by internal maintenance-free bearing material. This allows for greater equipment separation and high speeds, as well as high angular misalignment, which can be obtained with rubber flexible elements.



Model 6B, Rubber

The drawing at the lower left shows one of the many special designs available. In this case, a standard flywheel adapter plate (see Model 3) is used to couple to a diesel engine flywheel. The flanged hub on the other end is supplied with extra long S-style connecting screws. (Notice that the element is reversed from its normal direction). This arrangement permits extensive axial movement (free end float) of the drive package.

One of the many features of the Model 6 is that the center floating shaft can be radially removed without displacing the coupled machines. Flexible elements may be pre-assembled to the center segment and then final assembled to the hubs quickly, with little hardware.



Model 3, 6/S Rubber

LF Torsional Model 6 & 6B

Model 6 and 6B Dimensions (mm)

CLPG Size	Nominal Torque (Nm) Rubber	Nominal Torque (Nm) Zytel	Bore Diameter B2 Min.	Bore Diameter B2 Max.	Element OD Rubber	Element OD Zytel	Flange FOD	Hub LTB	Span L	Y	BT	FT	TD	ET Rubber	ET Zytel
LF1	10	-	8	25	56	-	56	24	*	13	5	7	30	24	-
LF2	20	30	12	38	85	88	85	28	*	14	5	8	40	24	24
LF4	50	60	15	45	100	100	100	30	*	16	5	8	45	28	25
LF8	100	120	18	55	120	125	120	42	*	18	5	10	60	32	30
LF12	140	-	18	55	122	-	120	42	*	18	5	10	60	32	-
LF16	200	240	20	70	150	155	150	50	*	24	5	12	70	42	36
LF22	275	-	20	70	150	-	150	50	*	24	5	12	70	42	-
LF25	315	370	20	85	170	175	170	55	*	26	5	14	85	46	40
LF28	420	-	20	85	170	-	170	55	*	26	5	14	85	46	-
LF30	500	550	25	100	200	205	200	66	*	33	5	16	100	58	50
LF50	700	-	25	100	200	-	200	66	*	33	5	16	100	58	-
LF80	900	-	25	100	205	-	200	66	*	34.5	5	16	100	65	-
LF90	1100	-	30	110	260	-	260	80	*	39	5	19	125	70	-
LF140	1,700	-	30	110	260	-	260	80	*	39	5	19	125	70	-
LF250	3,000	-	40	130	340	-	340	100	*	46	10	19	160	85	-
LF400	5,000	-	40	140	370	-	370	125	*	57	10	25	170	105	-

* Please specify distance between shaft ends L. Refer to table below for max. and min. values.

Model 6 and 6B Maximum Speed and Length Data

Coupling Size	Max. Speed (RPM) (Short Spans Only) Model 6	Max. Speed (RPM) (Short Spans Only) Model 6B	Max. Speed (RPM) (Short Spans Only) Zytel Model 6	MIN Span L (mm) (All Versions)	Max. Span L (mm) @ 1750 RPM Model 6	Max. Span L (mm) @ 1750 RPM Model 6B	Max. Span L (mm) @ 1750 RPM Zytel Model 6
LF1	1500	6000	-	79	1140	1320	-
LF2	1500	6000	10,000	79	1320	1475	1475
LF4	2900	6000	8000	92	1500	1575	1575
LF8	2900	6000	7000	106	1625	1830	1830
LF12	2900	6000	-	106	1625	1830	-
LF16	2900	6000	6000	138	1650	1955	1955
LF22	2900	6000	-	138	1650	1955	-
LF25	2900	5000	5000	152	1475	2130	2130
LF28	2900	5000	-	152	1475	2130	-
LF30	2500	4000	4500	190	1500	2310	2310
LF50	2500	4000	-	190	2100	2310	-
LF80	2500	4000	-	190	2100	2310	-
LF90	1500	3600	-	230	865	2515	-
LF140	1500	3600	-	230	1855	2515	-
LF250	1500	3000	-	274	2185	2970	-
LF400	1500	2500	-	**Consult Lovejoy**			

Model 6 (Rubber) Max. Span L (mm) At Various Speeds*

* Longer spans for given speeds are possible with Model 6B. Please consult Lovejoy. Consult Lovejoy for maximum spans at higher speeds.

CLPG Size	Speed (RPM) 500	600	720	750	900	1000	1200	1500	1800
LF1	2390	2185	1980	1930	1750	1650	1470	1300	1140
LF2	2770	2515	2260	2235	2000	1880	1680	1450	1320
LF4	2950	2690	2440	2390	2190	2060	1850	1630	1500
LF8	3400	3070	2795	2720	2460	2310	2060	1780	1630
LF12	3400	3070	2795	2720	2460	2310	2060	1780	1630
LF16	3660	3275	2970	2900	2610	2440	2160	1830	1650
LF22	3660	3275	2970	2900	2610	2440	2160	1830	1650
LF25	3910	3505	3125	3050	2690	2490	2110	1630	1470
LF28	3910	3505	3125	3050	2690	2490	2110	1630	1470
LF30	4270	3835	3400	3330	2920	2690	2290	1730	1500
LF50	4395	3990	3630	3530	3200	3020	2670	2340	2100
LF80	4395	3990	3630	3530	3200	3020	2690	2340	2100
LF90	4495	3940	3400	3300	2720	2390	1750	965	860
LF140	4750	4290	3835	3730	3300	3070	2640	2100	1860
LF250	5360	4830	4340	4240	3760	3480	3000	2390	2190

Model 6 (Zytel®) Max. Span L (mm) At Various Speeds*

* Maximum span is based on tube deflection and a critical speed 1.5x above operating speed.

CLPG Size	Speed (RPM) 500	600	720	750	900	1000	1200	1500	1800
LF2 Zytel	2800	2570	2340	2290	2080	1980	1800	1630	1470
LF4 Zytel	2800	2690	2460	2410	2210	2080	1900	1700	1580
LF8 Zytel	3450	3150	2870	2800	2570	2440	2210	1980	1830
LF16 Zytel	3730	3400	3100	3050	2770	2620	2390	2130	1830
LF25 Zytel	4110	3760	3430	3350	3050	2900	2640	2360	2130
LF30 Zytel	4470	4090	3730	3660	3330	3150	2900	2590	2310

LF Torsional Model 6 & 6B (continued)

These guidelines cover additional considerations unique to the floating-shaft versions of the coupling. Use them together with the selection information for general applications or engine applications found on pages 8 through 11.

1. Torque capacity

Values for nominal torque T_{KN}, maximum torque T_{Kmax} and continuous vibratory torque T_{KW} remain the same and are found in the table of Performance Data on page 12 and 13.

2. Stiffness values and wind-up

Because 2 torsional rubber elements are used together in series, values from the Performance Data table on page 12 and 13 for dynamic torsional stiffness CT_{dyn}, static angular stiffness c_W, and static axial stiffness c_a, should be multiplied by one half. Values for wind-up should be doubled.

3. Misalignment

Performance Data table values for allowable axial misalignment are doubled for the standard element design. Values for the S-Style version will be the same but can be increased by use of special-length sleeves (consult Lovejoy).

Angular misalignment will be equal at both ends and should be kept within the limits given in the Performance Data table. Allowable parallel misalignment is related to the angular misalignment and the distance between shaft ends L. It is calculated by applying one of the two following equations:

For Model 6:

$r = (L-2Y)\tan\alpha$

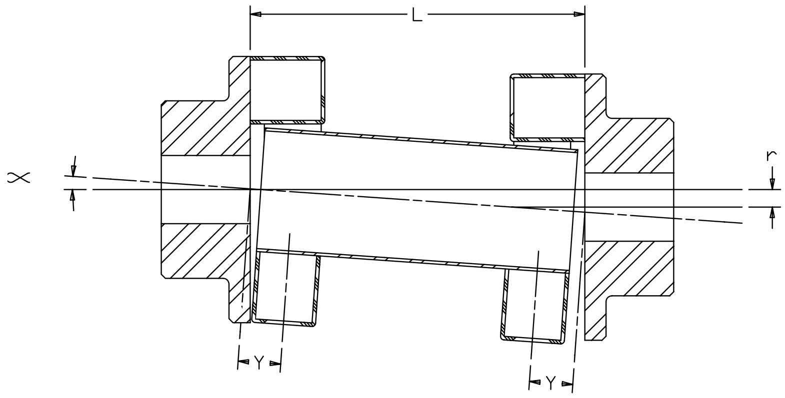
For Model 6B:

$r = [L-2(Y+BT)]\tan\alpha$

where

α = angular misalignment (degrees),
r = parallel misalignment (mm),
and L,Y and BT (mm) are from the dimension table.

Please note that angular and parallel misalignment values are dependent on speed and should be adjusted according to Fig. 2, page 14.



4. Which style, Model 6 or Model 6B? (HTR only)

In general, the basic Model 6 is suitable for most short- or medium-length spans (distance between shaft ends). Longer spans will require the bearing-supported floating shaft feature of the Model 6B. But regardless of length, some applications will still require the Model 6B design based on speed alone. Use the Maximum Speed and Length table to guide your choice, or consult Lovejoy for assistance.

LF Torsional Assembly Instructions

Assembly Notes and Instructions - Important Notes

For optimum coupling performance and longevity, the radial and axial screws connecting the element to the hubs or adapter plate must be tightened to the torque given in the table below. It is recommended that a torque wrench be used. This is particularly important with larger couplings. Tightening "by feel" is normally not sufficient.

Tightening torques which are too low will inevitably lead to slackening of the screws and consequently lead to undesirable results.

In order to reduce friction between the screw head and the metal insert in the element, it is suggested that a small amount of grease be applied to the underside of the screw head before assembly. This also reduces the possibility of twisting the element (see diagrams to the left). It is important that the element be mounted correctly and not be twisted.

Mounting Screws

Each radial and axial mounting screw is treated for corrosion resistance (minimum grade DIN 8.8, SAE Grade 8) and the threads are coated with micro-encapsulated adhesive. The adhesive is released at assembly and further enhances the performance and safety of the coupling. For adequate effect, the adhesive should be allowed to harden for 4-5 hours prior to operation.

