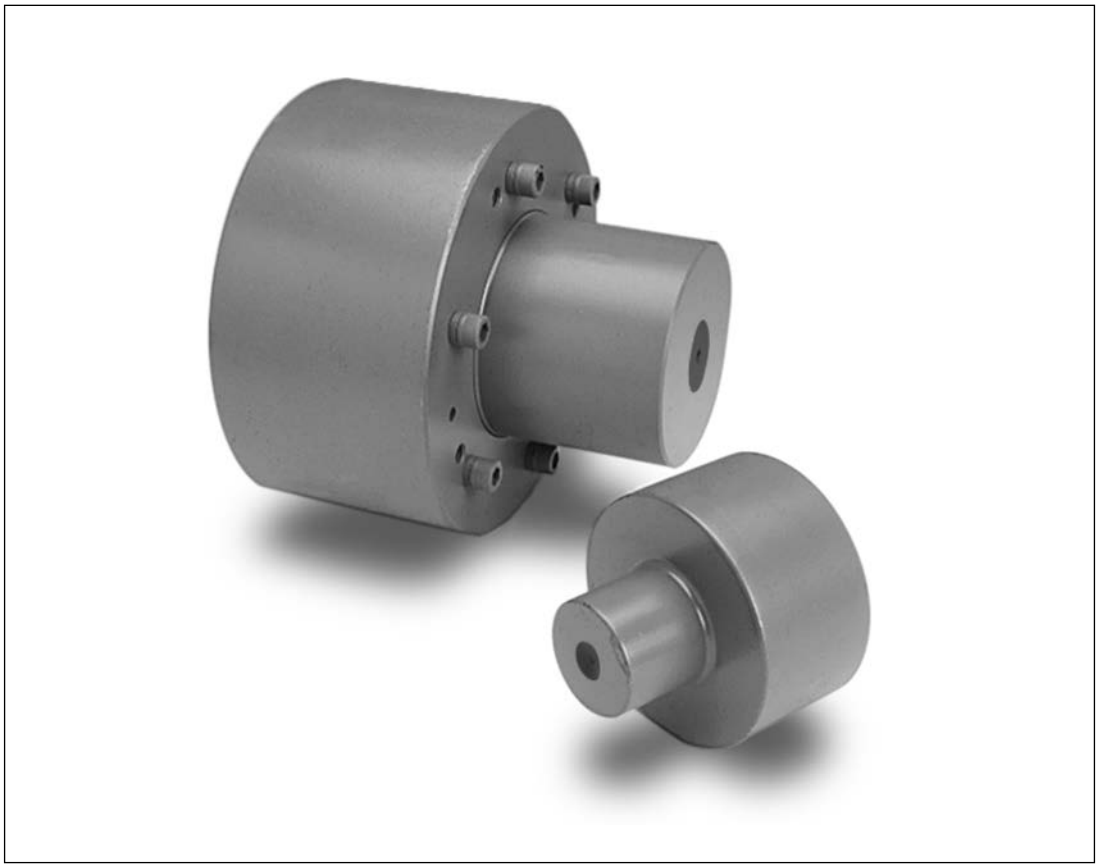

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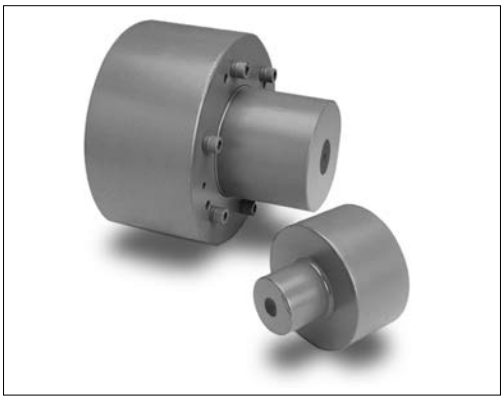
Centric Centrifugal Clutches CCC Series

Features

- Automatic engagement and disengagement
- Delayed engagement produces a “no load start”
- No slippage at full running speed
- Controlled soft-start acceleration
- 100% efficient at rated speed
- Standard, spring control, and deep pocket models
- Protection against shock loads during start-up
- Custom clutches can be designed to be RPM limiters or a “brake” on a runaway system



Why are they used?

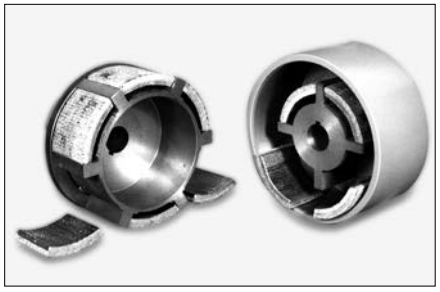
The Boston Gear Centric Centrifugal Clutch offers many advantages in motor and engine drive applications. Utilizing the centrifugal clutch enables the selection of normal torque motors for running loads rather than the selection of high torque motors for starting loads. The centrifugal clutch also sharply reduces the motor starting current requirements and heat losses inherent in the direct starting of a drive. This adds up to reduced power factors, greater efficiency and therefore, greater economy in motor drives.

When used with engine drives, the spring controlled centrifugal clutch allows the engine to warm up before starting the load or to stand by at an idling speed. Thus the spring controlled centrifugal clutch is used to great advantage in such applications as dual drives and engine driven pumping systems. This style clutch can also be used with turbines where a warm up period is necessary.

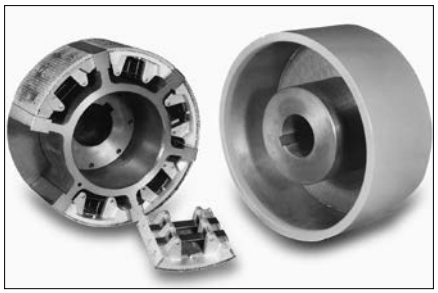
On any drive, the Boston Gear Centric Centrifugal Clutch provides protection against the shock loads which occur in the starting of a rigidly coupled drive. In many cases these loadings are capable of seriously damaging components of the drive and often expensive safety factors have to be designed into the machinery to protect against these loadings. The use of a centrifugal clutch eliminates these possibilities.

The use of a Boston Gear Centric Centrifugal Clutch allows the designer of a particular drive complete flexibility in clutch selection as each clutch is fabricated to order. Friction shoes of specific weights are custom designed therefore, any capacity within a particular clutch size can be obtained. The same holds true in the case of the spring controlled clutch. This style of clutch is designed to provide the specific engagement or disengagement speeds required by a specific application.

Free Engagement Standard Style



Spring Controlled Style



CCC Series Part Numbering System

CCC — **Series**
Centric Centrifugal Clutches

05 — **Size**

05	5 x 1-1/2	14	14 x 4
06	6 x 2	16	16 x 5
07	7 x 2-1/2	19	19 x 5
08	8 x 3	24	24 x 8
10	10 x 3	99	Special
12	12 x 4		

F — **Style**
F = Free Engagement
G = Free Engagement w/Steel Band
J = Deep Pocket
K = Deep Pocket w/Steel Band
L = Spring Control
M = Spring Control w/Steel Band

A — **Type**
A = Standard
V = Vertical Lift-Out (AVL)
H = Pulley Mounted/PTO Style
9 = Special

W — **Shoes**
W = With Shoes
L = Without Shoes

P16 — **Unit (DriveR) Bore (SPIDER)**
P = Bored to Size, (1/16”)

P16 — **Coupling (DriveN) Bore (DRUM)**
P = Bored to Size, (1/16”)

Operating Principles

The Boston Gear Centric Centrifugal Clutch utilizes two basic force principles in its operation, centrifugal force and friction force. Centrifugal force is that force which tends to pull a rotating body away from its center of rotation. Friction force exists between any two bodies in contact where one of the bodies is trying to move relative to the other body.

Figure 1, a face view of a centrifugal clutch, shows the basic components of the device. The driver half or spider is mounted to the motor or engine shaft and the driven half is connected to the load either directly or by means of some indirect drive arrangement. The friction shoes are the connective element between the driver and driven.

When the drive is set in motion, the spider and the shoes start to rotate. The spider imposes a driving force (F_3) on the friction shoe as shown in Figure 2. The centrifugal force (F_1) developed by the rotary motion of the friction shoe impresses it against the drum creating a frictional force (F_2) between the shoe and the drum.

As the drive increases in speed, the centrifugal force increases and thereby frictional force increases. When the frictional force reaches sufficient magnitude, it overcomes the resistance of the load, and the clutch drives. At full load speed, the shoe is “locked” firmly against the drum and no slippage occurs.

In engine and turbine applications, where it is necessary to “warm up” before attempting to drive a load, a spring controlled clutch is utilized. Figure 3 shows a typical spring control shoe. Here, a flat spring is placed over pins which run through the base of the shoe. This spring is retained in slots which are milled in the legs of the spider creating additional forces (F_S) which are applied to the friction shoes. The thickness of the spring utilized determines at what speed the particular drive may idle while warming up. At this idling speed the centrifugal force (F_1) developed by the rotation is not of sufficient magnitude to overcome the total spring force ($2F_S$) acting in the opposite direction on the friction shoe. As the speed of the drive increases above the point at which the spring forces (F_S) and the centrifugal force (F_1) are balanced, the shoe is pressed against the drum creating a friction force. The operation from this point on is as described above.

Selection

There are an infinite number of combinations of Boston Gear Centric Centrifugal Clutches. While operating on the same basic principles, every clutch is designed to suit a specific customer application. To assure that the appropriate clutch is selected, please complete the Selection Guide on Page 94 and fax it to Boston Gear.

Upon receipt, our application engineering department will review your requirements and return the optimal Boston Gear Centric Centrifugal Clutch design along with its dimensional drawings.

