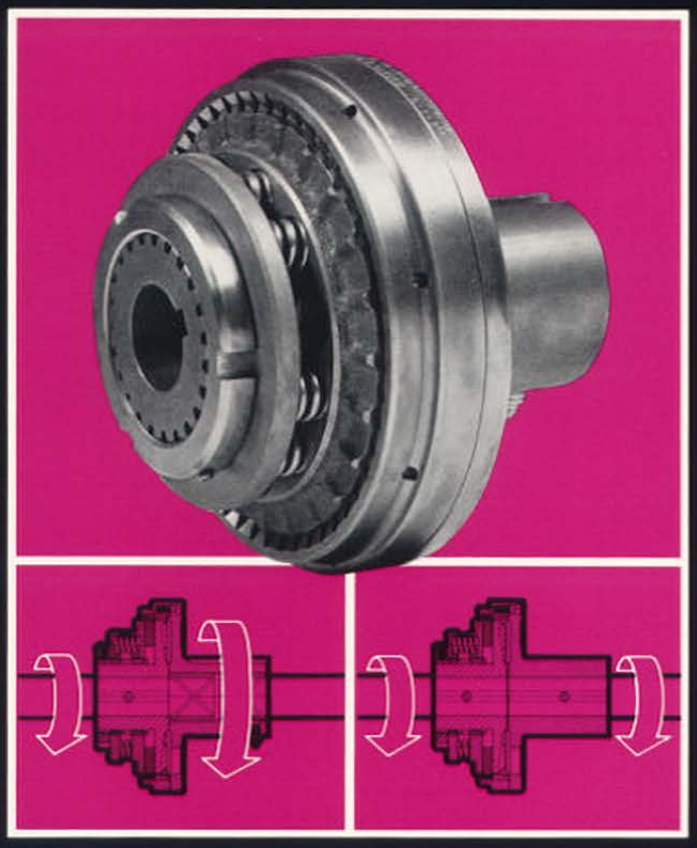
OVERLOAD PROTECTION. CONTROLLED TORQUE.



Hilliard Slip Clutches and Clutch-Couplings.

Hilliard

TORQUE CONTROL &

Hilliard Slip Clutches and Clutch-Couplings: Low maintenance design and automatic operation mean less downtime and longer equipment life.

Hilliard slip clutches and clutch-couplings provide dependable solutions to the problems of torque control and overload protection in power transmission equipment.

Hilliard slip clutches and clutch-couplings are available in torque ratings from 1/2 lb.-in. to 33,825 lb.-ft. The result: more flexibility in design and application, and reliable protection of expensive power transmission equipment.

Hilliard slip clutches and clutch-couplings include one or more friction discs mounted on an inner hub. The outer disc(s) engage a splined drive ring fastened to the sleeve. Springs compress the disc stack, transmitting torque.

A single nut adjustment easily pre-sets the torque. When the pre-set torque is exceeded, the clutch slips. Once the overload is removed, the clutch automatically resumes normal operation. There are no shear pins to replace. Resetting of torque is not required.

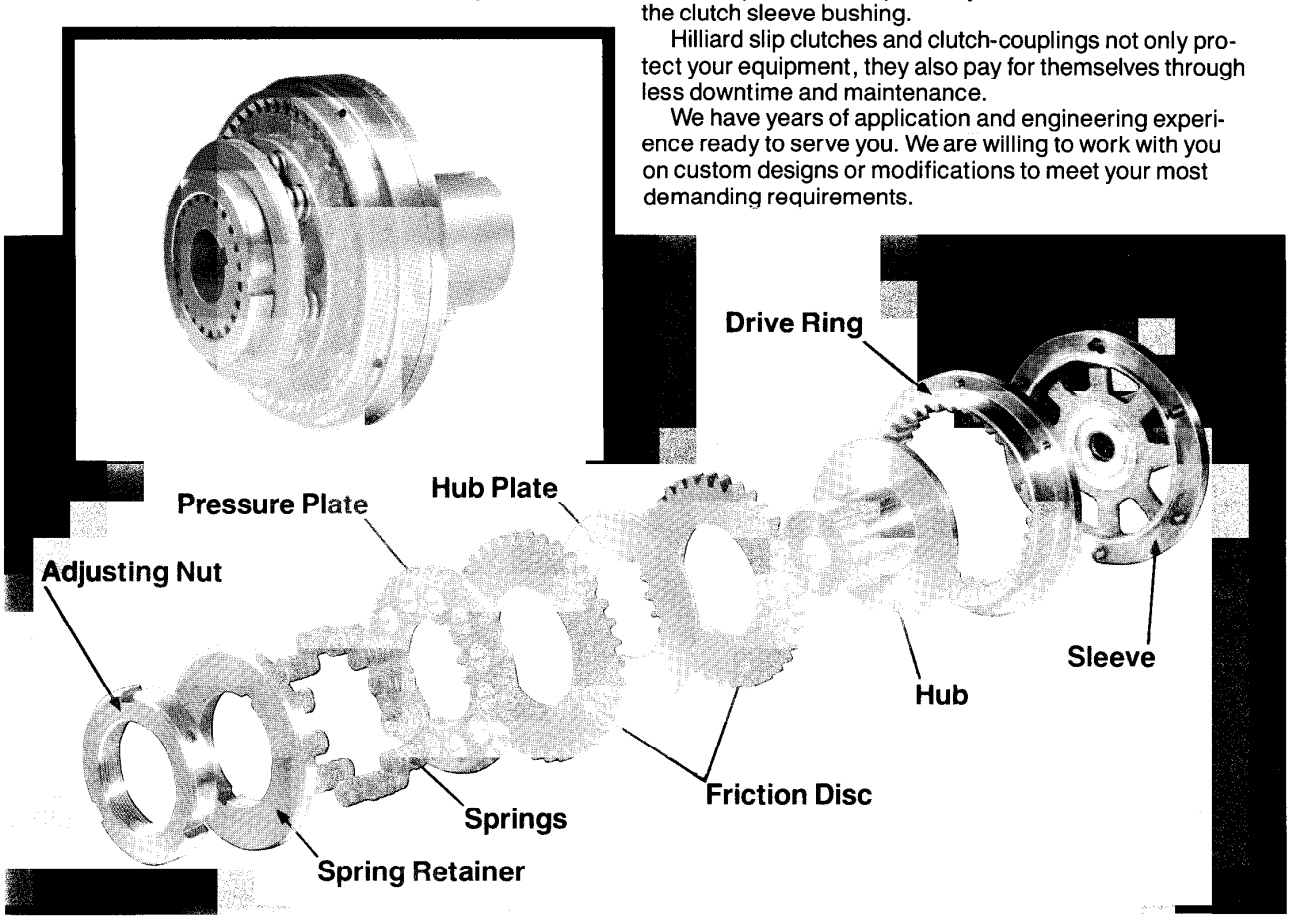
Bronze sleeve bushings are provided on Hilliard slip clutches. Keyways are provided on the hub and sleeve bores of Hilliard slip clutch-couplings.