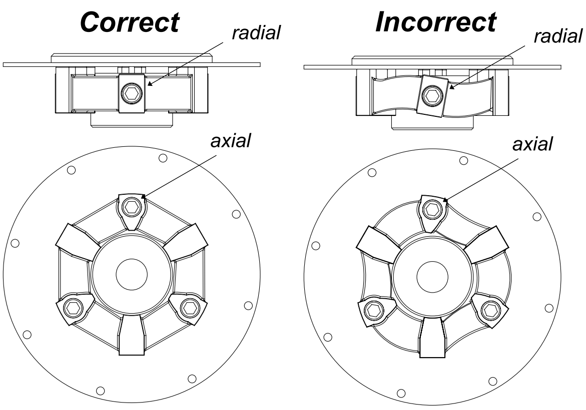
NOTE:
Anaerobic adhesives (such as Loctite™, etc) should **NOT** be used, as they have a detrimental effect on the bond between the rubber and the insert if dripped or splashed to those areas.

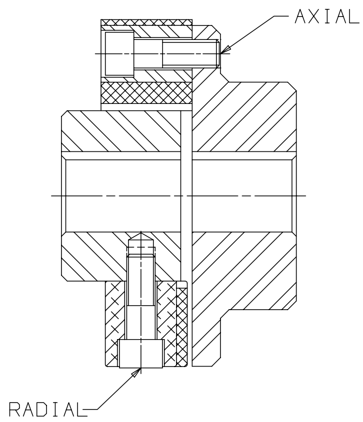
Recommended adhesives are 3M™ 2353 or Nylok Precote 80. Screws that we provide with this adhesive may be used up to 3 times.

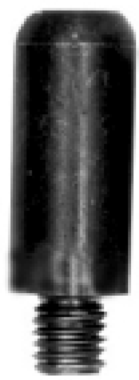
Mounting Screw Data

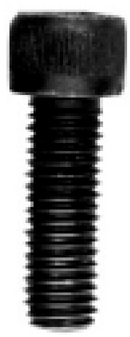
CLPG Size	Radial and Axial Screws: Screw Size	Thread Pitch	Quantity	Torque (Nm)	L-Loc Screws: Set Screw	Torque (Nm)
LF1	M6	1.00	4	10	-	-
LF2	M8	1.25	4	25	-	-
LF4	M8	1.25	6	25	-	-
LF8	M10	1.50	6	50	M10	30
LF12	M10	1.50	8	50	M10	30
LF16	M12	1.75	6	90	M12	50
LF22	M12	1.75	8	90	M14	70
LF25	M14	2.00	6	140	M14	70
LF28	M14	2.00	8	140	M16	120
LF30	M16	2.00	6	220	M16	120
LF50	M16	2.00	8	220	M16	120
LF80	M16	2.00	8	220	M16	120
LF90	M20	2.50	6	500	M20	200
LF140	M20	2.50	8	500	M20	200
LF250	M20	2.50	12	500	M20	200
LF400	M20/M24	*	8/4	610/1050	*	*

* Consult Lovejoy






S-Style Axial Screw


Standard Radial & Axial Screw

LF Torsional Assembly Instructions — Continued

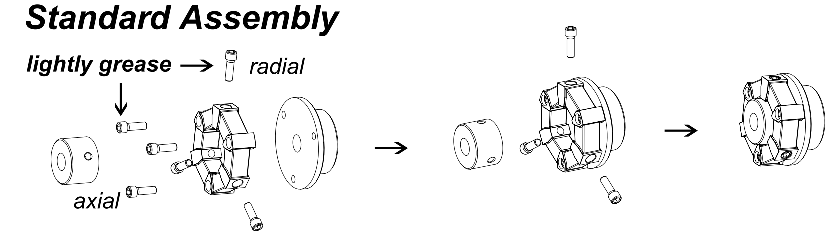
Models 1, 2 & 3

- Place hubs on shafts, or the adapter plate onto the flywheel. If a key is used, make sure it does not extend past the end of the shaft.
- Attach rubber element to the flanged hub (or adapter plate) with the axial screws. Hand tighten. (Be sure to place a drop of oil or grease under each screw head to reduce friction and twisting of the element at final assembly).
- Align equipment so the cylindrical hub in the other shaft is placed into the center of the element. Install the radial screws.
- Tighten all axial screws first, then all radial screws to the proper torque shown above. Tighten set screws.

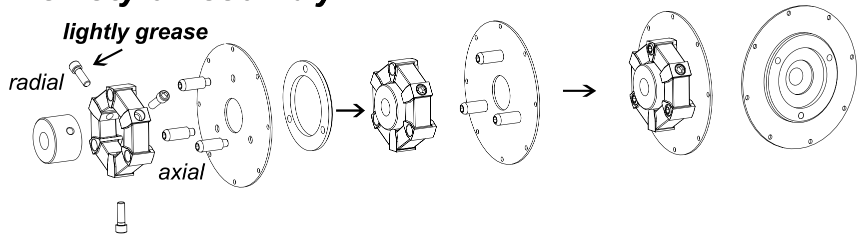
Model 1S, 2/S, 3/S

- Same as above except:
- Install S-Type axial screws on flanged hub or flanged plate.
- Mount the element on the cylindrical hub and fasten with radial screws. Torque these screws to the proper value. Do not forget to place a drop of oil or grease under the screw head before fastening. Also, make sure the hub is set on the shaft with the proper shaft engagement. Normally, the end of the shaft is flush with the end of the hub. Tighten set screws.
- Pilot the hub assembly onto the flanged hub or adapter plate.

Standard Assembly



"S" Style Assembly



LF Torsional Alignment and Assembly Notes

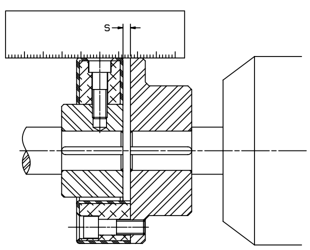
After assembly, the coupling (equipment) should be aligned carefully for long service life. Naturally, the higher the speed, the greater the care should be in alignment.

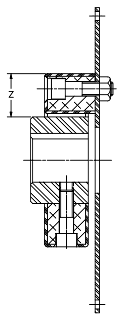
In Model 2, alignment can easily be checked with a straight edge. The outer diameter of the flanged hub must be flush with the element diameter where the radial screws are placed. Check each position for proper alignment. In Models 1 and 3 the distance must be measured at each axially bolted point of the rubber element, and should be set as accurately as possible to the value "Z" shown in the table on this page.

In models that use the S-Style screws, alignment is normally not required. The parallel and angular misalignment is small when the equipment is pilot assembled. As example of this would be a hydraulic pump mounted to an SAE engine pump mounting flange. Hytrel® Torsional couplings are pilot mounted only.

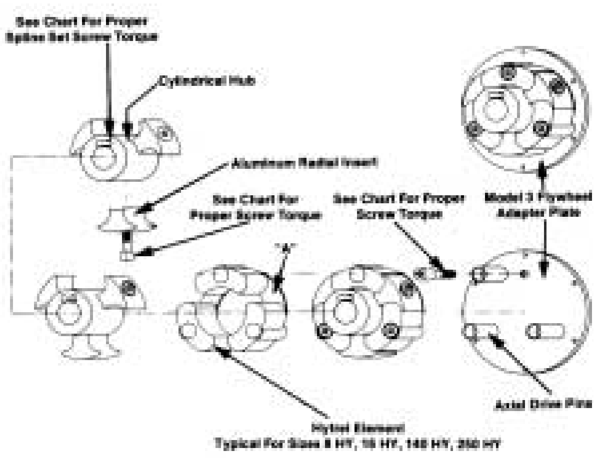
HTR Alignment Values (mm)

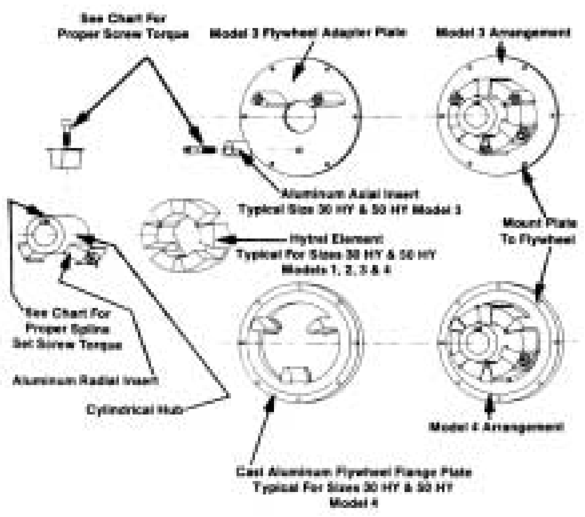
Size	Dimension S	Dimension Z
1	2	13
2	4	22.5
4	4	27.5
8	4	30
12	4	31
16	6	40
22	6	40
25	6	42.5
28	6	42.5
30	8	50
50	8	50
80	4	52.5
90	8	67.5
140	8	67.5
250	8	90
400	10	100





LF Torsional Hytrel® Assembly Instructions





For Sizes 8, 16, 140 and 250 (Models 1, 2 & 3)

1. Mount the cylindrical hub to the shaft and tighten set screws.

2. Mount the radial aluminum inserts to the cylindrical hub and tighten the radial screws to the proper torque. If the inserts are already mounted, do not disassemble.

3. Slide the Hytrel® element onto the cylindrical hub. The webbed part (A) must be placed toward the flanged hub or adapter plate. The size 140 consists of 4 single elastic Hytrel® cushions with shoulder "A". Size 250 has 4 cushions with shoulder "A" and 4 cushions without the shoulder. Cushions with shoulders are installed so that when they are assembled, they are nearest to the flanged hub or adapter plate.

4. Install the axial drive pins and screws to the flanged hub or adapter plate. Tighten to the specified torque.

5. Pilot the equipment together.

For Sizes 30 and 50 (Models 1, 2, 3, 4)

1. Mount the cylindrical hub to the shaft and tighten set screws.

2. Mount the radial aluminum inserts to the cylindrical hub and tighten the radial screws to the proper torque. If the inserts are already mounted, do not disassemble.