Figure 1

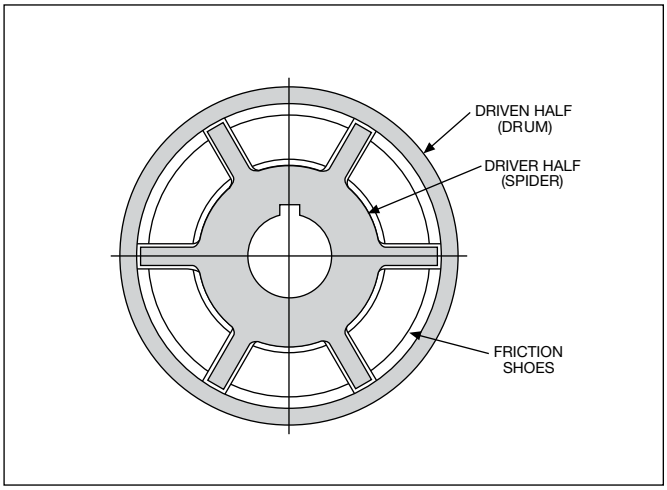


Figure 2

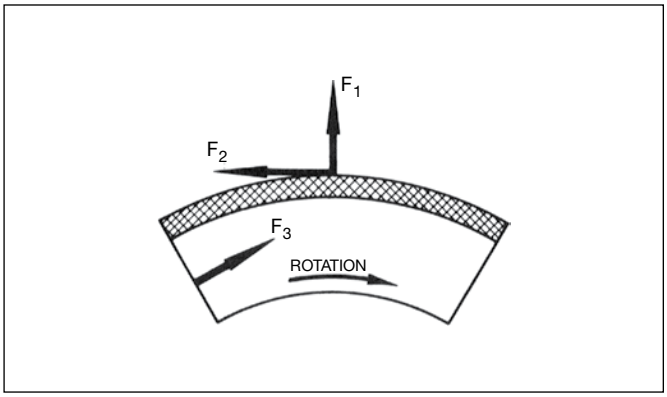
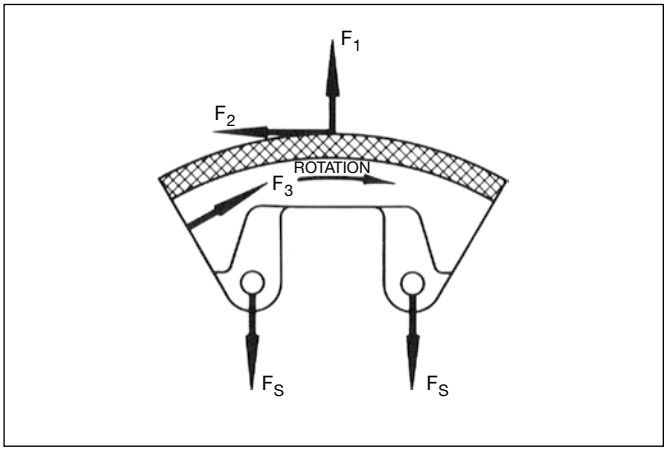


Figure 3

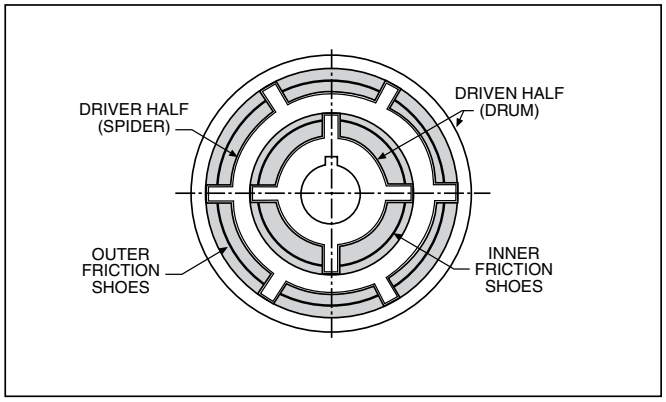


Centric Centrifugal Clutches

Available Styles

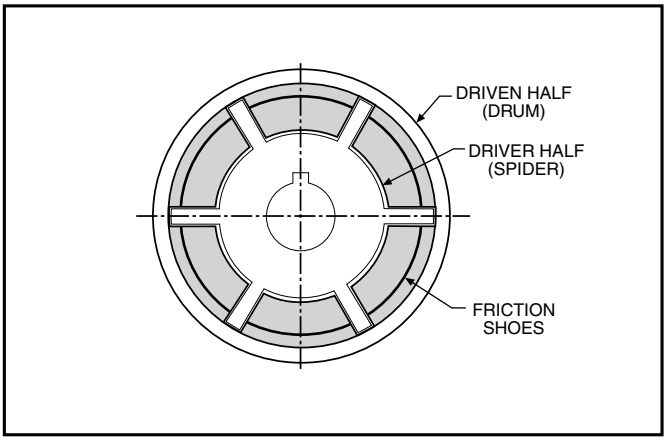
Boston Gear Centric Centrifugal Clutches are available for two basic applications: Styles F and J for electric motors and Style L for engines and turbines.
Standard Style F incorporates a shoe arrangement designed for electric motors, (Figure 4). As the motor comes up to speed, the outer friction shoes engage the driven half (the drum) and accelerate it. As it and the load come up to speed, the inner friction shoes engage the driver (the spider) locking up the drive.

Figure 4
Free Engagement Standard Style F/G



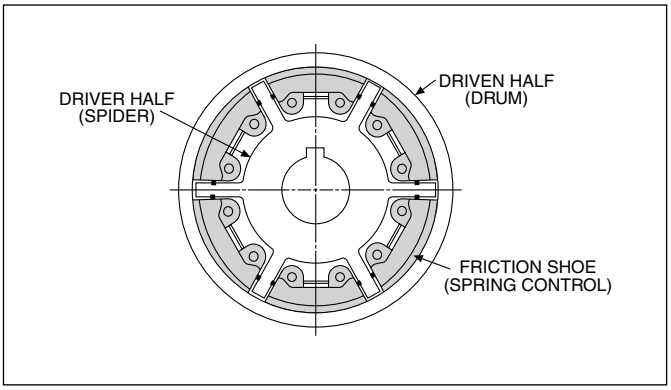
Where overload protection is required or greater capacity is needed in the drive, Style J containing deep pockets should be ordered, (Figure 5).

Figure 5
Deep Pocket Style J/K



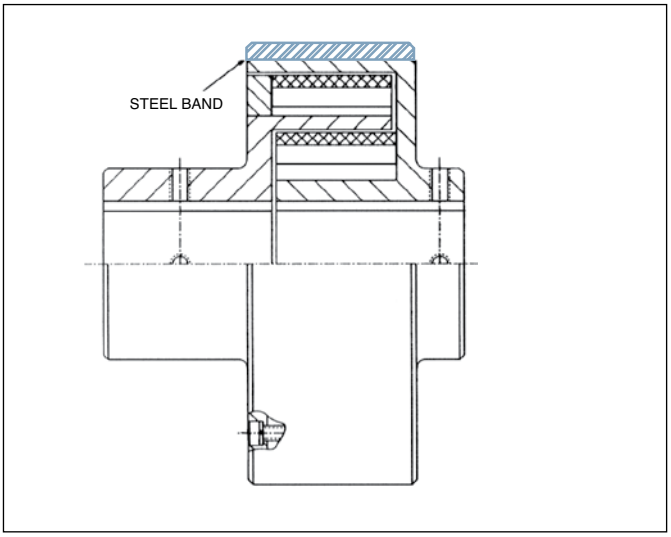
Style L incorporates a spring controlled shoe arrangement designed for engines, turbines, dual drives, or whenever a delayed engagement is desired, (Figure 6).

Figure 6
Spring Controlled Style L /M (Delayed Engagement)

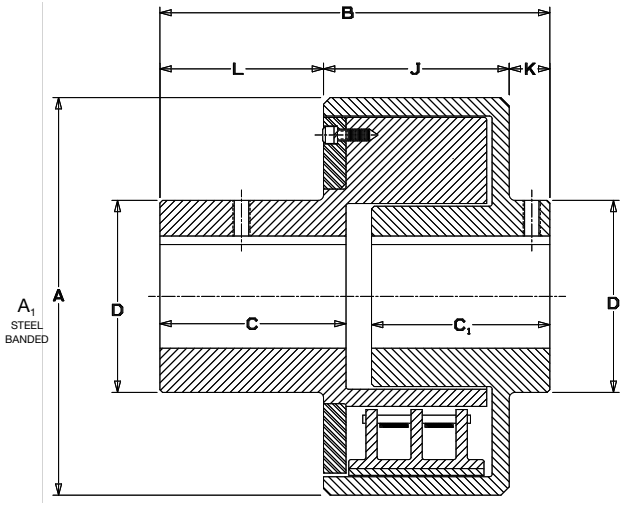


For applications where either high speeds or large horsepower conditions exist, Styles G, K and M may be provided. These styles are identical to the models shown in Figures 4, 5 and 6, however they also incorporate steel bands wrapped around the housing helping to reduce stress, (Figure 7).

Figure 7
Style F with Steel Band



Type A Free Engagement Style and Spring-Controlled Centrifugal Clutches Bored to Size

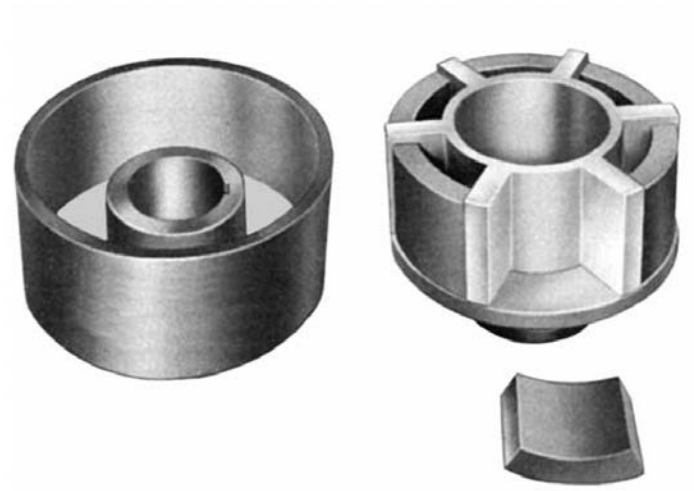


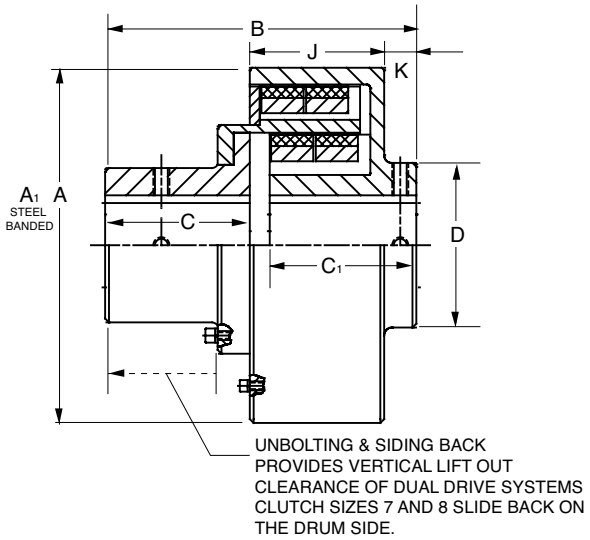
Clutch Coupling Sizes	Maximum Bore Inches	Minimum Bore Inches	Wt. in Lbs. with Max. Bore	DIMENSIONS IN INCHES									
				A	A_1 Steel Banded	B	C	C_1	D	J	K	L	HP*
5 x 1-1/2	1-3/8	3/4	15	5-3/8	–	4-11/16	2-3/16	2-7/16	2-1/2	2-3/16	5/8	1-13/16	40
6 x 2	1-5/8	3/4	25	6-1/2	7-3/4	6-1/4	2-15/16	3-3/16	3	3-1/16	3/4	2-7/16	92
7 x 2-1/2	1-7/8	1	40	7-5/8	8-5/8	7-1/4	3-7/16	3-11/16	3-3/8	3-9/16	3/4	2-15/16	125
8 x 3	2-3/8	1-1/4	65	8-7/8	9-3/4	8-3/4	4-1/8	4-1/2	4-1/4	4-1/8	1	3-5/8	160
10 x 3	2-7/8	1-1/4	100	10-13/16	11-3/4	8-13/16	4-1/8	4-9/16	5-1/8	4-3/16	1	3-5/8	215
12 x 4	3-1/2	1-1/2	200	13-1/8	14	11-3/8	5-1/2	5-11/16	6-1/4	5-1/2	1	4-7/8	356
14 x 4	4-1/8	2	300	15-1/8	16	11-3/8	5-1/2	5-5/8	7-3/8	5-1/2	1	4-7/8	500
16 X 5	4-3/4	2-1/2	400	17-3/8	18-1/4	13-3/4	6-3/4	6-13/16	8-1/2	6-5/8	1	6-1/8	562
19 x 5	5-5/8	2-1/2	1000	20-1/2	21-1/2	14-3/16	7	7	9-3/4	6-7/8	1-1/16	6-1/4	1500
24 x 8	7	3	1315	26-1/2	26-1/2	20-3/16	10	10	12-1/2	9-7/8	1-1/16	9-1/4	2280

Max Angular Misalignment- 1/4°
Max Parallel Misalignement- .010"
* The actual horsepower rating is largely dependent on RPM and may be higher or lower than the indicated HP. Contact engineering before finalizing clutch selection.