Adjustable-while-running models are available for constant tension applications.

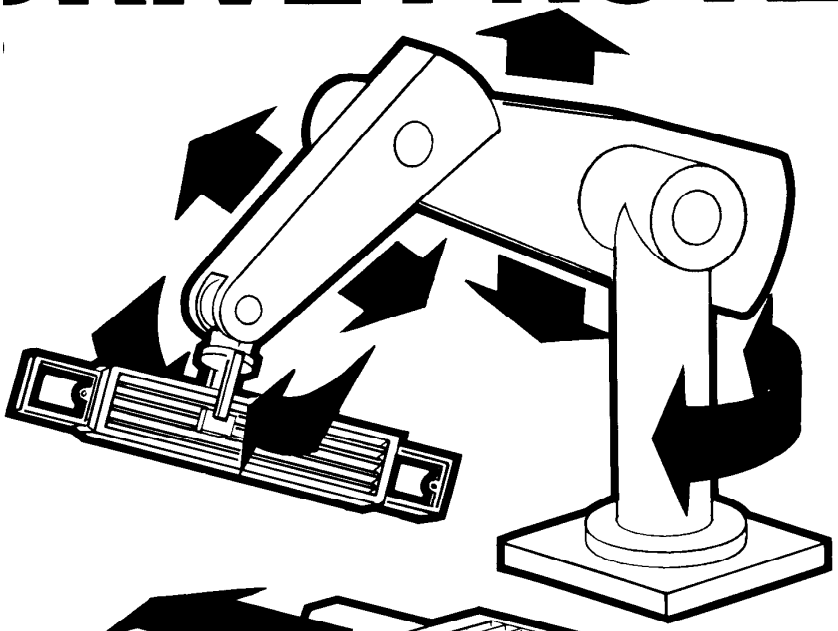
Hilliard slip clutch-couplings require no maintenance. Hilliard slip clutches require only occasional lubrication of the clutch sleeve bushing.

Hilliard slip clutches and clutch-couplings not only protect your equipment, they also pay for themselves through less downtime and maintenance.

We have years of application and engineering experience ready to serve you. We are willing to work with you on custom designs or modifications to meet your most demanding requirements.



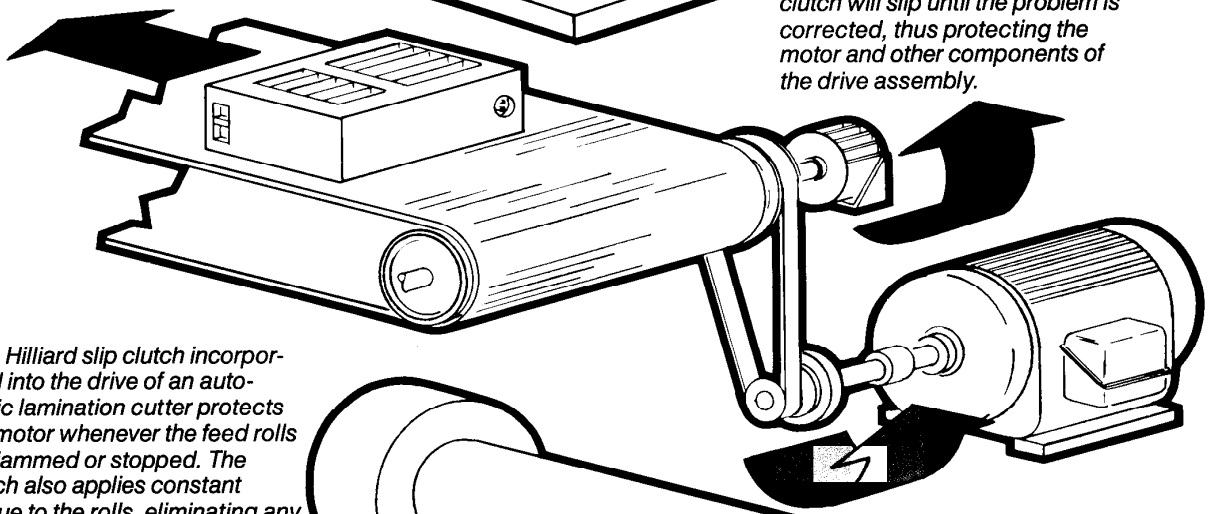
)RIVE PROTECTION.



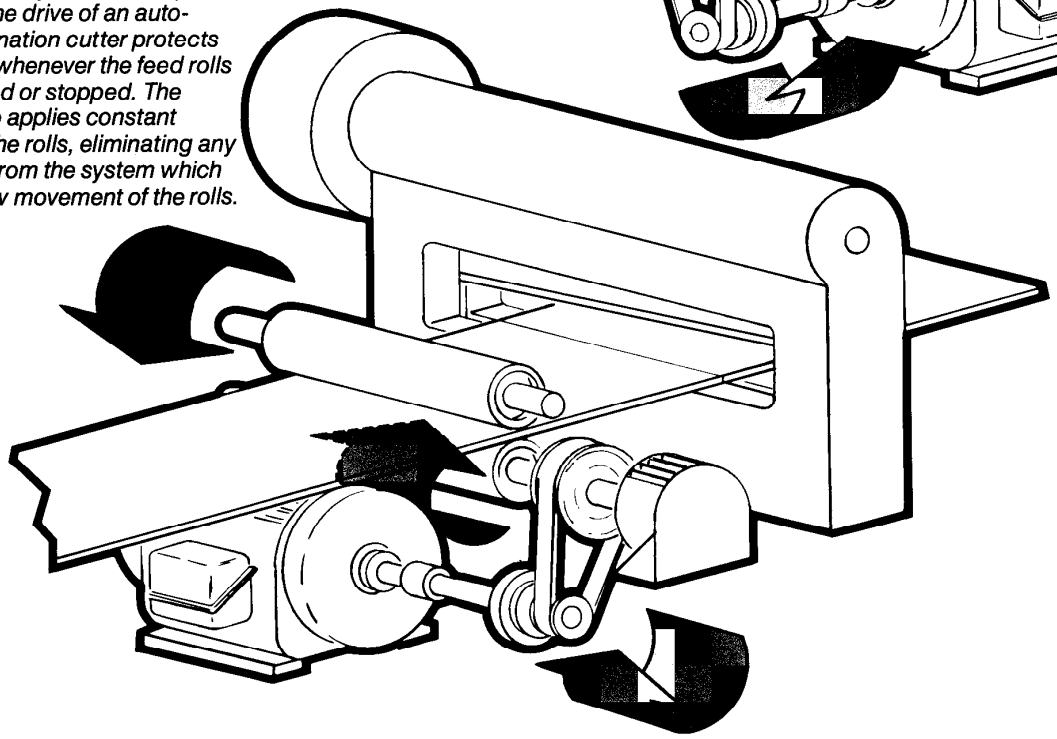
Applications

A Hilliard slip clutch-coupling is mounted on the axis of a small electric motor used to power the "fingers" of a manufacturing robot. When the fingers grip a part, the clutch-coupling slips, providing constant torque to maintain the robot's grip without damaging the part or the fingers.