3. Mount the axial aluminum inserts to the flanged hub or adapter plate. Tighten to specified torque. Be sure that these inserts are oriented properly so that they mate with the Hytrel® element. Slide the Hytrel® element onto the axial (flanged hub or adapter plate) inserts.

4. Model 4: mount the cast aluminum flange with the Hytrel® element installed to the engine flywheel. Mount the cylindrical hub to the driven equipment shaft.

5. Pilot the equipment together.

LK Torsional Coupling System

The LK Torsional coupling is a simple, robust, two-piece coupling consisting of an element or flywheel adapter flange together with a splined hub. It is used on applications that have a diesel, gasoline or natural gas engine driving one or more flange mounted hydraulic pumps. The couplings are torsionally very stiff (almost rigid) enabling drives of hydraulic pumps and similar equipment having low mass or inertia to operate below the critical speed. The very stiff LK raises the critical speed well above the operating range providing a drive free of any harmful torsional vibrations. The LK is an ideal choice for hydrostatic construction drives, mainly in the low to mid power ranges. Typical applications are excavators, vibratory rollers, loaders, cranes, manlifts, forklifts, tractors, etc. Virtually all engine driven hydrostatic applications in the low to mid power range can use the LK coupling.

Salient features and advantages:

- Compact, light, robust and safe in operation with long service life.
- Oil Resistant and suitable for temperatures of -40° up to +150°C.
- High torsional stiffness-allowing operation below critical speed without resonances, provided it is correctly selected.
- Service free combination of sintered metal with highly shock resistant, temperature stabilized special polyamide.
- Short mounting length, easy assembly since it can be mounted axially.
- The hubs can be equipped with the proven patented L-Loc clamping system. With L-Loc, the coupling hub can be fit to splined shafts absolutely free of movement to eliminate fretting.
- The hubs can be modified in form and length as needed.
- Various series for standardized SAE-flywheels and non-standard flywheels.
- Low priced and normally available from stock.

Design and materials:

Modern construction to give rational and economic manufacture-good material properties-design principle proven over the years.

Hubs:

High-quality, precision powdered-metal hubs are used for all sizes of the LK. These hubs are thoroughly tested by Lovejoy and proven in many applications. These one-piece hubs (or hubstars) have "dogs" that provide the engagement with the element. The sides of the dogs are lightly crowned to avoid edge pressure at angular misalignments.

Flywheel flanges:

These flanges are molded in high quality plastic, strengthened with glass fiber to produce a heat-stabilized product displaying high impact strength. Fundamentally the flywheel flange or element is available in two different designs:

A) One-Piece with mounting measurements to SAE J620 as well as to various metric sizes.
B) Two-Piece consisting of one universal plastic flange, which can be fitted with steel adapter to any flywheel.
Such steel adapters can be produced either by the customer himself or delivered by us. In the latter case, the plastic flange is mounted in our factory onto the steel adapter.

The one-piece flanges can be mounted to the flywheel in two different positions, resulting in two different axial mounting lengths. The two- piece flanges with adapter can be arranged in four different positions, resulting in four different axial mounting lengths. By using the different positions of the flanges and different lengths of the hubs, the ideal overall length for the coupling can be reached.

LK Torsional Coupling System

LK Performance Data

CLPG Size	NOM Torque TKN	MAX Torque TKmax	MAX Speed (RPM)	Dynamic Torsional Stiffness Ctdyn (kNm/rad)				Relative Damping Ψ
				0.25 TKN	0.50 TKN	0.75 TKN	1.00 TKN	
LK80	125 Nm	330 Nm	6000	44	50	72	96	0.4
LK100	400 Nm	800 Nm	5000	55	62	90	120	
LK125	800 Nm	1600 Nm	4500	155	180	315	460	
LK150	1200 Nm	3000 Nm	4000	260	280	420	900	
LK150D	2400 Nm	6000 Nm	4000	520	560	840	1800	

Misalignment:

As the coupling is torsionally very stiff, it is also very stiff in the radial direction. It is suitable for accurately aligned drives, (flange mounted). The coupling is able to compensate for the small radial and angular misalignments that must normally be expected on flange mounted drives. In the axial direction, the hub can move freely and be located a few millimeters from the ideal axial position, even to the point of protruding out of the flange. However, for highly loaded couplings, it is recommended that the dogs be completely engaged at all times.

Mounting:

In most cases, the diameter of the hubstar is smaller than the center locating diameter of the pump flange (the hubstar passes through bore in the flange which connects the pump with the flywheel housing). The diameter of the hubstar is always a little smaller than the normal size of the coupling (the rotation diameter of the hubstar for LF-K-100 is <100mm; it will pass through the bore in the pump mounting plate provided it is 100 mm in diameter or greater). In this case the installation can be carried out as follows: (See bottom left picture)

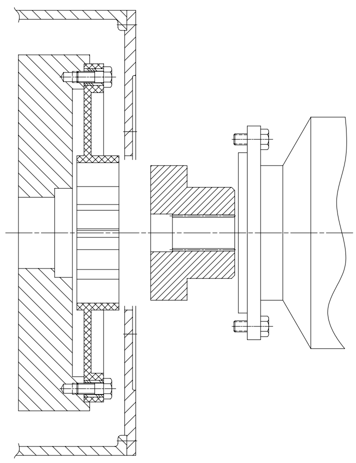
1. Bolt the coupling flange onto the flywheel.
2. Bolt the pump mounting plate onto the flywheel housing.
3. Fit coupling onto the pump shaft and secure.
4. Offer up pump to engage coupling and pump in the pump mounting plate.

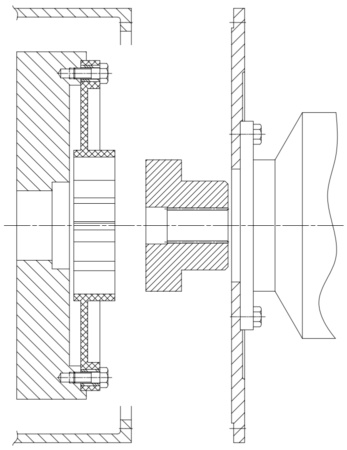
For the occasional case where the hubstar diameter is larger than the bore in the pump mounting plate, the installation should be carried out as follows: (See bottom center picture)

1. Bolt the coupling flange onto the flywheel.
2. Bolt pump mounting plate to pump.
3. Fit coupling hub onto the pump shaft and secure.
4. Offer up pump and mounting plate so coupling engages and locate the pump mount plate in the flywheel housing. Bolt complete assembly to flywheel housing.

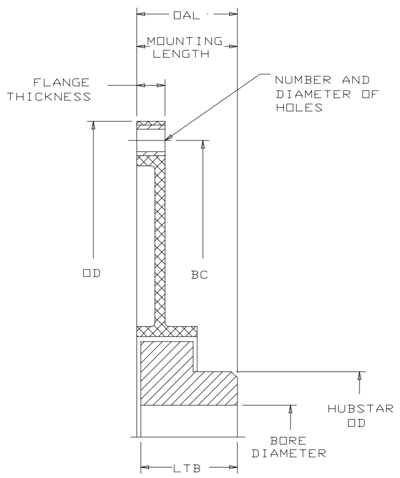
Axial Securing Of Hub

The hub can adjust its axial position freely as there is no axial stop. Therefore, the hub has to be secured onto the pump shaft axially.
For best results use our proven L-Loc clamping system. For light drives where the pump shaft has a shoulder it can be sufficient to clamp the hub against the shoulder using a bolt and washer fastened onto the end of the pump shaft, provided it has a tapped hole.

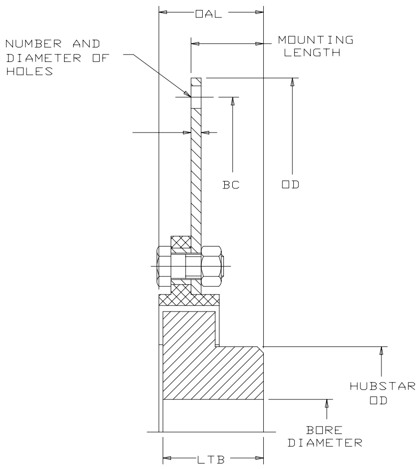




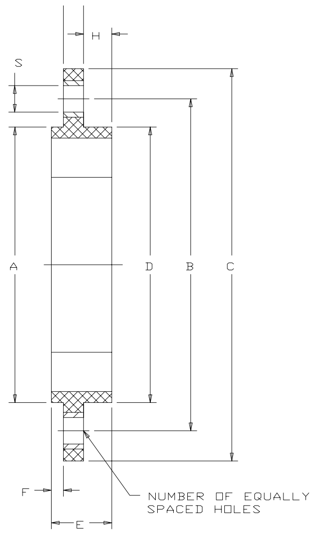
LK Torsional Coupling System



1-Piece Flange



2-Piece Flange



Universal Element

LK Dimensions for SAE J620 Flywheel Applications (mm)

CLPG Size	NOM Torque Rating Nm	Bore Diameter MIN	Bore Diameter MAX	SAE Flywheel Size	Flange Dimensions: Flange Style	OD	BC	Number & Diameter Of Holes	Flange Thickness	Hubstar DIM: Hubstar OD	LTB*	Assembly DIM: OAL	Mounting Length
LK100	400	15	40	6.5	1-PIECE	215.9	200	6 x 8.5	14	65	32	34	23+/-3
				7.5	1-PIECE	241.3	222.3	8 x 8.5	14		32	34	23+/-3
				8	1-PIECE	263.5	244.5	6 x 10.5	14		56	58	58+/-3
				10	1-PIECE	314.3	295.3	8 x 10.5	14		48	50	50+/-3
LK125	800	20	55	10	1-PIECE	314.3	295.3	8 x 10.5	20	85	48	50	50+/-3
				11.5	1-PIECE	352.4	333.4	8 x 10.5	20		42	46	36+/-3
LK150	1200	25	70	11.5	1-PIECE	352.4	333.4	8 x 10.5	20	110	53	53	33+/-1
				14	2-PIECE	466.7	438.2	8 x 12.7	5		53	53	25+/-1
LK150D	2400	30	70	14	**	466.7	438.2	8 x 12.7	3.4	110	52	54	25+/-1

*Other shorter or longer hub lengths available for special requirements.
**LK150D uses 2 Zytel elements in parallel with 1 steel plate.