Centric Centrifugal Clutches

Type V Free Engagement and Spring-Controlled Vertical Liftout Centrifugal Clutches



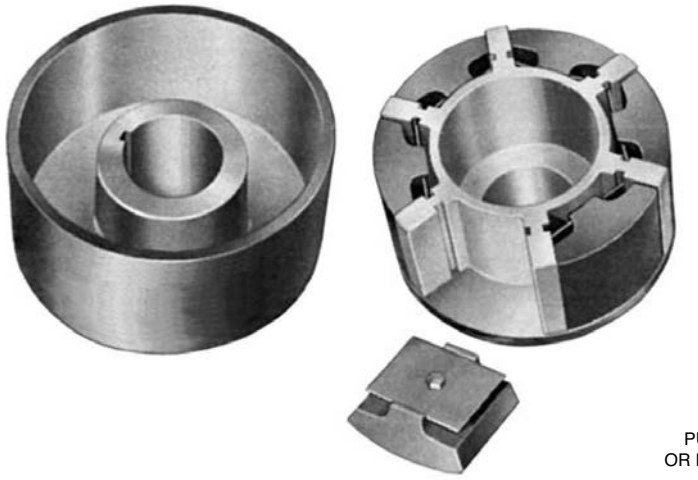


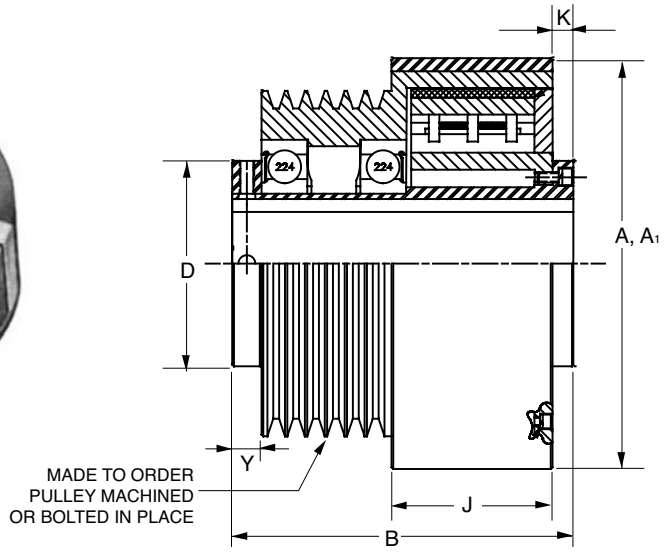
Clutch Coupling Sizes	Maximum Bore Inches	Wt. in Lbs. with Max. Bore	DIMENSIONS IN INCHES								
			A	A_1	B	C	C_1	D	J	K	HP**
7 x 2-1/2	2.375	40	7.62	8.62	8.25	4.12	4.00	3.93	4.00	3.25	125
8 x 3	2.875	55	8.83	9.75	9.50	4.62	4.75	4.68	4.75	3.75	160
10 x 3	2.625	100	10.81	11.75	9.75	4.50	4.56	5.12	4.19	1.00	215
12 x 4	3.00	200	13.12	14.00	12.31	5.75	5.68	6.25	5.50	1.00	356
14 x 4	3.50	325	15.16	16.00	12.31	5.75	5.68	7.38	5.50	1.00	450
16 x 5	4.75	400	17.38	18.25	14.68	7.00	6.80	8.50	6.62	1.00	562
19 x 5	5.00	900	20.50	21.50	15.00	7.00	7.00	10.00	8.87	1.06	1400
24 x 8	7.00	1350	26.50	26.50	21.81	10.68	10.00	12.00	9.94	1.06	2280

Max Angular Misalignment 1/4°
Max Parallel Misalignment .010"

** The actual horsepower rating is largely dependent on RPM and may be higher or lower than the indicated HP. Contact engineering before finalizing clutch selection.

Type H Spring Controlled Pulley Mounted PTO Centrifugal Clutches
Available as Shaft or Engine Mounted





Clutch Coupling Sizes	Maximum Bore Inches	Typ. Grooves	A	DIMENSIONS IN INCHES						
				A_1	B	D	J	K	Y	HP**
6 x 2	1.4375	2	6.56	7.50	5.43	2.62	3.68	0.0	.63	90
8 x 3	2.000	4	8.95	8.95	6.30	5.12	4.30	0.0	0.0	160
12 x 4	3.500	6	13.12	14.00	11.69	7.00	5.50	.75	1.0	350
16 x 5	4.500	8	17.38	18.25	15.32	8.50	6.62	1.70	1.0	560

** The actual horsepower rating is largely dependent on RPM and may be higher or lower than the indicated HP. Contact engineering before finalizing clutch selection.

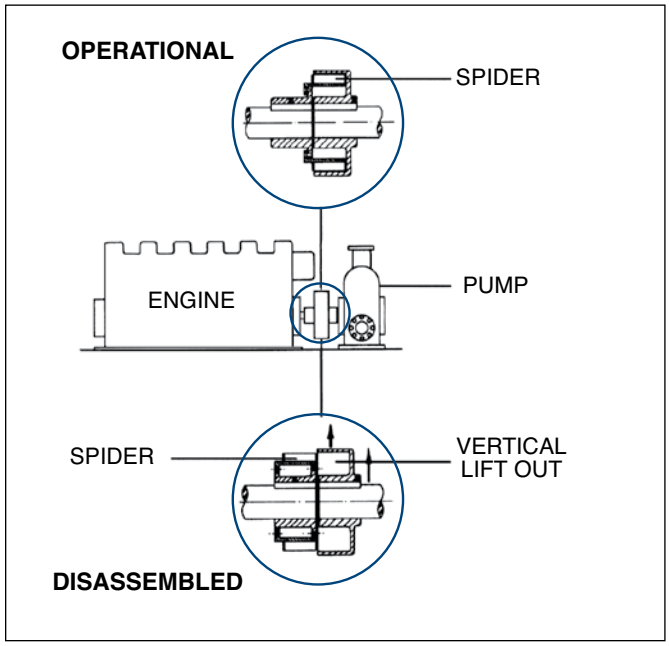
Centric Centrifugal Clutches

Available Types

Type A Centric Centrifugal Clutches are similar to standard coupling/clutch designs in that the installation and removal of the clutch requires horizontal clearance. This type of design may necessitate the relocation of other drive train components to achieve this clearance.

The Type V clutch is a modification of the basic Type A unit. This construction is utilized to a great advantage in direct drive applications where the equipment used is too heavy to be conveniently telescoped at assembly or disassembly. Figure 8 shows how either piece of equipment can be vertically lifted out of its assembled position. The Type V clutch construction allows the clutch spider to be slipped back over its own hub, completely clearing the clutch drum (see page 80). If a Type A construction had been used here, it would have been necessary to first move the pump horizontally in order to clear the drum and spider before a vertical lift could have been accomplished. This horizontal movement is often not convenient and sometimes impossible such as in certain dual drives and of course where space limitations exist.

Figure 8
Vertical Liftout Type V



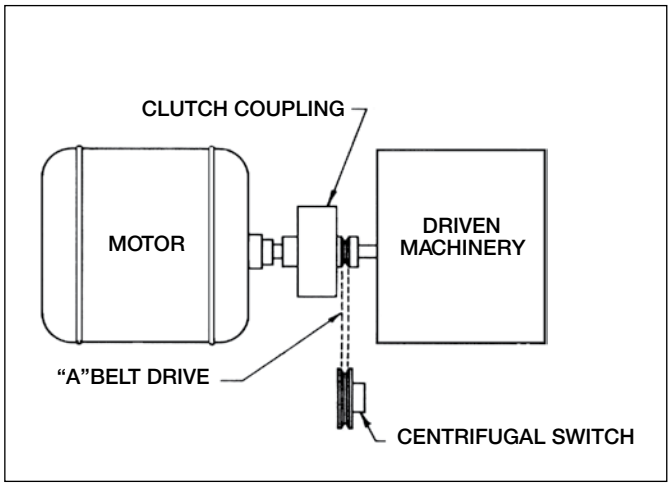
Overload Detection

In Figure 9 a safety device is incorporated to indicate an overload condition. In such applications a centrifugal switch is utilized. The switch is set to trip below a certain critical RPM determined by the application, and in so doing, actuate a signal or shut down the drive, The illustration shows the most common method of using a centrifugal switch in conjunction with a Boston Gear centrifugal clutch. “A” groove sheaves are mounted on the driven member of the clutch and the centrifugal switch. These sheaves are of such a ratio as to allow the centrifugal switch to operate within its limits.

For example, a drive arrangement is set to turn at 1750 RPM. It is determined that the desired cut out speed for the application is at 1500 RPM. The centrifugal switch is set to trip at speeds below 750 RPM and normally will run at 875 RPM which, through a 2:1 ratio corresponds to the drive RPM of 1750.

In actual operation the drive is turning at 1750 RPM. An overload occurs in the driven machinery and the capacity of the clutch is exceeded. While the driver half is still turning at the 1750 RPM, the driven half is dragging due to the increased capacity and drops below the 1500 RPM speed. The switch is actuated by this decrease in speed and an alarm is sounded or the drive is shut down.

Figure 9

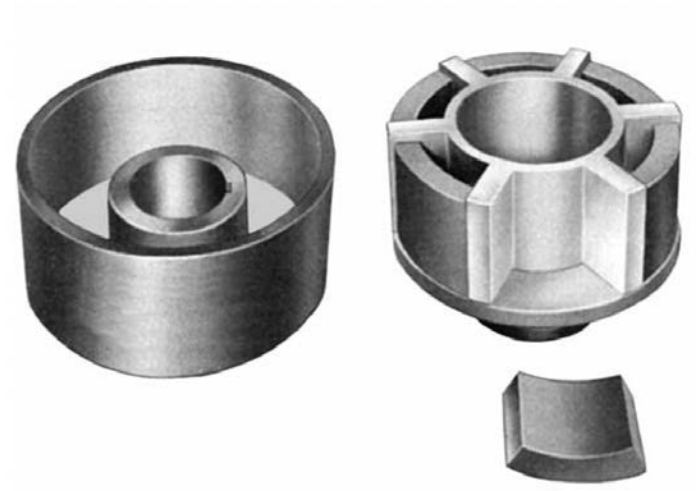


Operating Principles

The NLS centrifugal clutch is a rugged time-proven unit which provides equipment protection and system overload protection. This is done by allowing the motor or other driving source to accelerate to operating speed without load and to slip automatically when overloaded. This clutch is available in a free (type A) and delayed engagement (type AD) model, also in various sizes to handle different horsepower capacities.