A Hilliard slip clutch is mounted on the output shaft of a motor used to drive a conveyor belt. If the conveyor jams, the clutch will slip until the problem is corrected, thus protecting the motor and other components of the drive assembly.



A Hilliard slip clutch incorporated into the drive of an automatic lamination cutter protects the motor whenever the feed rolls are jammed or stopped. The clutch also applies constant torque to the rolls, eliminating any backlash from the system which could allow movement of the rolls.



L2 LIGHT SERIES

L2 Light Series with dry type bronze metallic friction discs and adjustable torque for overload protection or constant torque. Not recommended for operation in oil. Oilite bushings require no lubrication.

COIL-SPRING TYPE

For installation requiring extra close adjustment or low torque range down to 1/2 lb.-in. Offered in both regular and double capacity and with heavy, medium or light springs. The number of springs used can be varied to develop the exact torque range needed.

Clutch-coupling models are used to directly connect two shaft ends. Excellent shaft alignment should be maintained within .005" parallel and 1/4° angular.

Models L2-1-313XA and L2-1-323XA feature a setscrew to anchor the hub on the shaft. Slightly more shaft length is needed for mounting.

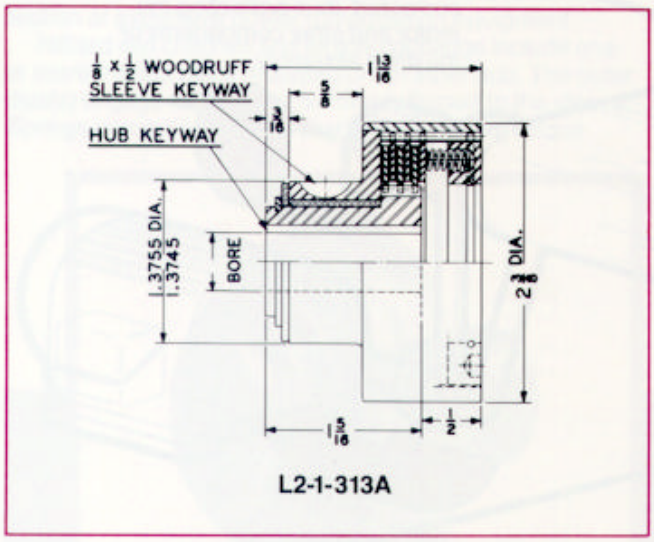
Maximum Operating Speed—1800 RPM

#SK-2172 Spanner Wrench for all size L2 adjusting nuts

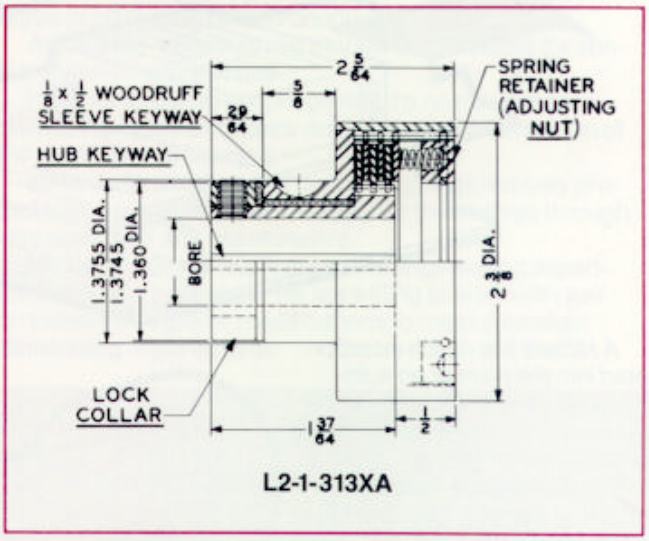
Stock Bore and Keyway Sizes (Specify Bore Size on your Order)	
SIZE L2 CLUTCHES	**SIZE L2 CLUTCH-COUPLINGS**
1/2" bore 1/8" × 1/16" keyway 5/8" bore 3/16" × 3/32" keyway 3/4" bore 3/16" × 1/32" keyway	1/2" bore 1/8" × 1/16" keyway 5/8" bore 3/16" × 3/32" keyway 3/4" bore 3/16" × 3/32" keyway (sleeve) 3/16" × 1/32" keyway (hub)

MODEL	SHIPPING WT.	TORQUE RANGE
L2-1-313A L2-1-323A L2-1-313XA L2-1-323XA	3 lbs.	Regular: 8 Heavy Springs—6 to 88 lb.-in. 8 Medium Springs—3 to 30 lb.-in. 8 Light Springs—1/2 to 6 lb.-in.
• DL2-1-313A • DL2-1-323A • DL2-1-313XA • DL2-1-323XA	3 lbs.	Double Capacity: 16 Heavy Springs—12 to 176 lb.-in. 16 Medium Springs—6 to 60 lb.-in. 16 Light Springs—1 to 12 lb.-in.

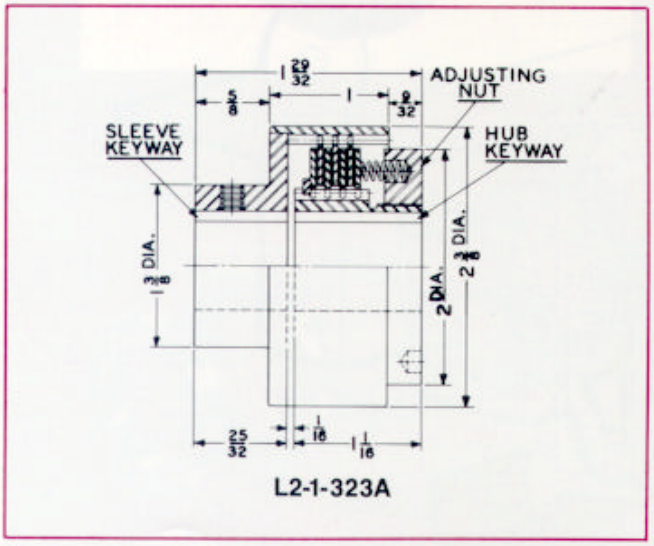
• Letter "D" in size denotes Double Capacity.