Dimensions For Universal Elements (mm) (for Non-SAE Flywheels, etc.)

Element Size	Pilot A	B.C. B	Number OF Holes	Hole Diameter S	O.D. C	D	E	F	G	H
LK80-6-106 *	106	130	5	8.4	150	91.4	28.4	4.8	14.0	9.7
LK80-6-135	135	100	3	10.4	135	92.2	25.4	*	9.9	15.5
LK100-165	125	142	3	12.5	174	125	34	4	10	20
LK100-072	72	165	3	16.5	200	110	34	4	10	20
LK125-195	135	165	6	12.5	195	135	30	6	10	14
LK150-230	165	200	8	12.5	230	165	27	5	10	12

*Size LK80-6-135 pilots on the O.D.

SAE Pump Splines*

SAE Code	Number of Teeth	Spline Pitch	Major Diameter
A-A	9	20/40	12.7 mm
A	9	16/32	15.9 mm
B	13	16/32	22.2 mm
B-B	15	16/32	25.4 mm
C	14	12/24	31.8 mm
C-C	17	12/24	38.1 mm
D	13	8/16	44.5 mm
E	13	8/16	44.5 mm
F	15	8/16	50.8 mm

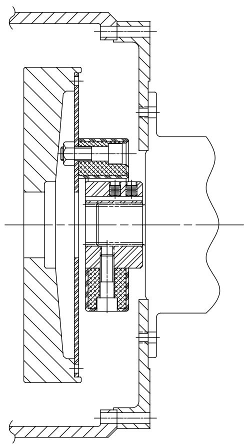
*SAE J744

Lovejoy Pump Mounting Plates

Lovejoy pump mounting plates complete your engine, coupling, and hydraulic pump package. These plates provide easy mounting of pumps to the engine flywheel housing.

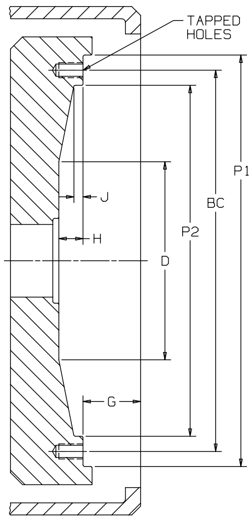
Pump mounting plates are available in two standard types: flat and spacer types. Stock plates are available for all SAE housings size 1 to 6 and all types of SAE A to D hydraulic pumps. DIN hydraulic pump pilot and bolt patterns also available.

NOTE: Pump mounting plate is cut away in photo to right, for clarity.



SAE J620 Dimension Reference (mm)

Nominal Clutch Size	Pilot P1	Bolt Circle BC	G	H	J	P2	D	Tapped Holes No.	Tapped Holes Size
6-1/2	215.90	200.03	30.2	12.7	9.7	184.2	127.0	6	5/16"-18
7-1/2	241.30	222.25	30.2	12.7	12.7	206.4	-	8	5/16"-18
8	263.53	244.48	62.0	12.7	12.7	225.4	-	6	3/8"-16
10	314.33	295.28	53.8	15.7	12.7	276.2	196.9	8	3/8"-16
11-1/2	352.43	333.38	39.6	28.4	22.4	314.3	203.2	8	3/8"-16
14	466.73	438.15	25.4	28.4	22.4	409.6	203.2	8	1/2"-13
16	517.53	488.95	15.7	28.4	22.4	460.4	1905.0	8	1/2"-13
18	571.50	542.93	15.7	31.8	31.8	498.5	254.0	6	5/8"-11
21	673.10	641.35	0.0	31.8	29.2	584.2	-	12	5/8"-11
24	733.43	692.15	0.0	31.8	31.8	644.5	-	12	3/4"-10

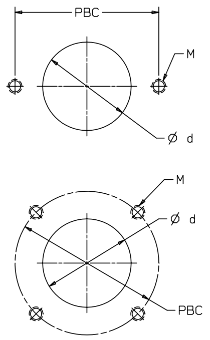


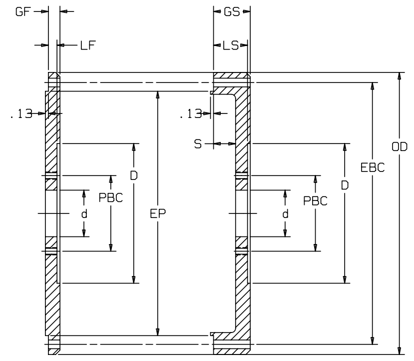
Typical Flywheel Housing Combinations

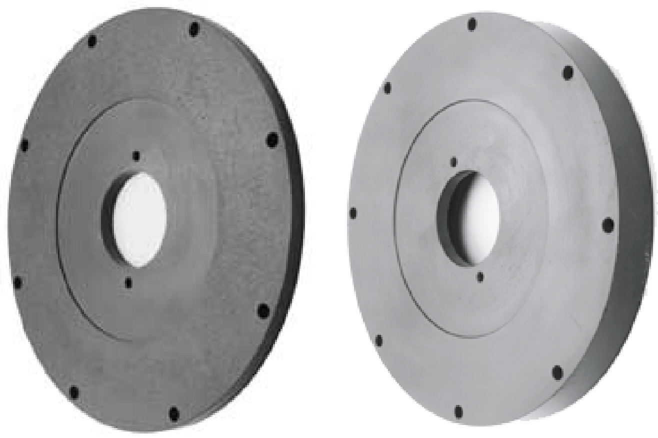
SAE Clutch Size	Coupling Sizes	SAE Flywheel Housing 6	5	4	3	2	1
6.5	8, 16, 25	■	■				
7.5	8, 16, 25	●	●				
8	16, 25, 30			■			
10	25, 30, 50			●	■	■	
11.5	30, 50, 90, 140				●	●	■
14	90, 140, 250						●

■ Preferred
● Other Sizes Available

Lovejoy Pump Mounting Plates



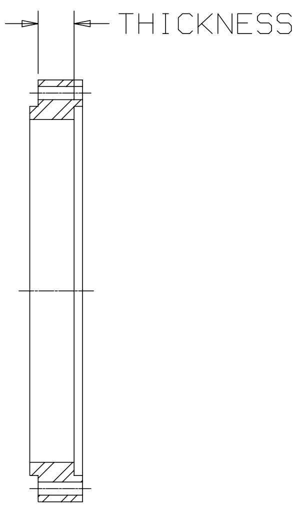




Pump Mounting Plates (mm)
For Use With Hydraulic Pumps Having Standard SAE Mountings And Spline Shafts

Flywheel Housing Size (SAE J617)	Pilot DIA EP	Bolt Circle EBC	Outside DIA OD	Flat Plate		Spacer Plate		
				GF	LF	GS	LS	S
1	511.2	530.2	552	22.4	19.1	67.1	65.5	48.0
						95.3	93.7	76.2
2	447.7	466.7	489	22.4	19.1	52.8	51.3	33.3
3	409.6	428.6	451	12.7	11.2	58.7	57.2	42.7
						26.4	24.9	11.2
4	362.0	381.0	403	12.7	12.7	44.2	42.7	28.2
						36.3	34.8	20.3
					11.2	19.6	18.0	3.6
5	314.3	333.4	356	12.7	11.2	49.0	47.5	33.0
6	266.7	285.8	308	12.7	11.2	40.1	38.6	24.1

*Custom sizes available. Please ask Lovejoy.

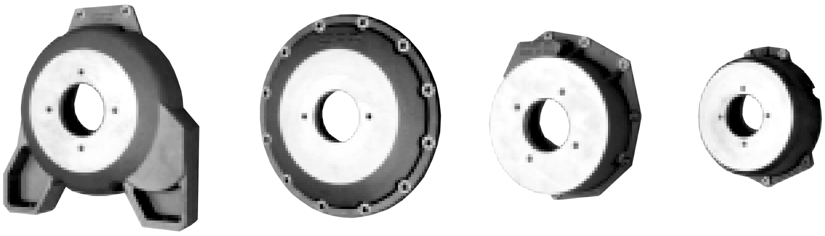


Spacer Rings

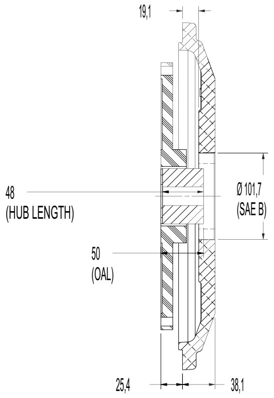
Spacer rings are available for all SAE bell housing sizes (1,2,3,4,5,6). These rings will provide additional space standoff from the engine flywheel housing and the pump mounting spacer plate. In most cases, the standard pump mounting spacer plate will provide the necessary area between the flywheel and the pump for the proper Torsional coupling. When ordering spacer rings, simply specify the SAE bell housing size and required thickness, T. *Example*: Spacer Ring, SAE 3/12.7 (min. thickness is 12.7mm, use increments of 3.175mm).

Lovejoy Pump Mounting Housings

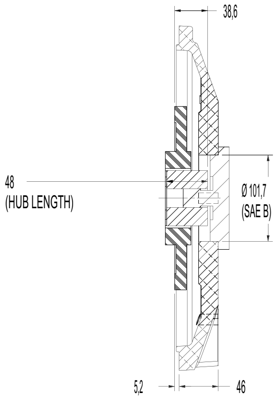
Typical Housings



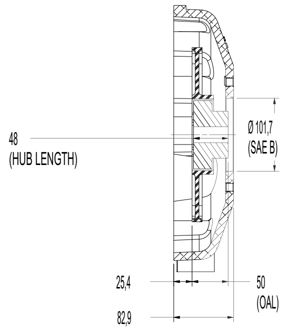
For hydraulic pumps mounting to engines that do not have an SAE flywheel housing, Lovejoy offers pump mounting housings for the following engines. All are available with SAE pump mounting pilots and bolt pattern, or can be custom made to your requirements. Housings are high-strength aluminum, designed to support the weight of hydraulic pumps without the need for a rear support bracket while reducing the overall length of engine/pump package. The LK80 and/or LK100 are available to match flywheel options for the various engines and can be paired with the appropriate housing to provide a complete kit.