TYPE A
Free Engagement

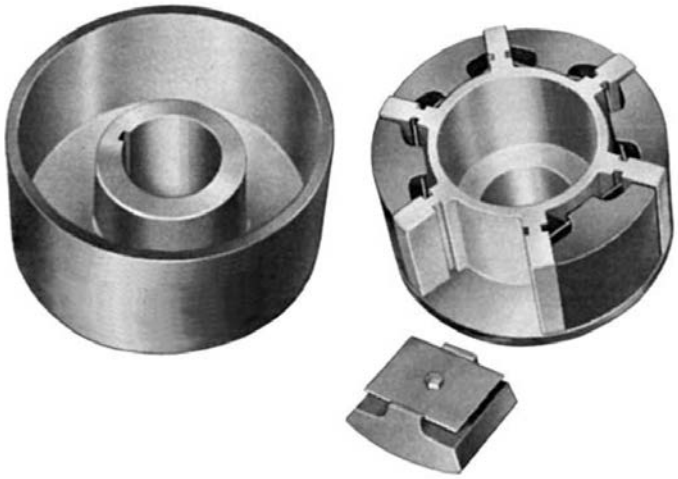
The shoes are a free floating part of the driving unit to which the power is applied. As the driver picks up speed, the shoes are forced outward by centrifugal force to make contact with the inside surface of the driven half. The shoes will make smooth contact and slip until the load reaches full speed. Both members then rotate as a unit with no slippage or power loss. Larger units have both inner and outer shoes.



TYPE A
WITH ONE ROW OF SHOES

TYPE AD
Delayed Engagement (Spring Controlled)

Operating under the same principle as the type A unit, the type AD uses springs to hold the shoes out of engagement until the driver reaches a predetermined rpm. At this point centrifugal force, acting on the shoes, overcomes the spring force, allowing smooth engagement of the power source with the load. Because the shoes are out of engagement until the driver is above the predetermined speed, this unit is ideal for dual or stand-by drives as well as idling or warming-up engines.



TYPE AD
FOR DELAYED ENGAGEMENT

NLS™ Centrifugal Clutches

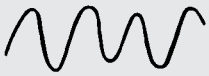
Easy Step by Step Selection Method

Step #1

Determine HP and minimum driving RPM (also idle RPM if delayed engagement type is required).

Step #2

Using the service factor chart, determine the proper service factor based on the prime mover and driven equipment.

	DRIVEN EQUIPMENT LOAD CLASSIFICATIONS			
	LIGHT STEADY LOADS Starting torque is equal to or slightly greater than running torque.	MODERATE LOADS High starting torque or above average running torque.	MEDIUM LOADS Starting torque is approximately double running torque.	HEAVY-DUTY LOADS High starting torque, shock loading, light torque reversals during drive.
				
PRIME MOVER	Centrifugal pumps, uniformly loaded conveyors, light-duty fans and blowers, liquid mixers and agitators, centrifugal compressors, lobe and vane type blowers, gear pumps, textile machinery, wood-working machinery.	Machine tools, hot oil pumps, heavy-duty centrifugal pumps, cooling towers, slurry agitators, boiler feed pumps, hoists, conveyors.	Dredge pumps, dynamometer drives, light-duty hammermills, lineshafts, paper-converting machinery, rotary kilns, rotary or screw-type pumps for high viscosity fluids, paper mill cranes.	Mine ventilating fans, reciprocating pumps or compressors, paper making machinery, heavy-duty hammer-mills, ore crushers, pulverizing mills.
Steam, gas or air turbine	1.00	1.25	1.50	1.75
AC electric motor	1.25	1.50	1.50	1.75
DC electric motor or DOL start AC electric motor, hydraulic motors	1.25	1.50	1.75	2.00
Gasoline, natural gas, propane or other spark ignition engine	1.75	1.75	2.00	CONSULT ENGINEERING
Diesel*	2.00	2.50	2.75	CONSULT ENGINEERING

* Consult application engineering on all engine drives.
Dual drive applications are to be treated as two single drives for service factor purposes.
For conveyor applications consult applications engineering.
For any application with extremes in inertia, starting torque, or questionable equipment, consult application engineering.

Easy Step by Step Selection Method

Step #3

Specify the clutch selected.

N0	-	16	-	1	-	B
Free Engagement-0 Spring Controlled-1		**Clutch Size**		**Shoe Compliment** No Shoes-0 Per Cat Rating-1,2,3		**Codes** B - Dynamic Balance L - Limited End Float S - Steel Band on Output

Sure-Grip bushings are sold separately.

Ordering examples:

N016-2	16A-2 clutch (no modifications)
N016-2-B	16A-2 clutch with dynamic balancing
N016-2-S	16A-2 clutch with steel ring
N016-2-B-S	16A-2 clutch with dynamic balancing and steel ring
N016-B-L-S	16A-2 clutch with dynamic balancing, limited end float, and steel ring
J3316	J Sure-Grip bushing with a 3-3/16 bore

Note: All NLS clutches use non-asbestos shoe linings.

NLS™ Centrifugal Clutches

Easy Step by Step Selection Method

Step #4

Calculate the Design HP (HP x service factor). Using the Design HP and the driving RPM, select the type and size clutch from the following charts.

TYPE A

Free Engagement Horsepower Tables

In the NLS free engagement clutch the shoes are a free-moving part of the driving half to which the power is applied. As the driving half picks up speed the shoes are forced outward by centrifugal force into contact with the inside surface of the driven half (drum) which is attached to the load or driven machine. As the shoes make smooth contact, they slip momentarily, or until friction causes the driven half to rotate. When the driven equipment reaches full speed, complete engagement of the shoes with the driven half has taken place, and both members rotate as a unit with **no slippage, or power loss.**

Description	Bushing	Max. Bore	Product Number	Minimum Dynamic HP							Shoe Replacement			
				Minimum Driving RPM							Outer		Inner	
				400	500	600	720	870	1160	1750	Product No.	Qty.	Product No.	Qty.
4A-1	SH		N004-1	0.02	0.04	0.07	0.11	0.20	0.50	1.60	N004-408	2	NONE	
4A-2	SH	1-5/8	N004-2	0.04	0.07	0.13	0.23	0.40	0.90	3.30	N004-408	4	NONE	
4A-3	SH		N004-3	0.05	0.09	0.15	0.27	0.50	1.10	3.90	N004-412	4	NONE	
6A-1	SDS		N006-1	0.09	0.20	0.30	0.50	1.00	2.40	8.00	N006-613	2	NONE	
6A-2	SDS	1-15/16	N006-2	0.15	0.30	0.50	0.90	1.60	3.80	13.00	N006-613	3	NONE	
6A-3	SDS		N006-3	0.20	0.40	0.70	1.20	2.10	5.00	17.00	N006-613	4	NONE	
6A-4	SDS		N006-4	0.29	0.60	1.00	1.80	3.20	7.50	26.00	N006-613	6	NONE	
7A-1	SK		N007-1	0.38	0.75	1.30	2.20	3.90	9.40	32.00	N007-726	3	NONE	
7A-2	SK	2-9/16	N007-2	0.51	1.00	1.70	3.00	5.20	12.00	43.00	N007-726	4	NONE	
7A-3	SK		N007-3	0.77	1.50	2.60	4.50	7.90	19.00	64.00	N007-726	6	NONE	
8A-1	SF		N008-1	0.90	1.80	3.20	5.60	9.80	23.00	80.00	N008-834	4	NONE	
8A-2	SF	2-15/16	N008-2	1.00	2.00	3.60	6.00	11.00	26.00	88.00	N008-842	4	NONE	
8A-3	SF		N008-3	1.30	2.70	4.90	8.20	14.00	35.00	120.00	N008-834	6	NONE	
8A-4	SF		N008-4	1.50	3.00	5.40	9.10	16.00	38.00	132.00	N008-842	6	NONE	
10A-1	E		N010-1	1.50	3.00	5.50	9.00	16.00	38.00	132.00	N010-1033	4	N010-1026-I	4
10A-2	E	3-1/2	N010-2	1.50	3.50	6.00	10.00	18.00	43.00	149.00	N010-1042	4	N010-1026-I	4
10A-3	E		N010-3	2.00	4.50	7.50	13.00	24.00	56.00	192.00	N010-1033	6	N010-1026-I	6
10A-4	E		N010-4	2.50	5.00	9.00	15.00	28.00	65.00	224.00	N010-1042	6	N010-1026-I	6
12A-1	F		N012-1	3.00	6.50	12.00	19.00	35.00	82.00	285.00	N012-1275	3	N012-1256-I	3
12A-2	F	3-15/16	N012-2	4.00	8.50	16.00	26.00	47.00	110.00	380.00	N012-1275	4	N012-1256-I	3
12A-3	F		N012-3	6.00	12.00	21.00	36.00	65.00	154.00	533.00	N012-1260	6	N012-1256-I	6
12A-4	F		N012-4	6.50	13.00	23.00	39.00	70.00	165.00	570.00	N012-1275	6	N012-1256-I	6
14A-1	F		N014-1	8.50	17.00	31.00	51.00	92.00	217.00	749.00	N014-1453	6	N014-1468-I	3
14A-2	F	3-15/16	N014-2	10.00	20.00	36.00	60.00	108.00	255.00	879.00	N014-1470	6	N014-1468-I	4
14A-3	F		N014-3	13.00	27.00	48.00	81.00	144.00	340.00	1170.00	N014-1470	8	N014-1468-I	6
16A-1	J		N016-1	13.00	26.00	47.00	79.00	141.00	333.00	1150.00	N016-16110	4	N016-16100-I	3
16A-2	J	4-1/2	N016-2	14.00	28.00	50.00	84.00	150.00	354.00	1220.00	N016-1685	6	N016-16100-I	4
16A-3	J		N016-3	20.00	39.00	70.00	118.00	212.00	499.00	1720.00	N016-16110	6	N016-16100-I	4
16A-4	J		N016-4	26.00	53.00	93.00	158.00	282.00	666.00	2290.00	N016-16110	8	N016-16100-I	6
19A-1	BTS		N019-1	43.00	87.00	154.00	260.00	461.00	1090.00	...	N019-19150	6	N019-19100-I	6
19A-2	BTS		N019-2	57.00	115.00	204.00	346.00	614.00	1450.00	...	N019-19150	8	N019-19100-I	8
24A-1	BTS		N024-1	77.00	156.00	276.00	468.00	828.00	1967.00	...	N024-24140	8	N024-24180-I	4
24A-2	BTS		N024-2	114.00	221.00	391.00	663.00	1170.00	2785.00	...	N024-24200	8	N024-24180-I	6
24A-3	BTS		N024-3	164.00	332.00	587.00	995.00	1760.00	4180.00	...	N024-24200	12	N024-24180-I	8
24A-4	BTS		N024-4	219.00	443.00	783.00	1327.00	2345.00	5570.00	...	N024-24200	16	N024-24220-I	8
25A-1	BTS		N025-1	246.00	498.00	881.00	1490.00	2640.00	6270.00	...	N024-24200	18	N024-24180-I	8
25A-2	BTS		N025-2	287.00	581.00	1030.00	1740.00	3080.00	7310.00	...	N024-24200	21	N024-24220-I	8
25A-3	BTS		N025-3	342.00	669.00	1160.00	2000.00	3530.00	8360.00	...	N024-24200	24	N024-24180-I	8

Horsepower tables are based on ideal test conditions. As with all friction clutches, the actual horsepower will vary with application conditions.
When using a model with inner shoes:

A) horsepower ratings prior to shoe lock-up (dynamic horsepower ratings) do not include inner shoe.