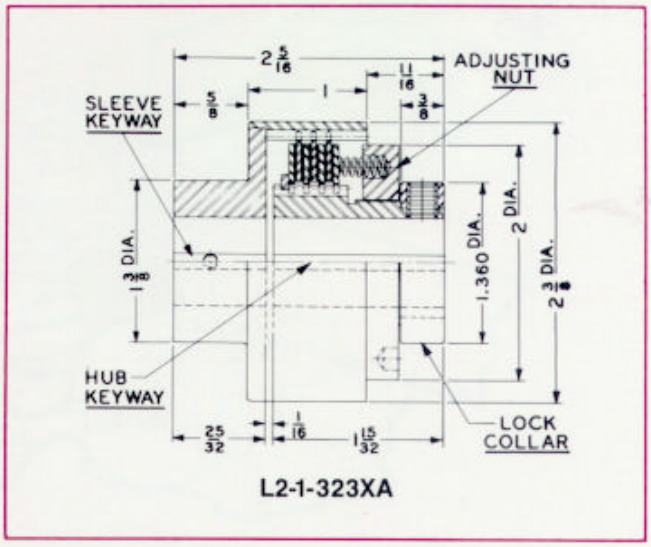
L2-1-313A



L2-1-313XA



L2-1-323A



L2-1-323XA

L2 LIGHT SERIES

DISC-SPRING TYPE

For the average installation and normal duty in a torque range one lb.-ft. (12 lb.-in.) and higher where the exact setting is not critical. Available in regular or double capacity. Excellent for overload protection in all kinds of drive systems.

Clutch-coupling models are used to connect two shaft ends and close alignment is required within .005" parallel and 1/4° angular.

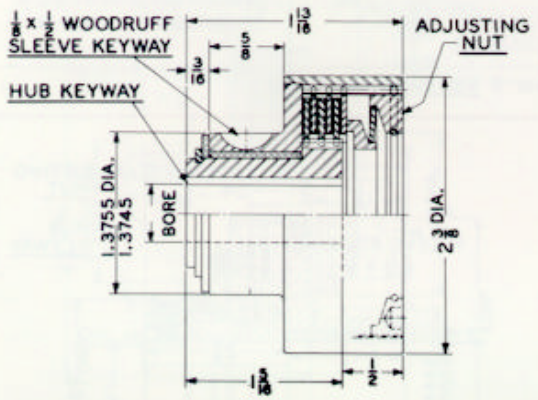
Models L2-1-313X and L2-1-323X feature a setscrew to anchor the hub on the shaft. Slightly more shaft length is needed for mounting.

Maximum Operating Speed—1800 RPM

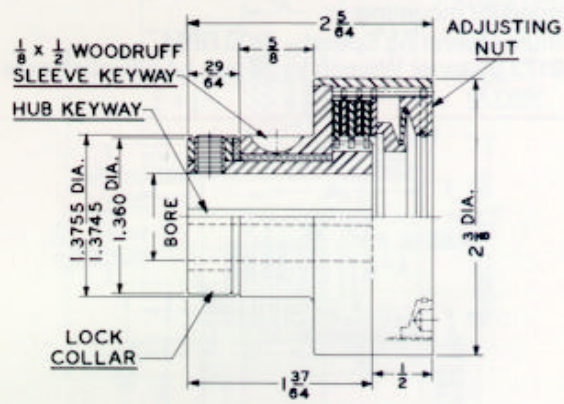
#SK-2172 Spanner Wrench for all size L2 adjusting nuts

MODEL	SHIPPING WT.	TORQUE RANGE
L2-1-313 L2-1-323 L2-1-313X L2-1-323X	3 lbs.	Regular: 12 to 108 lb.-in. (Single Disc Spring)
• DL2-1-313 • DL2-1-323 • DL2-1-313X • DL2-1-323X	3 lbs.	Double Capacity: 24 to 216 lb.-in. (Two Disc Springs)

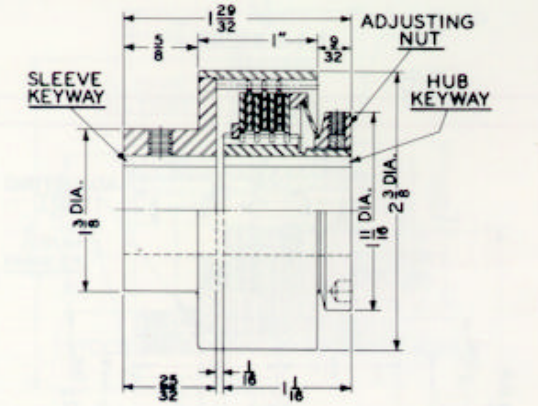
• Letter "D" in size denotes Double Capacity.



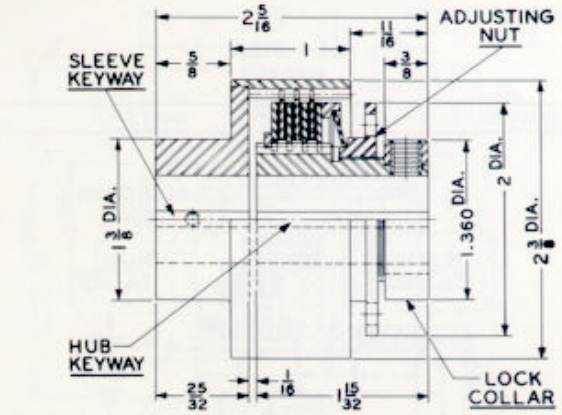
L2-1-313



L2-1-313X



L2-1-323



L2-1-323X

L4 LIGHT SERIES

L4 Light Series with dry type bronze metallic friction discs and adjustable torque for overload protection or constant torque. Not recommended for operation in oil. Lubricate clutch sleeve bushing sparingly. Clutch-couplings need no lubrication.

COIL-SPRING TYPE

For installation requiring extra close adjustment or operation in low torque range down to 1.0 lb.-ft. (12 lb.-in.). Offered in regular and double capacity and with heavy, medium or light springs. The number of springs used can be varied to develop the exact torque range needed.

Clutch-coupling models are used to directly connect two shaft ends. Excellent shaft alignment should be maintained within .005" parallel and 1/4° angular.

Models L4-1-312XA and L4-1-322XA include a setscrew to anchor the hub on the shaft. Slightly more shaft length is needed for mounting.

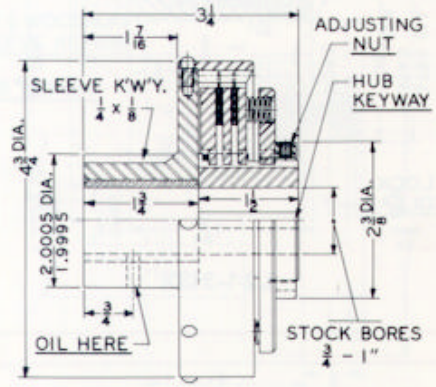
Maximum Operating Speed—1800 RPM

#SK-2173 Spanner Wrench for all size L4 adjusting nuts

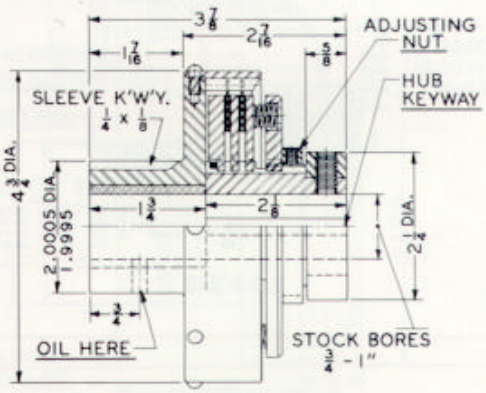
Stock Bore and Keyway Sizes (Specify Bore Size on your Order)	
SIZE L4 CLUTCHES	SIZE L4 CLUTCH-COUPLINGS
3/4" bore { 3/16" x 3/32" keyway (hub); 1/4" x 1/8" keyway (sleeve) }	3/4" bore 3/16" x 3/32" keyways
1" bore 1/4" x 1/8" keyways	1" bore 1/4" x 1/8" keyways