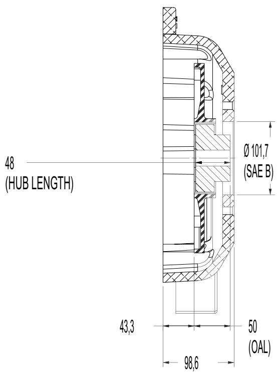
Cummins® B3.3 - *Shown with LK 100*



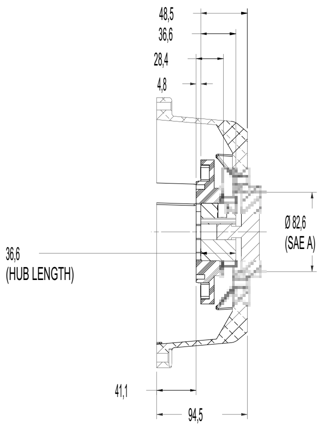
Deutz® FL 1011 - *Shown with LK 100*



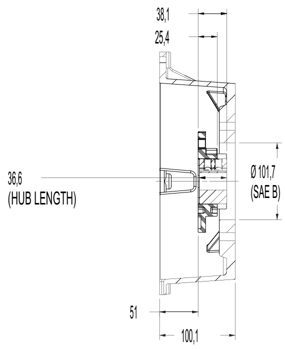
Ford VSG 413 - *Shown with LK 100*



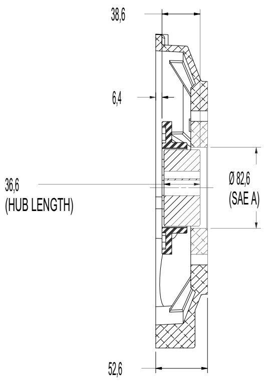
Ford LRG 425 - *Shown with LK 100*



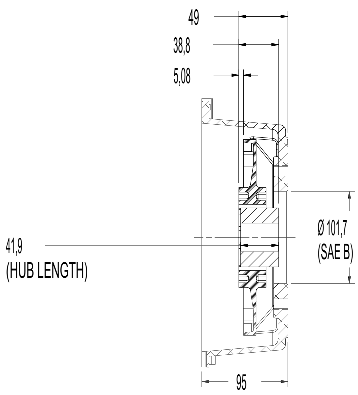
Kubota Super Mini - *Shown with LK 80*



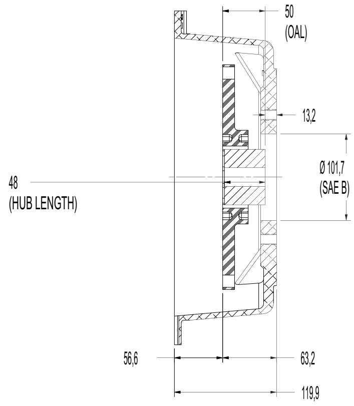
Kubota Super 05 - *Shown with LK 80*



Kubota Super 03 - *Shown with LK 80*



Perkins® 103-10 - *Shown with LK 100*



Perkins® 104-22 - ***Shown with LK 100***

LM Torsional Coupling System

LM Couplings

The Lovejoy LM torsional couplings, are made especially for diesel engine drives. In particular, the LM couplings are highly elastic torsionally, allowing the engine to drive a relatively small inertia load safely free from damaging torsional resonance over a wide speed range from low idle RPM to full engine speed. They accomplish this task by shifting the critical speeds far enough below the idle speed to allow full use of the entire working speed range of the engine without limitation. In essence, these sophisticated couplings effect an attenuated level of stress throughout the whole drive train by reducing vibratory torque to a very low level.

How They Work

A compact, disc-shaped elastomeric element lies at the heart of the LM coupling that gives it its high torsional elasticity. This element has molded cogs or teeth around its outside diameter. These cogs make a backlash-free engagement with internal cogs on an aluminum ring which drives it from the engine flywheel. This arrangement pre-loads the elastomer to increase its damping and load carrying capacity, and gives the coupling the ability to slip together and "blind assemble" inside the engine's flywheel housing. It also gives the coupling some torque limiting ability to further protect the drive train, as the cogs are able to slip position during rare transient torque spikes (5 to 6 times rated torque) without damage to the coupling. If these spikes were to occur frequently, only harmless bits of rubber would shed from the coupling causing no further damage.

The shape of the elastomeric element distributes operating stresses equally over its working section, allowing for a large angle of twist (6 to 12° at nominal torque load depending on size) while minimizing stress. This feature places the LM coupling amongst the highest torsional elasticities of all couplings available on the market. And at the thick center portion near the hub, as well as at the cogs, stresses are further reduced to a very low level, providing a very reliable and robust drive.

We bond a steel ring to the center of the elastomeric element that assembles to a steel hub. The center of this hub is machined to fit the customer's driven shaft and is clamped solidly to the shaft at assembly by a tapered split hub, set screws or the L-Loc clamping system.

Range Of Sizes

LM couplings come in 8 different sizes covering a range of nominal torques from 250 to 3800 Nm. This wide range of sizes make these couplings capable of handling applications driven from small single-cylinder engines on up to large multi-cylinder engines producing in excess of 600 kW.

Materials

- **Elastomeric Element**
  Temperature-resistant natural rubber available in a variety of Shore hardnesses to suite individual application requirements. Our natural rubber is good for -45°C to +90°C.

  For unusually high ambient temperatures, especially in non-ventilated flywheel housings, we recommend using our special silicone version, rated for -45°C to+120°C.

- **Outer Ring**
  High-grade cast aluminum alloy.

- **Inner Hub**
  Steel with minimum tensile strength of 600 N/mm^2.

LM Coupling

LM Torsional Coupling System

Typical Applications

- Splitter-gear multiple pump drives
- Generator sets (2-bearing)
- Locomotives
- Hydraulic pumps
- Centrifugal pumps
- Compressors
- Ship propulsion

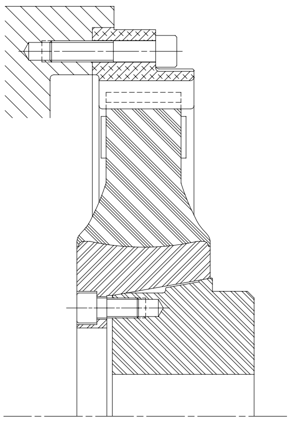
Features of the LM Coupling

Design Features	Benefits
Torsionally very soft. Backlash-free, even after long service hours. No moving parts to wear out or make noise. No wearing parts and no lubrication needed.	• Protects equipment from vibration and shock load damage • Noise silencing for quieter equipment running • Maintenance-free • Reliable service • Long life
Simple "plug-in" assembly designed for blind fitting inside a fly-wheel housing. No mounting bolts to access through holes. Special tapered hub grips firmly yet removes without special tools or pullers.	• Installation is easy and fast
No axial forces generated by transmission of torque. Compensates for axial, parallel and angular misalignment. Permits free axial float.	• Extends life of bearings and seals on coupled equipment
Wide range of toque sizes. Suitable for high engine speeds. Standard input flanges for SAE flywheels. Large bore capacity hubs. Slim profile, compact design.	• Versatile solutions for small, medium or large horsepower applications
Unique torque limiting feature provides fast, automatic disconnect of the engine should the driven machinery lock up or a gen-set experience incorrect synchronization or short circuit.	• Protects engine and equipment from extreme overload damage
Coupling torsional stiffness is adjustable by simply changing the elastomeric elements, which are available in several Shore A hard-ness ratings and torque values.	• Simple frequency tuning of the power train
Special high-temperature rubber compound. Holes in hub and adapter flange promote flow-through air cooling.	• Good intrinsic heat dissipation for extended life
Linear torsional stiffness characteristic (rubber) means resonance frequencies are not shifted by the load.	• Allows gen-sets to perform even when engines misfire
Elastomeric working element.	• Electrically isolates engine from driven equipment

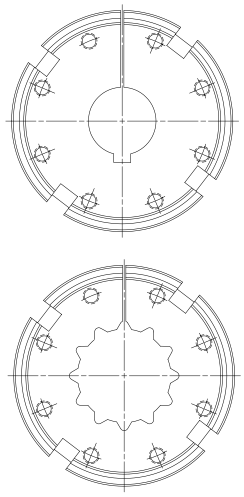
LM Torsional Coupling Design Types

1. **Type SB Sizes 240 to 2400**
   The driven inner hub consists of two pieces: the vulcanized steel ring and the inner tapered hub. These two parts are bolted together and the torque is transmitted by the friction force created by the axial bolts, drawing the tapered hub into a mating taper in the element.

   This is a long tapered fit, but it can easily be disassembled if the coupling has to be removed. The vulcanized steel ring creates a very high inward pressure acting on the inner driven tapered hub. To utilize this pressure, the driven hub is slotted in an axial direction. This compresses the driven hub to provide a very strong backlash-free connection between the driven hub and driven shaft. This clamping effect can be used equally well on cylindrical shafts with keys or splined shafts.



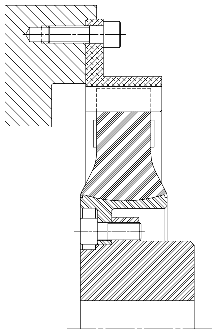
Type SB



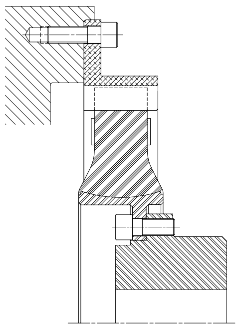
Shaft Lock

2. **Type SC – Sizes 2800 to 3500**
   An inner ring made of spheroidal cast iron is vulcanized into the elastomeric element. This flange is bolted to the inner tapered hub. Depending upon the arrangement of the elastomeric element, two different lengths are possible utilizing the same components.