B) horsepower rating after complete shoe lock-up with inner shoe (static horsepower ratings) are approximately double the dynamic rating.

For high speed applications and models above 10", consult application engineering.

TYPE AD

Delayed Engagement Horsepower Tables

In the NLS delayed engagement clutch, shoe engagement is controlled by springs. The springs are fastened to the clutch shoes and inserted in slots in the driving half. Spring action holds the shoes out of engagement with the driven half until the driving half reaches a pre-determined RPM. Above this RPM, centrifugal force acting on the shoes overcomes the spring force allowing smooth engagement of the power source with the driven equipment. Since the shoes do not contact the driven half unless the driving half is started and accelerated, the delayed engagement type AD is ideal for dual or standby drives. The cushioned contact also means no sudden load imposed on motor, electrical, clutch or driven equipment.

Description	Bushing	Max. Bore	Product Number	Minimum Dynamic HP Minimum Driving RPM / Maximum Idle RPM				Max. Idle RPM	Shoe Replacement Outer	
				870/300*	1160/700*	1750/1000*	2500/1500*		Product No.	Qty.
4AD-1	SH	1-5/8	N104-1	0.18	0.31	1.10	3.20	300-1500	N104-9001	2
4AD-2	SH	1-5/8	N104-2	0.37	0.63	2.30	6.40	300-1500	N104-9001	4
6AD-1	SDS	1-15/16	N106-1	0.80	1.40	5.00	14.60	300-1500	N106-9001	2
6AD-2	SDS	1-15/16	N106-2	1.20	2.10	8.00	21.90	300-1500	N106-9001	3
6AD-3	SDS	1-15/16	N106-3	1.70	2.80	10.50	29.20	300-1500	N106-9001	4
6AD-4	SDS	1-15/16	N106-4	2.50	4.30	15.50	43.80	300-1500	N106-9001	6
7AD-1	SK	2-1/2	N107-1	3.00	5.00	18.50	50.00	300-1500	N107-9001	3
7AD-2	SK	2-1/2	N107-2	4.00	6.80	24.50	67.00	300-1500	N107-9001	4
7AD-3	SK	2-1/2	N107-3	6.00	10.90	37.00	100.00	300-1500	N107-9001	6
8AD-1	SF	2-15/16	N108-1	7.50	13.00	47.00	136.00	300-1500	N108-9001	4
8AD-2	SF	2-15/16	N108-2	11.50	19.50	71.00	204.00	300-1500	N108-9001	6
10AD-1	SF	2-15/16	N110-1	17.00	30.00	109.00	—	300-1000	N110-9001	4
10AD-2	SF	2-15/16	N110-2	26.00	45.00	164.00	—	300-1000	N110-9001	6
12AD-1	F	3-15/16	N112-1	27.00	47.00	173.00	—	300-1000	N112-9001	2
12AD-2	F	3-15/16	N112-2	41.00	71.00	259.00	—	300-1000	N112-9001	3
12AD-3	F	3-15/16	N112-3	55.00	95.00	346.00	—	300-1000	N112-9001	4
12AD-4	F	3-15/16	N112-4	83.00	142.00	519.00	—	300-1000	N112-9001	6
14AD-1	F	3-15/16	N114-1	73.00	125.00	—	—	200-700	N114-9001	4
14AD-2	F	3-15/16	N114-2	110.00	188.00	—	—	200-700	N114-9001	6
14AD-3	F	3-15/16	N114-3	147.00	251.00	—	—	200-700	N114-9001	8
16AD-1	J	4-1/2	N116-1	100.00	172.00	—	—	200-700	N116-9001	2
16AD-2	J	4-1/2	N116-2	201.00	344.00	—	—	200-700	N116-9001	4
16AD-3	J	4-1/2	N116-3	302.00	516.00	—	—	200-700	N116-9001	6
16AD-4	J	4-1/2	N116-4	402.00	689.00	—	—	200-700	N116-9001	8
19AD-1	BTS		N119-1	521.00	—	—	—	200-500	N119-9001	6
19AD-2	BTS		N119-2	695.00	—	—	—	200-500	N119-9001	8
24AD-1	BTS		N124-1	701.00	—	—	—	50-300	N124-9001	4
24AD-2	BTS		N124-2	1402.00	—	—	—	50-300	N124-9001	8
24AD-3	BTS		N124-3	2103.00	—	—	—	50-300	N124-9001	12
24AD-4	BTS		N124-4	2805.00	—	—	—	50-300	N124-9001	16

* Horsepower ratings listed are based on idle speed as indicated.
For high speed applications, models above 10", or special idle speeds, consult application engineering.
Horsepower ratings listed are based on ideal test conditions. As with all friction clutches, the actual horsepower will vary with application conditions.

Step #5

Check high speed applications for dynamic balancing and steel band requirements.

Clutch Size	RPM		
	Dynamic Balance Between	Steel Band On Required Output Member Above	Max RPM with Max Shoe Compliment
4	4700-11500	5700	11500
6	3200-7600	3900	7600
7	2700-6600	3300	6600
8	2400-5700	2900	5700
10	1900-4600	2300	4600
12	1225-3800	1900	3800
14	1400-3300	1600	3300
16	1200-2900	1400	2900
19	1000-1750	1200	1750
24	900-1600	1000	1600
25	500-1600	1000	1600

NLS™ Centrifugal Clutches

Easy Step by Step Selection Method

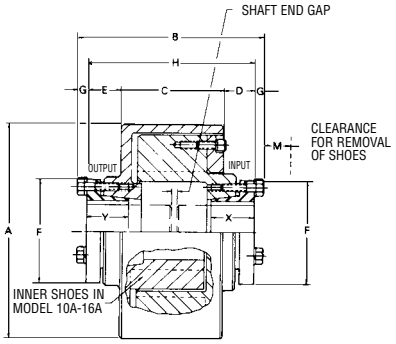
Step #6

Check bore size and available space envelope.

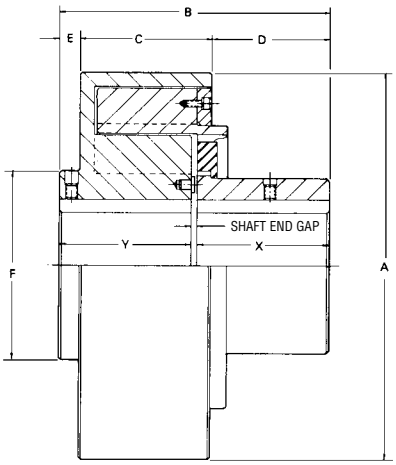
TYPE A

Free Engagement

Dimensions in Inches



MODELS 4A THRU 16A



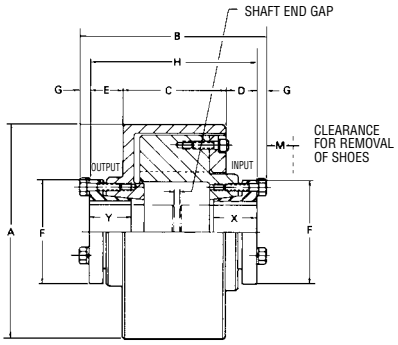
MODELS 19A & 24A

Clutch Size	Sure-Grip Bushing	Max. Keyed Bore	A	A with Steel Band	B	C	D	E	F	G	H	X	Y	Shaft End Gap Min	Shaft End Gap Max	M	B+M	Approx. Wt. Lbs.
4A	SH	1-5/8	4.4375	—	4.8125	2.2500	1.1250	1.0000	2.7500	.2500	4.3750	1.0625	1.0625	.0625	2.0000	—	4.8125	8
6A	SDS	1-15/16	6.5000	7.4375	5.5313	3.0625	.9375	1.0313	3.1250	.2500	5.0313	1.3125	1.3125	.1250	2.4063	.8125	6.3438	25
7A	SK	2-1/2	7.6250	8.4375	7.3125	3.6250	1.5000	1.5625	3.8750	.3125	6.6875	1.9375	1.9375	.1250	2.8125	.6875	8.0000	40
8A	SF	2-15/16	8.7500	9.4375	8.0000	4.2500	1.2813	1.7813	4.6250	.3438	7.3125	2.2500	2.2500	.1250	2.8125	1.8750	9.8750	55
10A	E	3-1/2	10.750	11.750	10.5000	4.1250	3.1250	2.2500	6.0000	.5000	9.5000	3.0000	3.0000	.1250	3.5000	—	10.5000	105
12A	F	3-15/16	13.000	14.000	11.3750	5.5000	3.4375	1.3125	6.6250	.5625	10.2500	3.9375	3.9375	.1250	2.3750	—	11.3750	225
14A	F	3-15/16	15.000	16.000	11.3750	5.5000	3.4375	1.3125	6.6250	.5625	10.2500	3.9375	3.9375	.1250	2.3750	—	11.3750	250
16A	J	4-1/2	17.250	18.250	13.6250	6.6250	4.1875	1.5625	7.2500	.6250	12.3750	4.8750	4.8750	.1250	2.6250	—	13.6250	400
19A	BTS		20.500	21.500	14.8125	6.8750	6.2500	1.0625	10.00	—	—	7.0000	7.0000	.1250	.1875	—	14.1875	600
24A	BTS		25.500	26.500	19.0625	9.8750	8.0000	1.0625	12.50	—	—	8.7500	10.0000	.1250	.1875	—	19.0625	1225
25A	BTS		—	26.500	24.1875	13.8750	9.2500	1.0625	12.50	—	—	10.0000	10.0000	.1250	4.0781	—	24.1875	1400