MODEL	SHIPPING WT.	TORQUE RANGE
L4-1-312A L4-1-322A L4-1-312XA L4-1-322XA	7 lbs.	Regular: 10 Heavy Springs—48 to 432 lb.-in. 10 Medium Springs—24 to 168 lb.-in. 10 Light Springs—12 to 84 lb.-in.
*DL4-1-312A *DL4-1-322A *DL4-1-312XA *DL4-1-322XA	7 lbs.	Double Capacity: 20 Heavy Springs—96 to 864 lb.-in. 20 Medium Springs—48 to 336 lb.-in. 20 Light Springs—24 to 168 lb.-in.

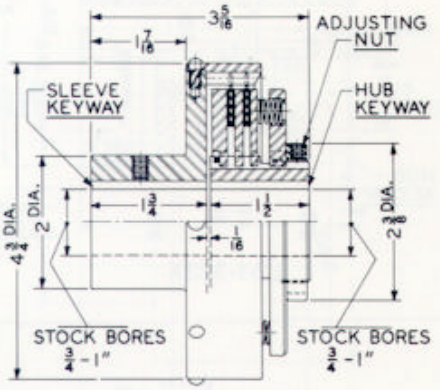
* Letter "D" in size denotes Double Capacity.



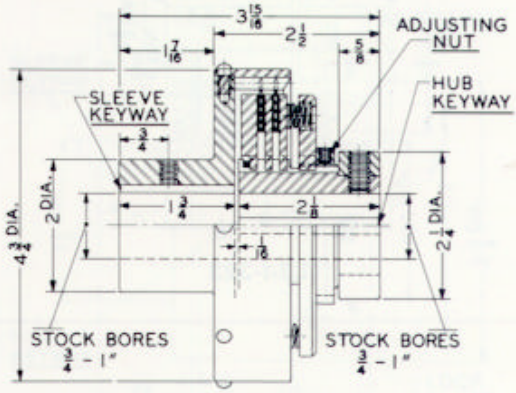
L4-1-312A



L4-1-312XA



L4-1-322A



L4-1-322XA

L4 LIGHT SERIES

DISC-SPRING TYPE

For the average installation and normal duty in a torque range five lb.-ft. and higher where the exact setting is not critical. Available in regular or double capacity. Excellent for overload protection in all kinds of drive systems.

Clutch-coupling models are used to connect two shaft ends and close alignment is required within .005" parallel and 1/4° angular.

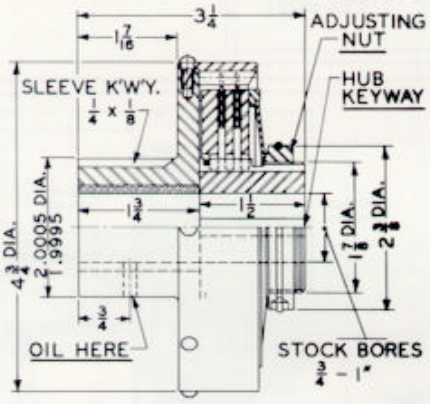
Models L4-1-312X and L4-1-322X include a setscrew for locking the hub on the shaft. Slightly more shaft length is needed for mounting.

Maximum Operating Speed—1800 RPM

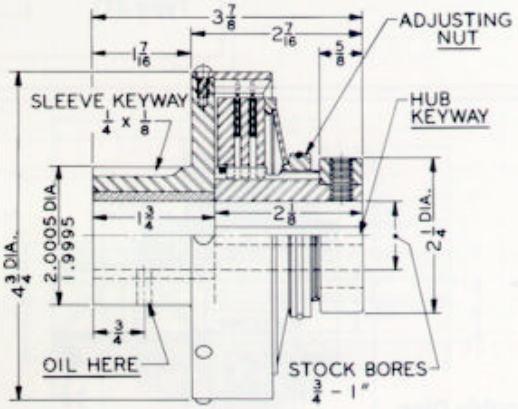
#SK-2173 Spanner Wrench for all size L4 adjusting nuts

MODEL	SHIPPING WT.	TORQUE RANGE
L4-1-312 L4-1-322 L4-1-312X L4-1-322X	7 lbs.	Regular: 60 to 504 lb.-in. (Single Disc Spring)
*DL4-1-312 *DL4-1-322 *DL4-1-312X *DL4-1-322X	7 lbs.	Double Capacity: 120 to 1008 lb.-in. (Two Disc Springs)

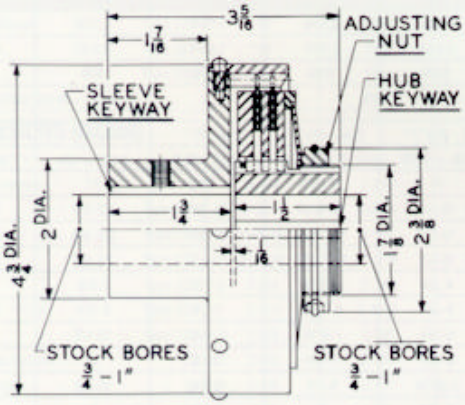
* Letter "D" in size denotes Double Capacity.



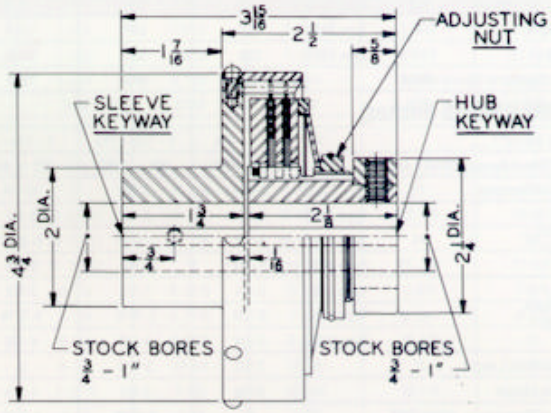
L4-1-312



L4-1-312X



L4-1-322



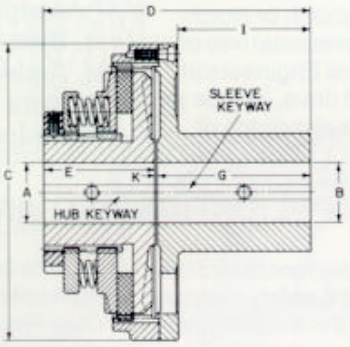
L4-1-322X

STANDARD SERIES SLIP CLUTCHES

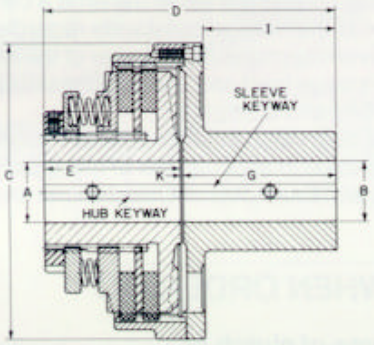
STANDARD SERIES SLIP CLUTCH-COUPLINGS

Standard Series Slip Clutch-Couplings with dry type molded friction material for overload protection or constant torque. Not recommended for operation in oil. No lubrication needed.