   Short Version: SCA
   Long Version: SCB

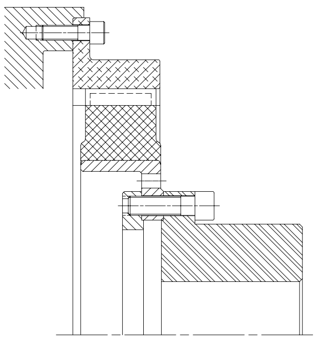


Type SCA

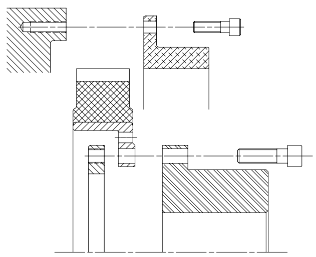


Type SCB

3. **Types SBE and SCE – Special Radial Assembly/Disassembly Types (Drop-Out Types) All Sizes**
   The elastomeric element can be changed quickly and easily without disturbing the coupling shaft, provided the flywheel housing does not protrude too much. These versions can be particularly advantageous on larger sizes, especially if the hub is interference fit.



Type SCE (Assembled)



Type SCE (Disassembled)

LM Torsional Coupling Selection

Use the following 3 steps in conjunction with the technical data and dimension tables contained in the following sections to make the preliminary coupling selection:

1. Application Torque

Select a coupling size with a nominal torque rating (T_{KN}) greater or equal to the application torque (T) calculated with the equation:

T = kW * 9550/RPM

provided

$T < T_{kn} * S_{t1}$

where S_{t1} is the temperature factor for nominal torque found from the chart. This number will typically be at least .6 or .7 (for typical ambient temperature of at least 60 to 70°C inside the flywheel housing).

2. SAE Flywheel Size

Select the appropriate SAE J620 flange size to match your flywheel.

3. Shaft Dimensions

Make sure maximum bore capacity of coupling will accommodate the dimensions of your driven shaft. Coupling hub length can usually be shortened if necessary to fit into tight space envelopes.

IMPORTANT:

Final selection of coupling size requires verification by torsional vibration analysis. This analysis will identify the location of critical speeds and confirm the absence of excessive steady-state and peak resonance conditions over the normal operating cycle of the equipment.

LM couplings are robust, reliable and unique in their ability to solve torsional vibration problems in certain applications. But as with all torsional couplings, inappropriate coupling selection can lead to unstable conditions that place the coupling as well as the rest of the drive train at danger. Lovejoy can perform the torsional vibration analysis for you if necessary. Simply complete the worksheet found on page 10 and fax it to us.

You can find more details regarding coupling selection based on this analysis on pages 8 and 9.

Torsional Couplings

Lovejoy

LM Torsional Coupling Technical Data — Natural Rubber

CLPG Size	Shore Hardness (Durometer) SHORE A	NOM Torque T_{kn} (Nm)	MAX Torque T_{kmax} (Nm)	*CONT Vibratory Torque T_{kw} (Nm)	Allowable Power Loss P_{kv} (W)	**Dynamic Torsional Stiffness C_{tdyn} (Nm/rad)	Flange Size SAE J 620 Flywheel	MAX Speed M_{max} (RPM)	Mass Moment Of Inertia ***Primary J_1 (kgm²)	Mass Moment Of Inertia Secondary J_2 (kgm²)	CLPG Size
LM240	50	250	500	100	37	925	8	4000	0.0208	0.0038	LM240
	60	300	600	120		1400	10	3600	0.0313	0.0038	
	70	350	750	140		2250					
LM400	50	400	800	160	62	1600	10	3600	0.0373	0.0114	LM400
	60	500	1000	200		2500					
	70	550	1100	220		4000					
LM800	50	700	1400	280	105	2800	10	3600	0.0599	0.0296	LM800
	60	850	1700	340		4200	11½	3500	0.0732	0.0296	
	70	950	2000	380		6800	14	3000	0.1378	0.0295	
LM1200	50	1000	2000	400	150	4500	11½	3500	0.0768	0.0456	LM1200
	60	1200	2400	480	150	7000	14	3000	0.01432	0.0456	
	70	1300	3000	520	150	11700					
LM1600	50	1450	2900	580	220	6000	11½	3200	0.224	0.078	LM1600
	60	1800	3600	720		9000	14	3000	0.197	0.078	
	70	2000	4000	800		15000	16	2500	0.274	0.078	
							18	2300	0.3855	0.078	
LM2400	50	2000	4000	800	300	10000	14	3000	0.213	0.153	LM2400
	60	2500	5000	1000		15000	16	2500	0.29	0.153	
	70	2800	6000	1120		25000	18	2300	0.4015	0.153	
LM2800	50	2800	6000	1120	360	25000	14	3000	0.2836	0.2257	LM2800
	60	3000	7500	1200		37500	16	2500	0.3158	0.02257	
	70	3200	8000	1280		63000	18	2300	0.4271	0.2257	
LM3500	50	3200	6500	1280	450	16000	14	3000	0.2836	0.2295	LM3500
	60	3500	8000	1400		24000	16	2500	0.4388	0.2295	
	70	3800	8500	1520		38000	18	2300	0.5873	0.2295	

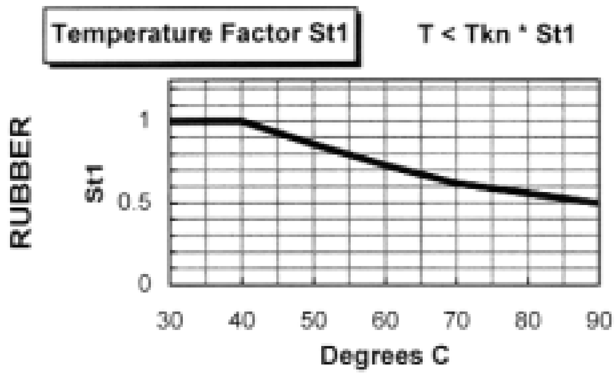
* At 10 Hz.
** Constant value for natural rubber because of linear characteristic
*** Primary means the flywheel side of the coupling

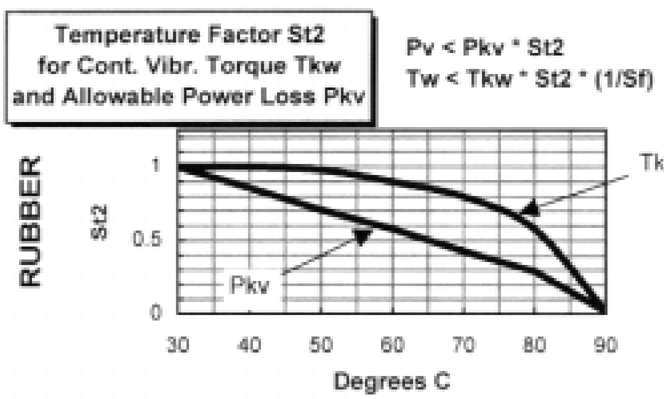
Frequency Factor S_f

f in H_z	≤10	>10
Sf	1	$\sqrt{f/10}$

Resonance Factor V_R
Relative Damping Factor Ψ

Natural Rubber (NR)		
f in Hz	V_r	Ψ
35-40	12	0.52
50	6.0	1.05
60	5.7	1.10
70	5.5	1.15





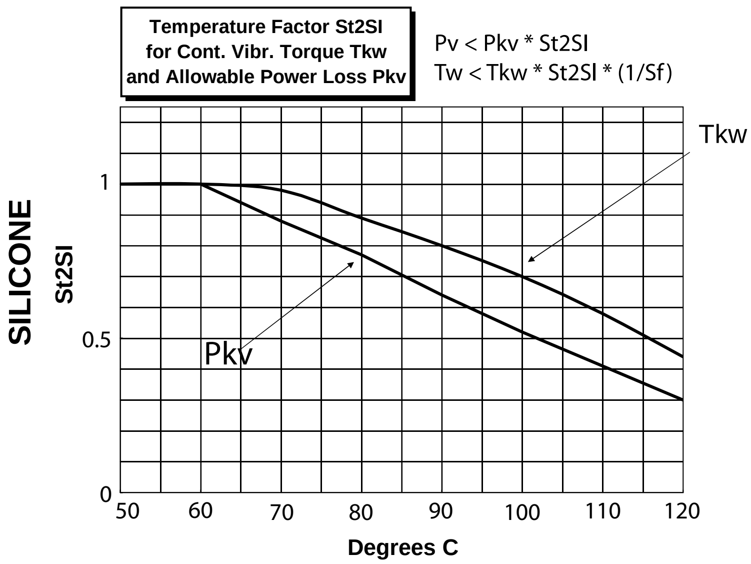
LM Torsional Coupling Technical Data - Silicone (50 Shore A)

CLPG SIZE	NOM TORQUE RATING Tkn (Nm)	*MAX TORQUE$_1$ Tkmax$_1$ (Nm)	**MAX TORQUE$_2$ Tkmax$_2$ (Nm)	CONTINUOUS VIBRATORY TORQUE Tkw (Nm)	ALLOWABLE POWER LOSS Pkv (W)	***DYNAMIC TORSIONAL STIFFNESS Ctdyn (Nm/rad)					RELATIVE DAMPING Ψ
						10% Tkn	25% Tkn	50% Tkn	75% Tkn	100% Tkn	
LM800	700	1050	1400	280	105	2200	2400	2800	3500	4600	1.15
LM1200	1000	1500	2000	400	150	3600	3900	4500	5600	7400	
LM1600	1450	2200	2900	580	220	4800	5200	6000	7500	9900	
LM2400	2000	3000	4000	800	300	8000	8700	10000	12500	16500	
LM2800	2800	4200	5600	1120	360	21000	2300	25000	32500	42500	
LM3500	3200	4800	6400	1280	450	12800	13900	16000	20000	26500	

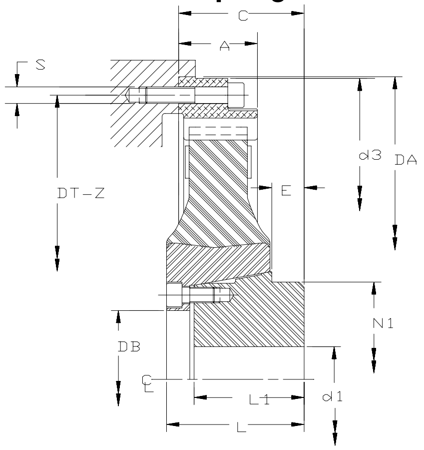
* Tmax1 indicates the maximum allowable value for transient torque spikes during the normal work cycle, for example, from accelerating through a resonance during starting and stopping or clutching.