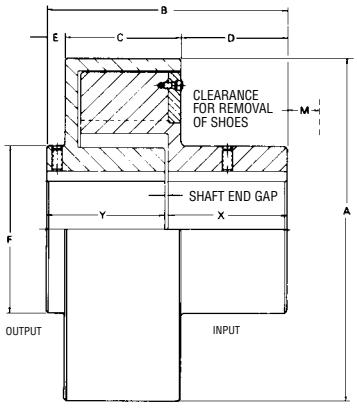
TYPE AD

Delayed Engagement

Dimensions in Inches



MODELS 4AD THRU 16AD



MODELS 19AD & 24AD

Clutch Size	Sure-Grip Bushing	Max. Keyed Bore	A	A with Steel Band	B	C	D	E	F	G	H	X	Y	Shaft End Gap Min	Shaft End Gap Max	M	B+M	Approx. Wt. Lbs.
4AD	SH	1-5/8	4.4375	—	4.8125	2.2500	1.1250	1.0000	2.7500	.2500	4.3750	1.0625	1.0625	.0625	2.0000	—	4.8125	8
6AD	SDS	1-15/16	6.5000	7.4375	5.5313	3.0625	.9375	1.0313	3.1250	.2500	5.0313	1.3125	1.3125	.1250	2.0313	.8125	6.3438	25
7AD	SK	2-1/2	7.6250	8.4375	7.3125	3.6250	1.5000	1.5625	3.8750	.3125	6.6875	1.9375	1.9375	.1250	2.8125	.6875	8.0000	40
8AD	SF	2-15/16	8.7500	9.4375	8.0000	4.2500	1.2813	1.7813	4.6250	.3438	7.3125	2.2500	2.2500	.1250	2.8125	1.3750	9.3750	55
10AD	SF	2-15/16	10.7500	11.7500	8.5625	4.1250	2.0000	1.7500	5.1250	.3438	7.8750	2.2500	2.2500	.1250	3.5000	.6875	9.2500	105
12AD	F	3-15/16	13.0000	14.0000	11.3750	5.5000	3.4375	1.3125	6.6250	.5625	10.2500	3.9375	3.9375	.1250	2.3750	.6250	12.0000	215
14AD	F	3-15/16	15.0000	16.0000	11.3750	5.5000	2.1250	1.3125	6.6250	.5625	10.2500	3.9375	3.9375	.1250	2.3750	.6250	12.0000	240
16AD	J	4-1/2	17.2500	18.2500	13.6250	6.6250	4.1875	1.5625	7.2500	.6250	12.3750	4.8750	4.8750	.1250	2.6250	.6250	14.2500	385
19AD	BTS		20.5000	21.5000	14.1875	6.8750	6.2500	1.0625	10.0000	—	—	7.0000	7.0000	.1250	.1875	—	14.1875	575
24AD	BTS		25.5000	26.5000	18.9375	9.8750	8.0000	1.0625	12.5000	—	—	8.7500	8.7500	.1250	1.4375	—	18.9375	1175

Bore and keyseat information

Sure Grip Bushing	Bores	Keyseat
SH	1/2 - 1-3/8 1-7/16 - 1-5/8 1-11/16	Standard 3/8 x 1/16 No K.S.
SDS	1/2 - 1-11/16 1-3/4 1-13/16 1-7/8 - 1-15/16 2	Standard 3/8 x 1/8 1/2 x 1/8 1/2 x 1/16 No K.S.
SK	1/2 - 2-1/8 2-3/16 - 2-1/4 2-5/16 - 2-1/2 2-9/16 - 2-5/8	Standard 1/2 x 1/8 5/8 x 1/16 NO K.S.
SF	1/2 - 2-1/4 2-5/16 - 2-1/2 2-9/16 - 2-3/4 2-13/16 - 2-15/16	Standard 5/8 X 3/16 5/8 X 1/16 NO K.S.

Sure Grip Bushing	Bores	Keyseat
E	7/8 - 2-7/8 2-15/16 - 3-1/4 3-5/16 - 3-1/2	Standard 3/4 X 1/8 7/8 X 1/16
F	1 - 3-1/4 3-5/16 - 3-3/4 3-13/16 - 3-15/16 4	Standard 7/8 X 3/16 1 X 1/8 NO K.S.
J	1-7/16 - 3-13/16 3-7/8 - 3-15/16 4 - 4-1/2	Standard 1 X 3/8 1 X 1/8

BTS NLS Models		
Model	Bores	Keyseat
19A & 19AD	3 - 5-5/8 5-11/16 - 6-5/8	Standard Shallow
24A, 25A & 24AD	3-1/4 - 7 7-1/16 - 8-3/8	Standard Shallow

Standard Keyseat Dimensions		
Shaft Dia.	Width	Depth
1/2- 9/16	1/8	1/16
5/8 - 7/8	3/16	3/32
15/16 - 1-1/4	1/4	1/8
1-5/16 - 1-3/8	5/16	5/32
1-7/16 - 1-3/4	3/8	3/16
1-13/16 - 2-1/4	1/2	1/4
2-5/16 - 2-3/4	5/8	5/16
2-13/16 - 3-1/4	3/4	3/8
3-15/16 - 3-3/4	7/8	7/16
3-13/16 - 4-1/2	1	1/2
4-9/16 - 5-1/2	1-1/4	5/8
5-9/16 - 6-1/2	1-1/2	3/4
6-9/16 - 7-1/2	1-3/4	3/4
7-9/16 - 9	2	3/4

NOTE: When installing Sure-Grip bushings follow wrench torque supplied in NLS instructions.

Step #7

Check clutch capacity for high inertia starts.

If inertia is not known or clutch speed is not listed, see step # 8.

Maximum WR^2 (lbs. ft.^{2}) that may be started at standard motor speeds.							
Clutch	870 RPM	1170 RPM	1750 RPM	Clutch	870 RPM	1170 RPM	1750 RPM
4	500	290	130	14	8000	4700	2100
6	1400	800	350	16	15000	8000	3700
7	2000	1100	510	19	22000	13000	5600
8	3000	1700	790	24	38000	20000	—
10	3800	2100	880	25	47600	26400	—
12	7000	4000	1800				

Step #8

If inertia is not known or clutch speed is not listed on WR^2 chart.

ACCELERATION TABLE

Clutch Model No.	Energy Capacity Horsepower-Seconds
4A, 4AD	245
6A, 6AD	680
7A, 7AD	980
8A, 8AD	1,400
10A, 10AD	1,650
12A, 12AD	3,400
14A, 14AD	4,000
16A, 16AD	7,200
19A, 19AD	11,000
24A, 24AD	17,000
25A	25,000
30A	38,000

Maximum allowable acceleration time in seconds can be calculated by dividing the energy capacity in horsepower-seconds by the clutch design horsepower.

If actual acceleration time exceeds the maximum allowable time, a larger clutch should be selected or if the start-up frequency is more than 1 every half-hour.

Example: A 12A-3 is rated at 533 hp @ 1750 with an energy capacity of 3400 Horsepower-seconds

$$\frac{\text{3400 Horsepower-seconds}}{\text{533 Horsepower}} = \text{6.4 seconds maximum allowable acceleration time without a Steel Band}$$

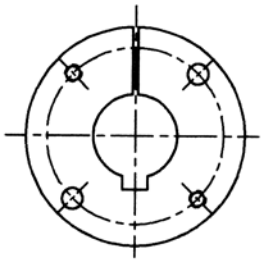
By adding a Steel Band the acceleration time is increased by 35%

6.4 x 1.35 = 8.6 seconds with a Steel Band

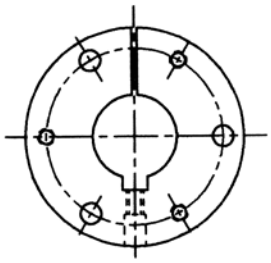
Sure-Grip Bushings

Dimensions

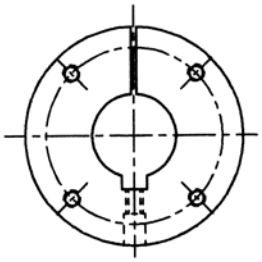
Sure-Grip bushings are designed to transmit the rated torque capacity listed in the table below when the cap screws are tightened as indicated. The bushings are stocked in all popular bore sizes, including metric bores, within the bore range for a particular bushing.



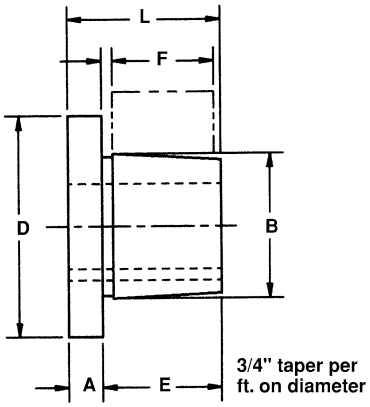
Bushing
QT



Bushings
JA to J inclusive
w/Setscrew
Except JA



Bushings
M to S inclusive
w/Setscrew



SURE-GRIP BUSHING
TORQUE RATINGS AND DIMENSIONS

Bush.	Torque Capacity (In.-Lbs.)	(Note 1) Max. Bore	(Note 2) Max. Bore	DIMENSIONS IN INCHES						Bolt Circle	Cap Screws Required	Recommended Cap Screw Torque (Ft.-Lbs.)
				A	B	D	E	F*	L			
SH	3,500	1.6250	36	.3750	1.8710	2.6875	.8750	.8125	1.2500	2.2500	3-1/4 x 1-3/8	6
SDS	5,000	1.9375	42	.4375	2.1875	3.1875	.8750	.7500	1.3125	2.6875	3-1/4 x 1-3/8	6
SD	5,000	1.9375	42	. 4375	2.1875	3.1875	1.3750	1.2500	1.8125	2.6875	3-1/4 x 1-7/8	6
SK	7,000	2.5000	56	.5000	2.8125	3.8750	1.3750	1.2500	1.8750	3.3125	3-5/16 x 2	10
SF	11,000	2.9375	63	.5000	3.1250	4.6250	1.5000	1.2500	2.0000	3.8750	3-3/8 x 2	2
E	20,000	3.5000	78	.7500	3.8340	6.0000	1.8750	1.6250	2.6250	5.0000	3-1/2 x 2-3/4	40
F	40,000	3.9375	90	.8125	4.4375	6.6250	2.8125	2.5000	3.6250	5.6250	3-9/16 x 3-5/8	50
J	55,000	4.5000	105	1.000	5.1484	7.2500	3.5000	3.1875	4.5000	6.2500	3-5/8 x 4-1/2	75
M	125,000	5.5000	130	1.250	6.500	9.1250	5.5000	5.1875	6.7500	7.8750	4-3/4 x 6-3/4	100
N	150,000	6.0000	140	1.500	7.000	10.000	6.6250	6.2500	8.1250	8.5000	4-7/8 x 8	150

* Mating hub length.
1. MAX INCH BORE WITH KEYSEAT.
2. MAX MM BORE WITH STANDARD KEYSEAT.

SEE PAGES 91-93 FOR BORE AND KEYSEAT INFORMATION AND WEIGHTS.

BORE AND KEYSEAT DIMENSIONS

(INCHES)

Sure-Grip Bushings are available from stock with all the bores and keyseats listed below. In some cases, as the bore increases in diameter, a shallow keyseat is provided—due to insufficient metal thickness. When this happens, the correct rectangular key is furnished at no charge. This does not affect the bushing's ability to transmit the load. The rectangular key, or flat key as some call it, fits into the standard keyway in the shaft.