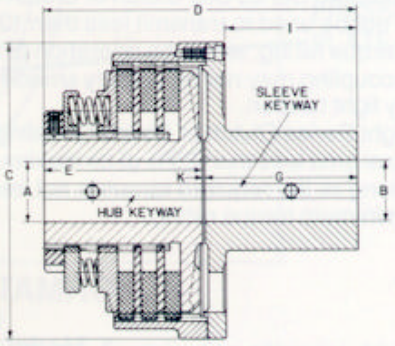
#SK-3549 Spanner Wrench for sizes 4 & 6 adjusting nuts
#SK-2174 Spanner Wrench for sizes 8 & 10 adjusting nuts



Single Disc Type 321



Double Disc Type 322



Triple Disc Type 323

CLUTCH-COUPLING SIZE		4	6	8	10	12	14	16	18	24
Maximum Torque	Type 321	76	194	572	1,017	1,481	1,903	2,548	3,300	11,275
Rating—*	Type 322	152	387	1,144	2,034	2,962	3,806	5,096	6,600	22,550
(lb.-ft.)	Type 323	228	581	1,716	3,051	4,444	5,709	7,644	9,900	33,825
Max. Operating Speed — RPM		1800	1800	1800	1600	1400	1200	1000	900	700
DIMENSIONS (Inches)										
Stock Bores**	A-B	¾ - 1 - 1¼	1 - 1¼ - 1½	1 - 1½ - 2	1½ - 2 - 2½	2 - 3½***	2¼ - 4½***	2½ - 5***	2¾ - 6***	3 - 8***
Outside Diameter	C	5-3/4	7-3/8	10-1/4	12	14	16-5/8	19	21	27
Overall Length	Type 321	4-13/16	6-9/16	8-19/32	10-3/8	13-21/32	16-3/4	18-19/32	22-5/8	28-3/4
	D Type 322	5-5/16	7-1/8	9-9/32	11	14-21/32	17-7/8	19-31/32	24	30
	Type 323	5-13/16	7-11/16	9-31/32	11-5/8	15-21/32	19	21-11/32	25-3/8	31-5/8
Hub Bore Length	Type 321	2-1/4	2-3/4	3-1/2	4	4-3/4	5-5/16	5-7/8	7-3/8	7-3/4
	E Type 322	2-3/4	3-5/16	4-3/16	4-5/8	5-3/4	6-7/16	7-1/4	8-3/4	9-3/8
	Type 323	3-1/4	3-7/8	4-7/8	5-1/4	6-3/4	7-9/16	8-5/8	10-1/8	11
Sleeve Bore Length	G	2-1/2	3-3/4	5	6-1/4	8-3/4	11-1/4	12-1/2	15	20-3/8
Sleeve Length	I	2-1/8	3-1/4	4-3/8	5-9/16	7-15/16	9-1/2	10-5/8	12-7/8	17-1/4
Clearance	K	1/16	1/16	3/32	1/8	5/32	3/16	7/32	1/4	1/4
Shipping	Type 321	12	25	50	85	140	250	410	550	850
Weight—	Type 322	13	27	55	95	160	275	450	650	1000
Pounds	Type 323	14	30	65	110	190	325	525	800	1200

* Maximum torque may be reduced by decreasing the number of springs.
** Largest bore listed is the maximum size the clutch-coupling will accommodate.
*** Clutch-Couplings Sizes 12-24 are bored after receipt of order to any size within the range listed.

NOTE 1. Clutch-Coupling Mechanisms with a drive ring and screws, but without a sleeve, are available.
NOTE 2. Clutch-Coupling Type 322 is also available in Sizes 6 and larger with ventilated plates for higher heat capacity.
NOTE 3. Shaft alignment should be held to .005" parallel and 1/4° angular. When greater flexibility is needed, use a commercial flexible coupling in conjunction with a Hilliard Slip Clutch.

SELECTION PROCEDURES

The three major factors which influence the selection of a slip clutch or clutch-coupling are:

1. The torque to be transmitted.
2. The heat capacity.
3. The operating speed.

It is good policy to discuss your slip clutch or clutch-coupling application with one of our representatives or submit complete data to the Applications Engineers at Hilliard. When describing the proposed drive, include an explanation of exactly what function the slip clutch or clutch-coupling will perform, outline the general arrangement, give the load characteristics and be sure to provide full operating data including:

1. Torque to be transmitted.
2. Input and output speed of the clutch or clutch-coupling.
3. Duration of slip periods.
4. Ambient conditions.
5. Bore size(s).
6. Space limitations.

APPLICATION REQUIREMENTS

1. Overload Protection When the sole function of the slip clutch or clutch-coupling is to act as a safety measure for overload protection, the size of the unit is determined by the torque that will be transmitted. Select a clutch or clutch-coupling so that the required torque falls within 25% to 75% of the unit's maximum torque rating.

A Standard Series Slip Clutch or Clutch-Coupling should not be used to transmit less than 10% of its maximum torque rating, since the operation of the clutch or clutch-coupling may not be entirely smooth under extremely light tension.

A Light Series Clutch or Clutch-Coupling may be selected to transmit less than 25% of its maximum torque rating as long as the required torque is not less than the unit's minimum torque rating.

The heat factor is not important in this type of application unless there will be frequent or long periods of slip. See Formulas and Examples of Calculations on page 12.

2. Constant Torque A slip clutch or clutch-coupling is used when a mechanism must be operated at variable speed but is driven by a constant speed driver. The clutch or clutch-coupling is set to transmit a certain torque and transmits that torque constantly regardless of the speed of the driven mechanism. The size of the unit is determined by the torque load and the amount of heat which must be absorbed and dissipated.

The heat value assumes equal importance with the torque value in applications of this type. See Tables, Formulas and Examples of Calculations on pages 11 and 12.

INFORMATION REQUIRED WHEN ORDERING

1. Model Number or Size and Type of clutch or clutch-coupling.
2. For Light Series Coil-Spring units, indicate whether light, medium or heavy springs are desired.
3. Clutch bore size or clutch-coupling bore sizes and keyway sizes.
4. Quantity required.