** Tmax2 represents the absolute maximum peak torque allowable during rare occasions such as during a short circuit of a gen-set or incorrect synchronization.

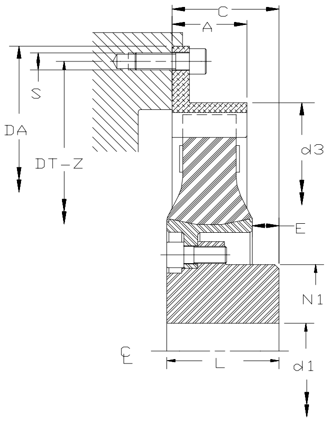
*** The silicone material creates a progressive stiffness characteristic dependent on load. These values have tolerance of + or -15%.



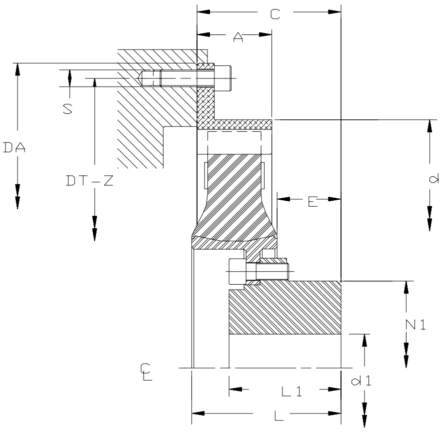
LM Torsional Coupling Dimensions



240 – 2400 SB



2800 – 3500 SCA



2800 – 3500 SCB

Standard Types

CLPG SIZE	SAE J620	DIMENSIONS (mm)										WEIGHT (kg)	ORDER CODE
		A	C*	d1 (bore) MIN	MAX	d_3	D_B	E	L	L_1	N_1		
240 SB1	8	46	75 ± 9	15	50	262	50	27	75	60	73	6.1	LM - 240 - SB1 - ** - 8
240 SB1	10	46	75 ± 9	15	50	225	50	27	75	60	73	6.5	LM - 240 - SB1 - ** - 10
400 SB1	10	45	75 ± 7	20	60	313	61	25	80	65	90	8.6	LM - 400 - SB1 - ** - 10
800 SB1	10	50	82 ± 2	20	70	316	71	18	84	66	107	11.1	LM - 800 - SB1 - ** - 10
800 SB1	11½	39	71 ± 3	20	70	351	71	18	84	66	107	10.1	LM - 800 - SB1 - ** - 11
800 SB1	14	46	74 ± 6	20	70	318	71	18	84	66	107	11.5	LM - 800 - SB1 - ** - 14
1200 SB1	11½	39	65 ± 4	20	70	351	71	18	84	66	107	14.5	LM - 1200 - SB1 - ** -11L
1200 SB1	14	46	74 ± 6	20	70	351	71	18	84	66	107	16.4	LM - 1200 - SB1 - ** - 14
1600 SB1	14	61	97 ± 11	30	105	465	106	26	106	85	150	22.5	LM - 1600 - SB1 - ** - 14
1600 SB1	16	61	97 ± 11	30	105	417	106	26	106	85	150	23.8	LM - 1600 - SB1 - ** - 16
1600 SB1	18	61	97 ± 11	30	105	417	106	26	106	85	150	25.3	LM - 1600 - SB1 - ** - 18
2400 SB1	14	61	97 ± 6	30	105	465	106	26	106	85	150	31.1	LM - 2400 - SB1 - ** - 14
2400 SB1	16	61	97 ± 6	30	105	417	106	26	106	85	150	32.4	LM - 2400 - SB1 - ** - 16
2400 SB1	18	61	97 ± 6	30	105	417	106	26	106	85	150	33.9	LM - 2400 - SB1 - ** - 18
2800 SCA 1	14	61	93 ± 4	35	110	465	--	34	--	105	162	31.5	LM - 2800 - SCA1- ** - 14
2800 SCB 1	14	61	135 ± 4	35	110	465	--	76	131	105	162	31.5	LM - 2800 - SCB1- ** - 14
2800 SCA 1	16	61	93 ± 4	35	110	417	--	34	--	105	162	32.8	LM - 2800 - SCA1- ** - 16
2800 SCB 1	16	61	135 ± 4	35	110	417	--	76	131	105	162	32.8	LM - 2800 - SCB1- ** - 16
2800 SCA 1	18	61	93 ± 4	35	110	417	--	34	--	105	162	34.3	LM - 2800 - SCA1- ** - 18
2800 SCB 1	18	61	135 ± 4	35	110	417	--	76	126	105	162	34.3	LM - 2800 - SCB1- ** - 18
3500 SCA 1	14	70	100 ± 8	35	110	465	--	25	--	105	162	33.9	LM - 3500 - SCA1- ** - 14
3500 SCB 1	14	70	135 ± 8	6	110	465	--	60	140	105	162	33.9	LM - 3500 - SCB1- ** - 14
3500 SCA 1	16	70	100 ± 8	35	110	465	--	25	--	105	162	36.6	LM - 3500 - SCA1- ** - 16
3500 SCB 1	16	70	135 ± 8	35	110	465	--	60	140	105	162	36.6	LM - 3500 - SCB1- ** - 16
3500 SCA 1	18	70	100 ± 8	35	110	465	--	25	--	105	162	38.5	LM - 3500 - SCA1- ** - 18
3500 SCB 1	18	70	135 ± 8	35	110	465	--	60	140	105	162	38.5	LM - 3500 - SCB1- ** - 18

* The LM coupling is very adaptable with regard to axial length. The rubber element can be positioned closer to or farther from the flywheel within the limits shown for this dimension, while maintaining full engagement with the outer drive ring. Hub length L_1 is adjustable as well with corresponding changes to mounting length dimension C.

** Indicate Shore hardness for rubber element here.

SAE Flywheel Dimensions*

*SAE J620

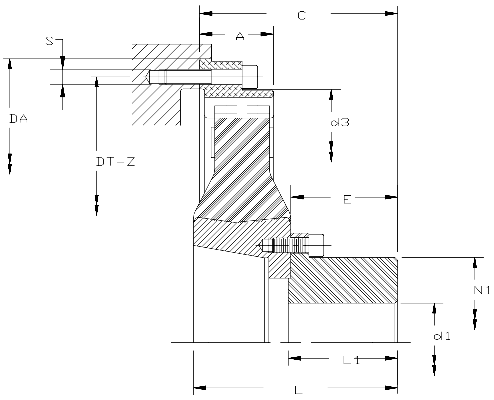
SAE Size	Pilot D_A (mm)	Bolt Circle D_T(mm)	Thru Holes Number Z	Thru Holes Size S(mm)
6-1/2	215.9	200.0	6 x 60°	9
7-1/2	241.3	222.3	8 x 45°	9
8	263.5	244.5	6 x 60°	11
10	314.3	295.3	8 x 45°	11
11-1/2	352.4	333.4	8 x 45°	11
14	466.7	438.2	8 x 45°	13
16	517.5	489.0	8 x 45°	13
18	571.5	542.9	6 x 60°	17
21	673.1	641.4	12 x 30°	17
24	733.4	692.2	12 x 30°	19

SAE Pump Splines*

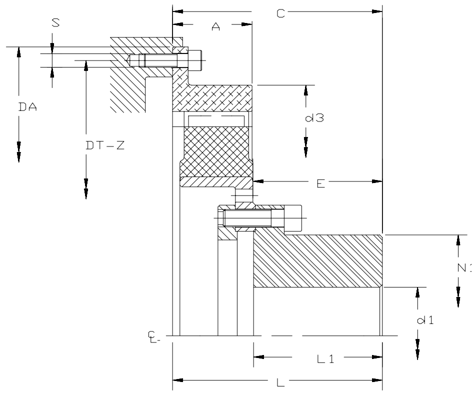
*SAE J744

SAE Code	Number OF Teeth	Spline Pitch	Major Diameter
A-A	9	20/40	12.7 mm
A	9	16/32	15.9 mm
B	13	16/32	22.2 mm
B-B	15	16/32	25.4 mm
C	14	12/24	31.8 mm
C-C	17	12/24	38.1 mm
D	13	8/16	44.5 mm
E	13	8/16	44.5 mm
F	15	8/16	50.8 mm

LM Torsional Dimensions – Continued



2800 – 3500 SBE



2800 – 3500 SCE

Special Types For Radial Change Of Elements

CLPG Size	SAE J620	Dimensions (mm)									Weight (kg)	Order Code
		A	C*	d1 (bore) MIN	d1 (bore) MAX	d_3	E	L	L_1	N_1		
240 SBE	8	46	113 ± 2	15	45	262	58	106	60	66	4.8	LM -240 - SBE - ** - 8- 113 - ***
	10	46	113 ± 2	15	45	225	58	106	60	66	5.2	LM -240 - SBE - ** - 10- 113 - ***
400 SBE	10	45	117 ± 2	20	55	313	63	118	65	85	7.6	LM -400 - SBE - ** - 10- 117 - ***
800 SBE	11½	39	117 ± 2	20	65	351	64	130	66	100	11.1	LM -800 - SBE - ** - 11- 117 - ***
	14	46	119 ± 2	20	65	318	64	130	66	100	14	LM -800 - SBE - ** - 14- 119 - ***
1200 SBE	11½	39	113 ± 2	20	65	351	64	130	66	100	15.2	LM -1200 - SBE - ** - 11L- 113 - ***
	14	46	120 ± 2	20	65	351	64	130	66	100	18.3	LM -1200 - SBE - ** - 14- 120 - ***
1600 SBE	14	61	168 ± 2	30	100	465	88	168	90	140	25.2	LM -1600 - SBE - ** - 14- 168 - ***
	16	61	168 ± 2	30	100	417	88	168	90	140	26.5	LM -1600 - SBE - ** - 16- 168 - ***
	18	61	168 ± 2	30	100	417	88	168	90	140	28	LM -1600 - SBE - ** - 18- 168 - ***
2400 SBE	14	61	163 ± 2	30	100	465	88	168	90	140	32.7	LM -2400 - SBE - ** - 14- 163 - ***
	16	61	163 ± 2	30	100	417	88	168	90	140	34	LM -2400 - SBE - ** - 16- 163 - ***
	18	61	163 ± 2	30	100	417	88	168	90	140	35.5	LM -2400 - SBE - ** - 18- 163 - ***
2800 SCE	14	61	164 ± 2	35	105	465	103	158	105	154	32.3	LM -2800 - SCE - ** - 14- 164 - ***
	16	61	164 ± 2	35	105	417	103	158	105	154	33.6	LM -2800 - SCE - ** - 16- 164 - ***
	18	61	164 ± 2	35	105	417	103	158	105	154	35.1	LM -2800 - SCE - ** - 18- 164 - ***
3500 SCE	14	70	185 ± 2	6	105	465	103	183	105	154	37.3	LM -3500 - SCE - ** - 14- 185 - ***
	16	70	185 ± 2	35	105	465	103	183	105	154	40	LM -3500 - SCE - ** - 16- 185 - ***
	18	70	185 ± 2	35	105	465	103	183	105	154	41.9	LM -3500 - SCE - ** - 18- 185 - ***

* The LM coupling is very adaptable with regard to axial length. The rubber element can be positioned closer to or farther from the flywheel within the limits shown for this dimension, while maintaining full engagement with the outer drive ring. Hub length L_1 is adjustable as well with corresponding changes to mounting length dimension C.

**Indicate Shore hardness for rubber element here.

***Indicate finished bore here.

Order Code Example

LM3500 – SCAI – 50 – 14 – 100 – **

- ** – Finished Bore
- 100 – Dimension "C" Overall Length (mm)
- 14 – SAE Flywheel Size
- 50 – Shore A Hardness Of Elastomeric Element
- SCAI – Coupling Type
- LM3500 – Coupling Size

LM Coupling Installation Instructions

Installation Instructions

The outer aluminum ring is bolted to the engine flywheel with tightening torque TA2 (see page 46). The driven hub is mounted onto the driven shaft. The rubber disc with the vulcanized ring is then assembled to the hub with screws, which must be tightened to the correct torque T_{A1} (SB, SC) or T_{A3} (SBE, SCE) as stated in the tables.

Should Loctite or other anaerobic adhesives be used, apply a minimum only. The rubber – metal connection must not be wetted.

For types SB with conical hub: The screws must be tightened alternately in several steps until they have all reached the correct tightening torque. The tightening torque of all screws must then be checked all around. Secure axial fixing of the inner hub on the shaft has to be ensured.

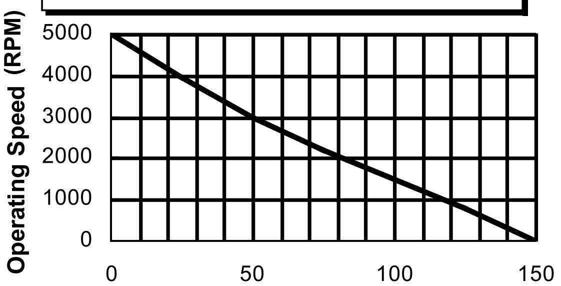
Allowable Misalignment

The couplings can accommodate the following maximum misalignment:

Axial: Several mm (as stated in dimension tables)
Angular: 0.5 degrees
Parallel: 0.5 mm

These values for angular and radial misalignment are based on 1500 RPM. For other speeds convert according to the diagram at right.

Allowable Misalignment vs. Speed



Percent of Rating for Allowable Axial and Parrallel Misalignment at T_{KN}

Since radial and angular misalignment cause relative movement, that means wear between the rubber elements and the outer aluminum ring, it is advisable to keep the misalignment as low as possible - better than above values - in order to ensure long coupling life and smooth running. For non-flanged drives, we recommend the following effective range of maximum misalignment:

Angular: 0.1 degree
Parallel: 0.2 mm

Above values are for continuous duty. For short periods (i.e. during starting and stopping the engine, at heavy sea, etc.) up to five times higher values for radial and angular misalignment are allowable.

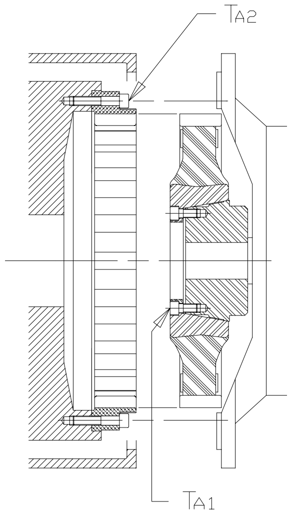
Alignment of Coupling

The alignment of free mounted, non-flanged drives should be checked in the usual way, by checking the radial and angular misalignment between driving and driven side with a dial indicator. As a reference surface, the inner hub should be used on the driven and the other a fly-wheel or flywheel housing. If the engine is placed on flexible mounts, then the alignment should be checked at the earliest, 2 days after the engine has been put on its flexible mounts, because only then will these mounts have taken most of their permanent set. In addition, the rigidly mount driven unit should be placed about 0.3 mm lower than the flexibly mounted engine. In this way, upon further setting of the engine a mis-alignment improvement can be achieved and the engine's position, after some running time, will not be essentially lower than the driven unit. Further setting of the engine is thus anticipated and compensated if necessary.

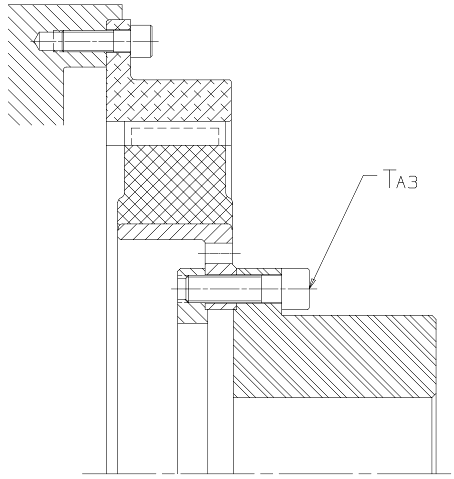
Ventilation

The LM Torsional Couplings are produced of special rubber which has a higher temperature resistance than normal rubber. However, it is a fact, that every rubber becomes harder with time under the influence of high temperature, and its mechanical properties are reduced. Therefore, it is always advantageous to ensure that the flange and flywheel housing have many rather large ventilation holes in order to pro-vide adequate air flow. The temperature will then be reduced and the life of the coupling element considerably increased.

LM Coupling Installation Instructions - Continued



Standard Types SB, SCA, SCB



Drop Out Types SBE, SCE

Tightening Torque - Inner Hub Screws (T_{A1})
For Standard Types SB, SCA, SCB

Coupling Size	LM240	LM400	LM800 LM1200	LM1600 LM2400	LM2800 LM3500
Screw Size DIN 912 Class	M8X20 8.8	M8X20 8.8	M10X20 8.8	M12X25 8.8	M16X40 10.9
Tightening Torque T_{A1} (Nm)	25	25	50	85	310
Quantity	8	8	8	8	8

Tightening Torque - Inner Hub Screws (T_{A3})
For Special Types SBE, SCE

Coupling Size	LM240	LM400	LM800 LM1200	LM1600 LM2400	LM2800	LM3500
Screw Size DIN 912 Class	M8X25 10.9	M8X25 10.9	M10X30 10.9	M12X30 10.9	M16X40 10.9	M16X50 10.9
Tightening Torque T_{A3} (Nm)	35	35	70	120	310	310
Quantity	12	16	16	16	8	8

Tightening Torque - Flywheel Adapter Flange Screws* (T_{A2})
For All LM types

SAE Size	6½	7½	8	10	11½	14	16	18	21	24
Metric screws	M 8	M 8	M 10	M 10	M 10	M 12	M 12	M 16	M 16	M 18
DIN 912 class 8.8										
(Nm)	25	25	50	50	50	90	90	220	220	290
Inch screws	5/16-18	5/16-18	3/8-16	3/8-16	3/8-16	1/2-13	1/2-13	5/8-11	5/8-11	3/4-10
SAE grade 5										
(Nm)	25	25	40	40	40	110	110	205	205	375
(ft-lb)	19	19	30	30	30	80	80	150	150	275

*Lovejoy does not furnish these screws.

Product Warranty

Lovejoy, Inc. warrants all products it manufactures to be of good material and workmanship and to be free of defects if properly installed and operated. REMEDY FOR BREACH OF THIS WARRANTY IS EXPRESSLY LIMITED TO REPLACEMENT OF DEFECTIVE PARTS, AS HEREINAFTER SET FORTH, LOVEJOY EXPRESSLY DISCLAIMS ALL CLAIMS FOR INCIDENTAL AND CONSEQUENTIAL DAMAGES ARISING FROM ANY BREACH OF THIS WARRANTY. Any product which, under normal use and service, is proven to breach the warranty contained herein within ONE YEAR from date of sale will, upon examination by Lovejoy, be replaced free. All freight shall be for buyer's account. In all cases, transportation costs and charges for returned goods shall be paid for by the purchaser, Lovejoy hereby disclaims all responsibility for such transportation cost and charges. This warranty will not be breached, and Lovejoy will give no credit for products it manufacturers which shall have received normal wear and tear, been damaged, improperly installed, repaired or altered outside of Lovejoy's factory.

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