Product No.	Bore	Key Seat	Wt. (*)
SH BUSHINGS			
SHMPB	7/16	No KS	1.1
SH12	1/2	1/8 x 1/16	1.1
SH9/16	9/16	1/8 x 1/16	1.1
SH58	5/8	3/16 x 3/32	1.1
SH11/16	11/16	3/16 x 3/32	1.0
SH34	3/4	3/16 x 3/32	1.0
SH13/16	13/16	3/16 x 3/32	1.0
SH78	7/8	3/16 x 3/32	1.0
SH15/16	15/16	1/4 x 1/8	1.0
SH1	1	1/4 x 1/8	.9
SH1116	1-1/16	1/4 x 1/8	.9
SH118	1-1/8	1/4 x 1/8	.9
SH1316	1-3/16	1/4 x 1/8	.8
SH114	1-1/4	1/4 x 1/8	.8
SH1516	1-5/16	5/16 x 5/32	.7
SH138	1-3/8	5/16 x 5/32	.7
SH1716	1-7/16	3/8 x 1/16	.7
SH112	1-1/2	3/8 x 1/16	.6
SH1916	1-9/16	3/8 x 1/16	.6
SH158	1-5/8	3/8 x 1/16	.5
SH11116	1-11/16	No KS	.5
SDS BUSHINGS			
SDSMPB	7/16	No KS	1.7
SDS12	1/2	1/8 x 1/16	1.7
SDS9/16	9/16	1/8 x 1/16	1.7
SDS58	5/8	3/16 x 3/32	1.6
SDS11/16	11/16	3/16 x 3/32	1.6
SDS34	3/4	3/16 x 3/32	1.6
SDS13/16	13/16	3/16 x 3/32	1.6
SDS78	7/8	3/16 x 3/32	1.5
SDS15/16	15/16	1/4 x 1/8	1.5
SDS1	1	1/4 x 1/8	1.5
SDS1116	1-1/16	1/4 x 1/8	1.4
SDS118	1-1/8	1/4 x 1/8	1.4
SDS1316	1-3/16	1/4 x 1/8	1.4
SDS114	1-1/4	1/4 x 1/8	1.3
SDS1516	1-5/16	5/16 x 5/32	1.3
SDS138	1-3/8	5/16 x 5/32	1.2
SDS13838KS	1-3/8	3/8 x 3/16	1.2
SDS1716	1-7/16	3/8 x 3/16	1.2
SDS112	1-1/2	3/8 x 3/16	1.1
SDS1916	1-9/16	3/8 x 3/16	1.1
SDS158	1-5/8	3/8 x 3/16	1.0
SDS11116	1-11/16	3/8 x 3/16	1.0
SDS134	1-3/4	3/8 x 1/8	1.0
SDS11316	1-13/16	1/2 x 1/8	.9
SDS178	1-7/8	1/2 x 1/16	.9
SDS11516	1-15/16	1/2 x 1/16	.8
SDS2	2	No KS	.7
SD BUSHINGS			
SDMPB	7/16	No KS	2.1
SD12	1/2	1/8 x 1/16	2.1
SD9/16	9/16	1/8 x 1/16	2.1
SD58	5/8	3/16 x 3/32	2.1

* Approximate weight in lbs.

Product No.	Bore	Key Seat	Wt. (*)
SD BUSHINGS (continued)			
SD11/16	11/16	3/16 x 3/32	2.0
SD34	3/4	3/16 x 3/32	2.0
SD13/16	13/16	3/16 x 3/32	2.0
SD78	7/8	3/16 x 3/32	1.9
SD15/16	15/16	1/4 x 1/8	1.9
SD1	1	1/4 x 1/8	1.8
SD1116	1-1/16	1/4 x 1/8	1.8
SD118	1-1/8	1/4 x 1/8	1.7
SD1316	1-3/16	1/4 x 1/8	1.7
SD114	1-1/4	1/4 x 1/8	1.6
SD1516	1-5/16	5/16 x 5/32	1.6
SD138	1-3/8	5/16 x 5/32	1.5
SD13838KS	1-3/8	3/8 x 3/16	1.5
SD1716	1-7/16	3/8 x 3/16	1.4
SD112	1-1/2	3/8 x 3/16	1.4
SD1916	1-9/16	3/8 x 3/16	1.3
SD158	1-5/8	3/8 x 3/16	1.2
SD11116	1-11/16	3/8 x 3/16	1.2
SD134	1-3/4	3/8 x 1/8	1.1
SD11316	1-13/16	1/2 x 1/8	1.1
SD178	1-7/8	1/2 x 1/16	1.0
SD11516	1-15/16	1/2 x 1/16	.9
SD2	2	No KS	.8
SK BUSHINGS			
SKMPB	7/16	No KS	3.6
SK12	1/2	1/8 x 1/16	3.6
SK9/16	9/16	1/8 x 1/16	3.6
SK58	5/8	3/16 x 3/32	3.6
SK11/16	11/16	3/16 x 3/32	3.5
SK34	3/4	3/16 x 3/32	3.5
SK13/16	13/16	3/16 x 3/32	3.5
SK78	7/8	3/16 x 3/32	3.4
SK15/16	15/16	1/4 x 1/8	3.4
SK1	1	1/4 x 1/8	3.3
SK1116	1-1/16	1/4 x 1/8	3.3
SK118	1-1/8	1/4 x 1/8	3.2
SK1316	1-3/16	1/4 x 1/8	3.2
SK114	1-1/4	1/4 x 1/8	3.1
SK1516	1-5/16	5/16 x 5/32	3.1
SK151638KS	1-5/16	3/8 x 3/16	3.1
SK138	1-3/8	5/16 x 5/32	3.0
SK13838KS	1-3/8	3/8 x 3/16	3.0
SK1716	1-7/16	3/8 x 3/16	2.9
SK112	1-1/2	3/8 x 3/16	2.9
SK1916	1-9/16	3/8 x 3/16	2.8
SK158	1-5/8	3/8 x 3/16	2.7
SK11116	1-11/16	3.8 x 3/16	2.6
SK134	1-3/4	3/8 x 3/16	2.5
SK13412KS	1-3/4	1/2 x 1/4	2.5
SK11316	1-13/16	1/2 X 1/4	2.4
SK178	1-7/8	1/2 X 1/4	2.4
SK11516	1-15/16	1/2 X 1/4	2.3
SK2	2	1/2 X 1/4	2.2
SK2116	2-1/16	1/2 X 1/4	2.1
SK218	2-1/8	1/2 X 1/4	2.0

MPB Bushings are unsplit.

Product No.	Bore	Key Seat	Wt. (*)
SK BUSHINGS (continued)			
SK2316	2-3/16	1/2 X 1/8	2.0
SK214	2-1/4	1/2 X 1/8	1.9
SK21458KS	2-1/4	5/8 X 1/8	1.9
SK2516	2-5/16	5/8 X 1/16	1.8
SK238	2-3/8	5/8 X 1/16	1.7
SK2716	2-7/16	5/8 X 1/16	1.6
SK212	2-1/2	5/8 X 1/16	1.5
SK2916	2-9/16	No KS	1.3
SK258	2-5/8	No KS	1.1
SF BUSHINGS			
SFMPB	1/2	No KS	5.1
SF12	1/2	1/8 X 1/16	5.1
SF58	5/8	3/16 X 3/32	5.0
SF34	3/4	3/16 X 3/32	5.0
SF78	7/8	3/16 X 3/32	4.9
SF15/16	15/16	1/4 X 1/8	4.8
SF1	1	1/4 X 1/8	4.8
SF1116	1-1/16	1/4 X 1/8	4.7
SF118	1-1/8	1/4 X 1/8	4.7
SF1316	1-3/16	1/4 X 1/8	4.6
SF114	1-1/4	1/4 X 1/8	4.5
SF1516	1-5/16	5/16 X 5/32	4.5
SF138	1-3/8	5/16 X 5/32	4.4
SF13838KS	1-3/8	3/8 X 3/16	4.4
SF1716	1-7/16	3/8 X 3/16	4.3
SF112	1-1/2	3/8 X 3/16	4.2
SF1916	1-9/16	3/8 X 3/16	4.2
SF158	1-5/8	3/8 X 3/16	4.1
SF11116	1-11/16	3/8 X 3/16	4.0
SF134	1-3/4	3/8 X 3/16	3.9
SF11316	1-13/16	1/2 X 1/4	3.8
SF178	1-7/8	1/2 X 1/4	3.7
SF11516	1-15/16	1/2 X 1/4	3.6
SF2	2	1/2 X 1/4	3.5
SF2116	2-1/16	1/2 X 1/4	3.4
SF218	2-1/8	1/2 X 1/4	3.3
SF2316	2-3/16	1/2 X 1/4	3.2
SF214	2-1/4	1/2 X 1/4	3.1
SF21458KS	2-1/4	5/8 X 5/16	3.1
SF2516	2-5/16	5/8 X 3/16	3.1
SF238	2-3/8	5/8 X 3/16	3.0
SF2716	2-7/16	5/8 X 3/16	2.9
SF212	2-1/2	5/8 X 3/16	2.8
SF2916	2-9/16	5/8 X 1/16	2.6
SF258	2-5/8	5/8 X 1/16	2.5
SF21116	2-11/16	5/8 X 1/16	2.4
SF234	2-3/4	5/8 X 1/16	2.2
SF278	2-7/8	3/4 X 1/16	1.8
SF21516	2-15/16	3/4 X 1/32	1.7
E BUSHINGS			
EMPB	7/8	No KS	10.8
E78	7/8	3/16 X 3/32	10.8
E15/16	15/16	1/4 X 1/8	10.8

(Continued—next page)

Sure-Grip Bushings

BORE AND KEYSEAT DIMENSIONS

(INCHES)

Product No.	Bore	Key Seat	Wt. (*)
E BUSHINGS (continued)			
E1	1	1/4 X 1/8	10.7
E118	1-1/8	1/4 X 1/8	10.6
E1316	1-3/16	1/4 X 1/8	10.5
E114	1-1/4	1/4 X 1/8	10.4
E1516	1-5/16	5/16 X 5/32	10.3
E138	1-3/8	5/16 X 5/32	10.2
E13838KS	1-3/8	3/8 X 3/16	10.2
E1716	1-7/16	3/8 X 3/16	10.1
E112	1-1/2	3/8 X 3/16	10.0
E1916	1-9/16	3/8 X 3/16	9.9
E158	1-5/8	3/8 X 3/16	9.8
E11116	1-11/16	3/8 X 3/16	9.7
E134	1-3/4	3/8 X 3/16	9.6
E11316	1-13/16	1/2 X 1/4	9.4
E178	1-7/8	1/2 X 1/4	9.3
E11516	1-15/16	1/2 X 1/4	9.2
E2	2	1/2 X 1/4	9.0
E2116	2-1/16	1/2 X 1/4	8.9
E218	2-1/8	1/2 X 1/4	8.8
E2316	2-3/16	1/2 X 1/4	8.6
E214	2-1/4	1/2 X 1/4	8.5
E21458KS	2-1/4	5/8 X 5/16	8.5
E2516	2-5/16	5/8 X 5/16	8.3
E238	2-3/8	5/8 X 5/16	8.1
E2716	2-7/16	5/8 X 5/16	8.0
E212	2-1/2	5/8 X 5/16	7.8
E2916	2-9/16	5/8 X 5/16	7.6
E258	2-5/8	5/8 X 5/16	7.5
E2116	2-11/16	5/8 X 5/16	7.3
E234	2-3/4	5/8 X 5/16	7.1
E21316	2-13/16	3/4 X 3/8	7.2
E278	2-7/8	3/4 X 3/8	7.1
E21516	2-15/16	3/4 X 1/8	6.9
E3	3	3/4 X 1/8	6.7
E318	3-1/8	3/4 X 1/8	6.3
E3316	3-3/16	3/4 X 1/8	6.0
E314	3-1/4	3/4 X 1/8	5.8
E3516	3-5/16	7/8 X 1/16	5.7
E338	3-3/8	7/8 X 1/16	5.5
E3716	3-7/16	7/8 X 1/16	5.2
E312	3-1/2	7/8 X 1/16	4.7
F BUSHINGS			
FMPB	1	No KS	17.9
F1	1	1/4 X 1/8	17.9
F118	1-1/8	1/4 X 1/8	17.7
F1316	1-3/16	1/4 X 1/8	17.6
F114	1-1/4	1/4 X 1/8	17.5
F138	1-3/8	5/16 X 5/32	17.2
F1716	1-7/16	3/8 X 3/16	17.1
F112	1-1/2	3/8 X 3/16	16.9
F1916	1-9/16	3/8 X 3/16	16.8

* Approximate weight in lbs.