HEAT CAPACITY — IN TERMS OF HORSEPOWER

The heat values represented are based on operation in an ambient temperature of 70° Fahrenheit (21° Celsius). If the slip periods are short (30 minutes or so) with equal or greater cooling periods, the heat values can be increased 50% to 75%. Sometimes it is advisable to use a larger clutch or clutch-coupling with greater friction area and reduced disc pressure to obtain a slower rate of wear.

Ambient temperatures above or below 70°F. (21°C) affect the heat capacity of slip units. The heat cannot be dissipated as readily in high temperature atmosphere. For that reason the following correction factors must be introduced. (Refer to bottom of page) The heat value for any particular installation should be multiplied by the factor corresponding to the average ambient temperature that will exist.

SIZE	TYPE	REVOLUTIONS PER MINUTE														
		0	100	200	300	400	500	600	700	800	900	1000	1200	1400	1600	1800
L2	313–323 313A–323A	.03	.03	.03	.033	.035	.036	.036	.037	.037	.039	.04	.042	.045	.048	.051
L4	312–322 312A–322A	.06	.06	.063	.066	.068	.072	.075	.077	.078	.081	.084	.088	.093	.099	.104
4	311–321	.082	.088	.093	.096	.099	.102	.105	.111	.114	.117	.12	.127	.135	.142	.15
	312–322	.097	.102	.108	.111	.115	.12	.123	.127	.132	.135	.14	.146	.156	.165	.173
	313–323	.112	.117	.123	.126	.13	.135	.139	.144	.149	.153	.158	.168	.177	.186	.195
6	311–321	.21	.218	.223	.24	.255	.27	.282	.292	.306	.318	.33	.357	.38	.405	.43
	312–322	.225	.24	.255	.27	.285	.30	.315	.324	.338	.35	.364	.39	.42	.45	.48

HEAT CALCULATIONS

General Operating Conditions:

1. Overload Protection
2. Input Speed Constant-Torque Constant-Slip Constant
3. Input Speed Constant-Torque Constant-Slip Variable
4. Input Speed Constant-Torque Variable-Slip Variable
5. Input Speed Variable-Torque Variable-Slip Constant

Formulas:

HP = Horsepower
5252 = A constant
T = Lb.-Ft. Torque
N = RPM = Clutch Input Speed

A. $\%\ \text{Clutch Slip} = 1 - \frac{\text{Output Speed}}{N}$

B. $\text{HP Input} = \frac{T \times N}{5252}$

C. $\text{HP Heat} = \text{HP Input} \times \%\ \text{Clutch Slip}$

CALCULATIONS

1. **Overload Protection Application.** Assume a slip clutch-coupling is to be used between a 20 HP 1750 RPM electric motor and speed reducer on a mixer drive. The purpose is to limit the torque to 150% full load motor torque if there is an overload. Close alignment can be maintained.

   Motor shaft is 3/4" diameter and reducer input shaft is 1-1/4" diameter.

   Torque Required in Slip Clutch-Coupling = $\frac{20HP \times 5252}{1750} \times 1.5 = 90$ Lb.-Ft.

   Selection. Model 4-1-322 is selected since 90 lb.-ft. is within 25%–75% of the maximum torque rating.

2. **Constant Torque Application.** Assume a slip clutch-coupling is to be used on a mechanical robot gripper between a 1 HP 1750 RPM motor and a speed reducer. The force of the gripper jaws, when handling an object, must be limited to the equivalent of 125% full load motor torque. Shafts are 5/8" and are closely aligned. Customer does not wish to use collars or snap rings to prevent axial movement. The slip clutch-coupling will slip for very brief, infrequent periods for up to a maximum of 3% total time.

   Torque Required in Slip Clutch-Coupling = $\frac{1\ HP \times 5252}{1750} \times 1.25 = 3.8$ Lb.-Ft.

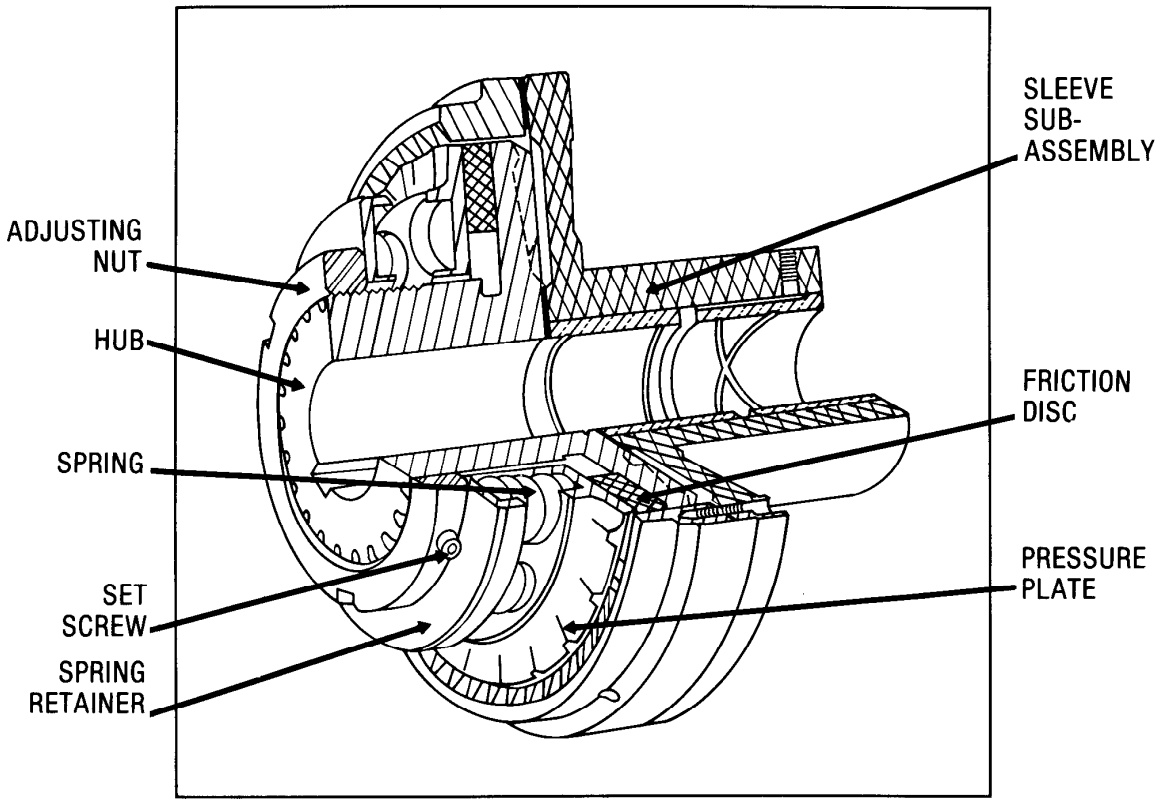
   HP Heat = $\frac{3.8 \times 1750}{5252} \times .03 = .038$ HP

   Selection. Model DL2-1-323XA with 5/8" bores is selected since 3.8 lb.-ft. is within 25%–75% of the rating and .038 HP Heat is below the maximum permissible. The "X" option is selected since the set screws will prevent axial movement.

STANDARD BORE TOLERANCES-KEYWAY SIZES

Nominal Bore	Internal Keyway	Bore Tolerance
1/2	1/8 x 1/16	+ .000 - .001
5/8 – 7/8	3/16 x 3/32	
15/16 – 1-1/8	1/4 x 1/8	
1-3/16 – 1-3/8	5/16 x 5/32	
1-7/16 – 1-3/4	3/8 x 3/16	
1-13/16 – 2-1/4	1/2 x 1/4	
2-5/16 – 2-3/4	5/8 x 5/16	
2-13/16 – 3-1/4	3/4 x 3/8	+ .000 - .002
3-15/16 – 3-3/4	7/8 x 7/16	
3-13/16 – 4-1/2	1 x 1/2	
4-9/16 – 5-1/2	1-1/4 x 5/8	
5-9/16 – 6-1/2	1-1/2 x 3/4	
6-9/16 – 7-1/2	1-3/4 x 3/4	
7-9/16 – 9	2 x 3/4	

OPERATING AND INSTALLATION INFORMATION



Operation

Although either the clutch hub or sleeve can be the driving member, we recommend rotating the hub at the higher speed to take advantage of better heat dissipation due to air circulation.

The torque transmitted by the clutch at any particular setting will remain substantially constant regardless of the rotating speed.

The required slipping point of the clutch is determined by trial after it is installed. Start with the adjusting nut backed off to a light setting and gradually increase the spring pressure until the clutch will drive without slipping. Whenever the load exceeds the torque at which the clutch is set, the clutch will slip. Normal drive will resume as soon as the overload is eliminated.

Operating Speed

In general, the speed is limited to normal 1800 RPM motor speed because the semi-floating friction disc construction does not permit perfect balance. We recommend 5000 feet per minute peripheral speed as a maximum.

Installation

Slip clutches can be installed on either the driving or driven shafts. The hub should be a light press fit on the shaft with not more than .001" interference. The bronze bushed sleeve will be a running fit. A shaft collar or equivalent must be placed at the end of the sleeve to hold it in correct position on the shaft. The customer furnishes a sprocket, gear, or sheave for mounting on the sleeve to transmit the drive.

When clutch-couplings are involved, both the hub and sleeve should be a light press fit on the shafts. The shafts should be in close alignment since Hilliard slip clutch-couplings are not flexible in the sense commonly applied to ordinary commercial couplings.

Lubrication

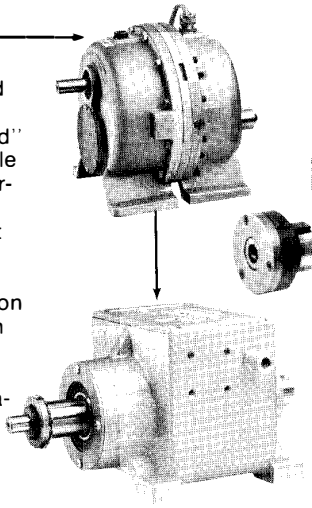
The bronze sleeve bushings in the slip clutches should be lubricated occasionally, but excessive lubrication must be avoided to prevent oil or grease from spreading to the friction surfaces. Oilite bushings are used in the L2 clutches.

Hilliard slip clutch-couplings need no lubrication.

Hilliard's Complete Line of Quality Motion Control Products.

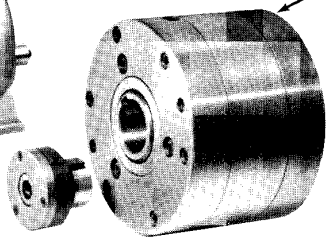
Intermittent Drive Units

Single-rotation, totally-enclosed clutch packages with sealed-oil bath lubrication permit "demand" type operation in fixed or variable cycles. The acceleration/deceleration unit (ADU) is a special arrangement of gears with input and output shafts providing soft starts and stops. Our integrated IDU/ADU unit gives single-rotation intermittent motion with smooth acceleration and deceleration. Rugged, long-lasting and extremely accurate—no cumulative error. Repeatable stopping from ± ½°, depending on model and options selected.



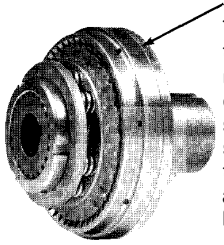
Over-Running Clutch

For dual, two-speed or standby drives on boiler stokers, blowers, induced or forced-draft fans, dry cleaning machines, ventilating fans and similar equipment. Made in 7 types and 15 standard sizes plus special designs.



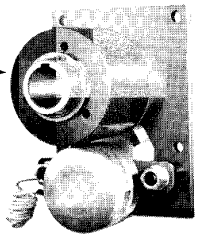
Slip Clutch

To protect speed reducers or gear trains against destructive overload, to reduce shock in door opening and closing mechanisms, to serve as a safety feature where a machine is subject to jamming or to limit the torque of any drive. Made in 10 types and 13 sizes, torque range from ½ lb.-in. to 33,825 lb.-ft.



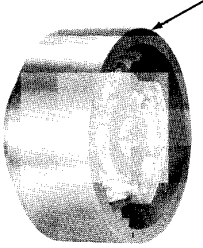
Intermittent Drive Assembly

Now one complete package provides bolt-on control of intermittent motion from a constantly rotating power source. Our IDA simplifies design of thousands of applications. Clip and bend; shear or slash; insert and withdraw; raise or lower; index and position . . . without having to design a complicated custom device. Currently available in standard sizes for torque ratings up to 106 lb.-ft.



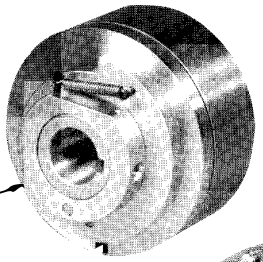
Centrifugal Automatic Clutch Coupling

A standard for the industry, its operating mechanism allows for misalignment and requires no lubrication. Used as a speed-limiting brake for starting high inertia equipment, for internal combustion engine drives and emergency and dual drive systems.



Single Revolution Clutch

For rivet and snap fastener machines, shears, staplers, bottling machinery, cut-off mechanisms, indexing and feeding equipment, packaging processes or whenever controlled intermittent motion is necessary from a continuously rotation source of power. Made in 3 types in 11 standard sizes, plus special designs to suit particular applications; range: 2 to 9,240 lb.-ft. torque.



Spring-Engaged Electric Brake

Rugged, of high quality . . . the perfect complement to our line of clutches and motion-control packages. It allows you to stop or hold rotating devices with confidence. Standard sizes offer a wide range of torque capabilities, or our Applications Engineers can meet the requirements of most applications by design modification.