Product No.	Bore	Key Seat	Wt. (*)
F BUSHINGS (continued)			
F158	1-5/8	3/8 X 3/16	16.7
F134	1-3/4	3/8 X 3/16	16.3
F178	1-7/8	1/2 X 1/4	16.0
F11516	1-15/16	1/2 X 1/4	15.8
F2	2	1/2 X 1/4	15.6
F2116	2-1/16	1/2 X 1/4	15.4
F218	2-1/8	1/2 X 1/4	15.2
F2316	2-3/16	1/2 X 1/4	15.0
F214	2-1/4	1/2 X 1/4	14.8
F21458KS	2-1/4	5/8 X 5/16	14.8
F2516	2-5/16	5/8 X 5/16	14.5
F238	2-3/8	5/8 X 5/16	14.3
F2716	2-7/16	5/8 X 5/16	14.1
F212	2-1/2	5/8 X 5/16	13.9
F2916	2-9/16	5/8 X 5/16	13.7
F258	2-5/8	5/8 X 5/16	13.4
F21116	2-11/16	5/8 X 5/16	13.2
F234	2-3/4	5/8 X 5/16	12.9
F21316	2-13/16	3/4 X 3/8	12.6
F278	2-7/8	3/4 X 3/8	12.3
F21516	2-15/16	3/4 X 3/8	12.1
F3	3	3/4 X 3/8	11.8
F318	3-1/8	3/4 X 3/8	11.2
F3316	3-3/16	3/4 X 3/8	10.9
F314	3-1/4	3/4 X 3/8	10.6
F3516	3-5/16	7/8 X 3/16	11.0
F338	3-3/8	7/8 X 3/16	10.6
F3716	3-7/16	7/8 X 3/16	10.3
F312	3-1/2	7/8 X 3/16	10.0
F358	3-5/8	7/8 X 3/16	9.4
F31116	3-11/16	7/8 X 3/16	9.0
F334	3-3/4	7/8 X 3/16	8.7
F378	3-7/8	1 X 1/8	8.1
F31516	3-15/16	1 X 1/8	7.7
F4	4	No KS	6.9
J BUSHINGS			
JMPBR	1-7/16	No KS	28.1
J1716	1-7/16	3/8 X 3/16	28.1
J112	1-1/2	3/8 X 3/16	28.0
J1916	1-9/16	3/8 X 3/16	27.8
J11116	1-11/16	3/8 X 3/16	27.4
J134	1-3/4	3/8 X 3/16	27.2
J178	1-7/8	1/2 X 1/4	26.7
J11516	1-15/16	1/2 X 1/4	26.5
J2	2	1/2 X 1/4	26.3
J218	2-1/8	1/2 X 1/4	25.8
J2316	2-3/16	1/2 X 1/4	25.6
J214	2-1/4	1/2 X 1/4	25.3
J2516	2-5/16	5/8 X 5/16	25.0
J238	2-3/8	5/8 X 5/16	24.7

MPB Bushings are unsplit.

Product No.	Bore	Key Seat	Wt. (*)
J BUSHINGS (continued)			
J2716	2-7/16	5/8 X 5/16	24.5
J212	2-1/2	5/8 X 5/16	24.2
J258	2-5/8	5/8 X 5/16	23.6
J21116	2-11/16	5/8 X 5/16	23.3
J234	2-3/4	5/8 X 5/16	23.0
J278	2-7/8	3/4 X 3/8	22.2
J21516	2-15/16	3/4 X 3/8	21.9
J3	3	3/4 X 3/8	21.6
J318	3-1/8	3/4 X 3/8	20.9
J3316	3-3/16	3/4 X 3/8	20.5
J314	3-1/4	3/4 X 3/8	20.1
J3516	3-5/16	7/8 X 7/16	19.6
J338	3-3/8	7/8 X 7/16	19.3
J3716	3-7/16	7/8 X 7/16	18.9
J312	3-1/2	7/8 X 7/16	18.5
J358	3-5/8	7/8 X 7/16	17.7
J31116	3-11/16	7/8 X 7/16	17.2
J334	3-3/4	7/8 X 7/16	16.8
J31316	3-13/16	1 X 1/2	17.4
J378	3-7/8	1 X 3/8	17.0
J31516	3-15/16	1 X 3/8	16.5
J4	4	1 X 1/8	16.1
J418	4-1/8	1 X 1/8	15.2
J4316	4-3/16	1 X 1/8	14.7
J414	4-1/4	1 X 1/8	14.2
J438	4-3/8	1 X 1/8	13.2
J4716	4-7/16	1 X 1/8	12.7
J412	4-1/2	1 X 1/8	12.2

(INCHES) WITH METRIC BORE AND KEYSEAT

BORE AND KEY INFORMATION

Product No.	Bore (mm)	Key □	Wt. (*)
SH BUSHINGS			
SH24MM	24	8 X 7	.9
SH25MM	25	8 X 7	.9
SH28MM	28	8 X 7	.9
SH30MM	30	8 X 7	.8
SH32MM	32	10 X 8	.8
SH35MM	35	10 X 8	.7
SDS BUSHINGS			
SDS24MM	24	8 X 7	1.5
SDS25MM	25	8 X 7	1.5
SDS28MM	28	8 X 7	1.4
SDS30MM	30	8 X 7	1.4
SDS32MM	32	10 X 8	1.3
SDS35MM	35	10 X 8	1.2
SDS38MM	38	10 X 8	1.1
SDS40MM	40	12 X 8	1.1
SDS42MM	42	12 X 8	1.0
SD BUSHINGS			
SD24MM	24	8 X 7	1.8
SD25MM	25	8 X 7	1.8
SD28MM	28	8 X 7	1.7
SD30MM	30	8 X 7	1.7
SD32MM	32	10 X 8	1.6
SD35MM	35	10 X 8	1.5
SD38MM	38	10 X 8	1.4
SD40MM	40	12 X 8	1.3
SD42MM	42	12 X 8	1.2
SK BUSHINGS			
SK24MM	24	8 X 7	3.3
SK25MM	25	8 X 7	3.3
SK28MM	28	8 X 7	3.2
SK30MM	30	8 X 7	3.2
SK32MM	32	10 X 8	3.1
SK35MM	35	10 X 8	3.0
SK38MM	38	10 X 8	2.9
SK40MM	40	12 X 8	3.6
SK42MM	42	12 X 8	2.7
SK45MM	45	14 X 9	2.6
SK48MM	48	14 X 9	2.4
SK50MM	50	14 X 9	2.3
SK55MM	55	16 X 10	2.0

Product No.	Bore (mm)	Key □	Wt. (*)
SF BUSHINGS			
SF28MM	28	8 X 7	4.7
SF30MM	30	8 X 7	4.6
SF32MM	32	10 X 8	4.5
SF35MM	35	10 X 8	4.4
SF38MM	38	10 X 8	4.2
SF40MM	40	12 X 8	4.2
SF42MM	42	12 X 8	4.1
SF45MM	45	14 X 9	3.9
SF48MM	48	14 X 9	3.7
SF50MM	50	14 X 9	3.6
SF55MM	55	16 X 10	3.2
SF60MM	60	18 X 11	3.0
SF65MM	65	18 X 8†	2.6
E BUSHINGS			
E35MM	35	10 X 8	10.2
E38MM	38	10 X 8	10.0
E40MM	40	12 X 8	9.9
E42MM	42	12 X 8	9.8
E45MM	45	14 X 9	9.6
E48MM	48	14 X 9	9.3
E50MM	50	14 X 9	9.2
E55MM	55	16 X 10	8.6
E60MM	60	18 X 11	8.1
E65MM	65	18 X 11	7.6
E70MM	70	20 X 12	7.1
E75MM	75	20 X 12	6.9
E80MM	80	22 X 11†	6.3
F BUSHINGS			
F45MM	45	14 X 9	16.2
F48MM	48	14 X 9	16.0
F50MM	50	14 X 9	15.8
F55MM	55	16 X 10	15.0
F60MM	60	18 X 11	14.3
F65MM	65	18 X 11	13.7
F70MM	70	20 X 12	12.9
F75MM	75	20 X 12	12.1
F80MM	80	22 X 14	11.2
F85MM	85	22 X 14	10.6
F90MM	90	25 X 14	9.7

Product No.	Bore (mm)	Key □	Wt. (*)
J BUSHINGS			
J50MM	50	14 X 9	26.5
J55MM	55	16 X 10	25.6
J60MM	60	18 X 11	24.7
J65MM	65	18 X 11	23.9
J70MM	70	20 X 12	23.0
J75MM	75	20 X 12	21.9
J80MM	80	22 X 14	20.9
J85MM	85	22 X 14	19.3
J90MM	90	25 X 14	18.1
J95MM	95	25 X 14	16.8
J100MM	100	28 X 16	16.5

* Approximate weight in lbs.

□ The metric system does not refer to keyseat or keyway dimensions as does the English system; instead, dimensions are given for the key itself, which is rectangular in shape and not square as in the English system. This meets ISO standards.

† SHALLOW KEY FURNISHED

Centric Centrifugal Clutches

Selection Guide

To select or order a Boston Gear Centric Centrifugal Clutch, please complete the following information and fax this form to Product Support at 800-816-5608.

General Information

Company		
Address	City	State
Contact Person	Tel. No.	Fax No.

Application Data

1. Drive method: ☐ Electric Motor ☐ Engine/Turbine ☐ Other
2. Method of drive: ☐ Direct (Coupling Style) ☐ Indirect Pulley Mounted (provide sketch)
3. Power transmission requirements at clutch location:
   Horsepower _____
   Typical running RPM (If range required, specify range.) _____
4. Type: ☐ Standard (A) ☐ Vertical Lift-Out (V)
5. Speeds (required for engines, turbines, dual drives):
   Idling_____ RPM Engagement_____ RPM
6. Bores: Driver (input) _____ inches Driver (output) _____ inches
7. Service Factor Required: _____

Use the space below to sketch any relevant application data: